Junos® OS

SONET/SDH Interfaces Feature Guide for Routing Devices

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Junos® OS SONET/SDH Interfaces Feature Guide for Routing Devices

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Documentation and Release Notes

To obtain the most current version of all Juniper Networks® technical documentation, see the product documentation page on the Juniper Networks website at https://www.juniper.net/documentation/.

If the information in the latest release notes differs from the information in the documentation, follow the product Release Notes.

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Using the Examples in This Manual

If you want to use the examples in this manual, you can use the **load merge** or the **load merge relative** command. These commands cause the software to merge the incoming configuration into the current candidate configuration. The example does not become active until you commit the candidate configuration.

If the example configuration contains the top level of the hierarchy (or multiple hierarchies), the example is a *full example*. In this case, use the **load merge** command.

If the example configuration does not start at the top level of the hierarchy, the example is a *snippet*. In this case, use the **load merge relative** command. These procedures are described in the following sections.

Merging a Full Example

To merge a full example, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration example into a text file, save the file with a name, and copy the file to a directory on your routing platform.

   For example, copy the following configuration to a file and name the file **ex-script.conf**. Copy the **ex-script.conf** file to the **/var/tmp** directory on your routing platform.

   ```
   system {
     scripts {
       commit {
         file ex-script.xsl;
       }
     }
   }
   interfaces {
     fxp0 {
       disable;
       unit 0 {
         family inet {
           address 10.0.0.1/24;
         }
       }
     }
   }
   ```

2. Merge the contents of the file into your routing platform configuration by issuing the **load merge** configuration mode command:

   ```
   [edit]
   user@host# load merge /var/tmp/ex-script.conf
   load complete
   ```

Merging a Snippet

To merge a snippet, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration snippet into a text file, save the file with a name, and copy the file to a directory on your routing platform.

   For example, copy the following snippet to a file and name the file **ex-script-snippet.conf**. Copy the **ex-script-snippet.conf** file to the **/var/tmp** directory on your routing platform.

   ```
   commit {
     file ex-script-snippet.xsl; }
   ```

2. Move to the hierarchy level that is relevant for this snippet by issuing the following configuration mode command:

```
[edit]
user@host# edit system scripts
[edit system scripts]
```

3. Merge the contents of the file into your routing platform configuration by issuing the **load merge relative** configuration mode command:

```
[edit system scripts]
user@host# load merge relative /var/tmp/ex-script-snippet.conf
load complete
```

For more information about the **load** command, see CLI Explorer.

Documentation Conventions

Table 1 on page xvii defines notice icons used in this guide.

Table 1: Notice Icons

Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates a situation that might result in loss of data or hardware damage.
	Warning	Alerts you to the risk of personal injury or death.
	Laser warning	Alerts you to the risk of personal injury from a laser.
	Tip	Indicates helpful information.
	Best practice	Alerts you to a recommended use or implementation.

Table 2 on page xviii defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the **configure** command: user@host> **configure**
`Fixed-width text like this`	Represents output that appears on the terminal screen.	`user@host>` **show chassis alarms** `No alarms currently active`
Italic text like this	• Introduces or emphasizes important new terms. • Identifies guide names. • Identifies RFC and Internet draft titles.	• A policy *term* is a named structure that defines match conditions and actions. • *Junos OS CLI User Guide* • RFC 1997, *BGP Communities Attribute*
Italic text like this	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# **set system domain-name** *domain-name*
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	• To configure a stub area, include the **stub** statement at the **[edit protocols ospf area area-id]** hierarchy level. • The console port is labeled **CONSOLE**.
< > (angle brackets)	Encloses optional keywords or variables.	**stub <default-metric** *metric***>;**
| (pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	**broadcast | multicast** **(*string1* | *string2* | *string3*)**
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	**rsvp { # Required for dynamic MPLS only**
[ ] (square brackets)	Encloses a variable for which you can substitute one or more values.	**community name members [** ***community-ids*** **]**

Indention and braces ({ })	Identifies a level in the configuration hierarchy.	[edit]
		routing-options {
		  static {
		  route default {
		  nexthop *address*;
		  retain;
		  }
		  }
		}

; (semicolon)	Identifies a leaf statement at a configuration hierarchy level.	

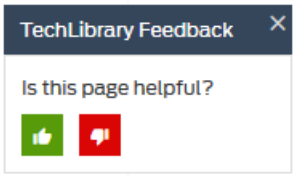
Table 2: Text and Syntax Conventions (continued)

Convention	Description	Examples
GUI Conventions		
Bold text like this	Represents graphical user interface (GUI) items you click or select.	• In the Logical Interfaces box, select **All Interfaces**. • To cancel the configuration, click **Cancel**.
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select **Protocols>Ospf**.

Documentation Feedback

We encourage you to provide feedback so that we can improve our documentation. You can use either of the following methods:

- Online feedback system—Click TechLibrary Feedback, on the lower right of any page on the Juniper Networks TechLibrary site, and do one of the following:



  - Click the thumbs-up icon if the information on the page was helpful to you.
  - Click the thumbs-down icon if the information on the page was not helpful to you or if you have suggestions for improvement, and use the pop-up form to provide feedback.

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Requesting Technical Support

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- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at https://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf.
- Product warranties—For product warranty information, visit https://www.juniper.net/support/warranty/.

- JTAC hours of operation—The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

Self-Help Online Tools and Resources

For quick and easy problem resolution, Juniper Networks has designed an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

- Find CSC offerings: https://www.juniper.net/customers/support/
- Search for known bugs: https://prsearch.juniper.net/
- Find product documentation: https://www.juniper.net/documentation/
- Find solutions and answer questions using our Knowledge Base: https://kb.juniper.net/
- Download the latest versions of software and review release notes: https://www.juniper.net/customers/csc/software/
- Search technical bulletins for relevant hardware and software notifications: https://kb.juniper.net/InfoCenter/
- Join and participate in the Juniper Networks Community Forum: https://www.juniper.net/company/communities/
- Open a case online in the CSC Case Management tool: https://www.juniper.net/cm/

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: https://entitlementsearch.juniper.net/entitlementsearch/

Opening a Case with JTAC

You can open a case with JTAC on the Web or by telephone.

- Use the Case Management tool in the CSC at https://www.juniper.net/cm/.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, see https://www.juniper.net/support/requesting-support.html.

PART 1

Overview

- SONET/SDH Interfaces Overview on page 3

CHAPTER 1

SONET/SDH Interfaces Overview

- SONET/SDH Interfaces Overview on page 3

SONET/SDH Interfaces Overview

Synchronous Digital Hierarchy (SDH) is a CCITT standard for a hierarchy of optical transmission rates. Synchronous Optical Network (SONET) is a USA standard that is largely equivalent to SDH. Both are widely used methods for very high speed transmission of voice and data signals across the numerous world-wide fiber-optic networks.

SDH and SONET use light-emitting diodes or lasers to transmit a binary stream of light-on and light-off sequences at a constant rate. At the far end optical sensors convert the pulses of light back to electrical representations of the binary information.

In wavelength-division multiplexing (WDM), light at several different wavelengths (colors to a human eye) is transmitted on the same fiber segment, greatly increasing the throughput of each fiber cable.

In dense wavelength-division multiplexing (DWDM), many optical data streams at different wavelengths are combined into one fiber.

The basic building block of the SONET/SDH hierarchy in the optical domain is an OC1; in the electrical domain, it is an STS-1. An OC1 operates at 51.840 Mbps. OC3 operates at 155.520 Mbps.

A SONET/SDH stream can consist of discrete lower-rate traffic flows that have been combined using time-division multiplexing (TDM) techniques. This method is useful, but a portion of the total bandwidth is consumed by the TDM overhead. When a SONET/SDH stream consists of only a single, very high speed payload, it is referred to as operating in concatenated mode. A SONET/SDH interface operating in this mode has a “c” added to the rate descriptor. For example, a concatenated OC48 interface is referred to as OC48c.

SONET and SDH traffic streams exhibit very few differences in behavior that are significant to Juniper Networks SONET/SDH interfaces; in general, this chapter uses *SONET/SDH* to indicate behavior that is identical for the two standards. However, there is one important difference that requires you to configure the interface specifically for SONET or SDH mode. That difference is in the setting of two bits (the ss-bits) in the pointer. SONET equipment ignores these bits, but SDH equipment uses them to distinguish a VC-4 payload from other types. When configured in SDH mode, Juniper Networks SONET/SDH PICs

set the **ss-bits** to **s1s0 2** (binary 10). For more information, see *Junos OS Administration Library*.

CAUTION: To extend the life of the laser, when a SONET/SDH PIC is not being actively used with any valid links, take the PIC offline until you are ready to establish a link to another device. To do this, issue the **request chassis pic offline fpc-slot** *slot-number* **pic-slot** *slot-number* operational mode command:

user@host> request chassis pic offline fpc-slot *slot-number* **pic-slot** *slot-number*

After you have connected the PIC to another device, bring the PIC back online by issuing the **request chassis pic online fpc-slot** *slot-number* **pic-slot** *slot-number* operational mode command.

user@host> request chassis pic online fpc-slot *slot-number* **pic-slot** *slot-number*

For information about taking a PIC offline or online, see *request chassis pic*.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8

PART 2

Configuring SONET/SDH Interfaces

- Configuring SONET/SDH Physical Interface Properties on page 7
- Configuring Interface Encapsulation on SONET/SDH Interfaces on page 49
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- Configuring APS and MSP to Protect from Circuit Failures on page 63
- Configuring Aggregated SONET/SDH Interfaces for High Availability on page 99

CHAPTER 2

Configuring SONET/SDH Physical Interface Properties

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Configuring SONET/SDH Physical Interface Properties

You can configure SONET/SDH physical interface options to accomplish various tasks.

Note that when you configure SONET/SDH OC48 interfaces for channelized (multiplexed) mode (by including the **no-concatenate** statement at the **[edit chassis fpc *slot-number* pic *pic-number*]** hierarchy level), the **bytes f1** statement has no effect. Currently, the **bytes e1-quiet** statement is ignored if you include it in the configuration. The **bytes f2**, **bytes z3**, **bytes z4**, and **path-trace** options work correctly on channel 0 and work in the transmit direction only on channels 1, 2, and 3. When using **no-concatenate**, you must specify a channel. For more information, see the *Junos OS Administration Library*.

For DS3 channels on a channelized OC12 interface, the **bytes f1**, **bytes f2**, **bytes z3**, and **bytes z4** options have no effect. The **bytes s1** option is supported only for channel 0; it is ignored if configured on channels 1 through 11. The **bytes s1** value configured on channel 0 applies to all channels on the interface.

You can also include some of the statements in the **sonet-options** statement to set SONET/SDH parameters on ATM interfaces.

This topic includes the following tasks:

1. Configuring SONET/SDH Physical Interface Options on page 8
2. Configuring SONET/SDH Interface-Specific Options on page 9
3. Configuring MPLS Option for Passive Monitoring on page 11
4. Configuring Automatic Protection Switching Options on page 12

Configuring SONET/SDH Physical Interface Options

To configure the SONET/SDH physical interface options:

1. In configuration mode, go to the **[edit interfaces *interface-name*]** hierarchy level, where the *interface-name* is **so-*fpc/pic/port***.

   ```
   [edit]
   user@host# edit interfaces so-fpc/pic/port
   ```

2. Configure the framing mode in SONET mode or SDH mode.

   ```
   [edit interfaces so-fpc/pic/port]
   user@host# set framing (sonet | sdh)
   ```

   For more information, see "Configuring SONET/SDH Framing Mode for Ports" on page 18 .

3. Configure the virtual tributary mapping standard as either International Telephony Union standard (**itu-t**) or KLM standard (**klm**). Here, the KLM standard is set by default.

```
[edit interfaces so-fpc/pic/port]
user@host# set vt (itu-t | klm)
```

For more information, see "Configuring Virtual Tributary Mapping" on page 19.

4. Configure an incrementing STM ID rather than a static one in the SDH overhead with the **z0-increment**. Note that you should include this option only for SDH mode. You can explicitly disable incrementing of the STM ID with the **no-z0-increment** option.

```
[edit interfaces so-fpc/pic/port]
user@host# set z0-increment | no-z0-increment
```

For more information, see "Configuring an Incrementing STM ID to Interoperate with Older Equipment in SDH Mode" on page 20.

5. Configure the interface speed with the **oc3 | oc12 | oc48** option when the PIC is in concatenated mode and configure the speed with **oc3 | oc12** option when the PIC is in non-concatenated mode.

```
[edit interfaces so-fpc/pic/port]
user@host# set speed (oc3 | oc12 | oc48)
```

For more information, see "Configuring SONET/SDH Interface Speed" on page 26.

Configuring SONET/SDH Interface-Specific Options

To configure the SONET/SDH interface-specific options:

1. Configure the **sonet-options** statement.

```
[edit interfaces so-fpc/pic/port]
user@host# edit sonet-options
```

For more information, see **sonet-options**.

2. Configure the aggregated SONET/SDH logical interface number from 0 through 15.

```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set aggregate asx
```

For more information, see **aggregate**.

3. Configure the **bytes** option to set values in some SONET/SDH header bytes. You can configure this option with **c2** *value*, **e1-quiet** *value* **f1** *value*, **f2** *value*, **s1** *value*, **z3** *value*, and **z4** *value*.

```
[edit interfaces so-fpc/pic/port sonet-options]
```

```
user@host# set bytes c2 value
user@host# set bytes e1-quiet value
user@host# set bytes f1 value
user@host# set bytes f2 value
user@host# set bytes s1 value
user@host# set bytes z3 value
user@host# set bytes z4 value
```

For more information, see "Configuring SONET/SDH Header Byte Values to Identify Error Conditions" on page 30.

4. Configure the frame checksum (FCS) on the interface as either 16-bit frame checksum or 32-bit frame checksum.

```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set fcs (16 | 32)
```

For more information, see "Configuring the SONET/SDH Frame Checksum" on page 31.

5. Configure a loopback connection. To turn off the loopback capability, remove the **loopback** statement from the configuration.

```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set loopback (local | payload | remote)
```

For more information, see "Configuring SONET/SDH Loopback Capability to Identify a Problem as Internal or External" on page 32.

6. Configure a path trace identifier, which is a text string that identifies the circuit. The text string that identifies the circuit.

```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set path-trace trace-string
```

For more information, see "Configuring the SONET/SDH Path Trace Identifier for a Circuit" on page 36.

7. Configure HDLC scrambling which provides better link stability. You can enable HDLC scrambling with **payload-scrambler** option and disable it with **no-payload-scrambler** option.

```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set payload-scrambler
user@host# set no-payload-scrambler
```

For more information, see "Configuring SONET/SDH HDLC Payload Scrambling for Link Stability" on page 37.

8. Configure the **rfc-2615** option to enable features described in RFC 2615, PPP over SONET/SDH.


```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set rfc-2615
```

For more information, see "Configuring PPP Support on SONET/SDH Interfaces" on page 55.

9. Configure SONET/SDH defect triggers as either ignore or hold time.

   The defect triggers can be ignored. By default all SONET/SDH defect triggers are honored if you do not include the **trigger defect ignore** statement.

   You can apply up and down hold times to SONET/SDH defect trigger. If you do not include the **trigger defect hold-time** statement, when a defect is detected the interface is marked down immediately and when the defect becomes absent the interface is marked up immediately.

   ```
   [edit interfaces so-fpc/pic/port sonet-options]
   user@host# set trigger defect ignore
   user@host# set trigger defect hold-time up milliseconds down milliseconds
   ```

   For more information, see "Configuring SONET/SDH Defect Triggers" on page 60.

Configuring MPLS Option for Passive Monitoring

To configure the MPLS options for passive monitoring:

1. Configure the **mpls** option to process incoming IP packets that have MPLS labels for passive monitoring on ATM and SONET/SDH interfaces and 10-Gigabit Ethernet interfaces in WAN PHY mode.

   ```
   [edit interfaces so-fpc/pic/port sonet-options]
   user@host# edit mpls
   ```

   For more information, see mpls.

2. Configure the **pop-all-labels** option to remove up to two MPLS labels from incoming IP packets in passive monitoring.

   ```
   [edit interfaces so-fpc/pic/port sonet-options mpls]
   user@host# set pop-all-labels
   ```

   For more information, see pop-all-labels.

3. Configure the **required-depth** option as either **1** or **2** in the **pop-all-labels** statement to specify the number of MPLS labels an incoming packet must have for the pop-all-labels statement to take effect.

   If you include the **required-depth 1** statement, the **pop-all-labels** statement takes effect for incoming packets with one label only.

   If you include the **required-depth 2** statement, the **pop-all-labels** statement takes effect for incoming packets with two labels only.


```
[edit interfaces so-fpc/pic/port sonet-options mpls pop-all-labels]
user@host# set required-depth
```

For more information, see **required-depth**.

Configuring Automatic Protection Switching Options

To configure Automatic Protection Switching (APS) options:

1. Configure the Automatic Protection Switching option.

   ```
   [edit interfaces so-fpc/pic/port sonet-options]
   user@host# edit aps
   ```

   For more information, see "Configuring Basic Automatic Protect Switching" on page 69.

2. Configure the APS interval at which the protect and working routers send packets to their neighbors to advertise that they are operational. A router considers its neighbor to be operational for a period, called the hold time, that is, by default, three times the advertisement interval. You can set the APS interval from 1 through 65,534 millisecond. By default, 1000 milliseconds is set as advertise interval.

   ```
   [edit interfaces so-fpc/pic/port sonet-options aps]
   user@host# set advertise-interval milliseconds
   ```

   For more information, see "Configuring APS Timers" on page 75.

3. Configure the **annex-b** option for Multiplex Section Protection (MSP) switching on SDH interfaces for M320 and M120 routers only.

   ```
   [edit interfaces so-fpc/pic/port sonet-options aps]
   user@host# set annex-b
   ```

   For more information, see "Configuring Lockout of Protection for SDH Interfaces" on page 74.

4. Configure the Automatic Protection Switching (APS) authentication key (password).

   ```
   [edit interfaces so-fpc/pic/port sonet-options aps]
   user@host# set authentication-key key
   ```

   For more information, see **authentication-key**.

5. Configure the **fast-aps-switch** option to reduce the Automatic Protection Switching (APS) switchover time in Layer 2 circuits in M320 routers with Channelized OC3/STM1 Circuit Emulation PIC with SFP only.

   ```
   [edit interfaces so-fpc/pic/port sonet-options aps]
   user@host# set fast-aps-switch
   ```

For more information, see fast-aps-switch.

6. Configure the **force** option to either protect mode or working mode to perform a forced switch between the protect and working circuits. This statement is honored only if there are no higher-priority reasons to switch. It can be overridden by a signal failure on the protect circuit, thus causing a switch to the working circuit.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set force (protect | working)
```

For more information, see force.

7. Configure the **hold-time** value in milliseconds to determine whether a neighbor APS router is operational where the hold-time value ranges from 1 through 65,354 milliseconds. By default, 3000 milliseconds (3 times the advertisement interval) is set as hold time.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set hold-time milliseconds
```

For more information, see hold-time.

8. Configure a lockout of protection, forcing the use of the working circuit and locking out the protect circuit regardless of anything else.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set lockout
```

For more information, see lockout.

9. Configure the address of the remote interface when you are configuring one router to be the working router and a second to be the protect router. You can configure this on one or both of the interfaces.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set neighbor address
```

For more information, see neighbor.

10. Configure load sharing between two working protect circuit pairs where circuit's group name is as configured with the **protect-circuit** or **working-circuit** statement.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set paired-group group-name
```

For more information, see "Configuring APS Load Sharing" on page 85.

11. Configure link state replication with **preserve-interface** option


```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set preserve-interface
```

For more information, see "Configuring Link PIC Redundancy" on page 89.

12. Configure the protect router in an APS circuit pair. When the working interface fails, APS brings up the protection circuit and the traffic is moved to the protection circuit.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set protect-circuit group-name
```

For more information, see **protect-circuit**.

13. Configure the **request** option as protect circuit or working circuit to perform a manual switch between the protect and working circuits. This statement is honored only if there are no higher-priority reasons to switch.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set request (protect | working)
```

For more information, see "Configuring Switching Between the Working and Protect Circuits" on page 92.

14. Configure APS revertive mode in seconds ranging from 1 through 65,535 seconds which denotes the time to wait after the working circuit has again become functional before making the working circuit active again. By default, APS operates in nonrevertive mode.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set revert-time seconds
```

For more information, see "Configuring Revertive Mode" on page 94.

15. Configure the interface in bidirectional mode or in unidirectional mode. By default, if the **switching-mode** statement is not configured, the mode is bidirectional, and the interface does not interoperate with a unidirectional SONET/SDH LTE.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set switching-mode (bidirectional | unidirectional)
```

For more information, see "Configuring Switching Mode" on page 97.

16. Configure the working router in an APS circuit pair.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set working-circuit group-name
```

For more information, see **working-circuit**.

Related Documentation

- Automatic Protection Switching and Multiplex Section Protection Overview on page 64
- Configuring SONET Options for 10-Gigabit Ethernet Interfaces on page 42
- SONET/SDH Interfaces Overview on page 3

Configuring the Media MTU

The media maximum transmission unit (MTU) is the largest data unit that can be forwarded without fragmentation. The default media MTU size used on a physical interface depends on the encapsulation being used on that interface. For a listing of MTU sizes for each encapsulation type, see *Media MTU Sizes by Interface Type*.

To configure the media-MTU size:

1. In configuration mode, go to the **[edit interfaces *interface-name*]** hierarchy level.

```
[edit ]
user@host# [edit interfaces interface-name]
```

2. Include the **mtu** statement.

```
[edit interfaces interface-name]
mtu bytes;
```

- If you change the size of the media MTU, you must ensure that the size is equal to or greater than the sum of the protocol MTU and the encapsulation overhead. You configure the protocol MTU by including the **mtu** statement at the following hierarchy levels:
  - **[edit interfaces *interface-name* unit *logical-unit-number* family *family*]**

- [edit logical-systems *logical-system-name* interfaces *interface-name* unit *logical-unit-number* family *family*]

NOTE:

- Changing the media MTU or protocol MTU causes an interface to be deleted and added again.
- Because tunnel services interfaces are considered logical interfaces, you cannot configure the MTU setting for the physical interface. This means you cannot include the mtu statement at the [edit interfaces interface-name] hierarchy level for the following interface types: generic routing encapsulation (gr-), IP-IP (ip-), loopback (lo-), link services (ls-), multilink services (ml-), and multicast (pe-, pd-). You can, however, configure the protocol MTU on all tunnel interfaces except virtual tunnel (vt) interfaces. Starting in Junos OS Release 17.1R3, you cannot configure the maximum transmission unit (MTU) size for vt interfaces because the **mtu bytes** option is deprecated for vt interfaces. Junos OS sets the MTU size for vt interfaces by default to unlimited.
- If you configure an MTU value by including the mtu statement at the [edit interfaces interface-name unit logical-unit-number family mpls] hierarchy level, the configured value is used.

Related Documentation

- *Media MTU Overview*
- *Media MTU Sizes by Interface Type*
- *Encapsulation Overhead by Interface Encapsulation Type*

Configuring the Media MTU on SONET/SDH Interfaces

The default media MTU size used on a physical interface depends on the encapsulation being used on that interface. For a listing of MTU sizes for each encapsulation type, see "Configuring the Media MTU" on page 15.

To configure the media-MTU size:

1. In configuration mode, go to the **[edit interfaces *interface-name*]** hierarchy level.

```
[edit ]
user@host# [edit interfaces interface-name]
```

2. Include the **mtu** statement.

```
[edit interfaces interface-name]
mtu bytes;
```

- If you change the size of the media MTU, you must ensure that the size is equal to or greater than the sum of the protocol MTU and the encapsulation overhead. You configure the protocol MTU by including the **mtu** statement at the following hierarchy levels:
  - **[edit interfaces *interface-name* unit *logical-unit-number* family *family*]**
  - **[edit logical-systems *logical-system-name* interfaces *interface-name* unit *logical-unit-number* family *family*]**

Related Documentation

- Configuring Interface Encapsulation on SONET/SDH Interfaces on page 52
- **mtu on page 233**
- *Setting the Protocol MTU*

Framing Mode Overview

You can use the **framing** statement to configure incoming SDH links from Europe and outgoing SONET links to the US on the same PIC or MIC. Traffic flowing through other ports of the same PIC or MIC will not be affected.

When you change SONET/SDH mode on a port, only the port's framing type is changed. The PIC or MIC does not go offline.

NOTE: Per-port framing configuration is applicable for SONET interfaces in concatenated mode (default mode) only. When you configure a PIC or MIC to operate in nonconcatenated mode, the individual channels inherit framing configuration from the **[edit chassis fpc *number* pic *number* framing (sonet | sdh)]** hierarchy level. However, per-port framing is currently not supported on SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP (MIC-3D-8OC3OC12-4OC48) in MX80 routers.

NOTE: Automatic Protection Switching (APS) is used by SONET add/drop multiplexers (ADMs) to protect against circuit failures. If APS is configured, and you do not change the SONET/SDH mode on both the working and protection port, APS support will not function properly. Both the working and protection ports must have the same mode configuration.

The following MICs and PICs support SONET or SDH framing mode on a per-port basis:

- The 4-port OC48 PIC with SFP installed, the next-generation SONET/SDH PICs with SFP, and the 4-port OC192 PIC on M Series, MX Series, and T Series routers.
- The SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP, the Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP, and the OC192/STM64 MICs with XFP on MX Series routers.

The 1-port OC192/STM64 MICs with XFP on MX Series routers support SONET or SDH framing on the single port. This functionality allows you to mix SONET and SDH modes on interfaces on a single PIC or MIC.

To view interface information, use the **show interfaces so-*fpc/pic/port*** operational mode command.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring SONET/SDH Framing Mode for Ports on page 18
- SONET/SDH Interfaces Overview on page 3

Configuring SONET/SDH Framing Mode for Ports

To configure framing on a per-port basis:

1. In configuration mode, go to the **[edit interfaces]** hierarchy level.

```
[edit]
user@host# edit interfaces
```

2. Configure the SONET/SDH interface.

```
[edit interfaces]
user@host# edit so-fpc/pic/port
```

3. Configure the framing option in SDH mode or in SONET mode.

```
[edit interfaces so-fpc/pic/port]
user@host# set framing (sdh | sonet)
```

NOTE: For a channelized MIC, replace so with coc3/coc12 when configuring the framing option as sonet. Similarly, replace so with cstm1/cstm4 when configuring the framing option as sdh.

To view interface information, use the **show interfaces so-*fpc/pic/port*** operational mode command.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Framing Mode Overview on page 17
- SONET/SDH Interfaces Overview on page 3

Configuring Virtual Tributary Mapping

You can configure virtual tributary mapping standard as either International Telephony Union standard (itu-t) or KLM standard (klm). Here, the KLM standard is set by default. For more information about virtual tributary mapping, see *Configuring Channelized STM1 Interfaces*.

To configure virtual tributary mapping on Channelized STM1 IQ and IQE PICs:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level, where the interface name is **cau4-*fpc/pic/port***.

```
[edit]
user@host# edit interfaces cau4-fpc/pic/port sonet-options
```

2. Configure virtual tributary mapping option in KLM standard. By default, virtual tributary mapping uses KLM standard.

```
[edit interfaces cau4-fpc/pic/port sonet-options]
user@host# set vtmapping klm
```

3. Configure virtual tributary mapping option in ITU-T standard alternatively.

```
[edit interfaces cau4-fpc/pic/port sonet-options]
user@host# set vtmapping itu-t
```

To configure virtual tributary mapping on STM1 PIC:

1. In configuration mode, go to the **[edit chassis fpc *slot-number* pic *pic-number*]** hierarchy level.

```
[edit]
user@host# edit chassis fpc slot-number pic pic-number
```

2. Configure virtual tributary mapping option in KLM mode. By default, virtual tributary mapping uses KLM mode.

```
[edit chassis fpc slot-number pic pic-number]
user@host# set vtmapping klm
```

3. Configure virtual tributary mapping option in ITU-T mode alternatively.

```
[edit chassis fpc slot-number pic pic-number]
user@host# set vtmapping itu-t
```

Channelized STM1-to-E1 Channel Mapping lists the KLM mappings used by the Channelized STM1-to-E1 PIC interfaces.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- SONET/SDH Interfaces Overview on page 3

Incrementing STM ID Overview

When configured in SDH framing mode, SONET/SDH interfaces on a Juniper Networks router might not interoperate with some older versions of ADMs or regenerators that require an incrementing STM ID.

Current SDH standards specify a set of 3*n* overhead bytes in an STM*n* that includes the J0 section trace byte. The rest are essentially unused (spare Z0) and contain hexadecimal values (0x01, 0xCC, 0xCC ... 0xCC). The older version of the standard specified that the same set of bytes should contain an incrementing sequence: 1, 2, 3, ..., 3*n*. Their use was still unspecified although they might have been used to assist in frame alignment. You can configure an incrementing STM ID to enable your Juniper Networks router to interoperate with older equipment that relies on these bytes for frame alignment.

The STM identifier has a precise definition in the SDH specifications. In ITU-T Recommendation G.707, *Network node interface for the synchronous digital hierarchy (SDH)* (03/96), Section 9.2.2.2.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring an Incrementing STM ID to Interoperate with Older Equipment in SDH Mode on page 20

Configuring an Incrementing STM ID to Interoperate with Older Equipment in SDH Mode

To configure an incrementing STM ID explicitly.

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level, where the *interface-name* is **so-*fpc/pic/port***.

```
[edit]
user@host# edit interfaces so-fpc/pic/port sonet-options
```

2. Configure an incrementing STM ID rather than a static one in the SDH overhead with the **z0-increment**. Note that you should include this option only for SDH mode.

```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set z0-increment
```

To explicitly disable incrementing of the STM ID.

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level, where the *interface-name* is **so-*fpc/pic/port***.

```
[edit]
user@host# edit interfaces so-fpc/pic/port sonet-options
```

2. Configure the **no-z0-increment** option explicitly to disable incrementing of the STM ID.

```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set no-z0-increment
```

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Incrementing STM ID Overview on page 20

SONET/SDH Rate-Selectability Overview

You can configure rate selectability on the SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP, Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP, and Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP by specifying the port speed as oc12-stm4, oc3-stm1, or oc48-stm16.

By default, rate selectability is enabled on the SONET/SDH OC3/STM1 (Multi-Rate) MICs with *oc3-stm1* speed.

NOTE: You cannot disable the rate selectability on the 4-port SONET/SDH OC3/STM1(Multi-Rate) MIC and the Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP.

Table 3 on page 21 shows the port speed restrictions on the SONET/SDH OC3/STM1 (Multi-Rate) MICs.

Table 3: Port Speed Restrictions for SONET/SDH OC3/STM1 (Multi-Rate) MICs

Mode\MIC Name	8-port SONET/SDH OC3/STM1 (Multi-Rate) MIC with SFP	4-port SONET/SDH OC3/STM1 (Multi-Rate) MIC with SFP
Rate-selectable Mode	• Only the first two ports (0–1) can be configured for **oc48-stm16** speed. • All eight ports can be configured for **oc3-stm1** or **oc12-stm4** speed. • Total available bandwidth is 8.75 Gbps.	• Only the first port (0) can be configured for **oc48-stm16** speed. • All four ports can be configured for **oc3-stm1** or **oc12-stm4** speed. • Total available bandwidth is 4.375 Gbps.

Table 3: Port Speed Restrictions for SONET/SDH OC3/STM1 (Multi-Rate) MICs (continued)

Mode\MIC Name	8-port SONET/SDH OC3/STM1 (Multi-Rate) MIC with SFP	4-port SONET/SDH OC3/STM1 (Multi-Rate) MIC with SFP
Non-rate-selectable Mode	• Only the first four ports (0–3) are available and set to **oc48-stm16** speed. • Total available bandwidth is 10 Gbps.	This mode is not available on this MIC.

All ports of the 8-port Channelized SONET/SDH OC3/STM1 (Multi-Rate) MIC with SFP can be configured as channelized OC3/channelized STM1. However, only four ports (ports 0, 1, 2, and 3) can be configured as channelized OC12/channelized STM4. Table 4 on page 22 and Table 5 on page 22 indicate the port configuration restrictions of the 8-port Channelized SONET/SDH OC3/STM1 (Multi-Rate) MIC with SFP.

Table 4: OC12/STM4 Port Configuration Restrictions on MIC-3D-8CHOC3-4CHOC12

Ports Configured as OC3/STM1	Ports Available for OC12/STM4 Configuration
None	0, 1, 2, and 3
0 or 4	1, 2, and 3
1 or 5	0, 2, and 3
2 or 6	0, 1, and 3
3 or 7	0, 1, and 2

Table 5: OC3/STM1 Port Configuration Restrictions on MIC-3D-8CHOC3-4CHOC12

Ports Configured as OC12/STM4	Ports Available for OC3/STM1 Configuration
None	All ports (0 through 7)
0	All ports except port 4
1	All ports except port 5
2	All ports except port 6
3	All ports except port 7

All ports of the 4-port Channelized SONET/SDH OC3/STM1 (Multi-Rate) MIC with SFP can be configured as channelized OC3/channelized STM1. However, only two ports (ports 0 and 1) can be configured as channelized OC12/channelized STM4. Table 6 on page 23 and Table 7 on page 23 indicate the port configuration restrictions of the 4-port Channelized SONET/SDH OC3/STM1 (Multi-Rate) MIC with SFP.

Table 6: OC12/STM4 Port Configuration Restrictions on MIC-3D-4CHOC3-2CHOC12

Ports Configured as OC3/STM1	Ports Available for OC12/STM4 Configuration
None	0 and 1
0 or 2	1
1 or 3	0

Table 7: OC3/STM1 Port Configuration Restrictions on MIC-3D-4CHOC3-2CHOC12

Ports Configured as OC12/STM4	Ports Available for OC3/STM1 Configuration
None	All ports (0 through 3)
0	All ports except 2
1	All ports except 3

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring SONET/SDH Rate-Selectability on page 23

Configuring SONET/SDH Rate-Selectability

You can configure rate selectability on the SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP, Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP, and Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP by specifying the port speed.

To configure the rate selectability:

1. In configuration mode, go to the **[edit chassis fpc *slot-number* pic *pic-number* port *port-number*]** hierarchy level.

```
[edit]
user@host# edit chassis fpc slot-number pic pic-number port port-number
```

2. Configure the **speed** option to enable rate selectability on SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP, Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP, and Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP.

```
[edit chassis fpc slot-number pic pic-number port port-number]
user@host# set speed (oc12-stm4 | oc3-stm1 | oc48-stm16)
```

NOTE:

- By default, rate selectability is enabled on the SONET/SDH OC3/STM1 (Multi-Rate) MICs with **oc3-stm1** speed.
- You cannot disable the rate selectability on the 4-port SONET/SDH OC3/STM1(Multi-Rate) MIC and the Channelized SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP.

To disable the rate selectability feature on the 8-port SONET/SDH OC3/STM1 (Multi-Rate) MIC:

1. In configuration mode, go to the **[edit chassis fpc *slot-number* pic *pic-number* port *port-number*]** hierarchy level.

```
[edit]
user@host# edit chassis fpc slot-number pic pic-number port port-number
```

2. Configure the **no-multi-rate** option to disable rate selectability.

```
[edit chassis fpc slot-number pic pic-number port port-number]
user@host# set no-multi-rate
```

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- SONET/SDH Rate-Selectability Overview on page 21
- SONET/SDH Interfaces Overview on page 3

SONET/SDH Interface Speed Overview

You can configure the interface speed. The speed you select is dependent upon whether the PIC is in concatenated or nonconcatenated mode. Available speeds depend on whether the PIC is in concatenated mode or nonconcatenated mode.

- Concatenated mode—Here, the bandwidth of the interface is in a single channel. You can select the **oc3 | oc12 | oc48** option when the PIC is in concatenated mode.
- Nonconcatenated mode—Here, the PIC operates in channelized (multiplexed) mode. You can select the **oc3 | oc12** option when the PIC is in nonconcatenated mode.

You can configure the speed of SONET/SDH interfaces on next-generation SONET/SDH Type 1 and Type 2 PICs with SFP.

By default, SONET/SDH PICs operate in concatenated mode.

To configure the PIC to operate in channelized (multiplexed) mode, include the **no-concatenate** statement at the **[edit chassis fpc *slot-number* pic *pic-number*]** hierarchy level.

NOTE: On SONET/SDH OC3/STM1 (Multi-Rate) MIC with SFP and Channelized SONET/SDH OC3/STM1 (Multi-Rate) MIC with SFP, you cannot set the interface speed at the [edit interfaces] hierarchy level. To enable the speed on these MICs, you need to set the port speed at the [edit chassis fpc *slot-number* pic *pic-number* port *port-number*] hierarchy level.

For more information about using the **non-concatenate** statement, see the *Junos OS Administration Library*.

Table 8 on page 25 shows the mode combinations for the next-generation SONET/SDH Type 1 PICs with SFP.

Table 8: Type 1 PIC Mode Combinations

PIC	Mode	Speed Configuration	Default Mode
2-port OC3	2xOC3 concatenated	*fpc/pic*/0 speed oc3	Concatenated
4-port OC3	1xOC12 concatenated	*fpc/pic*/0 speed oc12	
	1xOC12 nonconcatenated	*fpc/pic*/0:0 speed oc3	Nonconcatenated
	4xOC3 concatenated	*fpc/pic/port* speed oc3	Concatenated
1-port OC12	1xOC12 concatenated	*fpc/pic*/0 speed oc12	Concatenated
	1xOC12 nonconcatenated	*fpc/pic*/0:0 speed oc3	Nonconcatenated
	1xOC3 concatenated	*fpc/pic*/0 speed oc3	

Table 9 on page 25 shows the mode combinations for the next-generation SONET/SDH Type 2 PICs with SFP.

Table 9: Type 2 PIC Mode Combinations

PIC	Mode	Speed Configuration	Default Mode
1-port OC48	1xOC48 concatenated	*fpc/pic*/0 speed oc48	Concatenated
	1xOC48 nonconcatenated	*fpc/pic*/0:0 speed oc12	Nonconcatenated
	1xOC12 concatenated	*fpc/pic*/0 speed oc12	
	1xOC12 nonconcatenated	*fpc/pic*/0 0 speed oc3	
	1xOC3 concatenated	*fpc/pic*/0 speed oc3	

Table 9: Type 2 PIC Mode Combinations (continued)

PIC	Mode	Speed Configuration	Default Mode
4-port OC12	1xOC48 concatenated	*fpc/pic*/0 speed oc48	
	1xOC48 nonconcatenated	*fpc/pic*/0:0 speed	Nonconcatenated
	1xOC12 nonconcatenated	*fpc/pic*/0 speed oc3	
	4xOC12 concatenated	*fpc/pic/port* speed oc3|oc12	Concatenated
4-port OC3	1xOC12 concatenated	*fpc/pic*/0 speed oc12	
	1xOC12 nonconcatenated	*fpc/pic*/0:0 speed oc3	Nonconcatenated
	4xOC3 concatenated	*fpc/pic/port* speed oc3	Concatenated

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring SONET/SDH Interface Speed on page 26

Configuring SONET/SDH Interface Speed

To configure the speed of SONET/SDH interfaces in concatenated mode:

1. In configuration mode, go to the **[edit interfaces *interface-name*]** hierarchy level, where the *interface-name* is **so-*fpc/pic/port***.

```
[edit]
user@host# edit interfaces so-fpc/pic/port
```

2. Configure interface speed in concatenated mode.

   For example, each port of 4-port OC12 PIC can be configured to be in OC3 or OC12 speed independently when this PIC is in 4xOC12 concatenated mode.

```
[edit interfaces so-fpc/pic/port]
user@host# set speed (oc3 | oc12 | oc48)
```

To configure the speed of SONET/SDH interfaces in nonconcatenated mode:

1. In configuration mode, go to the **[edit interfaces *interface-name*]** hierarchy level, where the ***interface-name*** is **so-*fpc/pic/port***.

```
[edit]
user@host# edit interfaces so-fpc/pic/port
```

2. Configure interface speed in nonconcatenated mode.

   For example, each port of 4-port OC12 PIC can be configured to be in OC3 or OC12 speed independently when this PIC is in 4xOC12 concatenated mode.

   ```
   [edit interfaces so-fpc/pic/port]
   user@host# set speed (oc3 | oc12)
   ```

To configure the PIC to operate in channelized (multiplexed) mode:

1. In configuration mode, go to the **[edit chassis fpc *slot-number* pic *pic-number*]** hierarchy level.

   ```
   [edit]
   user@host# [edit chassis fpc slot-number pic pic-number]
   ```

2. Configure the **no-concatenate** option.

   ```
   [edit interfaces so-fpc/pic/port]
   user@host# set no-concatenate
   ```

NOTE: On SONET/SDH OC3/STM1 (Multi-Rate) MIC with SFP, Channelized SONET/SDH OC3/STM1 (Multi-Rate) MIC with SFP, and Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP, you cannot set the interface speed at the **[edit interfaces]** hierarchy level. To enable the speed on these MICs, you need to set the port speed at the **[edit chassis fpc *slot-number* pic *pic-number* port *port-number*]** hierarchy level.

For more information about using the **non-concatenate** statement, see the *Junos OS Administration Library*.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- SONET/SDH Interface Speed Overview on page 24
- SONET/SDH Interfaces Overview on page 3

SONET/SDH Header Byte Values Overview

Header bytes are regenerated in every router in the network path. They help us to identify error conditions.

You can configure the following SONET/SDH header bytes:

- **c2**—Path signal label SONET/SDH overhead byte. SONET/SDH frames use the C2 byte to indicate the contents of the payload inside the frame. SONET/SDH interfaces use the C2 byte to indicate whether the payload is scrambled. For the c2 byte, ***value*** can be from **0** through **255**. The default value is **0xCF**.
- **e1-quiet**—Default idle byte sent on the orderwire SONET/SDH overhead bytes. The router does not support the orderwire channel, and hence sends this byte continuously.
- **f1**, **f2**, **z3**, **z4**—SONET/SDH overhead bytes. For these bytes, ***value*** can be from **0** through **255**. The default value is **0x00**.
- **s1**—Synchronization message SONET/SDH overhead byte. This byte is normally controlled as a side effect of the system reference clock configuration and the state of the external clock coming from an interface if the system reference clocks have been configured to use an external reference. For the s1 byte, ***value*** can be from **0** through **255**.

Table 10 on page 28 displays Junos OS framing bytes for several specific speeds.

Table 10: SONET/SDH Framing Bytes for Specific Speeds

Overhead Bytes	STM4	STM16	STM64	OC12	OC48	OC192
A1	F6	F6	F6	F6	F6	F6
A2	28	28	28	28	28	28
C1	—	—	—	1..12	1..48	1..192
H1/H2	6A0A	6A0A	6A0A	620A	620A	620A
Z0	01/CC	01/CC	01/CC	—	—	—
Concatenated mode	93FF	93FF	93FF	93FF	93FF	93FF

When you configure SONET/SDH header bytes, note the following:

- The C2 byte is the path signal label. If the C2 byte value on an interface does not match the C2 byte value on the remote interface, the path label mismatch (PLM-P) or unequipped (UNEQ-P) alarm might occur.
- When you configure SONET/SDH OC48 interfaces for channelized (multiplexed) mode (by including the **no-concatenate** statement at the **[edit chassis fpc *slot-number* pic *pic-number*]** hierarchy level), the **bytes f1** statement has no effect.
- Currently, the **bytes e1-quiet** statement is ignored if you include it in the configuration.
- The **bytes f2**, **bytes z3**, **bytes z4**, and **path-trace** options work correctly on channel 0 and work in the transmit direction only on channels 1, 2, and 3.
- For DS3 channels on a channelized OC12 interface, the **bytes f1, bytes f2, bytes z3,** and **bytes z4** options have no effect.
- The **bytes s1** option is supported only for channel 0; it is ignored if configured on channels 1 through 11. The **bytes s1** value configured on channel 0 applies to all channels on the interface.
- Embedded operations channel (EOC) D1, D2, and D3 bytes are not supported.
- For channelized OC12 IQE and channelized OC48 IQE PICs with SFPs:
  - Only C2 (Path signal label) and S1 byte setting is supported.
  - Following header bytes are not supported. The router will syslog an INFO message if a command for an unsupported header byte is received.

    F1—Section user channel byte

    F2—Path user channel byte

    Z3, Z4—SONET/SDH overhead bytes

    E1—quiet default idle byte
  - The following header bytes are supported on the SONET/SDH OC3/STM1 (Multi-Rate) MICs with SFP.

    Z0, F1—Section user channel bytes

    K1, K2, S1— Line user channel bytes

    G1, F2, Z3, Z4, C2, E1—Path user channel bytes
  - The following header bytes are supported on the Channelized SONET/SDH OC3/STM1 (Multi-Rate) MIC with SFP.

    Z0, F1—Section user channel bytes

    S1— Line user channel bytes

    G1, F2, Z3, Z4, C2, E1—Path user channel bytes
  - The following header bytes are supported on the OC192/STM64 MIC with XFP.

    F1—Section user channel bytes

    K1, K2, S1— Line user channel bytes

    G1, F2, Z3, Z4, C2, E1—Path user channel bytes

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring SONET/SDH Header Byte Values to Identify Error Conditions on page 30
- SONET/SDH Interfaces Overview on page 3

Configuring SONET/SDH Header Byte Values to Identify Error Conditions

To configure the values in SONET/SDH header bytes:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options
```

2. Configure the **bytes** option to set values in some SONET/SDH header bytes. You can configure this option with **c2** ***value***, **e1-quiet** ***value*** **f1** ***value***, **f2** ***value***, **s1** ***value***, **z3** ***value***, and **z4** ***value***.

```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set bytes c2 value
user@host# set bytes e1-quiet value
user@host# set bytes f1 value
user@host# set bytes f2 value
user@host# set bytes s1 value
user@host# set bytes z3 value
user@host# set bytes z4 value
```

You can configure the following SONET/SDH header bytes:

- **c2**—Path signal label SONET/SDH overhead byte. SONET/SDH frames use the C2 byte to indicate the contents of the payload inside the frame. SONET/SDH interfaces use the C2 byte to indicate whether the payload is scrambled. For the c2 byte, ***value*** can be from **0** through **255**. The default value is **0xCF**.
- **e1-quiet**—Default idle byte sent on the orderwire SONET/SDH overhead bytes. The router does not support the orderwire channel, and hence sends this byte continuously.
- **f1**, **f2**, **z3**, **z4**—SONET/SDH overhead bytes. For these bytes, ***value*** can be from **0** through **255**. The default value is **0x00**.
- **s1**—Synchronization message SONET/SDH overhead byte. This byte is normally controlled as a side effect of the system reference clock configuration and the state of the external clock coming from an interface if the system reference clocks have been configured to use an external reference. For the s1 byte, ***value*** can be from **0** through **255**.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- SONET/SDH Header Byte Values Overview on page 28

Understand the SONET Frame Checksum

Problem

Description: The SONET frame checksum is a calculation that is added to a frame for error control purposes. SONET frame checksum is used in High-Level Data Link Control (HDLC), Frame Relay, and other data-link layer protocols. For example, Router A calculates the frame check sequence (FCS) and adds it to the outgoing message. Router B, on receiving the message recalculates the FCS and compares it to the FCS from Router A. If there is a difference, both sides of the connection might not match in relation to the FCS configuration.

Solution

If you are having problems with a connection, check whether the FCS matches on both sides of the connection. To check the SONET frame checksum, see "Checking the SONET Frame Checksum" on page 181.

After you have checked the FCS and determined that a problem exists, you must configure a SONET frame checksum. For more information, see "Configuring a SONET Frame Checksum" on page 185.

Related Documentation

- Checklist for Checking the SONET Frame Checksum on page 180

Configuring the SONET/SDH Frame Checksum

By default, SONET/SDH interfaces use a 16-bit frame checksum. You can configure a 32-bit checksum, which provides more reliable packet verification. However, some older equipment might not support 32-bit checksums.

To configure a 32-bit checksum:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options
```

2. Configure the **fcs** option with 32-bit checksum.

```
[edit interfaces interface-name sonet-options]
user@host# set fcs 32
```

To return to default 16-bit frame checksum:

1. In configuration mode, go to the **[edit]** hierarchy level.

```
user@host# edit
```

2. Delete the **fcs** option.

```
[edit]
user@host# delete interfaces so-fpc/pic/port sonet-options fcs 32
```

To configure 16-bit frame checksum explicitly:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options
```

2. Configure the **fcs** option a 16-bit checksum explicitly.

```
[edit interfaces interface-name sonet-options]
user@host# set fcs 16
```

On a channelized OC12 interface, the **sonet-options fcs** statement is not supported. To configure the frame checksum sequence (FCS) on each DS3 channel, you must include the **t3-options fcs** statement in the configuration for each channel.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8

Configuring SONET/SDH Loopback Capability to Identify a Problem as Internal or External

- Configuring SONET/SDH Loopback Capability on page 32
- Displaying SONET/SDH Loopback Capability Configuration on page 33
- Determining Whether the Problem Is Internal or External with Loopback Capability on page 34

Configuring SONET/SDH Loopback Capability

To configure loopback capability on a SONET/SDH interface:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options
```

2. Configure the **loopback** option as local loopback, remote loopback, or payload.

NOTE: To exchange BERT patterns between a local router and a remote router, include the **loopback remote** statement in the interface configuration at the remote end of the link. From the local router, issue the **test interface** command.

```
[edit interfaces interface-name sonet-options]
user@host# set loopback (local | remote | payload)
```

For more information about configuring BERT, see *Configuring Interface Diagnostics Tools to Test the Physical Layer Connections*. For more information about using operational mode commands to test interfaces, see the CLI Explorer.

To turn off the loopback capability:

1. In configuration mode, go to the **[edit]** hierarchy level.

```
user@host# edit
```

2. Remove the **loopback** option to turn off the loopback capability.

```
[edit ]
user@host# delete interfaces so-fpc/pic/port sonet-options loopback
```

For channel 0 on channelized interfaces only, you can include the **loopback** statement at the **[edit interfaces *interface-name interface-type*-options]** hierarchy level. The loopback setting configured for channel 0 applies to all channels on the channelized interface. The **loopback** statement is ignored if you include it at this hierarchy level in the configuration of other channels. To configure loopbacks on individual channels, you must include the ***channel-type*-options loopback** statement in the configuration for each channel. This allows each channel to be put in loopback mode independently.

For example, for DS3 channels on a channelized OC12 interface, the **sonet-options loopback** statement is supported only for channel 0; it is ignored if included in the configuration for channels 1 through 11. The SONET/SDH loopback configured for channel 0 applies to all 12 channels equally. To configure loopbacks on the individual DS3 channels, you must include the **t3-options loopback** statement in the configuration for each channel. This allows each DS3 channel can be put in loopback mode independently.

Displaying SONET/SDH Loopback Capability Configuration

Purpose To display the loopback capability configuration in SONET/SDH.

Action To display loopback capability, for example on the so-1/0/0 interface, perform the following steps:

1. In configuration mode, go to the **[edit interfaces *interface-name*]** hierarchy level, where the *interface-name* is so-1/0/0.

```
[edit]
user@host# edit interfaces so-1/0/0
```

2. Display the loopback capability by issuing the **show** operational mode command.

```
[edit interfaces so-1/0/0]
user@host# show
```

3. The following output is displayed.

```
no-keepalives;
encapsulation cisco-hdlc;
sonet-options {
 loopback local;
}
unit 0 {
 family inet {
  address 10.100.100.1/24;
 }
}
```

With this configuration, the link stays up, so you can loop ping packets to a remote router. The **loopback local** statement causes the interface to loop within the PIC just before the data reaches the transceiver.

Determining Whether the Problem Is Internal or External with Loopback Capability

Problem **Description:** Problem is internal or external.

Solution To determine whether a problem is internal or external, you have to loop packets on both the local and the remote router using the loopback capability.

To loop packets on both the local and the remote router, perform the following steps:

1. In configuration mode, go to the **[edit interfaces *interface-name*]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options]
```

2. Configure the **no-keepalives** and **encapsulation cisco-hdlc** options.

```
[edit interfaces interface-name]
user@host# set no-keepalives
user@host# set encapsulation cisco-hdlc
```

3. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options]
```

4. Configure the **loopback local** option. This option causes the interface to loop within the PIC just before the data reaches the transceiver.

```
[edit interfaces interface-name sonet-options]
user@host# set loopback local
```

You can also determine whether there is an internal problem or an external problem by checking the error counters in the output of the **show interface *interface-name* extensive** operational mode command.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8

SONET/SDH Path Trace Identifier Overview

The SONET/SDH *path trace identifier* is a text string that identifies the circuit. If the string contains spaces, enclose it in quotation marks.

By default, the Junos OS uses the router and interface names for the path trace identifier. Depending on the router and interface names, the default path trace identifier might be longer then 16 bytes. The SDH standards define a maximum 16-byte path trace. For this reason, the default path trace identifier might be truncated in SDH mode. You can prevent the path trace identifier from being truncated in SDH mode by configuring a path trace identifier that is under 16-bytes long. In SONET mode, a path trace identifier can be up to 64-bytes long.

For DS3 channels on a channelized OC12 interface, you can configure a unique path trace for each of the 12 channels. Each path trace can be up to 16 bytes. For channels on a channelized OC12 intelligent queuing (IQ and IQE) interface, each path trace can be up to 64 bytes.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring the SONET/SDH Path Trace Identifier for a Circuit on page 36

Configuring the SONET/SDH Path Trace Identifier for a Circuit

To configure path trace identifier:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level.

```
[edit]
user@host# edit interfaces so-fpc/pic/port sonet-options
```

2. Configure path trace identifier.

   A common convention is to use the circuit identifier as the path trace identifier.

```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set path-trace trace-string
```

To display the local router's path trace identifier, issue the **show interfaces** operational mode command on the remote router.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- SONET/SDH Path Trace Identifier Overview on page 35

SONET/SDH HDLC Payload Scrambling Overview

SONET/SDH HDLC payload scrambling, which is enabled by default, provides better link stability. Both sides of a connection must either use or not use scrambling.

NOTE: HDLC payload scrambling conflicts with traffic shaping configured using leaky bucket properties. If you configure leaky bucket properties, you must disable payload scrambling, because the Junos OS rejects configurations that have both features enabled. For more information, see "Configuring Receive and Transmit Leaky Bucket Properties to Reduce Network Congestion" on page 46.

On a channelized OC12 interface, the **sonet-options payload-scrambler** statement is ignored. To configure scrambling on the DS3 channels on the interface, include the **t3-options payload-scrambler** statement in the configuration for each DS3 channel.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring SONET/SDH HDLC Payload Scrambling for Link Stability on page 37

Configuring SONET/SDH HDLC Payload Scrambling for Link Stability

To explicitly enable payload scrambling, perform the following steps:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level, where the *interface-name* is **so-*fpc/pic/port***.

```
[edit]
user@host# edit interfaces so-fpc/pic/port sonet-options
```

2. Configure the **payload-scrambler** option to enable HDLC payload scrambling.

```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set payload-scrambler
```

To disable HDLC payload scrambling:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level, where the *interface-name* is **so-*fpc/pic/port***.

```
[edit]
user@host# edit interfaces so-fpc/pic/port sonet-options
```

2. Configure the **no-payload-scrambler** option to disable HDLC payload scrambling.

```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set no-payload-scrambler
```

To re-enable payload scrambling and to return to the default setting.

1. In configuration mode, go to the **[edit]** hierarchy level.

```
user@host# edit
```

2. To return to the default setting, delete the **no-payload-scrambler** statement from the configuration.

```
[edit]
user@host# delete interfaces so-fpc/pic/port sonet-options no-payload-scrambler
```

On a channelized OC12 interface, the **sonet-options payload-scrambler** statement is ignored. To configure scrambling on the DS3 channels on the interface, include the **t3-options payload-scrambler** statement in the configuration for each DS3 channel.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8

- SONET/SDH HDLC Payload Scrambling Overview on page 36

Configuring the Clock Source on SONET/SDH Interfaces

For interfaces such as SONET/SDH that can use different clock sources, you can configure the source of the transmit clock on each interface. The source can be internal or external. The default source is internal, which means that each interface uses the router's internal Stratum 3 clock.

For DS3 channels on a channelized OC12 interface, the **clocking** statement is supported only for channel 0; it is ignored if included in the configuration of channels 1 through 11. The clock source configured for channel 0 applies to all channels on the channelized OC12 interface. The individual DS3 channels use a gapped 45-MHz clock as the transmit clock.

To configure the loop timing:

1. In configuration mode, go to the **[edit interfaces *interface-name*]** hierarchy level.

```
[edit ]
user@host# [edit interfaces interface-name]
```

2. Include the **clocking external** statement.

```
[edit interfaces interface-name]
clocking external;
```

To explicitly configure line timing on an interface:

1. In configuration mode, go to the **[edit interfaces *interface-name*]** hierarchy level.

```
[edit ]
user@host# [edit interfaces interface-name]
```

2. Include the **clocking internal** statement.

```
[edit interfaces interface-name]
clocking internal;
```

NOTE: On Channelized SONET/SDH PICs, if you set the parent (or the master) controller clock to external, then you must set the child controller clocks to the default value—that is, internal.

For example, on the Channelized STM1 PIC, if the clock on the Channelized STM1 interface (which is the master controller) is set to external, then you must not configure the CE1 interface (which is the child controller) clock to external. Instead you must configure the CE1 interface clock to internal.

Related Documentation

- *Clock Sources on Channelized Interfaces*
- clocking on page 200

Configuring Channelized IQ and IQE SONET/SDH Loop Timing

The **loop-timing** and **no-loop-timing** statements apply only to E1 and T1 interfaces you configure on channelized IQ and IQE PICs. If you attempt to include these statements on any other interface type, they are ignored.

To configure SONET/SDH or DS3-level clocking:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level *or* to the **[edit interfaces ct3-*fpc/pic/port* t3-options]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options
```

```
[edit]
user@host# edit interfaces ct3-fpc/pic/port t3-options
```

2. Configure SONET/SDH or DS3-level clocking. By default, internal clocking (line timing) is used on channelized IQ and IQE interfaces.

```
[edit interfaces interface-name sonet-options]
user@host# set loop-timing
```

```
[edit interfaces ct3-fpc/pic/port t3-options]
user@host# set loop-timing
```

To configure the default line timing explicitly:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level *or* to the **[edit interfaces ct3-*fpc/pic/port* t3-options]**.

