JUNIPER NETWORKS

Junos® OS

Circuit Emulation Interfaces Feature Guide for Routing Devices

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The information in this document is current as of the date on the title page.

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Documentation and Release Notes

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

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Supported Platforms

For the features described in this document, the following platforms are supported:

- M Series
- MX Series
- J Series

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 the *CLI User Guide*.

Documentation Conventions

Table 1 on page xiii 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.

Table 2 on page xiii 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`

Table 2: Text and Syntax Conventions *(continued)*

Convention	Description	Examples
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)	Enclose 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)	Enclose a variable for which you can substitute one or more values.	**community name members [** ***community-ids*** **]**

Indention and braces ({ })	Identify 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.	
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, comments, and suggestions so that we can improve the documentation. You can send your comments to techpubs-comments@juniper.net, or fill out the documentation feedback form at https://www.juniper.net/cgi-bin/docbugreport/ . If you are using e-mail, be sure to include the following information with your comments:

- Document or topic name
- URL or page number
- Software release version (if applicable)

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or JNASC support contract, or are covered under warranty, and need post-sales technical support, you can access our tools and resources online or open a case with JTAC.

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

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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: http://www.juniper.net/customers/support/
- Search for known bugs: http://www2.juniper.net/kb/
- Find product documentation: http://www.juniper.net/techpubs/
- Find solutions and answer questions using our Knowledge Base: http://kb.juniper.net/
- Download the latest versions of software and review release notes: http://www.juniper.net/customers/csc/software/
- Search technical bulletins for relevant hardware and software notifications: https://www.juniper.net/alerts/

- Join and participate in the Juniper Networks Community Forum: http://www.juniper.net/company/communities/
- Open a case online in the CSC Case Management tool: http://www.juniper.net/cm/

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

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 http://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 http://www.juniper.net/support/requesting-support.html.

PART 1

Overview

CHAPTER 1

Circuit Emulation Interfaces

Mobile Backhaul and Circuit Emulation Overview

Juniper Networks IP/MPLS-based mobile backhaul solutions provide the following benefits:

- Flexibility to support converged networks that accommodate both IP and legacy services (leveraging proven circuit emulation techniques).
- Scalability to support emerging data-intensive technologies.
- Cost-effectiveness to compensate for rising levels of backhaul traffic.

M7i, M10i, M40e, M120, and M320 routers with 12-port T1/E1 interfaces, 4-port Channelized OC3/STM1 interfaces, and MX Series routers with ATM MICs with SFP, with 2-port OC3/STM1 or 8-port OC12/STM4 circuit emulation interfaces, offer IP/MPLS-based mobile backhaul solutions that enable operators to combine diverse transport technologies onto a single transport architecture, to reduce operating costs while enhancing user features and increasing profits. This architecture accommodates the backhaul of legacy services, emerging IP-based services, location-based services, mobile gaming and mobile TV, and new emerging technologies such as LTE and WiMAX.

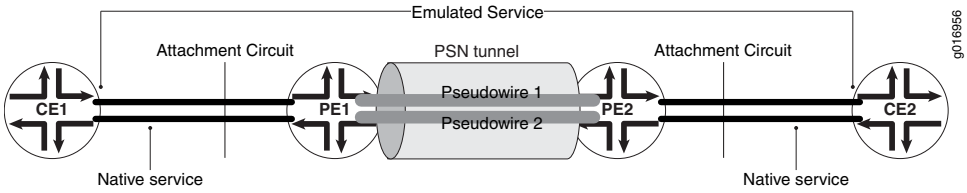
Related Documentation

- Mobile Backhaul Application Overview on page 4
- Understanding Circuit Emulation PIC Types on page 5
- Understanding Circuit Emulation PIC Clocking Features on page 6
- Understanding T1 and E1 Options Exceptions on Circuit Emulation PICs on page 7
- Displaying Information About Circuit Emulation PICs on page 25

Mobile Backhaul Application Overview

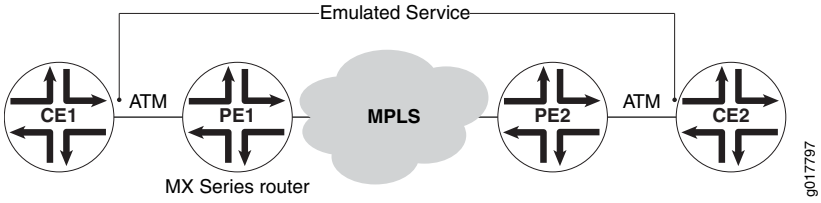
This topic provides an application example (see Figure 1 on page 4) based on the mobile backhaul reference model where customer edge 1 (CE1) is a base station controller (BSC), provider edge 1 (PE1) is a cell site router, PE2 is an M Series (aggregation) router, and CE2 is a BSC and Radio Network Controller (RNC). The Internet Engineering Task Force (RFC 3895) describes pseudowire as "a mechanism that emulates the essential attributes of a telecommunications service (such as a T1 leased line or Frame Relay) over a PSN" (Packet Switching Network).

Figure 1: Mobile Backhaul Application



For MX Series routers with ATM MICs with SFP, the mobile backhaul reference model is modified (see Figure 2 on page 4), where the provider edge 1 (PE1) router is an MX Series router with an ATM MIC with SFP. The PE2 router can be any router, such as an M Series (aggregation router) that might or might not support swapping (rewriting) of virtual path identifier (VPI) or virtual circuit identifier (VCI) values. An ATM pseudowire carries ATM cells over an MPLS network. The pseudowire encapsulation can be either cell relay or AAL5. Both modes enable sending of ATM cells between the ATM MIC and the Layer 2 network. You can configure the ATM MIC to swap the VPI value, VCI value, or both. You can also disable swapping of the values.

Figure 2: Mobile Backhaul Application on MX Series Routers with ATM MICs with SFP



Related Documentation

- ATM Cell Relay Pseudowire VPI/VCI Swapping Overview on page 74
- Mobile Backhaul and Circuit Emulation Overview on page 3

- no-vpivci-swapping on page 124
- psn-vci on page 125
- psn-vpi on page 125

Layer 2 Circuit Standards

The Junos OS substantially supports the following Layer 2 circuit standards:

- RFC 4447, *Pseudowire Setup and Maintenance Using the Label Distribution Protocol (LDP)* (except section 5.3)
- RFC 4448, *Encapsulation Methods for Transport of Ethernet over MPLS Networks*
- Internet draft draft-martini-l2circuit-encap-mpls-11.txt, *Encapsulation Methods for Transport of Layer 2 Frames Over IP and MPLS Networks* (expires August 2006)

The Junos OS has the following exceptions:

- A packet with a sequence number of 0 is treated as out of sequence.
  - Any packet that does not have the next incremental sequence number is considered out of sequence.
  - When out-of-sequence packets arrive, the expected sequence number for the neighbor is set to the sequence number in the Layer 2 circuit control word.
- Internet draft draft-martini-l2circuit-trans-mpls-19.txt, *Transport of Layer 2 Frames Over MPLS* (expires September 2006).

These drafts are available on the IETF website at **http://www.ietf.org/**.

Understanding Circuit Emulation PIC Types

The following Circuit Emulation PICs are specifically designed for mobile backhaul applications:

- 4-port Channelized OC3/STM1 Circuit Emulation PIC
- 12-port T1/E1 Circuit Emulation PIC
- 8-port OC3/STM1 or 12-port OC12/STM4 ATM MIC

The four-port Channelized OC3/STM1 Circuit Emulation PIC allows each of its four ports to be independently configured to either SONET or SDH framing mode, and supports mixed SAToP and ATM interfaces on any port. In SONET mode, each OC3 port can be channelized down to 3 coc1 channels, and then each coc1 can channel down to 28 T1 channels. In SDH mode, each STM1 port can be channelized down to 4 cau4 channels, and then each cau4 can channel down to 63 E1 channels. The T1/E1 channels support time-division multiplexing (TDM) interfaces using the Structure-Agnostic time-division multiplexing over Packet (SAToP) protocol [RFC 4553] encapsulation, and support T1/E1 and SONET clocking features. Mixing T1 and E1 channels is not supported on individual ports.

The 12-port Channelized T1/E1 Circuit Emulation PIC supports TDM interfaces using the SAToP protocol [RFC 4553] encapsulation, and supports T1/E1 and SONET clocking features. The 12-port Channelized T1/E1 Circuit Emulation PIC can be configured to work as either 12 T1s or 12 E1s. Mixing T1s and E1s is not supported.

The 8-port OC3/STM1 or 2-port OC12/STM4 Circuit Emulation ATM MIC supports both SONET and SDH framing mode. The mode can be set at the MIC level or at the port level. ATM MICs are rate-selectable at the following rates: 2-port OC12 or 8-port OC3. The ATM MIC supports ATM pseudowire encapsulation and swapping of VPI and VCI values in both directions.

NOTE: **Cell-relay VPI/VCI swapping and cell-relay VPI swapping on both egress and ingress are not compatible with the ATM policing feature.**

Related Documentation

- Configuring the PIC Type on page 86
- Displaying Information About Circuit Emulation PICs on page 25

Understanding Circuit Emulation PIC Clocking Features

All Circuit Emulation PICs support the following clocking features:

- External clocking—Also known as *loop timing.* Clock is distributed via TDM interfaces.
- Internal clocking with external synchronization—Also known as *external timing* or *external synchronization.*
- Internal clocking with PIC-level line synchronization—The PIC's internal clock is synchronized with a clock recovered from a TDM interface local to the PIC.

This feature set is useful for aggregation in mobile backhaul applications.

NOTE: **The primary reference source (PRS) of the clock recovered from one interface may not be the same as that of another TDM interface. There is a limitation on the number of timing domains that can be supported in practice.**

Related Documentation

- Mobile Backhaul Application Overview on page 4
- Mobile Backhaul and Circuit Emulation Overview on page 3

Understanding T1 and E1 Options Exceptions on Circuit Emulation PICs

The 12-port T1/E1 Circuit Emulation PICs support T1 and E1 options with the following exceptions:

- **bert-algorithm**, **bert-error-rate**, and **bert-period** options are supported for CT1 or CE1 configurations only.
- **framing** is supported for CT1 or CE1 configurations only. It is not applicable in SAToP configurations.
- **buildout** is supported in CT1 configurations only.
- **line-encoding** is supported in CT1 configurations only.
- **loopback *local*** and **loopback *remote*** are supported in CE1 and CT1 configurations only.
- **loopback payload** is not supported. It is not applicable in SAToP configurations.
- **idle-cycle-flag** is not supported. It is not applicable in SAToP or ATM configurations.
- **start-end-flag** is not supported. It is not applicable in SAToP or ATM configurations.
- **invert-data** is not supported. It is not applicable in SAToP configurations.
- **fcs32** is not supported. **fcs** is not applicable in SAToP or ATM configurations.
- **timeslots** is not supported. It is not applicable in SAToP configurations.
- **byte-encoding nx56** is not supported. It is not applicable in SAToP or ATM configurations.
- **crc-major-alarm-threshold** and **crc-minor-alarm-threshold** are not supported.
- **remote-loopback-respond** is not supported. It is not applicable in SAToP configurations.

The 4-port Channelized OC3/STM1 Circuit Emulation PICs support T1 and E1 options with the following exceptions:

- **bert-algorithm**, **bert-error-rate**, and **bert-period** options are supported for CT1 or CE1 configurations only.
- **framing** is supported for CT1 or CE1 configurations only. It is not applicable in SAToP configurations.
- **buildout** is supported in CT1 configurations only.
- **line-encoding** is supported in CT1 configurations only.
- **loopback *local*** and **loopback *remote*** are supported in CE1 and CT1 configurations only. By default, no loopback is configured.
- **loopback payload** is not supported. It is not applicable in SAToP configurations.
- **idle-cycle-flag** is not supported. It is not applicable in SAToP configurations.
- **start-end-flag** is not supported. It is not applicable in SAToP configurations.
- **invert-data** is not supported. It is not applicable in SAToP configurations.
- **fcs16** is not supported in E1 and T1 configurations only.

- **fcs32** is not supported in E1 and T1 configurations only. It is not applicable in SAToP configurations.
- **timeslots** is not supported. It is not applicable in SAToP or ATM configurations.
- **byte-encoding** is not supported in T1 configurations only. It is not applicable in SAToP configurations. **nx56** byte encoding is not supported.
- **crc-major-alarm-threshold** and **crc-minor-alarm-threshold** are T1 options supported in SAToP configurations only.
- **remote-loopback-respond** is not supported. It is not applicable in SAToP configurations.
- If you attempt to configure the local loopback capability on an AT interface (ATM1 or ATM2 intelligent queuing (IQ) interface or a virtual ATM interface on a Circuit Emulation (CE) interface) by including the **loopback local** statement at the **[edit interfaces at-*fpc/pic/port* e1-options]**, **[edit interfaces at-*fpc/pic/port* e3-options]**, **[edit interfaces at-*fpc/pic/port* t1-options]**, or the **[edit interfaces at-*fpc/pic/port* t3-options]** hierarchy level (to define the E1, E3, T1, or T3 physical interface properties) and commit the configuration, the commit is successful. However, local loopback on AT interfaces does not take effect and a system log message is generated stating that local loopback is not supported. You must not configure local loopback because it is not supported on AT interfaces.

Related Documentation

- Configuring the 4-Port Channelized COC3/STM1 Circuit Emulation PIC Operating Mode on page 65
- Configuring the 12-Port Channelized T1/E1 Circuit Emulation PIC Operating Mode on page 63

Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP Overview

The Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP is a channelized circuit emulation MIC with rate-selectability. You can specify its port speed as COC3-CSTM1 or COC12-CSTM4. The default port speed is COC3-CSTM1.

The following features are supported on this MIC:

- Per-MIC SONET/SDH framing
- Internal and loop clocking
- Structure-Agnostic time-division multiplexing (TDM) over Packet (SAToP)
- Structure-aware time-division multiplexed Circuit Emulation Service over Packet Switched Network (CESoPSN)
- Pseudowire Emulation Edge to Edge (PWE3) control word for use over an MPLS packet-switched network (PSN)

Related Documentation

- *Configuring Channelized IQ and IQE SONET/SDH Loop Timing*
- Configuring SAToP on Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP on page 33

- Configuring CESoPSN on Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP on page 47

16-Port Channelized E1/T1 Circuit Emulation MIC Overview

The Channelized E1/T1 Circuit Emulation MIC (MIC-3D-16CHE1-T1-CE) is a channelized MIC with 16 E1 or T1 ports. The following features are supported on this MIC:

- Each MIC can be separately configured in either T1 or E1 framing mode.
- Each T1 port supports the following framing modes:
  - Superframe (D4)
  - Extended superframe (ESF)
- Each E1 port supports the following framing modes:
  - G704 with CRC4
  - G704 without CRC4
  - Unframed
- Clear channel and *N*xDS0 channelization. For T1 the value of *N* ranges from 1 through 24 and for E1 the value of *N* ranges from 1 through 31.
- Diagnostic features:
  - T1/E1
  - T1 facilities data link (FDL)
  - Channel service unit (CSU)
  - Bit error rate test (BERT)
  - Juniper Integrity Test (JIT)
- T1/E1 alarm and performance monitoring (a Layer 1 OAM function)
- External (loop) timing and internal (system) timing
- TDM circuit emulation services CESoPSN and SAToP
- CoS parity with IQE PICs. The CoS features supported on MPCs are supported on this MIC.
- The following encapsulations are supported on this MIC:
  - ATM CCC cell relay
  - ATM CCC VC multiplex
  - ATM VC multiplex
  - Multilink Point-to-Point Protocol (MLPPP)
  - Multilink Frame Relay (MLFR) FRF.15

  - Multilink Frame Relay (MLFR) FRF.16
  - Point-to-Point Protocol (PPP)
  - Cisco High-Level Data Link Control
- ATM class-of-service (CoS) features—traffic shaping, scheduling, and policing
- ATM Operation, Administration, and Maintenance
- Graceful Routing Engine switchover (GRES)

NOTE:
- When GRES is enabled, clear statistics is performed and on initiating the Routing Engine switchover, the updated statistics is not reflected on the secondary Routing Engine.
- ISSU is not supported on the 16-Port Channelized E1/T1 Circuit Emulation MIC (MIC-3D-16CHE1-T1-CE).

Related Documentation

- Configuring SAToP on Channelized E1/T1 Circuit Emulation MIC on page 43
- Configuring CESoPSN on Channelized E1/T1 Circuit Emulation MIC on page 59

ATM Support on Circuit Emulation PICs Overview

M7i, M10i routers with 4-port COC3/CSTM1 Circuit Emulation PIC and 12-port T1/E1 Circuit Emulation PIC and MX Series routers with Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP and 16-Port Channelized E1/T1 Circuit Emulation MIC support ATM over MPLS (RFC 4717) and packet encapsulations (RFC 2684). Circuit Emulation PIC ATM configuration and behavior is consistent with existing ATM2 PICs.

The following protocols are supported:

- QoS or CoS queues. All VCs are unspecified bit rate (UBR).

NOTE: This protocol is not supported on M7i and M10i routers.

- ATM over MPLS (RFC 4717)
- ATM via dynamic labels (LDP, RSVP-TE)

ATM OAM support:

- Generation and monitoring of F4 and F5 OAM cells
- Generation and monitoring of end-to-end cells of type AIS and RDI
- Monitor and terminate loopback cells
- Supports OAM on each VP and VC simultaneously

The following protocols are not supported:

- NxDS0 grooming.

The following ATM2 encapsulations are not supported:

- **atm-cisco-nlpid**—Cisco-compatible ATM NLPID encapsulation
- **atm-mlppp-llc**—ATM MLPPP over AAL5/LLC
- **atm-nlpid**—ATM NLPID encapsulation
- **atm-ppp-llc**—ATM PPP over AAL5/LLC
- **atm-ppp-vc-mux**—ATM PPP over raw AAL5
- **atm-snap**—ATM LLC/SNAP encapsulation
- **atm-tcc-snap**—ATM LLC/SNAP for translational cross-connect
- **atm-tcc-vc-mux**—ATM VC for translational cross-connect
- **vlan-vci-ccc**—CCC for VLAN Q-in-Q and ATM VPI/VCI interworking
- **atm-vc-mux**—ATM VC multiplexing
- **ether-over-atm-llc**—Ethernet over ATM (LLC/SNAP) encapsulation
- **ether-vpls-over-atm-llc**—Ethernet VPLS over ATM (bridging) encapsulation

NOTE: **Circuit Emulation PICs require firmware version rom-ce-9.3.pbin or rom-ce-10.0.pbin for ATM IMA functionality on M7i, M10i, M40e, M120, and M320 routers running JUNOS OS Release 10.0R1 or later.**

Related Documentation

- Configuring the 12-Port Channelized T1/E1 Circuit Emulation PIC Operating Mode on page 63
- Configuring the 4-Port Channelized COC3/STM1 Circuit Emulation PIC Operating Mode on page 65
- ATM IMA Configuration Overview on page 14
- Configuring ATM IMA on page 67
- Configuring ATM Pseudowires on page 69
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- Configuring Layer 2 Circuit and Layer 2 VPN Pseudowires on page 87
- ATM Limitations on page 88

Understanding Inverse Multiplexing for ATM

Inverse multiplexing for ATM (IMA) is a technique of transporting ATM traffic over a bundle of T1 or E1 interfaces. The following sections explain IMA in detail:

Understanding Asynchronous Transfer Mode

Asynchronous Transfer Mode (ATM) is a high-speed networking technology that handles data in fixed-size units called cells. It enables high-speed communication between edge routers and core routers in an ATM network.

ATM is designed to facilitate the simultaneous handling of various types of traffic streams (voice, data, and video) at very high speeds over a dedicated connection. ATM uses asynchronous time-division multiplexing (TDM) and it encodes data into 53-byte cells, thereby simplifying the design of hardware and enabling it to quickly determine the destination address of each cell. ATM operates over either fiber optic cables or twisted-pair cables. Each ATM PIC is assigned an ATM switch ID that displays the switch's IP address and the local interface names of the adjacent Fore ATM switches. For information about ATM PICs, see the platform-specific *Hardware Guide*.

ATM relies on the concepts of virtual paths (VPs) and virtual circuits (VCs). A virtual path, represented by a specific virtual path identifier (VPI), establishes a route between two devices in a network. Each VPI can contain multiple VCs, each represented by a virtual circuit identifier (VCI). VPIs and VCIs are local to the router, which means that only the two devices connected by the VCI or VPI need know the details of the connection. In a typical ATM network, user data might traverse multiple connections, using many different VPI and VCI connections. Each end device, just like each device in the network, needs to know only the VCI and VPI information for the path to the next device.

An ATM interface is indicated by the **at-*fpc/pic/port*** CLI descriptor.

Understanding Inverse Multiplexing for ATM

Inverse multiplexing is a method where a single data stream is divided into multiple smaller data streams that are transmitted over either fiber optic cables or twisted pair cables and are recombined on the other end to form the original data stream. This concept is useful for attaining high-speed data transmission rates. This concept has been extended to ATM and is called inverse multiplexing for ATM or IMA.

IMA is a technique of transporting ATM traffic over a bundle of T1 or E1 interfaces. IMA divides a single data stream into multiple smaller data streams, that is transmitted at the same time across separate channels (such as T1 or E1 interfaces) and then reconstructed at the other end back into the original data stream.