```
[edit]
user@host# edit interfaces interface-name sonet-options
```

```
[edit]
user@host# edit interfaces ct3-fpc/pic/port t3-options
```

2. Configure the default line timing explicitly.

```
[edit interfaces interface-name sonet-options]
user@host# set no-loop-timing
```

```
[edit interfaces ct3-fpc/pic/port t3-options]
user@host# set no-loop-timing
```

To configure clocking for all channelized IQ and IQE PICs which is supported on all channels.

1. In configuration mode, go to the **[edit interfaces *type-fpc/pic/port*]** hierarchy level.

```
[edit]
user@host# edit interfaces type-fpc/pic/port
```

2. Configure the **clocking** option. If you do not include the **clocking** statement, the individual interfaces use internal clocking by default.

```
[edit interfaces type-fpc/pic/port]
user@host# set clocking
```

For more information, see *Configuring the Clock Source* and *Clock Sources on Channelized Interfaces*.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- loop-timing on page 226

Damping Shorter Physical Interface Transitions

By default, when an interface changes from being up to being down, or from down to up, this transition is advertised immediately to the hardware and Junos OS. In some situations—for example, when an interface is connected to an add/drop multiplexer (ADM) or wavelength-division multiplexer (WDM), or to protect against SONET/SDH framer holes—you might want to damp interface transitions. This means not advertising the interface's transition until a certain period of time has passed, called the *hold-time*. When you have damped interface transitions and the interface goes from up to down, the down hold-time timer is triggered. Every interface transition that occurs during the hold-time is ignored. When the timer expires and the interface state is still *down*, then the router begins to advertise the interface as being down. Similarly, when an interface goes from down to up, the up hold-time timer is triggered. Every interface transition that occurs during the hold-time is ignored. When the timer expires and the interface state is still *up*, then the router begins to advertise the interface as being up. For information about physical interface damping, see *Physical Interface Damping Overview*.

This task applies to damping shorter physical interface transitions in milliseconds. To damp longer physical interface transitions in seconds, see *Damping Longer Physical Interface Transitions*.

To configure damping of shorter physical interface transitions:

1. Select the interface to damp, where the interface name is ***interface-type-fpc/pic/port***:

   ```
   [edit]
   user@host# edit interfaces interface-name
   ```

2. Configure the hold-time for link up and link down.

   ```
   [edit interfaces interface-name]
   user@host# set hold-time up milliseconds down milliseconds
   ```

The hold time can be a value from 0 through 4,294,967,295 milliseconds. The default value is 0, which means that interface transitions are not damped. Junos OS advertises the transition within 100 milliseconds of the time value you specify.

For most Ethernet interfaces, hold timers are implemented using a one-second polling algorithm. For 1-port, 2-port, and 4-port Gigabit Ethernet interfaces with small form-factor pluggable transceivers (SFPs), hold timers are interrupt-driven.

NOTE: **The hold-time option is not available for controller interfaces.**

Related Documentation

- *Physical Interface Damping Overview*
- *Damping Longer Physical Interface Transitions*

- SONET/SDH Defect Hold Times for Damping Interface Transitions Overview on page 59
- Configuring SONET/SDH Defect Triggers on page 60
- **hold-time on page 220**

Configuring SONET Options for 10-Gigabit Ethernet Interfaces

The 10-Gigabit Ethernet IQ2 and IQ2-E PICs are supported on the M120, M320, and T Series routers. The 10-Gigabit Ethernet LAN/WAN PICs are supported on the T4000 routers. These PICs provides external interfaces running at 10 Gbps. The interface operates in either LAN PHY or WAN PHY mode. When the external interface is running in WAN PHY mode, it uses the WIS sublayer to transport 10-Gigabit Ethernet frames in an OC192c SONET payload, and can interoperate with SONET section or line level repeaters. This creates an advantage when the interface is used for long-distance, point-to-point 10-Gigabit Ethernet links.

When the external interface is running in WAN PHY mode, you can configure specific physical SONET options. When WAN PHY mode is configured on an interface, the following SONET options are supported:

- Loopback (local and remote)
- Path trace
- Trigger options

To configure SONET options for 10-Gigabit Ethernet Interfaces:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level, where the *interface-name* is **so-*fpc/pic/port***.

   ```
   [edit]
   user@host# edit interfaces so-fpc/pic/port sonet-options
   ```

2. Configure a loopback connection.

   ```
   [edit interfaces so-fpc/pic/port sonet-options]
   user@host# set loopback (local | payload | remote)
   ```

3. Configure a path trace identifier, which is a text string that identifies the circuit.

   ```
   [edit interfaces so-fpc/pic/port sonet-options]
   user@host# set path-trace trace-string
   ```

4. Configure SONET/SDH defect triggers as either ignore or hold time.

   The defect triggers can be ignored. By default all SONET/SDH defect triggers are honored if you do not include the **trigger defect ignore** statement.

You can apply up and down hold times to SONET/SDH defect trigger. When a defect is detected the interface is marked down immediately and when the defect becomes absent the interface is marked up immediately if you do not include the **trigger defect hold-time** statement.

```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set trigger defect ignore
user@host# set trigger defect hold-time up milliseconds down milliseconds
```

5. Configure the **mpls** option to process incoming IP packets that have MPLS labels for passive monitoring on ATM and SONET/SDH interfaces and 10-Gigabit Ethernet interfaces in WAN PHY mode.

```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set mpls
```

6. Configure the **pop-all-labels** option to remove up to two MPLS labels from incoming IP packets in passive monitoring.

```
[edit interfaces so-fpc/pic/port sonet-options mpls]
user@host# set pop-all-labels
```

7. Configure the **required-depth** option as either **1** or **2** in the **pop-all-labels** statement. to specify the number of MPLS labels an incoming packet must have for the pop-all-labels statement to take effect. If you include the **required-depth 1** statement, the **pop-all-labels** statement takes effect for incoming packets with one label only. If you include the **required-depth 2** statement, the **pop-all-labels** statement takes effect for incoming packets with two labels only.

```
[edit interfaces so-fpc/pic/port sonet-options mpls pop-all-labels]
user@host# set required-depth
```

For information about using the **mpls** statement, see "Enabling Packet Flow Monitoring on SONET/SDH Interfaces" on page 112.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- SONET/SDH Interfaces Overview on page 3

Configuring 4-Port OC192 PIC to Operate in OC768-over-OC192 Mode

In the 4-port OC192 PIC with OC768-over-OC192 mode, four OC192 links are aggregated into one OC768 link with one logical interface. This single interface achieves data rates of approximately 40 Gbps. OC768 optics are expensive, and most long-distance networks currently use fiber optics and regenerators that cannot carry OC768 SONET. When you create an OC768 pipe as a large data pipe running over existing infrastructures, you transfer network traffic without link bonding or load sharing over parallel links. Load sharing is automatically accomplished in the Junos OS using a proprietary method, and does not need to be manually configured.

The following limitations apply to OC768-over-OC192 mode:

- The maximum difference in delay between all links in the bundle is 8 µ (microseconds), equivalent to approximately 1.5 km maximum difference in length between the longest and shortest fiber pairs.
- If a single link in the bundle fails, the whole bundle fails. If link redundancy is required, implement an aggregated SONET/SDH bundle instead.
- Only routers that contain 4-port OC192 PICs can operate in OC768-over-OC192 mode.

To configure the 4-port OC192 PIC to operate in OC768-over-OC192 mode:

1. In the configuration mode go to the **[edit chassis]** hierarchy level.

   ```
   [edit]
   user@host# edit chassis
   ```

2. Configure the aggregate-ports.

   - On standalone T640, T1600, and T4000 routers, include the **aggregate-ports** statement at the **[edit chassis fpc *slot-number* pic *pic-number*]** hierarchy level.

     ```
     [edit chassis]
     user@host# edit fpc slot-number pic pic-number
     user@host# set aggregate-ports
     ```

   - On TX Matrix and TX Matrix Plus router, configure the **aggregate-ports** statement at the **[edit chassis lcc *lcc-number* fpc *slot-number* pic *pic-number*]** hierarchy level.

     ```
     [edit chassis]
     user@host# edit lcc lcc-number fpc slot-number pic pic-number
     user@host# set aggregate-ports
     ```

3. To verify the configuration, execute the **show interfaces so-*fpc/pic/port* extensive** operational command. When this command is used for the 4-port OC192 PIC configured for OC768-over-OC192 mode, only port 0 (**so-*fpc/pic*/0**) is displayed. This port is displayed as **OC768**.

NOTE: When you configure the 4-port OC192 PIC for OC768-over-OC192 mode, only port 0 (the first port) needs be configured as the OC768 port.

Related Documentation

- *aggregate-ports*

Receive and Transmit Leaky Bucket Properties Overview

Congestion control is particularly difficult in high-speed networks with high volumes of traffic. When congestion occurs in such a network, it is usually too late to react. You can avoid congestion by regulating the flow of packets into your network. Smoother flows prevent bursts of packets from arriving at (or being transmitted from) the same interface and causing congestion.

For all interface types except ATM, Fast Ethernet, Gigabit Ethernet, and channelized IQ and IQE, you can configure leaky bucket properties, which allow you to limit the amount of traffic received on and transmitted by a particular interface. You effectively specify what percentage of the interface's total capacity can be used to receive or transmit packets. You might want to set leaky bucket properties to limit the traffic flow from a link that is known to transmit high volumes of traffic.

NOTE: Instead of configuring leaky bucket properties, you can limit traffic flow by configuring policers. Policers work on all interfaces. For more information, see the *Routing Policies, Firewall Filters, and Traffic Policers Feature Guide*.

The leaky bucket is used at the host-network interface to allow packets into the network at a constant rate. Packets might be generated in a bursty manner, but after they pass through the leaky bucket, they enter the network evenly spaced. In some cases, you might want to allow short bursts of packets to enter the network without smoothing them out. By controlling the number of packets that can accumulate in the bucket, the **threshold** property controls burstiness. The maximum number of packets entering the network in **t** time units is **threshold + rate * t**.

By default, leaky buckets are disabled and the interface can receive and transmit packets at the maximum line rate.

For each DS3 channel on a channelized OC12 interface, you can configure unique receive and transmit buckets.

NOTE: HDLC payload scrambling conflicts with traffic shaping configured using leaky bucket properties. If you configure leaky bucket properties, you must disable payload scrambling, because the Junos OS rejects configurations that have both features enabled. For more information, see "Configuring SONET/SDH HDLC Payload Scrambling for Link Stability" on page 37.

Related Documentation

- Configuring Receive and Transmit Leaky Bucket Properties to Reduce Network Congestion on page 46
- SONET/SDH Interfaces Overview on page 3
- receive-bucket on page 246
- transmit-bucket on page 257

Configuring Receive and Transmit Leaky Bucket Properties to Reduce Network Congestion

You can configure leaky bucket properties which allow you to limit the amount of traffic received on and transmitted by a particular interface. You can specify what percentage of the interface's total capacity can be used to receive or transmit packets. You might want to set leaky bucket properties to limit the traffic flow from a link that is known to transmit high volumes of traffic.

To configure leaky bucket properties:

1. In configuration mode, go to the **[edit interfaces *interface-name*]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name
```

2. Configure the **receive-bucket** statement.

```
[edit interfaces interface-name]
user@host# set receive-bucket
```

3. Configure the **overflow** option, the **threshold** option, and the **rate** option for the receive leaky bucket, which specifies what percentage of the interface's total capacity can be used to receive packets.

```
[edit interfaces interface-name receive-bucket]
user@host# set overflow (discard | tag)
user@host# set threshold bytes
user@host# set rate percentage
```

4. Configure the **transmit-bucket** statement.

```
[edit interfaces interface-name]
user@host# set transmit-bucket
```

5. Configure the **overflow** option, the **threshold** option, and the **rate** option for the transmit leaky bucket, which specifies what percentage of the interface's total capacity can be used to transmit packets.

```
[edit interfaces interface-name transmit-bucket]
user@host# set overflow (discard | tag)
user@host# set threshold bytes
user@host# set rate percentage
```

Related Documentation

- Receive and Transmit Leaky Bucket Properties Overview on page 45
- SONET/SDH Interfaces Overview on page 3
- receive-bucket on page 246
- transmit-bucket on page 257

CHAPTER 3

Configuring Interface Encapsulation on SONET/SDH Interfaces

- Understanding Interface Encapsulation on SONET/SDH Interfaces on page 49
- Configuring Interface Encapsulation on SONET/SDH Interfaces on page 52
- PPP Support on SONET/SDH Interfaces on page 55
- Configuring PPP Support on SONET/SDH Interfaces on page 55

Understanding Interface Encapsulation on SONET/SDH Interfaces

Point-to-Point Protocol (PPP) encapsulation is the default encapsulation type for physical interfaces. You need not configure encapsulation for any physical interfaces that support PPP encapsulation. Note that if you do not configure encapsulation, PPP is used by default.

For physical interfaces that do not support PPP encapsulation, you must configure an encapsulation to use for packets transmitted on the interface. You can optionally configure an encapsulation on a logical interface, which is the encapsulation used within certain packet types.

When you configure a point-to-point encapsulation (such as PPP or Cisco HDLC) on a physical interface, the physical interface can have only one logical interface (that is, only one **unit** statement) associated with it. When you configure a multipoint encapsulation (such as Frame Relay), the physical interface can have multiple logical units, and the units can be either point to point or multipoint. Use PPP if you are running Cisco IOS Release 12.0 or later. If you need to run Cisco HDLC, the Junos OS automatically configures an ISO family MTU of 4469 in the router. This is due to an extra byte of padding used by Cisco.

NOTE: **When the encapsulation type is set to Cisco-compatible Frame Relay encapsulation, ensure that the LMI type is set to ANSI or Q933-A.**

For more information about physical interface encapsulation, see *Configuring Interface Encapsulation on Physical Interfaces*.

Understanding Encapsulation on a Physical SONET/SDH Interface

For SONET/SDH interfaces, the physical interface encapsulation can be one of the following:

- Point-to-Point Protocol (PPP) on page 50
- Cisco HDLC on page 50
- Frame Relay on page 50
- Frame Relay Ether Type on page 51

Point-to-Point Protocol (PPP)

PPP encapsulation is defined in RFC 1661, *The Point-to-Point Protocol (PPP) for the Transmission of Multiprotocol Datagrams over Point-to-Point Links*. PPP is the default encapsulation type for physical interfaces. Two related versions are supported:

- Circuit cross-connect (CCC) version (**ppp-ccc**)—The logical interfaces do not require an encapsulation statement. When you use this encapsulation type, you can configure the **ccc** family only.
- Translational cross-connect (TCC) version (**ppp-tcc**)—Similar to CCC and has the same configuration restrictions, but used for circuits with different media on either side of the connection.

Cisco HDLC

E1, E3, SONET/SDH, T1, and T3 interfaces can use Cisco HDLC encapsulation. Two related versions are supported:

- CCC version (**cisco-hdlc-ccc**)—The logical interfaces do not require an encapsulation statement. When you use this encapsulation type, you can configure the **ccc** family only.
- TCC version (**cisco-hdlc-tcc**)—Similar to CCC and has the same configuration restrictions, but used for circuits with different media on either side of the connection.

Frame Relay

Defined in RFC 1490, *Multiprotocol Interconnect over Frame Relay*. E1, E3, SONET/SDH, T1, and T3 interfaces can use Frame Relay encapsulation. Two related versions are supported:

- CCC version (**frame-relay-ccc**)—The same as standard Frame Relay for DLCIs 0 through 511. DLCIs 512 through 1022 are dedicated to CCC. This numbering restriction does not apply to IQ and IQE interfaces. The logical interface must also have **frame-relay-ccc** encapsulation.
- TCC version (**frame-relay-tcc**)—Similar to Frame Relay CCC and has the same configuration restrictions, but used for circuits with different media on either side of the connection.

Frame Relay Ether Type

Physical interfaces can use Frame Relay ether type (**frame-relay-ether-type** encapsulation for compatibility with Cisco Frame Relay. IETF Frame Relay encapsulation identifies the payload format using NLPID and SNAP formats. Cisco-compatible Frame Relay encapsulation uses the Ethernet type to identify the type of payload. Two related versions are supported:

- TCC version (**frame-relay-ether-type-tcc**)—Cisco-compatible Frame Relay for DLCIs 0 through 511. DLCIs 512 through 1022 are dedicated to TCC. This numbering restriction does not apply to IQ and IQE interfaces. This encapsulation is used for circuits with different media on either side of the connection.
- Extended TCC version (**extended-frame-relay-ether-type-tcc**)—This encapsulation allows you to dedicate Cisco-compatible Frame Relay TCC for DLCIs 1 through 1022. This encapsulation is used for circuits with different media on either side of the connection. All ether type TCC encapsulation is supported on the same PICs as non-ether type Frame Relay TCC encapsulation.

Understanding Encapsulation on a Logical SONET/SDH Interface

Generally, you configure an interface's encapsulation at the **[edit interfaces interface-name]** hierarchy level. However, for Frame Relay encapsulation, you can also configure the encapsulation type that is used inside the Frame Relay packet itself. To configure an encapsulation on a logical SONET/SDH interface, see "Configuring Interface Encapsulation on SONET/SDH Interfaces" on page 52.

NOTE:

- With the **atm-nlpid**, **atm-cisco-nlpid**, and **atm-vc-mux** encapsulations, you can configure the **inet** family only.
- With the circuit cross-connect (CCC) encapsulations, you cannot configure a family on the logical interface.
- A logical interface cannot have **frame-relay-ccc** encapsulation unless the physical device also has **frame-relay-ccc** encapsulation. A logical interface cannot have **frame-relay-tcc** encapsulation unless the physical device also has **frame-relay-tcc** encapsulation.

  You must assign this logical interface a DLCI from 512 through 1022. This numbering restriction does not apply to IQ and IQE interfaces. You must configure the logical interface as point-to-point.

The ATM encapsulations are defined in RFC 2684, *Multiprotocol Encapsulation over ATM Adaptation Layer 5*.

For more information about logical interface encapsulation, see *Configuring Interface Encapsulation on Logical Interfaces*.

Related Documentation

- Configuring Interface Encapsulation on SONET/SDH Interfaces on page 52

Configuring Interface Encapsulation on SONET/SDH Interfaces

You can configure encapsulation on a physical SONET/SDH interface and on a logical SONET/SDH interface. SONET/SDH interfaces can use either PPP or Cisco HDLC encapsulation. Use PPP if you are running Cisco IOS Release 12.0 or later. If you need to run Cisco HDLC, the Junos OS automatically configures an ISO family MTU of 4469 in the router. This is due to an extra byte of padding used by Cisco.

The following tasks explain configuring encapsulation on a physical SONET/SDH interface, configuring frame relay encapsulation on a logical SONET/SDH interface, and configuring Point-to-Point Protocol encapsulation to get a SONET/SDH OC3 or OC12 interface up and running:

- Configuring the Encapsulation on a Physical SONET/SDH Interface on page 52
- Displaying the Encapsulation on a Physical SONET/SDH Interface on page 53
- Configuring the Frame Relay Encapsulation on a Logical SONET/SDH Interface on page 53
- Configuring the Point-to-Point Protocol Encapsulation on a Physical SONET/SDH Interface on page 54

Configuring the Encapsulation on a Physical SONET/SDH Interface

To configure encapsulation on a physical SONET/SDH interface:

1. In configuration mode, go to the **[edit interfaces so-*fpc/pic/port*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces so-fpc/pic/port
   ```

2. Configure the encapsulation as **cisco-hdlc**, **cisco-hdlc-ccc**, **cisco-hdlc-tcc**, **frame-relay**, **frame-relay-ccc**, **frame-relay-tcc**, **frame-relay-ether-type**, **frame-relay-ether-type-tcc**, **extended-frame-relay-ether-type-tcc**, **ppp**, **ppp-ccc**, or as **ppp-tcc**.

   ```
   [edit interfaces mo-fpc/pic/port]
   user@host# set encapsulation encapsulation-type
   ```

When you configure a point-to-point encapsulation (such as PPP or Cisco HDLC) on a physical interface, the physical interface can have only one logical interface (that is, only one **unit** statement) associated with it. When you configure a multipoint encapsulation (such as Frame Relay), the physical interface can have multiple logical units, and the units can be either point to point or multipoint. Use PPP if you are running Cisco IOS Release 12.0 or later. If you need to run Cisco HDLC, the Junos OS automatically configures an ISO family MTU of 4469 in the router. This is due to an extra byte of padding used by Cisco.

NOTE: When the encapsulation type is set to Cisco-compatible Frame Relay encapsulation, ensure that the LMI type is set to ANSI or Q933-A.

For more information about physical interface encapsulation, see *Configuring Interface Encapsulation on Physical Interfaces*.

Displaying the Encapsulation on a Physical SONET/SDH Interface

Purpose To display the configured encapsulation and its associated set options on a physical SONET/SDH interface when the following are set at the **[edit interfaces *interface-name*]** hierarchy level:

- interface-name—so-7/0/0
- Encapsulation—**ppp**
- Unit—0
- Family—**inet**
- Address—192.168.1.113/32
- Destination—192.168.1.114
- Family—**iso** and **mpls**

Action Run the **show** command at the **[edit interfaces *interface-name*]** hierarchy level.

```
[edit interfaces so-7/0/0]
user@host# show
encapsulation ppp;
unit 0 {
   point-to-point;
   family inet {
      address 192.168.1.113/32 {
         destination 192.168.1.114;
      }
   }
   family iso;
   family mpls;
}
```

Meaning The configured encapsulation and its associated set options are displayed as expected. Note that the second set of two **family** statements allow IS-IS and MPLS to run on the interface.

Configuring the Frame Relay Encapsulation on a Logical SONET/SDH Interface

Generally, you configure an interface's encapsulation at the **[edit interfaces *interface-name*]** hierarchy level. However, for Frame Relay encapsulation, you can also configure the encapsulation type that is used inside the Frame Relay packet itself.

To configure Frame Relay encapsulation on a logical SONET/SDH interface:

1. In configuration mode, go to the **[edit interfaces so-*fpc/pic/port* unit *logical-unit-number*]** hierarchy level.

```
[edit]
user@host# edit interfaces so-fpc/pic/port unit logical-unit-number
```

2. Configure the encapsulation as **frame-relay-ccc**, **frame-relay-tcc**, **frame-relay-ether-type**, or as **frame-relay-ether-type-tcc**.

```
[edit interfaces so-fpc/pic/port unit logical-unit-number]
user@host# set encapsulation encapsulation-type
```

The ATM encapsulations are defined in RFC 2684, *Multiprotocol Encapsulation over ATM Adaptation Layer 5*.

For more information about logical interface encapsulation, see *Configuring Interface Encapsulation on Logical Interfaces*.

Configuring the Point-to-Point Protocol Encapsulation on a Physical SONET/SDH Interface

SONET/SDH interfaces can use either PPP or Cisco HDLC encapsulation. Use PPP if you are running Cisco IOS Release 12.0 or later. If you need to run Cisco HDLC, the Junos OS automatically configures an ISO family MTU of 4469 in the router. This is due to an extra byte of padding used by Cisco. The following configuration, which uses PPP encapsulation, is sufficient to get a SONET/SDH OC3 or OC12 interface up and running:

To configure PPP encapsulation on a physical SONET/SDH interface:

1. In configuration mode, go to the **[edit interfaces so-*fpc/pic/port*]** hierarchy level.

```
[edit]
user@host# edit interfaces so-fpc/pic/port
```

2. Configure the encapsulation as **ppp**.

```
[edit interfaces so-fpc/pic/port]
user@host# set encapsulation ppp
```

3. Configure local IP address and remote IP address with family inet.

```
[edit interfaces so-fpc/pic/port]
user@host# set unit 0 family inet address local-address destination remote-address
```

Related Documentation

- Understanding Interface Encapsulation on SONET/SDH Interfaces on page 49

PPP Support on SONET/SDH Interfaces

RFC 2615, *PPP over SONET/SDH*, requires certain C2 header byte and FCS settings that vary from the default values configured in accordance with RFC 1619 (the previous version of RFC 2615). The newer values are optimized for stronger error detection, especially when combined with payload scrambling at higher bit rate links.

Table 11 on page 55 shows the older (RFC 1619) and newer (RFC 2615) values, together with the Juniper Networks default values.

Table 11: SONET/SDH Default Settings

Value	RFC 1619	Default	RFC 2615
SONET/SDH C2 header byte	0XCF	0XCF	0X16
Frame checksum (bit)	16	16	32
Payload scrambling	n/a	Enabled	Enabled

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring PPP Support on SONET/SDH Interfaces on page 55
- Understanding Interface Encapsulation on SONET/SDH Interfaces on page 49
- SONET/SDH Interfaces Overview on page 3

Configuring PPP Support on SONET/SDH Interfaces

RFC 2615, *PPP over SONET/SDH*, requires certain C2 header byte and FCS settings that vary from the default values configured in accordance with RFC 1619 (the previous version of RFC 2615). The newer values are optimized for stronger error detection, especially when combined with payload scrambling at higher bit rate links.

To enable support for the RFC 2615 features:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options
```

2. Configure the **rfc-2615** option.

```
[edit interfaces interface-name sonet-options]
user@host# set rfc-2615
```

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- PPP Support on SONET/SDH Interfaces on page 55
- Configuring Interface Encapsulation on SONET/SDH Interfaces on page 52
- SONET/SDH Interfaces Overview on page 3

CHAPTER 4

Configuring How SONET/SDH Interface Defects Are Handled

- SONET/SDH Defect Triggers Overview on page 57
- SONET/SDH Defect Hold Times for Damping Interface Transitions Overview on page 59
- Configuring SONET/SDH Defect Triggers on page 60

SONET/SDH Defect Triggers Overview

A trigger is a defect alarm that causes a physical interface to be marked down. By default, all defects are honored with no hold time. For SONET/SDH and ATM over SONET/SDH interfaces only, you can configure individual triggers to ignore a defect, honor a defect, and apply up and down hold timers to the defect.

Table 12 on page 57 lists the defects you can configure.

Table 12: SONET/SDH and ATM Active Alarms and Defects

Alarm	Description
Physical	
pll	Phase-locked loop out of lock
lol	Loss of light
Section	
lof	Loss of frame
los	Loss of signal
Line	
ais-l	Alarm indication signal—line
rfi-l	Remote failure indication—line
ber-sd	Bit error rate defect-signal degrade
ber-sf	Bit error rate fault-signal fail

Table 12: SONET/SDH and ATM Active Alarms and Defects (continued)

Alarm	Description
Path	
ais-p	Alarm indication signal—path
locd (ATM only)	Loss of cell delineation
lop-p	Loss of pointer—path
plm-p	Payload (signal) label mismatch
rfi-p	Remote failure indication—path
uneq-p	Path unequipped

If you configure a defect to be ignored, that defect does not contribute to the interface being marked down or up.

After you configure a defect to be ignored, the Junos OS reevaluates the state of the defect on the interface. If the defect is outstanding and has caused the interface to be marked down, the interface is marked up.

When you configure a trigger on a low-level defect—for example, an LOS—only the low-level defect is affected. Higher-level defects that might result from the lower-level defect are not affected by the low-level trigger configuration. Therefore, you must configure higher-level defects as well.

You can prevent a loss of signal (LOS) from bringing down an interface. An LOS can lead to the following defects:

- AIS-L
- LOF
- PLL
- RFI-L
- RFI-P

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring SONET/SDH Defect Triggers on page 60
- SONET/SDH Interfaces Overview on page 3

SONET/SDH Defect Hold Times for Damping Interface Transitions Overview

By default, an interface is marked down as soon as a defect is detected, and is marked up as soon as the defect is absent. You might want to apply hold times to defects for the following reasons:

- To prevent route flaps from happening before a defect has been outstanding for a longer period than would be expected for an Automatic Protection Switching (APS) cutover
- To reduce the number of interface transitions

NOTE: On M Series and T Series routers with Channelized SONET IQ PICs and Channelized SONET IQE PICs, the SONET defect alarm trigger **hold-time** statement is not supported.

When you apply a "down" hold time to a defect, the defect must be present for at least the hold-time period before the interface is marked down. When you apply an "up" hold time to a defect, the defect must remain absent for at least the hold-time period before the interface is marked up, assuming no other defect is outstanding.

When a hold-down timer is configured and the interface goes from up to down, the down hold-time timer is triggered. Every interface transition that occurs during the hold-time is ignored. When the timer expires and the interface state is still *down*, then the router begins to advertise the interface as being down. Similarly, when a hold-up timer is configured and an interface goes from down to up, the up hold-time timer is triggered. Every interface transition that occurs during the hold-time is ignored. When the timer expires and the interface state is still *up*, then the router begins to advertise the interface as being up.

When you configure defect hold times, you should note the following:

- You can configure an up hold time, a down hold time, or both.
- Each interface on a SONET/SDH PIC controls certain aspects of the SONET/SDH overhead. For example, when you configure an OC48 PIC to be nonconcatenated, four interfaces are created. Each interface has its own path overhead. However, all four path interfaces share the same physical, section, and line overhead. This means the following:
  - Each interface's path trigger configuration is honored.
  - The physical, section, and line trigger configuration for the primary interface (**so-*fpc/pic/slot*:0**) is applied to all four interfaces.

Therefore, if you configure the **so-*fpc/pic/slot*:0** interface to have a hold time for the LOS trigger, when an LOS event occurs, all four interfaces remain up until the trigger expires, and then all four interfaces are marked down.

- The hold timers on the SONET/SDH defects are applied in addition to any other hold timers you configure on the interface. For example, if an interface is up and you configure a SONET/SDH trigger down hold time of 100 milliseconds and an interface down hold time of 250 milliseconds, when the SONET/SDH defect occurs, the SONET/SDH trigger timer starts. After 100 milliseconds, assuming the defect is still present, the SONET/SDH defect starts the 250 millisecond down timer. After this has expired and again assuming the defect is still outstanding, the interface will be marked down. For more information about interface hold timers, see "Damping Shorter Physical Interface Transitions" on page 41.
- Some defects are reported through a periodic poll (once every second). For these defects, there could be up to one second lost before the defect is detected and the hold timer is started. The hold timer expires in precisely the amount of time configured. At that point, the existence of the defect is checked again and the interface is marked up or down accordingly. These defects are as follows:
  - lol
  - pll
  - ber-sf
  - ber-sd

BEST PRACTICE:

We recommend the following settings:

- Configure SONET/SDH defect timers on no more than 64 interfaces per FPC.
- Configure a combined up hold time and down hold time for a SONET/SDH defect to be at least 100 milliseconds.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring SONET/SDH Defect Triggers on page 60
- SONET/SDH Interfaces Overview on page 3

Configuring SONET/SDH Defect Triggers

You can configure SONET/SDH defect triggers as either ignore or hold time. The following topics explain defect triggers in detail.

- Configuring SONET/SDH Defect Triggers to Be Ignored on page 61
- Configuring SONET/SDH Defect Hold Times on page 61
- Displaying the Configuration Where the SONET/SDH Defects to be Ignored are Listed on page 61

Configuring SONET/SDH Defect Triggers to Be Ignored

A trigger is a defect alarm that causes a physical interface to be marked down. By default, all defects are honored with no hold time. For SONET/SDH and ATM over SONET/SDH interfaces only, you can configure individual triggers to ignore a defect, honor a defect, and apply up and down hold timers to the defect.

To configure defects to be ignored:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options trigger]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options trigger
```

2. Configure the **defect ignore** option to turn off the loopback capability.

```
[edit interfaces interface-name sonet-options trigger]
user@host# set defect ignore
```

Configuring SONET/SDH Defect Hold Times

To configure hold timers:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options trigger]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options trigger
```

2. Configure the **hold-time** statement with **up** and **down** options in milliseconds ranging from 1 through 65,534 milliseconds.

```
[edit interfaces interface-name sonet-options trigger]
user@host# set defect hold-time up milliseconds down milliseconds
```

Displaying the Configuration Where the SONET/SDH Defects to be Ignored are Listed

Purpose To display the configuration where the SONET/SDH defects to be ignored are listed.

Action To display the defects in an interface, for example on so-1/0/0 interface, perform the following steps:

1. In configuration mode, go to the **[edit interfaces so-1/0/0 sonet-options trigger]** hierarchy level.

```
[edit]
user@host# edit interfaces so-1/0/0 sonet-options trigger
```

2. Issue the **show defect** operational mode command.

```
[edit interfaces so-1/0/0 sonet-options trigger]
user@host# show defect
```

The following output is displayed:

```
ais-l ignore;
lof ignore;
los ignore;
pll ignore;
rfi-l ignore;
rfi-p ignore;
```

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- SONET/SDH Defect Hold Times for Damping Interface Transitions Overview on page 59
- SONET/SDH Defect Triggers Overview on page 57
- SONET/SDH Interfaces Overview on page 3

CHAPTER 5

Configuring APS and MSP to Protect from Circuit Failures

- Automatic Protection Switching and Multiplex Section Protection Overview on page 64
- Configuring Automatic Protect Switching on page 65
- Basic Automatic Protect Switching Overview on page 68
- Configuring Basic Automatic Protect Switching on page 69
- Example: Configuring Basic APS Support on Routers on page 70
- Configuring Lockout of Protection for SDH Interfaces on page 74
- APS Timers Overview on page 74
- Configuring APS Timers on page 75
- Container Interfaces for APS on SONET Links Overview on page 76
- Configuring Container Interfaces for APS on SONET Links on page 76
- APS Using a Container Interface with ATM Encapsulation Overview on page 81
- Configuring APS Using a Container Interface with ATM Encapsulation on page 81
- Displaying APS Using a Container Interface with ATM Encapsulation on page 82
- APS Load Sharing Between Circuit Pairs Overview on page 84
- Configuring APS Load Sharing on page 85
- Example: Configuring APS Load Sharing Between Circuit Pairs on page 85
- Link PIC Redundancy Overview on page 89
- Configuring Link PIC Redundancy on page 89
- Switching Between the Working and Protect Circuits Overview on page 91
- Configuring Switching Between the Working and Protect Circuits on page 92
- Revertive Mode Overview on page 94
- Configuring Revertive Mode on page 94
- Switching Mode Overview on page 96
- Configuring Switching Mode on page 97

Automatic Protection Switching and Multiplex Section Protection Overview

Automatic Protection Switching (APS) is used by SONET add/drop multiplexers (ADMs) to protect against circuit failures. The Junos implementation of APS allows you to protect against circuit failures between an ADM and one or more routers, and between multiple interfaces in the same router. When a circuit or router fails, a backup immediately takes over.

NOTE: For SDH interfaces, the Junos OS supports multiplex section protection (MSP). You configure MSP with the same CLI statements you use to configure APS.

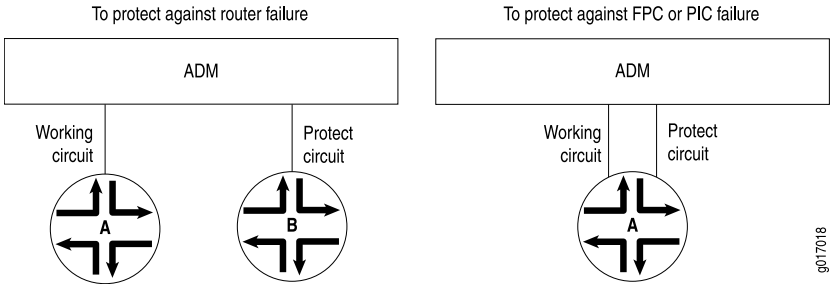
The Junos OS supports APS 1+1 switching, either revertive or nonrevertive mode, and bidirectional mode only (although you can configure interoperation with line-terminating equipment [LTE] provisioned for unidirectional mode). The Junos OS does not transmit identical data on the working and protect circuits, as the APS specification requires for 1+1 switching, but this causes no operational impact.

For DS3 channels on a channelized OC12 interface, you can configure APS on channel 0 only. If you configure APS on channels 1 through 11, it is ignored.

With APS and MSP, you configure two circuits, a *working circuit* and a *protect circuit*. Normally, traffic is carried on the working circuit (that is, the working circuit is the active circuit), and the protect circuit is disabled. If the working circuit fails or degrades, or if the working router fails, the ADM and the protect router switch the traffic to the protect circuit, and the protect circuit becomes the active circuit.

To configure APS or MSP, you configure a working and a protect circuit, as shown in Figure 1 on page 64. To protect against a router failure, you connect two routers to the ADM, configuring one of them as the working router and the second as the protect router. To protect against a PIC or FPC failure, you connect one router to the ADM through both the working and protect circuits, configuring one of the PICs or FPCs as the working circuit and the second as the protect circuit.

Figure 1: APS/MSP Configuration Topologies



NOTE: This implementation of APS is not supported on Layer 2 circuits. For Layer 2 circuits, configure APS by including the **protect-interface** statement. You can include this statement at the following hierarchy levels:

- **[edit logical-systems** *logical-system-name* **protocols l2circuit neighbor** *neighbor-id* **interface** *interface-name***]**
- **[edit protocols l2circuit neighbor** *neighbor-id* **interface** *interface-name***]**

For more information and a configuration example, see the *Junos OS VPNs Library for Routing Devices*.

When configuring the APS **annex-b** option, the APS options *must* be configured as follows:

- **switching-mode** *cannot* be uni-directional
- **revert-time** *cannot* be configured
- **fast-aps-switch** *cannot* be configured
- **lockout** is allowed to be configured
- **wait-to-restore-time** is allowed *only* when Annex-B is configured
- **protect-circuit** *must* be configured
- **working-circuit** *must* be configured

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring Basic Automatic Protect Switching on page 69
- Basic Automatic Protect Switching Overview on page 68
- Example: Configuring Basic APS Support on Routers on page 70
- SONET/SDH Interfaces Overview on page 3

Configuring Automatic Protect Switching

To configure basic Automatic Protection Switching (APS) options:

1. In configuration mode, go to the **[edit interfaces so-*fpc/pic/port* sonet-options aps]** hierarchy level.

```
[edit]
user@host# edit interfaces so-fpc/pic/port sonet-options aps
```

2. Configure the APS interval at which the protect and working routers send packets to their neighbors to advertise that they are operational. A router considers its neighbor to be operational for a period, called the hold time, that is, by default, three times the

advertisement interval. You can set the APS interval from 1 through 65,534 milliseconds. By default, 1000 milliseconds is set.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set advertise-interval milliseconds
```

3. Configure the **annex-b** option for Multiplex Section Protection (MSP) switching on SDH interfaces for M320 and M120 routers only.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set annex-b
```

4. Configure the Automatic Protection Switching (APS) authentication key (password).

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set authentication-key key
```

5. Configure the **fast-aps-switch** option to reduce the Automatic Protection Switching (APS) switchover time in Layer 2 circuits in M320 routers with Channelized OC3/STM1 Circuit Emulation PIC with SFP only.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set fast-aps-switch
```

6. Configure the **force** option to either protect mode or working mode to perform a forced switch between the protect and working circuits. This statement is honored only if there are no higher-priority reasons to switch. It can be overridden by a signal failure on the protect circuit, thus causing a switch to the working circuit.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set force (protect | working)
```

7. Configure the **hold-time** value in milliseconds to determine whether a neighbor APS router is operational where the hold-time value ranges from 1 through 65,354 milliseconds. By default, 3000 milliseconds (3 times the advertisement interval) is set as hold time value.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set hold-time milliseconds
```

8. Configure a lockout of protection, forcing the use of the working circuit and locking out the protect circuit regardless of anything else.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set lockout
```

9. Configure the address of the remote interface when you are configuring one router to be the working router and a second to be the protect router. You can configure this on one or both of the interfaces.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set neighbor address
```

10. Configure load sharing between two working protect circuit pairs where circuit's group name is as configured with the **protect-circuit** or **working-circuit** statement.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set paired-group group-name
```

11. Configure the protect router in an APS circuit pair. When the working interface fails, APS brings up the protection circuit and the traffic is moved to the protection circuit.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set protect-circuit group-name
```

12. Configure the **request** option as protect circuit or working circuit to perform a manual switch between the protect and working circuits. This statement is honored only if there are no higher-priority reasons to switch.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set request (protect | working)
```

13. Configure APS revertive mode in seconds ranging from 1 through 65,535 seconds which denotes the time to wait after the working circuit has again become functional before making the working circuit active again. By default, APS operates in nonrevertive mode.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set revert-time seconds
```

14. Configure the interface in bidirectional mode or in unidirectional mode. By default, if the **switching-mode** statement is not configured, the mode is bidirectional, and the interface does not interoperate with a unidirectional SONET/SDH LTE.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set switching-mode (bidirectional | unidirectional)
```

15. Configure the working router in an APS circuit pair.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set working-circuit group-name
```

Related Documentation

- Automatic Protection Switching and Multiplex Section Protection Overview on page 64
- Basic Automatic Protect Switching Overview on page 68
- Configuring SONET/SDH Physical Interface Properties on page 8
- Example: Configuring Basic APS Support on Routers on page 70

Basic Automatic Protect Switching Overview

To set up a basic APS configuration, configure one interface to be the working circuit and a second to be the protect circuit. If you are using APS to protect against router failure, configure one interface on each router. If you are using APS to protect against FPC failure, configure two interfaces on the router, one on each FPC.

For each working–protect circuit pair, configure the following:

- Group name—Creates the association between the two circuits. Configure the same group name for both the working and protect routers.
- Authentication key—You configure this on both interfaces. Configure the same key for both the working and protect routers.
- Address of the other interface on the other router—If you are configuring one router to be the working router and a second to be the protect router, you must configure the address of the remote interface. You configure this on one or both of the interfaces.

The address you specify for the neighbor must never be routed through the interface on which APS is configured, or instability will result. APS neighbor only applies to inter-router configurations. We strongly recommend that you directly connect the working and protect routers and that you configure the interface address of this shared network as the neighbor address.

The working and protect configurations on the routers must match the circuit configurations on the ADM; that is, the working router must be connected to the ADM's working circuit and the protect router must be connected to the protect circuit.

Related Documentation

- Automatic Protection Switching and Multiplex Section Protection Overview on page 64
- Configuring Basic Automatic Protect Switching on page 69
- Configuring SONET/SDH Physical Interface Properties on page 8
- Example: Configuring Basic APS Support on Routers on page 70

Configuring Basic Automatic Protect Switching

To set up a basic APS configuration, configure one interface to be the working circuit and a second to be the protect circuit. If you are using APS to protect against router failure, configure one interface on each router. If you are using APS to protect against FPC failure, configure two interfaces on the router, one on each FPC.

To configure basic Automatic Protection Switching (APS) options on the working circuit:

1. In configuration mode, go to the **[edit interfaces so-*fpc/pic/port* sonet-options aps]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces so-fpc/pic/port sonet-options aps
   ```

2. Configure the group name of the working circuit.

   ```
   [edit]
   user@host# set working-circuit group-name
   ```

3. Configure the authentication key.

   ```
   [edit]
   user@host# set authentication-key key
   ```

4. Configure the IP address in the **neighbor** statement. Note that this option is set only if the protect circuit is on a different router

   ```
   [edit]
   user@host# set neighbor address
   ```

To configure basic Automatic Protection Switching (APS) options on the protect circuit:

1. In configuration mode, go to the **[edit interfaces so-*fpc/pic/port* sonet-options aps]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces so-fpc/pic/port sonet-options aps
   ```

2. Configure the group name of the protect circuit.

   ```
   [edit]
   user@host# set protect-circuit group-name
   ```

3. Configure the authentication key.

```
[edit]
user@host# set authentication-key key
```

4. Configure the IP address in the **neighbor** statement. Note that this option is set only if the working circuit is on a different router

```
[edit]
user@host# set neighbor address
```

Related Documentation

- Automatic Protection Switching and Multiplex Section Protection Overview on page 64
- Basic Automatic Protect Switching Overview on page 68
- Configuring SONET/SDH Physical Interface Properties on page 8
- Example: Configuring Basic APS Support on Routers on page 70
- SONET/SDH Interfaces Overview on page 3

Example: Configuring Basic APS Support on Routers

- Requirements for a Basic APS Support on page 70
- Basic APS Overview on page 70
- Configuring Basic APS Support on Routers on page 71

Requirements for a Basic APS Support

This example uses the following hardware and software components:

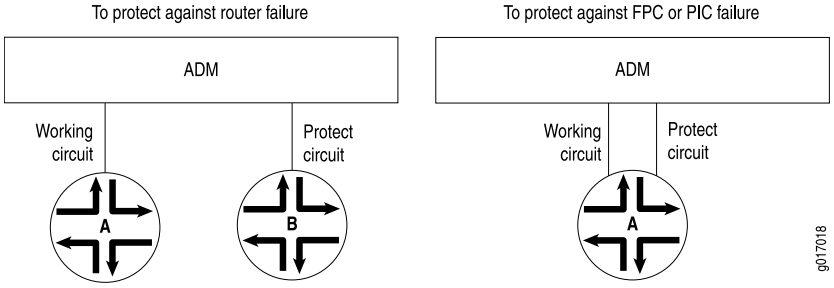
- Two MX Series, M Series, or T Series routers.
- Junos OS Release 7.4 or later

Basic APS Overview

Automatic Protection Switching (APS) is used by SONET add/drop multiplexers (ADMs) to protect against circuit failures. The Junos implementation of APS allows you to protect against circuit failures between an ADM and one or more routers, and between multiple interfaces in the same router. When a circuit or router fails, a backup immediately takes over.

To configure APS or MSP, you configure a working and a protect circuit, as shown in Figure 2 on page 71. To protect against a router failure, you connect two routers to the ADM, configuring one of them as the working router and the second as the protect router. To protect against a PIC or FPC failure, you connect one router to the ADM through both the working and protect circuits, configuring one of the PICs or FPCs as the working circuit and the second as the protect circuit.

Figure 2: APS/MSP Configuration Topologies



NOTE: For SDH interfaces, the Junos OS supports multiplex section protection (MSP). You configure MSP with the same CLI statements you use to configure APS.

Configuring Basic APS Support on Routers

To configure Router A to be the working router and Router B to be the protect router as shown in Figure 2 on page 71.

- On Router A (the Working Router) on page 71
- On Router B (the Protect Circuit) on page 72
- On a Single Platform, One Interface as the Working Circuit and Another Interface as the Protect Circuit on page 72
- Results on page 73

On Router A (the Working Router)

Step-by-Step Procedure

Configure basic APS support on Router A as the working router.

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level, where the interface is so-6/1/1.

```
[edit]
user@host# edit interfaces so-6/1/1 sonet-options
```

2. Configure the **working-circuit** option as **San-Jose**

```
[edit interfaces so-6/1/1 sonet-options]
user@host# set working-circuit San-Jose
```

3. Configure the **authentication-key** option as **“ $ABC123”**

```
[edit]
user@host# set authentication-key “ $ABC123”
```

On Router B (the Protect Circuit)

Step-by-Step Procedure

Configure basic APS support on Router B as the protect router.

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level, where the interface is so-0/0/0.

```
[edit]
user@host# edit interfaces so-0/0/0 sonet-options
```

2. Configure the **protect-circuit** option as **San-Jose**

```
[edit edit interfaces so-0/0/0 sonet-options]
user@host# set protect-circuit San-Jose
```

3. Configure the **authentication-key** option as **" 9B2612345"**

```
[edit edit interfaces so-0/0/0 sonet-options]
user@host# set authentication-key " $9$B2612345"
```

4. Configure the **neighbor** option as **192.168.1.2** that is the address of Router A on the link between A and B.

```
[edit edit interfaces so-0/0/0 sonet-options]
user@host# set neighbor 192.168.1.2
```

On a Single Platform, One Interface as the Working Circuit and Another Interface as the Protect Circuit

Step-by-Step Procedure

Configure one interface as the working circuit.

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level, where the interface is so-2/1/1 .

```
[edit]
user@host# edit interfaces so-2/1/1 sonet-options
```

2. Configure the **working-circuit** option as **Bayward**

```
[edit edit interfaces so-2/1/1 sonet-options]
user@host# set protect-circuit Bayward
```

3. Configure the **authentication-key** option as **blarney**

```
[edit edit interfaces so-2/1/1 sonet-options]
user@host# set authentication-key blarney
```

Step-by-Step Procedure

Configure one interface as the protect circuit.

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level, where the interface is so-3/0/2.

```
[edit]
user@host# edit interfaces o-3/0/2 sonet-options
```

2. Configure the **working-circuit** option as **Bayward**

```
[edit edit interfaces so-3/0/2 sonet-options]
user@host# set protect-circuit Bayward
```

3. Configure the **authentication-key** option as **blarney**

```
[edit edit interfaces so-3/0/2 sonet-options]
user@host# set authentication-key blarney
```

Results

Display the results of the configuration.

On Router A (the Working Router)

```
[edit interfaces so-6/1/1 sonet-options]
aps {
 working-circuit San-Jose;
 authentication-key “ $9$B2612345” ;
}
```

On Router B (the Protect Circuit)

```
[edit interfaces so-0/0/0 sonet-options]
aps {
 protect-circuit San-Jose;
 authentication-key “ $9$B2612345” ;
 neighbor 192.168.1.2;
}
```

On a Single Platform, One Interface as the Working Circuit and Another Interface as the Protect Circuit

```
[edit interfaces so-2/1/1 sonet-options]
aps {
 working-circuit bayward;
 authentication-key blarney;
}

[edit interfaces so-3/0/2 sonet-options]
aps {
 protect-circuit bayward;
```

```
 authentication-key blarney;
}
```

Related Documentation

- Automatic Protection Switching and Multiplex Section Protection Overview on page 64
- Basic Automatic Protect Switching Overview on page 68
- Configuring Basic Automatic Protect Switching on page 69
- Configuring SONET/SDH Physical Interface Properties on page 8

Configuring Lockout of Protection for SDH Interfaces

To configure Annex B lockout, perform the following steps:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options aps]** hierarchy level, where the *interface-name* is **so-*fpc/pic/port***.

   ```
   [edit]
   user@host# edit interfaces so-fpc/pic/port sonet-options aps
   ```

2. Configure the **annex-b** option.

   ```
   [edit interfaces so-fpc/pic/port sonet-options aps]
   user@host# edit annex-b
   ```

3. Configure the **lockout** option to provide a lockout of protection, forcing the use of the working circuit and locking out the protect circuit regardless of anything else.

   ```
   [edit interfaces so-fpc/pic/port sonet-options aps anex-b]
   user@host# set lockout
   ```

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Switching Between the Working and Protect Circuits Overview on page 91
- Configuring Switching Between the Working and Protect Circuits on page 92
- SONET/SDH Interfaces Overview on page 3

APS Timers Overview

The protect and working routers periodically send packets to their neighbors to advertise that they are operational. By default, these advertisement packets are sent every 1000 milliseconds. A router considers its neighbor to be operational for a period, called the hold time, that is, by default, three times the advertisement interval. If the protect router does not receive an advertisement packet from the working router within the hold

time configured on the protect router, the protect router assumes that the working router has failed and becomes active.

APS is symmetric; either side of a circuit can time out the other side (for example, when detecting a crash of the other). Under normal circumstances, the failure of the protect router does not cause any changes because the traffic is already moving on the working router. However, if you had configured **request protect** and the protect router failed, the working router would enable its interface.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring APS Timers on page 75
- SONET/SDH Interfaces Overview on page 3

Configuring APS Timers

To configure advertise interval and hold time:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options aps]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces interface-name sonet-options aps
   ```

2. Configure the **advertise-interval** option in milliseconds to modify the advertisement interval.

   ```
   [edit interfaces so-fpc/pic/port sonet-options aps]
   user@host# set advertise-interval milliseconds
   ```

3. Configure the **hold-time** option in milliseconds to modify hold time..

   ```
   [edit interfaces so-fpc/pic/port sonet-options aps]
   user@host# set hold-time milliseconds
   ```

The advertisement intervals and hold times on the protect and working routers can be different.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- APS Timers Overview on page 74
- SONET/SDH Interfaces Overview on page 3

Container Interfaces for APS on SONET Links Overview

The Junos OS supports container interfaces for APS on SONET links. Physical interfaces and logical interfaces remain up on switchover, and their APS parameters are auto-copied from the container interface to the member links. See *Understanding Container Interfaces* for more information.

Container interfaces support the following features:

- Cisco HDLC or PPP encapsulation methods.
- Unpaired groups.
- Bidirectional APS.
- Non-container and container-based APS on the same system.
- Use of any combination of (nonchannelized) SONET interfaces installed on the same router.

To configure a container interface, you must first create the number of container devices that you require. You can create up to a maximum of 128 container interfaces per router using the **device-count** statement at the **[edit chassis container-devices]** hierarchy level.

To configure each container interface, you must assign two SONET interfaces (**so-*fpc/pic/port***) using the **container-list ci*n*** statement, and specify the **member-interface-speed *speed*** and **container-options** for each SONET interface.

Within each of the two SONET interfaces' container options, you must set one container-type as **primary** (corresponding to an APS working circuit) and the other as **standby** (corresponding to an APS protect circuit). For each SONET interface, you can also use the **allow-configuration-override** statement to allow the physical configuration of a member link to override the container configuration.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring Container Interfaces for APS on SONET Links on page 76

Configuring Container Interfaces for APS on SONET Links

- Configuring Container Interfaces on SONET Links on page 76
- Displaying Container Interface Configuration on page 79
- Displaying the APS Container Interface Configuration on page 80

Configuring Container Interfaces on SONET Links

To configure a container interface on SONET links, you should perform the following:

- First create the number of container devices that you require. You can create up to a maximum of 128 container interfaces per router using the **device-count** statement at the **[edit chassis container-devices]** hierarchy level.

- Configure each container interface, here, you must assign two SONET interfaces (**so-*fpc/pic/port***) using the **container-list ci*n*** statement, and specify the **member-interface-speed *speed*** and **container-options** for each SONET interface.
- Within each of the two SONET interfaces' container options, you must set one container-type as **primary** (corresponding to an APS working circuit) and the other as **standby** (corresponding to an APS protect circuit). For each SONET interface, you can also use the **allow-configuration-override** statement to allow the physical configuration of a member link to override the container configuration.

The following procedure explains configuring a container interface on SONET links in detail.

To configure a container interface on SONET links:

1. In configuration mode, go to the **edit chassis container-devices** hierarchy level.

```
[edit]
user@host# edit chassis container-devices
```

2. Specify the total number of container interfaces (up to 128) to create using the **device-count *number*** statement.

```
[edit chassis container-devices]
user@host# set device-count number
```

NOTE: You can create more container interfaces later if required, up to 128 (total). The resulting container interfaces are designated sequentially from ci0 up to a maximum of ci127, depending on the device-count *number* specified. SONET interfaces can be assigned to any container interface ci*n*.

3. Configure the container interface parameters for a specified container ci*n* as follows:
   a. Specify the container interface using the numbered identifier ci*n*.

```
[edit interfaces]
user@host# edit cin
```

   b. Specify the container interface encapsulation as **cisco-hdlc** or **ppp**.

```
[edit interfaces cin]
user@host# set encapsulation (cisco-hdlc | ppp)
```

   c. Specify the container options **container-type** as **aps**; a SONET interface is required for APS selection

```
[edit interfaces cin]
user@host# set container-options container-type aps
```

d. Specify the container interface **member-interface type** as **sonet**

```
[edit interfaces ci n]
user@host# set container-options member-interface-type sonet
```

e. Specify the container **member-interface-speed *speed*** to match the specified installed SONET interface links; the available values are ***OC3, OC12, OC48, OC192, OC768,*** or ***mixed***. The **member-interface-speed *speed*** statement setting applies to all SONET member interfaces of the specified container **ci*n***.

```
[edit interfaces ci n]
user@host# set container-options member-interface-type sonet
  member-interface-speed speed
```

f. Specify the container interface's unit number, family, IP address, and mask

```
[edit interfaces ci n]
user@host# set unit number family inet address ip-address/mask
```

4. Configure each of the required two SONET interfaces as follows:

a. Specify the SONET interfaces and their container options; including the **container-list**, identified by its **ci*n***.

b. Specify the **container-type** as ***primary*** (corresponding to an APS working-circuit) or ***standby*** (corresponding to an APS protect-circuit).

For example, set the so-0/0/0 interface as the primary circuit and the so-0/0/1 interface as the standby circuit for the container interface **ci*n*** :

```
[edit]
user@host# edit interfaces so-0/0/0 # Enter configuration mode for interface
  so-0/0/0
[edit interfaces so-0/0/0]
user@host# set container-options container-list cin primary # Set so-0/0/0 as
  APS primary interface
[edit interfaces so-0/0/0]
user@host# top
[edit]
user@host# edit interfaces so-0/0/1 # Enter configuration mode for interface
  so-0/0/1
[edit interfaces so-0/0/1]
user@host# set container-options container-list cin standby # Set so-0/0/1 as APS
  standby interface
```

Optionally, you can set the **allow-configuration-override** statement to allow the physical configuration of a member link to override the container configuration

```
[edit interfaces so-0/0/1]
user@host# set container-options container-list cin standby
  allow-configuration-override
```

Displaying Container Interface Configuration

Purpose To display a container interface.

Action To display a container interface configuration in SONET/SDH where the **device-count** is **1** with the so-0/0/0 interface as primary and the so-0/0/1 interface as secondary, and the encapsulation is set to **cisco-hdlc**.

1. In configuration mode, go to the **[edit chassis]** hierarchy level.

```
[edit]
user@host# edit chassis
```

2. Issue the **show** command in configuration mode.

```
[edit chassis]
user@host# show
```

3. The following output is displayed.

```
container-devices {
    device-count 1;
}
```

4. In configuration mode, go to the **[edit interfaces]** hierarchy level.

```
[edit]
user@host# edit interfaces
```

5. Issue the **show** command in configuration mode.

```
[edit interfaces]
user@host# show
```

6. The following output is displayed.

```
so-0/0/0 {
    container-options {
        container-list ci0;
        primary;
    }

}
so-0/0/1 {
    container-options {
        container-list ci0;
        standby;
    }
```

```
}

ci0 {
    encapsulation cisco-hdlc;
    container-options {
        container-type {
            aps;
        }
        member-interface-type {
            sonet {
                member-interface-speed mixed;
            }
        }
    }
    unit 0 {
        family inet {
            address 192.168.11.1/24;
        }
    }
}
```

Displaying the APS Container Interface Configuration

Purpose Display the APS container interface configuration parameters.

Action You can run the **show aps** operational mode command to display the APS container interface configuration.

```
user@host> show aps
Interface    Group                          Circuit    Intf state
ci0           CONTAINER_ci0                 Container  enabled, up
so-1/2/2      MEMBER_OF_ci0                 Working    enabled, up
so-1/2/3      MEMBER_OF_ci0                 Protect    disabled, up
```

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Container Interfaces for APS on SONET Links Overview on page 76

APS Using a Container Interface with ATM Encapsulation Overview

M Series and T Series routers with ATM2 PICs automatically copy the parent container interface (CI) configuration to the specified children interfaces. All ATM configurations configured in a single location on the parent container interface are automatically copied to the children interfaces. Container interfaces do not go down during APS switchover, shielding upper layers (Layer 3 and above) from noticing the Layer 1 failures. This feature allows the various ATM features to work over the container ATM for APS.

For more information on container interfaces, see *Understanding Container Interfaces*.

Container ATM APS does not support interchassis APS.

MLPPP over ATM CI is not supported.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Displaying APS Using a Container Interface with ATM Encapsulation on page 82
- Configuring APS Using a Container Interface with ATM Encapsulation on page 81

Configuring APS Using a Container Interface with ATM Encapsulation

To configure APS using a container interface with ATM encapsulation by specifying the ATM children within a container interface:

1. In configuration mode, go to the **[edit interface at-*fpc/pic/slot* container-options]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces at-fpc/pic/slot container-options
   ```

2. Configure the **container-list ci*n*** statement.

   ```
   [edit interfaces at-fpc/pic/slot container-options]
   user@host# set container-list cin
   ```

3. Configure primary or standby option as needed.

   ```
   [edit interfaces at-fpc/pic/slot container-options]
   user@host# set (primary | standby)
   ```

To configure a container interface by including its children:

1. In configuration mode, go to the **[edit interfaces]** hierarchy level.

   ```
   [edit]
   user@host# edit interface at-fpc/pic/slot container-options
   ```

2. Configure the **ci*n*** statement where **n** is the number of children.

```
[edit interface at-fpc/pic/slot container-options]
user@host# set container-list cin
```

Container ATM APS does not support interchassis APS.

MLPPP over ATM CI is not supported.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- APS Using a Container Interface with ATM Encapsulation Overview on page 81
- SONET/SDH Interfaces Overview on page 3
- Displaying APS Using a Container Interface with ATM Encapsulation on page 82

Displaying APS Using a Container Interface with ATM Encapsulation

- Displaying APS Using a Container Interface with ATM Encapsulation on page 82
- Displaying the APS Container Interface Configuration on page 83

Displaying APS Using a Container Interface with ATM Encapsulation

Purpose Display APS using a container interface with ATM encapsulation.

Action To display APS using a container interface with ATM encapsulation **atm-pvc** where the configuration of a parent container interface **ci0** and the resulting automatic configuration of its children (**at-0/0/0** and **at-0/0/1**), perform the following steps:

1. In configuration mode, go to the **[edit interfaces]** hierarchy level.

```
[edit]
user@host# edit interfaces
```

2. Issue the **show** operational mode command.

```
[edit interfaces]
user@host# show
```

3. The following output is displayed.

```
at-0/0/0 {
 container-options {
  container-list ci0;
  primary;
 }
}
```

```
at-0/0/1 {
 container-options {
  container-list ci0;
  standby;
 }
}
ci0 {
 encapsulation atm-pvc;
 atm-options {
  vpi 0 {
   oam-period 3;
  }
  ilmi;
 }
container-options {
 container-type {
  aps;
 }
 member-interface-type {
  atm {
   member-interface-speed oc3;
  }
 }
}
unit 0 {
 vci 100;
 oam-period 3;
 family inet {
  address 10.0.0.1/30;
 }
}
unit 1 {
 vci 200;
  oam-period 3;
  family inet {
   address 192.168.0.1/30;
  }
 }
}
```

Displaying the APS Container Interface Configuration

Purpose To display the APS container interface configuration

Action You can use the following **show** operational mode commands to view the APS container interface configuration:

- **show aps**
- **show aps extensive**
- **show interfaces ci*n* extensive**
- **show interfaces at-*fpc/pic/port* extensive**

See the CLI Explorer.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- APS Using a Container Interface with ATM Encapsulation Overview on page 81
- SONET/SDH Interfaces Overview on page 3

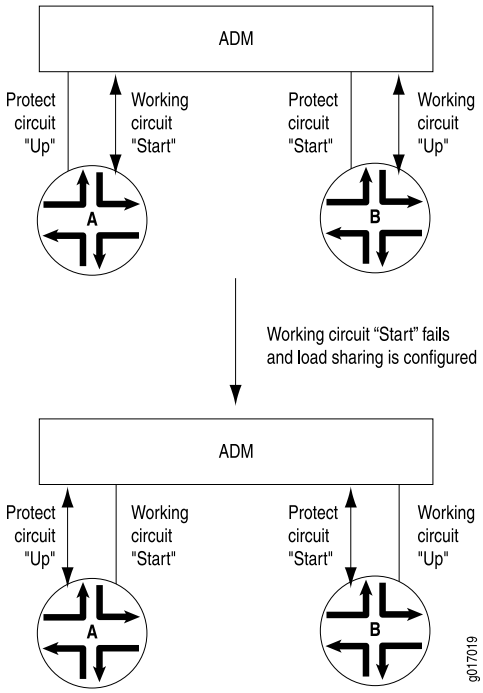
APS Load Sharing Between Circuit Pairs Overview

When two routers are connected to a single add/drop multiplexer (ADM), you can have them back up each other on two different pairs of circuits. This arrangement provides load balancing between the routers if one of the working circuits fails.

Figure 3 on page 84 illustrates load sharing between circuits on two routers. Router A has a working circuit “Start” and a protect circuit “Up,” and Router B has a working circuit “Up” and a protect circuit “Start.” Under normal circumstances, Router A carries the “Start” circuit traffic and Router B carries the “Up” circuit traffic. If the working circuit “Start” were to fail, Router B would end up carrying all the traffic for both the “Start” and “Up” circuits.

To balance the load between the circuits, you pair the two circuits. In this case, you pair the “Start” and “Up” circuits. Then, if the working circuit “Start” fails, the two routers automatically switch the “Up” traffic from the working to the protect circuit so that each router is still carrying only one circuit’s worth of traffic. That is, the working circuit on Router A would be “Up” and the working circuit on Router B would be “Start.”

Figure 3: APS Load Sharing Between Circuit Pairs



Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring APS Load Sharing on page 85
- SONET/SDH Interfaces Overview on page 3

Configuring APS Load Sharing

To configure load sharing between two working–protect circuit pair:

1. In configuration mode, go to the **[edit interfaces interface-name sonet-options aps]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options aps
```

2. Configure the **paired-group** option when configuring one of the circuits on one of the routers. In this statement, the *group-name* variable is the name of the group you assigned to one of the circuits with the working-circuit and protect-circuit statements.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set paired-group group-name
```

The Junos OS automatically configures the remainder of the load-sharing setup based on the group name.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- SONET/SDH Interfaces Overview on page 3

Example: Configuring APS Load Sharing Between Circuit Pairs

- Requirements for APS Load Sharing Between Circuit Pairs on page 85
- Overview on page 85
- Configuring APS Load Sharing Between Circuit Pairs on page 86

Requirements for APS Load Sharing Between Circuit Pairs

This example uses the following hardware and software components:

- Two MX Series, M Series, or T Series routers.
- Junos OS Release 7.4 or later

Overview

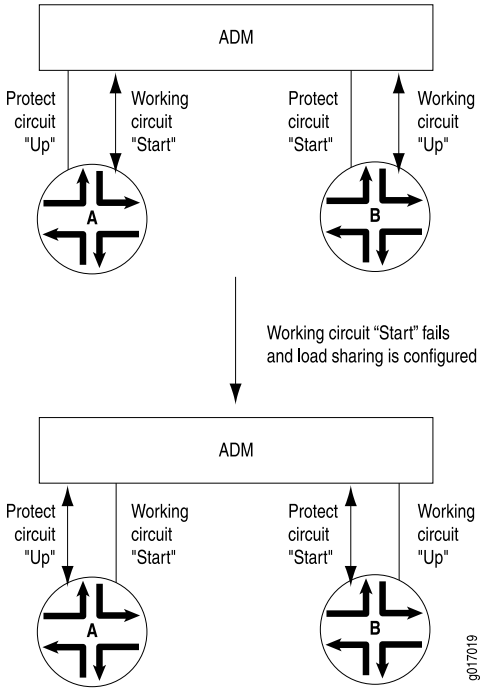
When two routers are connected to a single add/drop multiplexer (ADM), you can have them back up each other on two different pairs of circuits. This arrangement provides load balancing between the routers if one of the working circuits fails.

Figure 4 on page 86 illustrates load sharing between circuits on two routers. Router A has a working circuit “Start” and a protect circuit “Up,” and Router B has a working circuit “Up” and a protect circuit “Start.” Under normal circumstances, Router A carries the “Start” circuit traffic and Router B carries the “Up” circuit traffic. If the working circuit “Start” were to fail, Router B would end up carrying all the traffic for both the “Start” and “Up” circuits.

To balance the load between the circuits, you pair the two circuits. In this case, you pair the “Start” and “Up” circuits. Then, if the working circuit “Start” fails, the two routers automatically switch the “Up” traffic from the working to the protect circuit so that each router is still carrying only one circuit’s worth of traffic. That is, the working circuit on Router A would be “Up” and the working circuit on Router B would be “Start.”

Topology

Figure 4: APS Load Sharing Between Circuit Pairs



Configuring APS Load Sharing Between Circuit Pairs

To configure APS load sharing to match the configuration shown in Figure 4 on page 86, perform the following tasks:

- Configuring APS Load Sharing on Router A on page 86
- Configuring APS Load Sharing on Router B on page 87

Configuring APS Load Sharing on Router A

Step-by-Step Procedure

Perform the following steps on the first interface—that is, on the so-7/0/0 interface:

1. Configure the working circuit as **start**.

```
[edit interfaces so-7/0/0 sonet-options aps]
user@host# set working-circuit start
```

2. Configure the authentication key as **linsey**.

```
[edit interfaces so-7/0/0 sonet-options aps]
user@host# set authentication-key linsey
```

3. Configure the paired group as **Router A-Router B**.

```
[edit interfaces so-7/0/0 sonet-options aps]
user@host# set paired-group "Router A-Router B"
```

Configure the other options as needed.

Step-by-Step Procedure

Perform the following steps on the other interface—on the so-0/0/0 interface:

1. Configure the protect circuit as **up**.

```
[edit interfaces so-0/0/0 sonet-options aps]
user@host# set protect-circuit up
```

2. Configure the authentication key as woolsey.

```
[edit interfaces so-0/0/0 sonet-options aps]
user@host# set authentication-key woolsey
```

3. Configure the paired group as Router A-Router B.

```
[edit interfaces so-0/0/0 sonet-options aps]
user@host# sset paired-group "Router A-Router B"
```

Configure the other options as needed.

Configuring APS Load Sharing on Router B

Step-by-Step Procedure

Perform the following steps on the first interface—that is, on the so-1/0/0 interface:

1. Configure the working circuit as **up**.

```
[edit interfaces so-1/0/0 sonet-options aps]
user@host# set working-circuit up
```

2. Configure the authentication key as **woolsey**.

```
[edit interfaces so-1/0/0 sonet-options aps]
user@host# set authentication-key woolsey
```

3. Configure the paired group as Router A-Router B.

```
[edit interfaces so-1/0/0 sonet-options aps]
user@host# set paired-group "Router A-Router B"
```

Configure the other options as needed.

Step-by-Step Procedure

Perform the following steps on the other interface—that is, on the so-6/0/0 interface:

1. Configure the protect circuit as **start**.

```
[edit interfaces so-6/0/0 sonet-options aps]
user@host# set protect-circuit start
```

2. Configure the authentication key as linsey.

```
[edit interfaces so-6/0/0 sonet-options aps]
user@host# set authentication-key linsey
```

3. Configure the paired group as Router A-Router B.

```
[edit interfaces so-6/0/0 sonet-options aps]
user@host# set paired-group "Router A-Router B"
```

Configure the other options as needed.

Related Documentation

- Automatic Protection Switching and Multiplex Section Protection Overview on page 64
- Basic Automatic Protect Switching Overview on page 68
- Configuring Basic Automatic Protect Switching on page 69
- Configuring SONET/SDH Physical Interface Properties on page 8
- SONET/SDH Interfaces Overview on page 3

Link PIC Redundancy Overview

Link state replication, also called interface preservation, is an addition to the SONET Automatic Protection Switching (APS) functionality that helps promote redundancy of link PICs used in LSQ configurations, providing MLPPP link redundancy at the port level.

Link state replication provides the ability to add two sets of links, one from the active SONET PIC and the other from the standby SONET PIC, to the same bundle. If the active SONET PIC fails, links from the standby PIC are used without link renegotiation. All the negotiated state is replicated from the active links to the standby links to prevent link renegotiation. For more information about LSQ configurations, see the *Junos OS Services Interfaces Library for Routing Devices*.

APS functionality must be available on the SONET PICs and the interface configurations must be identical on both ends of the link. Any configuration mismatch causes the commit operation to fail.

This feature is supported with SONET APS and the following link PICs:

- Channelized OC3 IQ and IQE PICs
- Channelized OC12 IQ and IQE PICs
- Channelized STM1 IQ and IQE PICs

Link state replication supports MLPPP and PPP over Frame Relay (**frame-relay-ppp**) encapsulation, and fully supports GRES.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring Link PIC Redundancy on page 89
- SONET/SDH Interfaces Overview on page 3

Configuring Link PIC Redundancy

- Configuring Link State Replication on page 89
- Displaying Link PIC Redundancy on page 90

Configuring Link State Replication

To configure link state replication:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options aps]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options aps
```

2. Configure the **preserve-interface** option.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set preserve-interface
```

Displaying Link PIC Redundancy

Purpose To display the link state replication configuration.

Action To display link state replication options between the ports coc3-1/0/0 and coc3-2/0/0:

1. In configuration mode, go to the **[edit interfaces coc3-1/0/0]** hierarchy level.

```
[edit]
user@host# edit interfaces coc3-1/0/0
```

2. Display the link state replication details by issuing the **show** operational mode command.

```
[edit interfaces coc3-1/0/0]
user@host# show
```

3. The following output is displayed.

```
sonet-options {
 aps {
 preserve-interface;
 working-circuit aps-group-1;
 }
}
```

4. In configuration mode, go to the **[edit interfaces coc3-2/0/0]** hierarchy level.

```
[edit]
user@host# edit interfaces coc3-1/0/0
```

5. Display the link state replication details by issuing the **show** operational mode command.

```
[edit interfaces coc3-2/0/0]
user@host# show
```

6. The following output is displayed.

```
sonet-options {
 aps {
 preserve-interface;
```

```
working-circuit aps-group-1;
}
}
```

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Link PIC Redundancy Overview on page 89
- SONET/SDH Interfaces Overview on page 3

Switching Between the Working and Protect Circuits Overview

When there are multiple reasons to switch between the working and protect circuits, a priority scheme is used to decide which circuit to use. The routers and the ADM might automatically switch traffic between the working and protect circuits because of circuit and router failures. You can also choose to switch traffic manually between the working and protect circuits.

When an ATM2 PIC is configured for APS, and the protect circuit comes online for the first time, there are no open VCs and the PIC discards the input traffic received on the protect circuit. The **show interface extensive** or **show monitor interface traffic** operational mode commands display the statistics as zero since the PIC drops the packets at the VC.

When the APS switches from the working circuit to the protect circuit, VCs are created on the protect circuit to accept traffic. However, the VCs on the working circuit remain open to support any future APS switches even though the interface is down or disabled. The input traffic received on the working circuit (current backup) is accepted by the PIC but discarded in the PFE. The **show interface extensive** or **show monitor interface traffic** operational mode commands displays live statistics for the traffic since it is accepted by the PIC.

When APS switches from the protect circuit to the working circuit again, the VCs on the protect circuit remain open to support a future APS switch even though the interface is down or disabled. The input traffic received on the current backup protect circuit is accepted by the PIC but discarded in the PFE. The **show interface extensive** or the **show monitor interface traffic** operational mode command displays live statistics for this traffic since it is accepted by the PIC.

There are three priority levels of manual configuration, listed here in order from lowest to highest priority:

- Request (also known as manual switch)—Overridden by signal failures, signal degradations, or any higher-priority reasons.
- Force (also known as forced switch)—Overrides manual switches, signal failures, and signal degradation.
- Lockout (also known as lockout of protection)—Do not switch between the working and protect circuits.

NOTE: Do not use the **disable** statement at the **[edit interfaces *interface-name* aps]** hierarchy level to switch between interface working and protect circuits; it can cause loss of traffic on the disabled interface. Use only the **request** statement or the **force** statement at the **[edit interfaces interface-name aps]** hierarchy level to modify interface status.

A router failure is considered to be equivalent to a signal failure on a circuit.

M120 routers and M320 routers with Enhanced III FPCs support Annex B lockout.

The lockout feature is supported as follows:

- The selector position will be at what it was before the lockout feature was configured (no switching of working and protect circuits).
- Transmitted K1/K2 will be frozen (same K1 and K2 bytes will be transmitted as before the lockout).
- The APS will ignore requests from the peer to switch working and protect circuits.
- For Annex B, **lockout** must be configured on both local and remote ends, as they are not signaled using K1/K2 bytes as in a non Annex B configuration.

Related Documentation

- Configuring Switching Between the Working and Protect Circuits on page 92
- Configuring Lockout of Protection for SDH Interfaces on page 74
- Configuring Switching Between the Working and Protect Circuits on page 92
- Configuring SONET/SDH Physical Interface Properties on page 8

Configuring Switching Between the Working and Protect Circuits

You can perform a manual switch between the working and protect circuits.

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options aps]** hierarchy level.

```
[edit]
user@host# [edit interfaces interface-name sonet-options aps
```

2. Configure the **request** option as protect or working to perform a manual switch. This option is honored only if there are no higher-priority reasons to switch.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set request (protect | working)
```

To switch the circuit manually to being the working circuit or to override the revert timer when the working circuit is operating in nonrevertive mode:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options aps]** hierarchy level.

```
[edit]
user@host# [edit interfaces interface-name sonet-options aps
```

2. Configure the **request working** option to switch the circuit manually to being the working circuit or to override the revert timer when the working circuit is operating in nonrevertive mode.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set request working
```

To perform a forced switch:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options aps]** hierarchy level.

```
[edit]
user@host# [edit interfaces interface-name sonet-options aps
```

2. Configure the **force** option to perform a forced switch. This option is honored only if there are no higher-priority reasons to switch. This configuration can be overridden by a signal failure on the protect circuit, thus causing a switch to the working circuit.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set force (protect | working)
```

To configure a lockout of protection, forcing the use of the working circuit and locking out the protect circuit regardless of anything else.

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options aps]** hierarchy level.

```
[edit]
user@host# [edit interfaces interface-name sonet-options aps
```

2. Configure a lockout of protection, forcing the use of the working circuit and locking out the protect circuit regardless of anything else.

```
[edit interfaces so-fpc/pic/port sonet-options aps annex-b]
user@host# set lockout
```

To display an Annex B lockout configuration, use the **show aps extensive** operational command.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Switching Between the Working and Protect Circuits Overview on page 91
- Configuring Lockout of Protection for SDH Interfaces on page 74
- Switching Between the Working and Protect Circuits Overview on page 91

Revertive Mode Overview

By default, APS is nonrevertive, which means that if the protect circuit becomes active, traffic is not switched back to the working circuit unless the protect circuit fails or you manually configure a switch to the working circuit. In revertive mode, traffic is automatically switched back to the working circuit.

You should configure the ADM and routers consistently with regard to revertive or nonrevertive mode.

If you are using nonrevertive APS, you can use the **request working** statement to switch the circuit manually to being the working circuit or to override the revert timer (configured with the **revert-time** statement).

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring Revertive Mode on page 94
- SONET/SDH Interfaces Overview on page 3

Configuring Revertive Mode

By default, APS is nonrevertive, which means that if the protect circuit becomes active, traffic is not switched back to the working circuit unless the protect circuit fails or you manually configure a switch to the working circuit. In revertive mode, traffic is automatically switched back to the working circuit.

You should configure the ADM and routers consistently with regard to revertive or nonrevertive mode.

To configure APS in revertive mode:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options aps]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options aps
```

2. Configure revertive mode by setting the **revert-time** option in seconds which specifies the amount of time to wait after the working circuit has again become functional before making the working circuit active again.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set revert-time seconds
```

To configure APS in nonrevertive mode:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options aps]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options aps
```

2. Configure the nonrevertive mode by setting the **request working** option to switch the circuit manually to being the working circuit or to override the revert timer. This is configured with the **revert-time** option.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set request working
```

NOTE:

If you are using nonrevertive APS, you can use the **request working** statement to switch the circuit manually to being the working circuit or to override the revert timer (configured with the **revert-time** statement).

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Revertive Mode Overview on page 94
- SONET/SDH Interfaces Overview on page 3

Switching Mode Overview

There are two types of switching mode:

- Unidirectional mode
- Bidirectional mode

You can configure interoperation with SONET/SDH Line Terminating Equipment (LTE) that is provisioned for unidirectional linear APS in 1+1 architecture on the following interfaces:

- Unchannelized OC3, OC12, and OC48 SONET/SDH interfaces on T Series routers
- SONET/SDH interfaces on the M40e router
- ATM over SONET interfaces

By default, APS supports only SONET/SDH LTE that is provisioned for bidirectional mode.

In bidirectional switching mode, the working interface switches to the protect interface for both receipt and transmission of data, regardless of whether the signal failure is in the transmit or receive direction.

In true unidirectional mode, the working interface switches to the protect interface only for the direction in which signal failure occurs; for example, if there is a signal failure in the transmit direction, the working interface switches over to the protect interface for transmission but not receipt of data. When the protect interface operates in unidirectional mode, the working and protect interfaces must cooperate to operate the transmit and receive interfaces in a bidirectional fashion.

The Junos OS does not support true unidirectional mode. Instead the software supports interoperation with SONET/SDH LTE provisioned for unidirectional switching. This means that the SONET/SDH LTE on the router receives and transmits on one interface, even when you configure unidirectional support.

The Junos implementation of unidirectional mode support allows the router to do the following:

- Accept a unidirectional mode as valid
- Trigger the peer (ADM) selector to switch receive from working interface to protect interface or the reverse
- Not send reverse requests to the far end (ADM)

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Configuring Switching Mode on page 97
- SONET/SDH Interfaces Overview on page 3

Configuring Switching Mode

To configure switching mode in unidirectional mode:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options aps]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options aps
```

2. Configure unidirectional mode by setting the **unidirectional** option.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set switching-mode unidirectional
```

NOTE: On interfaces with unidirectional APS support configured, revertive mode and load sharing between circuits are not supported.

To configure switching mode in bidirectional mode:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options aps]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options aps
```

2. Configure bidirectional mode to restore the default behavior by setting the **bidirectional** option.

```
[edit interfaces so-fpc/pic/port sonet-options aps]
user@host# set switching-mode bidirectional
```

NOTE: By default, APS supports only SONET/SDH LTE that is provisioned for bidirectional mode.

Related Documentation

- Configuring SONET/SDH Physical Interface Properties on page 8
- Switching Mode Overview on page 96
- SONET/SDH Interfaces Overview on page 3

CHAPTER 6

Configuring Aggregated SONET/SDH Interfaces for High Availability

- Understanding Aggregated SONET/SDH Interfaces on page 99
- Configuring Aggregated SONET/SDH Interfaces on page 101

Understanding Aggregated SONET/SDH Interfaces

Junos OS enables link aggregation of SONET/SDH interfaces; this is similar to Ethernet link aggregation, but is not defined in a public standard. Junos OS balances traffic across the member links within an aggregated SONET/SDH bundle based on the Layer 3 information carried in the packet. This implementation uses the same load balancing algorithm used for per-packet load balancing. For information about per-packet load balancing, see the *Junos OS Routing Protocols Library*.

You configure an aggregated SONET/SDH virtual link by specifying the link number as a physical device and then associating a set of physical interfaces that have the same speed.

NOTE: Channelized OC IQ, IQE, and SONET/SDH OC48/STM16 IQE PICs do not support SONET aggregation.

NOTE: SONET/SDH aggregation is proprietary to the Junos OS and might not work with other software.

Understanding Aggregated SONET/SDH Properties

- Creating Aggregated SONET/SDH Interfaces on page 100
- SONET/SDH Link Aggregation Overview on page 100
- Aggregated SONET/SDH Link Speed Overview on page 100
- Configuring Aggregated SONET/SDH Minimum Links on page 101

Creating Aggregated SONET/SDH Interfaces

By default, no aggregated SONET/SDH interfaces are created. You must define the number of aggregated SONET/SDH interfaces by including the **device-count** statement at the **[edit chassis aggregated-devices sonet]** hierarchy level. For information about configuring device count, see "Configuring Aggregated SONET/SDH Interfaces" on page 101.

Starting with Junos OS Release 13.2, a maximum of 64 aggregated interfaces are supported for link aggregation of SONET/SDH interfaces. Prior to Junos OS Release 13.2, a maximum of 16 aggregated interfaces were supported for link aggregation of SONET/SDH interfaces. The aggregated SONET/SDH interfaces are numbered from **as0** through **as63**. For more information, see the *Junos OS Services Interfaces Library for Routing Devices*.

Additionally, you must assign a number for the variable **x** for the aggregated SONET/SDH interface **as*x*** at the **[edit interfaces]** hierarchy level and also specify the constituent physical interfaces by including the **aggregate** statement at the **[edit interfaces *interface-name* sonet-options]** hierarchy level.

You can optionally specify other physical properties that apply specifically to the aggregated SONET/SDH interfaces; for details, see "SONET/SDH Interfaces Overview" on page 3

SONET/SDH Link Aggregation Overview

On SONET/SDH interfaces, you can associate a physical interface with an aggregated SONET/SDH interface. To associate the interface with an aggregated SONET/SDH link, include the **aggregate** statement at the **[edit interfaces *interface-name* sonet-options]** hierarchy level.

x is the interface instance number and can be from 0 through 63, for a total of 64 aggregated interfaces. You should not mix SONET and SDH mode on the same aggregated interface. In addition, you must also include a statement configuring **as*x*** at the **[edit interfaces]** hierarchy level.

Aggregated SONET/SDH Link Speed Overview

On aggregated SONET/SDH interfaces, you can set the required link speed for all interfaces included in the bundle, or specify that the bundle contains interfaces with mixed interface speeds.

NOTE: For nonconcatenated interfaces on aggregated SONET/SDH interfaces, you can configure the link speed of the aggregate to match the speed of the nonconcatenated interface. For example, an OC12 PIC can have nonconcatenated interfaces with a link speed of OC3.

To set the required link speed or specify mixed interface speeds, include the **link-speed** statement at the **[edit interfaces *interface-name* aggregated-sonet-options]** hierarchy level.

The link speed can be one of the following values:

- **oc3**—Links are OC3c or STM1c.
- **oc12**—Links are OC12c or STM4c.
- **oc48**—Links are OC48c or STM16c.
- **oc192**—Links are OC192c or STM64c.
- **oc768**—Links are OC768c or STM256c.

Configuring Aggregated SONET/SDH Minimum Links

On aggregated SONET/SDH interfaces, you can configure the minimum number of links that must be up for the bundle as a whole to be labeled **up**. By default, only one link must be up for the bundle to be labeled **up**.

On a T Series, TX Matrix router with SONET interfaces, the valid range for **minimum-links** ***number*** is from 1 through 16. When the maximum value (16) is specified, all configured links of a bundle must be up for the bundle to be labeled **up**.

On all other router routers, the range of valid values for **minimum-links** ***number*** is 1 through 8 and the maximum number of links supported in an aggregate is eight. When the maximum value (8) is specified, all configured links of a bundle must be up for the bundle to be labeled **up**.

Related Documentation

- Configuring Aggregated SONET/SDH Interfaces on page 101

Configuring Aggregated SONET/SDH Interfaces

- Configuring Aggregated SONET/SDH Interfaces on page 101
- Deleting an Aggregated SONET/SDH Interface on page 104
- Configuring Filtering on a Aggregated SONET/SDH Interface on page 105
- Configuring Sampling on Aggregated SONET/SDH Interfaces on page 106

Configuring Aggregated SONET/SDH Interfaces

To configure the aggregated SONET/SDH interfaces, perform the following tasks:

1. Configuring Device Count on page 101
2. Configuring Constituent Physical Interface on page 102
3. Configuring an Aggregated SONET/SDH Interfaces on page 102
4. Displaying the Aggregated SONET/SDH Interface Configuration on page 103

Configuring Device Count

To configure the number of aggregated SONET/SDH interfaces as per requirement.

1. In configuration mode, go to the **[edit chassis aggregated-devices sonet]** hierarchy level.

```
[edit]
user@host# edit chassis aggregated-devices sonet
```

2. Configure the number of aggregated SONET interfaces from 1 through 64.

```
[edit chassis aggregated-devices sonet]
user@host# set device-count device-count
```

For example, if you set the **device-count** statement as 12, you can configure the aggregated SONET/SDH interfaces from **as0** through **as11**.

Configuring Constituent Physical Interface

After you set the device count at the **[edit chassis aggregated-devices sonet]** hierarchy level, you can associate a physical interface with an aggregated SONET/SDH interface.

To associate the physical interface with an aggregated SONET/SDH link.

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options]** hierarchy level. For example, set the interface name as so-1/3/0.

```
[edit]
user@host# [edit interfaces so-1/3/0 aggregated-sonet-options]
```

2. Configure the **aggregate** statement with the aggregated interface to join a SONET aggregate.

```
[edit interfaces so-1/3/0 aggregated-sonet-options]
user@host# set aggregate asx
```

NOTE: *x* is the interface instance number and can be from 0 through 63, for a total of 64 aggregated interfaces. You should not mix SONET and SDH mode on the same aggregated interface.

You can optionally specify other physical properties that apply specifically to the aggregated SONET/SDH interface; for details, see "SONET/SDH Interfaces Overview" on page 3.

Configuring an Aggregated SONET/SDH Interfaces

To configure an aggregated SONET/SDH interface, for example as0 interface.

1. In configuration mode, go to the **[edit interfaces as0 aggregated-sonet-options]** hierarchy level.

```
[edit]
user@host# edit interfaces as0 aggregated-sonet-options
```

2. Configure the aggregated links speed of the as0 interface as **mixed**, **oc12**, **oc192**, **oc3**, **oc48**, or **oc768**.

```
[edit interfaces as0 aggregated-sonet-options]
user@host# set link-speed mixed | oc12 | oc192 | oc48 | oc768
```

   You can set the required link speed for all interfaces included in the bundle, or specify that the bundle contains interfaces with mixed interface speeds.

   NOTE: For nonconcatenated interfaces on aggregated SONET/SDH interfaces, you can configure the link speed of the aggregate to match the speed of the nonconcatenated interface. For example, an OC12 PIC can have nonconcatenated interfaces with a link speed of OC3.

3. Configure the minimum bandwidth necessary to sustain the bundle in bits per second (bps).

```
[edit interfaces as0 aggregated-sonet-options]
user@host# set minimum-bandwidth minimum-bandwidth
```

4. Configure the minimum number of aggregated links that must be up for the bundle as a whole to be labeled **up** on the ae0 interface from 1 through 32. By default, only one link must be up for the bundle to be labeled **up**

```
[edit interfaces as0 aggregated-sonet-options]
user@host# set minimum-links minimum-links
```

On a T Series, TX Matrix router with SONET interfaces, the valid range for **minimum-links** ***number*** is from 1 through 16. When the maximum value (16) is specified, all configured links of a bundle must be up for the bundle to be labeled **up**.

On all other router routers, the range of valid values for **minimum-links** ***number*** is 1 through 8 and the maximum number of links supported in an aggregate is eight. When the maximum value (8) is specified, all configured links of a bundle must be up for the bundle to be labeled **up**.

Displaying the Aggregated SONET/SDH Interface Configuration

Purpose To display the aggregated SONET/SDH configuration for the as0 interface when the following options are set to get an aggregated SONET/SDH interface up and running:

- Minimum links—1
- Link speed—oc3
- Device count—15
- SONET interface name—so-1/3/0

Action Run the **show** command after setting the aforementioned parameters.

```
[edit]
user@host# show
interfaces {
   as0 {
      aggregated-sonet-options {
         minimum-links 1;
         link-speed oc3;
      }
      unit 0 {
         family inet {
            address 10.2.11.1/30;
         }
      }
   }
   so-1/3/0 {
      sonet-options {
         aggregate as0;
      }
   }
chassis {
   aggregated-devices {
      sonet {
         device-count 15;
      }
   }
```

Deleting an Aggregated SONET/SDH Interface

To delete an aggregated SONET/SDH interface (for example as0 interface) and to set the aggregated SONET/SDH interface to down state, perform the following tasks:

1. Deleting the Interface on page 104
2. Deleting Device Count on page 105

Deleting the Interface

To delete an aggregated SONET/SDH interface, for example the as0 interface.

1. In configuration mode, go to the **[edit interfaces]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces
   ```

2. Delete the aggregated SONET/SDH interface.

   ```
   [edit interfaces]
   user@host# delete asx
   ```


To set the aggregated SONET/SDH interface to down state

1. In configuration mode, go to the **[edit chassis aggregated-devices sonet]** hierarchy level.

```
[edit]
user@host# edit chassis aggregated-devices sonet
```

2. Delete the aggregated SONET/SDH interface.

```
[edit interfaces]
user@host# delete device-count
```

Deleting Device Count

To delete the device count for the aggregated SONET/SDH interfaces.

To set the aggregated SONET/SDH interface to down state

1. In configuration mode, go to the **[edit chassis aggregated-devices sonet]** hierarchy level.

```
[edit]
user@host# edit chassis aggregated-devices sonet
```

2. Delete the aggregated SONET/SDH interface.

```
[edit interfaces]
user@host# delete device-count
```

Configuring Filtering on a Aggregated SONET/SDH Interface

1. Configuring Filters or Sampling on Aggregated SONET/SDH Links on page 105
2. Configuring Filter Options on page 106

Configuring Filters or Sampling on Aggregated SONET/SDH Links

To set up firewall filters or sampling on the aggregated SONET/SDH interfaces, you must configure the **as*x*** interface with the following properties.

1. In configuration mode, go to the **[edit interfaces as*x* unit *logical-unit-number* filter]** hierarchy level.

```
[edit]
user@host# edit interfaces asx unit logical-unit-number filter
```

2. Configure the **input** option with a name for the filter to be applied to received packets.

```
[edit interfaces asx unit logical-unit-number filter]
```

```
user@host# set input input-filter-name
```

3. Configure the **output** option with a name for the filter to be applied to transmitted packets.

```
[edit interfaces asx unit logical-unit-number filter]
user@host# set output output-filter-name
```

Configuring Filter Options

To configure firewall filters options for input filter ***input-filter-name*** and output filter ***output-filter-name***..

1. In configuration mode, go to the **[edit firewall]** hierarchy level.

```
[edit]
user@host# edit firewall
```

2. Configure the input filter.

```
[edit firewall]
user@host# edit filter input-filter-name
```

3. Configure the input filter options.

```
[edit firewall filter input-filter-name
user@host# set term match-any-input then accept
```

4. Configure the output filter.

```
[edit firewall]
user@host# up
user@host# edit filter output-filter-name
```

5. Configure the output filter options.

```
[edit firewall filter input-filter-name
user@host# set term match-any-output then accept
```

Configuring Sampling on Aggregated SONET/SDH Interfaces

1. Configuring Sampling on a Aggregated SONET/SDH Interface on page 107
2. Configuring Sampling Filter Options on page 107
3. Configuring Forwarding Options For a Sampling Filter on page 107

Configuring Sampling on a Aggregated SONET/SDH Interface

To set up sampling on the aggregated SONET/SDH interfaces, you must configure the **as*x*** interface with the following properties.

1. In configuration mode, go to the **[edit interfaces as*x* unit *logical-unit-number* filter]** hierarchy level.

```
[edit]
user@host# edit interfaces asx unit logical-unit-number filter
```

2. Configure the **input** option with a name for the filter to be applied to received packets.

```
[edit interfaces asx unit logical-unit-number filter]
user@host# set input input-sampler-name
```

Configuring Sampling Filter Options

To configure firewall sampling filters options for input sampling filter ***input-sampler-name***.

1. In configuration mode, go to the **[edit firewall]** hierarchy level.

```
[edit]
user@host# edit firewall
```

2. Configure the input filter.

```
[edit firewall]
user@host# edit filter input-sampler-name
```

3. Configure the input filter options.

```
[edit firewall filter input-filter-name
user@host# set term match-any-input then sample
user@host# set term match-any-input then accept
```

Configuring Forwarding Options For a Sampling Filter

To configure the forwarding optons for a sampling filter.

1. In configuration mode, go to the **[edit forwarding-options sampling input]** hierarchy level.

```
[edit]
user@host# edit forwarding-options sampling input
```

2. Configure the ratio of packets to be sampled (1 out of N number of packets) from 1 through 65535.

```
[edit forwarding-options sampling input]
user@host# set rate rate
```

3. Configure the number of samples after initial trigger from 0 through 20.

```
[edit forwarding-options sampling input]
user@host# set run-length length
```

4. Configure the threshold of samples per second before dropping.

```
[edit forwarding-options sampling input]
user@host# set max-packets-per-second
```

5. Configure the maximum length of the sampled packet from 0 through 9192 bytes.

```
[edit forwarding-options sampling input]
user@host# set maximum-packet-length length
```

Related Documentation

- Understanding Aggregated SONET/SDH Interfaces on page 99

PART 3

Monitoring and Troubleshooting Information

- Monitoring SONET/SDH Interfaces on page 111
- Troubleshooting SONET/SDH Interfaces on page 117

CHAPTER 7

Monitoring SONET/SDH Interfaces

- Packet Flow Monitoring on SONET/SDH Interfaces Overview on page 111
- Enabling Packet Flow Monitoring on SONET/SDH Interfaces on page 112
- Configuring Multicast Statistics Collection on SONET Interfaces on page 115
- Configuring Multicast Statistics Collection on Aggregated SONET Interfaces on page 115

Packet Flow Monitoring on SONET/SDH Interfaces Overview

The Monitoring Services I and Monitoring Services II PICs are designed to enable IP services. If you have a Monitoring Services PIC and a SONET/SDH PIC installed in an M Series, MX Series, or T Series router, you can monitor IPv4 and IPv6 traffic from another router.

For information about enabling packet flow monitoring on SONET/SDH interfaces, see "Enabling Packet Flow Monitoring on SONET/SDH Interfaces" on page 112.

For the monitoring services interface, you can configure multiservice physical interface properties. For more information, see *Configuring Multiservice Physical Interface Properties* and the *Junos OS Services Interfaces Library for Routing Devices*.

To Monitor Packets with MPLS Labels

The Junos OS can forward only IPv4 packets to a Monitoring Services PIC. IPv4 packets with MPLS labels cannot be forwarded to a Monitoring Services PIC. By default, if packets with MPLS labels are forwarded to the Monitoring Services PIC, they are discarded. To monitor packets with MPLS labels, you must remove the MPLS labels as the packets arrive on the interface.

For information about removing MPLS labels from an incoming packet to a Monitoring Services PIC, see "Enabling Packet Flow Monitoring on SONET/SDH Interfaces" on page 112.

NOTE: On T Series routers, the **pop-all-labels** command can remove up to five MPLS labels from incoming packets.

NOTE: When you remove MPLS labels from incoming packets, note the following:

- By default, the **pop-all-labels** statement takes effect for incoming packets with one or two labels.
- The **pop-all-labels** statement has no effect on IP packets with three or more MPLS labels.
- When you enable MPLS label removal, you must configure all ports on a PIC with the same label popping mode and required depth.
- You use the **pop-all-labels** statement to enable passive monitoring applications, not active monitoring.
- You cannot apply MPLS filters or accounting to the MPLS labels because the labels are removed as soon as the packet arrives on the interface.

Related Documentation

- Enabling Packet Flow Monitoring on SONET/SDH Interfaces on page 112

Enabling Packet Flow Monitoring on SONET/SDH Interfaces

You can enable packet flow monitoring on SONET/SDH interfaces.

This topic includes the following tasks:

- Configuring Packet Flow Monitoring on a SONET/SDH Interface on page 112
- Configuring Packet Flow Monitoring on a Monitoring Services Interface on page 113
- Removing MPLS Labels from Incoming Packets on page 113

Configuring Packet Flow Monitoring on a SONET/SDH Interface

To configure packet flow monitoring on SONET/SDH interfaces:

1. In configuration mode, go to the **[edit interfaces so-*fpc/pic/port* unit *logical-unit-number*]** hierarchy level.

```
[edit]
user@host# edit interfaces so-fpc/pic/port unit logical-unit-number
```

2. Configure packet flow monitoring to monitor packet flows from another router.

```
[edit interfaces so-fpc/pic/port unit logical-unit-number]
user@host# set passive-monitor-mode
```

NOTE:

- If you include this statement in the configuration, the SONET/SDH interface does not send keepalives or alarms, and does not participate actively on the network.
- For SONET/SDH interfaces, you can include this statement on the logical interface only.

Configuring Packet Flow Monitoring on a Monitoring Services Interface

To configure packet flow monitoring on a monitoring services interface:

1. In configuration mode, go to the **[edit interfaces mo-*fpc/pic/port* unit *logical-unit-number*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces mo-fpc/pic/port unit logical-unit-number
   ```

2. Enable packet flow monitoring to monitor packet flows from another router on a monitoring services interface by specifying the **family** option as inet.

   ```
   [edit interfaces mo-fpc/pic/port unit logical-unit-number]
   user@host# set family inet
   ```

3. Configure the **receive-options-packets** and the **receive-ttl-exceeded** statements for conformity with cflowd record structure.

   ```
   [edit interfaces mo-fpc/pic/port unit logical-unit-number family inet]
   user@host# set receive-options-packets
   user@host# set receive-ttl-exceeded
   ```

For the monitoring services interface, you can configure multiservice physical interface properties. For more information, see *Configuring Multiservice Physical Interface Properties* and the *Junos OS Services Interfaces Library for Routing Devices*.

Removing MPLS Labels from Incoming Packets

The Junos OS can forward only IPv4 packets to a Monitoring Services PIC. IPv4 packets with MPLS labels cannot be forwarded to a Monitoring Services PIC. By default, if packets with MPLS labels are forwarded to the Monitoring Services PIC, they are discarded. To monitor packets with MPLS labels, you must remove the MPLS labels as the packets arrive on the interface. You can remove up to two MPLS labels from an incoming packet to a Monitoring Services PIC.

To remove MPLS labels from an incoming packet to a Monitoring Services PIC:

1. In configuration mode, go to the **[edit interfaces *interface-name* sonet-options mpls]** hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options mpls
```

2. Configure the **pop-all-labels** statement to remove up to two MPLS labels from incoming IP packets. Note that on T Series routers, the **pop-all-labels** statement removes up to five MPLS labels from incoming IP packets.

```
[edit interfaces interface-name sonet-options mpls]
user@host# set pop-all-labels
```

3. Configure the required-depth *number* statement to specify the number of MPLS labels an incoming packet must have for the **pop-all-labels** statement to take effect.

```
[edit interfaces interface-name sonet-options mpls pop-all-labels]
user@host# set required-depth number
```

The required depth can be 1, 2, or [1 2]. If you include the **required-depth 1** statement, the **pop-all-labels** statement takes effect for incoming packets with one label only.

If you include the **required-depth 2** statement, the **pop-all-labels** statement takes effect for incoming packets with two labels only. If you include the **required-depth [1 2]** statement, the **pop-all-labels** statement takes effect for incoming packets with one or two labels.

A required depth of **[1 2]** is equivalent to the default behavior of the **pop-all-labels** statement.

NOTE: When you remove MPLS labels from incoming packets, note the following:

- By default, the **pop-all-labels** statement takes effect for incoming packets with one or two labels.
- The **pop-all-labels** statement has no effect on IP packets with three or more MPLS labels.
- When you enable MPLS label removal, you must configure all ports on a PIC with the same label popping mode and required depth.
- You use the **pop-all-labels** statement to enable passive monitoring applications, not active monitoring.
- You cannot apply MPLS filters or accounting to the MPLS labels because the labels are removed as soon as the packet arrives on the interface.

Related Documentation

- Packet Flow Monitoring on SONET/SDH Interfaces Overview on page 111

Configuring Multicast Statistics Collection on SONET Interfaces

T Series and TX Matrix routers support multicast statistics collection on SONET interfaces in both ingress and egress directions. The multicast statistics functionality can be configured on a physical interface thus enabling multicast accounting for all the logical interfaces below the physical interface.

The multicast statistics information is displayed only when the interface is configured with the **multicast-statistics** statement, which is not enabled by default.

Multicast statistics collection requires at least one logical interface is configured with family inet and/or inet6; otherwise, the commit for **multicast-statistics** will fail.

The multicast in/out statistics can be obtained via interfaces statistics query through CLI and via MIB objects through SNMP query.

To configure multicast statistics:

1. Include the **multicast-statistics** statement at the [**edit interfaces interface-name**] hierarchy level.

An example of a multicast statistics configuration for a SONET interface follows:

```
[edit interfaces]
so-fpc/pic/port {
   multicast-statistics;
}
```

To display multicast statistics, use the **show interfaces *interface-name* statistics detail** command.

Related Documentation

- *multicast-statistics*
- Configuring Multicast Statistics Collection on Aggregated SONET Interfaces on page 115

Configuring Multicast Statistics Collection on Aggregated SONET Interfaces

T Series and TX Matrix routers support multicast statistics collection on aggregated SONET interfaces in both ingress and egress directions. The multicast statistics functionality can be configured on a physical interface thus enabling multicast accounting for all the logical interfaces below the physical interface.

The multicast statistics information is displayed only when the interface is configured with the **multicast-statistics** statement, which is not enabled by default.

Multicast statistics collection requires at least one logical interface is configured with family inet and/or inet6; otherwise, the commit for **multicast-statistics** will fail.

The multicast in/out statistics can be obtained via interfaces statistics query through CLI and via MIB objects through SNMP query.

To configure multicast statistics:

1. Include the **multicast-statistics** statement at the **[edit interfaces interface-name]** hierarchy level.

An example of a multicast statistics configuration for an aggregated SONET interface follows:

```
[edit interfaces]
as0 {
   multicast-statistics;
}
```

To display multicast statistics, use the **show interfaces *interface-name* statistics detail** command.

Related Documentation

- *multicast-statistics*
- Configuring Multicast Statistics Collection on SONET Interfaces on page 115

CHAPTER 8

Troubleshooting SONET/SDH Interfaces

- Configuring Interface Diagnostics Tools to Test the Physical Layer Connections on page 117
- Investigating Interface Steps and Commands on page 124
- Monitoring SONET Interfaces on page 128
- Using Loopback Testing for SONET Interfaces on page 136
- Locating SONET Alarms and Errors on page 150
- Enabling SONET Payload Scrambling on page 175
- Checking the SONET Frame Checksum on page 180

Configuring Interface Diagnostics Tools to Test the Physical Layer Connections

- Configuring Loopback Testing on page 117
- Configuring BERT Testing on page 119
- Starting and Stopping a BERT Test on page 123

Configuring Loopback Testing

Loopback testing allows you to verify the connectivity of a circuit. You can configure any of the following interfaces to execute a loopback test: aggregated Ethernet, Fast Ethernet, Gigabit Ethernet, E1, E3, *N*xDS0, serial, SONET/SDH, T1, and T3.

The physical path of a network data circuit usually consists of segments interconnected by devices that repeat and regenerate the transmission signal. The transmit path on one device connects to the receive path on the next device. If a circuit fault occurs in the form of a line break or a signal corruption, you can isolate the problem by using a loopback test. Loopback tests allow you to isolate segments of the circuit and test them separately.

To do this, configure a *line loopback* on one of the routers. Instead of transmitting the signal toward the far-end device, the line loopback sends the signal back to the originating router. If the originating router receives back its own Data Link Layer packets, you have verified that the problem is beyond the originating router. Next, configure a line loopback farther away from the local router. If this originating router does not receive its own Data Link Layer packets, you can assume that the problem is on one of the segments between the local router and the remote router's interface card. In this case, the next

troubleshooting step is to configure a line loopback closer to the local router to find the source of the problem.

The following types of loopback testing are supported by Junos OS:

- DCE local—Loops packets back on the local data circuit-terminating equipment (DCE).
- DCE remote—Loops packets back on the remote DCE.
- Local—Useful for troubleshooting physical PIC errors. Configuring local loopback on an interface allows transmission of packets to the channel service unit (CSU) and then to the circuit toward the far-end device. The interface receives its own transmission, which includes data and timing information, on the local router's PIC. The data received from the CSU is ignored. To test a local loopback, issue the **show interfaces *interface-name*** command. If PPP keepalives transmitted on the interface are received by the PIC, the **Device Flags** field contains the output **Loop-Detected**.
- Payload—Useful for troubleshooting the physical circuit problems between the local router and the remote router. A payload loopback loops data only (without clocking information) on the remote router's PIC. With payload loopback, overhead is recalculated.
- Remote—Useful for troubleshooting the physical circuit problems between the local router and the remote router. A remote loopback loops packets, including both data and timing information, back on the remote router's interface card. A router at one end of the circuit initiates a remote loopback toward its remote partner. When you configure a remote loopback, the packets received from the physical circuit and CSU are received by the interface. Those packets are then retransmitted by the PIC back toward the CSU and the circuit. This loopback tests all the intermediate transmission segments.

Table 13 on page 118 shows the loopback modes supported on the various interface types.

Table 13: Loopback Modes by Interface Type

Interface	Loopback Modes	Usage Guidelines
Aggregated Ethernet, Fast Ethernet, Gigabit Ethernet	Local	*Configuring Ethernet Loopback Capability*
Circuit Emulation E1	Local and remote	*Configuring E1 Loopback Capability*
Circuit Emulation T1	Local and remote	*Configuring T1 Loopback Capability*
E1 and E3	Local and remote	*Configuring E1 Loopback Capability* and *Configuring E3 Loopback Capability*
*N*xDS0	Payload	*Configuring NxDS0 IQ and IQE Interfaces*, *Configuring T1 and NxDS0 Interfaces*, *Configuring Channelized OC12/STM4 IQ and IQE Interfaces (SONET Mode)*, *Configuring Fractional E1 IQ and IQE Interfaces*, and *Configuring Channelized T3 IQ Interfaces*

Table 13: Loopback Modes by Interface Type (continued)

Interface	Loopback Modes	Usage Guidelines
Serial (V.35 and X.21)	Local and remote	*Configuring Serial Loopback Capability*
Serial (EIA-530)	DCE local, DCE remote, local, and remote	*Configuring Serial Loopback Capability*
SONET/SDH	Local and remote	"Configuring SONET/SDH Loopback Capability to Identify a Problem as Internal or External" on page 32
T1 and T3	Local, payload, and remote	*Configuring T1 Loopback Capability* and *Configuring T3 Loopback Capability* See also *Configuring the T1 Remote Loopback Response*

To configure loopback testing, include the **loopback** statement:

```
user@host# loopback mode;
```

You can include this statement at the following hierarchy levels:

- **[edit interfaces *interface-name* aggregated-ether-options]**
- **[edit interfaces *interface-name* ds0-options]**
- **[edit interfaces *interface-name* e1-options]**
- **[edit interfaces *interface-name* e3-options]**
- **[edit interfaces *interface-name* fastether-options]**
- **[edit interfaces *interface-name* gigether-options]**
- **[edit interfaces *interface-name* serial-options]**
- **[edit interfaces *interface-name* sonet-options]**
- **[edit interfaces *interface-name* t1-options]**
- **[edit interfaces *interface-name* t3-options]**

Configuring BERT Testing

To configure BERT:

- Configure the duration of the test.

  ```
  [edit interfaces interface-name interface-type-options]
  user@host#bert-period seconds;
  ```

  You can configure the BERT period to last from 1 through 239 seconds on some PICs and from 1 through 240 seconds on other PICs. By default, the BERT period is 10 seconds.

- Configure the error rate to monitor when the inbound pattern is received.

  ```
  [edit interfaces interface-name interface-type-options]
  user@host#bert-error-rate rate;
  ```

  rate is the bit error rate. This can be an integer from 0 through 7, which corresponds to a bit error rate from 10^{-0} (1 error per bit) to 10^{-7} (1 error per 10 million bits).

- Configure the bit pattern to send on the transmit path.