Two versions of IMA are available—IMA 1.0 (af-phy-0086.000-IMA) and IMA 1.1 (af-phy-0086.001-IMA). You can configure either of these versions, by using the Junos OS CLI. If not specified, IMA 1.1 is selected by default. Note that IMA 1.0 and IMA 1.1 do not interoperate. The IMA v1.1 specification increments the OAM (operations and maintenance) label value used in the IMA OAM cells in order to differentiate v1.1 from v1.0 IMA units.

How Inverse Multiplexing for ATM Works

An IMA frame consists of ATM cells, an ICP cell, and filler cells (if required). On the transmission side of the ATM IMA network, the ATM cell stream (received from the ATM layer) is divided across multiple links in an IMA group on a cell by cell basis. On the receiving end of the ATM IMA network, the cells are recombined to form the original ATM cells stream (with the help of ICP cells), and then passed on to the ATM layer.

IMA Control Protocol (ICP) cells are special cells that are sent over the ATM IMA interface with the ATM cell stream to help align the ATM cells at the receiving end. An ICP cell tracks link differential delay, reduces cell delay variation (CDV), and performs other functions.

When there are no ATM cells to be sent on an IMA frame, the IMA transmitter inserts filler cells to maintain a continuous stream of cells at the physical layer. The filler cells are discarded by the IMA receiver. An OAM cell has codes that define it as an ICP cell or a filler cell.

Supported Platforms

The following are the various Juniper Networks routers and their components that support inverse multiplexing for ATM (IMA):

- 16-port Channelized E1/T1 Circuit Emulation MIC (MIC-3D-16CHE1-T1-CE) on MX Series routers (from Junos OS Release 13.2R1 onward).
- 4-port Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP (MIC-3D-4COC3-1COC12-CE) on MX Series routers (from Junos OS Release 13.2R1 onward).
- 4-port Channelized OC3/STM1 Circuit Emulation PIC with SFP (PB-4CHOC3-CE-SFP) on M7i, M10i, M40e, M120, and M320 routers supports channelized OC3/STM1 (down to T1) ATM IMA.
- 12-port E1/T1 Circuit Emulation PIC (PB-12T1E1-CE-TELCO) on M7i, M10i, M40e, M120, and M320 routers supports discrete T1 ATM IMA.

NOTE: **Circuit Emulation PICs require firmware version rom-ce-9.3.pbin or rom-ce-10.0.pbin for ATM IMA functionality on M7i, M10i, M40e, M120, and M320 routers running Junos OS Release 10.0R1 or later.**

Related Documentation

- ATM IMA Configuration Overview on page 14
- ATM Support on Circuit Emulation PICs Overview on page 10
- Configuring ATM IMA on page 67

ATM IMA Configuration Overview

IMA involves inverse multiplexing and demultiplexing of ATM cells in a round-robin sequence among links grouped to form a higher-bandwidth logical link whose rate is the sum of all the link rates. This group of links is called an IMA group. An IMA group can also be defined as a group of links at the transmitting end that is used to establish an IMA virtual link to the receiving end. The IMA virtual link is a virtual link that is established between two IMA units or routers over a number of physical links (in an IMA group). IMA groups terminate at each end of the IMA virtual link.

You can configure 42 IMA groups. Each group can contain from 1 through 32 links.

You can configure a maximum of 16 IMA groups on the 16-port Channelized E1/T1 Circuit Emulation MIC (MIC-3D-16CHE1-T1-CE) and each group can have from 1 through 8 IMA links. Port numbers starting from 0 through 15 are used for T1/E1 ports; therefore, IMA port numbers start from 16 onward.

You can configure a maximum of 42 IMA groups on the 4-port Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP (MIC-3D-4COC3-1COC12-CE). The IMA port numbers start from 16 onward.

To configure an IMA group, execute the **set chassis fpc *fpc-slot* pic *pic-slot* aggregated devices ima device-count *count*** configuration command, where ***count*** results in the creation of interfaces from at-x/y/*g* through at-x/y/*g*+*count*-1. The variable *g* is chosen such that there is no conflict with non-IMA ATM interfaces on the same PIC. For example, if the count variable is set to 4, then the new ATM interfaces are created from at-x/y/16 through at-x/y/19.

You can implement inverse multiplexing for ATM (IMA) on Juniper Networks routers by configuring an IMA group and its options. The following sections explain the various options that can be set for an IMA group:

- IMA Clocking on page 21
- Differential Delay on page 21

IMA Version

Either IMA 1.0 (af-phy-0086.000-IMA) or IMA 1.1 (af-phy-0086.001-IMA) can be selected through the CLI. To choose the IMA specification version, execute the **set interfaces *interface-name* ima-group-options (1.0|1.1)** configuration command. Note that, if you do not specify the version, IMA 1.1 is selected by default.

IMA 1.0 and IMA 1.1 do not interoperate.

The IMA v1.1 specification increments the operations and maintenance (OAM) label value used in the IMA OAM cells in order to differentiate v1.1 from v1.0 IMA units.

IMA Frame Length

An IMA frame consists of ATM cells, an ICP cell, and filler cells (if required). When you configure an IMA group, you can choose a frame length of 32, 64, 128, or 256. The frame length can be selected independently in each direction and in each group. To set the frame length, execute the **set interface *interface-name* frame-length (32 |64 |128 |256)** configuration command. Note that if the frame length is not specified, the frame length value of 128 is selected by default.

Transmit Clock

When you create an IMA group, you can configure a common transmit clock timing mode or an independent transmit clock timing mode to reflect the primary reference source (PRS) of the clock for each link in a group. By default, the common mode is selected. To select the transmit clock timing mode, execute the **set interface *interface-name* ima-group-options transmit-clock (common | independent)** configuration command.

IMA Group Symmetry

You can configure an IMA group to allow symmetric or asymmetric cell rate transfer over an IMA virtual link. You can configure the IMA group with one of the following modes:

- Symmetrical configuration and operation—In this mode, on the ATM IMA device, an IMA link must be configured in each direction for all physical links that the ATM IMA device is configured to use. In this mode, the ATM IMA device can transmit and receive ATM layer cells over the physical links on which the IMA links running in both directions are **Active**.
- Symmetrical configuration and asymmetrical operation—In this mode, on the ATM IMA device, an IMA link must be configured in each direction for all physical links that the ATM IMA device is configured to use. In this mode, the ATM IMA device can transmit ATM layer cells over the physical links on which the IMA links in the transmit direction are **Active**, while the IMA links in the receive direction are not **Active** or contrariwise.

Asymmetrical configuration and operation are not supported.

The mode can be configured through the CLI when an IMA group is created. To select the symmetry option, execute the **set interface *interface-name* ima-group-options symmetry**

(symmetrical-config-and-operation | symmetrical-config-asymmetrical-operation) configuration command. By default, symmetrical configuration and operation is selected.

Minimum Active Links

You can set the minimum active links for an IMA group from 1 through 32.

- P_{Tx} is the minimum number of links required to be active in the transmit direction for the IMA group to move into the operational state.
- P_{Rx} is the minimum number of links required to be active in the receive direction for the IMA group to move into the operational state.

You configure P_{Tx} and P_{Rx} through the CLI when an IMA group is created. By default, 1 is selected.

For a symmetrical configuration, P_{Tx} is equal to P_{Rx}.

To set minimum links, execute the **set interface** ***interface-name*** **ima-group-options minimum-links** ***links*** configuration command. By default, symmetrical configuration and operation is selected.

State Transition Variables: Alpha, Beta, and Gamma

Frame synchronization is a process of recovery of the aggregated frames. The frame synchronization states form a basis for the different error and maintenance states. You can configure the IMA frame synchronization link state transition variables as alpha, beta, and gamma. The valid ranges and default values are shown in Table 3 on page 16.

Table 3: IMA Frame Synchronization Link State Transition Variables

Setting	Range	Default	Description
alpha	1–2	2	Consecutive invalid ICP cells
beta	1–5	2	Consecutive errored ICP cells
gamma	1–5	1	Consecutive valid ICP cells

To set the frame synchronization option, execute the **set interface** ***interface-name*** **ima-group-options frame-synchronization alpha** ***number*** **beta** ***number*** **gamma** ***number*** configuration command.

IMA Link Addition and Deletion

When an IMA group is up, you can add links to or delete links from the group without dropping cells.

To create an IMA link, you must:

- Configure the encapsulation as **ima** at the **[edit interfaces** ***interface-name*** **encapsulation]** hierarchy level.

- Configure an ATM interface with one T1 link or one E1 link with the **set interfaces** ***interface-name*** **ima-link-options group-id** ***g*** configuration command.

The ***interface-name*** variable refers to the T1 or E1 interface to be set as an IMA interface link and the variable ***g*** refers to the port in the *at-x/y/g* interface.

To delete the configured IMA link, you must execute the following configuration commands:

- **delete interfaces** ***interface-name*** **encapsulation ima**
- **delete interfaces** ***interface-name*** **ima-link-options group** ***g***

IMA Test Pattern Procedure

A test pattern procedure is supported for IMA to test the ATM, T1, and E1 interfaces for irregularities. You can use the CLI to start and end the test pattern procedure.

The following options can be set according to the requirement at the **[edit interface** ***interface-name*** **ima-group-options test-procedure]** hierarchy level:

- **interface** ***interface-name***—Interface name of the IMA link to test.
- **pattern** ***number***—IMA test pattern that can be set from 1 through 254
- **period** ***number***—Length of the IMA test pattern that can be set from 1 second through 4,294,967,294 seconds.

To perform the test pattern procedure, execute the **test interface** ***interface-name*** **ima-test-start** and **test interface** ***interface-name*** **ima-test-stop** operational mode commands to start and to stop the IMA test, respectively.

Per-PIC Limit on the Number of Links

The per-PIC limit on the number of links with the 12-port E1/T1 Circuit Emulation PIC (PB-12T1E1-CE-TELCO) is up to 12 T1 or E1 links.

The per-PIC limits on the number of links with the 4-port Channelized OC3/STM1 Circuit Emulation PIC with SFP (PB-4CHOC3-CE-SFP) are:

- T1—0 through 168
- E1—0 through 126
- Mixed: total bandwidth limited to 2xOC3; 258,048,000 bps

The per-PIC limits on the number of links with the 4-port Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP (MIC-3D-4COC3-1COC12-CE) are:

- T1—0 through 336
- E1—0 through 252

IMA Group Alarms and Group Defects

Table 4 on page 18 shows the supported IMA group alarms and their associated IMA standard requirement numbers. This is displayed in the *group status and control* field of an ICP cell.

Table 4: IMA Group Alarms with IMA Standard Requirement Numbers

Alarm	IMA Standard Requirement Number
Start-up-FE	R-145
Config-Aborted	R-146
Config-Aborted-FE	R-147
Insufficient-Links	R-148
Insufficient-Links-FE	R-149
Blocked-FE	R-150
GR-Timing-Mismatch	R-151

Table 5 on page 18 shows the supported IMA group defects and their associated IMA standard requirement numbers. This is displayed in the *group status and control* field of an ICP cell.

Table 5: IMA Group Defects with IMA Standard Requirement Numbers

Defects	IMA Standard Requirement Number
Start-up-FE	R-145
Config-Aborted	R-146
Config-Aborted-FE	R-147
Insufficient-Links	R-148
Insufficient-Links-FE	R-149
Blocked-FE	R-150
GR-Timing-Mismatch	R-151

IMA Link Alarms and Link Defects

Table 6 on page 19 shows the supported IMA link alarms that are reported to the IMA unit management with their associated IMA standard requirement numbers.

Table 6: IMA Link Alarms with IMA Standard Requirement Numbers

Alarm	IMA Standard Requirement Number	Description
LIF	R-138	Loss of IMA frame
LODS	R-139	Link out of delay synchronization
RFI-IMA	R-140	Remote defect/failure
Tx-Mis-Connected	R-141	Transmit misconnected
Rx-Mis-Connected	R-142	Receive misconnected
Tx-Unusable-FE	R-143	Transmit unusable far end
Rx-Unusable-FE	R-144	Receive unusable far end
Link Fault		Link fault

An IMA unit management is defined by SNMP MIBs.

Table 7 on page 19 shows the supported IMA link defects that are reported to the unit management with their associated IMA standard requirement numbers.

Table 7: IMA Link Defects with IMA Standard Requirement Numbers

Defect	IMA Standard Requirement Number	Description
LIF	R-138	Loss of IMA frame
LODS	R-139	Link out of delay synchronization
RFI-IMA	R-140	Remote defect/failure
Tx-Mis-Connected	R-141	Transmit misconnected
Rx-Mis-Connected	R-142	Receive misconnected
Tx-Unusable-FE	R-143	Transmit unusable far end
Rx-Unusable-FE	R-144	Receive unusable far end
Link Fault		Link fault

IMA Group Statistics

You can use the **show interfaces** command to display the following IMA group statistics:

- Near-end failure count
- Far-end failure count
- Receive end (R_x) faulty cells due to address mismatch
- Running seconds
- Unavailable seconds

For more information about IMA group statistics, see the **show interfaces** command description in the *Junos OS Operational Mode Commands*.

IMA Link Statistics

Table 8 on page 20 shows the IMA link statistics.

Table 8: IMA Link Statistics with IMA Standard Requirement Numbers

Performance Parameter	IMA Standard Requirement Number
Rx LIF	–
Rx ICP cells	–
Rx errored ICP cells	R-106
Rx LODS	R-106
Rx ICP violation	R-107
Rx stuff	O-17
Near-end Rx SES	R-108
Near-end Rx UAS	R-110
Near-end Rx UUS	R-113
Near-end Rx failure	R-117
Near-end Tx failure	–
Far-end Rx SES	R-109
Far-end Rx UAS	R-111
Far-end Rx UUS	R-115

Table 8: IMA Link Statistics with IMA Standard Requirement Numbers *(continued)*

Performance Parameter	IMA Standard Requirement Number
Far-end defects	–
Far-end Rx failure	–
Tx ICP cells	–
Tx stuff	O-16
Near-end Tx UUS	R-112
Far-end Tx UUS	R-114
Far-end Tx failure	–

IMA Clocking

Interface clock source is applicable only to IMA links.

You can set the interface clock source as external or internal with the **set interfaces *at-x/y/z* clocking (external | internal)** configuration command. Note that the **clocking** statement is not applicable to the **at-*x/y/g*** interface because the IMA group it represents is a virtual interface.

Differential Delay

You can set the maximum differential delay from 1 millisecond through 56 milliseconds among links in an IMA group. By default, a differential delay of 25 milliseconds is set. Execute the **set interfaces *interface-name* ima-group-options differential-delay *delay*** configuration command to set the differential delay.

Related Documentation

- ATM Support on Circuit Emulation PICs Overview on page 10
- Configuring ATM IMA on page 67
- Understanding Inverse Multiplexing for ATM on page 12

PART 2

Configuration

CHAPTER 2

SAToP Support on Circuit Emulation PICs

Displaying Information About Circuit Emulation PICs

Use the CLI **show chassis hardware** command to display information about the PIC configuration.

- For a T1 Circuit Emulation PIC configuration, the output designation is **T1 CE**.
- For an E1 Circuit Emulation PIC configuration, the output designation is **E1 CE**.
- For a COC3 Circuit Emulation PIC configuration, the output designation is **COC1 CE**.
- For a CSTM1 Circuit Emulation PIC configuration, the output designation is **CSTM1 CE**.
- For a OC3/STM1 or OC12/STM4 Circuit Emulation ATM MIC configuration, the output designation is **2xOC12/8xOC3 CC-CE**.

Related Documentation

- Mobile Backhaul and Circuit Emulation Overview on page 3
- Understanding Circuit Emulation PIC Types on page 5
- 16-Port Channelized E1/T1 Circuit Emulation MIC Overview on page 9
- Configuring the 4-Port Channelized COC3/STM1 Circuit Emulation PIC Operating Mode on page 65
- Configuring the 12-Port Channelized T1/E1 Circuit Emulation PIC Operating Mode on page 63

Configuring SAToP on 4-Port Channelized OC3/STM1 Circuit Emulation PICs

This configuration applies to the mobile backhaul application shown in Figure 1 on page 4.

Configuring SONET/SDH Framing Mode at the PIC Level

To set the framing mode at the PIC level, for all four ports on the PIC, include the **framing** statement at the **[edit chassis fpc *fpc-slot* pic *pic-slot*]** hierarchy level.

```
[edit chassis fpc fpc-slot pic pic-slot]
user@host# set framing (sonet | sdh); # SONET for COC3 or SDH for CSTM1
```

After a PIC is brought online, interfaces are created for the PIC's available ports according to the PIC type and the framing option used.

- If you include the **framing sonet** statement (for a COC3 Circuit Emulation PIC), four COC3 interfaces are created.
- If you include the **framing sdh** statement (for a CSTM1 Circuit Emulation PIC), four CSTM1 interfaces are created.
- If you do not specify framing at the PIC level, then the default framing is SONET for all four ports.

NOTE: If you set the framing option incorrectly for the PIC type, the commit operation fails.

Bit error rate test (BERT) patterns with all ones received by T1/E1 interfaces on Circuit Emulation PICs configured for SAToP do not result in an alarm indication signal (AIS) defect. As a result, the T1/E1 interfaces remain up.

Configuring SONET/SDH Framing Mode at the Port Level

Each port's framing mode can be configured individually, as either COC3 (SONET) or STM1 (SDH). Ports not configured for framing retain the PIC framing configuration, which is SONET by default if you have not specified framing at the PIC level. To set the framing mode for individual ports, include the **framing** statement at the **[edit chassis fpc *fpc-slot* pic *pic-slot* port *port-number*]** hierarchy level:

```
[edit chassis fpc fpc-slot pic pic-slot port port-number]
user@host# set framing (sonet | sdh); # SONET for COC3 or SDH for CSTM1
```

Configuring the framing mode at the port level overwrites the previous PIC-level framing mode configuration for the specified port. Subsequently, configuring the PIC-level framing mode overwrites the port-level framing configuration. For example, if you want three

STM1 ports and one COC3 port, then it is practical to first configure the PIC for SDH framing and then configure one port for SONET framing.

Configuring COC3 Ports Down to T1 Channels

On any port configured for SONET framing (numbered 0 through 3), you can configure three COC1 channels (numbered 1 through 3). On each COC1 channel, you can configure 28 T1 channels (numbered 1 through 28).

To configure COC3 channelization down to COC1 and then down to T1 channels, include the **partition** statement at the **[edit interfaces (coc1 | coc3)-*fpc-slot/pic-slot/port*]** hierarchy level:

1. In configuration mode, go to the **[edit interfaces coc3-*fpc-slot/pic-slot/port*]**

   ```
   [edit]
   user@host# edit interfaces coc3-fpc-slot/pic-slot/port
   ```

   For example:

   ```
   [edit]
   user@host# edit interfaces coc3-1/0/0
   ```

2. Configure the sublevel interface partition index, range of SONET/SDH slices, and sublevel interface type.

   ```
   [edit interfaces coc3-1/0/0]
   user@host# set partition partition-number oc-slice oc-slice interface-type coc1
   ```

   For example:

   ```
   [edit interfaces coc3-1/0/0]
   user@host# set partition 1 oc-slice 1 interface-type coc1
   ```

3. Enter **up** command to go to **[edit interfaces]** hierarchy level.

   ```
   [edit interfaces coc3-1/0/0]
   user@host# up
   ```

4. Configure the channelized OC1 interface, sublevel interface partition index, and the interface type.

   ```
   [edit interfaces]
   user@host# set coc1-1/0/0:1 partition partition-number interface-type t1
   ```

   For example:

   ```
   [edit interfaces]
   user@host# set coc1-1/0/0:1 partition 1 interface-type t1
   ```

To verify the configuration use the **show** command at the **[edit interfaces]** hierarchy level.

```
[edit interfaces]
user@host# show
coc3-1/0/0 {
   partition 1 oc-slice 1 interface-type coc1;
}
coc1-1/0/0:1 {
   partition 1 interface-type t1;
```

```
}
```

After you partition the T1 channels, configure the SAToP options on them in the same way as you do on T1 interfaces. See "Setting the SAToP Options" on page 31.

Configuring CSTM1 Ports Down to E1 Channels

On any port configured for SDH framing (numbered 0 through 3), you can configure one CAU4 channel. On each CAU4 channel, you can configure 63 T1 channels (numbered 1 through 63).

To configure CSTM1 channelization down to CAU4 and then down to E1 channels, include statements for the various interface types at the **[edit interfaces]** hierarchy level.

1. In configuration mode, go to the **[edit interfaces cstm1-*fpc-slot/pic-slot/port*]**

   ```
   [edit]
   [edit interfaces cstm1-fpc-slot/pic-slot/port]
   ```

   For example:

   ```
   [edit]
   [edit interfaces cstm1-1/0/1]
   ```

2. Configure the channelize interface as clear channel and the set the interface-type as cau4

   ```
   [edit interfaces cstm1-1/0/1]
   user@host# set no-partition interface-type cau4;
   ```

3. Enter **up** to go to **[edit interfaces]** hierarchy level.

4. Configure the fpc slot, pic slot and the port for CAU4 interface. Set the sublevel interface partition index and set the interface type as E1.

   ```
   [edit interfaces]
   user@host# set cau4-fpc-slot/pic-slot/port partition partition-number interface-type
     e1
   ```

   For example:

   ```
   [edit interfaces]
   user@host# set cau4-1/0/1 partition 1 interface-type e1
   ```

5. Enter **up** to go to **[edit interfaces]** hierarchy level.

6. Configure the fpc slot, pic slot and the port for E1 interface. Set the Structure-Agnostic TDM over Packet and the logical interface for E1 interface

   ```
   [edit interfaces]
   user@host# set e1-fpc-slot/pic-slot/port:channel encapsulation encapsulation-type
     unit interface-unit-number;
   ```

   For example:

   ```
   [edit interfaces]
   user@host# set e1-1/0/:1 encapsulation satop unit 0;
   ```

To verify the configuration use the **show** command at the **[edit interfaces]** hierarchy level.

```
[edit interfaces]
```



```
user@host# show
cstm1-1/0/1 {
    no-partition interface-type cau4;
}
cau4-1/0/1 {
    partition 1 interface-type e1;
}
e1-1/0/1:1 {
    encapsulation satop;
    unit 0;
}
```

After you configure the E1 channels, configure SAToP options on them in the same way as you do on E1 interfaces. See "Setting the SAToP Options" on page 31.

Related Documentation

- Mobile Backhaul and Circuit Emulation Overview on page 3
- Configuring SAToP Emulation on T1/E1 Interfaces on Circuit Emulation PICs on page 29

Configuring SAToP Emulation on T1/E1 Interfaces on Circuit Emulation PICs

This configuration applies to the mobile backhaul application shown in Figure 1 on page 4.

Setting the Emulation Mode

To set the framing emulation mode, include the **framing** statement at the **[edit chassis fpc *fpc-slot* pic *pic-slot*]** hierarchy level:

```
[edit chassis fpc fpc-slot pic pic-slot]
user@host# set framing (t1 | e1);
```

After a PIC is brought online, interfaces are created for the PIC's available ports according to the PIC type and the framing option used:

- If you include the **framing t1** statement (for a T1 Circuit Emulation PIC), 12 CT1 interfaces are created.
- If you include the **framing e1** statement (for an E1 Circuit Emulation PIC), 12 CE1 interfaces are created.

NOTE: If you set the framing option incorrectly for the PIC type, the commit operation fails.

Circuit Emulation PICs with SONET and SDH ports require prior channelization down to T1 or E1 before you can configure them. Only T1/E1 channels support SAToP encapsulation or SAToP options.

Bit error rate test (BERT) patterns with all ones received by T1/E1 interfaces on Circuit Emulation PICs configured for SAToP do not result in an alarm indication signal (AIS) defect. As a result, the T1/E1 interfaces remain up.

Configuring SAToP Emulation on T1/E1 Interfaces

Setting the Encapsulation Mode

E1 channels on Circuit Emulation PICs can be configured with SAToP encapsulation at the provider edge (PE) router, as follows:

NOTE: The below mentioned procedure can be used to configure T1 channels on circuit emulation PICs with SAToP encapsulation at the PE router.

1. In the configuration mode, go to **[edit interfaces e1-*fpc-slot/pic-slot/port*]** hierarchy level.

   ```
   [edit]
   user@host# [edit interfaces e1 fpc-slot/pic-slot/port]
   ```

   For example:

   ```
   [edit]
   [edit interfaces e1-1/0/0]
   ```

2. Configure SAToP encapsulation and the logical interface for E1 interface

   ```
   [edit interfaces e1-1/0/0]
   user@host# set encapsulation encapsulation-typeunit interface-unit-number;
   ```

   For example:

   ```
   [edit interfaces e1-1/0/0]
   user@host# set encapsulation satop unit 0;
   ```

You do not need to configure any cross-connect circuit family because it is automatically created for the above encapsulation.

T1/E1 Loopback Support

Use the CLI to configure remote and local loopback as T1 (CT1) or E1 (CE1). By default, no loopback is configured. See *Configuring T1 Loopback Capability* and *Configuring E1 Loopback Capability*.

T1 FDL Support

If T1 is used for SAToP, the T1 facility data-link (FDL) loop is *not* supported on the CT1 interface device because SAToP does not analyze T1 framing bits.

Setting the SAToP Options

To configure SAToP options on T1/E1 interfaces:

1. In configuration mode, go to the **[edit interfaces e1-*fpc-slot/pic-slot/port*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces e1-fpc-slot/pic-slot/port
   ```

   For example:

   ```
   [edit]
   user@host# edit interfaces e1-1/0/0
   ```

2. Use the **edit** command to go to the **satop-options** hierarchy level.

   ```
   [edit]
   user@host# edit satop-options
   ```

3. In this hierarchy level, using the **set** command you can configure the following SAToP options:

   - **excessive-packet-loss-rate**—Set packet loss options. The options are **groups**, **sample-period**, and **threshold**.
     - **groups**—Specify groups.
     - **sample-period**—Time required to calculate excessive packet loss rate (from 1000 through 65,535 milliseconds).
     - **threshold**—Percentile designating the threshold of excessive packet loss rate (1–100 percent).
   - **idle-pattern**—An 8-bit hexadecimal pattern to replace TDM data in a lost packet (from 0 through 255).
   - **jitter-buffer-auto-adjust**—Automatically adjust the jitter buffer.

     NOTE: **The jitter-buffer-auto-adjust option is not applicable on MX Series routers.**

   - **jitter-buffer-latency**—Time delay in the jitter buffer (from 1 through 1000 milliseconds).

- **jitter-buffer-packets**—Number of packets in the jitter buffer (from 1 through 64 packets).
- **payload-size**—Configure the payload size, in bytes (from 32 through 1024 bytes).

NOTE: In this section, we are configuring only one SAToP option. You can follow the same method to configure all the other SAToP options.

```
[edit interfaces e1-1/0/0 satop-options]
user@host# set excessive-packet-loss-rate sample-period sample-period
```

For example:

```
[edit interfaces e1-1/0/0 satop-options]
user@host# set excessive-packet-loss-rate sample-period 4000
```

To verify this configuration, use the **show** command at the **[edit interfaces e1-1/0/0]** hierarchy level:

```
[edit interfaces e1-1/0/0]
user@host# show
satop-options {
   excessive-packet-loss-rate {
      sample-period 4000;
   }
}
```

Configuring the Pseudowire Interface

To configure the TDM pseudowire at the provider edge (PE) router, use the existing Layer 2 circuit infrastructure, as shown in the following procedure:

1. In the configuration mode, go to **[edit protocols l2circuit]** hierarchy level.

   ```
   [edit]
   user@host# edit protocol l2circuit
   ```

2. Configure the IP address of the neighboring router or switch, interface forming the layer 2 circuit and the identifier for the layer 2 circuit.

   ```
   [edit protocol l2circuit]
   user@host# set neighbor ip-address interface
     interface-name-fpc-slot/pic-slot/port.interface-unit-number virtual-circuit-id
     virtual-circuit-id;
   ```

   NOTE: To configure T1 interface as the layer 2 circuit, replace e1 with t1 in the below statement.

   For example:

   ```
   [edit protocol l2circuit]
   user@host# set neighbor 10.255.0.6 interface e1-1/0/0.0 virtual-circuit-id 1
   ```

3. To verify the configuration use the **show** command at the **[edit protocols l2circuit]** hierarchy level.

```
[edit protocols l2circuit]
user@host# show
neighbor 10.255.0.6 {
    interface e1-1/0/0.0 {
        virtual-circuit-id 1;
    }
}
```

After the customer edge (CE)-bound interfaces (for both PE routers) are configured with proper encapsulation, payload size, and other parameters, the two PE routers try to establish a pseudowire with Pseudowire Emulation Edge-to-Edge (PWE3) signaling extensions. The following pseudowire interface configurations are disabled or ignored for TDM pseudowires:

- **ignore-encapsulation**
- **mtu**

The supported pseudowire types are:

- 0x0011 Structure-Agnostic E1 over Packet
- 0x0012 Structure-Agnostic T1 (DS1) over Packet

When the local interface parameters match the received parameters, and the pseudowire type and control word bit are equal, the pseudowire is established.

For detailed information about configuring TDM pseudowire, see the *Junos OS VPNs Library for Routing Devices*.

For detailed information about PICs, see the *PIC Guide* for your router.

Related Documentation

- Mobile Backhaul and Circuit Emulation Overview on page 3
- Configuring SAToP on 4-Port Channelized OC3/STM1 Circuit Emulation PICs on page 26

Configuring SAToP on Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP

This configuration applies to the mobile backhaul application shown in Figure 1 on page 4.

- Configuring SONET/SDH Rate-Selectability on page 34
- Configuring SONET/SDH Framing Mode at the MIC Level on page 34
- Configuring COC3/COC12 Ports Down to T1 Channels on page 35
- Configuring CSTM1 Ports Down to E1 Channels on page 36
- Configuring CSTM4 Ports Down to E1 Channels on page 38

Configuring SONET/SDH Rate-Selectability

You can configure rate-selectability on the Channelized OC3/STM1 (Multi-Rate) MICs with SFP (MIC-3D-4COC3-1COC12-CE) by specifying its port speed as COC3-CSTM1 or COC12-CSTM4.

To configure the rate-selectability:

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

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

   For example:

   ```
   [edit]
   user@host# edit chassis fpc 1 pic 0 port 0
   ```

2. Set the speed as **coc3-cstm1** or **coc12-cstm4**.

   ```
   [edit chassis fpc slot pic slot port slot]
   user@host# set speed (coc3-cstm1 | coc12-cstm4)
   ```

   For example:

   ```
   [edit chassis fpc 1 pic 0 port 0]
   user@host# set speed coc3-cstm1
   ```

NOTE: When the speed is set as **coc12-cstm4**, instead of configuring COC3 ports down to T1 channels and CSTM1 ports down to E1 channels, you must configure COC12 ports down to T1 channels and CSTM4 channels down to E1 channels.

Configuring SONET/SDH Framing Mode at the MIC Level

To set the framing mode at the MIC (MIC-3D-4COC3-1COC12-CE) level, for all four ports on the MIC, include the **framing** statement at the **[edit chassis fpc *slot* pic *slot*]** hierarchy level.

```
[edit chassis fpc slot pic slot]
user@host# set framing (sonet | sdh)# SONET for COC3/COC12 or SDH for CSTM1/CSTM4
```

After a MIC is brought online, interfaces are created for the MIC's available ports on the basis of the MIC type and the framing option used.

- If you include the **framing sonet** statement, four COC3 interfaces are created when the speed is configured as **coc3-cstm1**.
- If you include the **framing sdh** statement, four CSTM1 interfaces are created when the speed is configured as **coc3-cstm1**.
- If you include the **framing sonet** statement, one COC12 interface is created when the speed is configured as **coc12-cstm4**.

- If you include the **framing sdh** statement, one CSTM4 interface is created when the speed is configured as **coc12-cstm4**.
- If you do not specify framing at the MIC level, then the default framing is SONET for all the ports.

NOTE: If you set the framing option incorrectly for the MIC type, the commit operation fails.

Bit error rate test (BERT) patterns with all binary 1s (ones) received by T1/E1 interfaces on Circuit Emulation MICs configured for SAToP do not result in an alarm indication signal (AIS) defect. As a result, the T1/E1 interfaces remain up.

Configuring COC3/COC12 Ports Down to T1 Channels

When configuring COC3 ports down to T1 channels, on any port configured for SONET framing (numbered 0 through 3), you can configure three COC1 channels (numbered 1 through 3). On each COC1 channel, you can configure 28 T1 channels (numbered 1 through 28).

When configuring COC12 ports down to T1 channels, on a port configured for SONET framing, you can configure twelve COC1 channels (numbered 1 through 12). On each COC1 channel, you can configure 28 T1 channels (numbered 1 through 28).

To configure COC3 channelization down to COC1 and then down to T1 channels, include the **partition** statement at the **[edit interfaces (coc1 | coc3)-*mpc-slot/mic-slot/port-number*]** hierarchy level:

NOTE: To configure COC12 ports down to T1 channels, replace coc3 with coc12 ports in the following procedure.

1. In configuration mode, go to the **[edit interfaces coc3-*mpc-slot/mic-slot/port-number*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces coc3-mpc-slot/mic-slot/port-number
   ```

   For example:

   ```
   [edit]
   user@host# edit interfaces coc3-1/0/0
   ```

2. Configure the sublevel interface partition index and the range of SONET/SDH slices, and set the sublevel interface type as **coc1**.

   ```
   [edit interfaces coc3-mpc-slot/mic-slot/port-number]
   user@host# set partition partition-number oc-slice oc-slice interface-type coc1
   ```

   For example:

   ```
   [edit interfaces coc3-1/0/0]
   ```

```
user@host# set partition 1 oc-slice 1 interface-type coc1
```

3. Enter the **up** command to go to the **[edit interfaces]** hierarchy level.

```
[edit interfaces coc3-mpc-slot/mic-slot/port-number]
user@host# up
```

For example:

```
[edit interfaces coc3-1/0/0]
user@host# up
```

4. Configure the channelized OC1 interface and the sublevel interface partition index, and set the interface type as **t1**.

```
[edit interfaces]
user@host# set coc1-mpc-slot/mic-slot/port-number:channel partition partition-number
  interface-type t1
```

For example:

```
[edit interfaces]
user@host# set coc1-1/0/0:1 partition 1 interface-type t1
```

To verify this configuration, use the **show** command at the **[edit interfaces]** hierarchy level.

```
[edit interfaces]
user@host# show
coc3-1/0/0 {
  partition 1 oc-slice 1 interface-type coc1;
}
coc1-1/0/0:1 {
  partition 1 interface-type t1;
}
```

After you partition the T1 channels, configure the SAToP options on them in the same way as you do on T1 interfaces. See "Setting the SAToP Options" on page 31.

Configuring CSTM1 Ports Down to E1 Channels

On any port configured for SDH framing (numbered 0 through 3), you can configure one CAU4 channel. On each CAU4 channel, you can configure 63 T1 channels (numbered 1 through 63).

To configure CSTM1 channelization down to CAU4 and then down to E1 channels, include statements for the various interface types at the **[edit interfaces]** hierarchy level.

1. In configuration mode, go to the **[edit interfaces cstm1-*mpc-slot/mic-slot/port-number*]** hierarchy level.

```
[edit]
user@host# [edit interfaces cstm1-mpc-slot/mic-slot/port-number]
```

For example:

```
[edit]
user@host# [edit interfaces cstm1-1/0/1]
```

2. Configure the channelized interface as clear channel and then set the interface type as CAU4.

   ```
   [edit interfaces cstm1-mpc-slot/mic-slot/port-number]
   user@host# set no-partition interface-type cau4
   ```

3. Enter **up** to go to the **[edit interfaces]** hierarchy level.

   ```
   [edit interfaces cstm1-mpc-slot/mic-slot/port-number]
   user@host# up
   ```

   For example:

   ```
   [edit interfaces cstm1-1/0/1]
   user@host# up
   ```

4. Configure the MPC slot, the MIC slot, and the port for the CAU4 interface. Set the sublevel interface partition index and set the interface type as E1.

   ```
   [edit interfaces]
   user@host# set cau4-mpc-slot/mic-slot/port-number partition partition-number
     interface-type e1
   ```

   For example:

   ```
   [edit interfaces]
   user@host# set cau4-1/0/1 partition 1 interface-type e1
   ```

5. Configure the MPC slot, the MIC slot, and the port for the E1 interface. Set SAToP as the encapsulation type and then set the logical interface for E1 interface.

   ```
   [edit interfaces]
   user@host# set e1-mpc-slot/mic-slot/port-number:channel encapsulation satop unit
     interface-unit-number
   ```

   For example:

   ```
   [edit interfaces]
   user@host# set e1-1/0/:1 encapsulation satop unit 0
   ```

To verify this configuration, use the **show** command at the **[edit interfaces]** hierarchy level.

```
[edit interfaces]
user@host# show
cstm1-1/0/1 {
  no-partition interface-type cau4;
}
cau4-1/0/1 {
  partition 1 interface-type e1;
}
e1-1/0/1:1 {
  encapsulation satop;
  unit 0;
}
```

After you configure the E1 channels, configure SAToP options on them in the same way as you do on E1 interfaces. See "Setting the SAToP Options" on page 31.

Configuring CSTM4 Ports Down to E1 Channels

NOTE: When the port speed is configured as coc12-cstm4 at the **[edit chassis fpc *slot* pic *slot* port *slot*]** hierarchy level, you must configure CSTM4 ports down to E1 channels.

On any port configured for SDH framing (numbered 0 through 3), you can configure four CAU4 channels. On each CAU4 channel, you can configure 63 T1 channels (numbered 1 through 63).

To configure CSTM4 ports down to E1 channels, include statements for the various interface types at the **[edit interfaces]** hierarchy level.

1. In configuration mode, go to the **[edit interfaces cstm4-*mpc-slot/mic-slot/port-number*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces cstm4-mpc-slot/mic-slot/port-number
   ```

   For example:

   ```
   [edit]
   user@host# edit interfaces cstm4-1/0/1
   ```

2. Configure the sublevel interface partition index and the range of SONET/SDH slices, and set the sublevel interface type as **cau4**.

   ```
   [edit interfaces cstm4-mpc-slot/mic-slot/port-number]
   user@host# set partition partition-number oc-slice oc-slice interface-type cau4
   ```

   For example:

   ```
   [edit interfaces cstm4-1/0/1]
   user@host# set partition 1 oc-slice 1 interface-type cau4
   ```

3. Enter **up** to go to the **[edit interfaces]** hierarchy level.

   ```
   [edit interfaces cstm4-mpc-slot/mic-slot/port-number]
   user@host# up
   ```

   For example:

   ```
   [edit interfaces cstm4-1/0/1]
   user@host# up
   ```

4. Configure the MPC slot, the MIC slot, and the port for the CAU4 interface. Set the sublevel interface partition index and set E1 as the interface type.

   ```
   [edit interfaces]
   user@host# set cau4-mpc-slot/mic-slot/port-number:channel partition
     partition-number interface-type e1
   ```

   For example:

   ```
   [edit interfaces]
   user@host# set cau4-1/0/1:1 partition 1 interface-type e1
   ```

5. Configure the MPC slot, the MIC slot, and the port for the E1 interface. Set SAToP as the encapsulation type and then set the logical interface for the E1 interface.

   ```
   [edit interfaces]
   user@host# set e1-mpc-slot/mic-slot/port-number:channel encapsulation satop unit
     interface-unit-number
   ```

   For example:

   ```
   [edit interfaces]
   user@host# set e1-1/0/1:1:1 encapsulation satop unit 0
   ```

To verify this configuration, use the **show** command at the **[edit interfaces]** hierarchy level.

```
[edit interfaces]
user@host# show
cstm4-1/0/1 {
   partition 1 oc-slice 1 interface-type cau4;
}
cau4-1/0/1:1 {
   partition 1 interface-type e1;
}
e1-1/0/1:1:1 {
   encapsulation satop;
   unit 0;
}
```

After you configure the E1 channels, configure the SAToP options on them in the same way as you do on E1 interfaces. See "Setting the SAToP Options" on page 31.

Related Documentation

- Mobile Backhaul and Circuit Emulation Overview on page 3
- Configuring SAToP Encapsulation on T1/E1 Interfaces on Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP on page 39

Configuring SAToP Encapsulation on T1/E1 Interfaces on Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP

This configuration applies to the mobile backhaul application shown in Figure 1 on page 4.

This topic includes the following tasks:

Setting the Encapsulation Mode

E1 channels on Circuit Emulation MICs can be configured with SAToP encapsulation at the provider edge (PE) router, as follows:

NOTE: The below mentioned procedure can be used to configure T1 channels on circuit emulation MICs with SAToP encapsulation at the PE router.

1. In configuration mode, go to the **[edit interfaces e1-*fpc-slot/pic-slot/port*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces e1-fpc-slot/pic-slot/port
   ```

   For example:

   ```
   [edit]
   user@host# edit interfaces e1-1/0/0
   ```

2. Configure the SAToP encapsulation and the logical interface for E1 interface.

   ```
   [edit interfaces e1-1/0/0]
   user@host# set encapsulation satop unit interface-unit-number
   ```

   For example:

   ```
   [edit interfaces e1-1/0/0]
   user@host# set encapsulation satop unit 0
   ```

You do not need to configure any cross-connect circuit family because it is automatically created for the SAToP encapsulation.

T1/E1 Loopback Support

Use the CLI to configure remote and local loopback as T1 (CT1) or E1 (CE1). By default, no loopback is configured. See *Configuring T1 Loopback Capability* and *Configuring E1 Loopback Capability*.

T1 FDL Support

If T1 is used for SAToP, the T1 facility data-link (FDL) loop is *not* supported on the CT1 interface device because SAToP does not analyze T1 framing bits.