  ```
  [edit interfaces interface-name interface-type-options]
  user@host#bert-algorithm algorithm;
  ```

  algorithm is the pattern to send in the bit stream. For a list of supported algorithms, enter a **?** after the **bert-algorithm** statement; for example:

  ```
  [edit interfaces t1-0/0/0 t1-options]
  ```

  ```
  user@host# set bert-algorithm ?
  ```

  ```
  Possible completions:
    pseudo-2e11-o152     Pattern is 2^11 -1 (per O.152 standard)
    pseudo-2e15-o151     Pattern is 2^15 - 1 (per O.152 standard)
    pseudo-2e20-o151     Pattern is 2^20 - 1 (per O.151 standard)
    pseudo-2e20-o153     Pattern is 2^20 - 1 (per O.153 standard)
          ...
  ```

For specific hierarchy information, see the individual interface types.

NOTE: The four-port E1 PIC supports only the following algorithms:

```
pseudo-2e11-o152     Pattern is 2^11 -1 (per O.152 standard)
pseudo-2e15-o151     Pattern is 2^15 - 1 (per O.151 standard)
pseudo-2e20-o151     Pattern is 2^20 - 1 (per O.151 standard)
pseudo-2e23-o151     Pattern is 2^23 (per O.151 standard)
```

When you issue the help command from the CLI, all BERT algorithm options are displayed, regardless of the PIC type, and no commit check is available. Unsupported patterns for a PIC type can be viewed in system log messages.

NOTE: The 12-port T1/E1 Circuit Emulation (CE) PIC supports only the following algorithms:

```
all-ones-repeating   Repeating one bits
all-zeros-repeating  Repeating zero bits
alternating-double-ones-zeros  Alternating pairs of ones and zeros
alternating-ones-zeros  Alternating ones and zeros
pseudo-2e11-o152     Pattern is 2^11 -1 (per O.152 standard)
pseudo-2e15-o151     Pattern is 2^15 - 1 (per O.151 standard)
pseudo-2e20-o151     Pattern is 2^20 - 1 (per O.151 standard)
pseudo-2e7           Pattern is 2^7 - 1
pseudo-2e9-o153      Pattern is 2^9 - 1 (per O.153 standard)
repeating-1-in-4     1 bit in 4 is set
repeating-1-in-8     1 bit in 8 is set
repeating-3-in-24    3 bits in 24 are set
```

When you issue the help command from the CLI, all BERT algorithm options are displayed, regardless of the PIC type, and no commit check is available. Unsupported patterns for a PIC type can be viewed in system log messages.

NOTE: The IQE PICs support only the following algorithms:

```
all-ones-repeating   Repeating one bits
all-zeros-repeating  Repeating zero bits
alternating-double-ones-zeros  Alternating pairs of ones and zeros
alternating-ones-zeros  Alternating ones and zeros
pseudo-2e9-o153      Pattern is 2^9  -1 (per O.153 (511 type) standard)
pseudo-2e11-o152     Pattern is 2^11 -1 (per O.152 and O.153 (2047 type)
 standards)
pseudo-2e15-o151     Pattern is 2^15 -1 (per O.151 standard)
pseudo-2e20-o151     Pattern is 2^20 -1 (per O.151 standard)
pseudo-2e20-o153     Pattern is 2^20 -1 (per O.153 standard)
pseudo-2e23-o151     Pattern is 2^23 -1 (per O.151 standard)
repeating-1-in-4     1 bit in 4 is set
repeating-1-in-8     1 bit in 8 is set
repeating-3-in-24    3 bits in 24 are set
```

When you issue the help command from the CLI, all BERT algorithm options are displayed, regardless of the PIC type, and no commit check is available. Unsupported patterns for a PIC type can be viewed in system log messages.

NOTE: BERT is supported on the PDH interfaces of the Channelized SONET/SDH OC3/STM1 (Multi-Rate) MIC with SFP and the DS3/E3 MIC. The following BERT algorithms are supported:

```
all-ones-repeating            Repeating one bits
all-zeros-repeating           Repeating zero bits
alternating-double-ones-zeros Alternating pairs of ones and zeros
alternating-ones-zeros        Alternating ones and zeros
repeating-1-in-4              1 bit in 4 is set
repeating-1-in-8              1 bit in 8 is set
repeating-3-in-24             3 bits in 24 are set
pseudo-2e9-o153               Pattern is 2^9 - 1 (per O.153 standard)
pseudo-2e11-o152              Pattern is 2^11 - 1 (per O.152 standard)
pseudo-2e15-o151              Pattern is 2^15 - 1 (per O.151 standard)
pseudo-2e20-o151              Pattern is 2^20 - 1 (per O.151 standard)
pseudo-2e20-o153              Pattern is 2^20 - 1 (per O.153 standard)
pseudo-2e23-o151              Pattern is 2^23 (per O.151 standard)
```

Table 14 on page 122 shows the BERT capabilities for various interface types.

Table 14: BERT Capabilities by Interface Type

Interface	T1 BERT	T3 BERT	Comments
12-port T1/E1 Circuit Emulation	Yes (ports 0–11)	—	• Limited algorithms
4-port Channelized OC3/STM1 Circuit Emulation	Yes (port 0–3)	—	• Limited algorithms
E1 or T1	Yes (port 0–3)	Yes (port 0–3)	• Single port at a time • Limited algorithms
E3 or T3	Yes (port 0–3)	Yes (port 0–3)	• Single port at a time
Channelized OC12	—	Yes (channel 0–11)	• Single channel at a time • Limited algorithms • No bit count
Channelized STM1	Yes (channel 0–62)	—	• Multiple channels • Only one algorithm • No error insert • No bit count
Channelized T3 and Multichannel T3	Yes (channel 0–27)	Yes (port 0–3 on channel 0)	• Multiple ports and channels • Limited algorithms for T1 • No error insert for T1 • No bit count for T1

These limitations do not apply to channelized IQ interfaces. For information about BERT capabilities on channelized IQ interfaces, see *Channelized IQ and IQE Interfaces Properties*.

Starting and Stopping a BERT Test

Before you can start the BERT test, you must disable the interface. To do this, include the **disable** statement at the **[edit interfaces *interface-name*]** hierarchy level:

```
[edit interfaces interface-name]
disable;
```

After you configure the BERT properties and commit the configuration, begin the test by issuing the **test interface *interface-name interface-type*-bert-start** operational mode command:

```
user@host> test interface interface-name interface-type-bert-start
```

The test runs for the duration you specify with the **bert-period** statement. If you want to terminate the test sooner, issue the **test interface *interface-name interface-type*-bert-stop** command:

```
user@host> test interface interface-name interface-type-bert-stop
```

For example:

```
user@host> test interface t3-1/2/0 t3-bert-start
user@host> test interface t3-1/2/0 t3-bert-stop
```

To view the results of the BERT test, issue the **show interfaces extensive | find BERT** command:

```
user@host> show interfaces interface-name extensive | find BERT
```

For more information about running and evaluating the results of the BERT procedure, see the CLI Explorer.

NOTE: To exchange BERT patterns between a local router and a remote router, include the **loopback remote** statement in the interface configuration at the remote end of the link. From the local router, issue the **test interface** command.

Related Documentation

- *show interfaces diagnostics optics (Gigabit Ethernet, 10-Gigabit Ethernet, 40-Gigabit Ethernet, 100-Gigabit Ethernet, and Virtual Chassis Port)*

Investigating Interface Steps and Commands

This section includes the following information to assist you when troubleshooting interfaces:

- Investigating Interface Steps and Commands Overview on page 124
- Monitoring Interfaces on page 124
- Performing a Loopback Test on an Interface on page 125
- Locating Interface Alarms on page 127

Investigating Interface Steps and Commands Overview

The "Monitoring Interfaces" on page 124 section helps you determine the nature of the interface problem. The "Performing a Loopback Test on an Interface" on page 125 section provides information to help you isolate the source of the problem. The "Locating Interface Alarms" on page 127 section explains some of the alarms and errors for the media.

See Also

- Monitoring Interfaces on page 124
- Performing a Loopback Test on an Interface on page 125
- Locating Interface Alarms on page 127

Monitoring Interfaces

Problem **Description:** The following steps are a general outline of how you monitor interfaces to determine the nature of interface problems. For more detailed information on a specific interface, see the corresponding monitor interfaces section.

Solution To monitor interfaces, follow these steps:

1. Display the status of an interface.
2. Display the status of a specific interface.
3. Display extensive status information for a specific interface.
4. Monitor statistics for an interface.

The Table 15 on page 124 lists and describes the operational mode commands you use to monitor interfaces.

Table 15: Commands Used to Monitor Interfaces

CLI Command	Description
show interfaces terse ***interface-name*** For example: **show interfaces terse t1***	Displays summary information about the named interfaces.

Table 15: Commands Used to Monitor Interfaces (continued)

CLI Command	Description
show interfaces ***interface-name*** For example: **show interfaces t1-***x/y/z*	Displays static status information about a specific interface.
show interfaces ***interface-name*** **extensive** For example: **show interfaces t1-***x/y/z* **extensive**	Displays very detailed interface information about a specific interface.
monitor interface ***interface-name*** For example: **monitor interface t1-***x/y/z*	Displays real-time statistics about a physical interface, updated every second.

See Also

- Investigating Interface Steps and Commands Overview on page 124
- Performing a Loopback Test on an Interface on page 125
- Locating Interface Alarms on page 127

Performing a Loopback Test on an Interface

Problem **Description:** The following steps are a general outline of how you use loopback testing to isolate the source of the interface problem. For more detailed information on a specific interface, see the corresponding loopback section.

Solution To use loopback testing for interfaces, follow these steps:

1. To diagnose a suspected hardware problem:
   a. Create a loopback.
   b. Set clocking to internal. (Not for Fast Ethernet/Gigabit Ethernet or Multichannel DS3 interfaces.)
   c. Verify that the status of the interface is up.
   d. Configure a static address resolution protocol table entry. (Fast Ethernet/Gigabit Ethernet interfaces only)
   e. Clear the interface statistics.
   f. Force the link layer to stay up.
   g. Verify the status of the logical interface.
   h. Ping the interface.
   i. Check for interface error statistics.
2. To diagnose a suspected connection problem:

a. Create a loop from the router to the network.

b. Create a loop to the router from various points in the network.

The Table 16 on page 126 lists and describes the operational and configuration mode commands you use to perform loopback testing on interfaces (the commands are shown in the order in which you perform them).

Table 16: Commands Used to Perform Loopback Testing on Interfaces

CLI Statement or Command	Interface Type	Description
[edit interfaces *interface-name* interface-options] **set loopback (local | remote)**	All interfaces	The **loopback** statement at the hierarchy level configures a loopback on the interface. Packets can be looped on either the local router or the remote channel service unit (CSU). To turn off loopback, remove the **loopback** statement from the configuration.
show	All interfaces	Verify the configuration before you commit it.
commit	All interfaces	Save the set of changes to the database and cause the changes to take operational effect. Use after you have verified a configuration in all configuration steps.
[edit interfaces *interface-name*] **set clocking internal**	T1, T3, ATM, and SONET interfaces	The **clocking** statement at this hierarchy level configures the clock source of the interface to internal.
show interfaces *interface-name*	Used for all interfaces	Display static status information about a specific interface.
[edit interfaces *interface-name* unit *logical-unit-number* family inet address *ip-address*] **set arp *ip-address mac mac-address***	Fast Ethernet and Gigabit Ethernet interfaces	The **arp** statement at this hierarchy level defines mappings between IP and Media Access Control (MAC) addresses.
show arp no-resolve	Fast Ethernet and Gigabit Ethernet interfaces	Display the entries in the ARP table without attempting to determine the hostname that corresponds to the IP address (the **no-resolve** option).
clear interfaces statistics *interface-name*	All interfaces	Reset the statistics for an interface to zero.
[edit interfaces *interface-name*] **set encapsulation cisco-hdlc**	T1, T3, SONET, and Multichannel DS3 interfaces	The **encapsulation** statement at this hierarchy level sets the encapsulation to the Cisco High-level Data-Link Control (HDLC) transport protocol on the physical interface.
[edit interfaces *interface-name*] **set no-keepalives**	T1, T3, SONET, and Multichannel DS3 interfaces	The **no-keepalives** statement at this level disables the sending of keepalives on the physical interface.

Table 16: Commands Used to Perform Loopback Testing on Interfaces (continued)

CLI Statement or Command	Interface Type	Description
show interfaces *interface-name* **terse**	T1, T3, and SONET interfaces	Display summary information about interfaces. (Use to display the status of the logical interfaces for these interfaces.)
ping interface t1-*x/y/z local-ip-address* **bypass-routing count 1000 rapid**	All interfaces	Check the reachability of network hosts by sending **ICMP ECHO_REQUEST** messages to elicit **ICMP ECHO_RESPONSE** messages from the specified host. Use the **bypass-routing** option to ping a local system through an interface that has no route through it. The **count** option sends 1000 ping requests through the system. Type **Ctrl+C** to interrupt a **ping** command.
show interfaces *interface-name* **extensive**	All interfaces	Display very detailed interface information about a specific interface.

See Also
- Investigating Interface Steps and Commands Overview on page 124
- Monitoring Interfaces on page 124
- Locating Interface Alarms on page 127

Locating Interface Alarms

Problem **Description:** Locating alarms and errors for the media can be a simple process.

Solution To locate interface alarms and errors, use the **show interfaces** *interface-name* **extensive** command and examine the output for active alarms and defects.

See Also
- Investigating Interface Steps and Commands Overview on page 124
- Monitoring Interfaces on page 124
- Performing a Loopback Test on an Interface on page 125

Monitoring SONET Interfaces

This section includes the following information to assist you when troubleshooting SONET interfaces:

- Checklist for Monitoring SONET Interfaces on page 128
- Monitoring SONET Interfaces on page 128
- Verifying the Status of the Logical Interface on page 135

Checklist for Monitoring SONET Interfaces

Purpose To monitor SONET interfaces and begin the process of isolating SONET interface problems when they occur.

Action Table 17 on page 128 provides the links and commands for monitoring SONET interfaces.

Table 17: Checklist for Monitoring SONET Interfaces

Tasks	Command or Action
"Monitoring SONET Interfaces" on page 128	
1. Displaying the Status of SONET Interfaces on page 128	**show interfaces terse so***
2. Displaying the Status of a Specific SONET Interface on page 129	**show interfaces so-*fpc/pic/port***
3. Displaying Extensive Status Information for a Specific SONET Interface on page 131	**show interfaces so-*fpc/pic/port* extensive**
4. Monitoring Statistics for a SONET Interface on page 132	**monitor interface so-*fpc/pic/port***

Monitoring SONET Interfaces

By monitoring SONET interfaces, you begin the process of isolating SONET interface problems when they occur.

To monitor your SONET interface, follow these steps:

1. Displaying the Status of SONET Interfaces on page 128
2. Displaying the Status of a Specific SONET Interface on page 129
3. Displaying Extensive Status Information for a Specific SONET Interface on page 131
4. Monitoring Statistics for a SONET Interface on page 132

Displaying the Status of SONET Interfaces

Purpose To display the status of SONET interfaces, use the following Junos OS command-line interface (CLI) operational mode command:

Action **user@host> show interfaces terse so***

Meaning The sample output lists only the SONET interfaces. It shows the status of both the physical and logical interfaces.

For a description of what the output means, see Table 18 on page 129.

Table 18: Status of SONET Interfaces

Physical Interface	Logical Interface	Status Description
so-1/0/0 **Admin Up** **Link Up**	**so-1/0/0.0** **Admin Up** **Link Up**	This interface has both the physical and logical links up and running.
so-1/1/1 **Admin Down** **Link Up**	**so-1/1/1.0** **Admin Up** **Link Down**	This interface is administratively disabled. The physical link is healthy (**Link Up**), but the logical link is not established end to end (**Link Down**).
so-3/0/1 **Admin Up** **Link Up**	**so-3/0/1.0** **Admin Up** **Link Down**	This interface is administratively enabled and the physical link is healthy (**Link Up**), but the logical interface is not established end to end (**Link Down**).
so-5/3/0 **Admin Up** **Link Down**	**so-5/3/0.0** **Admin Up** **Link Down**	This interface has the physical link down and the logical interface is down also.

See Also
- *SONET Interfaces*
- Monitoring SONET Interfaces on page 128
- Checklist for Monitoring SONET Interfaces on page 128

Displaying the Status of a Specific SONET Interface

Purpose To display the status of a specific SONET interface when you need to investigate its status further, use the following Junos OS CLI operational mode command:

Action **user@host> show interfaces so-*fpc/pic/port***

Sample Output 1

The following sample output is for an interface with the physical link down:

```
user@router> show interfaces so-1/1/1
Physical interface: so-1/1/1, Enabled, Physical link is Down
  Interface index: 17, SNMP ifIndex: 16
  Description: router-02 pos 4/0
  Link-level type: Cisco-HDLC, MTU: 4474, Clocking: Internal, SONET mode
  Speed: OC3, Loopback: None, CRC: 32, Payload scrambler: Enabled
  Device flags   : Present Running Down
  Interface flags: Hardware-Down Link-Layer-Down Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Keepalive Input: 621 (00:02:57 ago), Output: 889 (00:00:09 ago)
  Input rate     : 0 bps (0 pps), Output rate: 0 bps (0 pps)
  Active alarms  : LOL, LOS
  Active defects : LOL, LOF, LOS, SEF, AIS-L, AIS-P, PLM-P
  Logical interface so-1/1/1.0 (Index 18) (SNMP ifIndex 30)
    Description: router-02 pos 4/0
    Flags: Device-down Point-To-Point SNMP-Traps, Encapsulation: Cisco-HDLC
    Protocol inet, MTU: 4470
      Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
        Destination: 10.10.10.48/30, Local: 10.10.10.50
    Protocol iso, MTU: 4469
```

Sample Output 2

The following output is for an interface with the physical layer up and the link layer down:

```
user@router> show interfaces so-3/0/1
Physical interface: so-3/0/1, Enabled, Physical link is Up
  Interface index: 28, SNMP ifIndex: 55
  Description:  Customer ABC
  Link-level type: Cisco-HDLC, MTU: 4474, Clocking: Internal, SONET mode, Speed:
 OC3,
  Loopback: None, FCS: 16, Payload scrambler: Enabled
  Device flags   : Present Running
  Interface flags: Link-Layer-Down Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive: Input: 113 (00:00:02 ago), Output: 119 (00:00:02 ago)
  Input rate     : 80 bps (0 pps)
  Output rate    : 88 bps (0 pps)
  SONET alarms   : None
  SONET defects  : None
  Logical interface so-3/0/1.0 (Index 22) (SNMP ifIndex 56)
    Flags: Device-Down Point-To-Point SNMP-Traps Encapsulation: Cisco-HDLC
    Protocol inet, MTU: 4470, Flags: None
      Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
        Destination: 192.168.2.124/30, Local: 192.168.2.125
```

Meaning In the first sample output, the first line of the sample output shows that the physical link is down. This means that the physical link is unhealthy and cannot pass packets. Further down the sample output, look for active alarms and defects. When you see this situation,

to further diagnose the problem, see "Displaying Extensive Status Information for a Specific SONET Interface" on page 131 to display more extensive information about the SONET interface and the physical interface that is down.

In the second sample output, the sample output shows that the link layer is down. This means that the logical interface is not established end to end. When you see this situation, to further diagnose the problem, see "Monitoring Statistics for a SONET Interface" on page 132 to monitor statistics for the SONET interface and the logical interface that is down.

Displaying Extensive Status Information for a Specific SONET Interface

Purpose To display extensive status information about a specific interface, use the following Junos OS CLI operational mode command:

Action **user@host> show interfaces so-*fpc/pic/port* extensive**

Sample Output

```
user@router> show interfaces so-1/1/1 extensive
Physical interface: so-1/1/1, Enabled, Physical link is Down
  Interface index: 17, SNMP ifIndex: 16
  Description: router-02 pos 4/0
  Link-level type: Cisco-HDLC, MTU: 4474, Clocking: Internal, SONET mode
  Speed: OC3, Loopback: None, CRC: 32, Payload scrambler: Enabled
  Device flags   : Present Running Down
  Interface flags: Hardware-Down Link-Layer-Down Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Keepalive statistics:
    Input : 621 (last seen 00:05:35 ago)
    Output: 905 (last seen 00:00:07 ago)
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :            378736540                    0 bps
   Output bytes  :              6786356                    0 bps
   Input  packets:               225924                    0 pps
   Output packets:               104798                    0 pps
   Input errors:
    Errors: 8, Drops: 0, Framing errors: 4181286, Runts: 0, Giants: 8
    Policed discards: 9474, L3 incompletes: 0, L2 channel errors: 0
    L2 mismatch timeouts: 3, HS link CRC errors: 0, HS link FIFO overflows: 0
   Output errors:
    Carrier transitions: 2, Errors: 0, Drops: 0, Aged packets: 0
    HS link FIFO underflows: 0
   Active alarms   : LOL, LOS  <--  SONET active alarms and defects
   Active defects : LOL, LOF, LOS, SEF, AIS-L, AIS-P, PLM-P
  SONET PHY:            Seconds        Count  State  <-- SONET media-specific
errors
    PLL Lock                  0            0  OK
    PHY Light               328            1  Light Missing
  SONET section: <--  SONET section errors
    BIP-B1                    0            0
    SEF                     329            3  Defect Active
    LOS                     329            2  Defect Active
    LOF                     329            2  Defect Active
```

```
    ES-S                    329
    SES-S                   329
    SEFS-S                  329
  SONET line:
    BIP-B2                    0           0
    REI-L                     0           0
    RDI-L                     0           0  OK
    AIS-L                   328           1  Defect Active
    BERR-SF                   0           0  OK
    BERR-SD                   0           0  OK
    ES-L                    329
    SES-L                   329
    UAS-L                   318
    ES-LFE                    0
    SES-LFE                   0
    UAS-LFE                   0
  SONET path:
    BIP-B3                    0           0
    REI-P                     0           0
    LOP-P                     1           1  OK
    AIS-P                   328           1  Defect Active
    RDI-P                     0           0  OK
    UNEQ-P                    0           0  OK
    PLM-P                   328           1  Defect Active
    ES-P                    329
    SES-P                   329
    UAS-P                   318
    ES-PFE                    0
    SES-PFE                   0
    UAS-PFE                   0
[...Output truncated...]
```

Meaning The sample output details where the errors might be occurring. Error details include input and output errors, active alarms and defects, and media-specific errors. The SONET section, line, and path errors help narrow down the source of the problem.

If the physical link is down, look at the active alarms and defects for the SONET interface and troubleshoot the SONET media accordingly. See"List of Common SONET Alarms and Errors" on page 150 for an explanation of SONET alarms.

Monitoring Statistics for a SONET Interface

Purpose To monitor statistics for a SONET interface, use the following Junos OS CLI operational mode command:

Action **user@host> monitor interface so-*fpc/pic/port***

CAUTION: We recommend that you use this command only for diagnostic purposes. Do not leave it on during normal router operations because real-time monitoring of traffic consumes additional CPU and memory resources.

Sample Output

```
user@router> monitor interface so-1/1/1

router                        Seconds: 168                Time: 15:48:50
Interface: so-1/1/1, Enabled, Link is Down
Encapsulation: Cisco-HDLC, Keepalives, Speed: OC3
Traffic statistics:                                           Current Delta
  Input bytes:                  375527568 (0 bps)                     [0]
  Output bytes:                   6612857 (0 bps)                   [475]
  Input packets:                   224001 (0 pps)                     [0]
  Output packets:                  102090 (0 pps)                    [20]
Encapsulation statistics:
  Input keepalives:                     0                            [0]
  Output keepalives:                  176                           [17]
Error statistics:
  Input errors:                         0                            [0]
  Input drops:                          0                            [0]
  Input framing errors:               179                           [17]
  Policed discards:                    47                            [0]
  L3 incompletes:                       0                            [0]
  L2 channel errors:                    0                            [0]
  L2 mismatch timeouts:                 0                            [0]
  Carrier transitions:                  1                            [0]
  Output errors:                        0                            [0]
  Output drops:                         0                            [0]
  F2      : 0x00  Z3        : 0x00  Z4        : 0x00
Interface warnings:
  o Received keepalive count is zero
  o Framing errors are increasing, check FCS configuration and link
Next='n', Quit='q' or ESC, Freeze='f', Thaw='t', Clear='c', Interface='i'
```

Meaning This output checks for and displays common interface failures, whether or not loopback is detected, and any increases in framing errors. Information from this command can help you narrow down possible causes of an interface problem.

NOTE: If you are accessing the router from the console connection, make sure you set the CLI terminal type using the set cli terminal command.

The statistics in the second column are the cumulative statistics since the last time they were cleared using the **clear interfaces statistics** ***interface-name*** command. The statistics in the third column are the statistics since the **monitor interface** ***interface-name*** command was executed.

If the framing errors are increasing, verify that the frame check sequence (FCS) and scrambling configuration match on both ends of the connection. If the configuration is correct, check the cabling to the router and have the carrier verify the integrity of the line.

If the input errors are increasing, check the cabling to the router and have the carrier verify the integrity of the line.

If you are sending output keepalives but are not receiving any input keepalives, verify that the encapsulation and keepalive configurations match on both ends of the connection.

Table 19 on page 134 lists and describes the SONET error statistics in the output for the **monitor interface** command. The output fields are listed in the order in which they appear in the output.

Table 19: SONET Error Statistics

Output Field	Output Field Description
Input errors	Sum of the incoming frame aborts and FCS errors.
Input drops	Number of packets dropped by the output queue of the I/O Manager ASIC. If the interface is saturated, this number increments once for every packet that is dropped by the ASIC's random early detection (RED) mechanism.
Input framing errors	The number of packets that have FCS errors.
Policed discards	Frames that the incoming packet match code discarded because they were not recognized or of interest. Usually, this field reports protocols that the Junos OS does not handle.
L3 incompletes	Increments when the incoming packet fails Layer 3 (usually IPv4) sanity checks of the header. For example, a frame with less than 20 bytes of available IP header would be discarded and this counter would increment.
L2 channel errors	Increments when the software cannot find a valid logical interface for an incoming frame.
L2 mismatch timeouts	Count of malformed or short packets that cause the incoming packet handler to discard the frame as unreadable.
Carrier transitions	Number of times the interface has gone from down to up. This number should not increment quickly, increasing only when the cable is unplugged, the far-end system is powered down and up, or a similar problem occurs. If it increments quickly (perhaps once every 10 seconds), then the cable, the far-end system, or the PIC is broken.
Output errors	Sum of the outgoing frame aborts and FCS errors. Because output errors are rare, hardware problems, configuration, or software bugs might contribute to the cause of them. Use the output of the **show interfaces *type-fpc/pic/port* extensive** command for more details about which output errors are incrementing. Also, analyze the system or interface load to determine if those areas are contributing to the cause of the problem. If the problem persists, open a case with the Juniper Networks Technical Assistance Center (JTAC) at **support@juniper.net** or at 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).
Output drops	Number of packets dropped by the output queue of the I/O Manager ASIC. If the interface is saturated, this number increments once for every packet that is dropped by the ASIC's RED mechanism.

See Also

- Configuring Multicast Statistics Collection on SONET Interfaces on page 115
- Clearing SONET Interface Statistics on page 143
- Checklist for Monitoring SONET Interfaces on page 128

- Checking for SONET Interface Error Statistics on page 147

Verifying the Status of the Logical Interface

Purpose To verify the status of the logical interface, use the following two Junos OS CLI operational mode commands:

Action **user@host> show interfaces so-*fpc/pic/port***

user@host> show interfaces so-*fpc/pic/port* terse

Sample Output 1

The following sample output displays the information for a logical interface that is up:

```
user@host> show interfaces so-2/2/0
Physical interface: so-2/2/0, Enabled, Physical link is Up
Interface index: 21, SNMP ifIndex: 45
Link-level type: Cisco-HDLC, MTU: 4474, Clocking: Internal, SONET mode, Speed:
OC3, Loopback: None
FCS: 16, Payload scrambler: Enabled
Device flags   : Present Running
Interface flags: Point-To-Point SNMP-Traps
Link flags     : No-Keepalives
Input rate     : 0 bps (0 pps)
Output rate    : 0 bps (0 pps)
SONET alarms   : None
SONET defects  : None
Logical interface so-2/2/0.0 (Index 7) (SNMP ifIndex 33)
Flags: Point-To-Point SNMP-Traps Encapsulation: Cisco-HDLC
Protocol inet, MTU: 4470, Flags: None
Addresses, Flags: Is-Preferred Is-Primary
Destination: 10.0.2/24, Local: 10.0.2.1

user@host> show interfaces so-2/2/0 terse
Interface       Admin Link Proto Local                 Remote
so-2/2/0        up    up
so-2/2/0.0      up    up   inet  10.0.2.1/24
```

Sample Output 2

The following sample output displays the information for a logical interface that is down:

```
user@host> show interfaces so-2/2/0
Physical interface: so-2/2/0, Enabled, Physical link is Up
Interface index: 21, SNMP ifIndex: 45
Link-level type: Cisco-HDLC, MTU: 4474, Clocking: Internal, SONET mode, Speed:
OC3, Loopback: None,
FCS: 16, Payload scrambler: Enabled
Device flags   : Present Running Loop-Detected
Interface flags: Link-Layer-Down  Point-To-Point SNMP-Traps
Link flags     : Keepalives
Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
Keepalive: Input: 14 (00:00:05 ago), Output: 14 (00:00:05 ago)
Input rate     : 0 bps (0 pps)
```

```
Output rate     : 0 bps (0 pps)
SONET alarms    : None
SONET defects   : None
Logical interface so-2/2/0.0 (Index 7) (SNMP ifIndex 33)
Flags: Device-Down  Point-To-Point SNMP-Traps Encapsulation: Cisco-HDLC
Protocol inet, MTU: 4470, Flags: None
Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
Destination: 10.0.2/24, Local: 10.0.2.1

user@host> show interfaces so-2/2/0 terse
Interface       Admin Link Proto Local                 Remote
so-2/2/0        up    down
so-2/2/0.0      up    down  inet  10.0.2.1/24
```

Meaning In the sample output 1, the **show interfaces** command in sample output 1 shows that the logical link is up because there are no flags indicating that the link layer is down. The output for the **show interfaces terse** command shows that logical interface **so-2/2/0.0** is up.

Both commands in sample output 2 show that the logical interface is down. The first command shows that the link layer, device, and destination route are all down. The second command shows that logical interface **so-2/2/0.0** is down.

See Also
- *Configuring Logical Interface Properties*

Related Documentation
- Monitoring Interfaces on page 124
- Performing a Loopback Test on an Interface on page 125

Using Loopback Testing for SONET Interfaces

This section includes the following information to assist you when troubleshooting SONET interfaces:

- Checklist for Using Loopback Testing for SONET Interfaces on page 137
- Diagnosing a Suspected Hardware Problem with a SONET Interface on page 138
- Creating a Loopback on page 138
- Setting Clocking to Internal on page 140
- Verifying That the SONET Interface Is Up on page 141
- Clearing SONET Interface Statistics on page 143
- Checking That the Received and Transmitted Path Trace Are the Same on page 143
- Forcing the Link Layer to Stay Up on page 144
- Pinging the SONET Interface on page 146

- Checking for SONET Interface Error Statistics on page 147
- Diagnosing a Suspected Circuit Problem on page 148

Checklist for Using Loopback Testing for SONET Interfaces

Purpose To use loopback testing to isolate SONET interface problems.

Action Table 20 on page 137 provides the links and commands for using loopback testing for SONET interfaces.

Table 20: Checklist for Using Loopback Testing for SONET Interfaces

Tasks	Command or Action
"Diagnosing a Suspected Hardware Problem with a SONET Interface" on page 138	
1. Creating a Loopback on page 138	Create a loopback.
a. Creating a Physical Loopback on page 139	Connect the transmit port to the receive port.
b. Configuring a Local Loopback on page 139	[edit interfaces *interface-name*sonet-options] set loopback local show commit
2. Setting Clocking to Internal on page 140	[edit interfaces *interface-name*] set clocking internal show commit
3. Verifying That the SONET Interface Is Up on page 141	show interfaces so-*fpc/pic/port*
4. Clearing SONET Interface Statistics on page 143	clear interfaces statistics so-*fpc/pic/port*
5. Checking That the Received and Transmitted Path Trace Are the Same on page 143	show interfaces so-*fpc/pic/port* extensive
6. Forcing the Link Layer to Stay Up on page 144	
a. Configuring Encapsulation to Cisco-HDLC on page 144	[edit interfaces *interface-name*] set encapsulation cisco-hdlc show commit
b. Configuring No-Keepalives on page 145	[edit interfaces *interface-name*] set no-keepalives show commit
7. Verifying the Status of the Logical Interface on page 135	show interfaces so-*fpc/pic/port* show interfaces so-*fpc/pic/port* terse
8. Pinging the SONET Interface on page 146	ping interface so-*fpc/pic/port local-IP-address* bypass-routing count 1000 rapid

Table 20: Checklist for Using Loopback Testing for SONET Interfaces (continued)

Tasks	Command or Action
9. Checking for SONET Interface Error Statistics on page 147	**show interfaces so-*fpc/pic/port* extensive**
"Diagnosing a Suspected Circuit Problem" on page 148	
1. Creating a Loop from the Router to the Network on page 148	**[edit interfaces *interface-name* sonet-options]** **set loopback remote** **show** **commit**
2. Creating a Loop to the Router from Various Points in the Network on page 149	Perform Steps 2 through 8 from "Diagnosing a Suspected Hardware Problem with a SONET Interface" on page 138.

Diagnosing a Suspected Hardware Problem with a SONET Interface

Problem **Description:** When you suspect a hardware problem, take the following steps to verify if there is a problem.

Solution To diagnose a suspected hardware problem with the SONET interface, follow these steps:

- Creating a Loopback on page 138
- Setting Clocking to Internal on page 140
- Verifying That the SONET Interface Is Up on page 141
- Clearing SONET Interface Statistics on page 143
- Checking That the Received and Transmitted Path Trace Are the Same on page 143
- Forcing the Link Layer to Stay Up on page 144
- Verifying the Status of the Logical Interface on page 135
- Pinging the SONET Interface on page 146
- Checking for SONET Interface Error Statistics on page 147

Creating a Loopback

You can create a physical loopback or configure a local loopback to help diagnose a suspected hardware problem. Creating a physical loopback is recommended because it allows you to test and verify the transmit and receive ports. If a field engineer is not available to create the physical loopback, you can configure a local loopback for the

interface. The local loopback creates a loopback internally in the Physical Interface Card (PIC).

1. Creating a Physical Loopback on page 139
2. Configuring a Local Loopback on page 139

Creating a Physical Loopback

Action

To create a physical loopback at the port, connect the transmit port to the receive port using a known good fiber cable.

NOTE: Make sure you use a single-mode fiber for a single-mode port and multimode fiber for a multimode port. (For OC192, you must use the appropriate attentuation.)

Meaning

When you create and test a physical loopback, you are testing the transmit and receive ports of the PIC. This action is recommended if a field engineer is available to create the physical loop as it provides a more complete test of the PIC.

See Also

- Checklist for Using Loopback Testing for SONET Interfaces on page 137
- Configuring SONET/SDH Loopback Capability to Identify a Problem as Internal or External on page 32
- *Configuring the Loopback Interface*

Configuring a Local Loopback

Action

To configure a local loopback without physically connecting the transmit port to the receive port, follow these steps:

1. In configuration mode, go to the following hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options
```

2. Configure the local loopback option.

```
[edit interfaces interface-name sonet-options]
user@host# set loopback local
```

3. Verify the configuration.

```
[edit interfaces interface-name sonet-options]
user@host# show
loopback local;
```

4. Commit the change.

```
user@host# commit
```

Meaning

When you create a local loopback, you create an internal loop on the interface being tested. A local loopback loops the traffic internally on that PIC. A local loopback tests the interconnection of the PIC but does not test the transmit and receive ports.

NOTE: Remember to delete the loopback statement after completing the test.

See Also
- Creating a Physical Loopback on page 139

See Also
- Setting Clocking to Internal on page 140
- Diagnosing a Suspected Hardware Problem with a SONET Interface on page 138

Setting Clocking to Internal

Purpose

Clocking is set to internal because there is no external clock source in a loopback connection.

Action

To configure clocking to internal, follow these steps:

1. In configuration mode, go to the following hierarchy level.

```
[edit]
user@host# edit interfaces interface-name
```

2. Configure clocking to internal.

```
[edit interfaces interface-name]
user@host# set clocking internal
```

3. Verify the configuration.

```
[edit interfaces interface-name]
user@host# show
clocking internal;
```

4. Commit the change.

```
user@host# commit
```

Meaning

The clock source for the interface is set to the internal Stratum 3 clock.

See Also

- Creating a Loopback on page 138
- Verifying That the SONET Interface Is Up on page 141

Verifying That the SONET Interface Is Up

Purpose Displaying the status of the SONET interface provides the information you need to determine whether the physical link is up or down.

Action To verify that the SONET interface is up, use the following Junos OS command-line interface (CLI) operational mode command:

```
user@host> show interfaces so-fpc/pic/port
```

Sample Output 1

The following output is for a SONET interface with the physical link up:

```
user@host#  show interfaces so-2/2/0
Physical interface: so-2/2/0, Enabled, Physical link is Up
Interface index: 21, SNMP ifIndex: 45
Link-level type: PPP, MTU: 4474, Clocking: Internal, SONET mode, Speed: OC3,
Loopback: None, FCS: 16,
Payload scrambler: Enabled
Device flags   : Present Running Loop-Detected
Interface flags: Point-To-Point SNMP-Traps
Link flags     : Keepalives
Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
Keepalive: Input: 0 (never), Output: 0 (never)
LCP state: Conf-req-sent
NCP state: inet: Down, inet6: Not-configured, iso: Not-configured, mpls:
Not-configured
Input rate     : 48 bps (0 pps)
Output rate    : 56 bps (0 pps)
SONET alarms   :  None
SONET defects  :  None
Logical interface so-2/2/0.0 (Index 7) (SNMP ifIndex 33)
Flags: Hardware-Down Point-To-Point SNMP-Traps Encapsulation: PPP
Protocol inet, MTU: 4470, Flags: Protocol-Down
```

```
Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
Destination: 10.0.2/24, Local: 10.0.2.1
```

Sample Output 2

When you see that the physical link is down, there might be a problem with the port. Sample output 2 shows that the physical link is down:

```
user@host# show interfaces so-2/2/0
Physical interface: so-2/2/0, Enabled, Physical link is Down
Interface index: 21, SNMP ifIndex: 45
Link-level type: PPP, MTU: 4474, Clocking: Internal, SONET mode, Speed: OC3,
Loopback: None, FCS: 16,
Payload scrambler: Enabled
Device flags   : Present Running Down
Interface flags: Hardware-Down Point-To-Point SNMP-Traps
Link flags     : Keepalives
Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
Keepalive: Input: 0 (never), Output: 0 (never)
LCP state: Conf-req-sent
NCP state: inet: Down, inet6: Not-configured, iso: Not-configured, mpls:
Not-configured
Input rate     : 0 bps (0 pps)
Output rate    : 0 bps (0 pps)
SONET alarms   :  LOL, LOS
SONET defects  :  LOL, LOF, LOS, SEF, AIS-L, AIS-P
Logical interface so-2/2/0.0 (Index 7) (SNMP ifIndex 33)
Flags: Hardware-Down Device-Down Point-To-Point SNMP-Traps Encapsulation: PPP
Protocol inet, MTU: 4470, Flags: Protocol-Down
Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
Destination: 10.0.2/24, Local: 10.0.2.1
```

Meaning Sample output 1 shows that the physical link is up, the loop is detected, and there are no SONET alarms or defects.

If the physical link is up, continue with "Checking That the Received and Transmitted Path Trace Are the Same" on page 143.

The sample output 2 shows that the physical link is down, the device flags and interface flags are down, and there are SONET alarms and defects.

Table 21 on page 142 lists problem situations and actions for a physical link that is down.

Table 21: Problems and Solutions for a Physical Link That Is Down

Problem	Action
Cable mismatch	Verify that the fiber connection is correct.
Damaged and/or dirty cable	Verify that the fiber can successfully loop a known good port of the same type.
Too much or too little optical attenuation	Verify that the attenuation is correct per the PIC optical specifications.

Table 21: Problems and Solutions for a Physical Link That Is Down (continued)

Problem	Action
The transmit port is not transmitting within the dBm optical range per the specifications	Verify that the Tx power of the optics is within range of the PIC optical specification.

See Also

- Setting Clocking to Internal on page 140
- Clearing SONET Interface Statistics on page 143

Clearing SONET Interface Statistics

Purpose

You must reset SONET interface statistics before you initiate the ping test. Resetting the statistics provides a clean start so that previous input/output errors and packet statistics do not interfere with the current diagnostics.

Action

To clear all statistics for the interface, use the following Junos OS CLI operational mode command:

user@host> clear interfaces statistics so-*fpc/pic/port*

Sample Output

```
user@host> clear interfaces statistics so-4/0/2
user@host>
```

Meaning

This command clears the interface statistics counters for interface **so-4/0/2** only.

See Also

- Verifying That the SONET Interface Is Up on page 141
- Checking That the Received and Transmitted Path Trace Are the Same on page 143

Checking That the Received and Transmitted Path Trace Are the Same

Purpose The received and transmitted path trace shows whether the transmitted path trace is looped back.

Action To check that the received path trace matches the transmitted path trace, use the following Junos OS CLI operational mode command:

```
user@host> show interfaces so-fpc/pic/port extensive
```

Sample Output

```
user@host# show interfaces so-2/2/0 extensive
Physical interface: so-2/2/0, Enabled, Physical link is Up
Interface index: 21, SNMP ifIndex: 45, Generation: 20
[...Output truncated...]
Received path trace: host so-2/2/0
70 6c 75 74 6f 6e 69 63 20 73 6f 2d 32 2f 32 2f   host so-2/2/
30 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   0 ...............
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
00 00 00 00 00 00 00 00 00 00 00 00 00 0d 0a      ...............
Transmitted path trace: host so-2/2/0
70 6c 75 74 6f 6e 69 63 20 73 6f 2d 32 2f 32 2f   host so-2/2/
30 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   0 ...............
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
[...Output truncated...]
```

Meaning This transmitted and received path trace information is near the end of the output. The sample output shows that the transmitted and received path trace are the same. When there is a loopback, the transmitted and received path trace should be the same. If they are, continue with "Forcing the Link Layer to Stay Up" on page 144.

If the transmitted and received path trace are not the same, the physical loopback cable is probably on the wrong port, or is incorrectly connected. In this case, verify the connection again.

See Also

- Clearing SONET Interface Statistics on page 143
- Forcing the Link Layer to Stay Up on page 144

Forcing the Link Layer to Stay Up

To complete the loopback test, the link layer must remain up. However, Junos OS is designed to recognize that loop connections are not valid connections and to bring the link layer down. You need to force the link layer to stay up by making some configuration changes to the encapsulation and keepalives.

To force the link layer to stay up, follow these steps:

1. Configuring Encapsulation to Cisco-HDLC on page 144
2. Configuring No-Keepalives on page 145

Configuring Encapsulation to Cisco-HDLC

Action

To configure encapsulation on a SONET physical interface, follow these steps:

1. In configuration mode, go to the following hierarchy level.

```
[edit]
user@host#  edit interfaces interface-name
```

2. Configure Cisco-HDLC encapsulation on the interface.

```
[edit interfaces interface-name]
user@host#  set encapsulation cisco-hdlc
```

3. Verify the configuration.

```
[edit interfaces interface-name]
user@host# show
encapsulation hdlc;
```

4. Commit the change.

```
user@host# commit
```

Meaning

This command sets the interface encapsulation to the Cisco High-level Data-Link Control (HDLC) transport protocol.

See Also

- Configuring No-Keepalives on page 145

Configuring No-Keepalives

Action

To disable the sending of link-layer keepalives on a SONET physical interface, follow these steps:

1. In configuration mode, go to the following hierarchy level.

```
[edit]
user@host# edit interfaces interface-name
```

2. Configure the **no-keepalives** statement.

```
[edit interfaces interface-name]
user@host# set no-keepalives
```

3. Verify the configuration.

```
[edit interfaces interface-name]
user@host# show
no-keepalives;
```

4. Commit the change.

```
user@host# commit
```

Meaning

By setting the **no-keepalives** statement, the link layer is forced to stay up. If the setting remains at keepalive, the router will recognize that the same link-layer keepalives are being looped back and will bring the link layer down.

See Also

- Configuring Encapsulation to Cisco-HDLC on page 144

See Also

- Verifying the Status of the Logical Interface on page 135
- Checking That the Received and Transmitted Path Trace Are the Same on page 143
- Pinging the SONET Interface on page 146

Pinging the SONET Interface

Purpose To ping the local interface and verify the loopback connection, use the following Junos OS CLI operational mode command:

Action

```
user@host> ping interface so-fpc/pic/port local-IP-address bypass-routing count 1000
  rapid
```

Sample Output

```
user@host# ping interface so-2/2/0 10.0.2.1 bypass-routing count 1000 rapid
PING 10.0.2.1 (10.0.2.1): 56 data bytes
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
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!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

--- 10.0.2.1 ping statistics ---
1000 packets transmitted, 1000 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.374/0.446/9.744/0.754 ms
```

Meaning This command sends 1000 ping packets out of the interface to the local IP address. The ping should complete successfully with no packet loss. If there is any persistent packet loss, open a case with the Juniper Networks Technical Assistance Center (JTAC) at **support@juniper.net** or at 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).

See Also
- Forcing the Link Layer to Stay Up on page 144
- Checking for SONET Interface Error Statistics on page 147

Checking for SONET Interface Error Statistics

Purpose Persistent interface error statistics indicate that you need to open a case with JTAC.

Action To check the local interface for error statistics, use the following Junos OS CLI operational mode command:

```
user@host> show interfaces so-fpc/pic/port extensive
```

Sample Output

```
user@host# show interfaces so-2/2/0 extensive
Physical interface: so-2/2/0, Enabled, Physical link is Up
[...Output truncated...]
Statistics last cleared: 2002-04-24 10:39:40 EDT (00:13:26 ago)
Traffic statistics:
Input  bytes  :               169686                    0 bps
Output bytes  :               179802                    0 bps
Input  packets:                 2101                    0 pps
Output packets:                 2102                    0 pps
Input errors:
Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Giants: 0, Bucket drops: 0,
Policed discards: 0, L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts:
 0, HS link CRC errors: 0,HS link FIFO overflows: 0
Output errors:
Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0, HS link FIFO
underflows: 0
SONET alarms   : None
SONET defects  : None
SONET PHY:            Seconds        Count  State
PLL Lock                  0            0  OK
PHY Light                 0            0  OK
SONET section:
BIP-B1                    0            0
SEF                       0            0  OK
LOS                       0            0  OK
LOF                       0            0  OK
ES-S                      0
SES-S                     0
SEFS-S                    0
SONET line:
BIP-B2                    0            0
REI-L                     0            0
RDI-L                     0            0  OK
AIS-L                     0            0  OK
BERR-SF                   0            0  OK
BERR-SD                   0            0  OK
ES-L                      0
SES-L                     0
UAS-L                     0
ES-LFE                    0
SES-LFE                   0
```

```
UAS-LFE                    0
SONET path:
BIP-B3                     0            0
REI-P                      0            0
LOP-P                      0            0  OK
AIS-P                      0            0  OK
RDI-P                      0            0  OK
UNEQ-P                     0            0  OK
PLM-P                      0            0  OK
ES-P                       0
SES-P                      0
UAS-P                      0
ES-PFE                     0
SES-PFE                    0
UAS-PFE                    0
[...Output truncated...]
```

Meaning Check for any error statistics that may appear in the section, line, and path areas of the output. There should not be any input or output errors. If there are any persistent input or output errors, open a case with JTAC at support@juniper.net or at 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).

See Also
- Pinging the SONET Interface on page 146
- Diagnosing a Suspected Circuit Problem on page 148

Diagnosing a Suspected Circuit Problem

When you suspect a circuit problem, it is important to work with the transport-layer engineer to resolve the problem. The transport-layer engineer may ask you to create a loop from the router to the network, or the engineer may create a loop to the router from various points in the network.

To diagnose a suspected circuit problem, follow these steps:

1. Creating a Loop from the Router to the Network on page 148
2. Creating a Loop to the Router from Various Points in the Network on page 149

Creating a Loop from the Router to the Network

Purpose

Creating a loop from the router to the network allows the transport-layer engineer to test the router from various points in the network. This helps the engineer isolate where the problem might be located.

Action

To create a loop from the router to the network, follow these steps:

1. In configuration mode, go to the following hierarchy level.

```
[edit]
user@host# edit interfaces interface-name sonet-options
```

2. Configure the remote loopback option.

```
[edit interfaces interface-name sonet-options]
user@host# set loopback remote
```

3. Verify the configuration.

```
[edit interfaces interface-name sonet-options]
user@host# show
loopback remote;
```

4. Commit the change.

```
user@host# commit
```

Meaning

This command loops any traffic from the network back into the network.

See Also
- *SONET Interfaces*

Creating a Loop to the Router from Various Points in the Network

Purpose

The transport-layer engineer creates a loop to the router from various points in the network. You can then perform tests to verify the connection from the router to that loopback in the network.

Action

After the transport-layer engineer has created the loop to the router from the network, you must verify the connection from the router to the loopback in the network. Follow Steps 2 through 8 in "Diagnosing a Suspected Hardware Problem with a SONET Interface" on page 138. Keep in mind that any problems encountered in the test indicate a problem with the connection from the router to the loopback in the network.

By performing tests to loopbacks at various points in the network, you can isolate the source of the problem.

See Also
- Creating a Loop from the Router to the Network on page 148

See Also
- Checking for SONET Interface Error Statistics on page 147

- Creating a Loop to the Router from Various Points in the Network on page 149

Related Documentation

- Investigating Interface Steps and Commands on page 124
- Monitoring SONET Interfaces on page 128
- Locating SONET Alarms and Errors on page 150
- Enabling SONET Payload Scrambling on page 175
- Checking the SONET Frame Checksum on page 180

Locating SONET Alarms and Errors

This section includes the following information to assist you when troubleshooting SONET interfaces:

- List of Common SONET Alarms and Errors on page 150
- Displaying SONET Alarms and Errors on page 152
- Locating Most Common SONET Alarms and Errors on page 155
- Locating Loss of Signal Alarms on page 156
- Locating Alarm Indication Signal Alarms on page 158
- Locating Remote Defect Indication Alarms on page 160
- Locating Remote Error Indication Line Errors on page 163
- Locating Bit Error Rate Alarms on page 165
- Locating Payload Label Mismatch Path Alarms on page 167
- Locating Loss of Pointer Path Alarms on page 169
- Locating Unequipped Payload Alarms on page 171
- Locating Phase Lock Loop Alarms on page 173

List of Common SONET Alarms and Errors

Purpose To check for the most common SONET alarms and errors you can encounter when investigating line problems on a Juniper Networks router.

Action Table 22 on page 150 provides links and commands for checking SONET alarms and errors.

Table 22: List of Common SONET Alarms and Errors

Tasks	Command or Action
"Displaying SONET Alarms and Errors" on page 152	**show interfaces so-*fpc/pic/port* extensive**
"Locating Most Common SONET Alarms and Errors" on page 155	

Table 22: List of Common SONET Alarms and Errors (continued)

Tasks	Command or Action
1. Locating Loss of Signal Alarms on page 156	Check the connection between the router port and the first SONET network element.
2. Locating Alarm Indication Signal Alarms on page 158	Downstream from the router, check the path-terminating equipment, section-terminating equipment, and line-terminating equipment for a loss of signal or loss of frame.
3. Locating Remote Defect Indication Alarms on page 160	Upstream from the router, check the path-terminating equipment, section-terminating equipment, and line-terminating equipment for a loss of signal or loss of frame.
4. Locating Remote Error Indication Line Errors on page 163	Upstream from the router, check the line-terminating equipment and path-terminating equipment for an error in the B2 or B3 byte.
5. Locating Bit Error Rate Alarms on page 165	Check the following: • Optical fiber • Optical transmitter and receiver • Clocking • Attenuation in the optical signal
6. Locating Payload Label Mismatch Path Alarms on page 167	Check the received and transmitted C2 byte.
7. Locating Loss of Pointer Path Alarms on page 169	Check that both sides of the connection are configured for concatenate mode or nonconcatenate mode.
8. Locating Unequipped Payload Alarms on page 171	Check provisioning with the SONET provider, and if possible, check the configuration of the add/drop multiplexer (ADM).
9. Locating Phase Lock Loop Alarms on page 173	Investigate the timing source, and configure the clocking to external or internal depending on the situation.

See Also

- Displaying SONET Alarms and Errors on page 152
- Locating Most Common SONET Alarms and Errors on page 155
- Locating Loss of Signal Alarms on page 156
- Locating Alarm Indication Signal Alarms on page 158
- Locating Remote Defect Indication Alarms on page 160
- Locating Remote Error Indication Line Errors on page 163
- Locating Bit Error Rate Alarms on page 165
- Locating Payload Label Mismatch Path Alarms on page 167
- Locating Loss of Pointer Path Alarms on page 169
- Locating Unequipped Payload Alarms on page 171

- Locating Phase Lock Loop Alarms on page 173

Displaying SONET Alarms and Errors

Action

To display SONET alarms and errors, use the following Junos OS command-line interface (CLI) operational mode command:

```
user@host> show interfaces so-fpc/pic/port extensive
```

Sample Output

```
user@host> show interfaces so-1/1/1 extensive
[...Output truncated...]
  Active alarms  : None
  Active defects : None
  SONET PHY:            Seconds        Count  State
    PLL Lock                  0            0  OK
    PHY Light                 0            0  OK
  SONET section:
    BIP-B1                    0            0
    SEF                       0            0  OK
    LOS                       0            0  OK
    LOF                       0            0  OK
    ES-S                      0
    SES-S                     0
    SEFS-S                    0
  SONET line:
    BIP-B2                    0            0
    REI-L                     0            0
    RDI-L                     0            0  OK
    AIS-L                     0            0  OK
    BERR-SF                   0            0  OK
    BERR-SD                   0            0  OK
    ES-L                      0
    SES-L                     0
    UAS-L                     0
    ES-LFE                    0
    SES-LFE                   0
    UAS-LFE                   0
  SONET path:
    BIP-B3                    0            0
    REI-P                     0            0
    LOP-P                     0            0  OK
    AIS-P                     0            0  OK
    RDI-P                     0            0  OK
    UNEQ-P                    0            0  OK
    PLM-P                     0            0  OK
    ES-P                      0
    SES-P                     0
    UAS-P                     0
    ES-PFE                    0
    SES-PFE                   0
    UAS-PFE                   0
[...Output truncated...]
```

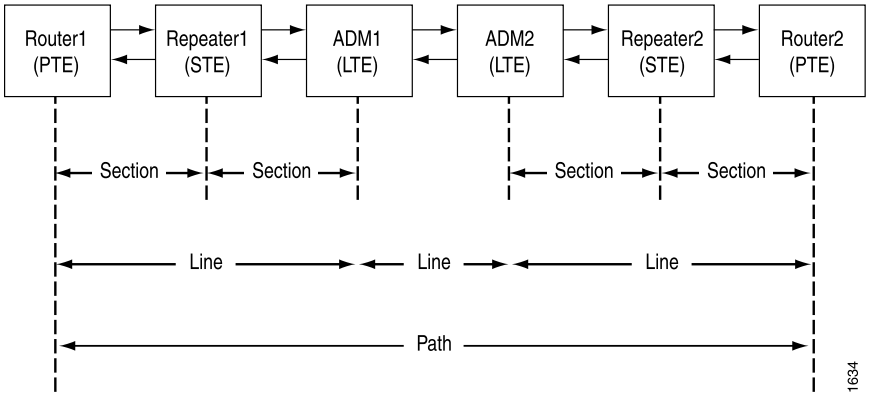
Meaning

The sample output shows where you find SONET alarms and errors. SONET alarms and errors fall into three different areas of the output: section, line, and path.

Section, line, and path errors occur over different spans of the SONET network and between different pieces of equipment. Figure 5 on page 153 shows an example of a SONET network with the section, line, and path areas delimited. Figure 5 on page 153 also shows the different pieces of equipment that comprise a SONET network:

- A router, usually a path-terminating equipment (PTE)
- An add/drop multiplexer (ADM), usually a line-terminating equipment (LTE)
- A repeater, usually a section-terminating equipment (STE)

Figure 5: Example of a SONET Network



SONET Section

The SONET section is the connection between two STEs. The STE performs the simple regeneration of the SONET signal to the next SONET equipment span between itself, the PTE, and the ADM. For example, Repeater 1 (STE) regenerates the SONET signal between itself and ADM1, and the section between itself andRouter 1 (PTE). The STE checks to make sure that the incoming SONET frame, arriving from a directly connected neighbor, is good. An STE does not have any knowledge of the rest of the span.

An STE looks at the section overhead bytes of the SONET frame even though it can rewrite the other overhead bytes if an alarm is generated.

SONET Line

The SONET line is the span between two LTEs. The LTE pays particular attention to the line overhead bytes of the SONET frame, can add and remove payload, and has more knowledge of the SONET network than the STEs. The LTE does not do the final processing of the SONET payload as does the PTE. The ADM is an LTE.

SONET Path

The SONET path is the span between two PTEs. The PTE is the final destination where the SONET frame is terminated and the payload it carries is processed. A PTE pays particular attention to the path overhead bytes of the SONET frame.

SONET System Hierarchy

The SONET system hierarchy is comprised of PTEs, LTEs, and STEs. The characteristics of each are as follows:

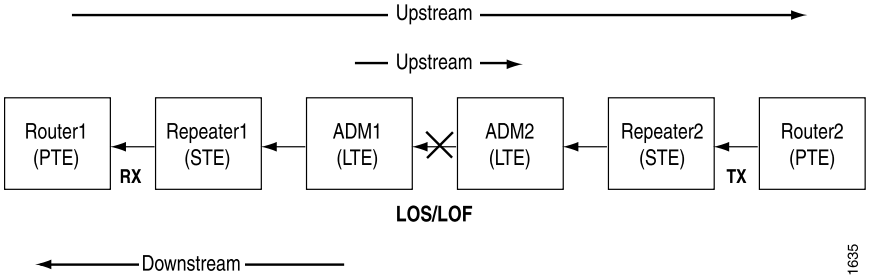
- The main role of a PTE is to read the path overhead bytes. However, it also reads the line overhead bytes and the section overhead bytes. Therefore the PTE also plays the role of an LTE and an STE.
- The main role of an LTE is to read the line overhead bytes. However, it also reads the section overhead bytes. Therefore the LTE also plays the role of an STE.
- An STE reads only the section overhead bytes of the SONET frame. (See Figure 6 on page 154.)

Upstream and Downstream

The terms *upstream* and *downstream* are used in defining SONET alarms and errors. The terms are meaningful when viewed from the point of view of the failure in the circuit.

For example, in Figure 6 on page 154 the failure occurs in the section between ADM 1 and ADM 2. The signal is transmitted from Router 2 in the direction of Router 1(from right to left). In this example, Router 1, Repeater 1, and ADM 1 are downstream from the failure. ADM 2, Repeater 2, and Router 2 are upstream from the failure.

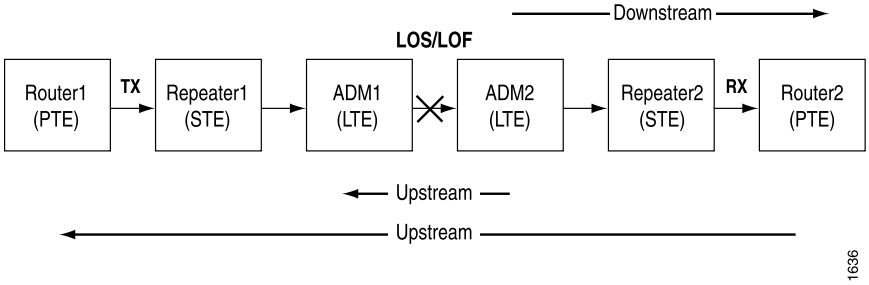
Figure 6: Example of an Upstream or Downstream Failure



The failure sends an alarm from ADM 1 to Router 1 in the direction of the signal transmission (downstream). Alarms are also sent from ADM1 to ADM2 and from Router1 to Router2 in the opposite direction of the signal transmission (upstream).

In Figure 7 on page 155, the failure is also between ADM 1 and ADM 2. However, the signal is transmitted from Router 1 in the direction of Router 2 (from left to right). Router 2, Repeater 2, and ADM 2 are downstream from the failure. ADM 1, Repeater 1, and Router 1 are upstream from the failure.

Figure 7: Another Example of an Upstream or Downstream Failure



This failure sends an alarm from ADM 2 to Router 2 in the direction of the signal transmission (downstream). Alarms are also sent from ADM 2 to ADM 1 and from Router 2 to Router 1 in the opposite direction of the signal transmission (upstream).

All diagnostics are from the perspective of the PTE (the Juniper Networks router). Although the exact source of the problem can be difficult to find without having access to the LTE or the STE, you can at least determine from the PTE output whether the problem is remote or local.

See Also

- List of Common SONET Alarms and Errors on page 150
- Locating Most Common SONET Alarms and Errors on page 155
- Locating Loss of Signal Alarms on page 156
- Locating Alarm Indication Signal Alarms on page 158
- Locating Remote Defect Indication Alarms on page 160
- Locating Remote Error Indication Line Errors on page 163
- Locating Bit Error Rate Alarms on page 165
- Locating Payload Label Mismatch Path Alarms on page 167
- Locating Loss of Pointer Path Alarms on page 169
- Locating Unequipped Payload Alarms on page 171
- Locating Phase Lock Loop Alarms on page 173

Locating Most Common SONET Alarms and Errors

Problem **Description:** This information describes the most common SONET alarms and errors you can encounter when investigating line problems on a Juniper Networks router.

Solution The following alarms and errors are described in this section:

- Locating Loss of Signal Alarms on page 156
- Locating Alarm Indication Signal Alarms on page 158

- Locating Remote Defect Indication Alarms on page 160
- Locating Remote Error Indication Line Errors on page 163
- Locating Bit Error Rate Alarms on page 165
- Locating Payload Label Mismatch Path Alarms on page 167
- Locating Loss of Pointer Path Alarms on page 169
- Locating Unequipped Payload Alarms on page 171
- Locating Phase Lock Loop Alarms on page 173

See Also

- List of Common SONET Alarms and Errors on page 150
- Displaying SONET Alarms and Errors on page 152
- Locating Loss of Signal Alarms on page 156
- Locating Alarm Indication Signal Alarms on page 158
- Locating Remote Defect Indication Alarms on page 160
- Locating Remote Error Indication Line Errors on page 163
- Locating Bit Error Rate Alarms on page 165
- Locating Payload Label Mismatch Path Alarms on page 167
- Locating Loss of Pointer Path Alarms on page 169
- Locating Unequipped Payload Alarms on page 171
- Locating Phase Lock Loop Alarms on page 173

Locating Loss of Signal Alarms

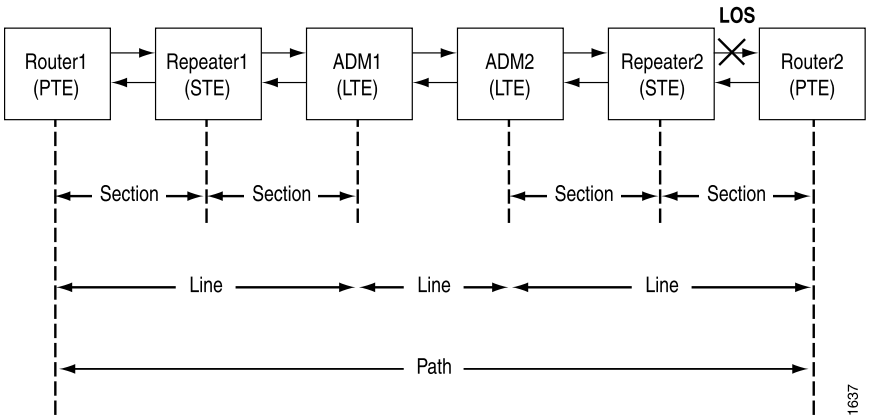
Problem

Description: A loss of signal (LOS) alarm indicates that there is a physical link problem with the connection to the router receive port from the neighboring SONET equipment transmit port.

Solution

To locate the LOS alarm, check the connection between the router port and the first SONET network element. In the example network in Figure 8 on page 157, the X indicates that there is a connection problem between Repeater 2 and Router 2.

Figure 8: Location of an LOS Alarm in a SONET Network



To display SONET alarms and errors, use the following Junos OS CLI operational mode command:

```
user@host> show interfaces so-fpc/pic/port extensive
```

Sample Output

user@router2> **show interfaces so-1/1/1 extensive**

```
[... Output truncated...]
  Active alarms   : LOL, PLL, LOS
  Active defects  : LOL, PLL, LOF, LOS , SEF, AIS-L, AIS-P, PLM-P
  SONET PHY:             Seconds        Count  State
    PLL Lock                  51            0  PLL Lock Error
    PHY Light                 51            0  Light Missing
  SONET section:
    BIP-B1                     0            0
    SEF                       51            0  Defect Active
    LOS 51            0  Defect Active
    LOF                       51            0  Defect Active
[...Output truncated...]
```

Meaning

The sample output shows at the time the command was run, Router 2 continued to be in a LOS alarm state for around 51 seconds.

See Also

- List of Common SONET Alarms and Errors on page 150
- Displaying SONET Alarms and Errors on page 152
- Locating Most Common SONET Alarms and Errors on page 155
- Locating Alarm Indication Signal Alarms on page 158
- Locating Remote Defect Indication Alarms on page 160
- Locating Remote Error Indication Line Errors on page 163

- Locating Bit Error Rate Alarms on page 165
- Locating Payload Label Mismatch Path Alarms on page 167
- Locating Loss of Pointer Path Alarms on page 169
- Locating Unequipped Payload Alarms on page 171
- Locating Phase Lock Loop Alarms on page 173

Locating Alarm Indication Signal Alarms

An alarm indication signal (AIS) is sent downstream to signal an error condition. There are two types of AIS alarms:

- Alarm indication signal path (AIS-P) is sent by an LTE to a downstream PTE when an LOS or LOF is detected on a upstream SONET section.
- Alarm indication signal line (AIS-L) is sent by an STE to a downstream LTE when an LOS or LOF is detected on an incoming SONET section.

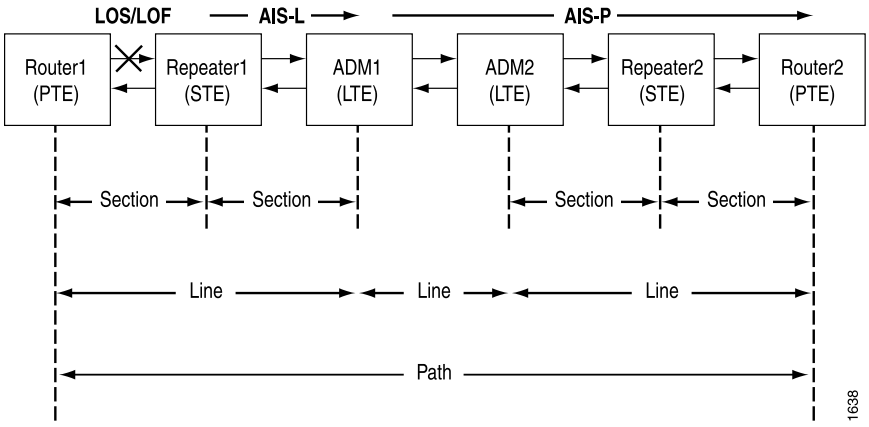
1. Example of a Router Receiving Only an AIS-P Alarm on page 158
2. Example of a Router Receiving Both an AIS-L and AIS-P Alarm on page 159

Example of a Router Receiving Only an AIS-P Alarm

Problem **Description:** Figure 9 on page 158 shows a router receiving only an AIS-P alarm. The X indicates that the LOS or LOF occurs in the section between Router 1 and Repeater 1.

Solution All diagnostics are from the perspective of Router 2 (the Juniper Networks router).

Figure 9: Example of a Router Receiving Only an AIS-P Alarm



Meaning

In Figure 9 on page 158, the progression of events occurring after the failure is as follows:

1. Repeater 1 detects an LOS or LOF on an incoming SONET section.
2. Repeater 1 sends an AIS-L downstream to ADM1 (LTE).
3. ADM 1 sends an AIS-P to Router 2 (PTE).
4. The only alarm that Router 2 receives is the AIS-P alarm from ADM 1.

See Also
- Example of a Router Receiving Both an AIS-L and AIS-P Alarm on page 159

Example of a Router Receiving Both an AIS-L and AIS-P Alarm

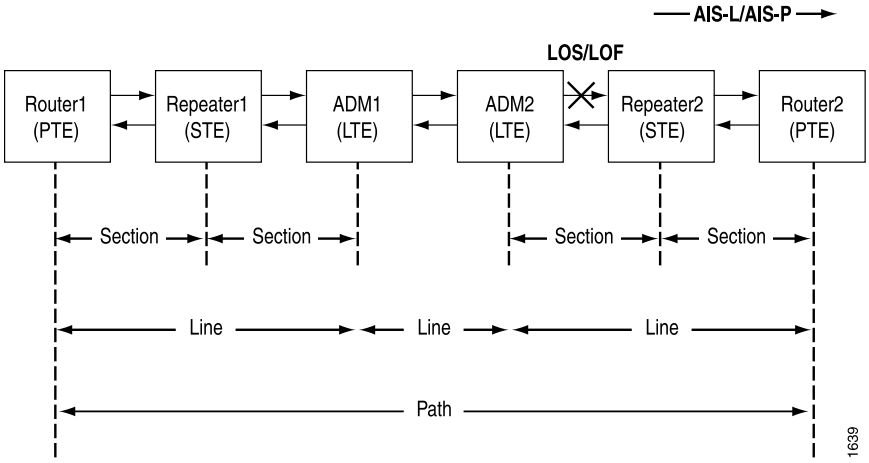
Problem

Description: Figure 10 on page 159 shows a router receiving both an IS-L and AIS-P Alarm. The X indicates that the LOS or LOF occurs in the section between ADM 2 and Repeater 2.

Solution

All diagnostics are from the perspective of Router 2 (the Juniper Networks router).

Figure 10: Example of a Router Receiving Both an AIS-L and an AIS-P Alarm



What It Means

In Figure 10 on page 159, the progression of events occurring after the failure is as follows:

1. Repeater 2 detects an LOS or LOF on the incoming section.
2. Repeater 2 sends an AIS-L and AIS-P downstream to Router 2.
3. Router 2 receives both an AIS-L and an AIS-P from Repeater 2.

See Also
- Example of a Router Receiving Only an AIS-P Alarm on page 158

See Also
- List of Common SONET Alarms and Errors on page 150

- Displaying SONET Alarms and Errors on page 152
- Locating Most Common SONET Alarms and Errors on page 155
- Locating Loss of Signal Alarms on page 156
- Locating Remote Defect Indication Alarms on page 160
- Locating Remote Error Indication Line Errors on page 163
- Locating Bit Error Rate Alarms on page 165
- Locating Payload Label Mismatch Path Alarms on page 167
- Locating Loss of Pointer Path Alarms on page 169
- Locating Unequipped Payload Alarms on page 171
- Locating Phase Lock Loop Alarms on page 173

Locating Remote Defect Indication Alarms

A remote defect indication (RDI) is sent upstream to signal an error condition. There are two types of RDI alarms:

- Remote defect indication line (RDI-L) is sent upstream to a peer LTE when an alarm indication signal line (AIS-L) or low-level defects are detected.
- Remote defect indication path (RDI-P) is sent upstream to a peer PTE when a defect in the signal, typically an AIS-P, is detected.

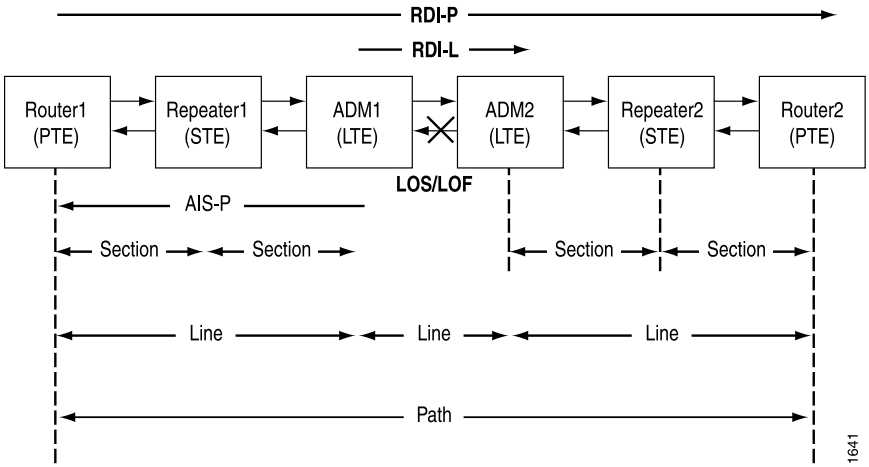
1. Example of a Router Receiving Only an RDI-P Alarm on page 160
2. Example of a Router Receiving Both an RDI-L and RDI-P Alarm on page 161

Example of a Router Receiving Only an RDI-P Alarm

Problem **Description:** Figure 11 on page 161 shows a router receiving only an RDI-P Alarm. The X indicates that the LOS or LOF occurs in the section between ADM 1 and ADM 2.

Solution All diagnostics are from the perspective of Router 2 (the Juniper Networks router).

Figure 11: Example of a Router Receiving Only an RDI-P Alarm



What It Means

In Figure 11 on page 161, the progression of events occurring after the failure is as follows:

1. ADM 1 detects an LOS or LOF on an incoming SONET section.
2. ADM 1 sends an RDI-L to ADM 2.
3. ADM 1 sends an AIS-P downstream to Router 1.
4. Router 1 sends an RDI-P upstream to Router 2.
5. Router 2 only receives an RDI-P alarm.

See Also

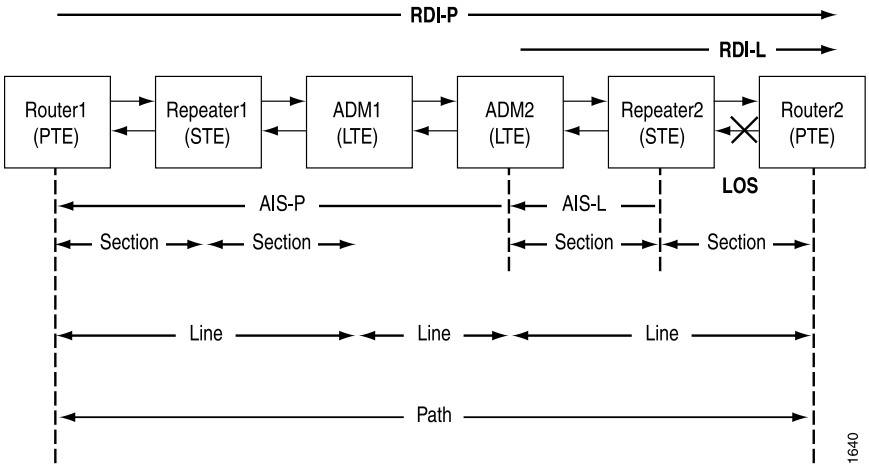
- Example of a Router Receiving Both an RDI-L and RDI-P Alarm on page 161
- Locating Remote Defect Indication Alarms on page 160

Example of a Router Receiving Both an RDI-L and RDI-P Alarm

Problem **Description:** Figure 12 on page 162 shows router receiving both an RDI-L and RDI-P Alarm. The X indicates that the LOS occurs in the section between Repeater 2 and Router 2.

Solution All diagnostics are from the perspective of Router 2 (the Juniper Networks router).

Figure 12: Example of a Router Receiving Both an RDI-L and RDI-P Alarm



Meaning

In Figure 12 on page 162, the progression of events occurring after the failure is as follows:

1. Repeater 2 detects an LOS on an incoming section.
2. Repeater 2 sends an AIS-L downstream to ADM 2.
3. ADM 2 sends an RDI-L upstream to Router 2.
4. ADM 2 sends an AIS-P downstream to Router 1.
5. Router 1 sends an RDI-P upstream to Router 2.
6. Router 2 receives both RDI-P and RDI-L alarms.

See Also

- Example of a Router Receiving Only an RDI-P Alarm on page 160
- Locating Remote Defect Indication Alarms on page 160

See Also

- List of Common SONET Alarms and Errors on page 150
- Displaying SONET Alarms and Errors on page 152
- Locating Most Common SONET Alarms and Errors on page 155
- Locating Loss of Signal Alarms on page 156
- Locating Alarm Indication Signal Alarms on page 158
- Locating Remote Error Indication Line Errors on page 163
- Locating Bit Error Rate Alarms on page 165
- Locating Payload Label Mismatch Path Alarms on page 167
- Locating Loss of Pointer Path Alarms on page 169

- Locating Unequipped Payload Alarms on page 171
- Locating Phase Lock Loop Alarms on page 173

Locating Remote Error Indication Line Errors

A remote error indication (REI) is sent upstream to signal an error condition. There are two types of REI alarms:

- Remote error indication line (REI-L) is sent to the upstream LTE when errors are detected in the B2 byte.
- Remote error indication path (REI-P) is sent to the upstream PTE when errors are detected in the B3 byte.

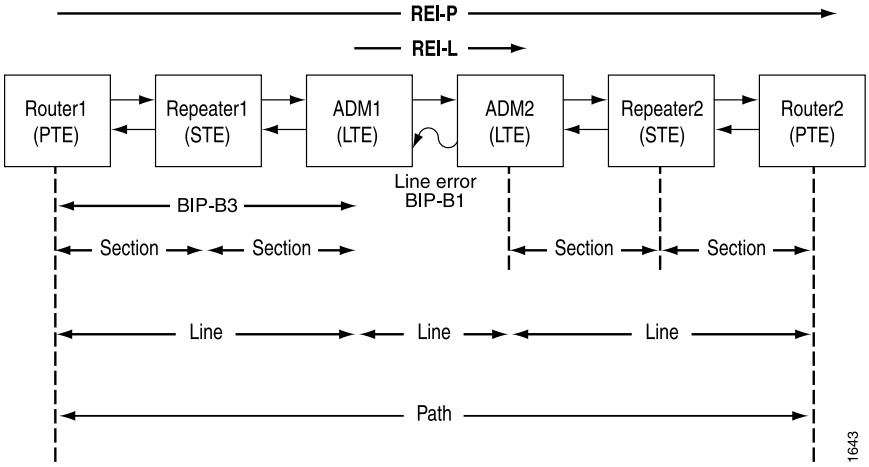
1. Example of Only an REI-P Counter Incrementing on page 163
2. Example of Both REI-L and REI-P Counters Incrementing on page 164

Example of Only an REI-P Counter Incrementing

Problem **Description:** Figure 13 on page 163 shows an REI-P Counter Incrementing. The wavy line indicates that there is a line error in the section between ADM 1 and ADM 2.

Solution All diagnostics are from the perspective of Router 2 (the Juniper Networks router).

Figure 13: Example of a Router Receiving Only an REI-P Counter Incrementing



Meaning

In Figure 13 on page 163, the progression of events occurring after the failure is as follows:

1. ADM 1 detects parity errors in the B1 byte.
2. ADM 1 sends an REI-L upstream to ADM 2.
3. Router 1 detects parity errors in the B3 byte.

4. Router 1 sends an REI-P upstream to Router 2.
5. Router 2 only sees an REI-P incrementing counter.

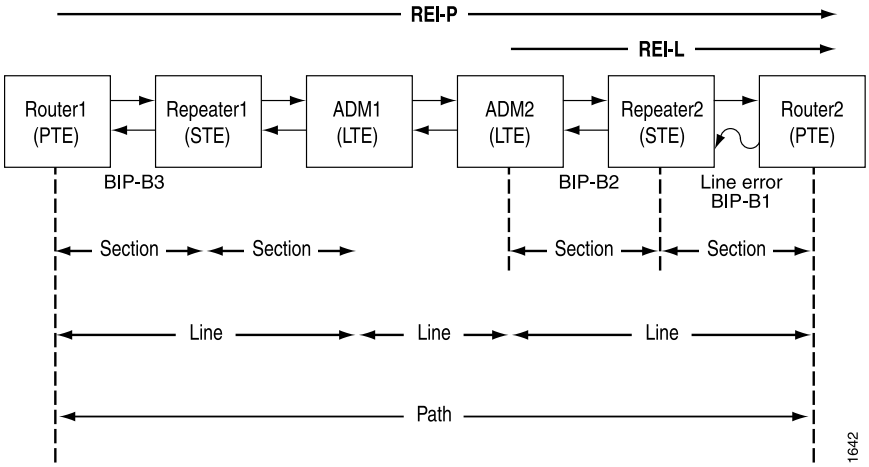
See Also
- Example of Both REI-L and REI-P Counters Incrementing on page 164

Example of Both REI-L and REI-P Counters Incrementing

Problem **Description:** Figure 14 on page 164 shows both REI-L and REI-P Counters Incrementing. The wavy line indicates that there is a line error in the section between Repeater 2 and Router 2.

Solution All diagnostics are from the perspective of Router 2 (the Juniper Networks router).

Figure 14: Example of a Router Receiving Both An REI-L and REI-P Counter Incrementing



Meaning

In Figure 14 on page 164, the progression of events occurring after the failure is as follows:

1. Repeater 2 detects some parity errors in the B1 byte from a corrupted SONET frame.
2. ADM 2 detects parity errors in the B2 byte.
3. ADM 2 sends an REI-L upstream to Router 2.
4. Router 1 detects parity errors in the B3 byte.
5. Router 1 sends back an REI-P upstream to Router 2.
6. Router 2 sees incrementing REI-L and REI-P errors.

See Also
- Example of Only an REI-P Counter Incrementing on page 163

See Also

- List of Common SONET Alarms and Errors on page 150
- Displaying SONET Alarms and Errors on page 152
- Locating Most Common SONET Alarms and Errors on page 155
- Locating Loss of Signal Alarms on page 156
- Locating Alarm Indication Signal Alarms on page 158
- Locating Remote Defect Indication Alarms on page 160
- Locating Bit Error Rate Alarms on page 165
- Locating Payload Label Mismatch Path Alarms on page 167
- Locating Loss of Pointer Path Alarms on page 169
- Locating Unequipped Payload Alarms on page 171
- Locating Phase Lock Loop Alarms on page 173

Locating Bit Error Rate Alarms

Problem **Description:** Bit error rate (BER) alarms are declared when the number of BIP-B2 errors hits a certain threshold. Depending on the threshold, there are two types of BER alarms. In both cases the interface is taken down.

- Bit error rate-signal degrade (BERR-SD) is declared when a bit error rate of 10^-6 is reached.
- Bit error rate-signal failure (BERR-SF) is declared when a bit error rate of 10^-3 is reached.

Solution To display SONET alarms and errors, use the following Junos OS CLI operational mode command:

```
user@host> show interfaces so-fpc/pic/port extensive
```

Sample Output

The following sample output displays a BERR-SD error:

```
user@router2> show interfaces so-1/1/1 extensive
[... Output truncated...]
  Active alarms  : BERR-SD
  Active defects : BERR-SD
  SONET PHY:             Seconds        Count  State
    PLL Lock                   0            0  OK
    PHY Light                  0            0  OK
  SONET section:
    BIP-B1                    22          101
    SEF                        0            0  OK
    LOS                        0            0  OK
```

```
  LOF                      0            0  OK
  ES-S                    22
  SES-S                    0
  SEFS-S                   0
SONET line:
  BIP-B2                  22          103
  REI-L                    0            0
  RDI-L                    0            0  OK
  AIS-L                    0            0  OK
  BERR-SF                  0            0  OK
  BERR-SD                 11           53  Defect Active
  ES-L                    22
  SES-L                    4
  UAS-L                    2
  ES-LFE                   0
  SES-LFE                  0
  UAS-LFE                  0
SONET path:
  BIP-B3                  22          166
  REI-P                    0            0
  LOP-P                    0            0  OK
  AIS-P                    0            0  OK
  RDI-P                    0            0  OK
  UNEQ-P                   0            0  OK
  PLM-P                    0            0  OK
  ES-P                    22
  SES-P                    3
  UAS-P                    1
  ES-PFE                   0
  SES-PFE                  0
  UAS-PFE                  0
```

Meaning

Bit error rates can be caused by any of the following situations:

- Degrading optical fiber
- Optical transmitter or receiver problems
- Dirty fiber-optic connector
- Clocking issues
- Too much attenuation in the optical signal
- BIP-B1 and BIP-B3 are not used in the BER alarm calculations

See Also

- List of Common SONET Alarms and Errors on page 150
- Displaying SONET Alarms and Errors on page 152
- Locating Most Common SONET Alarms and Errors on page 155
- Locating Loss of Signal Alarms on page 156
- Locating Alarm Indication Signal Alarms on page 158

- Locating Remote Defect Indication Alarms on page 160
- Locating Remote Error Indication Line Errors on page 163
- Locating Payload Label Mismatch Path Alarms on page 167
- Locating Loss of Pointer Path Alarms on page 169
- Locating Unequipped Payload Alarms on page 171
- Locating Phase Lock Loop Alarms on page 173

Locating Payload Label Mismatch Path Alarms

Problem **Description:** Payload mismatch path (PLM-P; also called signal label mismatch) alarms are reported by PTEs because the SONET byte used to determine the PLM-P alarm is located in the path overhead (the C2 byte). PLM-P alarms occur when the C2 byte received does not match the C2 byte transmitted by the PTE; for example, when the received C2 value is **0xcf**, the transmitted C2 value must also be **0xcf**.

NOTE: When the received C2 byte has a value of 0x01—indicating *equipped-nonspecific payload*—the PTE accepts this value (regardless of the PTE setting) since 0x01 is considered a wildcard value.

Solution To display SONET alarms and errors, use the following Junos OS CLI operational mode command:

```
user@host> show interfaces so-fpc/pic/port extensive
```

Sample Output

```
user@router2> show interfaces so-1/1/1 extensive
[...Output truncated...]
SONET alarms   : PLM-P
SONET defects  : PLM-P
  [...Output truncated...]
SONET path:
    BIP-B3                    0            0
    REI-P                     0            0
    LOP-P                     0            0  OK
    AIS-P                     0            0  OK
    RDI-P                     2            1  OK
    UNEQ-P                    0            0  OK
    PLM-P        96     1 Defect Active
    ES-P                      0
    SES-P                     0
    UAS-P                     0
    ES-PFE                    2
    SES-PFE                   2
    UAS-PFE                   0
```

```
Received SONET overhead:
  F1      : 0x00, J0      : 0x00, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      :0x13 , C2(cmp) : 0xcf, F2      : 0x00
  Z3      : 0x00, Z4      : 0x00, S1(cmp) : 0x00, V5      : 0x00
  V5(cmp) : 0x00
Transmitted SONET overhead:
  F1      : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0xcf , F2      : 0x00, Z3      : 0x00
  Z4      : 0x00, V5      : 0x00
```

Meaning

In the **SONET path** section of the sample output, the PLM-P counter is incrementing and defective. In the **Received SONET overhead** and **Transmitted SONET overhead** sections, the received C2 value is **0x13** and the transmitted C2 value is **0xcf**. The C2 byte mismatch has caused a PLM-P alarm.

The C2 byte tells the PTE what kind of information is in the synchronous payload envelope (SPE). For example, when the SPE contains Asynchronous Transfer Mode (ATM) cells, the C2 byte has a value of **0x13**. If a Packet over SONET (POS) card is used on the Juniper Networks router, the link does not come up and a PLM-P alarm is raised (since the Juniper Networks router sends **0xcf** and receives **0x13**). However, if the C2 byte has a value of **0x01**, the PTE accepts this value (regardless of what the PTE is set to) since **0x01** is considered a wildcard value.

The SONET specifications have assigned a small handful of values (of the 256 possible binary values), but Juniper Networks routers only use a few of these (**Oxcf** or **Ox16** for POS, **Ox13** for ATM, and so on). Table 23 on page 168 shows the synchronous transport signal (STS) path signal label assignments as described in Issue 3 (Sept. 2000) of the GR-253 CORE.

Table 23: STS Path Signal Label Assignments

Code (Hex)	Content of the STS SPE
00	Unequipped
01	Equipped - Nonspecific Payload
02	VT-Structured STS1 SPE a
03	Locked VT Mode a
04	Asynchronous Mapping for DS3
12	Asynchronous Mapping for DS4NA
13	Mapping for ATM
14	Mapping for DQDB

Table 23: STS Path Signal Label Assignments (continued)

Code (Hex)	Content of the STS SPE
15	Asynchronous Mapping for FDDI
16	HDLC-over-SONET Mapping
FE	O.181 Test Signal (TSS1 to TSS3) Mapping b

On POS interfaces, Juniper Networks routers by default accept a C2 value of either **0xcf** or **0x16**. Any other values raise a PLM-P alarm. An important thing to remember is that the C2 byte value of **0x16** is a standardized value (per RFC 2615, G.707, and GR-253) used for POS interfaces. **0xcf** is used by default since much SONET equipment still uses this value. If you need to change this byte, use the **rfc-2615** option as follows:

```
user@host# set interface so-fpc/pic/port sonet-options rfc-2615
```

This option changes the following values:

```
C2 byte 22 (0x16)
FCS 32
payload-scrambling (this was already the default)
```

See Also

- List of Common SONET Alarms and Errors on page 150
- Displaying SONET Alarms and Errors on page 152
- Locating Most Common SONET Alarms and Errors on page 155
- Locating Loss of Signal Alarms on page 156
- Locating Alarm Indication Signal Alarms on page 158
- Locating Remote Defect Indication Alarms on page 160
- Locating Remote Error Indication Line Errors on page 163
- Locating Bit Error Rate Alarms on page 165
- Locating Loss of Pointer Path Alarms on page 169
- Locating Unequipped Payload Alarms on page 171
- Locating Phase Lock Loop Alarms on page 173

Locating Loss of Pointer Path Alarms

Problem **Description:** A loss of pointer path (LOP-P) alarm indicates a possible provisioning problem and occurs when the Juniper Networks router cannot determine a valid payload pointer. The Juniper Networks router monitors the H1/H2 bytes, located in the line overhead area. This alarm is usually discovered upon initial provisioning of SONET circuits, and is not generally seen after the router has been deployed in the network for some time.

Solution To display SONET alarms and errors, use the following Junos OS CLI operational mode command:

```
user@host> show interfaces so-fpc/pic/port extensive
```

Sample Output

```
user@host> show interfaces so-1/1/1 extensive
[...Output truncated...]
SONET alarms  : LOP
  SONET defects : LOP
  SONET PHY:              Seconds        Count  State
    PLL Lock                    0            0  OK
    PHY Light                   0            0  OK
  SONET section:
    BIP-B1                      0            0
    SEF                         0            0  OK
    LOS                         0            0  OK
    LOF                         0            0  OK
    ES-S                        0
    SES-S                       0
    SEFS-S                      0
  SONET line:
    BIP-B2                      0            0
    REI-L                       0            0
    RDI-L                       0            0  OK
    AIS-L                       0            0  OK
    BERR-SF                     0            0  OK
    BERR-SD                     0            0  OK
    ES-L                        0
    SES-L                       0
    UAS-L                       0
    ES-LFE                      0
    SES-LFE                     0
    UAS-LFE                     0
  SONET path:
    BIP-B3                      0            0
    REI-P                       0            0
    LOP-P         174       0 Defect Active
    AIS-P                       0            0  OK
    RDI-P                       0            0  OK
    UNEQ-P                      0            0  OK
    PLM-P                       0            0  OK
     ES-P                     174
    SES-P                     174
    UAS-P                     174
    ES-PFE                      0
    SES-PFE                     0
    UAS-PFE                     0
[...Output truncated...]
```

Meaning

The sample output shows that an LOP-P alarm occurred for 174 seconds. An LOP-P alarm can occur when the ADM on the other end is configured for nonconcatenate mode, while the Juniper Networks router is configured for concatenate mode (the default

setting). In this instance, the pointer word in the required STS frame does not have the concatenation indicator set.

The condition of 8, 9, or 10 consecutive frames without valid pointer values can raise an LOP-P alarm.

NOTE: Although Juniper Networks routers do not report pointer adjustments, an LOP-P alarm will not occur as long as the pointer adjustments stay within tolerance levels.

See Also

- List of Common SONET Alarms and Errors on page 150
- Displaying SONET Alarms and Errors on page 152
- Locating Most Common SONET Alarms and Errors on page 155
- Locating Loss of Signal Alarms on page 156
- Locating Alarm Indication Signal Alarms on page 158
- Locating Remote Defect Indication Alarms on page 160
- Locating Remote Error Indication Line Errors on page 163
- Locating Bit Error Rate Alarms on page 165
- Locating Payload Label Mismatch Path Alarms on page 167
- Locating Unequipped Payload Alarms on page 171
- Locating Phase Lock Loop Alarms on page 173

Locating Unequipped Payload Alarms

Problem **Description:** An unequipped payload (UNEQ-P) alarm indicates a possible provisioning problem and occurs when the Juniper Networks router detects a value of **0x00** in the **C2** byte.

Solution To display SONET alarms and errors, use the following Junos OS CLI operational mode command:

```
user@host> show interfaces so-fpc/pic/port extensive
```

Sample Output

```
user@host> show interfaces so-1/1/1 extensive
[...Output truncated...]
SONET alarms  : UNEQ-P
  SONET defects : UNEQ-P
```

```
  SONET PHY:              Seconds        Count  State
    PLL Lock                    0            0  OK
    PHY Light                   0            0  OK
  SONET section:
    BIP-B1                      0            0
    SEF                         0            0  OK
    LOS                         0            0  OK
    LOF                         0            0  OK
    ES-S                        0
    SES-S                       0
    SEFS-S                      0
  SONET line:
    BIP-B2                      0            0
    REI-L                       0            0
    RDI-L                       0            0  OK
    AIS-L                       0            0  OK
    BERR-SF                     0            0  OK
    BERR-SD                     0            0  OK
    ES-L                        0
    SES-L                       0
    UAS-L                       0
    ES-LFE                      0
    SES-LFE                     0
    UAS-LFE                     0
  SONET path:
    BIP-B3                      0            0
    REI-P                       0            0
    LOP-P                       0            0  OK
    AIS-P                       0            0  OK
    RDI-P                       0            0  OK
    UNEQ-P                     10            2  Defect Active
    PLM-P                       0            0  OK
     ES-P                      10
    SES-P                      10
    UAS-P                       0
    ES-PFE                      0
    SES-PFE                     0
    UAS-PFE                     0
[...Output truncated...]
```

Meaning

The sample output shows that an UNEQ-P alarm occurred within 10 seconds and was declared twice. An UNEQ-P alarm can occur when the ADM on the other end has not provisioned the SPE. An UNEQ-P alarm sets the STS SPE to all zeros when it is provisioned. If the alarm occurs, the problem is probably with the configuration of the ADM. Since the UNEQ-P is not a common alarm reported by Juniper Networks routers, it is a good idea to first check with the SONET provider.

See Also

- List of Common SONET Alarms and Errors on page 150
- Displaying SONET Alarms and Errors on page 152
- Locating Most Common SONET Alarms and Errors on page 155
- Locating Loss of Signal Alarms on page 156

- Locating Alarm Indication Signal Alarms on page 158
- Locating Remote Defect Indication Alarms on page 160
- Locating Remote Error Indication Line Errors on page 163
- Locating Bit Error Rate Alarms on page 165
- Locating Payload Label Mismatch Path Alarms on page 167
- Locating Loss of Pointer Path Alarms on page 169
- Locating Phase Lock Loop Alarms on page 173

Locating Phase Lock Loop Alarms

Problem **Description:** The phase lock loop (PLL) alarm occurs when the PLL cannot lock on to a timing device, and indicates a possible hardware or network timing problem.

Solution To display SONET alarms and errors, use the following Junos OS CLI operational mode command:

```
user@host> show interfaces so-fpc/pic/port extensive
```

Sample Output

```
user@host> show interfaces so-1/1/1 extensive
[...Output truncated...]
Active alarms : PLL
  Active defects : PLL
  SONET PHY:            Seconds        Count  State
   PLL Lock       26     0 PLL Lock Error
    PHY Light                 0            0  OK
  SONET section:
    BIP-B1                    0            0
    SEF                       0            0  OK
    LOS                       0            0  OK
    LOF                       0            0  OK
    ES-S                      0
    SES-S                     0
    SEFS-S                    0
  SONET line:
    BIP-B2                    0            0
    REI-L                     0            0
    RDI-L                     3            3  OK
    AIS-L                     0            0  OK
    BERR-SF                   0            0  OK
    BERR-SD                   0            0  OK
    ES-L                      0
    SES-L                     0
    UAS-L                     0
    ES-LFE                    0
    SES-LFE                   0
    UAS-LFE                   0
  SONET path:
    BIP-B3                    0            0
```

```
    REI-P                       0           0
    LOP-P                       0           0   OK
    AIS-P                       0           0   OK
    RDI-P                       0           0   OK
    UNEQ-P                      0           0   OK
    PLM-P                       0           0   OK
    ES-P                        0
    SES-P                       0
    UAS-P                       0
    ES-PFE                      0
    SES-PFE                     0
    UAS-PFE                     0
[...Output truncated...]
```

Meaning

The sample output shows a PLL alarm lasting for 26 seconds. You must investigate the timing source to diagnose the problem. The timing source is derived from an incoming SONET circuit (when **clock external** is configured), or from the onboard Stratum 3 clock (when **clock internal** is configured). Internal clocking is the default for Juniper Networks routers.

The cause of the problem differs depending on the type of system board on the router. (See Table 24 on page 175.) For example:

- On the M20 and M40 Internet router OC48-SM-IR PIC and the M160 Internet router OC192 board, the problem might be caused by the following:
  - An out-of-tolerance clock coming from the far end, if clocking external is configured.
  - An out-of-tolerance clock coming from the far end or a problem with the board being unable to lock on to its internal clock to derive the transmit clock, if clocking internal is configured.
  - On OC3 and OC12 PICs, the PIC not establishing a lock to the onboard clock to derive the outgoing clock.
- To further diagnose the problem, try the following:
  - Configure clocking to external. If the alarm disappears, the board might not have locked to the internal clock used to derive the outgoing clock.
  - Configure clocking to internal and make sure that a loopback fiber is plugged in. If the PLL alarm persists, it is most likely a hardware problem. However, you may not be able to determine if the direction is on the inbound or outbound side of the board.

Table 24 on page 175 shows the location of the onboard clock on the various system boards of Juniper Networks routers.

Table 24: Location of the Onboard Clock

Router	System Board
M5, M10, M20, and M40 routers	System Control Board (SCB), System and Switch Board (SSB), Switching and Forwarding Module (SFM), and Single Board Router (SBR)
OC48-SM-IR PIC used on the M20 and M40 routers	Flexible PIC Concentrator (FPC)
M40e and M160 routers	Miscellaneous Control Subsystem (MCS)
T-series routing platforms	SONET Clock Generator (SCG)

See Also

- List of Common SONET Alarms and Errors on page 150
- Displaying SONET Alarms and Errors on page 152
- Locating Most Common SONET Alarms and Errors on page 155
- Locating Loss of Signal Alarms on page 156
- Locating Alarm Indication Signal Alarms on page 158
- Locating Remote Defect Indication Alarms on page 160
- Locating Remote Error Indication Line Errors on page 163
- Locating Bit Error Rate Alarms on page 165
- Locating Payload Label Mismatch Path Alarms on page 167
- Locating Loss of Pointer Path Alarms on page 169
- Locating Unequipped Payload Alarms on page 171

Related Documentation

- Investigating Interface Steps and Commands on page 124
- Monitoring SONET Interfaces on page 128
- Using Loopback Testing for SONET Interfaces on page 136
- Enabling SONET Payload Scrambling on page 175
- Checking the SONET Frame Checksum on page 180

Enabling SONET Payload Scrambling

This section includes the following information to assist you when troubleshooting SONET interfaces:

- Checklist for Enabling SONET Payload Scrambling on page 176
- Understanding SONET Payload Scrambling on page 176

Checklist for Enabling SONET Payload Scrambling

Table 25 on page 176 provides links and commands for SONET payload scrambling and how to check and configure it.

Table 25: Checklist for Enabling SONET Payload Scrambling

Tasks	Command or Action
"Understanding SONET Payload Scrambling" on page 176	
1. Checking SONET HDLC Payload Scrambling on page 177	**show configuration interfaces | *interface-name*** **show interfaces *interface-name***
2. Configuring SONET HDLC Payload Scrambling on page 179	**[edit]** **edit interfaces *so-fpc/pic/port* sonet-options** **set payload-scrambler** **show** **commit**

See Also
- Understanding SONET Payload Scrambling on page 176

Understanding SONET Payload Scrambling

SONET payload scrambling preserves data integrity. Scrambling is designed to randomize the digital bits (pattern of 1s and 0s) carried in the Asynchronous Transfer Mode (ATM) cells (physical layer frame). Randomizing the digital bits can prevent continuous, long strings of all 1s or all 0s. Transitions between 1s and 0s are used by some physical layer protocols to maintain clocking. SONET interfaces support two levels of scrambling, as follows:

- SONET frame scrambling mode required by the International Telecommunications Union Telecommunication Standardization (ITU-T) GR-253 standard. This mode uses a 1 + x6 + x7 algorithm to scramble the section overhead of the SONET frame. It does not scramble the first row of the section overhead.
- Cell payload scrambling is optional and is defined in ITU-T I.432, section 4.5.3. This mode randomizes the bits in the payload portion of an ATM cell to make sure that the beginning of each new cell is recognized. It leaves the 5-byte header unscrambled.

Synchronous Transport System (STS) stream scrambling must be enabled on every SONET device and is the default for SONET interfaces.

Cell payload scrambling or SONET High-level Data Link Control (HDLC) scrambling can be enabled or disabled, and on Juniper routers is enabled by default to provide better link stability. Both sides of a connection must either use scrambling or not use it.

NOTE: HDLC payload scrambling conflicts with traffic shaping configured using leaky bucket properties. If you configure leaky bucket properties, you must disable payload scrambling because the software rejects configurations that have both features enabled. For more information, see *Junos OS Network Interfaces Library for Routing Devices*.

On a Channelized OC12 interface, the SONET **payload-scrambler** statement is ignored. To configure scrambling on the DS3 channels on the interface, include the **t3-options payload-scrambler** statement in the configuration for each DS3 channel.

1. Checking SONET HDLC Payload Scrambling on page 177
2. Configuring SONET HDLC Payload Scrambling on page 179

Checking SONET HDLC Payload Scrambling

Purpose If you find that payload scrambling is not enabled, you might want to enable or configure it because it provides better link stability when it is working.

Action In the Junos OS command-line interface (CLI) operational mode, you can use one of the following two commands to check for SONET HDLC control payload scrambling:

```
user@host> show configuration interfaces | interface-name
```

or

```
user@host> show interfaces interface-name
```

Sample Output 1

```
user@host> show configuration interfaces so-0/0/0
encapsulation cisco-hdlc;
sonet-options {
    payload-scrambler;
}
unit 0 {
    family inet {
        address 10.0.0.2/32 {
            destination 10.0.0.1;
        }
    }
    family mpls;
}
```

Sample Output 2

```
user@host> show configuration interfaces so-0/0/0
encapsulation cisco-hdlc;
sonet-options {
    no-payload-scrambler;
}
```

```
unit 0 {
    family inet {
        address 10.0.0.2/32 {
            destination 10.0.0.1;
        }
    }
    family mpls;
}
```

Sample Output 3

```
user@host> show interfaces so-0/0/1
```

```
Physical interface: so-0/0/1, Enabled, Physical link is Up
  Interface index: 48, SNMP ifIndex: 114
  Link-level type: PPP, MTU: 4474, Clocking: Internal, SONET mode, Speed: OC3,
Loopback: None, FCS: 32,
  Payload scrambler: Disabled
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive: Input: 70627 (00:00:07 ago), Output: 70791 (00:00:08 ago)
  LCP state: Opened
 NCP state: inet: Opened, inet6: Not-configured, iso: Opened, mpls: Not-configured

  Input rate     : 78056456 bps (6504 pps)
  Output rate    : 78044840 bps (6503 pps)
  SONET alarms   : None
  SONET defects  : None
  Logical interface so-0/0/1.0 (Index 61) (SNMP ifIndex 118)
    Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
    Protocol inet, MTU: 4470, Flags: None
      Addresses, Flags: Is-Preferred Is-Primary
        Destination: 192.168.50.0/30, Local: 192.168.50.1
    Protocol iso, MTU: 4470, Flags: None
```

Meaning Sample output 1 shows that the SONET interface payload scrambling has been enabled.

Sample output 2 shows that HDLC payload scrambling has been disabled. If you use the **show configuration** or **show configuration interfaces** command, you must scroll to the particular interface for payload scrambling status.

Sample output 3 shows that payload scrambling has been disabled. To explicitly configure payload scrambling, see "Configuring SONET HDLC Payload Scrambling" on page 179.

See Also

- Configuring SONET HDLC Payload Scrambling on page 179

Configuring SONET HDLC Payload Scrambling

Purpose

You might want to configure SONET HDLC payload scrambling (which is the configurable cell payload scrambling mentioned earlier) if it has been disabled. Configuring payload scrambling provides better link stability.

NOTE: Payload scrambling is the default for Juniper Networks routers. To return to the default, that is, to re-enable payload scrambling, delete the **no-payload-scrambler** statement from the configuration.

Action

To explicitly configure HDLC payload scrambling, follow these steps:

1. In configuration mode, go to the following hierarchy level.

```
[edit]
user@host# edit interfaces so-fpc/pic/port sonet-options
```

2. Configure payload scrambling.

```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set payload-scrambler
```

3. Verify the configuration.

```
[edit interfaces interface-name sonet-options]
user@host# show
payload-scrambler;
```

4. Commit the configuration.

```
user@host# commit
```

See Also

- Checking SONET HDLC Payload Scrambling on page 177

See Also

- Checklist for Enabling SONET Payload Scrambling on page 176

Related Documentation

- Investigating Interface Steps and Commands on page 124
- Monitoring SONET Interfaces on page 128
- Using Loopback Testing for SONET Interfaces on page 136
- Locating SONET Alarms and Errors on page 150

- Checking the SONET Frame Checksum on page 180

Checking the SONET Frame Checksum

This section includes the following information to assist you when troubleshooting SONET interfaces:

- Checklist for Checking the SONET Frame Checksum on page 180
- Understand the SONET Frame Checksum on page 181
- Checking the SONET Frame Checksum on page 181
- Configuring a SONET Frame Checksum on page 185

Checklist for Checking the SONET Frame Checksum

Purpose To check and configure SONET frame checksum.

Action Table 26 on page 180 provides the links and commands for SONET frame checksum.

Table 26: Checklist for Checking the SONET Frame Checksum

Tasks	Command or Action
"Understand the SONET Frame Checksum" on page 31	
"Checking the SONET Frame Checksum" on page 181	
1. Examining Output for Framing Errors on page 181	**show interfaces *interface-name* extensive**
2. Checking the FCS Configuration on page 184	**show configuration interfaces | *interface-name*** **show interfaces *interface-name***
"Configuring a SONET Frame Checksum" on page 185	
1. Returning to the Default 16-Bit Checksum on page 186	**[edit]** **edit interfaces *so-fpc/pic/port* sonet-options** **delete fcs 32** **show** **commit**
2. Configuring a 16-Bit Checksum on page 186	**[edit]** **edit interfaces *so-fpc/pic/port* sonet-options** **set fcs 16** **show** **commit**
3. Configuring a 32-Bit Checksum on page 187	**[edit]** **edit interfaces *so-fpc/pic/port* sonet-options** **set (fcs 32 | rfc-2615)** **show** **commit**

See Also
- Checking the SONET Frame Checksum on page 181
- Configuring a SONET Frame Checksum on page 185

Understand the SONET Frame Checksum

Problem **Description:** The SONET frame checksum is a calculation that is added to a frame for error control purposes. SONET frame checksum is used in High-Level Data Link Control (HDLC), Frame Relay, and other data-link layer protocols. For example, Router A calculates the frame check sequence (FCS) and adds it to the outgoing message. Router B, on receiving the message recalculates the FCS and compares it to the FCS from Router A. If there is a difference, both sides of the connection might not match in relation to the FCS configuration.

Solution If you are having problems with a connection, check whether the FCS matches on both sides of the connection. To check the SONET frame checksum, see "Checking the SONET Frame Checksum" on page 181.

After you have checked the FCS and determined that a problem exists, you must configure a SONET frame checksum. For more information, see "Configuring a SONET Frame Checksum" on page 185.

See Also
- Checklist for Checking the SONET Frame Checksum on page 180

Checking the SONET Frame Checksum

If you are having problems with a connection, check that the FCS matches on both sides of the connection.

To check the SONET frame checksum, follow these steps:

1. Examining Output for Framing Errors on page 181
2. Checking the FCS Configuration on page 184

Examining Output for Framing Errors

Purpose By examining the output for an interface, you can determine if framing errors are incrementing in the absence of any SONET alarms or defects.

Action From the Junos OS command-line interface (CLI) operational mode, use the following command to check for framing errors:

```
user@host> show interfaces interface-name extensive
```

Sample Output

```
user@router1> show interfaces so-1/0/0 extensive
```

```
Physical interface: so-1/0/0, Enabled, Physical link is Up
  Interface index: 13, SNMP ifIndex: 18, Generation: 12
  Link-level type: PPP, MTU: 4474, Clocking: Internal, SONET mode, Speed: OC3,
Loopback: None, FCS: 16 , Payload scrambler: Enabled
  Device flags   : Present Running
  Interface flags: Link-Layer-Down Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Hold-times     : Up 0 ms, Down 0 ms
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive statistics:
    Input : 6 (last seen 00:00:52 ago)
    Output: 11 (last sent 00:00:05 ago)
  LCP state: Opened
  NCP state: inet: Opened, inet6: Not-configured, iso: Opened, mpls: Conf-req-sent

  CHAP state: Not-configured
  Last flapped   : 2002-11-01 22:28:30 UTC (1w5d 23:26 ago)
  Statistics last cleared: 2002-11-14 21:52:51 UTC (00:01:50 ago)
  Traffic statistics:
   Input  bytes  :                  692                    0 bps
   Output bytes  :                  716                   32 bps
   Input  packets:                   23                    0 pps
   Output packets:                   72                    0 pps
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 27 , Runs: 0, Giants: 0, Bucket drops: 0,
 Policed discards: 0, L3 incompletes: 0,
    L2 channel errors: 0, L2 mismatch timeouts: 0, HS link CRC errors: 0, HS link
 FIFO overflows: 0
  Output errors:
    Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0, HS link FIFO
underflows: 0
  SONET alarms  : None
  SONET defects : None
  SONET PHY:            Seconds        Count  State
    PLL Lock                  0            0  OK
    PHY Light                 0            0  OK
  SONET section:
    BIP-B1                    0            0
    SEF                       0            0  OK
    LOS                       0            0  OK
    LOF                       0            0  OK
    ES-S                      0
    SES-S                     0
    SEFS-S                    0
  SONET line:
    BIP-B2                    0            0
    REI-L                     0            0
    RDI-L                     0            0  OK
    AIS-L                     0            0  OK
    BERR-SF                   0            0  OK
    BERR-SD                   0            0  OK
    ES-L                      0
    SES-L                     0
    UAS-L                     0
    ES-LFE                    0
    SES-LFE                   0
    UAS-LFE                   0
  SONET path:
    BIP-B3                    0            0
    REI-P                     0            0
```

```
  LOP-P                     0            0  OK
  AIS-P                     0            0  OK
  RDI-P                     0            0  OK
  UNEQ-P                    0            0  OK
  PLM-P                     0            0  OK
  ES-P                      0
  SES-P                     0
  UAS-P                     0
  ES-PFE                    0
  SES-PFE                   0
  UAS-PFE                   0
Received SONET overhead:
  F1      : 0x00, J0      : 0x00, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0xcf, C2(cmp) : 0xcf, F2      : 0x00
  Z3      : 0x00, Z4      : 0x00, S1(cmp) : 0x00, V5      : 0x00
  V5(cmp) : 0x00
Transmitted SONET overhead:
  F1      : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0xcf, F2      : 0x00, Z3      : 0x00
  Z4      : 0x00, V5      : 0x00
Received path trace: router2 so-1/3/1
  73 6c 69 70 70 65 72 79 20 73 6f 2d 31 2f 33 2f   router2 so-1/3/1
  31 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 0d 0a   ................
Transmitted path trace: router1 so-1/0/0
  68 61 69 72 79 20 73 6f 2d 31 2f 30 2f 30 00 00   router1 so-1/0/0
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
HDLC configuration:
  Policing bucket: Disabled
  Shaping bucket : Disabled
  Giant threshold: 4484, Runt threshold: 3
Packet Forwarding Engine configuration:
  Destination slot: 1, PLP byte: 1 (0x00)
  CoS transmit queue             Bandwidth           Buffer Priority   Limit
                              %          bps   %        bytes
  0 best-effort              95    147744000  95            0      low    none
  3 network-control           5      7776000   5            0      low    none
Logical interface so-1/0/0.0 (Index 8) (SNMP ifIndex 108) (Generation 9)
  Flags: Device-Down Point-To-Point SNMP-Traps Encapsulation: PPP
  Protocol inet, MTU: 4470, Generation: 15, Route table: 1
    Flags: Is-Primary
    Addresses, Flags: Dest-route-down Is-Default Is-Preferred Is-Primary
     Destination: 1.1.6.1, Local: 1.1.6.2, Broadcast: Unspecified, Generation:
15
  Protocol iso, MTU: 4470, Generation: 16, Route table: 1
    Flags: Is-Primary
  Protocol mpls, MTU: 4458, Generation: 17, Route table: 1
    Flags: Protocol-Down, Is-Primary
```

Meaning

The sample output shows that Router 1 is configured for FCS 16, that framing errors have incremented to 27, and that there are no SONET alarms or defects. Incrementing framing errors, in the absence of any SONET alarms or defects, are a symptom of SONET frame checksum errors.

See Also
- Checking the FCS Configuration on page 184

Checking the FCS Configuration

Purpose If you are having problems with a connection, check your router's FCS configuration and, if possible, the FCS configuration on the router on the other side of the connection.

Action From the Junos OS CLI operational mode, use one of the following two commands to check the SONET frame checksum:

```
user@host> show configuration interfaces |interface-name
```

or

```
user@host> show interfacesinterface-name
```

NOTE: The option to display a specific configuration with the show configuration command hierarchy was introduced in Junos OS Release 5.3.

Sample Output 1

```
user@host> show configuration interfaces so-0/0/0
encapsulation cisco-hdlc;
sonet-options {
fcs 32;
    payload-scrambler;
}
unit 0 {
    family inet {
        address 10.0.0.2/32 {
            destination 10.0.0.1;
        }
    }
    family mpls;
}
```

Sample Output 2

```
user@host> show interfaces so-0/0/1
Physical interface: so-0/0/1, Enabled, Physical link is Up
  Interface index: 48, SNMP ifIndex: 114
  Link-level type: PPP, MTU: 4474, Clocking: Internal, SONET mode, Speed: OC3,
Loopback: None, FCS: 32,
   Payload scrambler: Disabled
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive: Input: 70627 (00:00:07 ago), Output: 70791 (00:00:08 ago)
```

```
LCP state: Opened
NCP state: inet: Opened, inet6: Not-configured, iso: Opened, mpls: Not-configured

Input rate     : 78056456 bps (6504 pps)
Output rate    : 78044840 bps (6503 pps)
SONET alarms   : None
SONET defects  : None
Logical interface so-0/0/1.0 (Index 61) (SNMP ifIndex 118)
  Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
  Protocol inet, MTU: 4470, Flags: None
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: 192.168.50.0/30, Local: 192.168.50.1
  Protocol iso, MTU: 4470, Flags: None
```

Meaning

Sample output 1 shows that FCS 32 is configured. If you use the **show configuration** or **show configuration interfaces** command, you must scroll to the particular interface for the FCS configuration status.

Meaning Sample output 2 shows that FCS 32 is configured. To change the FCS configuration, see "Returning to the Default 16-Bit Checksum" on page 186, "Configuring a 16-Bit Checksum" on page 186, or "Configuring a 32-Bit Checksum" on page 187.

See Also
- Examining Output for Framing Errors on page 181

See Also
- Checklist for Checking the SONET Frame Checksum on page 180
- Configuring a SONET Frame Checksum on page 185

Configuring a SONET Frame Checksum

After you have checked the FCS and determined that a problem exists, you might need to do one of the following, depending on the situation:

NOTE: By default, SONET interfaces use a 16-bit frame checksum. You can configure a 32-bit checksum, which provides more reliable packet verification. However, some older equipment may not support 32-bit checksums.

- Returning to the Default 16-Bit Checksum on page 186
- Configuring a 16-Bit Checksum on page 186
- Configuring a 32-Bit Checksum on page 187

Returning to the Default 16-Bit Checksum

Action

To return to the default 16-bit frame checksum, follow these steps:

1. In configuration mode, go to the following hierarchy level.

```
[edit]
user@host#  edit interfaces so-fpc/pic/port sonet-options
```

2. Delete the **fcs 32** statement from the configuration.

```
[edit interfaces interface-name sonet-options]
user@host#  delete fcs 32
```

3. Verify the configuration.

```
[edit interfaces interface-name sonet-options]
user@host# show
```

4. Commit the configuration.

```
user@host# commit
```

See Also

- Configuring a 16-Bit Checksum on page 186
- Configuring a 32-Bit Checksum on page 187

Configuring a 16-Bit Checksum

Action

To explicitly configure the 16-bit checksum, follow these steps:

1. In configuration mode, go to the following hierarchy level.

```
[edit]
user@host# edit interfaces so-fpc/pic/port sonet-options
```

2. Configure the 16-bit checksum.

```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set fcs 16
```

3. Verify the configuration.

```
[edit interfaces interface-name sonet-options]
user@host# show
fcs 16;
```

4. Commit the configuration.

```
user@host# commit
```

See Also

- Returning to the Default 16-Bit Checksum on page 186
- Configuring a 32-Bit Checksum on page 187

Configuring a 32-Bit Checksum

Action

To explicitly configure the 32-bit checksum, follow these steps:

1. In configuration mode, go to the following hierarchy level.

```
[edit]
user@host# edit interfaces so-fpc/pic/port sonet-options
```

2. Configure the 32-bit checksum.

```
[edit interfaces so-fpc/pic/port sonet-options]
user@host# set (fcs 32 | rfc-2615)
```

NOTE: The rfc-2615 statement automatically configures the interface to use FCS 32 and changes the C2 byte to 0x16, as per the RFC.

3. Verify the configuration.

```
[edit interfaces interface-name sonet-options]
user@host# show
fcs 32;
```

or

```
[edit interfaces interface-name sonet-options]
user@host# show
rfc-2615;
```

4. Commit the configuration.

```
user@host# commit
```

NOTE: On a Channelized OC12 interface, the sonet-options fcs statement is not supported. To configure FCS on each DS3 channel, you must include the t3-options fcs statement in the configuration for each channel.

See Also

- Returning to the Default 16-Bit Checksum on page 186
- Configuring a 16-Bit Checksum on page 186

See Also

- Checklist for Checking the SONET Frame Checksum on page 180
- Checking the SONET Frame Checksum on page 181

Related Documentation

- Investigating Interface Steps and Commands on page 124
- Monitoring SONET Interfaces on page 128
- Using Loopback Testing for SONET Interfaces on page 136
- Locating SONET Alarms and Errors on page 150
- Enabling SONET Payload Scrambling on page 175

PART 4

Configuration Statements and Operational Commands

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CHAPTER 9

Configuration Statements

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- required-depth on page 249
- revert-time (Interfaces) on page 250
- rfc-2615 on page 250
- sonet-options on page 251
- speed (SONET/SDH) on page 253
- switching-mode on page 254
- t3-options on page 255
- threshold on page 256
- transmit-bucket on page 257
- trigger on page 258
- vtmapping on page 259
- working-circuit on page 260
- z0-increment on page 260

advertise-interval

Syntax advertise-interval *milliseconds*;

Hierarchy Level [edit interfaces *interface-name* sonet-options aps]

Release Information Statement introduced before Junos OS Release 7.4.

Description Modify the Automatic Protection Switching (APS) interval at which the protect and working routers send packets to their neighbors to advertise that they are operational. A router considers its neighbor to be operational for a period, called the hold time, that is, by default, three times the advertisement interval.

Options ***milliseconds***—Interval between advertisement packets.
Range: 1 through 65,534 milliseconds
Default: 1000 milliseconds

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- Configuring APS Timers on page 75

aggregate (SONET/SDH)

Syntax aggregate as*x*;

Hierarchy Level [edit interfaces *interface-name* sonet-options]

Release Information Statement introduced before Junos OS Release 7.4.

Description Specify aggregated SONET/SDH logical interface number.

Options as*x*—Aggregated SONET/SDH logical interface number.
Range: 0 through 15

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- Configuring Aggregated SONET/SDH Interfaces on page 101

aggregated-sonet-options

Syntax

```
aggregated-sonet-options {
  link-speed speed;
  minimum-links number;
}
```

Hierarchy Level

[edit interfaces as*x*]

Release Information

Statement introduced before Junos OS Release 7.4.

Description

Configure aggregated SONET/SDH-specific interface properties.

The remaining statements are explained separately. See CLI Explorer.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring Aggregated SONET/SDH Interfaces on page 101

annex

Syntax

```
annex (annex-a | annex-b);
```

Hierarchy Level

[edit interfaces *interface-name* shdsl-options],
[edit interfaces *interface-name* sonet-options aps],
[edit logical-systems *logical-system-name* interfaces *interface-name* shdsl-options]

Release Information

Statement introduced in Junos OS Release 7.4.

Description

For M320 and M120 routers only, for Multiplex Section Protection (MSP) switching on SDH interfaces, set **annex-b**. You must also configure the **working protection circuit** under the **[edit interfaces so-*fpc/pic/port* sonet-options aps]** hierarchy level.

Default

annex-b

Options

annex-a—Use for North American SHDSL network implementations.

annex-b—Use for European SHDSL network implementations.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

aps

Syntax

```
aps {
  advertise-interval milliseconds;
  annex-b
  authentication-key key;
  (break-before-make | no-break-before-make);
  fast-aps-switch;
  force;
  hold-time milliseconds;
  lockout;
  neighbor address;
  paired-group group-name;
  preserve-interface;
  protect-circuit group-name;
  request;
  revert-time seconds;
  switching-mode (bidirectional | unidirectional);
  working-circuit group-name;
}
```

Hierarchy Level

[edit interfaces *interface-name* sonet-options]

Release Information

Statement introduced before Junos OS Release 7.4.

Description

Configure Automatic Protection Switching (APS) on the router.