Setting the SAToP Options

To configure SAToP options on T1/E1 interfaces:

1. In configuration mode, go to the **[edit interfaces e1-*fpc-slot/pic-slot/port*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces e1-fpc-slot/pic-slot/port
   ```

   For example:

   ```
   [edit]
   user@host# edit interfaces e1-1/0/0
   ```

2. Use the **edit** command to go to the **satop-options** hierarchy level.

   ```
   [edit]
   user@host# edit satop-options
   ```

3. In this hierarchy level, using the **set** command you can configure the following SAToP options:

   - **excessive-packet-loss-rate**—Set packet loss options. The options are **groups**, **sample-period**, and **threshold**.
     - **groups**—Specify groups.
     - **sample-period**—Time required to calculate excessive packet loss rate (from 1000 through 65,535 milliseconds).
     - **threshold**—Percentile designating the threshold of excessive packet loss rate (1–100 percent).
   - **idle-pattern**—An 8-bit hexadecimal pattern to replace TDM data in a lost packet (from 0 through 255).
   - **jitter-buffer-auto-adjust**—Automatically adjust the jitter buffer.

     NOTE: **The jitter-buffer-auto-adjust option is not applicable on MX Series routers.**
   - **jitter-buffer-latency**—Time delay in the jitter buffer (from 1 through 1000 milliseconds).
   - **jitter-buffer-packets**—Number of packets in the jitter buffer (from 1 through 64 packets).
   - **payload-size**—Configure the payload size, in bytes (from 32 through 1024 bytes).

     NOTE: **In this section, we are configuring only one SAToP option. You can follow the same method to configure all the other SAToP options.**

   ```
   [edit interfaces e1-1/0/0 satop-options]
   user@host# set excessive-packet-loss-rate sample-period sample-period
   ```

   For example:

   ```
   [edit interfaces e1-1/0/0 satop-options]
   user@host# set excessive-packet-loss-rate sample-period 4000
   ```

To verify this configuration, use the **show** command at the **[edit interfaces e1-1/0/0]** hierarchy level:

```
[edit interfaces e1-1/0/0]
user@host# show
satop-options {
   excessive-packet-loss-rate {
      sample-period 4000;
   }
}
```

Configuring the Pseudowire Interface

To configure the TDM pseudowire at the provider edge (PE) router, use the existing Layer 2 circuit infrastructure, as shown in the following procedure:

1. In configuration mode, go to the **[edit protocols l2circuit]** hierarchy level.

   ```
   [edit]
   user@host# edit protocol l2circuit
   ```

2. Configure the IP address of the neighboring router or switch, the interface forming the Layer 2 circuit, and the identifier for the Layer 2 circuit.

   ```
   [edit protocol l2circuit]
   user@host# set neighbor ip-address interface
     interface-name-fpc-slot/pic-slot/port.interface-unit-number virtual-circuit-id
     virtual-circuit-id
   ```

   NOTE: To configure the T1 interface as the Layer 2 circuit, replace **e1** with **t1** in the configuration statement.

   For example:

   ```
   [edit protocol l2circuit]
   user@host# set neighbor 10.255.0.6 interface e1-1/0/0.0 virtual-circuit-id 1
   ```

3. To verify this configuration, use the **show** command at the **[edit protocols l2circuit]** hierarchy level.

   ```
   [edit protocols l2circuit]
   user@host# show
   neighbor 10.255.0.6 {
     interface e1-1/0/0.0 {
       virtual-circuit-id 1;
     }
   }
   ```

After the customer edge (CE)-bound interfaces (for both PE routers) are configured with proper encapsulation, payload size, and other parameters, the two PE routers try to establish a pseudowire with Pseudowire Emulation Edge-to-Edge (PWE3) signaling extensions. The following pseudowire interface configurations are disabled or ignored for TDM pseudowires:

- **ignore-encapsulation**
- **mtu**

The supported pseudowire types are:

- 0x0011 Structure-Agnostic E1 over Packet
- 0x0012 Structure-Agnostic T1 (DS1) over Packet

When the local interface parameters match the received parameters, and the pseudowire type and control word bit are equal, the pseudowire is established.

For detailed information about configuring TDM pseudowire, see the *Junos OS VPNs Library for Routing Devices*.

For detailed information about MICs, see the *PIC Guide* for your router.

Related Documentation

- Mobile Backhaul and Circuit Emulation Overview on page 3
- Configuring SAToP on Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP on page 33

Configuring SAToP on Channelized E1/T1 Circuit Emulation MIC

The following sections describes configuring SAToP on the Channelized E1/T1 Circuit Emulation MIC (MIC-3D-16CHE1-T1-CE).

- Configuring T1/E1 Framing Mode at the MIC Level on page 43
- Configuring CT1 Ports Down to T1 Channels on page 44
- Configuring CT1 Ports Down to DS Channels on page 44

Configuring T1/E1 Framing Mode at the MIC Level

To set the framing mode at the MIC (MIC-3D-16CHE1-T1-CE) level, include the **framing** statement at the **[edit chassis fpc *slot* pic *slot*]** hierarchy level.

```
[edit chassis fpc slot pic slot]
user@host# set framing (t1 | e1);
```

After a MIC is brought online, all 16 CT1 or CE1 interfaces are created for the MIC according to the framing option used at the **[edit chassis fpc *slot* pic *slot*]** hierarchy level.

- If you include the **framing t1** statement, 16 channelized T1 (CT1) interfaces are created.
- If you include the **framing e1** statement, 16 channelized E1 (CE1) interfaces are created.

NOTE: If you set the framing option incorrectly for the MIC type, the commit operation fails.

By default, t1 framing mode is selected.

Bit error rate test (BERT) patterns with all binary 1s (ones) received by CT1/CE1 interfaces on Circuit Emulation MICs configured for SAToP do not result in an alarm indication signal (AIS) defect. As a result, the CT1/CE1 interfaces remain up.

Configuring CT1 Ports Down to T1 Channels

To configure a CT1 port down to a T1 channel, use the following procedure:

NOTE: To configure a CE1 port down to the E1 channel, replace ct1 with ce1 and t1 with e1 in the procedure.

1. In configuration mode, go to the **[edit interfaces ct1-*mpc-slot/mic-slot/port-number*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces ct1-mpc-slot/mic-slot/port-number
   ```

   For example:

   ```
   [edit]
   user@host# edit interfaces ct1-1/0/0
   ```

2. On the CT1 interface, set the **no-partition** option and then set the interface type as T1.

   ```
   [edit interfaces ct1-mpc-slot/mic-slot/port-number]
   user@host# set no-partition interface-type t1
   ```

   In the following example, the ct1-1/0/1 interface is configured to be of type T1 and to have no partitions.

   ```
   [edit interfaces ct1-1/0/1]
   user@host# set no-partition interface-type t1
   ```

Configuring CT1 Ports Down to DS Channels

To configure a channelized T1 (CT1) port down to a DS channel, include the **partition** statement at the **[edit interfaces ct1-*mpc-slot/mic-slot/port-number*]** hierarchy level:

NOTE: To configure a CE1 port down to a DS channel, replace ct1 with ce1 in the following procedure.

1. In configuration mode, go to the **[edit interfaces ct1-*mpc-slot/mic-slot/port-number*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces ct1-mpc-slot/mic-slot/port-number
   ```

   For example:

   ```
   [edit]
   user@host# edit interfaces ct1-1/0/0
   ```

2. Configure the partition, the time slot, and the interface type.

   ```
   [edit interfaces ct1-mpc-slot/mic-slot/port-number]
   user@host# set partition partition-number timeslots timeslots interface-type ds
   ```

In the following example, the ct1-1/0/0 interface is configured as a DS interface with one partition and three time slots:

```
[edit interfaces ct1-1/0/0]
user@host# set partition 1 timeslots 1-4,9,22-24 interface-type ds
```

To verify the configuration of the ct1-1/0/0 interface, use the **show** command at the **[edit interfaces ct1-1/0/0]** hierarchy level.

```
[edit interfaces ct1-1/0/0]
user@host# show
partition 1 timeslots 1-4,9,22-24 interface-type ds;
```

An *N*xDS0 interface can be configured from channelized T1 interface. Here *N* represents the time slots on the CT1 interface. The value of *N* is:

- 1 through 24 when a DS0 interface is configured from a CT1 interface.
- 1 through 31 when a DS0 interface is configured from a CE1 interface.

After you partition the DS interface, configure the SAToP options on it. See "Setting the SAToP Options" on page 31.

Related Documentation

- 16-Port Channelized E1/T1 Circuit Emulation MIC Overview on page 9

CHAPTER 3

CESoPSN support on Circuit Emulation MIC

Configuring CESoPSN on Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP

This configuration applies to the mobile backhaul application shown in Figure 1 on page 4.

Configuring SONET/SDH Rate-Selectability

You can configure rate-selectability on the Channelized OC3/STM1 (Multi-Rate) MICs with SFP(MIC-3D-4COC3-1COC12-CE) by specifying the port speed. The Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP is rate-selectable and its port speed can be specified as COC3-CSTM1 or COC12-CSTM4.

To configure the rate-selectability:

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

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

   For example:

   ```
   [edit]
   user@host# edit chassis fpc 1 pic 0 port 0
   ```

2. Set the speed as **coc3-cstm1** or **coc12-cstm4**.

   ```
   [edit chassis fpc slot pic slot port slot]
   ```

```
user@host# set speed (coc3-cstm1 | coc12-cstm4)
```

For example:

```
[edit chassis fpc 1 pic 0 port 0]
user@host# set speed coc3-cstm1
```

NOTE: When the speed is set as **coc12-cstm4**, instead of configuring COC3 ports down to T1 channels and CSTM1 ports down to E1 channels, you must configure COC12 ports down to T1 channels and CSTM4 channels down to E1 channels.

Configuring SONET/SDH Framing Mode at the MIC Level

To set the framing mode at the MIC (MIC-3D-4COC3-1COC12-CE) level, for all four ports on the MIC, include the **framing** statement at the **[edit chassis fpc *slot* pic *slot*]** hierarchy level.

```
[edit chassis fpc slot pic slot]
user@host# set framing (sonet | sdh) # SONET for COC3/COC12 or SDH for CSTM1/CSTM4
```

After a MIC is brought online, interfaces are created for the MIC's available ports on the basis of the MIC type and the framing option used.

- If you include the **framing sonet** statement, four COC3 interfaces are created when the speed is configured as **coc3-cstm1**.
- If you include the **framing sdh** statement, four CSTM1 interfaces are created when the speed is configured as **coc3-cstm1**.
- If you include the **framing sonet** statement, one COC12 interface is created when the speed is configured as **coc12-cstm4**.
- If you include the **framing sdh** statement, one CSTM4 interface is created when the speed is configured as **coc12-cstm4**.
- If you do not specify framing at the MIC level, then the default framing is SONET for all the ports.

NOTE: If you set the framing option incorrectly for the MIC type, the commit operation fails.

Bit error rate test (BERT) patterns with all binary 1s (ones) received by CT1/CE1 interfaces on Circuit Emulation MICs configured for CESoPSN do not result in an alarm indication signal (AIS) defect. As a result, the CT1/CE1 interfaces remain up.

Configuring CESoPSN Encapsulation on DS Interfaces on CT1 Channels

This topic includes the following tasks:

1. Configuring COC3 Ports Down to CT1 Channels on page 49
2. Configuring CT1 Channels Down to DS Interfaces on page 50
3. Configuring CESoPSN on DS Interfaces on page 51

Configuring COC3 Ports Down to CT1 Channels

When configuring COC3 ports down to CT1 channels, on any MIC configured for SONET framing (numbered 0 through 3), you can configure three COC1 channels (numbered 1 through 3). On each COC1 channel, you can configure a maximum of 28 CT1 channels and a minimum of 1 CT1 channel based on the time slots.

When configuring COC12 ports down to CT1 channels on a MIC configured for SONET framing, you can configure 12 COC1 channels (numbered 1 through 12). On each COC1 channel, you can configure 24 CT1 channels (numbered 1 through 28).

To configure COC3 channelization down to COC1 and then down to CT1 channels, include the **partition** statement at the **[edit interfaces (coc1 | coc3)-*mpc-slot/mic-slot/port-number*]** hierarchy level:

NOTE: To configure COC12 ports down to CT1 channels, replace coc3 with coc12 in the following procedure.

1. In configuration mode, go to the **[edit interfaces coc3-*mpc-slot/mic-slot/port-number*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces coc3-mpc-slot/mic-slot/port-number
   ```

   For example:

   ```
   [edit]
   user@host# edit interfaces coc3-1/0/0
   ```

2. Configure the sublevel interface partition index and the range of SONET/SDH slices, and set the sublevel interface type as **coc1**.

   ```
   [edit interfaces coc3-mpc-slot/mic-slot/port-number]
   user@host# set partition partition-number oc-slice oc-slice interface-type coc1
   ```

   For example:

   ```
   [edit interfaces coc3-1/0/0]
   user@host# set partition 1 oc-slice 1 interface-type coc1
   ```

3. Enter the **up** command to go to the **[edit interfaces]** hierarchy level.

   ```
   [edit interfaces coc3-mpc-slot/mic-slot/port-number]
   user@host# up
   ```

For example:

```
[edit interfaces coc3-1/0/0]
user@host# up
```

4. Configure the channelized OC1 interface and the sublevel interface partition index, and set the interface type as **ct1**.

   ```
   [edit interfaces]
   user@host# set coc1-1/0/0:1 partition partition-number interface-type ct1
   ```

   For example:

   ```
   [edit interfaces]
   user@host# set coc1-1/0/0:1 partition 1 interface-type ct1
   ```

To verify the configuration, use the **show** command at the **[edit interfaces]** hierarchy level.

```
[edit interfaces]
user@host# show
coc3-1/0/0 {
    partition 1 oc-slice 1 interface-type coc1;
}
coc1-1/0/0:1 {
    partition 1 interface-type ct1;
}
```

Configuring CT1 Channels Down to DS Interfaces

To configure CT1 channels down to a DS interface, include the **partition** statement at the **[edit interfaces ct1-*mpc-slot/mic-slot/port-number:channel:channel*]** hierarchy level:

1. In configuration mode, go to the **[edit interfaces ct1-*mpc-slot/mic-slot/port-number:channel:channel*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces ct1-mpc-slot/mic-slot/port-number:channel:channel
   ```

   For example:

   ```
   [edit]
   user@host# edit interfaces ct1-1/0/0:1:1
   ```

2. Configure the partition, the time slots, and the interface type.

   ```
   [edit interfaces ct1-mpc-slot/mic-slot/port-number:channel:channel]
   user@host# set partition partition-number timeslots timeslots interface-type ds
   ```

   For example:

   ```
   [edit interfaces ct1-1/0/0:1:1]
   user@host# set partition 1 timeslots 1-4 interface-type ds
   ```

NOTE: You can assign multiple time slots on a CT1 interface. In the set command, separate the time slots by commas and do not include spaces between them. For example:

```
[edit interfaces ct1-1/0/0:1:1]
user@host# set partition 1 timeslots 1-4,9,22-24 interface-type ds
```

To verify this configuration, use the **show** command at the **[edit interfaces ct1-1/0/0:1:1]** hierarchy level.

```
[edit interfaces ct1-1/0/0:1:1]
user@host# show
partition 1 timeslots 1-4 interface-type ds;
```

An *N*xDS0 interface can be configured from channelized T1 interface (ct1). Here *N* represents the time slots on the CT1 interface.

The value of *N* is 1 through 24 when a DS0 interface is configured from a CT1 interface.

After you partition the DS interface, configure the CESoPSN options on it. See "Setting the CESoPSN Options" on page 57.

Configuring CESoPSN on DS Interfaces

To configure CESoPSN encapsulation on a DS interface, include the **encapsulation** statement at the **[edit interfaces ds-*mpc-slot/mic-slot/port-number*:*channel*:*channel*:*channel*]** hierarchy level.

1. In configuration mode, go to the **[edit interfaces ds-*mpc-slot/mic-slot/port-number*:*channel*:*channel*:*channel*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces ds-mpc-slot/mic-slot/ port-number:channel:channel:channel
   ```

   For example:

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

2. Configure CESoPSN as the encapsulation type and the logical interface for the DS interface.

   ```
   [edit interfaces ds-mpc-slot/mic-slot/port-number:channel:channel:channel]
   user@host# set encapsulation cesopsn unit interface-unit-number
   ```

   For example:

   ```
   [edit interfaces ds-1/0/0:1:1:1 ]
   user@host# set encapsulation cesopsn unit 0
   ```

To verify this configuration, use the **show** command at the **[edit interfaces ds-1/0/0:1:1:1]** hierarchy level.

```
[edit interfaces ds-1/0/0:1:1:1]
user@host# show
encapsulation cesopsn;
```

unit 0;

Configuring CESoPSN Encapsulation on DS Interfaces on CE1 Channels

This topic includes the following tasks:

Configuring CSTM1 Ports Down to CE1 Channels

On any port configured for SDH framing (numbered 0 through 3), you can configure one CAU4 channel. On each CAU4 channel, you can configure 31 CE1 channels (numbered 1 through 31).

To configure CSTM1 channelization down to CAU4 and then down to CE1 channels, include the **partition** statement at the **[edit interfaces (cau4 | cstm1)-*mpc-slot/mic-slot/port-number*]** hierarchy level, as shown in the following example:

1. In configuration mode, go to the **[edit interfaces cstm1-*mpc-slot/mic-slot/port-number*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces cstm1-mpc-slot/mic-slot/port-number
   ```

   For example:

   ```
   [edit]
   user@host# edit interfaces cstm1-1/0/1
   ```

2. On the CSTM1 interface, set the **no-partition** option, and then set the interface type as **cau4**.

   ```
   [edit interfaces cstm1-mpc-slot/mic-slot/port-number]
   user@host# set no-partition interface-type cau4
   ```

   For example:

   ```
   [edit interfaces cstm1-1/0/1]
   user@host# set no-partition interface-type cau4
   ```

3. Enter the **up** command to go to the **[edit interfaces]** hierarchy level.

   ```
   [edit interfaces cstm1-mpc-slot/mic-slot/port-number]
   user@host# up
   ```

   For example:

   ```
   [edit interfaces cstm1-1/0/1]
   user@host# up
   ```

4. Configure the MPC slot, the MIC slot, and the port for the CAU4 interface. Set the sublevel interface partition index and set the interface type as **ce1**.

   ```
   [edit interfaces]
   ```

```
user@host# set cau4-mpc-slot/mic-slot/port-number partition partition-number
  interface-type ce1
```

For example:

```
[edit interfaces]
user@host# set cau4-1/0/1 partition 1 interface-type ce1
```

To verify this configuration, use the **show** command at the **[edit interfaces]** hierarchy level.

```
[edit interfaces]
user@host# show
cstm1-1/0/1 {
  no-partition interface-type cau4;
}
cau4-1/0/1 {
  partition 1 interface-type ce1;
}
```

Configuring CSTM4 Ports Down to CE1 Channels

NOTE: When the port speed is configured as **coc12-cstm4** at the **[edit chassis fpc *slot* pic *slot* port *slot*]** hierarchy level, you must configure CSTM4 ports down to CE1 channels.

On a port configured for SDH framing, you can configure one CAU4 channel. On the CAU4 channel, you can configure 31 CE1 channels (numbered 1 through 31).

To configure CSTM4 channelization down to CAU4 and then down to CE1 channels, include the **partition** statement at the **[edit interfaces (cau4|cstm4)-*mpc-slot/mic-slot/port-number*]** hierarchy level.

1. In configuration mode, go to the **[edit interfaces cstm4-*mpc-slot/mic-slot/port-number*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces cstm4-mpc-slot/mic-slot/port-number
   ```

   For example:

   ```
   [edit]
   user@host# edit interfaces cstm4-1/0/0
   ```

2. Configure the sublevel interface partition index and the range of SONET/SDH slices, and set the sublevel interface type as **cau4**.

   ```
   [edit interfaces cstm4-1/0/0]
   user@host# set partition partition-number oc-slice oc-slice interface-type cau4
   ```

   For **oc-slice**, select from the following ranges: 1–3, 4–6, 7–9, and 10–12.

   For **partition**, select a value from 1 through 4.

   For example:

   ```
   [edit interfaces cstm4-1/0/0]
   ```

```
user@host# set partition 1 oc-slice 1-3 interface-type cau4
```

3. Enter the **up** command to go to the **[edit interfaces]** hierarchy level.

```
[edit interfaces cstm4-mpc-slot/mic-slot/port-number]
user@host# up
```

For example:

```
[edit interfaces cstm4-1/0/0]
user@host# up
```

4. Configure the MPC slot, the MIC slot, and the port for the CAU4 interface. Set the sublevel interface partition index and set the interface type as **ce1**.

```
[edit interfaces]
user@host# set cau4-mpc-slot/mic-slot/port-number:channel partition
  partition-number interface-type ce1
```

For example:

```
[edit interfaces]
user@host# set cau4-1/0/0:1 partition 1 interface-type ce1
```

To verify this configuration, use the **show** command at the **[edit interfaces]** hierarchy level.

```
[edit interfaces]
user@host# show
cstm4-1/0/0 {
   partition 1 oc-slice 1-3 interface-type cau4;
}
cau4-1/0/0:1 {
   partition 1 interface-type ce1;
}
```

Configuring CE1 Channels Down to DS Interfaces

To configure CE1 channels down to a DS interface, include the **partition** statement at the **[edit interfaces ce1-*mpc-slot/mic-slot/port*:*channel*]** hierarchy level.

1. In configuration mode, go to the **[edit interfaces ce1-*mpc-slot/mic-slot/port*:*channel*]** hierarchy level.

```
[edit]
user@host# edit interfaces ce1-mpc-slot/mic-slot/port:channel
```

```
[edit]
user@host# edit interfaces ce1-1/0/0:1:1
```

2. Configure the partition and the time slots, and set the interface type as **ds**.

```
[edit interfaces ce1-1/0/0:1:1]
user@host# set partition partition-number timeslots timeslots interface-type ds
```

For example:

```
[edit interfaces ce1-1/0/0:1:1]
user@host# set partition 1 timeslots 1-4 interface-type ds
```

NOTE: You can assign multiple time slots on a CE1 interface. In the set command, separate the time slots by commas and do not include spaces between them. For example:

```
[edit interfaces ce1-1/0/0:1:1]
user@host# set partition 1 timeslots 1-4,9,22-31 interface-type ds
```

To verify this configuration, use the **show** command at the **[edit interfaces ce1-1/0/0:1:1** hierarchy level.

```
[edit interfaces ce1-1/0/0:1:1 ]
user@host# show
partition 1 timeslots 1-4 interface-type ds;
```

An *N*xDS0 interface can be configured from a channelized E1 interface (CE1). Here *N* represents the number of time slots on the CE1 interface.

The value of *N* is 1 through 31 when a DS0 interface is configured from a CE1 interface.