For DS3 channels on a channelized OC12 interface, configure APS on channel 0 only. If you configure APS on channels 1 through 11, it is ignored.

The remaining statements are explained separately. See CLI Explorer.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Automatic Protection Switching and Multiplex Section Protection Overview on page 64

atm-options

Syntax

```
atm-options {
  cell-bundle-size cells;
  ilmi;
  linear-red-profiles profile-name {
    high-plp-max-threshold percent;
    low-plp-max-threshold percent;
    queue-depth cells high-plp-threshold percent low-plp-threshold percent;
  }
  mpls {
    pop-all-labels {
      required-depth number;
    }
  }
  pic-type (atm1 | atm2);
  plp-to-clp;
  promiscuous-mode {
    vpi vpi-identifier;
  }
  scheduler-maps map-name {
    forwarding-class class-name {
      epd-threshold cells plp1 cells;
      linear-red-profile profile-name;
      priority (high | low);
      transmit-weight (cells number | percent number);
    }
    vc-cos-mode (alternate | strict);
  }
  use-null-cw;
  vpi vpi-identifier {
    maximum-vcs maximum-vcs;
    oam-liveness {
      up-count cells;
      down-count cells;
    }
    oam-period (disable | seconds);
    shaping {
      (cbr rate | rtvbr peak rate sustained rate burst length | vbr peak rate sustained rate burst
        length);
      queue-length number;
    }
  }
}
```

Hierarchy Level

```
[edit interfaces interface-name]
```

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 12.2 for the ACX Series Universal Metro Routers.

Description

Configure ATM-specific physical interface properties.

The remaining statements are explained separately. Search for a statement in CLI Explorer or click a linked statement in the Syntax section for details.

NOTE: Certain options apply only to specific platforms.

Required Privilege Level
interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- *Interface Encapsulations Overview*
- *multipoint-destination*
- *shaping*
- *vci*

authentication-key

Syntax
```
authentication-key key;
```

Hierarchy Level
```
[edit interfaces interface-name sonet-options aps]
```

Release Information
Statement introduced before Junos OS Release 7.4.

Description
Configure the Automatic Protection Switching (APS) authentication key (password).

Options
key—Authentication password. It can be 1 through 8 characters long. Configure the same key for both the working and protect routers.

Required Privilege Level
interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- Configuring Basic Automatic Protect Switching on page 69
- For information about the **authentication-key** statement at the **[edit interfaces *interface-name* unit *unit-number* family inet address *address* (vrrp-group | vrrp-inet6-group) *group-number*]** or **[edit logical-systems *logical-system-name* interfaces *interface-name* unit *unit-number* family (inet | inet6) address *address* (vrrp-group | vrrp-inet6-group) *group-number*]** hierarchy level, see the *High Availability Feature Guide*.

bytes

Syntax

```
bytes {
  c2 value;
  e1-quiet value;
  f1 value;
  f2 value;
  s1 value;
  z3 value;
  z4 value;
}
```

Hierarchy Level

[edit interfaces *interface-name* sonet-options]

Release Information

Statement introduced before Junos OS Release 7.4.

Description

Set values in some SONET/SDH header bytes.

Options

c2 *value*—Path signal label SONET/SDH overhead byte. SONET/SDH frames use the C2 byte to indicate the contents of the payload inside the frame. SONET/SDH interfaces use the C2 byte to indicate whether the payload is scrambled.

Range: 0 through 255

Default: 0xCF

e1-quiet *value*—Default idle byte sent on the orderwire SONET/SDH overhead bytes. The router does not support the orderwire channel, and hence sends this byte continuously.

Range: 0 through 255

Default: 0x7F

f1 *value*, **f2 *value***, **z3 *value***, **z4 *value***—SONET/SDH overhead bytes.

Range: 0 through 255

Default: 0x00

s1 *value*—Synchronization message SONET overhead byte. This byte is normally controlled as a side effect of the system reference clock configuration and the state of the external clock coming from an interface if the system reference clocks have been configured to use an external reference.

Range: 0 through 255

Default: 0xCC

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring SONET/SDH Header Byte Values to Identify Error Conditions on page 30
- *no-concatenate*

clocking

Syntax clocking (external [interface *interface-name*] | internal);

Hierarchy Level [edit interfaces *interface-name*]

Release Information Statement introduced before Junos OS Release 7.4.
interface option added in Junos OS Release 8.2.
Statement introduced in Junos OS Release 12.2 for the ACX Series Universal Metro Routers.

Description For interfaces that can use various clock sources, configure the source of the transmit clock on each interface.

NOTE: On Channelized SONET/SDH PICs, if you set the parent (or the master) controller clock to external, then you must set the child controller clocks to the default value—that is, internal.

For example, on the Channelized STM1 PIC, if the clock on the Channelized STM1 interface (which is the master controller) is set to external, then you must not configure the CE1 interface (which is the child controller) clock to external. Instead you must configure the CE1 interface clock to internal.

Options **external**—The clock source is provided by the data communication equipment (DCE).

interface *interface-name*—Configure clocking for the drop-and insert feature. When configuring this feature, both ports must use the same clock source: either the router's internal clock or an external clock on one of the interfaces. If an external clock source is required, one interface must specify clocking external and the other must specify the same clock.

internal—Use the internal stratum 3 clock as the reference clock.

Default: internal

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring the Clock Source*
- Configuring the Clock Source on SONET/SDH Interfaces on page 38
- *Clock Sources on Channelized Interfaces*
- *Configuring a Channelized T1/E1 Interface to Drop and Insert Time Slots*
- loop-timing on page 226

container-devices

Syntax

```
container-devices {
  device-count number;
}
```

Hierarchy Level

[edit chassis]

Release Information

Statement introduced in Junos OS Release 9.2.

Description

Specify the container devices configuration. The **number** option specifies the number of sequentially numbered container interfaces, from **ci0** to **ci127** maximum.

Options

number—Number of container devices.

Range: 1 through 128

Required Privilege Level

chassis—To view this statement in the configuration.
chassis-control—To add this statement to the configuration.

Related Documentation

- Displaying APS Using a Container Interface with ATM Encapsulation on page 82
- Configuring Container Interfaces for APS on SONET Links on page 76

container-list

Syntax container-list [*container-interface-names*];

Hierarchy Level [edit interfaces container-options]

Release Information Statement introduced in Junos OS Release 9.2.

Description Specify a list of container interfaces; for example: **ci*0***, **ci*1***, and up to **ci*127***.

Options ***container-interface-names***—Name of each container interface.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Displaying APS Using a Container Interface with ATM Encapsulation on page 82
- Configuring Container Interfaces for APS on SONET Links on page 76
- container-options on page 203

container-options

Syntax

```
container-options {
  container-list [ container-interface-names ];
  container-type aps;
  member-interface-type sonet {
    member-interface-speed [ speed ];
  }
}
```

Hierarchy Level

```
[edit interfaces]
```

Release Information

Statement introduced in Junos OS Release 9.2.

Description

Specify the container interface options.

Options

interface-name—Name of the SONET or the container interface.

aps—Specify the member link interface type of the container as APS.

sonet—Protocol type of the container interface.

speed—Set interface speed to OC3, OC12, OC48, OC192, OC768, or mixed.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Displaying APS Using a Container Interface with ATM Encapsulation on page 82
- Configuring Container Interfaces for APS on SONET Links on page 76

container-type

Syntax container-type *aps*;

Hierarchy Level [edit interfaces container-options]

Release Information Statement introduced in Junos OS Release 9.2.

Description Specify the container-options interface type.

Options **aps**—Configure the interface type to be Automatic Protection Switching (APS).

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- Displaying APS Using a Container Interface with ATM Encapsulation on page 82
- Configuring Container Interfaces for APS on SONET Links on page 76

encapsulation (Container Interface)

Syntax encapsulation (cisco-hdlc | ppp);

Hierarchy Level [edit interfaces c*in*]

Release Information Statement introduced in Junos OS Release 9.2.

Description Container link-layer encapsulation type.

Options **cisco-hdlc**—Use Cisco-compatible High-Level Data Link Control (HDLC) framing.

ppp—Use serial PPP encapsulation.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- Displaying APS Using a Container Interface with ATM Encapsulation on page 82
- Configuring Container Interfaces for APS on SONET Links on page 76

encapsulation (Logical Interface)

Syntax

```
encapsulation (atm-ccc-cell-relay | atm-ccc-vc-mux | atm-cisco-nlpid | atm-mlppp-llc |
  atm-nlpid | atm-ppp-llc | atm-ppp-vc-mux | atm-snap | atm-tcc-snap | atm-tcc-vc-mux
  | atm-vc-mux | ether-over-atm-llc | ether-vpls-over-atm-llc | ether-vpls-over-fr |
  ether-vpls-over-ppp | ethernet | ethernet-ccc | ethernet-vpls | ethernet-vpls-fr |
  frame-relay-ccc | frame-relay-ether-type | frame-relay-ether-type-tcc | frame-relay-ppp
  | frame-relay-tcc | gre-fragmentation | multilink-frame-relay-end-to-end | multilink-ppp
  | ppp-over-ether | ppp-over-ether-over-atm-llc | vlan-bridge | vlan-ccc | vlan-vci-ccc |
  vlan-tcc | vlan-vpls | vxlan);
```

Hierarchy Level

[edit interfaces *interface-name* unit *logical-unit-number*],
[edit logical-systems *logical-system-name* interfaces *interface-name* unit *logical-unit-number*],
[edit interfaces rlsq *number* unit *logical-unit-number*]
[edit protocols evpn]

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 12.1X48 for PTX Series Packet Transport Routers (**ethernet**,**vlan-ccc**, and **vlan-tcc** options only).
Statement introduced in Junos OS Release 12.2 for the ACX Series Universal Metro Routers. Only the **atm-ccc-cell-relay** and **atm-ccc-vc-mux** options are supported on ACX Series routers.
Statement introduced in Junos OS Release 17.3R1 for QFX10000 Series switches (**ethernet-ccc** and **vlan-ccc** options only).

Description

Configure a logical link-layer encapsulation type. Not all encapsulation types are supported on the switches. See the switch CLI.

Options

atm-ccc-cell-relay—Use ATM cell-relay encapsulation.

atm-ccc-vc-mux—Use ATM virtual circuit (VC) multiplex encapsulation on CCC circuits. When you use this encapsulation type, you can configure the **ccc** family only.

atm-cisco-nlpid—Use Cisco ATM network layer protocol identifier (NLPID) encapsulation. When you use this encapsulation type, you can configure the **inet** family only.

atm-mlppp-llc—For ATM2 IQ interfaces only, use Multilink Point-to-Point (MLPPP) over AAL5 LLC. For this encapsulation type, your router must be equipped with a Link Services or Voice Services PIC. MLPPP over ATM encapsulation is not supported on ATM2 IQ OC48 interfaces.

atm-nlpid—Use ATM NLPID encapsulation. When you use this encapsulation type, you can configure the **inet** family only.

atm-ppp-llc—(ATM2 IQ interfaces and MX Series routers with MPC/MIC interfaces using the ATM MIC with SFP only) Use PPP over AAL5 LLC encapsulation.

atm-ppp-vc-mux—(ATM2 IQ interfaces and MX Series routers with MPC/MIC interfaces using the ATM MIC with SFP only) Use PPP over ATM AAL5 multiplex encapsulation.

atm-snap—(All interfaces including MX Series routers with MPC/MIC interfaces using the ATM MIC with SFP) Use ATM subnetwork attachment point (SNAP) encapsulation.

atm-tcc-snap—Use ATM SNAP encapsulation on translational cross-connect (TCC) circuits.

atm-tcc-vc-mux—Use ATM VC multiplex encapsulation on TCC circuits. When you use this encapsulation type, you can configure the **tcc** family only.

atm-vc-mux—(All interfaces including MX Series routers with MPC/MIC interfaces using the ATM MIC with SFP) Use ATM VC multiplex encapsulation. When you use this encapsulation type, you can configure the **inet** family only.

ether-over-atm-llc—(All IP interfaces including MX Series routers with MPC/MIC interfaces using the ATM MIC with SFP) For interfaces that carry IP traffic, use Ethernet over ATM LLC encapsulation. When you use this encapsulation type, you cannot configure multipoint interfaces.

ether-vpls-over-atm-llc—For ATM2 IQ interfaces only, use the Ethernet virtual private LAN service (VPLS) over ATM LLC encapsulation to bridge Ethernet interfaces and ATM interfaces over a VPLS routing instance (as described in RFC 2684, *Multiprotocol Encapsulation over ATM Adaptation Layer 5*). Packets from the ATM interfaces are converted to standard ENET2/802.3 encapsulated Ethernet frames with the frame check sequence (FCS) field removed.

ether-vpls-over-fr—For E1, T1, E3, T3, and SONET interfaces only, use the Ethernet virtual private LAN service (VPLS) over Frame Relay encapsulation to support Bridged Ethernet over Frame Relay encapsulated TDM interfaces for VPLS applications, per RFC 2427, *Multiprotocol Interconnect over Frame Relay*.

NOTE: **The SONET/SDH OC3/STM1 (Multi-Rate) MIC with SFP, the Channelized SONET/SDH OC3/STM1 (Multi-Rate) MIC with SFP, and the DS3/E3 MIC do not support Ethernet over Frame Relay encapsulation.**

ether-vpls-over-ppp—For E1, T1, E3, T3, and SONET interfaces only, use the Ethernet virtual private LAN service (VPLS) over Point-to-Point Protocol (PPP) encapsulation to support Bridged Ethernet over PPP-encapsulated TDM interfaces for VPLS applications.

ethernet—Use Ethernet II encapsulation (as described in RFC 894, *A Standard for the Transmission of IP Datagrams over Ethernet Networks*).

ethernet-ccc—Use Ethernet CCC encapsulation on Ethernet interfaces.

ethernet-vpls—Use Ethernet VPLS encapsulation on Ethernet interfaces that have VPLS enabled and that must accept packets carrying standard Tag Protocol ID (TPID) values.

NOTE: The built-in Gigabit Ethernet PIC on an M7i router does not support extended VLAN VPLS encapsulation.

ethernet-vpls-fr—Use in a VPLS setup when a CE device is connected to a PE router over a time-division multiplexing (TDM) link. This encapsulation type enables the PE router to terminate the outer layer 2 Frame Relay connection, use the 802.1p bits inside the inner Ethernet header to classify the packets, look at the MAC address from the Ethernet header, and use the MAC address to forward the packet into a given VPLS instance.

frame-relay-ccc—Use Frame Relay encapsulation on CCC circuits. When you use this encapsulation type, you can configure the **ccc** family only.

frame-relay-ether-type—Use Frame Relay ether type encapsulation for compatibility with Cisco Frame Relay. The physical interface must be configured with flexible-frame-relay encapsulation.

frame-relay-ether-type-tcc—Use Frame Relay ether type TCC for Cisco-compatible Frame Relay on TCC circuits to connect different media. The physical interface must be configured with flexible-frame-relay encapsulation.

frame-relay-ppp—Use PPP over Frame Relay circuits. When you use this encapsulation type, you can configure the **ppp** family only.

frame-relay-tcc—Use Frame Relay encapsulation on TCC circuits for connecting different media. When you use this encapsulation type, you can configure the **tcc** family only.

gre-fragmentation—For adaptive services interfaces only, use GRE fragmentation encapsulation to enable fragmentation of IPv4 packets in GRE tunnels. This encapsulation clears the do not fragment (DF) bit in the packet header. If the packet' s size exceeds the tunnel' s maximum transmission unit (MTU) value, the packet is fragmented before encapsulation.

multilink-frame-relay-end-to-end—Use MLFR FRF.15 encapsulation. This encapsulation is used only on multilink, link services, and voice services interfaces and their constituent T1 or E1 interfaces, and is supported on LSQ and redundant LSQ interfaces.

multilink-ppp—Use MLPPP encapsulation. This encapsulation is used only on multilink, link services, and voice services interfaces and their constituent T1 or E1 interfaces.

ppp-over-ether—Use PPP over Ethernet encapsulation to configure an underlying Ethernet interface for a dynamic PPPoE logical interface on M120 and M320 routers with Intelligent Queuing 2 (IQ2) PICs, and on MX Series routers with MPCs.

ppp-over-ether-over-atm-llc—(MX Series routers with MPCs using the ATM MIC with SFP only) For underlying ATM interfaces, use PPP over Ethernet over ATM LLC encapsulation. When you use this encapsulation type, you cannot configure the interface address. Instead, configure the interface address on the PPP interface.

vlan-bridge—Use Ethernet VLAN bridge encapsulation on Ethernet interfaces that have IEEE 802.1Q tagging, flexible-ethernet-services, and bridging enabled and that must accept packets carrying TPID 0x8100 or a user-defined TPID.

vlan-ccc—Use Ethernet virtual LAN (VLAN) encapsulation on CCC circuits. When you use this encapsulation type, you can configure the **ccc** family only.

vlan-vci-ccc—Use ATM-to-Ethernet interworking encapsulation on CCC circuits. When you use this encapsulation type, you can configure the **ccc** family only.

vlan-tcc—Use Ethernet VLAN encapsulation on TCC circuits. When you use this encapsulation type, you can configure the **tcc** family only.

vlan-vpls—Use Ethernet VLAN encapsulation on VPLS circuits.

vxlan—Use VXLAN data plane encapsulation for EVPN.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring Layer 2 Switching Cross-Connects Using CCC*
- *Configuring the Encapsulation for Layer 2 Switching TCCs*
- *Configuring Interface Encapsulation on Logical Interfaces*
- *Configuring the CCC Encapsulation for LSP Tunnel Cross-Connects*
- *Circuit and Translational Cross-Connects Overview*
- *Identifying the Access Concentrator*
- *Configuring ATM Interface Encapsulation*
- *Configuring VLAN and Extended VLAN Encapsulation*
- *Configuring ATM-to-Ethernet Interworking*
- *Configuring Interface Encapsulation on PTX Series Packet Transport Routers*
- *Configuring CCC Encapsulation for Layer 2 VPNs*
- *Configuring TCC Encapsulation for Layer 2 VPNs and Layer 2 Circuits*
- *Configuring ATM for Subscriber Access*
- *Understanding CoS on ATM IMA Pseudowire Interfaces Overview*
- *Configuring Policing on an ATM IMA Pseudowire*

family

Syntax

```
family family {
  accounting {
    destination-class-usage;
    source-class-usage {
      (input | output | input output);
    }
  }
  access-concentrator name;
  address address {
    ... the address subhierarchy appears after the main [edit interfaces interface-name unit
      logical-unit-number family family-name] hierarchy ...
  }
  bundle interface-name;
  core-facing;
  demux-destination {
    destination-prefix;
  }
  demux-source {
    source-prefix;
  }
  direct-connect;
  duplicate-protection;
  dynamic-profile profile-name;
  filter {
    group filter-group-number;
    input filter-name;
    input-list [ filter-names ];
    output filter-name;
    output-list [ filter-names ];
  }
  interface-mode (access | trunk);
  ipsec-sa sa-name;
  keep-address-and-control;
  mac-validate (loose | strict);
  max-sessions number;
  max-sessions-vsa-ignore;
  mtu bytes;
  multicast-only;
  nd6-stale-time seconds;
  negotiate-address;
  no-neighbor-learn;
  no-redirects;
  policer {
    arp policer-template-name;
    input policer-template-name;
    output policer-template-name;
  }
  primary;
  protocols [inet iso mpls];
  proxy inet-address address;
  receive-options-packets;
```

```
receive-ttl-exceeded;
remote (inet-address address | mac-address address);
rpf-check {
  fail-filter filter-name
  mode loose;
}
sampling {
  input;
  output;
}
service {
  input {
    post-service-filter filter-name;
    service-set service-set-name <service-filter filter-name>;
  }
  output {
    service-set service-set-name <service-filter filter-name>;
  }
}
service-name-table table-name;
short-cycle-protection <lockout-time-min minimum-seconds lockout-time-max
  maximum-seconds> <filter [aci]>;
(translate-discard-eligible | no-translate-discard-eligible);
(translate-fecn-and-becn | no-translate-fecn-and-becn);
translate-plp-control-word-de;
unnumbered-address interface-name destination address destination-profile profile-name;
vlan-id number;
vlan-id-list [number number-number];
address address {
  arp ip-address (mac | multicast-mac) mac-address <publish>;
  broadcast address;
  destination address;
  destination-profile name;
  eui-64;
  master-only;
  multipoint-destination address dlci dlci-identifier;
  multipoint-destination address {
    epd-threshold cells;
    inverse-arp;
    oam-liveness {
      up-count cells;
      down-count cells;
    }
    oam-period (disable | seconds);
    shaping {
      (cbr rate | rtvbr burst length peak rate sustained rate | vbr burst length peak rate
        sustained rate);
      queue-length number;
    }
    vci vpi-identifier.vci-identifier;
  }
  preferred;
  primary;
  vrrp-groupgroup-id {
    (accept-data | no-accept-data);
```

```
        advertise-interval seconds;
        authentication-key key;
        authentication-type authentication;
        fast-interval milliseconds;
        (preempt | no-preempt) {
          hold-time seconds;
        }
        priority number;
        track {
          interface interface-name {
            bandwidth-threshold bits-per-second priority-cost priority;
            priority-cost priority;
          }
          priority-hold-time seconds;
          route prefix routing-instance instance-name priority-cost priority;
          }
        }
        virtual-address [ addresses ];
        }
      virtual-link-local-address ipv6-address;
    }
}
```

Hierarchy Level

[edit interfaces *interface-name* unit *logical-unit-number*],
[edit logical-systems *logical-system-name* interfaces *interface-name* unit *logical-unit-number*]

Release Information

Statement introduced before Junos OS Release 7.4.
Option **max-sessions-vsa-ignore** introduced in Junos OS Release 11.4.

Description

Configure protocol family information for the logical interface.

NOTE: Not all subordinate statements are available to every protocol family.

Options *family*—Protocol family:

- **any**—Protocol-independent family used for Layer 2 packet filtering

NOTE: This option is not supported on T4000 Type 5 FPCs.

- **bridge**—(M Series and T Series routers only) Configure only when the physical interface is configured with **ethernet-bridge** type encapsulation or when the logical interface is configured with **vlan-bridge** type encapsulation. You can optionally configure this protocol family for the logical interface on which you configure VPLS.
- **ethernet-switching**—(M Series and T Series routers only) Configure only when the physical interface is configured with **ethernet-bridge** type encapsulation or when the logical interface is configured with **vlan-bridge** type encapsulation
- **ccc**—Circuit cross-connect protocol suite. You can configure this protocol family for the logical interface of CCC physical interfaces. When you use this encapsulation type, you can configure the **ccc** family only.
- **inet**—Internet Protocol version 4 suite. You must configure this protocol family for the logical interface to support IP protocol traffic, including Open Shortest Path First (OSPF), Border Gateway Protocol (BGP), Internet Control Message Protocol (ICMP), and Internet Protocol Control Protocol (IPCP).
- **inet6**—Internet Protocol version 6 suite. You must configure this protocol family for the logical interface to support IPv6 protocol traffic, including Routing Information Protocol for IPv6 (RIPng), Intermediate System-to-Intermediate System (IS-IS), BGP, and Virtual Router Redundancy Protocol for IPv6 (VRRP).
- **iso**—International Organization for Standardization Open Systems Interconnection (ISO OSI) protocol suite. You must configure this protocol family for the logical interface to support IS-IS traffic.
- **mlfr-end-to-end**—Multilink Frame Relay FRF.15. You must configure this protocol or multilink Point-to-Point Protocol (MLPPP) for the logical interface to support multilink bundling.
- **mlfr-uni-nni**—Multilink Frame Relay FRF.16. You must configure this protocol or **mlfr-end-to-end** for the logical interface to support link services and voice services bundling.
- **multilink-ppp**—Multilink Point-to-Point Protocol. You must configure this protocol (or **mlfr-end-to-end**) for the logical interface to support multilink bundling.
- **mpls**—Multiprotocol Label Switching (MPLS). You must configure this protocol family for the logical interface to participate in an MPLS path.
- **pppoe**—Point-to-Point Protocol over Ethernet
- **tcc**—Translational cross-connect protocol suite. You can configure this protocol family for the logical interface of TCC physical interfaces.

- **tnp**—Trivial Network Protocol. This protocol is used to communicate between the Routing Engine and the router's packet forwarding components. The Junos OS automatically configures this protocol family on the router's internal interfaces only, as discussed in *Understanding Internal Ethernet Interfaces*.
- **vpls**—(M Series and T Series routers only) Virtual private LAN service. You can optionally configure this protocol family for the logical interface on which you configure VPLS. VPLS provides an Ethernet-based point-to-multipoint Layer 2 VPN to connect customer edge (CE) routers across an MPLS backbone. When you configure a VPLS encapsulation type, the **family vpls** statement is assumed by default.

  MX Series routers support dynamic profiles for VPLS pseudowires, VLAN identifier translation, and automatic bridge domain configuration.

  For more information about VPLS, see the *Junos OS VPNs Library for Routing Devices*.

The remaining statements are explained separately. See CLI Explorer.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring the Protocol Family*

fast-aps-switch

Syntax fast-aps-switch;

Hierarchy Level [edit interfaces *interface-name* sonet-options aps]

Release Information Statement introduced in Junos OS Release 12.1.

Description (M320 routers with Channelized OC3/STM1 Circuit Emulation PIC with SFP only, EX Series switches, and MX series routers with Channelized OC3/STM1 Circuit Emulation PIC with SFP only using container interfaces) Reduce the Automatic Protection Switching (APS) switchover time in Layer 2 circuits.

NOTE:

- The fast APS switching feature is supported only within a single chassis on a MX series router using a container interface.
- Configuring this statement reduces the APS switchover time only when the Layer 2 circuit encapsulation type for the interface receiving traffic from a Layer 2 circuit neighbor is SAToP.
- When the **fast-aps-switch** statement is configured in revertive APS mode, you must configure an appropriate value for revert time to achieve reduction in APS switchover time.
- To prevent the logical interfaces in the data path from being shut down, configure appropriate hold-time values on all the interfaces in the data path that support TDM.
- The **fast-aps-switch** statement cannot be configured when the APS **annex-b** option is configured.
- The interfaces that have the **fast-aps-switch** statement configured cannot be used in virtual private LAN service (VPLS) environments.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Reducing APS Switchover Time in Layer 2 Circuits*

fcs

Syntax

```
fcs (16 | 32);
```

Hierarchy Level

[edit interfaces e1-*fpc/pic/port*],
[edit interfaces t1-*fpc/pic/port*],
[edit interfaces *interface-name* ds0-options],
[edit interfaces *interface-name* e1-options],
[edit interfaces *interface-name* e3-options],
[edit interfaces *interface-name* sonet-options],
[edit interfaces *interface-name* t1-options],
[edit interfaces *interface-name* t3-options]

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 12.2 for the ACX Series Universal Metro Routers.

Description

For E1/E3, SONET/SDH, and T1/T3 interfaces, configure the frame checksum (FCS) on the interface. The checksum must be the same on both ends of the interface.

On a channelized OC12 interface, the SONET/SDH **fcs** statement is not supported. To configure FCS on each DS3 channel, you must include the **t3-options fcs** statement in the configuration for each channel. For SONET/SDH, the channelized OC12 interface supports DS3 to STS-1 to OC12. For SDH, the channelized OC12 interface supports *N*xDS3 to *N*xVC3 to AU3 to STM.

NOTE: When configuring E1 or T1 interfaces on 10-port Channelized E1/T1 IQE PICs, the **fcs** statement must be included at the **[edit interfaces e1-*fpc/pic/port*]** or **[edit interfaces t1-*fpc/pic/port*]** hierarchy level as appropriate.

Options

16—Use a 16-bit frame checksum on the interface.

32—Use a 32-bit frame checksum on the interface. Using a 32-bit checksum provides more reliable packet verification, but some older equipment might not support 32-bit checksums.

Default: 16

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring the E1 Frame Checksum*
- *Configuring the E3 Frame Checksum*
- Configuring the SONET/SDH Frame Checksum on page 31

- *Configuring the T1 Frame Checksum*
- *Configuring the T3 Frame Checksum*

filter

Syntax

```
filter {
  group filter-group-number;
  input filter-name;
  input-list [ filter-names ];
  output filter-name;
  output-list [ filter-names ];
}
```

Hierarchy Level

[edit interfaces *interface-name* unit *logical-unit-number* family *family*],
[edit logical-systems *logical-system-name* interfaces *interface-name* unit *logical-unit-number* family *family*]

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.

Description

NOTE: On EX Series switches, the **group**, **input-list**, **output-filter** statements are not supported under the [**edit interfaces** *interface-name* **unit** *logical-unit-number* **family inet**], [**edit interfaces** *interface-name* **unit** *logical-unit-number* **family inet6**], and [**edit interfaces** *interface-name* **unit** *logical-unit-number* **family mpls**] hierarchies.

Apply a filter to an interface. You can also use filters for encrypted traffic. When you configure filters, you can configure them under the **family ethernet-switching**, **inet**, **inet6**, **mpls**, or **vpls** only.

Options

group ***filter-group-number***—Define an interface to be part of a filter group. The default filter group number is 0.

Range: 0 through 255

input ***filter-name***—Name of one filter to evaluate when packets are received on the interface.

output ***filter-name***—Name of one filter to evaluate when packets are transmitted on the interface.

The remaining statements are explained separately. See CLI Explorer.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Applying a Filter to an Interface*

- *Junos OS Administration Library*
- *Configuring Gigabit Ethernet Interfaces (CLI Procedure)*
- *Configuring Firewall Filters (CLI Procedure)*
- *family*

force

Syntax

```
force (protect | working);
```

Hierarchy Level

```
[edit interfaces interface-name sonet-options aps]
```

Release Information Statement introduced before Junos OS Release 7.4.

Description Perform a forced switch between the protect and working circuits. This statement is honored only if there are no higher-priority reasons to switch. It can be overridden by a signal failure on the protect circuit, thus causing a switch to the working circuit.

Options

protect—Request the circuit to become the protect circuit.

working—Request the circuit to become the working circuit.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring Switching Between the Working and Protect Circuits on page 92
- request on page 248

framing (SONET and SDH Interfaces)

Syntax framing (sdh | sonet);

Hierarchy Level [edit interfaces so-*fpc/pic/port*]

Release Information Statement introduced in Junos OS Release 8.1.

Description This functionality allows you to mix SONET and SDH modes on interfaces on the same PIC.

- For the 4-port OC48 PIC with SFP installed and the 4-port OC192 PIC in T Series and M Series routers, configure SONET or SDH framing on a per-port basis.
- For 1-port OC192/STM64 MICs with XFP on MX Series routers, configure the SONET or SDH framing on the single port.

Default Default framing mode is **SONET**.

Options **sdh**—SDH framing.

sonet—SONET framing.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring SONET/SDH Framing Mode for Ports on page 18

hold-time (Physical Interface)

Syntax hold-time up *milliseconds* down *milliseconds*;

Hierarchy Level [edit interfaces *interface-name*],
[edit interfaces interface-range *interface-range-name*]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 10.4R5 for EX Series switches.
Statement introduced in Junos OS Release 11.1 for the QFX Series.
Statement introduced in Junos OS Release 12.2 for ACX Series Universal Metro Routers.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.
Statement introduced in Junos OS Release 12.1 for the SRX Series.

Description Specify the **hold-time** value to use to damp shorter interface transitions milliseconds. The hold timer enables interface damping by not advertising interface transitions until the hold timer duration has passed. When a hold-down timer is configured and the interface goes from up to down, the down hold-time timer is triggered. Every interface transition that occurs during the hold-time is ignored. When the timer expires and the interface state is still down, then the router begins to advertise the interface as being down. Similarly, when a hold-up timer is configured and an interface goes from down to up, the up hold-time timer is triggered. Every interface transition that occurs during the hold-time is ignored. When the timer expires and the interface state is still up, then the router begins to advertise the interface as being up.

NOTE:

- We recommend that you configure the **hold-time** value after determining an appropriate value by performing repeated tests in the actual hardware environment. This is because the appropriate value for **hold-time** depends on the hardware (XFP, SFP, SR, ER, or LR) used in the networking environment.
- The **hold-time** option is not available for controller interfaces.

NOTE: On MX Series routers with MPC3E and MPC4E, we recommend that you do not configure the hold-down timer to be less than 1 second. On MX Series routers with MPC5EQ-100G10G (MPC5EQ) or MPC6E (MX2K-MPC6E) with 100-Gigabit Ethernet MIC with CFP2 OTN interfaces, we recommend that you do not configure the hold-down timer to be less than 3 seconds.

Default Interface transitions are not damped.

Options

down *milliseconds*—Hold time to use when an interface transitions from up to down. Junos OS advertises the transition within 100 milliseconds of the time value you specify.

Range: 0 through 4,294,967,295

Default: 0 (interface transitions are not damped)

up *milliseconds*—Hold time to use when an interface transitions from down to up. Junos OS advertises the transition within 100 milliseconds of the time value you specify.

Range: 0 through 4,294,967,295

Default: 0 (interface transitions are not damped)

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- advertise-interval on page 193
- *interfaces (EX Series switches)*
- *Physical Interface Damping Overview*
- Damping Shorter Physical Interface Transitions on page 41
- *Damping Longer Physical Interface Transitions*

hold-time (APS)

Syntax

```
hold-time milliseconds;
```

Hierarchy Level

```
[edit interfaces interface-name sonet-options aps]
```

Release Information

Statement introduced before Junos OS Release 7.4.

Description

Hold-time value to use to determine whether a neighbor APS router is operational.

Options

milliseconds—Hold-time value.

Range: 1 through 65,534 milliseconds

Default: 3000 milliseconds (3 times the advertisement interval)

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring APS Timers on page 75
- advertise-interval on page 193

hold-time (SONET/SDH Defect Triggers)

Syntax hold-time up *milliseconds* down *milliseconds*;

Hierarchy Level [edit interfaces *interface-name* sonet-options trigger *defect*]

Release Information Statement introduced before Junos OS Release 7.4.

Description For ATM over SONET/SDH and SONET/SDH interfaces only, apply up and down hold times to SONET/SDH defect triggers. When you apply a down hold time to a defect, the defect must remain present for at least the hold-time period before the interface is marked down. When you apply an up hold time to a defect, the defect must remain absent for at least the hold-time period before the interface is marked up, assuming no other defect is outstanding.

NOTE:

- When up or down hold times are applied to SONET defect triggers of a 10-Gigabit Ethernet WAN-PHY interface, only the defects generated in the WAN Interface Sublayer (WIS) are damped. Therefore, if the hold times are applied to SONET defect triggers only, a 10-Gigabit Ethernet WAN-PHY interface might be marked up or down because of the faults that are generated in other layers, such as the Physical Coding Sublayer (PCS) or Physical Medium Attachment Sublayer (PMA), 10 Gigabit Media Independent Interface (XGMII) Extender Sublayer (XGXS), and Media Access Control (MAC). To damp the interface up or down events of a 10-Gigabit Ethernet WAN-PHY interface, you need to apply up or down hold-times for the interface at the **[edit interfaces *interface-name*]** hierarchy level.
- On M Series and T Series platforms with Channelized SONET IQ PICs and Channelized SONET IQE PICs, the SONET defect alarm trigger **hold-time** statement is not supported.

Default If you do not include this statement, when a defect is detected the interface is marked down immediately, and when the defect becomes absent the interface is marked up immediately.

Options **down *milliseconds***—Hold time to wait before the interface is marked down.

Range: 1 through 65,534 milliseconds

Default: No hold time

up *milliseconds*—Hold time to wait before the interface is marked up.

Range: 1 through 65,534 milliseconds

Default: No hold time

Required Privilege Level
interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- Configuring SONET/SDH Defect Triggers on page 60
- hold-time (Physical Interface) on page 220

ignore

Syntax
```
ignore;
```

Hierarchy Level
[edit interfaces *interface-name* sonet-options trigger *defect*]

Release Information
Statement introduced before Junos OS Release 7.4.

Description
For ATM over SONET/SDH and SONET/SDH interfaces only, ignore a specific SONET/SDH defect trigger.

Default
If you do not include this statement, all defects are honored with no hold time.

Required Privilege Level
interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- Configuring SONET/SDH Defect Triggers on page 60
- hold-time (Physical Interface) on page 220

link-speed (Aggregated SONET/SDH)

Syntax link-speed (*speed* | mixed);

Hierarchy Level [edit interfaces as*x* aggregated-sonet-options]

Release Information Statement introduced before Junos OS Release 7.4.
mixed option added in Release 8.0.

Description For aggregated SONET/SDH interfaces only, set the required link speed.

Options ***speed***—Aggregated SONET/SDH links can have one of the following speed values.

- **oc3**—Links are OC3c or STM1c.
- **oc12**—Links are OC12c or STM4c.
- **oc48**—Links are OC48c or STM16c.
- **oc192**—Links are OC192c or STM64c.
- **oc768**—Links are OC768c or STM256c.

mixed—For aggregated SONET/SDH links on T Series routers, you can mix interface speeds in SONET/SDH aggregation bundles. Interface speeds from OC3 through OC768 are supported.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring Aggregated Ethernet Link Speed*
- Configuring Aggregated SONET/SDH Interfaces on page 101

lockout

Syntax lockout;

Hierarchy Level [edit interfaces *interface-name* sonet-options aps]

Release Information Statement introduced before Junos OS Release 7.4.

Description Configure a lockout of protection, forcing the use of the working circuit and locking out the protect circuit regardless of anything else.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring Switching Between the Working and Protect Circuits on page 92

loop-timing

Syntax

```
(loop-timing | no-loop-timing);
```

Hierarchy Level

[edit interfaces ct3-*fpc/pic/port* t3-options],
[edit interfaces e1-*fpc/pic/port*:0 sonet-options],
[edit interfaces stm1-*fpc/pic/port* sonet-options]

Release Information

Statement introduced before Junos OS Release 7.4.

Description

For channelized IQ interfaces and non-IQ channelized STM1 interfaces only, configure the SONET/SDH or DS3-level clocking source.

NOTE: On M Series, MX Series, and T Series routers, under E1 channels, loop timing can be configured only at channel 0. When you configure on channel 0, it is applicable on all channels as internal by default.

Options

loop-timing—Configure loop timing (external) clocking.

no-loop-timing—Configure line timing (internal) clocking.

Default: no-loop-timing

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring Channelized IQ and IQE SONET/SDH Loop Timing on page 39
- *Configuring the Channelized T3 Loop Timing*
- clocking on page 200

loopback (ADSL, DS0, E1/E3, SONET/SDH, SHDSL, and T1/T3)

Syntax

```
loopback (local | payload | remote);
```

Hierarchy Level

```
[edit interfaces ce1-fpc/pic/port],
[edit interfaces ct1-fpc/pic/port],
[edit interfaces t1-fpc/pic/port],
[edit interfaces interface-name ds0-options],
[edit interfaces interface-name dsl-options],
[edit interfaces interface-name e1-options],
[edit interfaces interface-name e3-options],
[edit interfaces interface-name shdsl-options},
[edit interfaces interface-name sonet-options],
[edit interfaces interface-name t1-options],
[edit interfaces interface-name t3-options]
```

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 12.2 for the ACX Series Universal Metro Routers.

Description

Configure a loopback connection. To turn off the loopback capability, remove the **loopback** statement from the configuration.

NOTE: When configuring CE1 or CT1 interfaces on 10-port Channelized E1/T1 IQE PICs, the **loopback** statement must be included with the **local** or **remote** option at the **[edit interfaces ce1-*fpc/pic/port*]** or **[edit interfaces ct1-*fpc/pic/port*]** hierarchy level as appropriate.

When configuring T1 interfaces on 10-port Channelized E1/T1 IQE PICs, the **loopback** statement must be included with the **payload** option at the **[edit interfaces t1-*fpc/pic/port*]** hierarchy level.

NOTE: When configuring CE1 or CT1 interfaces on the 16-port Channelized E1/T1 MIC (MIC-3D-16CHE1-T1-CE), you must include the **loopback** statement at the **[edit interfaces ce1-*fpc/pic/port*]** hierarchy level, or **[edit interfaces ct1-*fpc/pic/port*]**

To configure loopback on channelized IQ and IQE PICs, SONET/SDH level, use the **sonet-options loopback** statement **local** and **remote** options at the controller interface (coc48, cstm16, coc12, cstm4, coc3, cstm1). It is ignored for path-level interfaces **so-*fpc/pic/port*** or **so-*fpc/pic/port*:*channel***.

Options

local—Loop packets, including both data and timing information, back on the local router's PIC. *N*xDS0 IQ interfaces do not support local loopback.

payload—For channelized T3, T1, and *N*xDS0 IQ interfaces only, loop back data only (without clocking information) on the remote router's PIC. With payload loopback, overhead is recalculated. Neither ATM-over-asymmetrical digital subscriber line (ADSL) interfaces nor ATM-over-SHDSL interfaces support payload loopback.

remote—Loop packets, including both data and timing information, back on the remote router's interface card. *N*xDS0 IQ interfaces do not support remote loopback.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring E3 and T3 Parameters on ATM Interfaces*
- *Configuring E1 Loopback Capability*
- *Configuring E3 Loopback Capability*
- Configuring SONET/SDH Loopback Capability to Identify a Problem as Internal or External on page 32
- *Configuring SHDSL Operating Mode on an ATM Physical Interface*
- *Configuring T1 Loopback Capability*
- *Configuring T3 Loopback Capability*
- *feac-loop-respond*

member-interface-speed

Syntax member-interface-speed *speed*;

Hierarchy Level [edit interfaces container-options member-interface-type]

Release Information Statement introduced in Junos OS Release 9.2.

Description Specify container-interface member-interface speed options.

Options ***speed***—Set interface speed to OC3, OC12, OC48, OC192, OC768, or mixed.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Displaying APS Using a Container Interface with ATM Encapsulation on page 82
- Configuring Container Interfaces for APS on SONET Links on page 76
- container-options on page 203

member-interface-type

Syntax

```
member-interface-type sonet {
  member-interface-speed [ speed ];
}
```

Hierarchy Level

[edit interfaces container-options]

Release Information

Statement introduced in Junos OS Release 9.2.

Description

Specify container-interface member-interface type as sonet and speed options.

Options

sonet—Protocol type of the container interface, specify sonet.

speed—Set interface speed to OC3, OC12, OC48, OC192, OC768, or mixed.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Displaying APS Using a Container Interface with ATM Encapsulation on page 82
- Configuring Container Interfaces for APS on SONET Links on page 76
- container-options on page 203

minimum-links

Syntax (SRX, MX, T, M, EX, QFX Series, EX4600, Qfabric System)

```
minimum-links number;
```

Hierarchy Level (EX Series)

```
[edit interfaces aex aggregated-ether-options],
[edit interfaces aex aggregated-sonet-options],
[edit interfaces interface-name mlfr-uni-nni-bundle-options],
[edit interfaces interface-name unit logical-unit-number],
[edit interfaces interface-range range aggregated-ether-options],
[edit interfaces interface-range range aggregated-sonet-options],
[edit logical-systems logical-system-name interfaces interface-name unit logical-unit-number]
```

Hierarchy Level (QFX Series)

```
[edit interfaces aex aggregated-ether-options]
```

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 11.1 for the QFX Series.

Description

For aggregated Ethernet, SONET/SDH, multilink, link services, and voice services interfaces only, set the minimum number of links that must be up for the bundle to be labeled up.

Options

number—Number of links.

Range: On M120, M320, MX Series, T Series, and TX Matrix routers with Ethernet interfaces, the valid range for minimum-links number is 1 through 64. When the maximum value (16) is specified, all configured links of a bundle must be up for the bundle to be labeled up.On all other routers and on EX Series switches, other than EX8200 switches, the range of valid values for minimum-links number is 1 through 8. When the maximum value (8) is specified, all configured links of a bundle must be up for the bundle to be labeled up.On EX8200 switches, the range of valid values for minimum-links number is 1 through 12. When the maximum value (12) is specified, all configured links of a bundle must be up for the bundle to be labeled up.On EX4600, QFX Series and Q Fabric Systems , the range of valid values for minimum-links number is 1 through 8. When the maximum value (8) is specified, all configured links of a bundle must be up for the bundle to be labeled up.

Default: 1

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring Aggregated Ethernet Minimum Links*
- Configuring Aggregated SONET/SDH Interfaces on page 101

- *Configuring Aggregated Ethernet Links (CLI Procedure)*
- *Example: Configuring Aggregated Ethernet High-Speed Uplinks Between an EX4200 Virtual Chassis Access Switch and an EX4200 Virtual Chassis Distribution Switch*
- *Junos OS Services Interfaces Library for Routing Devices*
- *Configuring Link Aggregation*

mpls (Interfaces)

Syntax

```
mpls {
  pop-all-labels {
    required-depth number;
  }
}
```

Hierarchy Level

```
[edit interfaces interface-name atm-options],
[edit interfaces interface-name sonet-options],
[edit interfaces interface-name fastether-options],
[edit interfaces interface-name gigether-options]
```

Release Information Statement introduced before Junos OS Release 7.4.

Description For passive monitoring on ATM and SONET/SDH interfaces and 10-Gigabit Ethernet interfaces in WAN PHY mode, process incoming IP packets that have MPLS labels.

The remaining statements are explained separately. See CLI Explorer.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Removing MPLS Labels from Incoming Packets*
- Enabling Packet Flow Monitoring on SONET/SDH Interfaces on page 112
- *Junos OS Services Interfaces Library for Routing Devices*

mtu

Syntax

mtu *bytes*;

Hierarchy Level

[edit interfaces *interface-name*],
[edit interfaces *interface-name* unit *logical-unit-number* family *family*],
[edit interfaces interface-range *name*],
[edit logical-systems *logical-system-name* interfaces *interface-name* unit *logical-unit-number* family *family*],
[edit logical-systems *logical-system-name* protocols l2circuit local-switching interface *interface-name* backup-neighbor *address*],
[edit logical-systems *logical-system-name* protocols l2circuit neighbor *address* interface *interface-name*],
[edit logical-systems *logical-system-name* protocols l2circuit neighbor *address* interface *interface-name* backup-neighbor *address*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols l2vpn interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols vpls],
[edit protocols l2circuit local-switching interface *interface-name* backup-neighbor *address*],
[edit protocols l2circuit neighbor *address* interface *interface-name*]
[edit protocols l2circuit neighbor *address* interface *interface-name* backup-neighbor *address*],
[edit routing-instances *routing-instance-name* protocols l2vpn interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols vpls],
[edit logical-systems *name* protocols ospf area *name* interface],
[edit logical-systems *name* routing-instances *name* protocols ospf area *name* interface],
[edit protocols ospf area *name* interface],
[edit routing-instances *name* protocols ospf area *name* interface]

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Support for Layer 2 VPNs and VPLS introduced in Junos OS Release 10.4.
Statement introduced in Junos OS Release 12.1X48 for PTX Series Packet Transport Routers.
Statement introduced in Junos OS Release 12.2 for ACX Series Universal Metro Routers.
Support at the **[set interfaces interface-name unit logical-unit-number family ccc]** hierarchy level introduced in Junos OS Release 12.3R3 for MX Series routers.
Statement introduced in Junos OS 17.3R1 Release for MX Series Routers.

Description

Specify the maximum transmission unit (MTU) size for the media or protocol. The default MTU size depends on the device type. Changing the media MTU or protocol MTU causes an interface to be deleted and added again.

To route jumbo data packets on an integrated routing and bridging (IRB) interface or routed VLAN interface (RVI) on EX Series switches, you must configure the jumbo MTU size on the member physical interfaces of the VLAN that you have associated with the IRB interface or RVI, as well as on the IRB interface or RVI itself (the interface named irb or vlan, respectively).

CAUTION: For EX Series switches, setting or deleting the jumbo MTU size on an IRB interface or RVI while the switch is transmitting packets might cause packets to be dropped.

NOTE:

The MTU for an IRB interface is calculated by removing the Ethernet header overhead [6(DMAC)+6(SMAC)+2(EtherType)]. Because, the MTU is the lower value of the MTU configured on the IRB interface and the MTU configured on the IRB's associated bridge domain IFDs or IFLs, the IRB MTU is calculated as follows:

- In case of Layer 2 IFL configured with the **flexible-vlan-tagging** statement, the IRB MTU is calculated by including 8 bytes overhead (SVLAN+CVLAN).
- In case of Layer 2 IFL configured with the **vlan-tagging** statement, the IRB MTU is calculated by including a single VLAN 4 bytes overhead.

NOTE:

- If a packet whose size is larger than the configured MTU size is received on the receiving interface, the packet is eventually dropped. The value considered for MRU (maximum receive unit) size is also the same as the MTU size configured on that interface.
- Not all devices allow you to set an MTU value, and some devices have restrictions on the range of allowable MTU values. You cannot configure an MTU for management Ethernet interfaces (fxp0, em0, or me0) or for loopback, multilink, and multicast tunnel devices.
- On ACX Series routers, you can configure the protocol MTU by including the **mtu** statement at the **[edit interfaces** *interface-name* **unit** *logical-unit-number* **family inet]** or **[edit interfaces** *interface-name* **unit** *logical-unit-number* **family inet6]** hierarchy level.
  - If you configure the protocol MTU at any of these hierarchy levels, the configured value is applied to all families that are configured on the logical interface.
  - If you are configuring the protocol MTU for both **inet** and **inet6** families on the same logical interface, you must configure the same value for both the families. It is not recommended to configure different MTU size values for **inet** and **inet6** families that are configured on the same logical interface.
- Starting in Release 14.2, MTU for IRB interfaces is calculated by removing the Ethernet header overhead (**6(DMAC)+6(SMAC)+2(EtherType)**), and the MTU is a minimum of the two values:
  - Configured MTU
  - Associated bridge domain's physical or logical interface MTU
    - For Layer 2 logical interfaces configured with **flexible-vlan-tagging**, IRB MTU is calculated by including 8 bytes overhead (**SVLAN+CVLAN**).
    - For Layer 2 logical interfaces configured with **vlan-tagging**, IRB MTU is calculated by including single VLAN 4 bytes overhead.

NOTE: Changing the Layer 2 logical interface option from **vlan-tagging** to **flexible-vlan-tagging** or vice versa adjusts the logical interface MTU by 4 bytes with the existing MTU size. As a result, the Layer 2 logical interface is deleted and re-added, and the IRB MTU is re-computed appropriately.

For more information about configuring MTU for specific interfaces and router or switch combinations, see "Configuring the Media MTU" on page 15.

Options

bytes—MTU size.

Range: 256 through 9192 bytes, 256 through 9216 (EX Series switch interfaces), 256 through 9500 bytes (Junos OS 12.1X48R2 for PTX Series routers), 256 through 9500 bytes (Junos OS 16.1R1 for MX Series routers)

NOTE: Starting in Junos OS Release 16.1R1, the MTU size for a media or protocol is increased from 9192 to 9500 for Ethernet interfaces on the following MX Series MPCs:

- MPC1
- MPC2
- MPC2E
- MPC3E
- MPC4E
- MPC5E
- MPC6E

Default: 1500 bytes (INET, INET6, and ISO families), 1448 bytes (MPLS), 1514 bytes (EX Series switch interfaces)

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring the Media MTU on page 15
- *Configuring the MTU for Layer 2 Interfaces*
- *Setting the Protocol MTU*

neighbor (Automatic Protection Switching for SONET/SDH)

Syntax

```
neighbor address;
```

Hierarchy Level

```
[edit interfaces interface-name sonet-options aps]
```

Release Information

Statement introduced before Junos OS Release 7.4.

Description

If you are configuring one router to be the working router and a second to be the protect router, configure the address of the remote interface. You configure this on one or both of the interfaces.

The address you specify for the neighbor must never be routed through the interface on which APS is configured, or instability will result. We strongly recommend that you directly connect the working and protect routers and that you configure the interface address of this shared network as the neighbor address.

Options

address—Neighbor's address.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring Basic Automatic Protect Switching on page 69

overflow (Receive Bucket)

Syntax
```
overflow (discard | tag);
```

Hierarchy Level
```
[edit interfaces interface-name receive-bucket]
```

Release Information Statement introduced before Junos OS Release 7.4.

Description Specify how to handle packets that exceed the threshold for the receive leaky bucket.

Options **tag**—Tag, count, and process received packets that exceed the threshold.

discard—Discard received packets that exceed the threshold. No counting is done.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- Configuring Receive and Transmit Leaky Bucket Properties to Reduce Network Congestion on page 46

overflow (Transmit Bucket)

Syntax
```
overflow discard;
```

Hierarchy Level
```
[edit interfaces interface-name transmit-bucket]
```

Release Information Statement introduced before Junos OS Release 7.4.

Description Discard packets that exceed the threshold for the transmit leaky bucket.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- Configuring Receive and Transmit Leaky Bucket Properties to Reduce Network Congestion on page 46

paired-group

Syntax paired-group *group-name*;

Hierarchy Level [edit interfaces *interface-name* sonet-options aps]

Release Information Statement introduced before Junos OS Release 7.4.

Description Configure load sharing between two working protect circuit pairs.

Options *group-name*—Circuit's group name, as configured with the **protect-circuit** or **working-circuit** statement.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring APS Load Sharing on page 85
- working-circuit on page 260

passive-monitor-mode

Syntax

```
passive-monitor-mode;
```

Hierarchy Level

[edit interfaces *interface-name*],
[edit interfaces *interface-name* unit *logical-unit-number*],
[edit logical-systems *logical-system-name* interfaces *interface-name* unit *logical-unit-number*]

Release Information

Statement introduced before Junos OS Release 7.4.

Description

Monitor packet flows from another router. If you include this statement in the configuration, the interface does not send keepalives or alarms, and does not participate actively on the network.

This statement is supported on ATM, Ethernet, and SONET/SDH interfaces. For more information, see *ATM Interfaces Feature Guide for Routing Devices*.

For ATM and Ethernet interfaces, you can include this statement on the physical interface only.

For SONET/SDH interfaces, you can include this statement on the logical interface only.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Enabling Passive Monitoring on ATM Interfaces*
- *Passive Monitoring on Ethernet Interfaces Overview*
- Enabling Packet Flow Monitoring on SONET/SDH Interfaces on page 112
- *multiservice-options*
- *Junos OS Services Interfaces Library for Routing Devices*

path-trace

Syntax path-trace *trace-string*;

Hierarchy Level [edit interfaces *interface-name* sonet-options]

Release Information Statement introduced before Junos OS Release 7.4.

Description For SONET/SDH interfaces and 10-Gigabit Ethernet interfaces in WAN PHY mode, configure a path trace identifier, which is a text string that identifies the circuit.

On SONET/SDH OC48 interfaces that are configured for channelized (multiplexed) mode (by including the **no-concatenate** statement at the **[edit chassis fpc *slot-number* pic *pic-number*]** hierarchy level), the **bytes e1-quiet** and **bytes f1** options have no effect. The **bytes f2**, **bytes z3**, **bytes z4**, and **path-trace** options work correctly on channel 0 and work in the transmit direction only on channels 1, 2, and 3.

For DS3 channels on a channelized OC12 interface, you can configure a unique path trace for each of the 12 channels. Each path trace can be up to 16 bytes. For channels on a channelized OC12 IQ interface, each path trace can be up to 64 bytes.

Options ***trace-string***—Text string that identifies the circuit. If the string contains spaces, enclose it in quotation marks. A common convention is to use the circuit identifier as the path trace identifier. If you do not configure an identifier, the Junos OS uses the system and interface names to construct the default ***trace-string***. For all nonchannelized SONET/SDH interfaces, the default ***trace-string*** is ***system-name interface-name***. For channelized SONET/SDH interfaces and 10–Gigabit Ethernet WAN-PHY interfaces, the default ***trace-string*** is ***interface-name***.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring the SONET/SDH Path Trace Identifier for a Circuit on page 36
- sonet-options on page 251

payload-scrambler

Syntax

```
(payload-scrambler | no-payload-scrambler);
```

Hierarchy Level

[edit interfaces *interface-name* e3-options],
[edit interfaces *interface-name* sonet-options],
[edit interfaces *interface-name* t3-options]

Release Information

Statement introduced before Junos OS Release 7.4.

Description

Enable or disable HDLC scrambling on an E3, a SONET/SDH, or a T3 interface. This type of scrambling provides better link stability. Both sides of a connection must either use or not use scrambling.

If you commit a T3 interface configuration that has HDLC payload scrambling enabled, the interface must also be configured to be compatible with the channel service unit (CSU) at the remote end of the line.

Disable payload scrambling on an E3 interface if Digital Link compatibility mode is used.

On a channelized OC12 interface, the **sonet payload-scrambler** statement is ignored. To configure scrambling on the DS3 channels on the interface, you can include the **t3-options payload-scrambler** statement in the configuration for each DS3 channel.

NOTE: The **payload-scrambler** statement at the **[edit interfaces *interface-name* e3-options]** hierarchy level is not valid for IQE PICs.

Default

Payload scrambling is disabled on all E3 and T3 interfaces; it is enabled by default on E3/T3 over ATM interfaces and on SONET/SDH interfaces.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring E3 and T3 Parameters on ATM Interfaces*
- *Configuring E3 HDLC Payload Scrambling*
- Configuring SONET/SDH HDLC Payload Scrambling for Link Stability on page 37
- *Configuring T3 HDLC Payload Scrambling*
- *Examples: Configuring T3 Interfaces*
- *compatibility-mode*

pop-all-labels

Syntax

```
pop-all-labels {
  required-depth number;
}
```

Hierarchy Level

[edit interfaces *interface-name* atm-options mpls],
[edit interfaces *interface-name* sonet-options mpls],
[edit interfaces *interface-name* fastether-options mpls],
[edit interfaces *interface-name* gigether-options mpls]

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 12.2 for ACX Series Universal Metro Routers.

Description

For passive monitoring on ATM, SONET/SDH, Fast Ethernet, and Gigabit Ethernet interfaces only, removes up to two MPLS labels from incoming IP packets. For passive monitoring on T Series devices, removes up to five MPLS labels from incoming IP packets.

This statement has no effect on IP packets with more than two MPLS labels, or IP packets with more than five MPLS labels on T Series devices. Packets with MPLS labels cannot be processed by the Monitoring Services PIC; if packets with MPLS labels are forwarded to the Monitoring Services PIC, they are discarded.

The remaining statement is explained separately. See CLI Explorer.

Default

If you omit this statement, the MPLS labels are not removed, and the packet is not processed by the Monitoring Services PIC.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Removing MPLS Labels from Incoming Packets*
- Enabling Packet Flow Monitoring on SONET/SDH Interfaces on page 112
- *Junos OS Services Interfaces Library for Routing Devices*

preserve-interface

Syntax preserve-interface;

Hierarchy Level [edit interfaces *interface-name* sonet-options aps]

Release Information Statement introduced in Junos OS Release 7.6.