After you partition the DS interface, configure the CESoPSN options on it. See "Setting the CESoPSN Options" on page 57.

Configuring CESoPSN on DS Interfaces

To configure CESoPSN encapsulation on a DS interface, include the **encapsulation** statement at the **[edit interfaces ds-*mpc-slot/mic-slot/port-number*:*channel*:*channel*:*channel*]** hierarchy level.

1. In configuration mode, go to the **[edit interfaces ds-*mpc-slot/mic-slot/port-number*:*channel*:*channel*:*channel*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces ds-mpc-slot/mic-slot/port-number:channel:channel:channel
   ```

   For example:

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

2. Configure CESoPSN as the encapsulation type and then set the logical interface for the ds interface.

   ```
   [edit interfaces ds-1/0/0:1:1:1 ]
   user@host# set encapsulation cesopsn unit interface-unit-number
   ```

   For example:

   ```
   [edit interfaces ds-1/0/0:1:1:1 ]
   user@host# set encapsulation cesopsn unit 0
   ```

To verify this configuration, use the **show** command at the **[edit interfaces ds-1/0/0:1:1:1]** hierarchy level.

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

```
encapsulation cesopsn;
unit 0;
```

Related Documentation

- Mobile Backhaul and Circuit Emulation Overview on page 3
- Configuring CESoPSN Encapsulation on DS Interfaces on Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP on page 56

Configuring CESoPSN Encapsulation on DS Interfaces on Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP

This configuration applies to the mobile backhaul application shown in Figure 1 on page 4.

This topic includes the following tasks:

1. Setting the Encapsulation Mode on page 56
2. Setting the CESoPSN Options on page 57
3. Configuring the Pseudowire Interface on page 58

Setting the Encapsulation Mode

To configure a DS interface on Circuit Emulation MICs with CESoPSN encapsulation at the provider edge (PE) router:

1. In configuration mode, go to the **[edit interfaces ds-*mpc-slot/mic-slot/port*<:channel>]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces ds-mpc-slot/mic-slot/port<:channel>
   ```

   For example:

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

2. Configure CESoPSN as the encapsulation type and set the logical interface for the DS interface.

   ```
   [edit interfaces ds-mpc-slot/mic-slot/port<:channel>]
   user@host# set encapsulation cesopsn unit logical-unit-number
   ```

   For example:

   ```
   [edit interfaces ds-1/0/0:1:1:1]
   user@host# set encapsulation cesopsn unit 0
   ```

To verify this configuration, use the **show** command at the **[edit interfaces ds-1/0/0:1:1:1]** hierarchy level:

```
[edit interfaces ds-1/0/0:1:1:1]
user@host# show
encapsulation cesopsn;
unit 0;
```

You do not need to configure any circuit cross-connect family because it is automatically created for the CESoPSN encapsulation.

Setting the CESoPSN Options

To configure CESoPSN options:

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

   ```
   [edit]
   user@host# edit interfaces ds-fpc-slot/pic-slot/port:channel
   ```

   For example:

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

2. Use the **edit** command to go to the **[edit cesopsn-options]** hierarchy level.

   ```
   [edit]
   user@host# edit cesopsn-options
   ```

3. In this hierarchy level, using the **set** command you can configure the following CESoPSN options:

   - **excessive-packet-loss-rate**—Set packet loss options. The options are **sample-period** and **threshold**.
     - **sample-period**—Time required to calculate excessive packet loss rate (from 1000 through 65,535 milliseconds).
     - **threshold**—Percentile designating the threshold of excessive packet loss rate (1–100 percent).
   - **idle-pattern**—An 8-bit hexadecimal pattern to replace TDM data in a lost packet (from 0 through 255).
   - **jitter-buffer-latency**—Time delay in the jitter buffer (from 1 through 1000 milliseconds).
   - **jitter-buffer-packets**—Number of packets in the jitter buffer (from 1 through 64 packets).
   - **packetization-latency**—Time required to create packets (from 1000 through 8000 microseconds).

   NOTE: In this section, we are configuring only one CESoPSN option. You can follow the same method to configure all the other CESoPSN options.

   ```
   [edit interfaces ds-1/0/0:1:1:1 cesopsn-options]
   user@host# set excessive-packet-loss-rate sample-period sample-period
   ```

   For example:

   ```
   [edit interfaces ds-1/0/0:1:1:1 cesopsn-options]
   user@host# set excessive-packet-loss-rate sample-period 4000
   ```

To verify this configuration, use the **show** command at the **[edit interfaces ds-1/0/0:1:1:1]** hierarchy level:

```
[edit interfaces ds-1/0/0:1:1:1]
user@host# show
cesopsn-options {
   excessive-packet-loss-rate {
      sample-period 4000;
   }
}
```

Configuring the Pseudowire Interface

To configure the TDM pseudowire at the provider edge (PE) router, use the existing Layer 2 circuit infrastructure, as shown in the following procedure:

1. In configuration mode, go to the **[edit protocols l2circuit]** hierarchy level.

   ```
   [edit]
   user@host# edit protocol l2circuit
   ```

2. Configure the IP address of the neighboring router or switch, the interface forming the Layer 2 circuit, and the identifier for the Layer 2 circuit.

   ```
   [edit protocol l2circuit]
   user@host# set neighbor ip-address interface
     interface-name-fpc-slot/pic-slot/port.interface-unit-number virtual-circuit-id
     virtual-circuit-id
   ```

   For example:

   ```
   [edit protocol l2circuit]
   user@host# set neighbor 10.255.0.6 interface ds-1/0/0:1:1:1 virtual-circuit-id 1
   ```

To verify this configuration, use the **show** command at the **[edit protocols l2circuit]** hierarchy level.

```
[edit protocols l2circuit]
user@host# show
neighbor 10.255.0.6 {
   interface ds-1/0/0:1:1:1 {
      virtual-circuit-id 1;
   }
}
```

After the customer edge (CE)-bound interfaces (for both PE routers) are configured with proper encapsulation, packetization latency, and other parameters, the two PE routers try to establish a pseudowire with Pseudowire Emulation Edge-to-Edge (PWE3) signaling extensions. The following pseudowire interface configurations are disabled or ignored for TDM pseudowires:

- **ignore-encapsulation**
- **mtu**

The supported pseudowire type is 0x0015 CESoPSN basic mode.

When the local interface parameters match the received parameters, and the pseudowire type and control word bit are equal, the pseudowire is established.

For detailed information about configuring TDM pseudowire, see the *Junos OS VPNs Library for Routing Devices*.

For detailed information about PICs, see the *PIC Guide* for your router.

Related Documentation

- Configuring CESoPSN on Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP on page 47
- Mobile Backhaul and Circuit Emulation Overview on page 3

Configuring CESoPSN on Channelized E1/T1 Circuit Emulation MIC

This configuration applies to the mobile backhaul application shown in Figure 1 on page 4.

- Configuring T1/E1 Framing Mode at the MIC Level on page 59
- Configuring CT1 Interface Down to DS channels on page 60
- Configuring CESoPSN on DS Interfaces on page 61

Configuring T1/E1 Framing Mode at the MIC Level

To set the framing mode at the MIC (MIC-3D-16CHE1-T1-CE) level, for all four ports on the MIC, include the **framing** statement at the **[edit chassis fpc *slot* pic *slot*]** hierarchy level.

```
[edit chassis fpc slot pic slot]
user@host# set framing (t1 | e1);
```

After a MIC is brought online, interfaces are created for the MIC's available ports on the basis of the MIC type and the framing option used.

- If you include the **framing t1** statement, 16 CT1 interfaces are created.
- If you include the **framing e1** statement, 16 CE1 interfaces are created.

NOTE: If you set the framing option incorrectly for the MIC type, the commit operation fails.

Bit error rate test (BERT) patterns with all binary 1s (ones) received by CT1/CE1 interfaces on Circuit Emulation MICs configured for CESoPSN do not result in an alarm indication signal (AIS) defect. As a result, the CT1/CE1 interfaces remain up.

Configuring CT1 Interface Down to DS channels

To configure a channelized T1 (CT1) interface down to DS channels, include the **partition** statement at the **[edit interfaces ct1-*mpc-slot/mic-slot/port-number*]** hierarchy level:

NOTE: To configure a CE1 interface down to DS channels, replace **ct1** with **ce1** in the following procedure.

1. In configuration mode, go to the **[edit interfaces ct1-*mpc-slot/mic-slot/port-number*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces ct1-mpc-slot/mic-slot/port-number
   ```

   For example:

   ```
   [edit]
   user@host# edit interfaces ct1-1/0/0
   ```

2. Configure the sublevel interface partition index and the time slots, and set the interface type as **ds**.

   ```
   [edit interfaces ct1-mpc-slot/mic-slot/port-number]
   user@host# set partition partition-number timeslots timeslots interface-type ds
   ```

   For example:

   ```
   [edit interfaces ct1-1/0/0]
   user@host# set partition 1 timeslots 1-4 interface-type ds
   ```

   NOTE: You can assign multiple time slots on a CT1 interface. In the **set** command, separate the time slots by commas and do not include spaces between them. For example:

   ```
   [edit interfaces ct1-1/0/0]
   user@host# set partition 1 timeslots 1-4,9,22-24 interface-type ds
   ```

To verify this configuration, use the **show** command at the **[edit interfaces ct1-1/0/0]** hierarchy level.

```
[edit interfaces ct1-1/0/0]
user@host# show
partition 1 timeslots 1-4 interface-type ds;
```

An *N*xDS0 interface can be configured from a CT1 interface. Here *N* represents the number of time slots on the CT1 interface. The value of *N* is:

- 1 through 24 when a DS0 interface is configured from a CT1 interface.
- 1 through 31 when a DS0 interface is configured from a CE1 interface.

After you partition the DS interface, configure CESoPSN options on it. See "Setting the CESoPSN Options" on page 57.

Configuring CESoPSN on DS Interfaces

To configure CESoPSN encapsulation on a DS interface, include the **encapsulation** statement at the **[edit interfaces ds-*mpc-slot/mic-slot/port-number*:*channel*]** hierarchy level.

1. In configuration mode, go to the **[edit interfaces ds-*mpc-slot/mic-slot/port-number*:*channel*]** hierarchy level.

   ```
   [edit]
   user@host# edit interfaces ds-mpc-slot/mic-slot/ port-number:channel
   ```

   For example:

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

2. Configure CESoPSN as the encapsulation type.

   ```
   [edit interfaces ds-mpc-slot/mic-slot/port-number:partition ]
   user@host# set encapsulation cesopsn
   ```

   For example:

   ```
   [edit interfaces ds-1/0/0:1 ]
   user@host# set encapsulation cesopsn
   ```

3. Configure the logical interface for the DS interface.

   ```
   [edit interfaces ds-mpc-slot/mic-slot/port-number:partition ]
   uset@host# set unit interface-unit-number
   ```

   For example:

   ```
   [edit interfaces ds-1/0/0:1 ]
   user@host# set unit 0
   ```

To verify this configuration, use the **show** command at the **[edit interfaces ds-1/0/0:1]** hierarchy level.

```
[edit interfaces ds-1/0/0:1]
user@host# show
encapsulation cesopsn;
unit 0;
```

Related Documentation

- 16-Port Channelized E1/T1 Circuit Emulation MIC Overview on page 9

CHAPTER 4

ATM Support on Circuit Emulation PICs

Configuring the 12-Port Channelized T1/E1 Circuit Emulation PIC Operating Mode

This section contains the following topics:

T1/E1 Mode Selection

After the PIC is brought online, 12 ct1 interfaces or 12 ce1 interfaces are created, depending on the T1 or E1 mode selection of the PIC.

Figure 3 on page 64 and Figure 4 on page 64 illustrate the possible interfaces that can be created on the 12-port T1/E1 Circuit Emulation PIC.

Figure 3: 12-Port T1/E1 Circuit Emulation PIC Possible Interfaces (T1 Size)

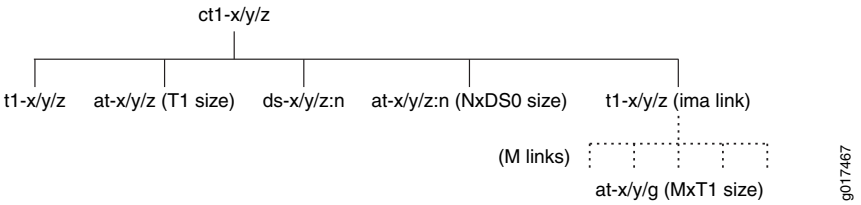
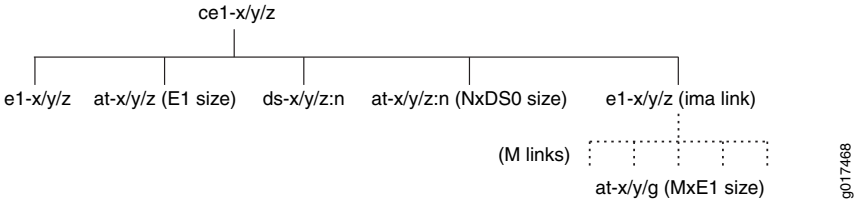


Figure 4: 12-Port T1/E1 Circuit Emulation PIC Possible Interfaces (E1 Size)



12-Port Channelized T1/E1 Circuit Emulation PIC Configuration Statements

Setting the T1/E1 Mode at the PIC Level

To set the T1/E1 mode at the PIC level, enter the following command:

set chassis fpc *fpc-slot* pic *pic-slot* framing (t1 | e1)

Or specify the following:

```
chassis {
  fpc fpc-slot {
    pic pic-slot {
      framing (t1 | e1);
    }
  }
}
```

After the PIC is brought online, 12 ct1 interfaces or 12 ce1 interfaces are created.

If the mode is not manually configured, then the PIC defaults to T1.

Creating an ATM Interface on a CT1 or CE1

To create an ATM interface on a CT1, enter the following command:

set interfaces ct1-*fpc/pic/port* no-partition interface-type at

Or specify the following:

```
interfaces {
  ct1-fpc/pic/port {
    no-partition {
      interface-type at;
    }
  }
}
```

To create an ATM interface on a CE1, enter the following command:

set interfaces ce1-*fpc/pic/port* no-partition interface-type at

Or specify the following:

```
interfaces {
  ce1-fpc/pic/port {
    no-partition {
      interface-type at;
    }
  }
}
```

The interface **at-*fpc/pic/port*** is created.

You can use the **show chassis hardware** command to display a list of the installed PICs.

Related Documentation

- ATM Support on Circuit Emulation PICs Overview on page 10

Configuring the 4-Port Channelized COC3/STM1 Circuit Emulation PIC Operating Mode

T1/E1 Mode Selection

All ATM interfaces are either T1 or E1 channels within the COC3/CSTM1 hierarchy. Each COC3 can be partitioned as 3 COC1 slices, each of which in turn can be partitioned further into 28 ATM interfaces and the size of each interface created is that of a T1. Each CS1 can be portioned as 1 CAU4, which can be further partitioned as E1 sized ATM interfaces.

To configure the T1/E1 mode selection, keep the following in mind:

1. To create **coc3-*fpc/pic/port*** or **cstm1-*fpc/pic/port*** interfaces, chassisd will look for configuration at the **[edit chassis fpc *fpc-slot* pic *pic-slot* port *port* framing (sonet | sdh)]** hierarchy level. If the **sdh** option is specified, chassisd will create a **cstm1-*fpc/pic/port*** interface. Otherwise, chassisd will create **coc3-*fpc/pic/port*** interfaces.
2. Only interface **coc1** can be created from **coc3**, and **t1** can be created from **coc1**.
3. Only interface **cau4** can be created from **cstm1**, and **e1** can be created from **cau4**.

Figure 5 on page 65 and Figure 6 on page 66 illustrate the possible interfaces that can be created on the 4-port Channelized COC3/STM1 Circuit Emulation PIC.

Figure 5: 4-Port Channelized COC3/STM1 Circuit Emulation PIC Possible Interfaces (T1 Size)

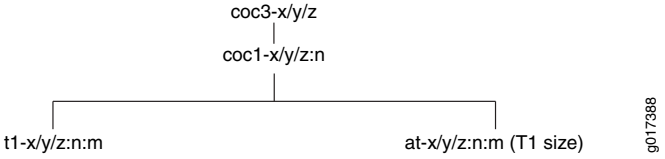
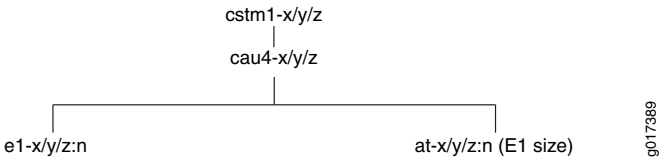


Figure 6: 4-Port Channelized COC3/STM1 Circuit Emulation PIC Possible Interfaces (E1 Size)



Subrate T1 is not supported.

ATM NxDS0 grooming is not supported.

External and internal loopback of T1/E1 (on ct1/ce1 physical interfaces) can be configured using the **sonet-options** statement. By default, no loopback is configured.

Configuring a Port for SONET or SDH Mode on a 4-Port Channelized COC3/STM1 Circuit Emulation PIC

Each port of the 4-port Channelized COC3/STM1 Circuit Emulation PIC can be independently configured for either SONET or SDH mode. To configure a port for either SONET or SDH mode, enter the **framing (sonet | sdh)** statement at the **[chassis fpc** *number* **pic** *number* **port** *number***]** hierarchy level.

The following example shows how to configure FPC 1, PIC 1, and port 0 for SONET mode and port 1 for SDH mode:

```
set chassis fpc 1 pic 1 port 0 framing sonet
set chassis fpc 1 pic 1 port 1 framing sdh
```

Or specify the following:

```
[edit]
fpc 1 {
  pic 1 {
    port 0 {
      framing sonet;
    }
    port 1 {
      framing sdh;
    }
  }
}
```

Configuring an ATM Interface on a COC1

To create an ATM interface on a COC1, enter the following command:

To create an ATM interface on CAU4, enter the following command:

```
set interfaces cau4-fpc/pic/port partition interface-type at
```

Or specify the following:

```
interfaces {
  cau4-fpc/pic/port {
  }
```

```
}
```

You can use the **show chassis hardware** command to display a list of the installed PICs.

Related Documentation

- ATM Support on Circuit Emulation PICs Overview on page 10

Configuring ATM IMA

The following sections explain how to create an ATM IMA group and to configure it according to your requirements:

- Creating an IMA Group (ATM Interfaces) on page 67
- Configuring Group ID for an IMA Link on a T1 Interface or an E1 Interface on page 67
- Configuring ATM Encapsulation Options on page 68
- Configuring IMA Group Options on page 68

Creating an IMA Group (ATM Interfaces)

To create an IMA group, perform the following steps:

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

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

2. Configure the Flexible Port Concentrator (FPC) slot and the Physical Interface Card (PIC) slot as needed.

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

3. Configure the device count. The device count can be set starting from 1 through 42 in the aggregated device options for inverse multiplexing for ATM at the **[edit chassis fpc *fpc-slot* pic *pic-slot*]** hierarchy level.

   ```
   [edit chassis fpc fpc-slot pic pic-slot]
   user@host# set aggregated-devices ima device-count count
   ```

This results in the creation of interfaces from at-x/y/*g* through at-x/y/*g*+*count*–1, where the variable *count* is the number of interfaces and the variable *g* is chosen such that there is no conflict with non-IMA at-x/y/z interfaces on the same PIC.

The PIC is automatically rebooted when a configuration that changes the IMA group count is committed.

Configuring Group ID for an IMA Link on a T1 Interface or an E1 Interface

A group ID is assigned to all links in an IMA group.

To assign a group ID to a T1 or an E1 interface:

1. In configuration mode, go to the **[edit interfaces *interface-name*]** hierarchy level, where the interface name is **t1-*fpc/pic/port*:*m*:*n***, **e1-*fpc/pic/port*:*n***, or **t1|e1-*fpc/pic/port***.

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

2. Configure the encapsulation as **ima**.

```
[edit interface interface-name]
user@host# set encapsulation ima
```

3. Configure the IMA group ID from 16 through 57. Note that this group ID is the same for all T1/E1 interfaces for a particular ATM IMA interface.

```
[edit interface interface-name]
user@host# set ima-link-options group-id number
```

Implement the aforementioned procedure to apply a group ID for all applicable T1 or E1 interfaces.

Configuring ATM Encapsulation Options

To configure the logical link-layer encapsulation for an ATM interface to support IMA:

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

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

2. Configure the logical interface (unit) as 0 and set the encapsulation for this logical interface as either ATM cell relay for CCC or ATM VC for CCC.

```
[edit interface interface-name]
user@host# set unit 0 encapsulation (atm-ccc-cell-relay | atm-ccc-vc-mux)
```

Configuring IMA Group Options

To configure the various options for an IMA group on an ATM interface:

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

```
[edit]
user@host# edit interface interface-name ima-group-options
```

2. Configure the maximum differential delay between the links in the IMA group. You can configure the maximum differential delay from 1 millisecond through 56 milliseconds. By default, 25 milliseconds is set.

```
[edit interface interface-name ima-atm-options]
user@host# set differential-delay delay
```

3. Configure the frame length of the ICP cell as 32, 64, 128, or 256. By default, 128 is set.

```
[edit interface interface-name ima-atm-options]
user@host# set frame-length length
```

4. Configure the IMA group frame synchronization state parameters alpha, beta, and gamma.

```
[edit interface interface-name ima-atm-options]
user@host# set alpha number beta number gamma number
```

For the default values and parameter range for alpha, beta, and gamma, see "ATM IMA Configuration Overview" on page 14.

5. Configure IMA group minimum active links.

   ```
   [edit interface interface-name ima-atm-options]
   user@host# set minimum-links links
   ```

6. Configure the symmetry of the IMA group as either *symmetrical configuration and operation* or *symmetrical configuration and asymmetrical operation*.

   ```
   [edit interface interface-name ima-atm-options]
   user@host# set symmetry (symmetrical-config-and-operation |
     symmetrical-config-asymmetrical-operation)
   ```

   For information about symmetry, see "ATM IMA Configuration Overview" on page 14.

7. Configure a test procedure to start and end the test pattern procedure.

   ```
   [edit interface interface-name ima-atm-options]
   user@host# set ima-test-start
   user@host# ima-test-stop
   user@host# interface interface-name
   user@host# pattern number
   user@host# period number
   ```

   For information about test procedure, see "ATM IMA Configuration Overview" on page 14.

8. Configure a transmit clock to reflect the primary reference source (PRS) of the clock for each link in a group either in common timing mode or independent timing mode. By default, common timing mode is selected.

   ```
   [edit interface interface-name ima-atm-options]
   user@host# set transmit-clock (common | independent)
   ```

9. Configure the IMA specification version as either version 1.0 or version 1.1. By default, IMA version 1.1 is selected.

   ```
   [edit interface interface-name ima-atm-options]
   user@host# set version (1.0|1.1)
   ```

Related Documentation

- ATM IMA Configuration Overview on page 14
- ATM Support on Circuit Emulation PICs Overview on page 10
- Understanding Inverse Multiplexing for ATM on page 12

Configuring ATM Pseudowires

ATM pseudowires are described in RFC 4717. Pseudowire encapsulation is selected by configuring for a cell-relay pseudowire:

```
[edit interfaces at-fpc/pic/port:unit n]

encapsulation atm-ccc-cell-relay;
atm-l2circuit-mode cell;
```

Or for an AAL5 pseudowire:

```
encapsulation atm-ccc-vc-mux;
atm-l2circuit-mode aal5;
```

NOTE: **encapsulation atm-ccc-cell-relay** can be set at either the physical interface or logical interface level. **atm-ccc-vc-mux** can only be set at the logical interface level.

The following sections describe:

- Cell Relay Mode (atm-l2circuit-mode cell) on page 70
- Configuring AAL5 SDU Mode (atm-l2circuit-mode aal5) on page 71

Cell Relay Mode (atm-l2circuit-mode cell)

In cell relay mode, one or more cells are bundled together to form a packet that is sent across the PSN tunnel. N-to-one mode is used to encapsulate cell bundles. In this mode, 52 bytes of each cell are transported across the PSN (the HEC field of the ATM header is omitted). The optional one-to-one mode is not supported.

By default, each ATM cell is encapsulated into a pseudowire packet (per RFC 4717) and sent over the pseudowire (**cell-bundle-size** = 1). The pseudowire may be configured to aggregate a user-configured number of cells into a packet to increase network utilization efficiency.

```
[edit interfaces at-fpc/pic/port]
atm-options {
   cell-bundle-size cells;
}
```

where ***cells*** is the number of cells each pseudowire packet should contain.

- Configuring VP or Port Promiscuous Mode on page 70

Configuring VP or Port Promiscuous Mode

By default, all incoming cells are mapped from a single VC to an ATM pseudowire. For ATM physical interfaces configured with **atm-l2circuit-mode cell**, you can configure port or VP promiscuous mode.

In VP promiscuous mode, all cells with the same VPI are forwarded on a single pseudowire:

```
[edit interfaces at-fpc/pic/port]
atm-options {
   pic-type atm-ce;
   promiscuous-mode {
      vpi number;
   }
}
unit 0 {
   vpi number;
}
```

In port promiscuous mode, all cells received on a T1 or E1 ATM port are forwarded across a single pseudowire:

```
[edit interfaces at-fpc/pic/port]
encapsulation atm-ccc-cell-relay;
atm-options {
   pic-type atm-ce;
   promiscuous-mode
}
unit 0 {
   allow-any-vci;
}
```

Use the **show interface at-*x/y/z:n*** command to view cell relay statistics.

Configuring AAL5 SDU Mode (atm-l2circuit-mode aal5)

In AAL5 SDU mode, the ATM logical interface (VC) expects all data to be either AAL5 encapsulated packets or OAM cells. AAL5 packets are deencapsulated (AAL5 trailer is stripped off), prepended with an ATM pseudowire control word (RFC 4717) and forwarded on the pseudowire.

OAM cells that are received while an AAL5 packet is being reassembled are forwarded on the pseudowire immediately (they are reordered ahead of the packet being reassembled).

Use the **show interface at-*x/y/z:n*** command to view AAL5 statistics.

Configuring ATM Cell-Relay Pseudowire

In ATM cell-relay mode, one or more ATM cells are bundled together to form a packet that is sent across the packet-switched network (PSN) using MPLS. In this mode, each ATM cell and its header are transported over the MPLS cloud. The ATM header consisting of the VPI and VCI values is transported across the MPLS cloud or the backhaul network.

By default, all incoming cells are mapped from a single virtual circuit to an ATM pseudowire. For ATM logical interfaces configured with **atm-ccc-cell-relay** encapsulation, you can configure ATM cell-relay pseudowire in VP-promiscuous mode, port-promiscuous mode, and VCC mode.

This topic includes the following tasks:

- Configuring ATM Cell-Relay Pseudowire in Port-Promiscuous Mode on page 71
- Configuring ATM Cell-Relay Pseudowire in VP-Promiscuous Mode on page 72
- Configuring ATM Cell-Relay Pseudowire in VCC Mode on page 73

Configuring ATM Cell-Relay Pseudowire in Port-Promiscuous Mode

To configure ATM cell-relay pseudowire in port-promiscuous mode:

1. In configuration mode, go to the **[edit interfaces]** hierarchy level and set the interface as at-0/2/2.

   ```
   [edit]
   ```

```
user@host#edit interfaces at-0/2/2
```

2. To map incoming traffic, include the **promiscuous mode** statement at the **[edit interfaces *interface-name* atm-options]** hierarchy level.

```
[edit interfaces at-0/2/2]
user@host#set atm-options promiscuous-mode
```

3. To configure ATM encapsulation on unit 0, include the **encapsulation** statement at the **[edit interfaces *interface-name*]** hierarchy level.

```
[edit interfaces at-0/2/2]
user@host#set unit 0 encapsulation atm-ccc-cell-relay
```

4. Include the **allow-any-vci** statement at the **[edit interfaces *interface-name*]** hierarchy level.

```
[edit interfaces at-0/2/2]
user@host#set unit 0 allow-any-vci
```

5. To verify the configuration, you can issue the following operational mode command in configuration mode:

```
[edit]
user@host#show at-0/2/2
```

```
atm-options{
promiscuous-mode;
}
unit 0{
encapsulation atm-ccc-cell-relay;
allow-any-vci;
}
```

Configuring ATM Cell-Relay Pseudowire in VP-Promiscuous Mode

To configure ATM cell-relay pseudowire in VP-promiscuous mode:

1. In configuration mode, go to the **[edit interfaces]** hierarchy level and set the interface as at-0/2/2.

```
[edit]
user@host#edit interfaces at-0/2/2
```

2. To map incoming traffic to a single LSP and to specify the VPI value as 8, include the **promiscuous mode** statement and **vpi *vpi-identifier*** statement at the **[edit interfaces *interface-name* atm-options]** hierarchy level.

```
[edit interfaces at-0/2/2]
user@host#set atm-options promiscuous-mode vpi 8
```

3. To configure ATM encapsulation on unit 0, include the **encapsulation** statement at the **[edit interfaces *interface-name*]** hierarchy level.

```
[edit interfaces at-0/2/2]
user@host#set unit 0 encapsulation atm-ccc-cell-relay
```

4. To specify 8 as the VPI value on unit 0, include the **vpi *vpi-identifier*** statement at the **[edit interfaces *interface-name*]** hierarchy level.

```
[edit interfaces at-0/2/2]
```

```
user@host#set unit 0 vpi 8
```

5. To verify the configuration, you can issue the following operational mode command in configuration mode:

```
[edit]
user@host#show at-0/2/2
```

```
atm-options{
vpi 8;
promiscuous-mode;
}
unit 0{
encapsulation atm-ccc-cell-relay;
vpi 8;
}
```

Configuring ATM Cell-Relay Pseudowire in VCC Mode

To configure ATM cell-relay pseudowire in VCC mode:

1. In configuration mode, go to the **[edit interfaces]** hierarchy level and set the interface as at-0/2/2.

```
[edit]
user@host#edit interfaces at-0/2/2
```

2. To map incoming traffic to a single LSP and to specify the VPI value as 9, include the **promiscuous mode** statement and **vpi** ***vpi-identifier*** statement at the **[edit interfaces** ***interface-name*** **atm-options]** hierarchy level.

```
[edit interfaces at-0/2/2]
user@host#set atm-options promiscuous-mode vpi 9
```

3. To configure ATM encapsulation on unit 0, include the **encapsulation** statement at the **[edit interfaces** ***interface-name*****]** hierarchy level.

```
[edit interfaces at-0/2/2]
user@host#set unit 0 encapsulation atm-ccc-cell-relay
```

4. To specify the VCI value as 9.99 on unit 0, include the **vci** ***vci-identifier*** statement at the **[edit interfaces** ***interface-name*****]** hierarchy level.

```
[edit interfaces at-0/2/2]
user@host#set unit 0 vci 9.99
```

5. To verify the configuration, you can issue the following operational mode command in configuration mode:

```
[edit]
user@host#show at-0/2/2
```

```
atm-options{
vpi 9;
promiscuous-mode;
}
unit 0{
encapsulation atm-ccc-cell-relay;
vci 9.99;
}
```

Related Documentation

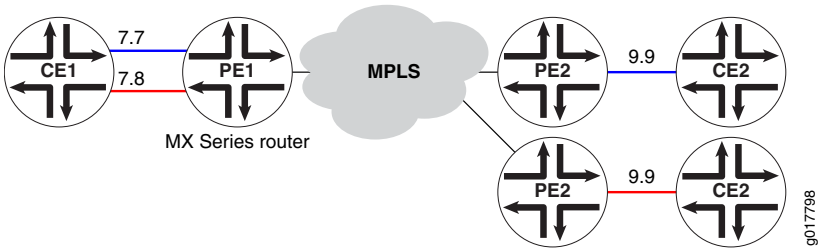
- ATM Cell Relay Pseudowire VPI/VCI Swapping Overview on page 74
- Configuring ATM Cell-Relay Pseudowire VPI/VCI Swapping on page 75
- *allow-any-vci*
- no-vpivci-swapping on page 124
- psn-vci (ATM CCC Cell-Relay Promiscuous Mode VPI/VCI Swapping) on page 125
- psn-vpi (ATM CCC Cell-Relay Promiscuous Mode VPI/VCI Swapping) on page 125
- *vci*
- *vpi*

ATM Cell Relay Pseudowire VPI/VCI Swapping Overview

In ATM cell-relay mode, one or more ATM cells are bundled together to form a packet that is sent across the packet-switched network (PSN) using MPLS. In this mode, each ATM cell and its header are transported over the MPLS cloud. The ATM header consisting of the VPI and VCI values is transported across the MPLS cloud or the backhaul network. You can configure the ATM MIC to swap the VPI value, the VCI value, or both. You can swap the VPI and VCI values in both directions (ingress and egress). You can also enable swapping only on the egress side. Further, you can disable swapping of the values.

Figure 7 on page 74 illustrates a sample application based on the mobile backhaul reference model.

Figure 7: ATM Cell Relay Pseudowire VPI/VCI Swapping



In the case of ingress swapping, PE1 (MX Series router with ATM MIC with SFP) swaps the ATM value (7.7 or 7.8) for the configured PSN value (9.9). PE2 transmits the cell without making any change.

In the case of egress swapping, PE1 (MX Series router with ATM MIC with SFP) swaps the PSN value (9.9) for the local ATM value. The local ATM value depends on the ATM pseudowire on which the value arrived. In this example, it can be either 7.7 or 7.8.

NOTE: **This feature is not supported in port-promiscuous mode.**

The following guidelines apply to configuring the ATM MIC for swapping:

NOTE: In the case of promiscuous ports, no swapping is done because the feature is not supported. Values in the ATM cell are inserted into the pseudowire unchanged.

Each locally configured virtual path connection (VPC) or virtual channel connection (VCC) might be assigned a PSN VPI value or a PSN VCI value such that:

- In the case of VCCs, the mapping is between the ATM identifier and the PSN identifier.
- In the case of VPCs, the mapping is between the ATM identifier and the PSN identifier. No change is made to the VCI.

The following rule applies when the MIC inserts the VPI or VCI values in the outgoing pseudowire cell headers—that is, in case of ingress swapping:

- VCCs or promiscuous VPCs—For a given ATM value, the specified PSN identifier is inserted in the outgoing pseudowire cell header.

  If no PSN value is specified, then the MIC does not perform ingress swapping. The value inserted in the pseudowire cell header is the one found the in ATM cell.

The following rule applies when the MIC inserts the VPI or VCI values in the outgoing ATM cells—that is, in case of egress swapping:

- VCCs or promiscuous VPCs—By default, the MIC performs egress swapping. The ATM identifier is inserted in the outgoing ATM cell irrespective of the value in the pseudowire cell header. If the **no-vpivci-swapping** statement is present, no swapping is performed and the value in the pseudowire is transmitted as is.

Related Documentation

- Configuring ATM Cell-Relay Pseudowire VPI/VCI Swapping on page 75
- no-vpivci-swapping on page 124
- psn-vci on page 125
- psn-vpi on page 125

Configuring ATM Cell-Relay Pseudowire VPI/VCI Swapping

Starting in Junos OS Release 12.1, on MX Series routers with ATM MIC with SFP, you can configure the ATM MIC to swap the VPI value, the VCI value, or both. You can also disable swapping of the VPI or VCI values. You can opt to swap the VPI and VCI values in both directions (ingress and egress). You can also enable swapping only on the egress side. In VPC mode, only the VPI values are swapped.

You can configure the ATM MIC on the local PE router to swap only VPI values in both directions when the remote PE router does not perform any swapping. If the remote PE router performs egress swapping by default, you can configure the ATM MIC on the local PE router to swap only in the egress direction. If you want to disable swapping, you can configure both the local and remote PE router to disable swapping.

This topic includes the following tasks:

Configuring VPI Swapping on Egress and Ingress on ATM MICs

This procedure describes the steps to configure swapping on the local PE router where the ATM MIC swaps in both directions (egress and ingress). You can also explicitly disable swapping on the remote PE router.

NOTE: The configuration included here is specific to VPI or VCI swapping and does not include the entire ATM pseudowire configuration. For information on ATM pseudowire configuration, see "Configuring ATM Cell-Relay Pseudowire" on page 71

To configure the local PE router to perform swapping in both directions:

1. To specify the VPI value as 1 on unit 1, include the **vpi *vpi-identifier*** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2]
   user@host#set unit 1 vpi 1
   ```

2. To specify the PSN identifier as 11 on unit 1, include the **psn-vpi *psn-vpi-identifier*** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2 ]
   user@host#set unit 1 psn-vpi 11
   ```

3. To specify the VPI value as 2 on unit 2, include the **vpi *vpi-identifier*** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2]
   user@host#set unit 2 vpi 2
   ```

4. To specify the PSN identifier as 11 on unit 2, include the **psn-vpi *psn-vpi-identifier*** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2 ]
   user@host#set unit 2 psn-vpi 11
   ```

5. To verify the configuration, you can issue the following operational mode command in configuration mode:

   ```
   [edit]
   user@host#show at-0/2/2

   ..
   unit 1{
   vpi 1;
   psn-vpi 11;
   }
   unit 2 {
   vpi 2;
   ```

```
psn-vpi 11;
}
..
```

To disable swapping by the remote PE router:

1. To specify the VPI value as 11 on unit 1, include the **vpi *vpi-identifier*** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2]
   user@host#set unit 1 vpi 11
   ```

2. To disable swapping on the remote PE router on unit 1, include the **no-vpivci-swapping** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2 ]
   user@host#set unit 1 no-vpivci-swapping
   ```

3. To specify the VPI value as 11 on unit 2, include the **vpi *vpi-identifier*** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2]
   user@host#set unit 2 vpi 11
   ```

4. To disable swapping on the remote PE router on unit 2, include the **no-vpivci-swapping** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2 ]
   user@host#set unit 2 no-vpivci-swapping
   ```

5. To verify the configuration, you can issue the following operational mode command in configuration mode:

   ```
   [edit]
   user@host#show at-0/2/2
   ```

```
..
unit 1{
vpi 11;
no-vpivci-swapping;
}
unit 2 {
vpi 11;
no-vpivci-swapping ;
}
..
```

Configuring Egress Swapping on ATM MICs

If the remote PE router only performs egress swapping, you must configure the local PE router to perform egress swapping as well. This procedure describes the steps to configure egress swapping on both the local and remote PE routers.

NOTE: The configuration included here is specific to VPI or VCI swapping and does not include the entire ATM pseudowire configuration. For information on ATM pseudowire configuration, see "Configuring ATM Cell-Relay Pseudowire" on page 71

To configure the local PE router to perform egress swapping:

1. To specify the VPI value as 1 on unit 1, include the **vpi *vpi-identifier*** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2]
   user@host#set unit 1 vpi 1
   ```

2. To specify the VPI value as 2 on unit 2, include the **vpi *vpi-identifier*** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2]
   user@host#set unit 2 vpi 2
   ```

3. To verify the configuration, you can issue the following operational mode command in configuration mode:

   ```
   [edit]
   user@host#show at-0/2/2
   ```

   ```
   ..
   unit 1{
   vpi 1;
   }
   unit 2 {
   vpi 2;
   }
   ..
   ```

To configure the remote PE router:

1. To specify the VPI value as 11 on unit 1, include the **vpi *vpi-identifier*** statement at the **[edit interfaces *interface-name*]** hierarchy level:

   ```
   [edit interfaces at-0/2/2]
   user@host#set unit 1 vpi 11
   ```

2. To specify the VPI value as 11 on unit 2, include the **vpi *vpi-identifier*** statement at the **[edit interfaces *interface-name*]** hierarchy level:

   ```
   [edit interfaces at-0/2/2]
   user@host#set unit 2 vpi 11
   ```

3. To verify the configuration, you can issue the following operational mode command in configuration mode:

   ```
   [edit]
   user@host#show at-0/2/2
   ```

   ```
   ..
   unit 1{
   vpi 11;
   }
   unit 2 {
   vpi 11;
   }
   ..
   ```

Disabling Swapping on Local and Remote Provider Edge (PE) Routers

To explicitly disable swapping, you must use the no-vpivci-swapping statement. When cell relay of many VPCs and VCCs happens over the same pseudowire, it is recommended that you explicitly disable swapping. This procedure describes the steps to explicitly disable swapping on both the local and remote PE routers.

NOTE: The configuration included here is specific to VPI or VCI swapping and does not include the entire ATM pseudowire configuration. For information on ATM pseudowire configuration, see "Configuring ATM Cell-Relay Pseudowire" on page 71

To disable swapping on the local PE router:

1. To specify the VPI value as 1 on unit 1, include the **vpi *vpi-identifier*** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2]
   user@host#set unit 1 vpi 1
   ```

2. To disable swapping, include the **no-vpivci-swapping** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2]
   user@host#set unit 1 no-vpivci-swapping
   ```

3. To specify the VPI value as 2 on unit 2, include the **vpi *vpi-identifier*** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2]
   user@host#set unit 2 vpi 2
   ```

4. To disable swapping, include the **no-vpivci-swapping** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2]
   user@host#set unit 2 no-vpivci-swapping
   ```

5. To verify the configuration, you can issue the following operational mode command in configuration mode:

   ```
   [edit]
   user@host#show at-0/2/2
   ```

```
..
unit 1{
vpi 1;
no-vpivci-swapping
}
unit 2{
vpi 2;
no-vpivci-swapping;
}
..
```

To disable swapping on the remote PE router:

1. To specify the VPI value as 1 on unit 1, include the **vpi *vpi-identifier*** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2]
   user@host#set unit 1 vpi 1
   ```

2. To disable swapping on unit 1, include the **no-vpivci-swapping** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2]
   user@host#set unit 1 no-vpivci-swapping
   ```

3. To specify the VPI value as 2 on unit 2, include the **vpi *vpi-identifier*** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2]
   user@host#set unit 2 vpi 2
   ```

4. To disable swapping on unit 2, include the **no-vpivci-swapping** statement at the **[edit interfaces *interface-name*]** hierarchy level.

   ```
   [edit interfaces at-0/2/2]
   user@host#set unit 2 no-vpivci-swapping
   ```

5. To verify the configuration, you can issue the following operational mode command in configuration mode:

   ```
   [edit]
   user@host#show at-0/2/2
   ```

```
..
unit 1{
vpi 1;
no-vpivci-swapping;
}
unit 2 {
vpi 2;
no-vpivci-swapping;
}
..
```

Related Documentation

- ATM Cell Relay Pseudowire VPI/VCI Swapping Overview on page 74
- *allow-any-vci*
- no-vpivci-swapping on page 124
- psn-vci on page 125
- psn-vpi on page 125
- *vci*
- *vpi*

Congestion Control

ATM encapsulations provide congestion control via EPD thresholds on a per logical interface basis. For Circuit Emulation PICs, the EPD number specifies the number of packets (or frames or cell bundles).