Description Provide link PIC replication, providing MLPPP link redundancy at the port level. This feature is supported with SONET APS and the following link PICs:

- Channelized OC3 IQ PIC
- Channelized OC12 IQ PIC
- Channelized STM1 IQ PIC

Link PIC replication provides the ability to add two sets of links, one from the active SONET PIC and the other from the standby SONET PIC, to the same bundle. If the active SONET PIC fails, links from the standby PIC are used without triggering link renegotiation. All the negotiated state is replicated from the active links to the standby links to prevent link renegotiation.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring Link PIC Redundancy on page 89
- *Junos OS Services Interfaces Library for Routing Devices*

protect-circuit

Syntax protect-circuit *group-name*;

Hierarchy Level [edit interfaces *interface-name* sonet-options aps]

Release Information Statement introduced before Junos OS Release 7.4.

Description Configure the protect router in an APS circuit pair. When the working interface fails, APS brings up the protection circuit and the traffic is moved to the protection circuit.

Options ***group-name***—Circuit's group name.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- Configuring Basic Automatic Protect Switching on page 69
- working-circuit on page 260

rate

Syntax rate *percentage*;

Hierarchy Level [edit interfaces *interface-name* receive-bucket],
[edit interfaces *interface-name* transmit-bucket]

Release Information Statement introduced before Junos OS Release 7.4.

Description Specify percentage of the interface line rate that is available to receive or transmit packets.

Options ***percentage***—Percentage of the interface line rate that is available to receive or transmit packets.

Range: 0 through 100

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- Configuring Receive and Transmit Leaky Bucket Properties to Reduce Network Congestion on page 46

receive-bucket

Syntax

```
receive-bucket {
  overflow (discard | tag);
  rate percentage;
  threshold bytes;
}
```

Hierarchy Level

```
[edit interfaces interface-name]
```

Release Information

Statement introduced before Junos OS Release 7.4.

Description

Set parameters for the receive leaky bucket, which specifies what percentage of the interface's total capacity can be used to receive packets.

For each DS3 channel on a channelized OC12 interface, you can configure a unique receive bucket.

The remaining statements are explained separately. See CLI Explorer.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring Receive and Transmit Leaky Bucket Properties to Reduce Network Congestion on page 46
- transmit-bucket on page 257

receive-options-packets

Syntax

```
receive-options-packets;
```

Hierarchy Level

```
[edit interfaces interface-name unit logical-unit-number family inet],
[edit logical-systems logical-system-name interfaces interface-name unit logical-unit-number
    family inet]
```

Release Information Statement introduced before Junos OS Release 7.4.

Description For a Monitoring Services PIC and an ATM or SONET/SDH PIC installed in an M160, M40e, or T Series router, guarantee conformity with cflowd records structure. This statement is required when you enable passive monitoring.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Enabling Passive Monitoring on ATM Interfaces*
- Enabling Packet Flow Monitoring on SONET/SDH Interfaces on page 112

receive-ttl-exceeded

Syntax

```
receive-ttl-exceeded;
```

Hierarchy Level

```
[edit interfaces interface-name unit logical-unit-number family inet],
[edit logical-systems logical-system-name interfaces interface-name unit logical-unit-number
    family inet]
```

Release Information Statement introduced before Junos OS Release 7.4.

Description For Monitoring Services PIC and an ATM or SONET/SDH PIC installed in an M160, M40e, or T Series router, guarantee conformity with cflowd records structure. This statement is required when you enable passive monitoring.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Enabling Passive Monitoring on ATM Interfaces*
- Enabling Packet Flow Monitoring on SONET/SDH Interfaces on page 112

request

Syntax

```
request (protect | working);
```

Hierarchy Level

```
[edit interfaces interface-name sonet-options aps]
```

Release Information

Statement introduced before Junos OS Release 7.4.

Description

Perform a manual switch between the protect and working circuits. This statement is honored only if there are no higher-priority reasons to switch.

Options

protect—Request that the circuit become the protect circuit.

working—Request that the circuit become the working circuit.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring Switching Between the Working and Protect Circuits on page 92
- force on page 218

required-depth

Syntax

required-depth *number*;

Hierarchy Level

[edit interfaces *interface-name* atm-options mpls pop-all-labels],
[edit interfaces *interface-name* sonet-options mpls pop-all-labels],
[edit interfaces *interface-name* fastether-options mpls pop-all-labels],
[edit interfaces *interface-name* gigether-options mpls pop-all-labels]

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 12.2 for ACX Series Universal Metro Routers.

Description

For passive monitoring on ATM and SONET/SDH interfaces only, specify the number of MPLS labels an incoming packet must have for the **pop-all-labels** statement to take effect.

If you include the **required-depth 1** statement, the **pop-all-labels** statement takes effect for incoming packets with one label only. If you include the **required-depth 2** statement, the **pop-all-labels** statement takes effect for incoming packets with two labels only.

Options

number—Number of MPLS labels on incoming IP packets.

Range: 1 or 2 labels

Default: If you omit this statement, the **pop-all-labels** statement takes effect for incoming packets with one or two labels. The default is equivalent to including the **required-depth [1 2]** statement.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Removing MPLS Labels from Incoming Packets*
- Enabling Packet Flow Monitoring on SONET/SDH Interfaces on page 112
- *Junos OS Services Interfaces Library for Routing Devices*

revert-time (Interfaces)

Syntax revert-time *seconds*;

Hierarchy Level [edit interfaces *interface-name* sonet-options aps]

Release Information Statement introduced before Junos OS Release 7.4.

Description Configure APS revertive mode.

Default APS operates in nonrevertive mode.

Options ***seconds***—Amount of time to wait after the working circuit has again become functional before making the working circuit active again.

Range: 1 through 65,535 seconds

Default: None (APS operates in nonrevertive mode)

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- Configuring Revertive Mode on page 94

rfc-2615

Syntax rfc-2615;

Hierarchy Level [edit interfaces *interface-name* sonet-options]

Release Information Statement introduced before Junos OS Release 7.4.

Description Include this statement to enable features described in RFC 2615, *PPP over SONET/SDH*.

Default Settings required by RFC 1619, *PPP over SONET/SDH*.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- Configuring PPP Support on SONET/SDH Interfaces on page 55

sonet-options

Syntax

```
sonet-options {
  aps {
    advertise-interval milliseconds;
    annex-b
    authentication-key key;
    (break-before-make | no-break-before-make);
    fast-aps-switch;
    force;
    hold-time milliseconds;
    lockout;
    neighbor address;
    paired-group group-name;
    protect-circuit group-name;
    request;
    revert-time seconds;
    switching-mode (bidirectional | unidirectional);
    working-circuit group-name;
  }
  bytes {
    c2 value;
    e1-quiet value;
    f1 value;
    f2 value;
    s1 value;
    z3 value;
    z4 value;
  }
  fcs (16 | 32);
  loopback (local | remote);
  mpls {
    pop-all-labels {
      required-depth number;
    }
  }
  path-trace trace-string;
  (payload-scrambler | no-payload-scrambler);
  rfc-2615;
  trigger {
    defect ignore;
    defect hold-time up milliseconds down milliseconds;
  }
}
vtmapping (itu-t | klm);
(z0-increment | no-z0-increment);
```

Hierarchy Level

[edit interfaces *interface-name*]

Release Information

Statement introduced before Junos OS Release 7.4.

Description Configure SONET/SDH-specific interface properties.

On SONET/SDH OC48 interfaces that you configure for channelized (multiplexed) mode (by including the **no-concatenate** statement at the **[edit chassis fpc *slot-number* pic *pic-number*]** hierarchy level), the **bytes e1-quiet** and **bytes f1** options have no effect. The **bytes f2**, **bytes z3**, **bytes z4**, and **path-trace** options work correctly on channel 0 and work in the transmit direction only on channels 1, 2, and 3.

On a channelized OC12 interface, the **bytes e1-quiet, bytes f1, bytes f2, bytes z3,** and **bytes z4** options are not supported. The **fcs** and **payload-scrambler** statements are also not supported; you must configure these for each DS3 channel using the **t3-options fcs** and **t3-options payload-scrambler** statements. The **aps** and **loopback** statements are supported only on channel 0 and are ignored if included in the configurations for channels 1 through 11. You can configure loopbacks for each DS3 channel with the **t3-options loopback** statement. The **path-trace** statement can be included in the configuration for each DS3 channel, thereby configuring a unique path trace for each channel.

To configure loopback on channelized IQ and IQE PICs, SONET/SDH level, use the **loopback** statement **local** and **remote** options at the controller interface (coc48, cstm16, coc12, cstm4, coc3, and cstm1). It is ignored for path-level interfaces **so-*fpc/pic/port*** or **so-*fpc/pic/port*:*channel***.

If you are running Intermediate System-to-Intermediate System (IS-IS) over SONET/SDH interfaces, use PPP if you are running Cisco IOS Release 12.0 or later. If you need to run HDLC, configure an ISO family MTU of 4469 on the router.

The remaining statements are explained separately. See CLI Explorer.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring SONET/SDH Parameters on ATM Interfaces*
- *Channelized OC12/STM4 IQ and IQE Interfaces Overview*
- *Channelized STM1 Interfaces Overview*
- SONET/SDH Interfaces Overview on page 3
- *no-concatenate*

speed (SONET/SDH)

Syntax

```
speed (oc3 | oc12 | oc48);
```

Hierarchy Level

[edit interfaces so-*fpc/pic/port*],
[edit interfaces so-*fpc/pic/port*:*channel*]

Release Information

Statement introduced in Junos OS Release 8.3.

Description

Configure the interface speed. This statement applies to SONET/SDH interfaces on next-generation SONET/SDH Type 1 and Type 2 PICs with SFP. Available speeds depend on whether the PIC is in concatenated mode or nonconcatenated mode. Include the channel in the interface name when configuring nonconcatenated interfaces.

Options

oc3 | oc12 | oc48—Speed when the PIC is in concatenated mode. For example, you can configure each port of a 4-port OC12 PIC to have a speed of **oc3**.

You can configure port 0 of a 4-port OC12 PIC to have a speed of **oc12**.

oc3 | oc12—Speed when the PIC is in nonconcatenated mode.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring SONET/SDH Interface Speed on page 26

switching-mode

Syntax switching-mode (bidirectional | unidirectional);

Hierarchy Level [edit interfaces *interface-name* sonet-options aps]

Release Information Statement introduced before Junos OS Release 7.4.

Description For unchannelized OC3, OC12, and OC48 SONET/SDH interfaces on T Series routers only, configure the interface to interoperate with SONET/SDH line-terminating equipment (LTE) that is provisioned for unidirectional linear APS in 1+1 architecture.

Default If the **switching-mode** statement is not configured, the mode is bidirectional, and the interface does not interoperate with a unidirectional SONET/SDH LTE.

Options **bidirectional**—Support bidirectional mode only.

unidirectional—Interoperate with a SONET/SDH LTE provisioned for unidirectional mode.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring Switching Mode on page 97

t3-options

Syntax

```
t3-options {
  atm-encapsulation (direct | plcp);
  bert-algorithm algorithm;
  bert-error-rate rate;
  bert-period seconds;
  (cbit-parity | no-cbit-parity);
  compatibility-mode (digital-link | kentrox | larscom) <subrate value>;
  fcs (16 | 32);
  (feac-loop-respond | no-feac-loop-respond);
  idle-cycle-flag value;
  (long-buildout | no-long-buildout);
  (loop-timing | no-loop-timing);
  loopback (local | payload | remote);
  start-end-flag value;
}
```

Hierarchy Level

```
[edit interfaces interface-name]
```

Release Information

Statement introduced before Junos OS Release 7.4.

Description

Configure T3-specific physical interface properties, including the properties of DS3 channels on a channelized OC12 interface. The **long-buildout** statement is not supported for DS3 channels on a channelized OC12 interface.

On T3 interfaces, the default encapsulation is PPP.

For ATM1 interfaces, you can configure a subset of E3 options statements.

The remaining statements are explained separately. See CLI Explorer.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *T3 Interfaces Overview*

threshold

Syntax threshold *bytes*;

Hierarchy Level [edit interfaces *interface-name*]

Release Information Statement introduced before Junos OS Release 7.4.

Description Specify the bucket threshold, which controls the burstiness of the leaky bucket mechanism. The larger the value, the more bursty the traffic, which means that over a very short amount of time, the interface can receive or transmit close to line rate, but the average over a longer time is at the configured bucket rate.

Options ***bytes***—Maximum size, in bytes, for traffic bursts. For ease of entry, you can enter ***number*** either as a complete decimal number or as a decimal number followed by the abbreviation **k** (1000). For example, the entry **threshold 2k** corresponds to a threshold of 2000 bytes.

Range: 0 through 65,535 bytes

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring Receive and Transmit Leaky Bucket Properties to Reduce Network Congestion on page 46

transmit-bucket

Syntax

```
transmit-bucket {
  overflow discard;
  rate percentage;
  threshold bytes;
}
```

Hierarchy Level

[edit interfaces *interface-name*]

Release Information

Statement introduced before Junos OS Release 7.4.

Description

Set parameters for the transmit leaky bucket, which specifies what percentage of the interface's total capacity can be used to transmit packets.

For each DS3 channel in a channelized OC12 interface, you can configure a unique transmit bucket.

The remaining statements are explained separately. See CLI Explorer.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring Receive and Transmit Leaky Bucket Properties to Reduce Network Congestion on page 46
- receive-bucket on page 246

trigger

Syntax

```
trigger {
  defect ignore;
  defect hold-time up milliseconds down milliseconds;
}
```

Hierarchy Level

[edit interfaces *interface-name* sonet-options]

Release Information

Statement introduced before Junos OS Release 7.4.

Description

For ATM over SONET/SDH, SONET/SDH interfaces, and 10-Gigabit Ethernet interfaces in WAN PHY mode, configure SONET/SDH defect triggers to be ignored.

Default

If you do not include this statement, all SONET/SDH defect triggers are honored.

Options

defect—Defect to ignore or hold. It can be one of the following:

- **ais-l**—Line alarm indication signal
- **ais-p**—Path alarm indication signal
- **ber-sd**—Bit error rate signal degrade
- **ber-sf**—Bit error rate signal fault
- **locd** (ATM only)—Loss of cell delineation
- **lof**—Loss of frame
- **lol**—PHY loss of light
- **lop-p**—Path loss of pointer
- **los**—Loss of signal
- **pll**—PHY phase-locked loop out of lock
- **plm-p**—Path payload (signal) label mismatch
- **rfi-l**—Line remote failure indication
- **rfi-p**—Path remote failure indication
- **uneq-p**—Path unequipped

The remaining statements are explained separately. See CLI Explorer.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring SONET/SDH Defect Triggers on page 60

vtmapping

Syntax

```
vtmapping (itu-t | klm);
```

Hierarchy Level

```
[edit chassis fpc number pic number],
[edit interfaces interface-name sonet-options]
```

Release Information Statement introduced before Junos OS Release 7.4.

Description For the Channelized STM1 IQ PIC or Channelized STM1 PIC, configure virtual tributary mapping.

For the Channelized STM1 PIC, you configure virtual tributary mapping at the **[edit chassis fpc *number* pic *number*]** hierarchy level.

NOTE: The vtmapping statement is not supported for cau4 interfaces on the Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP (H).

Options **itu-t**—International Telephony Union standard.

klm—KLM standard.
Default: klm

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring Virtual Tributary Mapping of Channelized STM1 Interfaces*
- *Configuring the Junos OS to Support Channelized STM1 Interface Virtual Tributary Mapping*

working-circuit

Syntax working-circuit *group-name*;

Hierarchy Level [edit interfaces *interface-name* sonet-options aps]

Release Information Statement introduced before Junos OS Release 7.4.

Description Configure the working router in an APS circuit pair.

Options *group-name*—Circuit's group name.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- Configuring Basic Automatic Protect Switching on page 69
- protect-circuit on page 245

z0-increment

Syntax (z0-increment | no-z0-increment);

Hierarchy Level [edit interfaces *interface-name* sonet-options]

Release Information Statement introduced before Junos OS Release 7.4.

Description Configure an incremental STM ID rather than a static one.

Default no-Z0-increment

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- Configuring an Incrementing STM ID to Interoperate with Older Equipment in SDH Mode on page 20
- sonet-options on page 251

CHAPTER 10

Operational Commands

- show aps
- show interfaces (Aggregated SONET/SDH)
- show interfaces (SONET/SDH)
- show interfaces diagnostics optics (SONET)

show aps

Syntax

```
show aps
<brief | detail | extensive | summary>
<group group  | interface so-fpc/pic/port>
```

Release Information Command introduced before Junos OS Release 7.4.

Description Display information about Automatic Protection Switching (APS) for SONET configurations and about Multiplex Section Protection (MSP) for SDH configurations.

Options

none—(Same as brief) Display brief information about APS or MSP for all groups and SONET/SDH interfaces.

brief | detail | extensive | summary—(Optional) Display the specified level of output.

group *group*—(Optional) Display APS or MSP information for the specified group.

interface *so-fpc/pic/port*—(Optional) Display APS information for the specified SONET/SDH interface.

Required Privilege Level view

Related Documentation

- Automatic Protection Switching and Multiplex Section Protection Overview on page 64

List of Sample Output

show aps on page 264
show aps brief on page 264
show aps detail on page 264
show aps extensive on page 265

Output Fields Table 27 on page 263 lists the output fields for the **show aps** command. Output fields are listed in the approximate order in which they appear.

Table 27: show aps Output Fields

Field Name	Field Description	Level of Output
Interface	Name of the SONET/SDH interface.	All levels
Group	Group name.	All levels
Circuit	Circuit type: **Working** or **Protect**.	All levels
Intf state	State of the circuit and interface in the format ***circuit-state***, ***interface-state***: For ***circuit-state***: • **enabled** • **disabled** • **invalid** • **unknown** For ***interface-state***: • **admin down** • **degraded** • **down** • **invalid** • **nonexistent** • **unknown** • **up**	All levels
Neighbor	Address and state of neighbor interface. If the working and protect interfaces are on the same router, the neighbor address is displayed as **0.0.0.0**.	**detail extensive**
adj	State of the neighbor adjacency: • **Down** • **Init** • **Invalid** • **Unknown** • **Up**	**detail extensive**
neighbor interface	State of the neighbor interface: **enabled** or **disabled**.	**detail extensive**
dead	Number of seconds before the neighbor is declared dead	**detail extensive**
Channel state	Circuit that has been selected: **Working** or **Protect**. On SDH configurations using Multiplex Section Protection (MSP), the APS Annex B (G.841) Lockout status is also shown in **extensive** output.	**detail extensive**
Local-mode	Mode in which the local router is configured to interoperate with SONET line-terminating equipment (LTE): **unidirectional** or **bidirectional**. The parenthetical value represents the mode type in the K2 byte.	**extensive**

Table 27: show aps Output Fields (continued)

Field Name	Field Description	Level of Output
neighbor-mode	Mode in which the neighboring device is operating: **unidirectional** or **bidirectional**. The parenthetical value represents the mode type in the K2 byte.	**extensive**
Protect circuit is on	Interface name of the APS protect circuit, displayed when both the working circuit and protect circuit are on the same router.	**detail extensive**
Working circuit is on	Interface name of the APS working circuit, displayed when both the working circuit and protect circuit are on the same router.	**detail extensive**
Req K1	Value of the SONET/SDH K1 byte requested to be transmitted by this circuit.	**extensive**
rcv K1	Value of the SONET/SDH K1 byte received on this interface. (Valid only on the protect circuit.)	**extensive**
xmit K1	Value of the SONET/SDH K1 byte being transmitted on this interface. (Valid only on the protect circuit.)	**extensive**
nbr K1	Value of the SONET/SDH K1 byte requested to be transmitted by the neighbor.	**extensive**
nbr paired req	Nonzero if the neighbor is requesting a particular K1 value because of a change in the paired circuit.	**extensive**
Revert time	Configured time to wait after the working circuit has become functional before making the working circuit active again.	**extensive**
neighbor revert time	Configured time, on the neighbor interface, to wait after the working circuit has again become functional before making the working circuit active again.	**extensive**
Hello due in	Time until the next hello packet is sent.	**extensive**

Sample Output

show aps

```
user@host> show aps
Interface    Group                          Circuit  Intf state
so-0/0/0     aviva-aps                      Working  enabled, up
so-0/0/1     aviva-aps                      Protect  disabled, up
```

show aps brief

The output for the **show aps brief** command is identical to that for the **show aps** command. For sample output, see show aps on page 264.

show aps detail

```
user@host> show aps detail
```

```
Interface    Group                          Circuit  Intf state
so-0/0/0     aviva-aps                      Working  enabled, up
  Neighbor 0.0.0.0, adj up, neighbor interface disabled, dead 2.987
so-0/0/1     aviva-aps                      Protect  disabled, up
  Neighbor 0.0.0.0, adj up, neighbor interface enabled, dead 2.147
```

show aps extensive

The following sample shows output from a SONET configuration:

```
user@host> show aps extensive
```

```
Interface    Group                          Circuit  Intf state
so-0/0/0     aviva-aps                      Working  enabled, up
  Neighbor 0.0.0.0, adj up, neighbor interface disabled, dead 2.511
  Channel state Working
  Protect circuit is on interface so-0/0/1
  Local-mode bidirectional(5), neighbor-mode bidirectional(5)
  Req K1 0x00, rcv K1 0x00, xmit K1 0x00, nbr K1 0x00, nbr paired req 0
  Revert time 0, neighbor revert time 0
  Hello due in 0.055
so-0/0/1     aviva-aps                      Protect  disabled, up
  Neighbor 0.0.0.0, adj up, neighbor interface enabled, dead 2.230
  Channel state Working
  Working circuit is on interface so-0/0/0
  Local-mode bidirectional(5), neighbor-mode bidirectional(5)
  Req K1 0x00, rcv K1 0x00, xmit K1 0x00, nbr K1 0x00, nbr paired req 0
  Revert time 0, neighbor revert time 0
  Hello due in 0.416
```

The following sample shows output from an SDH configuration:

```
user@host> show aps extensive
```

```
Interface    Group                          Circuit    Intf state
cstm4-1/1/0  TO_MALIBU                      Working    enabled, up
  Neighbor 0.0.0.0, adj up, neighbor interface disabled, dead 2.833
  Channel state Working, annex-b, lockout
  Protect circuit is on interface cstm4-1/2/0
  Local-mode bidirectional(5), neighbor-mode bidirectional(5)
  Req K1 0x00, rcv K1 0x00, xmit K1 0x00, nbr K1 0x00
          , rcv K2 0x10, xmit K2 0x10, nbr paired req 0
  Wait to restore time 30, neighbor wait to restore time 30
  Hello due in 0.945
cstm4-1/2/0  TO_MALIBU                      Protect    disabled, up
  Neighbor 0.0.0.0, adj up, neighbor interface enabled, dead 2.955
  Channel state Working, annex-b
  Working circuit is on interface cstm4-1/1/0
  Local-mode bidirectional(5), neighbor-mode bidirectional(5)
  Req K1 0x00, rcv K1 0x00, xmit K1 0x00, nbr K1 0x00
          , rcv K2 0x10, xmit K2 0x10, nbr paired req 0
  Wait to restore time 30, neighbor wait to restore time 30
  Hello due in 0.735
```

show interfaces (Aggregated SONET/SDH)

Syntax

```
show interfaces as number
<brief | detail | extensive | terse>
<descriptions>
<media>
<snmp-index snmp-index>
<statistics>
```

Release Information Command introduced before Junos OS Release 7.4.

Description (M Series and T Series routers only) Display status information about the specified aggregated SONET/SDH interface.

Options

as*number*—Display standard information about the specified aggregated SONET/SDH interface.

brief | detail | extensive | terse—(Optional) Display brief, detail, or extensive information about the interface.

descriptions—(Optional) Display interface description strings.

media—(Optional) Display media-specific information about network interfaces.

snmp-index *snmp-index*—(Optional) Display information for the specified SNMP index of the interface.

statistics—(Optional) Display static interface statistics.

Required Privilege Level view

Related Documentation

- Understanding Aggregated SONET/SDH Interfaces on page 99

List of Sample Output

show interfaces (Aggregated SONET) on page 270
show interfaces brief (Aggregated SONET) on page 270
show interfaces detail (Aggregated SONET) on page 271
show interfaces extensive (Aggregated SONET) on page 271

Output Fields Table 28 on page 266 lists the output fields for the **show interfaces** (aggregated SONET/SDH) command. Output fields are listed in the approximate order in which they appear.

Table 28: Aggregated SONET/SDH show interfaces Output Fields

Field Name	Field Description	Level of Output
Physical Interface		

Table 28: Aggregated SONET/SDH show interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
Physical interface	Name of the physical interface.	All levels
Enabled	State of the interface. Possible values are described in the "Enabled Field" section under *Common Output Fields Description*.	All levels
Interface index	Physical interface's index number, which reflects its initialization sequence.	**detail extensive** none
SNMP ifIndex	SNMP index number for the physical interface.	**detail extensive** none
Generation	Unique number for use by Juniper Networks technical support only.	**detail extensive**
Link-level type	Encapsulation being used on the physical interface.	All levels
MTU	MTU size on the physical interface.	All levels
Speed	Speed at which the interface is running.	All levels
Minimum links needed	Number of child links that must be operational for the aggregated interface to be operational.	**detail extensive** none
Device flags	Information about the physical device. Possible values are described in the "Device Flags" section under *Common Output Fields Description*.	All levels
Interface flags	Information about the interface. Possible values are described in the "Interface Flags" section under *Common Output Fields Description*.	All levels
Link flags	Information about the link. Possible values are described in the "Link Flags" section under *Common Output Fields Description*.	All levels
Keepalive settings	(PPP and HDLC) Configured settings for keepalives. • **interval** ***seconds***—The time in seconds between successive keepalive requests. The range is **10** seconds through **32,767** seconds, with a default of **10** seconds. • **up-count** ***number***—The number of keepalive packets a destination must receive to change a link's status from down to up. The range is**1** through **255**, with a default of **1**. • **down-count** ***number***—The number of keepalive packets a destination must fail to receive before the network takes a link down. The range is **1** through **255**, with a default of **3**.	All levels
Last flapped	Date, time, and how long ago the interface went from down to up. The format is **Last flapped:** ***year-month-day hour:minute:second timezone*** **(*hour:minute:second* ago)**. For example, **Last flapped: 2002-04-26 10:52:40 PDT (04:33:20 ago).**	**detail extensive** none
Input rate	Input rate in bits per second (bps) and packets per second (pps).	None specified
Output rate	Output rate in bps and pps.	None specified

Table 28: Aggregated SONET/SDH show interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
Statistics last cleared	Time when the statistics for the interface were last set to zero.	**detail extensive**
Traffic statistics	Number of bytes and packets received and transmitted on the physical interface, and the traffic rate in bits per seconds (bps). • **Input bytes**—Number of bytes received on the interface. • **Output bytes**—Number of bytes transmitted on the interface. • **Input packets**—Number of packets received on the interface. • **Output packets**—Number of packets transmitted on the interface.	**detail extensive**
Input errors	Input errors on the interface whose definitions are as follows: • **Errors**—Sum of the incoming frame aborts and FCS errors. • **Drops**—Number of packets dropped by the input queue of the I/O Manager ASIC. If the interface is saturated, this number increments once for every packet that is dropped by the ASIC's RED mechanism. • **Framing errors**—Number of packets received with an invalid frame checksum (FCS). • **Runts**—Number of frames received that are smaller than the runt threshold. • **Giants**—Number of frames received that are larger than the giant threshold. • **Policed discards**—Number of frames that the incoming packet match code discarded because they were not recognized or not of interest. Usually, this field reports protocols that the Junos OS does not handle. • **Resource errors**—Sum of transmit drops.	**extensive**
Output errors	Output errors on the interface. The following paragraphs explain the counters whose meaning might not be obvious: • **Carrier transitions**—Number of times the interface has gone from **down** to **up**. This number does not normally increment quickly, increasing only when the cable is unplugged, the far-end system is powered down and up, or another problem occurs. If the number of carrier transitions increments quickly (perhaps once every 10 seconds), the cable, the far-end system, or the PIC is malfunctioning. • **Errors**—Sum of the outgoing frame aborts and FCS errors. • **Drops**—Number of packets dropped by the output queue of the I/O Manager ASIC. If the interface is saturated, this number increments once for every packet that is dropped by the ASIC's RED mechanism. • **MTU errors**—Number of packets whose size exceeds the MTU of the interface. • **Resource errors**—Sum of transmit drops.	**extensive**
Egress queues	Total number of egress queues supported on the specified interface.	**detail extensive**
Queue counters	CoS queue number and its associated user-configured forwarding class name. • **Queued packets**—Number of queued packets. • **Transmitted packets**—Number of transmitted packets. • **Dropped packets**—Number of packets dropped by the ASIC's RED mechanism.	**extensive**

Table 28: Aggregated SONET/SDH show interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
Logical Interface		
Logical interface	Name of the logical interface.	All levels
Index	Logical interface's index number (which reflects its initialization sequence).	**detail extensive** none
SNMP ifIndex	Logical interface's SNMP interface index number.	**detail extensive** none
Generation	Unique number for use by Juniper Networks technical support only.	**detail extensive**
Flags	Information about the logical interface. Possible values are described in the "Logical Interface Flags" section under *Common Output Fields Description*.	All levels
Encapsulation	Encapsulation on the logical interface.	All levels
Bandwidth	Interface bandwidth.	**detail extensive** none
Statistics	Information about fragments and packets received and sent by the router All references to traffic direction (input or output) are defined with respect to the router. Input fragments received by the router are assembled into input packets; output packets are segmented into output fragments for transmission out of the router. Statistics include input and output counts for packets, packets per second (pps), bytes, and bytes per second (Bps) for the following entities: • **Bundle**—Information about bundles. • **Link**—Information about links used in the multilink operation.	**detail extensive** none
protocol-family	Protocol family configured on the logical interface. If the protocol is **inet**, the source and destination address are also displayed.	**brief**
Protocol	Protocol family configured on the logical interface.	**detail extensive** none
MTU	MTU size on the logical interface.	**detail extensive** none
Flags	Information about the protocol family flags. Possible values are described in the "Family Flags" section under *Common Output Fields Description*.	**detail extensive** none
Generation	Unique number for use by Juniper Networks technical support only.	**detail extensive**
Route table	Routing table in which the logical interface address is located. For example, **0** refers to the routing table inet.0.	**detail extensive**
Addresses, Flags	Information about the address flags. Possible values are described in the "Addresses Flags" section under *Common Output Fields Description*.	**detail extensive** none
Destination	IP address of the remote side of the connection.	**detail extensive** none
Local	IP address of the logical interface.	**detail extensive** none

Table 28: Aggregated SONET/SDH show interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
Broadcast	Broadcast address.	**detail extensive** none
Generation	Unique number for use by Juniper Networks technical support only.	**detail extensive**
Route table	Routing table in which the logical interface address is located. For example, **0** refers to the routing table inet.0.	**detail extensive**

Sample Output

show interfaces (Aggregated SONET)

```
user@host> show interfaces as0
Physical interface: as0, Enabled, Physical link is Up
  Interface index: 149, SNMP ifIndex: 45
  Link-level type: PPP, MTU: 4474, Speed: 466560kbps, Minimum links needed: 1
  Device flags   : Present Running
  Interface flags: SNMP-Traps Internal: 0x4000
  Link flags     : Keepalives
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Last flapped   : Never
  Input rate     : 216 bps (1 pps)
  Output rate    : 48 bps (0 pps)

  Logical interface as0.0 (Index 79) (SNMP ifIndex 55)
    Flags: Point-To-Point SNMP-Traps 0x4000 Encapsulation: PPP
    Bandwidth: 311040kbps
    Statistics        Packets        pps         Bytes          bps
    Bundle:
        Input :          1178          1         11772          176
        Output:             0          0             0            0
    Protocol inet, MTU: 4470
      Flags: None
      Addresses, Flags: Is-Preferred Is-Primary
        Destination: 10.100.1.1, Local: 10.100.1.2
```

show interfaces brief (Aggregated SONET)

```
user@host> show interfaces as0 brief
Physical interface: as0, Enabled, Physical link is Up
  Link-level type: PPP, MTU: 4474, Speed: 466560kbps
  Device flags   : Present Running
  Interface flags: SNMP-Traps Internal: 0x4000
  Link flags     : Keepalives
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3

  Logical interface as0.0
    Flags: Point-To-Point SNMP-Traps 0x4000 Encapsulation: PPP
    inet  10.100.1.2       --> 10.100.1.1
```

show interfaces detail (Aggregated SONET)

```
user@host> show interfaces as0 detail
Physical interface: as0, Enabled, Physical link is Up
  Interface index: 149, SNMP ifIndex: 45, Generation: 32
  Link-level type: PPP, MTU: 4474, Speed: 466560kbps, Minimum links needed: 1
  Device flags   : Present Running
  Interface flags: SNMP-Traps Internal: 0x4000
  Link flags     : Keepalives
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Last flapped   : Never
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :                15888                  272 bps
   Output bytes  :                 6189                   48 bps
   Input  packets:                 1547                    2 pps
   Output packets:                  393                    0 pps
  Egress queues: 4 supported, 4 in use
  Queue counters:       Queued packets  Transmitted packets      Dropped packets

    0 best-effort                    0                    0                    0

    1 expedited-fo                   0                    0                    0

    2 assured-forw                   0                    0                    0

    3 network-cont              196806               196806                    0


  Logical interface as0.0 (Index 79) (SNMP ifIndex 55) (Generation 18)
    Flags: Point-To-Point SNMP-Traps 0x4000 Encapsulation: PPP
    Bandwidth: 311040kbps
    Statistics        Packets        pps         Bytes          bps
    Bundle:
        Input :          1334          2         13332          232
        Output:             0          0             0            0
    Link:
      so-0/0/0.0 <-- down
        Input :             0          0             0            0
        Output:             0          0             0            0
      so-0/0/1.0
        Input :           541          1          5406          120
        Output:             0          0             0            0
      so-0/0/2.0
        Input :           793          1          7926          112
        Output:             0          0             0            0
    Protocol inet, MTU: 4470, Generation: 38, Route table: 0
      Flags: None
      Addresses, Flags: Is-Preferred Is-Primary
        Destination: 10.100.1.1, Local: 10.100.1.2, Broadcast: Unspecified,
        Generation: 40
```

show interfaces extensive (Aggregated SONET)

```
userhost1> show interfaces as0 extensive
Physical interface: as0, Enabled, Physical link is Up
  Interface index: 149, SNMP ifIndex: 45, Generation: 32
  Link-level type: PPP, MTU: 4474, Speed: 466560kbps, Minimum links needed: 1
```

```
Device flags   : Present Running
Interface flags: SNMP-Traps Internal: 0x4000
Link flags     : Keepalives
Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
Last flapped   : Never
Statistics last cleared: Never
Traffic statistics:
 Input  bytes  :                17562                  136 bps
 Output bytes  :                 6862                   72 bps
 Input  packets:                 1710                    1 pps
 Output packets:                  436                    0 pps
Input errors:
  Errors: 0, Drops: 0, Framing errors: 0, Runs: 0, Giants: 0,
  Policed discards: 0, Resource errors: 0
Output errors:
  Carrier transitions: 0, Errors: 0, Drops: 0, MTU errors: 0,
  Resource errors: 0
Egress queues: 4 supported, 4 in use
Queue counters:       Queued packets  Transmitted packets      Dropped packets

  0 best-effort                    0                    0                    0

  1 expedited-fo                   0                    0                    0

  2 assured-forw                   0                    0                    0

  3 network-cont              196848               196848                    0


Logical interface as0.0 (Index 79) (SNMP ifIndex 55) (Generation 18)
  Flags: Point-To-Point SNMP-Traps 0x4000 Encapsulation: PPP
  Bandwidth: 311040kbps
  Statistics        Packets        pps         Bytes          bps
  Bundle:
      Input :          1475          1         14742          136
      Output:             0          0             0            0
  Link:
    so-0/0/0.0 <-- down
      Input :             0          0             0            0
      Output:             0          0             0            0
    so-0/0/1.0
      Input :           598          0          5976           24
      Output:             0          0             0            0
    so-0/0/2.0
      Input :           877          1          8766          112
      Output:             0          0             0            0
  Protocol inet, MTU: 4470, Generation: 38, Route table: 0
    Flags: None
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: 10.100.1.1, Local: 10.100.1.2, Broadcast: Unspecified,
      Generation: 40
```

show interfaces (SONET/SDH)

Syntax

```
show interfaces so-fpc/pic/port
<brief | detail | extensive | terse>
<descriptions>
<media>
<snmp-index snmp-index>
<statistics>
```

Release Information Command introduced before Junos OS Release 7.4.

Description (M Series and T Series routers only) Display status information about the specified SONET/SDH interface.

Options

so-*fpc/pic/port*—Display standard information about the specified SONET/SDH interface.

brief | detail | extensive | terse—(Optional) Display the specified level of output.

descriptions—(Optional) Display interface description strings.

media—(Optional) Display media-specific information about network interfaces.

snmp-index *snmp-index*—(Optional) Display information for the specified SNMP index of the interface.

statistics—(Optional) Display static interface statistics.

Required Privilege Level view

Related Documentation

- SONET/SDH Interfaces Overview on page 3

List of Sample Output

show interfaces (SDH Mode, PPP) on page 286
show interfaces brief (SDH Mode, PPP) on page 287
show interfaces detail (SDH Mode, PPP) on page 287
show interfaces extensive (SDH Mode, PPP) on page 288
show interfaces brief (SONET Mode, Frame Relay) on page 290
show interfaces (SONET Mode, Frame Relay) on page 291
show interfaces detail (SONET Mode, Frame Relay) on page 291
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show interfaces detail (IPv6 Tracking) on page 299
show interfaces (Shared Interface) on page 300

Output Fields Table 29 on page 274 lists the output fields for the **show interfaces** (SONET/SDH) command. Output fields are listed in the approximate order in which they appear.

Table 29: SONET/SDH show interfaces Output Fields

Field Name	Field Description	Level of Output
Physical Interface		
Physical interface	Name of the physical interface.	All levels
Enabled	State of the interface. Possible values are described in the "Enabled Field" section under *Common Output Fields Description*.	All levels
Interface index	Physical interface's index number, which reflects its initialization sequence.	**detail extensive** none
SNMP ifIndex	SNMP index number for the physical interface.	**detail extensive** none
Generation	Unique number for use by Juniper Networks technical support only.	**detail extensive**
Link-level type	Encapsulation being used on the physical interface.	All levels
MTU	MTU size on the physical interface.	All levels
Clocking	SONET/SDH reference clock source: **Internal** or **External**. Clocking is configured and displayed only for channel 0.	All levels
***Framing* mode**	Framing mode: **SONET** or **SDH**.	All levels
Speed	Speed at which the interface is running.	All levels
Loopback	Whether loopback is enabled and the type of loopback (**local** or **remote**).	All levels
FCS	Frame check sequence on the interface (either **16** or **32**). The default is **16** bits.	All levels
Payload scrambler	Whether payload scrambling is enabled.	All levels
Device flags	Information about the physical device. Possible values are described in the "Device Flags" section under *Common Output Fields Description*.	All levels
Interface flags	Information about the interface. Possible values are described in the "Interface Flags" section under *Common Output Fields Description*.	All levels
Shared-interface	Indicates whether the routing domain is the owner or non-owner of the shared interface. If the routing domain is the Root System Domain (RSD), the value is **Owner**. If the routing domain is a Protected System Domain (PSD) under the RSD, the value is **Non-owner**.	All levels
Link flags	Information about the link. Possible values are described in the "Link Flags" section under *Common Output Fields Description*.	All levels

Table 29: SONET/SDH show interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
ANSI or ITU LMI settings	(Frame Relay) Settings for Local Management Interface (LMI). The format is **(ANSI or ITU) LMI settings:** *value*, *value*... *xx* seconds, where *value* can be: • **n391dte**—DTE full status polling interval (1-255) • **n392dce**—DCE error threshold (1-10) • **n392dte**—DTE error threshold (1-10) • **n393dce**—DCE monitored event count (1-10) • **n393dte**—DTE monitored event count (1-10) • **t391dte**—DTE polling timer (5-30 seconds) • **t392dce**—DCE polling verification timer (5-30 seconds)	All levels
LMI	**Input:** ***value*** **(*hh*:*mm*:*ss* ago), Output:** ***value*** **(*hh*:*mm*:*ss* ago)**	**brief** none
LMI statistics	(Frame Relay) LMI packet statistics: • **Input**—Number of packets coming in on the interface (*nn*) and how much time has passed since the last packet arrived. The format is **Input:** ***nn*** **(last seen *hh*:*mm*:*ss* ago)**. • **Output**—Number of packets sent out on the interface (*nn*) and how much time has passed since the last packet was sent. The format is **Output:** ***nn*** **(last sent *hh*:*mm*:*ss* ago)**.	**detail extensive**
DTE statistics	(Frame Relay) Statistics about messages transmitted from the data terminal equipment (DTE) to the data circuit-terminating equipment (DCE): • **Enquiries sent**—Number of link status enquiries sent from the DTE to the DCE. • **Full enquiries sent**—Number of full enquiries sent from the DTE to the DCE. • **Enquiry responses received**—Number of enquiry responses received by the DTE from the DCE. • **Full enquiry responses received**—Number of full enquiry responses sent from the DTE to the DCE.	**detail extensive** none
DCE statistics	(Frame Relay) Statistics about messages transmitted from the DCE to the DTE: • **Enquiries received**—Number of enquiries received by the DCE from the DTE. • **Full enquiries received**—Number of full enquiries received by the DCE from the DTE. • **Enquiry responses sent**—Number of enquiry responses sent from the DCE to the DTE. • **Full enquiry responses sent**—Number of full enquiry responses sent from the DCE to the DTE.	**detail extensive** none

Table 29: SONET/SDH show interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
Common statistics	(Frame Relay) Statistics about messages sent between the DTE and the DCE: • **Unknown messages received**—Number of received packets that do not fall into any category. • **Asynchronous updates received**—Number of link status peer changes received. • **Out-of-sequence packets received**—Number of packets for which the sequence of the packets received is different from the expected sequence. • **Keepalive responses timedout**—Number of keepalive responses that timed out when no LMI packet was reported for **n392dte** or **n393dce** intervals. (See **LMI settings**.)	**detail extensive** none
Nonmatching DCE-end DLCIs	(Frame Relay. Displayed only from the DTE) Number of DLCIs configured from the DCE.	**detail extensive**
Hold-times	Current interface hold-time up and hold-time down, in milliseconds.	**detail extensive**
Keepalive settings	(PPP and HDLC) Configured settings for keepalives. • **interval** ***seconds***—The time in seconds between successive keepalive requests. The range is **10** seconds through **32,767** seconds, with a default of **10** seconds. • **down-count** ***number***—The number of keepalive packets a destination must fail to receive before the network takes a link down. The range is **1** through **255**, with a default of **3**. • **up-count** ***number***—The number of keepalive packets a destination must receive to change a link's status from down to up. The range is **1** through **255**, with a default of **1**.	All levels

Keepalive or **Keepalive statistics**	(PPP and HDLC) Information about keepalive packets.
	• **Input**—Number of keepalive packets received by PPP.
	  • **(last seen 00:00:00 ago)**—Time since the last keepalive packet was received, in the format ***hh:mm:ss***.
	• **Output**—Number of keepalive packets sent by PPP and how long ago the last keepalive packets were sent and received.
	  • **(last seen 00:00:00 ago)**—Time since the last keepalive packet was sent, in the format ***hh:mm:ss***.
		All levels

LCP state	(PPP) Link Control Protocol state. • **Conf-ack-received**—Acknowledgement was received. • **Conf-ack-sent**—Acknowledgement was sent. • **Conf-req-sent**—Request was sent. • **Down**—LCP negotiation is incomplete (not yet completed or has failed). • **Not-configured**—LCP is not configured on the interface. • **Opened**—LCP negotiation is successful.	**detail extensive** none

Table 29: SONET/SDH show interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
NCP state	(PPP) Network Control Protocol state. • **Conf-ack-received**—Acknowledgement was received. • **Conf-ack-sent**—Acknowledgement was sent. • **Conf-req-sent**—Request was sent. • **Down**—NCP negotiation is incomplete (not yet completed or has failed). • **Not-configured**—NCP is not configured on the interface. • **Opened**—NCP negotiation is successful.	**detail extensive** none
CHAP state	(PPP) Displays the state of the Challenge Handshake Authentication Protocol (CHAP) during its transaction. • **Chap-Chal-received**—Challenge was received but response not yet sent. • **Chap-Chal-sent**—Challenge was sent. • **Chap-Resp-received**—Response was received for the challenge sent, but CHAP has not yet moved into the **Success** state. (Most likely with RADIUS authentication.) • **Chap-Resp-sent**—Response was sent for the challenge received. • **Closed**—CHAP authentication is incomplete. • **Failure**—CHAP authentication failed. • **Not-configured**—CHAP is not configured on the interface. • **Success**—CHAP authentication was successful.	**detail extensive** none
CoS queues	Number of CoS queues configured.	**detail extensive** none
Last flapped	Date, time, and how long ago the interface went from down to up. The format is **Last flapped:** ***year-month-day hour:minute:second timezone*** **(*****hour:minute:second*** **ago)**. For example, **Last flapped: 2002-04-26 10:52:40 PDT (04:33:20 ago).**	**detail extensive** none
Input rate	Input rate in bits per second (bps) and packets per second (pps).	None specified
Output rate	Output rate in bps and pps.	None specified
Statistics last cleared	Time when the statistics for the interface were last set to zero.	**detail extensive**
Traffic statistics	Number of bytes and packets received and transmitted on the physical interface, and the traffic rate in bits per seconds (bps). • **Input bytes**—Number of bytes received on the interface. • **Output bytes**—Number of bytes transmitted on the interface. • **Input packets**—Number of packets received on the interface. • **Output packets**—Number of packets transmitted on the interface.	**detail extensive**

Table 29: SONET/SDH show interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
Label-switched interface (LSI) traffic statistics	(Frame Relay) LSI traffic statistics: • **Input bytes**—Number of bytes and speed, in bits per second (bps), received on the interface. • **Output packets**—Number of packets and speed, in bps, transmitted on the interface.	**extensive**
Input errors	Input errors on the interface whose definitions are as follows: • **Errors**—Sum of the incoming frame aborts and FCS errors. • **Drops**—Number of packets dropped by the input queue of the I/O Manager ASIC. If the interface is saturated, this number increments once for every packet that is dropped by the ASIC's RED mechanism. • **Framing errors**—Number of packets received with an invalid frame checksum (FCS). • **Runts**—Number of frames received that are smaller than the runt threshold. • **Giants**—Number of frames received that are larger than the giant threshold. • **Bucket Drops**—Drops resulting from the traffic load exceeding the interface transmit/receive leaky bucket configuration. The default is **off**. • **Policed discards**—Number of frames that the incoming packet match code discarded because they were not recognized or not of interest. Usually, this field reports protocols that the Junos OS does not handle. • **L3 incompletes**—Number of incoming packets discarded because they failed Layer 3 (usually IPv4) sanity checks of the header. For example, a frame with less than 20 bytes of available IP header is discarded. • **L2 channel errors**—Number of times the software did not find a valid logical interface for an incoming frame. • **L2 mismatch timeouts**—Number of malformed or short packets that caused the incoming packet handler to discard the frame as unreadable. • **HS link CRC errors**—Number of errors on the high-speed links between the ASICs responsible for handling the router interfaces. • **HS link FIFO overflows**—Number of FIFO overflows on the high-speed links between the ASICs responsible for handling the router interfaces.	**extensive**

Table 29: SONET/SDH show interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
Output errors	Output errors on the interface. The following paragraphs explain the counters whose meaning might not be obvious: • **Carrier transitions**—Number of times the interface has gone from **down** to **up**. This number does not normally increment quickly, increasing only when the cable is unplugged, the far-end system is powered down and up, or another problem occurs. If the number of carrier transitions increments quickly (perhaps once every 10 seconds), the cable, the far-end system, or the PIC is malfunctioning. • **Errors**—Sum of the outgoing frame aborts and FCS errors. • **Drops**—Number of packets dropped by the output queue of the I/O Manager ASIC. If the interface is saturated, this number increments once for every packet that is dropped by the ASIC's RED mechanism. • **Aged packets**—Number of packets that remained in shared packet SDRAM so long that the system automatically purged them. The value in this field should never increment. If it does, it is most likely a software bug or possibly malfunctioning hardware. • **HS link FIFO underflows**—Number of FIFO underflows on the high-speed links between the ASICs responsible for handling the router interfaces. • **MTU errors**—Number of packets whose size exceeds the MTU of the interface.	**extensive**
IPv6 transit statistics	Number of transit bytes and packets received and transmitted on the physical interface if IPv6 statistics tracking is enabled. • **Input bytes**—Number of bytes received on the interface. • **Output bytes**—Number of bytes transmitted on the interface. • **Input packets**—Number of packets received on the interface. • **Output packets**—Number of packets transmitted on the interface.	**detail extensive**
Egress queues	Total number of egress queues supported on the specified interface.	**detail extensive**
Queue counters	CoS queue number and its associated user-configured forwarding class name. • **Queued packets**—Number of queued packets. • **Transmitted packets**—Number of transmitted packets. • **Dropped packets**—Number of packets dropped by the ASIC's RED mechanism.	**extensive**
SONET alarms **SONET defects**	(SONET) SONET media-specific alarms and defects that prevents the interface from passing packets. When a defect persists for a certain period, it is promoted to an alarm. Based on the router configuration, an alarm can ring the red or yellow alarm bell on the router or light the red or yellow alarm LED on the craft interface. See these fields for possible alarms and defects: **SONET PHY**, **SONET section**, **SONET line**, and **SONET path**.	All levels
Link	(For 4-port OC192c PIC operating in OC768-over-4xOC192 mode) The link number. Errors and alarms are displayed for each link.	**extensive**

Table 29: SONET/SDH show interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
SONET PHY	Counts of specific SONET errors with detailed information. • **Seconds**—Number of seconds the defect has been active. • **Count**—Number of times that the defect has gone from inactive to active. • **State**—State of the error. State other than **OK** indicates a problem. Subfields are: • **PLL Lock**—Phase-locked loop • **PHY Light**—Loss of optical signal	**extensive**
SONET section	Counts of specific SONET errors with detailed information. • **Seconds**—Number of seconds the defect has been active. • **Count**—Number of times that the defect has gone from inactive to active. • **State**—State of the error. State other than **OK** indicates a problem. Subfields are: • **BIP-B1**—Bit interleaved parity for SONET section overhead • **SEF**—Severely errored framing • **LOL**—Loss of light • **LOF**—Loss of frame • **ES-S**—Errored seconds (section) • **SES-S**—Severely errored seconds (section) • **SEFS-S**—Severely errored framing seconds (section)	**extensive**
SONET line	Active alarms and defects, plus counts of specific SONET errors with detailed information. • **Seconds**—Number of seconds the defect has been active. • **Count**—Number of times that the defect has gone from inactive to active. • **State**—State of the error. State other than **OK** indicates a problem. Subfields are: • **BIP-B2**—Bit interleaved parity for SONET line overhead • **REI-L**—Remote error indication (near-end line) • **RDI-L**—Remote defect indication (near-end line) • **AIS-L**—Alarm indication signal (near-end line) • **BERR-SF**—Bit error rate fault (signal failure) • **BERR-SD**—Bit error rate defect (signal degradation) • **ES-L**—Errored seconds (near-end line) • **SES-L**—Severely errored seconds (near-end line) • **UAS-L**—Unavailable seconds (near-end line) • **ES-LFE**—Errored seconds (far-end line) • **SES-LFE**—Severely errored seconds (far-end line) • **UAS-LFE**—Unavailable seconds (far-end line)	**extensive**

Table 29: SONET/SDH show interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
SONET path	Active alarms and defects, plus counts of specific SONET errors with detailed information. • **Seconds**—Number of seconds the defect has been active. • **Count**—Number of times that the defect has gone from inactive to active. • **State**—State of the error. State other than**OK** indicates a problem. Subfields are: • **BIP-B3**—Bit interleaved parity for SONET section overhead • **REI-P**—Remote error indication • **LOP-P**—Loss of pointer (path) • **AIS-P**—Path alarm indication signal • **RDI-P**—Path remote defect indication • **UNEQ-P**—Path unequipped • **PLM-P**—Path payload (signal) label mismatch • **ES-P**—Errored seconds (near-end STS path) • **SES-P**—Severely errored seconds (near-end STS path) • **UAS-P**—Unavailable seconds (near-end STS path) • **ES-PFE**—Errored seconds (far-end STS path) • **SES-PFE**—Severely errored seconds (far-end STS path) • **UAS-PFE**—Unavailable seconds (far-end STS path)	**extensive**
Received SONET overhead **Transmitted SONET overhead**	Values of the received and transmitted SONET overhead: • **C2**—Signal label. Allocated to identify the construction and content of the STS-level SPE and for PDI-P. • **F1**—Section user channel byte. This byte is set aside for the purposes of users. • **K1** and **K2**—These bytes are allocated for APS signaling for the protection of the multiplex section. • **J0**—Section trace. This byte is defined for STS-1 number 1 of an STS-*N* signal. Used to transmit a 1-byte fixed-length string or a 16-byte message so that a receiving terminal in a section can verify its continued connection to the intended transmitter. • **S1**—Synchronization status. The S1 byte is located in the first STS-1 of an STS-*N*. • **Z3** and **Z4**—Allocated for future use.	**extensive**
SDH alarms **SDH defects**	SDH media-specific defects that can prevent the interface from passing packets. When a defect persists for a certain period, it is promoted to an alarm. Based on the router configuration, an alarm can ring the red or yellow alarm bell on the router or light the red or yellow alarm LED on the craft interface. See these fields for possible alarms and defects: **SDH PHY**, **SDH regenerator section**, **SDH multiplex section**, and **SDH path**.	All levels

Table 29: SONET/SDH show interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
SDH PHY	Active alarms and defects, plus counts of specific SDH errors with detailed information. • **Seconds**—Number of seconds the defect has been active. • **Count**—Number of times that the defect has gone from inactive to active. • **State**—State of the error. State other than **OK** indicates a problem. Subfields are: • **PLL Lock**—Phase-locked loop • **PHY Light**—Loss of optical signal	**extensive**
SDH regenerator section	Active alarms and defects, plus counts of specific SDH errors with detailed information. • **Seconds**—Number of seconds the defect has been active. • **Count**—Number of times that the defect has gone from inactive to active. • **State**—State of the error. State other than **OK** indicates a problem. Subfields are: • **RS-BIP8**—24-bit BIP for multiplex section overhead (B2 bytes) • **OOF**—Out of frame • **LOS**—Loss of signal • **LOF**—Loss of frame • **RS-ES**—Errored seconds (near-end regenerator section) • **RS-SES**—Severely errored seconds (near-end regenerator section) • **RS-SEFS**—Severely errored framing seconds (regenerator section)	**extensive**
SDH multiplex section	Active alarms and defects, plus counts of specific SDH errors with detailed information. • **Seconds**—Number of seconds the defect has been active. • **Count**—Number of times that the defect has gone from inactive to active. • **State**—State of the error. State other than **OK** indicates a problem. Subfields are: • **MS-BIP24**—8-bit BIP for high-order path overhead (B3 byte) • **MS-FEBE**—Far-end block error (multiplex section) • **MS-FERF**—Far-end remote fail (multiplex section) • **MS-AIS**—Alarm indication signal (multiplex section) • **BERR-SF**—Bit error rate fault (signal failure) • **BERR-SD**—Bit error rate defect (signal degradation) • **MS-ES**—Errored seconds (near-end multiplex section) • **MS-SES**—Severely errored seconds (near-end multiplex section) • **MS-UAS**—Unavailable seconds (near-end multiplex section) • **MS-ES-FE**—Errored seconds (far-end multiplex section) • **MS-SES-FE**—Severely errored seconds (far-end multiplex section) • **MS-UAS-FE**—Unavailable seconds (far-end multiplex section)	**extensive**

Table 29: SONET/SDH show interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
SDH path	Active alarms and defects, plus counts of specific SDH errors with detailed information. • **Seconds**—Number of seconds the defect has been active. • **Count**—Number of times that the defect has gone from inactive to active. • **State**—State of the error. State other than **OK** indicates a problem. Subfields are: • **HP-BIP8**—8-bit BIP for regenerator section overhead (B1 byte) • **HP-FEBE**—Far-end block error (high-order path) • **HP-LOP**—Loss of pointer (high-order path) • **HP-AIS**—High-order-path alarm indication signal • **HP-FERF**—Far-end remote fail (high-order path) • **HP-UNEQ**—Unequipped (high-order path) • **HP-PLM**—Payload label mismatch (high-order path) • **HP-ES**—Errored seconds (near-end high-order path) • **HP-SES**—Severely errored seconds (near-end high-order path) • **HP-UAS**—Unavailable seconds (near-end high-order path) • **HP-ES-FE**—Errored seconds (far-end high-order path) • **HP-SES-FE**—Severely errored seconds (far-end high-order path) • **HP-UAS-FE**—Unavailable seconds (far-end high-order path)	**extensive**
Received SDH overhead **Transmitted SDH overhead**	Values of the received and transmitted SONET overhead: • **C2**—Signal label. Allocated to identify the construction and content of the STS-level SPE and for PDI-P. • **F1**—Section user channel byte. This byte is set aside for the purposes of users. • **K1** and **K2**—These bytes are allocated for APS signaling for the protection of the multiplex section. • **J0**—Section trace. This byte is defined for STS-1 number 1 of an STS-*N* signal. Used to transmit a 1-byte fixed-length string or a 16-byte message so that a receiving terminal in a section can verify its continued connection to the intended transmitter. • **S1**—Synchronization status. The S1 byte is located in the first STS-1 of an STS-*N*. • **Z3** and **Z4**—Allocated for future use.	**extensive**
Received path trace **Transmitted path trace**	SONET/SDH interfaces allow path trace bytes to be sent inband across the SONET/SDH link. Juniper Networks and other router manufacturers use these bytes to help diagnose misconfigurations and network errors by setting the transmitted path trace message so that it contains the system hostname and name of the physical interface. The received path trace value is the message received from the router at the other end of the fiber. The transmitted path trace value is the message that this router transmits.	**extensive**