[edit interfaces at-*fpc/pic/port* unit *logical-unit-number*]
epd-threshold *packets* plp1 *packets*;

Related Documentation

- ATM Support on Circuit Emulation PICs Overview on page 10

ATM OAM

Circuit Emulation PICs provide ATM support for the following OAM-FM cell types:

- F4 AIS (end-to-end)
- F4 RDI (end-to-end)
- F4 loopback (end-to-end)
- F5 loopback
- F5 AIS
- F5 RDI

The following sections describe:

- VP Pseudowires (CCC Encapsulation) on page 81
- Port Pseudowires (CCC Encapsulation) on page 81
- VC Pseudowires (CCC Encapsulation) on page 81

VP Pseudowires (CCC Encapsulation)

In the case of ATM VP pseudowires (all VCs in a VP are transported over a single *N-to-one* mode pseudowire), all F4 and F5 OAM cells are forwarded through the pseudowire.

Port Pseudowires (CCC Encapsulation)

Like VP pseudowires, with port pseudowires, all F4 and F5 OAM cells are forwarded through the pseudowire.

VC Pseudowires (CCC Encapsulation)

In the case of VC pseudowires, F5 OAM cells are forwarded through the pseudowire, while F4 OAM cells are terminated at the Routing Engine.

Related Documentation

- ATM Support on Circuit Emulation PICs Overview on page 10

Scaling

The 12-port Channelized T1/E1 Circuit Emulation PIC supports a maximum of 1000 VCs.

The 4-port Channelized COC3/STM1 Circuit Emulation PIC supports a maximum of 2000 VCs.

The Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP supports a maximum of 2000 VCs.

The 16-Port Channelized E1/T1 Circuit Emulation MIC supports a maximum of 1000 VCs.

Related Documentation

- ATM Support on Circuit Emulation PICs Overview on page 10

Configuring ATM QoS or Shaping

M7i, M10i, M40e, M120, and M320 routers with 4-port channelized OC3/STM1 Circuit Emulation PICs and 12-port T1/E1 Circuit Emulation PICs and MX Series routers with Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP and 16-Port Channelized E1/T1 Circuit Emulation MIC support ATM pseudowire service with QoS features for ingress and egress direction traffic shaping. Policing is performed by monitoring the configured parameters on the incoming traffic and is also referred to as ingress shaping. Egress shaping uses queuing and scheduling to shape the outgoing traffic. Classification is provided per virtual circuit (VC).

The following QoS features are supported:

- CBR, rtVBR, nrtVBR, and UBR
- Policing on a per VC basis
- Independent PCR and SCR policing
- Counting policing actions

Circuit Emulation PICs provide pseudowire service towards the core. This section describes the ATM service QoS features.

Circuit Emulation PICs support two types of ATM pseudowires:

- cell—**atm-ccc-cell-relay** encapsulation
- aal5—**atm-ccc-vc-mux**

NOTE: **Only ATM pseudowires are supported; no other encapsulation types are supported.**

Since cells within a VC cannot be re-ordered, and since only the VC is mapped to a pseudowire, classification is not meaningful in the context of a pseudowire. However,

different VCs can be mapped to different classes of traffic and can be classified in the core network.

Such a service would connect two ATM networks with an IP/MPLS core. Figure 8 on page 83 shows that the routers marked PE are equipped with Circuit Emulation PICs.

Figure 8: Two ATM Networks with QoS Shaping and Pseudowire Connection

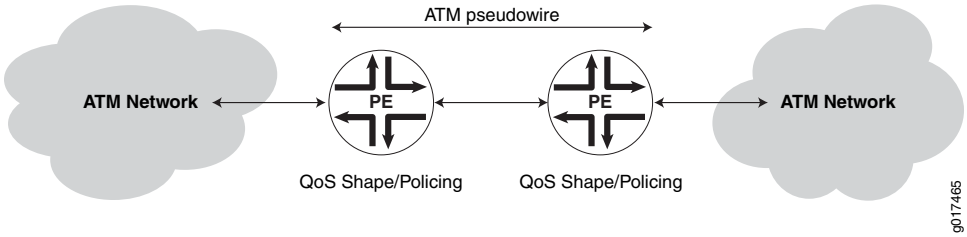


Figure 8 on page 83 shows that traffic is shaped in the egress direction towards the ATM networks. In the ingress direction towards the core, the traffic is policed and the appropriate action is taken. Depending on a very elaborate state machine in the PIC, the traffic is either discarded or sent towards the core with a particular QoS class.

Each port has four transmit queues and one receive queue. Packets arrive from the ingress network on this single queue. Remember that this is per port and multiple VCs arrive on this queue, each with its own QoS class. To simplify unidirectional connections, only a Circuit Emulation PIC (PE 1 router) to Circuit Emulation PIC (PE 2 router) configuration is shown in Figure 9 on page 83.

Figure 9: VC Mapping with Circuit Emulation PICs

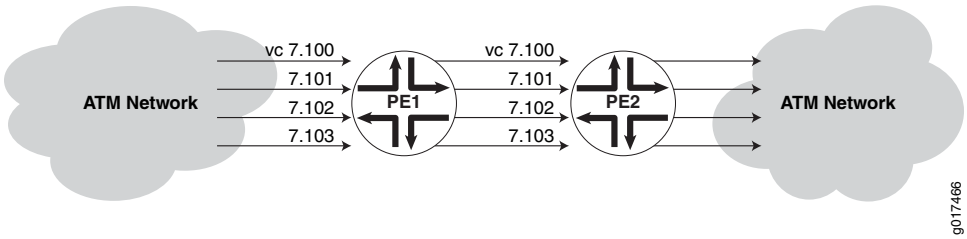


Figure 9 on page 83 shows the four VCs with different classes mapped to different pseudowires in the core. Each VC has a different QoS class and is assigned a unique queue number. This queue number is copied to the EXP bits in the MPLS header as follows:

Qn concatenated with CLP -> EXP

Qn is 2 bits and can have four combinations; 00, 01, 10, and 11. Since CLP cannot be extracted from the PIC and put into each packet prefix, it is 0. The valid combinations are shown in Table 9 on page 84.

Table 9: Valid EXP Bit Combinations

Qn	CLP
00	0
01	0
10	0
11	0

For example, VC 7.100 has CBR, VC 7.101 has rt-VBR, 7.102 has nrt-VBR, 7.103 has UBR, and each VC is assigned a queue number as follows:

- VC 7.100 -> 00
- VC 7.101 -> 01
- VC 7.102 -> 10
- VC 7.103 -> 11

NOTE: Lower queue numbers have higher priorities.

Each VC will have the following EXP bits:

- VC 7.100 -> 000
- VC 7.101 -> 010
- VC 7.102 -> 100
- VC 7.103 -> 110

A packet arriving on VC 7.100 at the ingress router has the queue number 00 before being forwarded to the Packet Forwarding Engine. The Packet Forwarding Engine then translates this to 000 EXP bits in the core. At the egress router, the Packet Forwarding Engine retranslates this to queue 00 and stamps the packet with this queue number. The PIC receiving this queue number sends the packet out on the transmit queue that is mapped to queue 0, which could be the highest priority transmit queue on the egress side.

To briefly summarize, shaping and policing are possible. Classification is possible at the VC level by mapping a specific VC to a particular class.

To configure QoS shaping for Circuit Emulation PICs, use the **shaping** statement and its subordinate statements at the **[interfaces at-*fpc/pic/port* unit *n*]** hierarchy level. Most Circuit Emulation PIC QoS CLI commands are similar to those used for the ATM2 PIC QoS features. The interface configuration is sent to the PIC and the PIC driver configures the PIC appropriately.

Example: Shaping for Logical Interfaces in Port Promiscuous Mode

Shaping for logical interfaces in port promiscuous mode is configured under the following hierarchy:

```
interfaces {
  at-<fpc>/<pic>/<port> {
    atm-options {
      pic-type atm-ce;
      promiscuous-mode {
        vpi 0;
        vpi 1;
      }
    }
    unit 0 {
      encapsulation atm-ccc-cell-relay;
      vpi 0;
    }
    unit 1 {
      encapsulation atm-ccc-cell-relay;
      vpi 1;
      shaping {
        cbr|rtvbr|vbr {
          <shaping specific parameters>
        }
      }
    }
  }
}
```

Example: Shaping for Logical Interfaces in VC Mode

Shaping for logical interfaces in VC mode is configured under the following hierarchy:

```
at-<fpc>/<pic>/<port> {
  atm-options {
    pic-type atm-ce;
    vpi 0;
    vpi 1;
  }
  unit 0 {
    encapsulation atm-ccc-cell-relay;
    vci 0.100;
  }
  unit 1 {
    encapsulation atm-ccc-cell-relay;
    vci 1.100;
    shaping {
      cbr|rtvbr|vbr {
        <shaping specific parameters>
      }
    }
  }
  }
}
```

The Routing Engine and the Packet Forwarding Engine prefix the packet with information including a field that indicates the queue number associated with the VC.

Circuit Emulation PICs internally define queue 0 for CBR, queue 1 for RTVBR, queue 2 for VBR, and queue 3 for UBR.

Example: Shaping for Logical Interfaces in VC Mode with a Policer

You can similarly configure shaping for a policer configuration under the following similar configuration, but you must additionally use the policer required **shaping specific parameters (cdvt)** statement option:

```
at-fpc/pic/port{
  atm-options {
    pic-type atm-ce;
    vpi 0;
    vpi 1;
  }
  unit 0 {
    encapsulation atm-ccc-cell-relay;
    vci 0.100;
  }
  unit 1 {
    encapsulation atm-ccc-cell-relay;
    vci 1.100;
    shaping {
      cbr|rtvbr|vbr {
        <shaping specific parameters> cdvt
      }
    }
  }
  }
}
```

Related Documentation

- ATM Support on Circuit Emulation PICs Overview on page 10
- *shaping*

Configuring the PIC Type

To configure Circuit Emulation PICs, you must specify the **atm-options** statement's **pic-type** option as **atm-ce**, as follows:

```
[edit interfaces at-fpc/pic/port]
atm-options {
  pic-type atm-ce;
}
```

On MX Series routers with ATM MICs with SFP, Junos OS automatically sets the PIC type to ATM MIC.

NOTE: This topic uses the term PIC for ATM MICs where the reference is to a CLI or Junos OS entity.

Related Documentation

- ATM Support on Circuit Emulation PICs Overview on page 10

Configuring Layer 2 Circuit and Layer 2 VPN Pseudowires

ATM Layer 2 circuit and Layer 2 VPN pseudowires are configured using the same syntax described for ATM2 PICs:

```
protocols {
  # MPLS and routing configuration omitted for brevity.
  l2circuit {
    neighbor 10.255.245.1 { # loopback address on remote router
      interface at-0/0/0.0 { # Circuit Emulation PIC ATM interface configured for CCC
        virtual-circuit-id 100;
      }
    }
  }
}
```

Related Documentation

- ATM Support on Circuit Emulation PICs Overview on page 10

Supported Interface Configurations

With 12-port Channelized T1/E1 Circuit Emulation PICs, ATM supports T1 and E1 interfaces:

```
[edit interfaces at-fpc/pic/port ]
t1-options
e1-options
```

A sample configuration follows:

```
at-0/2/1:3 {
  atm-options {
    pic-type atm-ce;
  }
  e1-options {
    framing g704;
  }
  t1-options {
    framing sf;
  }
}
```

NOTE: In the sample configuration above, both T1 and E1 framing are set. Depending on which Circuit Emulation PIC you are using (T1 or E1), only the appropriate options are functional.

The following CLI output showing the available T1 interface options:

```
[edit interfaces at-0/2/1:3]
user@host# set t1-options ?

  Possible completions:
  + apply-groups         Groups from which to inherit configuration data
  + apply-groups-except  Don't inherit configuration data from these groups
```

```
      bert-algorithm       Set BERT algorithm
      byte-encoding        Byte encoding
      crc-major-alarm-threshold  CRC Major alarm threshold value
      crc-minor-alarm-threshold  CRC Minor alarm threshold value
      framing              Framing mode
      invert-data          Invert data
      line-encoding        Line encoding
      loopback             Loopback mode
```

The following CLI output showing the available E1 interface options:

```
[edit interfaces at-0/2/1:3]
user@host#set e1-options ?

   Possible completions:
   + apply-groups         Groups from which to inherit configuration data
   + apply-groups-except  Don't inherit configuration data from these groups
     bert-error-rate      Bit error rate (10^-n for n > 0, and zero for n = 0)
(0..7)
     bert-period          Length of BERT test (1..86400 seconds)
     framing              Framing mode
     loopback             Loopback mode
```

Related Documentation

- ATM Support on Circuit Emulation PICs Overview on page 10

ATM Limitations

The following limitations apply to ATM support on Circuit Emulation PICs:

- Packet MTU—Packet MTU is limited to 2048 bytes.
- Trunk mode ATM pseudowires—Circuit Emulation PICs do not support trunk mode ATM pseudowires:
- OAM-FM segment—Segment F4 flows are not supported. Only end-to-end F4 flows are supported.
- IP and Ethernet encapsulations—IP and Ethernet encapsulations are not supported.
- F5 OAM—OAM termination is not supported.

Related Documentation

- ATM Support on Circuit Emulation PICs Overview on page 10

CHAPTER 5

Network Interfaces Configuration Statements and Hierarchy

[edit chassis] Hierarchy Level

```
chassis {
  aggregated-devices {
    ethernet {
      device-count number;
    }
    sonet {
      device-count number;
    }
  }
    maximum-links {
    }
  channel-group number {
    ethernet {
      device-count number;
    }
    fpc slot-number{
      pic pic-number {
        adaptive-services{
          service-package (layer-2 | layer-3);
        }
        aggregate-ports;
        atm-cell-relay-accumulation;
        atm-l2circuit-mode (aal5 | cell | trunk trunk);
        ce1 {
          e1 link-number {
            channel-group group-number;
            timeslots time-slot-range;
          }
        }
        channelization;
```

```
            ct1 {
              t1 link-number {
                channel-group group-number;
                timeslots time-slot-range;
              }
            }
            ct3 {
              port port-number {
                t1 link-number {
                  channel-group group-number;
                  timeslots time-slot-range;
                }
              }
              framing sdh;
            }
            max-queues-per-interface number;
            mlfr-uni-nni-bundles num-intf;
            no-concatenate;
            shdsl {
              pic-mode (1-port-atm | 2-port-atm);
            }
            vtmapping (klm | itu-t);
          }
        }
        fpc slot-number{
        pic pic-number{
          account-layer2-overhead
            egress-policer-overhead bytes;
            ingress-policer-overhead bytes;
          }
        }
      }
```

[edit interfaces] Hierarchy Level

The statements at the **[edit interfaces *interface-name* unit *logical-unit-number*]** hierarchy level can also be configured at the **[edit logical-systems *logical-system-name* interfaces *interface-name* unit *logical-unit-number*]** hierarchy level.