Table 29: SONET/SDH show interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
HDLC configuration	Information about the HDLC configuration. • **Policing bucket**—Configured state of the receiving policer. • **Shaping bucket**—Configured state of the transmitting shaper. • **Giant threshold**—Giant threshold programmed into the hardware. • **Runt threshold**—Runt threshold programmed into the hardware.	**extensive**
CoS information	Information about the CoS queue for the physical interface. • **CoS transmit queue**—Queue number and its associated user-configured forwarding class name. • **Bandwidth %**—Percentage of bandwidth allocated to the queue. • **Bandwidth bps**—Bandwidth allocated to the queue (in bps). • **Buffer %**—Percentage of buffer space allocated to the queue. • **Buffer usec**—Amount of buffer space allocated to the queue, in microseconds. This value is nonzero only if the buffer size is configured in terms of time. • **Priority**—Queue priority: **low** or **high**. • **Limit**—Displayed if rate limiting is configured for the queue. Possible values are **none** and **exact**. If **exact** is configured, the queue transmits only up to the configured bandwidth, even if excess bandwidth is available. If **none** is configured, the queue transmits beyond the configured bandwidth if bandwidth is available.	**extensive**
Packet Forwarding Engine configuration	Information about the configuration of the Packet Forwarding Engine: • **Destination slot**—FPC slot number. • **PLP byte**—Packet Level Protocol byte.	**extensive**
Logical Interface		
Logical interface	Name of the logical interface.	All levels
Index	Logical interface index number, which reflects its initialization sequence.	**detail extensive** none
SNMP ifIndex	Logical interface SNMP interface index number.	**detail extensive** none
Generation	Unique number for use by Juniper Networks technical support only.	**detail extensive**
Flags	Information about the logical interface. Possible values are described in the "Logical Interface Flags" section under *Common Output Fields Description*.	All levels
Encapsulation	Encapsulation on the logical interface.	All levels
PPP parameters	The PPP loopback clear timer value.	**extensive**

Table 29: SONET/SDH show interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
Shared interface	Provides the following information: • **shared with**—(RSD only) Indicates which PSD owns the logical shared interface. For example, **psd3**. • **peer interface**—(PSD only) Lists the logical tunnel interface that peers with the logical shared interface. For example, **ut-2/1/0.2**. • **tunnel token**—Specifies the receive (RX) and transmit (TX) tunnel tokens. For example, **Rx: 5.519, Tx: 13.514**.	All levels
Input packets	Number of packets received on the logical interface.	None specified
Output packets	Number of packets transmitted on the logical interface.	None specified
Traffic statistics	Total number of bytes and packets received and transmitted on the logical interface. These statistics are the sum of the local and transit statistics. When a burst of traffic is received, the value in the output packet rate field might briefly exceed the peak cell rate. It takes awhile (generally, less than 1 second) for this counter to stabilize.	**detail extensive**
Local statistics	Statistics for traffic received from and transmitted to the Routing Engine. When a burst of traffic is received, the value in the output packet rate field might briefly exceed the peak cell rate. It takes awhile (generally, less than 1 second) for this counter to stabilize.	**detail extensive**
Transit statistics	Statistics for traffic transiting the router. When a burst of traffic is received, the value in the output packet rate field might briefly exceed the peak cell rate. It takes awhile (generally, less than 1 second) for this counter to stabilize.	**detail extensive**
Protocol	Protocol family configured on the logical interface, such as **iso**, **inet6**, or **mpls**.	**detail extensive none**
protocol-family	Protocol family configured on the logical interface. If the protocol is **inet**, the IP address of the interface is also displayed.	**brief**
Multilink bundle	(If the logical interface is configured as part of a multilink bundle.) Interface name for the multilink bundle.	**detail extensive** none
AS bundle	(If the logical interface is configured as part of an aggregated SONET bundle.) AS bundle number.	**detail extensive**
MTU	MTU size on the logical interface.	**detail extensive none**
Generation	Unique number for use by Juniper Networks technical support only.	**detail extensive**
Route table	Routing table in which the logical interface address is located. For example, **0** refers to the routing table inet.0.	**detail extensive**
Flags	Information about the protocol family flags. Possible values are described in the “Family Flags” section under *Common Output Fields Description*.	**detail extensive** none

Table 29: SONET/SDH show interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
Addresses, Flags	Information about the address flags. Possible values are described in the "Addresses Flags" section under *Common Output Fields Description*.	**detail extensive** none
Destination	IP address of the remote side of the connection.	**detail extensive** none
Local	IP address of the logical interface.	**detail extensive** none
Broadcast	Broadcast address of the interface.	**detail extensive** none
DLCI	(Frame Relay) DLCI number of the logical interface. The following DLCI information is displayed: **Flags**, **Total down time**, **Last down**, and **Traffic statistics**. **Flags** is one or more of the following: • **Active**—Set when the link is active and the DTE and DCE are exchanging information. • **Down**—Set when the link is active, but no information is received from the DCE. • **Unconfigured**—Set when the corresponding DLCI in the DCE is not configured. • **Configured**—Set when the corresponding DLCI in the DCE is configured. • **Dce-configured**—Displayed when the command is issued from the DTE.	**detail extensive**
DLCI statistics	(Frame Relay) Data-link connection identifier (DLCI) statistics. • **Active DLCI**—Number of active DLCIs. • **Inactive DLCI**—Number of inactive DLCIs.	**detail extensive** none

Sample Output

show interfaces (SDH Mode, PPP)

```
user@host> show interfaces so-0/0/0
Physical interface: so-0/0/0, Enabled, Physical link is Up
  Interface index: 149, SNMP ifIndex: 66
  Link-level type: PPP, MTU: 4474, Clocking: Internal, SDH mode, Speed: OC3,
  Loopback: None, FCS: 16, Payload scrambler: Enabled
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps Internal: 0x4000
  Link flags     : Keepalives
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive: Input: 30 (00:00:07 ago), Output: 29 (00:00:05 ago)
  LCP state: Opened
  NCP state: inet: Opened, inet6: Not-configured, iso: Not-configured, mpls:
  Not-configured
  CHAP state: Closed
  CoS queues     : 4 supported, 4 maximum usable queues
  Last flapped   : 2006-03-24 13:20:56 PST (00:05:09 ago)
  Input rate     : 0 bps (0 pps)
  Output rate    : 0 bps (0 pps)
  SDH   alarms   : None
  SDH   defects  : None
```

```
  Logical interface so-0/0/0.0 (Index 66) (SNMP ifIndex 43)
    Flags: Point-To-Point SNMP-Traps 0x4000 Encapsulation: PPP
    Protocol inet, MTU: 4470
      Flags: None
      Addresses, Flags: Is-Preferred Is-Primary
        Destination: 10.0.12.0/30, Local: 10.0.12.1, Broadcast: 10.0.12.3
    Protocol iso, MTU: 4470
      Flags: Protocol-Down
    Protocol mpls, MTU: 4458, Maximum labels: 3
      Flags: Protocol-Down, Is-Primary
```

show interfaces brief (SDH Mode, PPP)

user@host> **show interfaces so-0/0/0 brief**

```
Physical interface: so-0/0/0, Enabled, Physical link is Up
  Link-level type: PPP, MTU: 4474, Clocking: Internal, SDH mode, Speed: OC3,
  Loopback: None, FCS: 16, Payload scrambler: Enabled
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps Internal: 0x4000
  Link flags     : Keepalives
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive: Input: 25 (00:00:01 ago), Output: 24 (00:00:04 ago)
  SDH   alarms   : None
  SDH   defects  : None

  Logical interface so-0/0/0.0
    Flags: Point-To-Point SNMP-Traps 0x4000 Encapsulation: PPP
    inet  10.0.12.1/30
    iso
    mpls
```

show interfaces detail (SDH Mode, PPP)

user@host> **show interfaces so-0/0/0 detail**

```
Physical interface: so-0/0/0, Enabled, Physical link is Up
  Interface index: 149, SNMP ifIndex: 66, Generation: 35
  Link-level type: PPP, MTU: 4474, Clocking: Internal, SDH mode, Speed: OC3,
  Loopback: None, FCS: 16, Payload scrambler: Enabled
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps Internal: 0x4000
  Link flags     : Keepalives
  Hold-times     : Up 0 ms, Down 0 ms
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive statistics:
    Input : 33 (last seen 00:00:05 ago)
    Output: 32 (last sent 00:00:06 ago)
  LCP state: Opened
  NCP state: inet: Opened, inet6: Not-configured, iso: Not-configured, mpls:
  Not-configured
  CHAP state: Closed
  CoS queues     : 4 supported, 4 maximum usable queues
  Last flapped   : 2006-03-24 13:20:56 PST (00:05:38 ago)
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :                  862                    0 bps
   Output bytes  :                 3592                   64 bps
   Input  packets:                   70                    0 pps
```

```
 Output packets:                 330                    0 pps
Egress queues: 4 supported, 4 in use
Queue counters:       Queued packets  Transmitted packets      Dropped packets

  0 best-effort                    0                    0                    0

  1 expedited-fo                   0                    0                    0

  2 assured-forw                   0                    0                    0

  3 network-cont                 329                  329                    0

SDH   alarms   : None
SDH   defects  : None

Logical interface so-0/0/0.0 (Index 66) (SNMP ifIndex 43) (Generation 19)
  Flags: Point-To-Point SNMP-Traps 0x4000 Encapsulation: PPP
  Protocol inet, MTU: 4470, Generation: 48, Route table: 0
    Flags: None
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: 10.0.12.0/30, Local: 10.0.12.1, Broadcast: 10.0.12.3,
      Generation: 48
  Protocol iso, MTU: 4470, Generation: 49, Route table: 0
    Flags: Protocol-Down
  Protocol mpls, MTU: 4458, Maximum labels: 3, Generation: 50, Route table: 0
    Flags: Protocol-Down, Is-Primary
```

show interfaces extensive (SDH Mode, PPP)

user@host> **show interfaces so-0/0/0 extensive**

```
Physical interface: so-0/0/0, Enabled, Physical link is Up
  Interface index: 149, SNMP ifIndex: 66, Generation: 35
  Link-level type: PPP, MTU: 4474, Clocking: Internal, SDH mode, Speed: OC3,
  Loopback: None, FCS: 16, Payload scrambler: Enabled
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps Internal: 0x4000
  Link flags     : Keepalives
  Hold-times     : Up 0 ms, Down 0 ms
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive statistics:
    Input : 36 (last seen 00:00:01 ago)
    Output: 35 (last sent 00:00:10 ago)
  LCP state: Opened
  NCP state: inet: Opened, inet6: Not-configured, iso: Not-configured, mpls:
  Not-configured
  CHAP state: Closed
  CoS queues     : 4 supported, 4 maximum usable queues
  Last flapped   : 2006-03-24 13:20:56 PST (00:06:08 ago)
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :                 922                    0 bps
   Output bytes  :                3850                   64 bps
   Input  packets:                  75                    0 pps
   Output packets:                 356                    0 pps
  Label-switched interface (LSI) traffic statistics:
   Input  bytes  :                   0                    0 bps
   Input  packets:                   0                    0 pps
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Giants: 0,
```

```
  Bucket drops: 0, Policed discards: 218, L3 incompletes: 0,
  L2 channel errors: 0, L2 mismatch timeouts: 2, HS link CRC errors: 0,
  HS link FIFO overflows: 0
Output errors:
  Carrier transitions: 3, Errors: 0, Drops: 0, Aged packets: 0,
  HS link FIFO underflows: 0, MTU errors: 0
Egress queues: 4 supported, 4 in use
Queue counters:       Queued packets  Transmitted packets      Dropped packets

  0 best-effort                    0                    0                    0

  1 expedited-fo                   0                    0                    0

  2 assured-forw                   0                    0                    0

  3 network-cont                 354                  354                    0

SDH   alarms   : None
SDH   defects  : None
SDH PHY:              Seconds        Count  State
  PLL Lock                  0            0  OK
  PHY Light                 2            1  OK
SDH regenerator section:
  RS-BIP8                   0            0
  OOF                       3            8  OK
  LOS                       3            2  OK
  LOF                       3            2  OK
  RS-ES                     3
  RS-SES                    3
  RS-SEFS                   3
SDH multiplex section:
  MS-BIP24                  0            0
  MS-FEBE                   0            0
  MS-FERF                   3            2  OK
  MS-AIS                    2            1  OK
  BERR-SF                   0            0  OK
  BERR-SD                   0            0  OK
  MS-ES                     3
  MS-SES                    3
  MS-UAS                    0
  MS-SES-FE                 3
  MS-UAS-FE                 0
SDH path:
  HP-BIP8                   0            0
  HP-FEBE                   0            0
  HP-LOP                    1            1  OK
  HP-AIS                    2            1  OK
  HP-FERF                   3            2  OK
  HP-UNEQ                   0            0  OK
  HP-PLM                    1            1  OK
  HP-ES                     3
  HP-SES                    3
  HP-UAS                    0
  HP-ES-FE                  3
  HP-SES-FE                 3
  HP-UAS-FE                 0
Received SDH overhead:
  F1      : 0x00, J0      : 0x00, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0xcf, C2(cmp) : 0xcf, F2      : 0x00
  Z3      : 0x00, Z4      : 0x00, S1(cmp) : 0x00
```

```
  Transmitted SDH overhead:
    F1      : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
    S1      : 0x00, C2      : 0xcf, F2      : 0x00, Z3      : 0x00
    Z4      : 0x00
  Received path trace: R2 so-0/0/0
    52 32 20 73 6f 2d 30 2f 30 2f 30 00 00 00 00 00   R2 so-0/0/0.....
  Transmitted path trace: R1 so-0/0/0
    52 31 20 73 6f 2d 30 2f 30 2f 30 00 00 00 00 00   R1 so-0/0/0.....
  HDLC configuration:
    Policing bucket: Disabled
    Shaping bucket : Disabled
    Giant threshold: 4484, Runt threshold: 3
  Packet Forwarding Engine configuration:
    Destination slot: 0, PLP byte: 1 (0x00)
  CoS information:
    CoS transmit queue    Bandwidth      Buffer Priority   Limit
                        %        bps   %   usec
    0 best-effort      95  147744000  95      0      low    none
    3 network-control   5    7776000   5      0      low    none

  Logical interface so-0/0/0.0 (Index 66) (SNMP ifIndex 43) (Generation 19)
    Flags: Point-To-Point SNMP-Traps 0x4000 Encapsulation: PPP
    PPP parameters:
      PPP loopback clear timer: 3 sec
    Protocol inet, MTU: 4470, Generation: 48, Route table: 0
      Flags: None
      Addresses, Flags: Is-Preferred Is-Primary
        Destination: 10.0.12.0/30, Local: 10.0.12.1, Broadcast: 10.0.12.3,
        Generation: 48
    Protocol iso, MTU: 4470, Generation: 49, Route table: 0
      Flags: Protocol-Down
    Protocol mpls, MTU: 4458, Maximum labels: 3, Generation: 50, Route table: 0
      Flags: Protocol-Down, Is-Primary
  MS-ES-FE                  3
```

show interfaces brief (SONET Mode, Frame Relay)

```
user@host> show interfaces so-0/0/0 brief
```

```
Physical interface: so-0/0/0, Enabled, Physical link is Up
  Link-level type: Frame-Relay, MTU: 4474, Clocking: Internal, SONET mode,
  Speed: OC3, Loopback: None, FCS: 16, Payload scrambler: Enabled
  Device flags   : Present Running
  Interface flags: Link-Layer-Down Point-To-Point SNMP-Traps Internal: 0x4000
  Link flags     : Keepalives DTE
  ANSI LMI settings: n391dte 6, n392dte 3, n393dte 4, t391dte 10 seconds
  LMI: Input: 29 (00:00:02 ago), Output: 28 (00:00:01 ago)
  SONET alarms   : None
  SONET defects  : None

  Logical interface so-0/0/0.0
    Flags: Device-Down Point-To-Point SNMP-Traps Encapsulation: FR-NLPID
    inet  10.0.12.1        --> 10.0.12.2
    iso
    mpls
    DLCI 16
      Flags: Down, DCE-Unconfigured
      Total down time: 00:04:12 sec, Last down: 00:04:12 ago
```

show interfaces (SONET Mode, Frame Relay)

```
user@host> show interfaces so-0/0/0
```

```
Physical interface: so-0/0/0, Enabled, Physical link is Up
  Interface index: 128, SNMP ifIndex: 66
  Link-level type: Frame-Relay, MTU: 4474, Clocking: Internal, SONET mode,
  Speed: OC3, Loopback: None, FCS: 16, Payload scrambler: Enabled
  Device flags   : Present Running
  Interface flags: Link-Layer-Down Point-To-Point SNMP-Traps Internal: 0x4000
  Link flags     : Keepalives DTE
  ANSI LMI settings: n391dte 6, n392dte 3, n393dte 4, t391dte 10 seconds
  LMI: Input: 23 (00:00:05 ago), Output: 22 (00:00:03 ago)
  DTE statistics:
    Enquiries sent                      : 19
    Full enquiries sent                 : 3
    Enquiry responses received          : 20
    Full enquiry responses received     : 3
  DCE statistics:
    Enquiries received                  : 0
    Full enquiries received             : 0
    Enquiry responses sent              : 0
    Full enquiry responses sent         : 0
  Common statistics:
    Unknown messages received           : 0
    Asynchronous updates received       : 0
    Out-of-sequence packets received    : 0
    Keepalive responses timedout        : 1
  CoS queues     : 4 supported, 4 maximum usable queues
  Last flapped   : 2006-03-06 11:53:20 PST (3d 03:09 ago)
  Input rate     : 0 bps (0 pps)
  Output rate    : 56 bps (0 pps)
  SONET alarms   : None
  SONET defects  : None

  Logical interface so-0/0/0.0 (Index 79) (SNMP ifIndex 43)
    Flags: Device-Down Point-To-Point SNMP-Traps Encapsulation: FR-NLPID
    Input packets : 0
    Output packets: 0
    Protocol inet, MTU: 4470
      Flags: None
      Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
        Destination: 10.0.12.2, Local: 10.0.12.1
    Protocol iso, MTU: 4470
      Flags: None
    Protocol mpls, MTU: 4450, Maximum labels: 3
    DLCI 16
      Flags: Down, DCE-Unconfigured
      Total down time: 00:03:11 sec, Last down: 00:03:11 ago
        Input packets : 0
        Output packets: 0
  DLCI statistics:
    Active DLCI  :0  Inactive DLCI  :1
```

show interfaces detail (SONET Mode, Frame Relay)

```
user@host> show interfaces so-0/0/0 detail
```

```
Physical interface: so-0/0/0, Enabled, Physical link is Up
  Interface index: 128, SNMP ifIndex: 66, Generation: 11
```

```
Link-level type: Frame-Relay, MTU: 4474, Clocking: Internal, SONET mode,
Speed: OC3, Loopback: None, FCS: 16, Payload scrambler: Enabled
Device flags   : Present Running
Interface flags: Link-Layer-Down Point-To-Point SNMP-Traps Internal: 0x4000
Link flags     : Keepalives DTE
Hold-times     : Up 0 ms, Down 0 ms
ANSI LMI settings: n391dte 6, n392dte 3, n393dte 4, t391dte 10 seconds
LMI statistics:
  Input : 33 (last seen 00:00:09 ago)
  Output: 32 (last sent 00:00:01 ago)
DTE statistics:
  Enquiries sent                       : 27
  Full enquiries sent                  : 5
  Enquiry responses received           : 28
  Full enquiry responses received      : 5
DCE statistics:
  Enquiries received                   : 0
  Full enquiries received              : 0
  Enquiry responses sent               : 0
  Full enquiry responses sent          : 0
Common statistics:
  Unknown messages received            : 0
  Asynchronous updates received        : 0
  Out-of-sequence packets received     : 0
  Keepalive responses timedout         : 1
CoS queues     : 4 supported, 4 maximum usable queues
Last flapped   : 2006-03-06 11:53:20 PST (3d 03:10 ago)
Statistics last cleared: Never
Traffic statistics:
 Input  bytes  :               495368                    0 bps
 Output bytes  :              2765014                   56 bps
 Input  packets:                41165                    0 pps
 Output packets:               133530                    0 pps
Egress queues: 4 supported, 4 in use
Queue counters:       Queued packets  Transmitted packets      Dropped packets

  0 best-effort                   18                   18                    0

  1 expedited-fo                   0                    0                    0

  2 assured-forw                   0                    0                    0

  3 network-cont              133506               133506                    0

SONET alarms   : None
SONET defects  : None
Logical interface so-0/0/0.0 (Index 79) (SNMP ifIndex 43) (Generation 28)
  Flags: Device-Down Point-To-Point SNMP-Traps Encapsulation: FR-NLPID
  Traffic statistics:
   Input  bytes  :                   0
   Output bytes  :                   0
   Input  packets:                   0
   Output packets:                   0
  Local statistics:
   Input  bytes  :                   0
   Output bytes  :                   0
   Input  packets:                   0
   Output packets:                   0
  Transit statistics:
   Input  bytes  :                   0                    0 bps
```

```
    Output bytes  :                   0                   0 bps
    Input  packets:                   0                   0 pps
    Output packets:                   0                   0 pps
   Protocol inet, MTU: 4470, Generation: 49, Route table: 0
     Flags: None
     Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
       Destination: 10.0.12.2, Local: 10.0.12.1, Broadcast: Unspecified,
       Generation: 61
   Protocol iso, MTU: 4470, Generation: 50, Route table: 0
     Flags: None
   Protocol mpls, MTU: 4450, Maximum labels: 3, Generation: 51, Route table: 0
   DLCI 16
     Flags: Down, DCE-Unconfigured
     Total down time: 00:04:54 sec, Last down: 00:04:54 ago
     Traffic statistics:
      Input  bytes  :                  0
      Output bytes  :                  0
      Input  packets:                  0
      Output packets:                  0
 DLCI statistics:
   Active DLCI  :0  Inactive DLCI  :1
```

show interfaces extensive (SONET Mode, Frame Relay)

user@host> **show interfaces so-0/0/0 extensive**

```
Physical interface: so-0/0/0, Enabled, Physical link is Up
  Interface index: 128, SNMP ifIndex: 66, Generation: 11
  Link-level type: Frame-Relay, MTU: 4474, Clocking: Internal, SONET mode,
  Speed: OC3, Loopback: None, FCS: 16, Payload scrambler: Enabled
  Device flags   : Present Running
  Interface flags: Link-Layer-Down Point-To-Point SNMP-Traps Internal: 0x4000
  Link flags     : Keepalives DTE
  Hold-times     : Up 0 ms, Down 0 ms
  ANSI LMI settings: n391dte 6, n392dte 3, n393dte 4, t391dte 10 seconds
  LMI statistics:
    Input : 39 (last seen 00:00:02 ago)
    Output: 36 (last sent 00:00:07 ago)
  DTE statistics:
    Enquiries sent                     : 30
    Full enquiries sent                : 6
    Enquiry responses received         : 33
    Full enquiry responses received    : 6
  DCE statistics:
    Enquiries received                 : 0
    Full enquiries received            : 0
    Enquiry responses sent             : 0
    Full enquiry responses sent        : 0
  Common statistics:
    Unknown messages received          : 0
    Asynchronous updates received      : 0
    Out-of-sequence packets received   : 0
    Keepalive responses timedout       : 1
  CoS queues     : 4 supported, 4 maximum usable queues
  Last flapped   : 2006-03-06 11:53:20 PST (3d 03:11 ago)
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :              495452                  56 bps
   Output bytes  :             2765074                   0 bps
   Input  packets:               41171                   0 pps
```

```
  Output packets:              133534                    0 pps
 Label-switched interface (LSI) traffic statistics:
  Input  bytes  :                   0                    0 bps
  Input  packets:                   0                    0 pps
 Input errors:
   Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Giants: 0,
   Bucket drops: 0, Policed discards: 0, L3 incompletes: 0,
   L2 channel errors: 0, L2 mismatch timeouts: 0, HS link CRC errors: 0,
   HS link FIFO overflows: 0
 Output errors:
   Carrier transitions: 3, Errors: 0, Drops: 0, Aged packets: 0,
   HS link FIFO underflows: 0, MTU errors: 0
 Egress queues: 4 supported, 4 in use
 Queue counters:       Queued packets  Transmitted packets      Dropped packets

   0 best-effort                 18                   18                    0

   1 expedited-fo                 0                    0                    0

   2 assured-forw                 0                    0                    0

   3 network-cont            133510               133510                    0

 SONET alarms   : None
 SONET defects  : None
 SONET PHY:            Seconds        Count  State
   PLL Lock                  0            0  OK
   PHY Light                60            1  OK
 SONET section:
   BIP-B1                    0            0
   SEF                     108          158  OK
   LOS                     108            2  OK
   LOF                     108            2  OK
   ES-S                    108
   SES-S                   108
   SEFS-S                  108
 SONET line:
   BIP-B2                    0            0
   REI-L                     0            0
   RDI-L                     1            1  OK
   AIS-L                   107            1  OK
   BERR-SF                   0            0  OK
   BERR-SD                  44            2  OK
   ES-L                    108
   SES-L                   108
   UAS-L                    97
   ES-LFE                    1
   SES-LFE                   1
   UAS-LFE                   0
SONET path:
   BIP-B3                    0            0
   REI-P                     0            0
   LOP-P                     1            1  OK
   AIS-P                   107            1  OK
   RDI-P                     1            1  OK
   UNEQ-P                    0            0  OK
   PLM-P                     1            1  OK
   ES-P                    108
   SES-P                   108
   UAS-P                    97
```

```
  ES-PFE                   1
  SES-PFE                  1
  UAS-PFE                  0
Received SONET overhead:
  F1      : 0x00, J0      : 0x00, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0xcf, C2(cmp) : 0xcf, F2      : 0x00
  Z3      : 0x00, Z4      : 0x00, S1(cmp) : 0x00
Transmitted SONET overhead:
  F1      : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0xcf, F2      : 0x00, Z3      : 0x00
  Z4      : 0x00
Received path trace: R2 so-0/0/0
  52 32 20 73 6f 2d 30 2f 30 2f 30 00 00 00 00 00   R2 so-0/0/0.....
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 0d 0a ................
Transmitted path trace: R1 so-0/0/0
  52 31 20 73 6f 2d 30 2f 30 2f 30 00 00 00 00 00   R1 so-0/0/0.....
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
HDLC configuration:
  Policing bucket: Disabled
  Shaping bucket : Disabled
  Giant threshold: 4484, Runt threshold: 3
Packet Forwarding Engine configuration:
  Destination slot: 0, PLP byte: 1 (0x00)
CoS information:
  CoS transmit queue        Bandwidth               Buffer  Priority   Limit
                          %           bps     %           usec
  0 best-effort      95     147744000    95             0       low    none
  3 network-control   5       7776000     5             0       low    none

Logical interface so-0/0/0.0 (Index 79) (SNMP ifIndex 43) (Generation 28)
  Flags: Device-Down Point-To-Point SNMP-Traps Encapsulation: FR-NLPID
  Traffic statistics:
   Input  bytes  :                   0
   Output bytes  :                   0
   Input  packets:                   0
   Output packets:                   0
  Local statistics:
   Input  bytes  :                   0
   Output bytes  :                   0
   Input  packets:                   0
   Output packets:                   0
  Transit statistics:
   Input  bytes  :                   0                  0 bps
   Output bytes  :                   0                  0 bps
   Input  packets:                   0                  0 pps
   Output packets:                   0                  0 pps
  Protocol inet, MTU: 4470, Generation: 49, Route table: 0
    Flags: None
    Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
      Destination: 10.0.12.2, Local: 10.0.12.1, Broadcast: Unspecified,
      Generation: 61
  Protocol iso, MTU: 4470, Generation: 50, Route table: 0
    Flags: None
  Protocol mpls, MTU: 4450, Maximum labels: 3, Generation: 51, Route table: 0
  DLCI 16
    Flags: Down, DCE-Unconfigured
```

```
    Total down time: 00:05:42 sec, Last down: 00:05:42 ago
    Traffic statistics:
     Input  bytes  :                   0
     Output bytes  :                   0
     Input  packets:                   0
     Output packets:                   0
  DLCI statistics:
    Active DLCI  :0  Inactive DLCI  :1
```

show interfaces extensive (OC768-over-4xOC192 Mode)

user@host> **show interfaces so-7/0/0 extensive**

```
Physical interface: so-7/0/0, Enabled, Physical link is Up
  Interface index: 163, SNMP ifIndex: 23, Generation: 186
  Link-level type: Cisco-HDLC, MTU: 4474, Clocking: Internal, SONET mode, Speed:
 OC768,
  Loopback: Local, FCS: 16, Payload scrambler: Enabled
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps Internal: 0x4000
  Link flags     : No-Keepalives
  Hold-times     : Up 0 ms, Down 0 ms
  CoS queues     : 8 supported, 8 maximum usable queues
  Last flapped   : 2006-01-13 10:43:39 PST (01:05:33 ago)
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :                76992                  200 bps
   Output bytes  :                83707                  216 bps
   Input  packets:                 1343                    0 pps
   Output packets:                 1343                    0 pps
  Input errors:
    Errors: 0, Drops: 3885, Framing errors: 68154624, Runts: 0, Giants: 0, Bucket
 drops: 0,
    Policed discards: 0, L3 incompletes: 95040248, L2 channel errors: 0, L2
mismatch timeouts: 0,
    HS link CRC errors: 0, HS link FIFO overflows: 30742070
  Output errors:
    Carrier transitions: 1, Errors: 0, Drops: 0, Aged packets: 0, HS link FIFO
underflows: 0,
    MTU errors: 0
  Egress queues: 8 supported, 4 in use
  Queue counters:       Queued packets  Transmitted packets      Dropped packets

    0 best-effort                    2                    2                    0

    1 expedited-fo                   0                    0                    0

    2 assured-forw                   0                    0                    0

    3 network-cont                1341                 1341                    0

  SONET alarms   : None
  SONET defects  : None
  Link : 0
  SONET alarms   : None
  SONET defects  : None
  SONET PHY:            Seconds        Count  State
    PLL Lock                  0            0  OK
    PHY Light                 0            0  OK
  SONET section:
```

```
  BIP-B1                    0           0
  SEF                       2           1  OK
  LOS                       0           0  OK
  LOF                       3           2  OK
  ES-S                      2
  SES-S                     2
  SEFS-S                    2
SONET line:
  BIP-B2                    0           0
  REI-L                     0           0
  RDI-L                     1           1  OK
  AIS-L                     2           1  OK
  BERR-SF                   0           0  OK
  BERR-SD                   0           0  OK
  ES-L                      3
  SES-L                     3
  UAS-L                     0
  ES-LFE                    1
  SES-LFE                   1
  UAS-LFE                   0
SONET path:
  BIP-B3                    0           0
  REI-P                     0           0
  LOP-P                     0           0  OK
  AIS-P                     2           1  OK
  RDI-P                     0           0  OK
  UNEQ-P                    0           0  OK
  PLM-P                     0           0  OK
  ES-P                      3
  SES-P                     3
  UAS-P                     0
  ES-PFE                    0
  SES-PFE                   0
  UAS-PFE                   0
Payload pointer:
  Current pointer             :  522
  Pointer increment count     :  0
  Pointer decrement count     :  0
  New pointer NDF count       :  0
Received SONET overhead:
  F1      : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0xcf, C2(cmp) : 0xcf, F2      : 0x00
  Z3      : 0x00, Z4      : 0x00, S1(cmp) : 0x00
Transmitted SONET overhead:
  F1      : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0xcf, F2      : 0x00, Z3      : 0x00
  Z4      : 0x00
Received path trace: fold so-7/0/0
  66 6f 6c 64 20 73 6f 2d 37 2f 30 2f 30 00 00 00   fold so-7/0/0...
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 0d 0a ................
Transmitted path trace: fold so-7/0/0
  66 6f 6c 64 20 73 6f 2d 37 2f 30 2f 30 00 00 00   fold so-7/0/0...
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
Link : 1
SONET alarms   : None
SONET defects  : None
```

```
SONET PHY:             Seconds        Count  State
  PLL Lock                   0            0  OK
  PHY Light                  0            0  OK
SONET section:
  BIP-B1                     0            0
  SEF                        2            1  OK
  LOS                        0            0  OK
  LOF                        3            2  OK
  ES-S                       2
  SES-S                      2
  SEFS-S                     2
SONET line:
  BIP-B2                     0            0
  REI-L                      0            0
  RDI-L                      0            0  OK
  AIS-L                      2            1  OK
  BERR-SF                    0            0  OK
  BERR-SD                    0            0  OK
  ES-L                       3
  SES-L                      3
  UAS-L                      0
  ES-LFE                     0
  SES-LFE                    0
  UAS-LFE                    0
SONET path:
  BIP-B3                     0            0
  REI-P                      0            0
  LOP-P                      0            0  OK
  AIS-P                      2            1  OK
  RDI-P                      0            0  OK
  UNEQ-P                     0            0  OK
  PLM-P                      0            0  OK
  ES-P                       3
  SES-P                      3
  UAS-P                      0
  ES-PFE                     0
  SES-PFE                    0
  UAS-PFE                    0
Payload pointer:
  Current pointer              :  522
  Pointer increment count      :  0
  Pointer decrement count      :  0
  New pointer NDF count        :  0
Received SONET overhead:
  F1      : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0xcf, C2(cmp) : 0xcf, F2      : 0x00
  Z3      : 0x00, Z4      : 0x00, S1(cmp) : 0x00
Transmitted SONET overhead:
  F1      : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0xcf, F2      : 0x00, Z3      : 0x00
  Z4      : 0x00
Received path trace: fold so-7/0/0
  66 6f 6c 64 20 73 6f 2d 37 2f 30 2f 30 00 00 00   fold so-7/0/0...
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 0d 0a ................
Transmitted path trace: fold so-7/0/0
  66 6f 6c 64 20 73 6f 2d 37 2f 30 2f 30 00 00 00   fold so-7/0/0...
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
```

```
   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
...
```

show interfaces detail (IPv6 Tracking)

```
user@host> show interfaces so-0/2/0 detail
Physical interface: so-0/2/0, Enabled, Physical link is Up
   Interface index: 130, SNMP ifIndex: 26, Generation: 131
   Link-level type: PPP, MTU: 4474, Clocking: Internal, SONET mode,
Speed: OC3,
   Loopback: None, FCS: 16, Payload scrambler: Enabled
   Device flags   : Present Running
   Interface flags: Point-To-Point SNMP-Traps Internal: 0x4000
   Link flags     : Keepalives
   Hold-times     : Up 0 ms, Down 0 ms
   Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
   Keepalive statistics:
     Input : 7 (last seen 00:00:01 ago)
     Output: 6 (last sent 00:00:08 ago)
   LCP state: Opened
   NCP state: inet: Not-configured, inet6: Opened, iso: Not- configured, mpls:
   Not-configured
   CHAP state: Closed
   PAP state: Closed
   CoS queues     : 4 supported, 4 maximum usable queues
   Last flapped   : 2007-11-29 08:45:47 PST (1d 03:44 ago)
   Statistics last cleared: Never
   Traffic statistics:
    Input  bytes  :              7407782                   40 bps
    Output bytes  :              7307322                   48 bps
    Input  packets:               107570                    0 pps
    Output packets:               108893                    0 pps
    IPv6 transit statistics:
     Input  bytes  :               57328
     Output bytes  :               57400
     Input  packets:                1024
     Output packets:                1025
   Egress queues: 4 supported, 4 in use
   Queue counters:       Queued packets  Transmitted packets   Dropped packets
     0 best-effort       1191             1191                 0
     1 expedited-fo      0                0                    0
     2 assured-forw      0                0                    0
     3 network-cont      107700           107700               0
   SONET alarms   : None
   SONET defects  : None

   Logical interface so-0/2/0.0 (Index 70) (SNMP ifIndex 47) (Generation 231)
     Flags: Point-To-Point SNMP-Traps 0x4000 Encapsulation: PPP
     Protocol inet6, MTU: 4470, Generation: 433, Route table: 0
       Flags: None
       Addresses, Flags: Is-Preferred Is-Primary
         Destination:  2001:db8::2:1/32, Local:  2001:db8::2:2,
         Broadcast: Unspecified, Generation: 683
       Addresses, Flags: Is-Preferred
         Destination:  2001:db8::1:2, Local: 2001:db8::1:3,
         Broadcast: Unspecified, Generation: 684
```

show interfaces (Shared Interface)

```
user@rsd1> show interfaces so-7/2/0
Physical interface: so-7/2/0, Enabled, Physical link is Down
  Interface index: 128, SNMP ifIndex: 109
  Link-level type: Frame-Relay, MTU: 4474, Clocking: Internal, SONET mode,
  Speed: OC192, Loopback: None, FCS: 16, Payload scrambler: Enabled
  Device flags   : Present Running Down
  Interface flags: Hardware-Down Point-To-Point SNMP-Traps Internal: 0x4000
  Shared-interface  : Owner
  Link flags     : No-Keepalives DTE
  ANSI LMI settings: n391dte 6, n392dte 3, n393dte 4, t391dte 10 seconds
  LMI: Input: 0 (never), Output: 0 (never)
  DTE statistics:
    Enquiries sent                      : 0
    Full enquiries sent                 : 0
    Enquiry responses received          : 0
    Full enquiry responses received     : 0
  DCE statistics:
    Enquiries received                  : 0
    Full enquiries received             : 0
    Enquiry responses sent              : 0
    Full enquiry responses sent         : 0
  Common statistics:
    Unknown messages received           : 0
    Asynchronous updates received       : 0
    Out-of-sequence packets received    : 0
    Keepalive responses timedout        : 0
  CoS queues     : 8 supported, 8 maximum usable queues
  Last flapped   : 2008-08-11 10:51:51 PDT (1w1d 04:47 ago)
  Input rate     : 0 bps (0 pps)
  Output rate    : 0 bps (0 pps)
  SONET alarms   : LOL, PLL
  SONET defects  : LOL, PLL, LOF, SEF, AIS-L, AIS-P

  Logical interface so-7/2/0.0 (Index 67) (SNMP ifIndex 117)
    Flags: Device-Down Point-To-Point SNMP-Traps 0x4000 Encapsulation: FR-NLPID
    Shared interface:
      Shared with: psd5
      Tunnel token: Rx: 2.517, Tx: 1.517
    Input packets : 0
    Output packets: 0
    DLCI 700
      Flags: Active
      Total down time: 00:01:09 sec, Last down: 284:58:21 ago
        Input packets : 0
        Output packets: 0
  DLCI statistics:
    Active DLCI  :1  Inactive DLCI  :0
```

show interfaces diagnostics optics (SONET)

Syntax show interfaces diagnostics optics so-*fpc/pic/port*

Release Information Command introduced in Junos OS Release 7.5.

Description (M320, T320, T640, and T1600 routers only) For SONET/SDH interfaces that support optical diagnostics and monitoring, display transceiver diagnostics and data alarms.

Options **so-*fpc/pic/port***—SONET/SDH interface name.

Additional Information The transceivers are polled in 1-second intervals for diagnostics data, alarms, and warnings and stores them into memory. The alarms will not cause the links to go down or the LEDs to change color or generate SNMP traps. Changes in alarm and warning status will generate system log messages.

Thresholds that trigger a high alarm, low alarm, high warning, or low warning are set by the transceiver vendors. Generally, a high alarm or low alarm indicates that the optics module is not operating properly. This information can be used to diagnose why a PIC is not working.

In the output fields, when an alarm is **On**, this indicates an error condition. Alarm **Off** indicates normal operation.

NOTE: The **show interfaces diagnostics optics** command for optical interfaces does not report the decibel (dBm) value of the received signal if the received power is zero milliwatts (0.0000 mW).

Required Privilege Level view

Related Documentation
- SONET/SDH Interfaces Overview on page 3

List of Sample Output
show interfaces diagnostics optics (OC768 PIC) on page 308
show interfaces diagnostics optics (Multi-rate SONET/SDH PICs with SFP) on page 309
show interfaces diagnostics optics (OC192 PICs with XFP) on page 309

Output Fields Table 30 on page 302 lists the output fields for the **show interfaces diagnostics optics** command for OC768 PICs. Output fields are listed in the approximate order in which they appear.

Table 30: OC768 PIC show interfaces diagnostics optics Output Fields

Field Name	Field Description
Physical interface	Name of the physical interface.
Laser bias current	Magnitude of the laser bias power setting current, in milliamperes. This indicator is a software equivalent to the **LsBIASMON** pin in hardware.
Laser output power	Laser output power, in milliwatts (mW) and decibels, referenced to 1.0 mW (dBm). This is a software equivalent to the **LsPOWMON** pin in hardware.
Receiver signal average optical power	Average received optical power, in mW and dBm. This indicator is a software equivalent to the **RxPOWMON** pin in hardware. Average optical power is vendor-specific.
Laser end-of-life alarm	Laser end-of-life alarm: **On** or **Off**.
Laser wavelength alarm	Laser wavelength alarm: **On** or **Off**.
Laser bias current alarm	Laser bias current alarm: **On** or **Off**.
Laser temperature alarm	Laser temperature alarm: **On** or **Off**.
Laser power alarm	Laser power alarm: **On** or **Off**.
Modulator temperature alarm	Modulator temperature alarm: **On** or **Off**. Transceivers from some vendors do not support this field.
Modulator bias alarm	Modulator bias alarm: **On** or **Off**.
Tx multiplexer FIFO error alarm	Transmit multiplexer first in, first out (FIFO) error alarm: **On** or **Off**.
Tx loss of PLL lock alarm	Transmit loss of phase-locked loop (PLL) lock alarm: **On** or **Off**.
Rx loss of average optical power alarm	Receive loss of average optical power alarm: **On** or **Off**.
Rx loss of AC power alarm	Receive loss of AC power alarm: **On** or **Off**. Transceivers from some vendors do not support this field.
Rx loss of PLL lock alarm	Receive loss of phase-locked loop (PLL) lock alarm: **On** or **Off**.

Table 31 on page 303 lists the output fields for the **show interfaces diagnostics optics** command for multi-rate SONET/SDH PICs with SFP transceivers. Output fields are listed in the approximate order in which they appear.

Table 31: Multi-Rate SONET/SDH PICs with SFP show interfaces diagnostics optics Output Fields

Field Name	Field Description
Physical interface	Name of the physical interface.
Laser bias current	Magnitude of the laser bias power setting current, in milliamperes. The laser bias provides direct modulation of laser diodes and modulates currents.
Laser output power	Laser output power, in milliwatts (mW) and decibels, referenced to 1.0 mW (dBm).
Module temperature	Temperature of the XFP optics module, in Celsius and Fahrenheit.
Module voltage	Internally measured module voltage.
Receiver signal average optical power	Average received optical power, in mW and dBm.
Laser bias current high alarm	Laser bias power setting high alarm. Displays **on** or **off**.
Laser bias current low alarm	Laser bias power setting low alarm. Displays **on** or **off**.
Laser bias current high warning	Laser bias power setting high warning. Displays **on** or **off**.
Laser bias current low warning	Laser bias power setting low warning. Displays **on** or **off**.
Laser output power high alarm	Laser output power high alarm. Displays **on** or **off**.
Laser output power low alarm	Laser output power low alarm. Displays **on** or **off**.
Laser output power high warning	Laser output power high warning. Displays **on** or **off**.
Laser output power low warning	Laser output power low warning. Displays **on** or **off**.
Module temperature high alarm	Module temperature high alarm. Displays **on** or **off**.
Module temperature low alarm	Module temperature low alarm. Displays **on** or **off**.
Module temperature high warning	Module temperature high warning. Displays **on** or **off**.
Module temperature low warning	Module temperature low warning. Displays **on** or **off**.

Table 31: Multi-Rate SONET/SDH PICs with SFP show interfaces diagnostics optics Output Fields (continued)

Field Name	Field Description
Module voltage high alarm	Module voltage high alarm. Displays **on** or **off**.
Module voltage low alarm	Module voltage low alarm. Displays **on** or **off**.
Module voltage high warning	Module voltage high warning . Displays **on** or **off**.
Module voltage low warning	Module voltage high warning . Displays **on** or **off**.
Laser rx power high alarm	Receive laser power high alarm. Displays **on** or **off**.
Laser rx power low alarm	Receive laser power low alarm. Displays **on** or **off**.
Laser rx power high warning	Receive laser power high warning. Displays **on** or **off**.
Laser rx power low warning	Receive laser power low warning. Displays **on** or **off**.
Laser bias current high alarm threshold	Vendor-specified threshold for the laser bias current high alarm: **80.000 mA.**
Laser bias current low alarm threshold	Vendor-specified threshold for the laser bias current low alarm: **2.000 mA.**
Laser bias current high warning threshold	Vendor-specified threshold for the laser bias current high warning: **70.000 mA.**
Laser bias current low warning threshold	Vendor-specified threshold for the laser bias current low warning: **4.000 mA.**
Laser output power high alarm threshold	Vendor-specified threshold for the laser output power high alarm: **1.2600 mW** or **1.00 dBm.**
Laser output power low alarm threshold	Vendor-specified threshold for the laser output power low alarm: **0.0440 mW** or **-13.57 dBm.**
Laser output power high warning threshold	Vendor-specified threshold for the laser output power high warning: **0.7950 mW** or **-1.00 dBm.**
Laser output power low warning threshold	Vendor-specified threshold for the laser output power low warning: **0.0700 mW** or **-11.55 dBm.**

Table 31: Multi-Rate SONET/SDH PICs with SFP show interfaces diagnostics optics Output Fields (continued)

Field Name	Field Description
Module temperature high alarm threshold	Vendor-specified threshold for the module temperature high alarm: **110**° C or **230**° F.
Module temperature low alarm threshold	Vendor-specified threshold for the module temperature low alarm: **-40**° C or **-40**° F.
Module temperature high warning threshold	Vendor-specified threshold for the module temperature high warning: **93**° C or **199**° F.
Module temperature low warning threshold	Vendor-specified threshold for the module temperature low warning: **-30**° C or **-22**° F.
Module voltage high alarm threshold	Module voltage high alarm threshold: **3.900 v**.
Module voltage low alarm threshold	Module voltage low alarm threshold: **2.700 v**.
Module voltage high warning threshold	Module voltage high warning threshold: **3.700 v**.
Module voltage low warning threshold	Module voltage high warning threshold: **2.900 v**.
Laser rx power high alarm threshold	Vendor-specified threshold for the laser Rx power high alarm: **1.1749 mW** or **0.70 dBm.**
Laser rx power low alarm threshold	Vendor-specified threshold for the laser Rx power low alarm: **0.0039 mW** or **-24.09 dBm.**
Laser rx power high warning threshold	Vendor-specified threshold for the laser Rx power high warning: **0.7942 mW** or **1.00 dBm.**
Laser rx power low warning threshold	Vendor-specified threshold for the laser Rx power low warning: **0.0100 mW** or **-20.00 dBm.**

Table 32 on page 305 lists the output fields for the **show interfaces diagnostics optics** command for OC192 PICs with XFP transceivers. Output fields are listed in the approximate order in which they appear.

Table 32: OC192 PIC with XFP show interfaces diagnostics optics Output Fields

Field Name	Field Description
Physical interface	Name of the physical interface.
Link	(For 4-port OC192c PIC operating in OC768-over-4xOC192 mode) The link number. Diagnostics and alarms are displayed for each link.

Table 32: OC192 PIC with XFP show interfaces diagnostics optics Output Fields (continued)

Field Name	Field Description
Laser bias current	Magnitude of the laser bias power setting current, in milliamperes. The laser bias provides direct modulation of laser diodes and modulates currents.
Laser output power	Laser output power, in milliwatts (mW) and decibels, referenced to 1.0 mW (dBm). This is a software equivalent to the **LsPOWMON** pin in hardware.
Module temperature	Temperature of the XFP optics module, in Celsius and Fahrenheit.
Laser rx power	Laser received optical power, in mW and dBm.
Laser bias current high alarm	Laser bias power setting high alarm. Displays **on** or **off**.
Laser bias current low alarm	Laser bias power setting low alarm. Displays **on** or **off**.
Laser bias current high warning	Laser bias power setting high warning. Displays **on** or **off**.
Laser bias current low warning	Laser bias power setting low warning. Displays **on** or **off**.
Laser output power high alarm	Laser output power high alarm. Displays **on** or **off**.
Laser output power low alarm	Laser output power low alarm. Displays **on** or **off**.
Laser output power high warning	Laser output power high warning. Displays **on** or **off**.
Laser output power low warning	Laser output power low warning. Displays **on** or **off**.
Module temperature high alarm	Module temperature high alarm. Displays **on** or **off**.
Module temperature low alarm	Module temperature low alarm. Displays **on** or **off**.
Module temperature high warning	Module temperature high warning. Displays **on** or **off**.
Module temperature low warning	Module temperature low warning. Displays **on** or **off**.
Laser rx power high alarm	Receive laser power high alarm. Displays **on** or **off**.

Table 32: OC192 PIC with XFP show interfaces diagnostics optics Output Fields (continued)

Field Name	Field Description
Laser rx power low alarm	Receive laser power low alarm. Displays **on** or **off**.
Laser rx power high warning	Receive laser power high warning. Displays **on** or **off**.
Laser rx power low warning	Receive laser power low warning. Displays **on** or **off**.
Module not ready alarm	Module not ready alarm. When **on**, indicates the module has an operational fault. Displays **on** or **off**.
Module power down alarm	Module power down alarm. When **on**, module is in a limited power mode, low for normal operation. Displays on or off.
Tx data not ready alarm	Any condition leading to invalid data on the transmit path. Displays **on** or **off**.
Tx not ready alarm	Any condition leading to invalid data on the transmit path. Displays **on** or **off**.
Tx laser fault alarm	Laser fault condition. Displays **on** or **off**.
Tx CDR loss of lock alarm	Transmit clock and data recovery (CDR) loss of lock. Loss of lock on the transmit side of the CDR. Displays **on** or **off**.
Rx not ready alarm	Any condition leading to invalid data on the receive path. Displays **on** or **off**.
Rx loss of signal alarm	Receive Loss of Signal alarm. When **on**, indicates insufficient optical input power to the module. Displays **on** or **off**.
Rx CDR loss of lock alarm	Receive CDR loss of lock. Loss of lock on the receive side of the CDR. Displays **on** or **off**.
Laser bias current high alarm threshold	Vendor-specified threshold for the laser bias current high alarm: **130.000 mA.**
Laser bias current low alarm threshold	Vendor-specified threshold for the laser bias current low alarm: **10.000 mA.**
Laser bias current high warning threshold	Vendor-specified threshold for the laser bias current high warning: **120.000 mA.**
Laser bias current low warning threshold	Vendor-specified threshold for the laser bias current low warning: **12.000 mA.**
Laser output power high alarm threshold	Vendor-specified threshold for the laser output power high alarm: **0.8910 mW** or **-0.50 dBm.**
Laser output power low alarm threshold	Vendor-specified threshold for the laser output power low alarm: **0.2230 mW** or **-6.52 dBm.**

Table 32: OC192 PIC with XFP show interfaces diagnostics optics Output Fields (continued)

Field Name	Field Description
Laser output power high warning threshold	Vendor-specified threshold for the laser output power high warning: **0.7940 mW** or **-100 dBm.**
Laser output power low warning threshold	Vendor-specified threshold for the laser output power low warning: **0.2510 mW** or **-600dBm.**
Module temperature high alarm threshold	Vendor-specified threshold for the module temperature high alarm: **90 °C** or **194 °F.**
Module temperature low alarm threshold	Vendor-specified threshold for the module temperature low alarm: **-5 °C** or **23 °F.**
Module temperature high warning threshold	Vendor-specified threshold for the module temperature high warning: **85 °C** or **185 °F.**
Module temperature low warning threshold	Vendor-specified threshold for the module temperature low warning: **0 °C** or **32 °F.**
Laser rx power high alarm threshold	Vendor-specified threshold for the laser Rx power high alarm: **1.2589 mW** or **1.00 dBm.**
Laser rx power low alarm threshold	Vendor-specified threshold for the laser Rx power low alarm: **0.0323 mW** or **-14.91 dBm.**
Laser rx power high warning threshold	Vendor-specified threshold for the laser Rx power high warning: **1.1220 mW** or **0.50 dBm.**
Laser rx power low warning threshold	Vendor-specified threshold for the laser Rx power low warning: **0.0363 mW** or **-14.40 dBm.**

Sample Output

show interfaces diagnostics optics (OC768 PIC)

```
user@host> show interfaces diagnostics optics so-4/0/0

Physical interface: so-4/0/0
  Laser bias current                    :  79.938 mA
  Laser output power                    :  1.592 mW / 2.02 dBm
  Receiver signal average optical power :  1.3854 mW / 1.42 dBm
  Laser end-of-life alarm               :  Off
  Laser wavelength alarm                :  Off
  Laser bias current alarm              :  Off
  Laser temperature alarm               :  Off
  Laser power alarm                     :  Off
  Modulator temperature alarm           :  Off
  Modulator bias alarm                  :  Off
  Tx multiplexer FIFO error alarm       :  Off
  Tx loss of PLL lock alarm             :  Off
  Rx loss of average optical power alarm:  Off
```

```
  Rx loss of AC power alarm            :  Off
  Rx loss of PLL lock alarm            :  Off
```

show interfaces diagnostics optics (Multi-rate SONET/SDH PICs with SFP)

```
user@host> show interfaces diagnostics optics so-1/0/0
```

```
Physical interface: so-1/0/0
    Laser bias current                        :  24.008 mA
    Laser output power                        :  0.2620 mW / -5.82 dBm
    Module temperature                        :  62 degrees C / 144 degrees F
    Module voltage                            :  3.3280 V
    Receiver signal average optical power     :  0.2685 mW / -5.71 dBm
    Laser bias current high alarm             :  Off
    Laser bias current low alarm              :  Off
    Laser bias current high warning           :  Off
    Laser bias current low warning            :  Off
    Laser output power high alarm             :  Off
    Laser output power low alarm              :  Off
    Laser output power high warning           :  Off
    Laser output power low warning            :  Off
    Module temperature high alarm             :  Off
    Module temperature low alarm              :  Off
    Module temperature high warning           :  Off
    Module temperature low warning            :  Off
    Module voltage high alarm                 :  Off
    Module voltage low alarm                  :  Off
    Module voltage high warning               :  Off
    Module voltage low warning                :  Off
    Laser rx power high alarm                 :  Off
    Laser rx power low alarm                  :  Off
    Laser rx power high warning               :  Off
    Laser rx power low warning                :  Off
    Laser bias current high alarm threshold   :  80.000 mA
    Laser bias current low alarm threshold    :  2.000 mA
    Laser bias current high warning threshold :  70.000 mA
    Laser bias current low warning threshold  :  4.000 mA
    Laser output power high alarm threshold   :  1.2600 mW / 1.00 dBm
    Laser output power low alarm threshold    :  0.0440 mW / -13.57 dBm
    Laser output power high warning threshold :  0.7950 mW / -1.00 dBm
    Laser output power low warning threshold  :  0.0700 mW / -11.55 dBm
    Module temperature high alarm threshold   :  110 degrees C / 230 degrees F
    Module temperature low alarm threshold    :  -40 degrees C / -40 degrees F
    Module temperature high warning threshold :  93 degrees C / 199 degrees F
    Module temperature low warning threshold  :  -30 degrees C / -22 degrees F
    Module voltage high alarm threshold       :  3.900 V
    Module voltage low alarm threshold        :  2.700 V
    Module voltage high warning threshold     :  3.700 V
    Module voltage low warning threshold      :  2.900 V
    Laser rx power high alarm threshold       :  1.1749 mW / 0.70 dBm
    Laser rx power low alarm threshold        :  0.0039 mW / -24.09 dBm
    Laser rx power high warning threshold     :  0.7942 mW / -1.00 dBm
    Laser rx power low warning threshold      :  0.0100 mW / -20.00 dBm
```

show interfaces diagnostics optics (OC192 PICs with XFP)

```
user@host> show interfaces diagnostics optics so-7/0/0
```

```
Physical interface: so-7/0/0
  Link : 0
  Laser bias current                         :  50.776 mA
  Laser output power                         :  0.4030 mW / -3.95 dBm
  Laser temperature                          :  29.0 degrees C / 84.2 degrees F
  Laser rx power                             :  0.4671 mW / -3.31 dBm
  Laser bias current high alarm              :  Off
  Laser bias current low alarm               :  Off
  Laser bias current high warning            :  Off
  Laser bias current low warning             :  Off
  Laser output power high alarm              :  Off
  Laser output power low alarm               :  Off
  Laser output power high warning            :  Off
  Laser output power low warning             :  Off
  Laser temperature high alarm               :  Off
  Laser temperature low alarm                :  Off
  Laser temperature high warning             :  Off
  Laser temperature low warning              :  Off
  Laser rx power high alarm                  :  Off
  Laser rx power low alarm                   :  Off
  Laser rx power high warning                :  Off
  Laser rx power low warning                 :  Off
  Module not ready alarm                     :  Off
  Module power down alarm                    :  Off
  Tx data not ready alarm                    :  Off
  Tx not ready alarm                         :  Off
  Tx laser fault alarm                       :  Off
  Tx CDR loss of lock alarm                  :  Off
  Rx not ready alarm                         :  Off
  Rx loss of signal alarm                    :  Off
  Rx CDR loss of lock alarm                  :  Off
  Laser bias current high alarm threshold    :  130.000 mA
  Laser bias current low alarm threshold     :  10.000 mA
  Laser bias current high warning threshold  :  120.000 mA
  Laser bias current low warning threshold   :  12.000 mA
  Laser output power high alarm threshold    :  0.8910 mW / -0.50 dBm
  Laser output power low alarm threshold     :  0.2230 mW / -6.52 dBm
  Laser output power high warning threshold  :  0.7940 mW / -1.00 dBm
  Laser output power low warning threshold   :  0.2510 mW / -6.00 dBm
  Laser temperature high alarm threshold     :  90.0 degrees C / 194.0 degrees F
  Laser temperature low alarm threshold      :  -5.0 degrees C / 23.0 degrees F
  Laser temperature high warning threshold   :  85.0 degrees C / 185.0 degrees F
  Laser temperature low warning threshold    :  0.0 degrees C / 32.0 degrees F
  Laser rx power high alarm threshold        :  1.2589 mW / 1.00 dBm
  Laser rx power low alarm threshold         :  0.0323 mW / -14.91 dBm
  Laser rx power high warning threshold      :  1.1220 mW / 0.50 dBm
  Laser rx power low warning threshold       :  0.0363 mW / -14.40 dBm
...
```