NOTE: The *accounting-profile* statement is an exception to this rule. The **accounting-profile** statement can be configured at the **[edit interfaces *interface-name* unit *logical-unit-number*]** hierarchy level, but it cannot be configured at the **[edit logical-systems *logical-system-name* interfaces *interface-name* unit *logical-unit-number*]** hierarchy level.

```
interfaces {
  traceoptions {
    file filename <files number> <match regular-expression> <size size> <world-readable |
      no-world-readable> ;
    flag flag <disable>;
  }
  interface-name {
```

```
account-layer2-overhead (Interface Level) {
  value;
  egress bytes;
  ingress bytes;
}
accounting-profile name;
aggregated-ether-options {
  (flow-control | no-flow-control);
  lacp {
    (active | passive);
    link-protection {
      disable;
    (revertive | non-revertive);
    periodic interval;
    system-priority priority;
  }
  link-protection;
  link-speed speed;
  (loopback | no-loopback);
  mc-ae{
    chassis-id chassis-id;
    mc-ae-id mc-ae-id;
    mode (active-active | active-standby);
    redundancy-group group-id;
    status-control (active | standby);
  }
  minimum-links number;
  source-address-filter {
    mac-address;
  }
  (source-filtering | no-source-filtering);
}
shared-scheduler;
aggregated-sonet-options {
  link-speed speed | mixed;
  minimum-links number;
}
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 {
          down-count cells;
          up-count cells;
        }
        oam-period (seconds | disable);
        shaping {
          (cbr rate | rtvbr peak rate sustained rate burst length | vbr peak rate sustained rate
            burst length);
          queue-length number;
        }
      }
    }
    clocking clock-source;
    data-input (system | interface interface-name);
    dce;
    serial-options {
      clock-rate rate;
      clocking-mode (dce | internal | loop);
      control-polarity (negative | positive);
      cts-polarity (negative | positive);
      dcd-polarity (negative | positive);
      dce-options {
        control-signal (assert | de-assert | normal);
        cts (ignore | normal | require);
        dcd (ignore | normal | require);
        dsr (ignore | normal | require);
        dtr signal-handling-option;
        ignore-all;
        indication (ignore | normal | require);
        rts (assert | de-assert | normal);
        tm (ignore | normal | require);
      }
      dsr-polarity (negative | positive);
      dte-options {
        control-signal (assert | de-assert | normal);
        cts (ignore | normal | require);
        dcd (ignore | normal | require);
        dsr (ignore | normal | require);
        dtr signal-handling-option;
        ignore-all;
        indication (ignore | normal | require);
        rts (assert | de-assert | normal);
        tm (ignore | normal | require);
      }
      dtr-circuit (balanced | unbalanced);
```

```
    dtr-polarity (negative | positive);
    encoding (nrz | nrzi);
    indication-polarity (negative | positive);
    line-protocol protocol;
    loopback mode;
    rts-polarity (negative | positive);
    tm-polarity (negative | positive);
    transmit-clock invert;
}
description text;
dialer-options {
    pool pool-name <priority priority>;
}
disable;
ds0-options {
    bert-algorithm algorithm;
    bert-error-rate rate;
    bert-period seconds;
    byte-encoding (nx56 | nx64);
    fcs (16 | 32);
    idle-cycle-flag (flags | ones);
    invert-data;
    loopback payload;
    start-end-flag (filler | shared);
}
e1-options {
    bert-error-rate rate;
    bert-period seconds;
    fcs (16 | 32);
    framing (g704 | g704-no-crc4 | unframed);
    idle-cycle-flag (flags | ones);
    invert-data;
    loopback (local | remote);
    start-end-flag (filler | shared);
    timeslots time-slot-range;
}
e3-options {
    atm-encapsulation (direct | plcp);
    bert-algorithm algorithm;
    bert-error-rate rate;
    bert-period seconds;
    framing feet;
    compatibility-mode (digital-link | kentrox | larscom) <subrate value>;
    fcs (16 | 32);
    framing (g.751 | g.832);
    idle-cycle-flag (filler | shared);
    invert-data;
    loopback (local | remote);
    (payload-scrambler | no-payload-scrambler);
    start-end-flag (filler | shared);
    (unframed | no-unframed);
}
encapsulation type;
es-options {
    backup-interface es-fpc/pic/port;
}
```

```
fastether-options {
   802.3ad ae x;
   (flow-control | no-flow-control);
   ignore-l3-incompletes;
   ingress-rate-limit rate;
   (loopback | no-loopback);
   mpls {
      pop-all-labels {
         required-depth number;
      }
   }
   source-address-filter {
      mac-address;
   }
   (source-filtering | no-source-filtering);
}
flexible-vlan-tagging;
gigether-options {
   802.3ad ae x;
   (asynchronous-notification | no-asynchronous-notification);
   (auto-negotiation | no-auto-negotiation) remote-fault <local-interface-online |
      local-interface-offline>;
   auto-reconnect seconds;
   (flow-control | no-flow-control);
   ignore-l3-incompletes;
   (loopback | no-loopback);
   mpls {
      pop-all-labels {
         required-depth number;
      }
   }
   no-auto-mdix;
   source-address-filter {
      mac-address;
   }
   (source-filtering | no-source-filtering);
   ethernet-switch-profile {
      (mac-learn-enable | no-mac-learn-enable);
      tag-protocol-id [ tpids ];
      ethernet-policer-profile {
         input-priority-map {
            ieee802.1p premium [ values ];
         }
         output-priority-map {
            classifier {
               premium {
                  forwarding-class class-name {
                     loss-priority (high | low);
                  }
               }
            }
         }
         policer cos-policer-name {
            aggregate {
               bandwidth-limit bps;
               burst-size-limit bytes;
```

```
            }
            premium {
              bandwidth-limit bps;
              burst-size-limit bytes;
            }
          }
        }
      }
    }
    (gratuitous-arp-reply | no-gratuitous-arp-reply);
    hold-time up milliseconds down milliseconds;
    ima-group-options {
      differential-delay number;
      frame-length (32 | 64 | 128 | 256);
      frame-synchronization {
        alpha number;
        beta number;
        gamma number;
      }
      minimum-links number;
      symmetry (symmetrical-config-and-operation |
        symmetrical-config-asymmetrical-operation);
      test-procedure {
        ima-test-start;
        ima-test-stop;
        interface name;
        pattern number;
        period number;
      }
      transmit-clock (common | independent);
      version (1.0 |1.1);
    }
    ima-link-options group-id group-id;
    interface-set interface-set-name {
      interface ethernet-interface-name {
        (unit unit-number | vlan-tags-outer vlan-tag);
      }
      interface interface-name {
        (unit unit-number);
      }
    }
    isdn-options {
      bchannel-allocation (ascending | descending);
      calling-number number;
      pool pool-name <priority priority>;
      spid1 spid-string;
      spid2 spid-string;
      static-tei-val value;
      switch-type (att5e | etsi | ni1 | ntdms100 | ntt);
      t310 seconds;
      tei-option (first-call | power-up);
    }
    keepalives <down-count number> <interval seconds> <up-count number>;
    link-mode mode;
    lmi {
      lmi-type (ansi | itu | c-lmi);
```

```
    n391dte number;
    n392dce number;
    n392dte number;
    n393dce number;
    n393dte number;
    t391dte seconds;
    t392dce seconds;
  }
  lsq-failure-options {
    no-termination-request;
    [ trigger-link-failure interface-name ];
  }
  mac mac-address;
  mlfr-uni-nni-bundle-options {
    acknowledge-retries number;
    acknowledge-timer milliseconds;
    action-red-differential-delay (disable-tx | remove-link);
    drop-timeout milliseconds;
    fragment-threshold bytes;
    cisco-interoperability send-lip-remove-link-for-link-reject;
    hello-timer milliseconds;
    link-layer-overhead percent;
    lmi-type (ansi | itu | c-lmi);
    minimum-links number;
    mrru bytes;
    n391 number;
    n392 number;
    n393 number;
    red-differential-delay milliseconds;
    t391 seconds;
    t392 seconds;
    yellow-differential-delay milliseconds;
  }
  modem-options {
    dialin (console | routable);
    init-command-string initialization-command-string;
  }
  mtu bytes;
  multi-chassis-protection {
    peer a.b.c.d {
      interfaceinterface-name;
      }
    }
  multiservice-options {
    (core-dump | no-core-dump);
    (syslog | no-syslog);
  }
  native-vlan-id number;
  no-gratuitous-arp-request;
  no-keepalives;
  no-partition {
    interface-type type;
  }
  no-vpivci-swapping;
  optics-options {
    alarm low-light-alarm {
```

```
      (link-down | syslog);
    }
    tx-power dbm;
    warning low-light-warning {
      (link-down | syslog);
    }
    wavelength nm;
  }
  otn-options {
    bytes transmit-payload-type value;
    fec (efec | gfec | gfec-sdfec | none);
    (is-ma | no-is-ma);
    (laser-enable | no-laser-enable);
    (line-loopback | no-line-loopback);
    (local-loopback | no-local-loopback);
    (odu-ttim-action-enable | no-odu-ttim-action-enable);
    (otu-ttim-action-enable | no-otu-ttim-action-enable);
    odu-delay-management {
      (bypass | no-bypass);
      (monitor-end-point | no-monitor-end-point);
      number-of-frames value;
      (no-start-measurement | start-measurement;
    }
    (prbs | no-prbs);
    preemptive-fast-reroute {
      (backward-frr-enable | no-backward-frr-enable);
      (signal-degrade-monitor-enable | no-signal-degrade-monitor-enable);
    }
    rate {
      (fixed-stuff-bytes | no-fixed-stuff-bytes);
      otu4;
      (pass-through | no-pass-through);
    }
    signal-degrade {
      ber-threshold-clear value;
      ber-threshold-signal-degrade value;
      interval value;
    }
    trigger trigger-identifier;
    tti tti-identifier;
  }
  partition partition-number oc-slice oc-slice-range interface-type type;
  timeslots time-slot-range;
  passive-monitor-mode;
  per-unit-scheduler;
  ppp-options {
    chap {
      access-profile name;
      default-chap-secret name;
      local-name name;
      passive;
    }
    compression {
      acfc;
      pfc;
    }
```

```
    dynamic-profile profile-name;
    no-termination-request;
    pap {
      access-profile name;
      local-name name;
      local-password password;
      compression;
    }
  }
  psn-vcipsn-vci-identifier;
  psn-vpipsn-vpi-identifier;
  receive-bucket {
    overflow (discard | tag);
    rate percentage;
    threshold bytes;
  }
  redundancy-options {
    priority sp-fpc/pic/port;
    secondary sp-fpc/pic/port;
    hot-standby;
  }
  satop-options {
    payload-size n;
  }
  schedulers number;
  serial-options {
    clock-rate rate;
    clocking-mode (dce | internal | loop);
    control-polarity (negative | positive);
    cts-polarity (negative | positive);
    dcd-polarity (negative | positive);
    dce-options {
      control-signal (assert | de-assert | normal);
      cts (ignore | normal | require);
      dcd (ignore | normal | require);
      dsr (ignore | normal | require);
      dtr signal-handling-option;
      ignore-all;
      indication (ignore | normal | require);
      rts (assert | de-assert | normal);
      tm (ignore | normal | require);
    }
    dsr-polarity (negative | positive);
    dte-options {
      control-signal (assert | de-assert | normal);
      cts (ignore | normal | require);
      dcd (ignore | normal | require);
      dsr (ignore | normal | require);
      dtr signal-handling-option;
      ignore-all;
      indication (ignore | normal | require);
      rts (assert | de-assert | normal);
      tm (ignore | normal | require);
    }
    dtr-circuit (balanced | unbalanced);
    dtr-polarity (negative | positive);
```

```
    encoding (nrz | nrzi);
    indication-polarity (negative | positive);
    line-protocol protocol;
    loopback mode;
    rts-polarity (negative | positive);
    tm-polarity (negative | positive);
    transmit-clock invert;
}
services-options {
    inactivity-timeout seconds;
    open-timeout seconds;
    session-limit {
        maximum number;
        rate new-sessions-per-second;
        }
        syslog {
        host hostname {
            facility-override facility-name;
            log-prefix prefix-number;
            services priority-level;
        }
    }
}
shdsl-options {
    annex (annex-a | annex-b);
    line-rate line-rate;
    loopback (local | remote);
    snr-margin {
        current margin;
        snext margin;
    }
}
sonet-options {
    aggregate asx;
    aps {
        advertise-interval milliseconds;
        annex-b;
        authentication-key key;
        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;
    }
    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;
        hold-time up milliseconds down milliseconds;
      }
      vtmapping (itu-t | klm);
      (z0-increment | no-z0-increment);
    }
    speed (10m | 100m | 1g | oc3 | oc12 | oc48);
    stacked-vlan-tagging;
    switch-options {
      switch-port port-number {
        (auto-negotiation | no-auto-negotiation);
        speed (10m | 100m | 1g);
        link-mode (full-duplex | half-duplex);
      }
    }
    t1-options {
      bert-algorithm algorithm;
      bert-error-rate rate;
      bert-period seconds;
      buildout value;
      byte-encoding (nx56 | nx64);
      crc-major-alarm-threshold (1e-3 | 5e-4 | 1e-4 | 5e-5 | 1e-5);
      crc-minor-alarm-threshold (1e-3 | 5e-4 | 1e-4 | 5e-5 | 1e-5 | 5e-6 | 1e-6);
      fcs (16 | 32);
      framing (esf | sf);
      idle-cycle-flag (flags | ones);
      invert-data;
      line-encoding (ami | b8zs);
      loopback (local | payload | remote);
      remote-loopback-respond;
      start-end-flag (filler | shared);
      timeslots time-slot-range;
    }
    t3-options {
      atm-encapsulation (direct | plcp);
      bert-algorithm algorithm;
      bert-error-rate rate;
      bert-period seconds;
      buildout feet;
      (cbit-parity | no-cbit-parity);
```

```
    compatibility-mode (adtran | digital-link | kentrox | larscom | verilink) <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);
    (mac | no-mac);
    (payload-scrambler | no-payload-scrambler);
    start-end-flag (filler | shared);
}
traceoptions {
    flag flag <flag-modifier> <disable>;
}
transmit-bucket {
    overflow discard;
    rate percentage;
    threshold bytes;
}
(traps | no-traps);
unidirectional;
vlan-tagging;
vlan-vci-tagging;
unit logical-unit-number {
    accept-source-mac {
        mac-address mac-address {
            policer {
                input cos-policer-name;
                output cos-policer-name;
            }
        }
    }
    account-layer2-overhead {
        value;
        egress bytes;
        ingress bytes;
    }
    accounting-profile name;
    advisory-options {
        downstream-rate rate;
        upstream-rate rate;
    }
    allow-any-vci;
    atm-scheduler-map (map-name | default);
    backup-options {
        interface interface-name;
    }
    bandwidth rate;
    cell-bundle-size cells;
    clear-dont-fragment-bit;
    compression {
        rtp {
            f-max-period number;
            maximum-contexts number <force>;
            queues [ queue-numbers ];
```

```
      port {
        minimum port-number;
        maximum port-number;
      }
    }
  }
  compression-device interface-name;
  copy-tos-to-outer-ip-header;
  demux-destination family;
  demux-source family;
  demux-options {
    underlying-interface interface-name;
  }
  description text;
  interface {
    l2tp-interface-id name;
    (dedicated | shared);
  }
  dialer-options {
    activation-delay seconds;
    callback;
    callback-wait-period time;
    deactivation-delay seconds;
    dial-string [ dial-string-numbers ];
    idle-timeout seconds;
    incoming-map {
      caller (caller-id | accept-all);
      initial-route-check seconds;
      load-interval seconds;
      load-threshold percent;
      pool pool-name;
      redial-delay time;
      watch-list {
        [ routes ];
      }
    }
  }
  disable;
  disable-mlppp-inner-ppp-pfc;
  dlci dlci-identifier;
  drop-timeout milliseconds;
  dynamic-call-admission-control {
    activation-priority priority;
    bearer-bandwidth-limit kilobits-per-second;
  }
  encapsulation type;
  epd-threshold cells plp1 cells;
  fragment-threshold bytes;
  inner-vlan-id-range start start-id end end-id;
  input-vlan-map {
    (pop | pop-pop | pop-swap | push | push-push | swap | swap-push | swap-swap);
    inner-tag-protocol-id tpid;
    inner-vlan-id number;
    tag-protocol-id tpid;
    vlan-id number;
  }
```

```
interleave-fragments;
inverse-arp;
layer2-policer {
   input-policer policer-name;
   input-three-color policer-name;
   output-policer policer-name;
   output-three-color policer-name;
}
link-layer-overhead percent;
minimum-links number;
mrru bytes;
multicast-dlci dlci-identifier;
multicast-vci vpi-identifier.vci-identifier;
multilink-max-classes number;
multipoint;
oam-liveness {
   down-count cells;
   up-count cells;
}
oam-period (seconds | disable);
output-vlan-map {
   (pop | pop-pop | pop-swap | push | push-push | swap | swap-push | swap-swap);
   inner-tag-protocol-id tpid;
   inner-vlan-id number;
   tag-protocol-id tpid;
   vlan-id number;
}
passive-monitor-mode;
peer-unit unit-number;
plp-to-clp;
point-to-point;
ppp-options {
   chap {
      access-profile name;
      default-chap-secret name;
      local-name name;
      passive;
   }
   compression {
      acfc;
      pfc;
      pap;
      default-pap-password password;
      local-name name;
      local-password password;
      passive;
   }
   dynamic-profile profile-name;
   lcp-max-conf-req number;
   lcp-restart-timer milliseconds;
   loopback-clear-timer seconds;
   ncp-max-conf-req number;
   ncp-restart-timer milliseconds;
}
pppoe-options {
   access-concentrator name;
```

```
    auto-reconnect seconds;
    (client | server);
    service-name name;
    underlying-interface interface-name;
  }
  proxy-arp;
  service-domain (inside | outside);
  shaping {
    (cbr rate | rtvbr peak rate sustained rate burst length | vbr peak rate sustained rate
      burst length);
    queue-length number;
  }
  short-sequence;
  transmit-weight number;
  (traps | no-traps);
  trunk-bandwidth rate;
  trunk-id number;
  tunnel {
    backup-destination address;
    destination address;
    key number;
    routing-instance {
      destination routing-instance-name;
    }
    source source-address;
    ttl number;
  }
  vci vpi-identifier.vci-identifier;
  vci-range start start-vci end end-vci;
  vpi vpi-identifier;
  vlan-id number;
  vlan-id-list [vlan-id vlan-id–vlan-id];
  vlan-id-range number-number;
  vlan-tags inner tpid.vlan-id outer tpid.vlan-id;
  vlan-tags-outer tpid.vlan-id inner-list [vlan-id vlan-id–vlan-id];
  family family {
    accounting {
      destination-class-usage;
      source-class-usage {
        direction;
      }
    }
    access-concentrator name;
    address address {
      destination address;
    }
    bundle ml-fpc/pic/port | ls-fpc/pic/port);
    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 ];
    }
}
ipsec-sa sa-name;
keep-address-and-control;
max-sessions number;
max-sessions-vsa-ignore;
mtu bytes;
multicast-only;
negotiate-address;
no-redirects;
policer {
    arp policer-template-name;
    input policer-template-name;
    output policer-template-name;
}
primary;
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 {
    direction;
}
service {
    input {
        service-set service-set-name <service-filter filter-name>;
        post-service-filter filter-name;
    }
    output {
        service-set service-set-names <service-filter filter-name>;
    }
}
service-name-table table-name;
short-cycle-protection <lockout-time-min minimum-seconds lockout-time-max
    maximum-seconds>;
targeted-broadcast {
    forward-and-send-to-re;
    forward-only;
}
(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 | preferred-source-address address>;
address address {
    arp ip-address (mac | multicast-mac) mac-address <publish>;
    broadcast address;
    destination address;
    destination-profile name;
    eui-64;
```

```
                multipoint-destination address (dlci dlci-identifier | vci vci-identifier);
                multipoint-destination address {
                  epd-threshold cells plp1 cells;
                  inverse-arp;
                  oam-liveness {
                    up-count cells;
                    down-count cells;
                  }
                  oam-period (seconds | disable);
                  shaping {
                    (cbr rate | rtvbr peak rate sustained rate burst length | vbr peak rate sustained
                      rate burst length);
                    queue-length number;
                  }
                  vci vpi-identifier.vci-identifier;
                }
                preferred;
                primary;
                (vrrp-group | vrrp-inet6-group) group-number {
                  (accept-data | no-accept-data);
                  advertise–interval seconds;
                  authentication-type authentication;
                  authentication-key key;
                  fast-interval milliseconds;
                  (preempt | no-preempt) {
                    hold-time seconds;
                  }
                  priority-number number;
                  track {
                    priority-cost seconds;
                    priority-hold-time interface-name {
                      bandwidth-threshold bits-per-second {
                        priority;
                      }
                      interface priority;
                    }
                    route ip-address/mask routing-instance instance-name priority-cost cost;
                  }
                  virtual-address [ addresses ];
                }
              }
            }
          }
        }
      }
    }
```

Related Documentation

- *Junos OS Hierarchy and RFC Reference*
- *Ethernet Interfaces*
- *Junos OS Network Interfaces Library for Routing Devices*

[edit logical-systems] Hierarchy Level

The following lists the statements that can be configured at the **[edit logical-systems]** hierarchy level that are also documented in this manual. For more information about logical systems, see the *Logical Systems Feature Guide for Routing Devices*.

```
logical-systems logical-system-name {
  interfaces interface-name {
    unit logical-unit-number {
      accept-source-mac {
        mac-address mac-address {
          policer {
            input cos-policer-name;
            output cos-policer-name;
          }
        }
      }
      allow-any-vci;
      atm-scheduler-map (map-name | default);
      bandwidth rate;
      backup-options {
        interface interface-name;
      }
      cell-bundle-size cells;
      clear-dont-fragment-bit;
      compression {
        rtp {
          f-max-period number;
          port {
            minimum port-number;
            maximum port-number;
          }
          queues [ queue-numbers ];
        }
      }
      compression-device interface-name;
      description text;
      interface {
        l2tp-interface-id name;
        (dedicated | shared);
      }
      dialer-options {
        activation-delay seconds;
        deactivation-delay seconds;
        dial-string [ dial-string-numbers ];
        idle-timeout seconds;
        initial-route-check seconds;
        load-threshold number;
        pool pool;
        remote-name remote-callers;
        watch-list {
          [ routes ];
        }
      }
```

```
disable;
dlci dlci-identifier;
drop-timeout milliseconds;
dynamic-call-admission-control {
  activation-priority priority;
  bearer-bandwidth-limit kilobits-per-second;
}
encapsulation type;
epd-threshold cells plp1 cells;
fragment-threshold bytes;
input-vlan-map {
  inner-tag-protocol-id;
  inner-vlan-id;
  (pop | pop-pop | pop-swap | push | push-push | swap | swap-push | swap-swap);
  tag-protocol-id tpid;
  vlan-id number;
}
interleave-fragments;
inverse-arp;
layer2-policer {
  input-policer policer-name;
  input-three-color policer-name;
  output-policer policer-name;
  output-three-color policer-name;
}
link-layer-overhead percent;
minimum-links number;
mrru bytes;
multicast-dlci dlci-identifier;
multicast-vci vpi-identifier.vci-identifier;
multilink-max-classes number;
multipoint;
oam-liveness {
  up-count cells;
  down-count cells;
}
oam-period (seconds | disable);
output-vlan-map {
  inner-tag-protocol-id;
  inner-vlan-id;
  (pop | pop-pop | pop-swap | push | push-push | swap | swap-swap);
  tag-protocol-id tpid;
  vlan-id number;
}
passive-monitor-mode;
peer-unit unit-number;
plp-to-clp;
point-to-point;
ppp-options {
  chap {
    access-profile name;
    default-chap-secret name;
    local-name name;
    passive;
  }
  compression {
```

```
        acfc;
        pfc;
        }
    }
    dynamic-profile profile-name;
    pap {
        default-pap-password password;
        local-name name;
        local-password password;
        passive;
    }
}
proxy-arp;
service-domain (inside | outside);
shaping {
    (cbr rate | rtvbr peak rate sustained rate burst length | vbr peak rate sustained rate
        burst length);
    queue-length number;
}
short-sequence;
transmit-weight number;
(traps | no-traps);
trunk-bandwidth rate;
trunk-id number;
tunnel {
    backup-destination address;
    destination address;
    key number;
    routing-instance {
        destination routing-instance-name;
    }
    source source-address;
    ttl number;
}
vci vpi-identifier.vci-identifier;
vlan-id number;
vlan-id-list [vlan-id vlan-id–vlan-id]
vlan-tags inner tpid.vlan-id outer tpid.vlan-id;
vlan-tags outer tpid.vlan-id inner-list [vlan-id vlan-id–vlan-id]
vpi vpi-identifier;
family family {
    accounting {
        destination-class-usage;
        source-class-usage {
            direction;
        }
    }
    bundle interface-name;
    filter {
        group filter-group-number;
        input filter-name;
        input-list {
            [ filter-names ];
        }
        output filter-name;
        output-list {
```

```
      [ filter-names ];
    }
}
ipsec-sa sa-name;
keep-address-and-control;
mtu bytes;
multicast-only;
no-redirects;
policer {
  arp policer-template-name;
  input policer-template-name;
  output policer-template-name;
}
primary;
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 {
  direction;
}
service {
  input {
    service-set service-set-name <service-filter filter-name>;
    post-service-filter filter-name;
  }
  output {
    service-set service-set-name <service-filter filter-name>;
  }
}
(translate-discard-eligible | no-translate-discard-eligible);
(translate-fecn-and-becn | no-translate-fecn-and-becn);
unnumbered-address interface-name destination address destination-profile
  profile-name;
address address {
  arp ip-address (mac | multicast-mac) mac-address <publish>;
  broadcast address;
  destination address;
  destination-profile name;
  eui-64;
  multipoint-destination address (dlci dlci-identifier | vci vci-identifier);
  multipoint-destination address {
    epd-threshold cells plp1 cells;
    inverse-arp;
    oam-liveness {
      up-count cells;
      down-count cells;
    }
    oam-period (seconds | disable);
    shaping {
      (cbr rate | rtvbr peak rate sustained rate burst length | vbr peak rate sustained
        rate burst length);
      queue-length number;
```

```
            }
            vci vpi-identifier.vci-identifier;
          }
          preferred;
          primary;
          (vrrp-group | vrrp-inet6-group) group-number {
            (accept-data | no-accept-data);
            advertise–interval seconds;
            authentication-type authentication;
            authentication-key key;
            fast-interval milliseconds;
            (preempt | no-preempt) {
              hold-time seconds;
            }
            priority-number number;
            track {
              priority-cost seconds;
              priority-hold-time interface-name {
                interface priority;
                bandwidth-threshold bits-per-second {
                  priority;
                }
              }
              route ip-address/mask routing-instance instance-name priority-cost cost;
            }
          }
          virtual-address [ addresses ];
        }
      }
    }
  }
}
```

Related Documentation

- *Junos OS Hierarchy and RFC Reference*
- *Ethernet Interfaces*
- *Junos OS Network Interfaces Library for Routing Devices*

[edit protocols oam] Hierarchy Level

```
ethernet {
  connectivity-fault-management {
    action-profile profile-name {
      default-actions {
        interface-down;
      }
      event {
        adjacency-loss;
        interface-status-tlv (down | lower-layer-down);
        port-status-tlv blocked;
        rdi;
      }
    }
    linktrace {
```

```
    age (30m | 10m | 1m | 30s | 10s);
    path-database-size path-database-size;
  }
  maintenance-domain domain-name {
    bridge-domain name;
    routing-instance r1 {
    bridge-domain name;
    instance vpls-instance;
    interface (ge | xe) fpc/pic/port.domain;
    level number;
    maintenance-association name{
      mep identifier {
        direction (up | down)
        interface (ge | xe) fpc/pic/port.domain (working | protect );
        auto-discovery;
        lowest-priority-defect (all-defects | err-xcon | mac-rem-err-xcon | no-defect |
          rem-err-xcon | xcon);
        priority number;
      }
    }
    mip-half-function (none | default | explicit);
    name-format (character-string | none | dns | mac+2oct);
    short-name-format (character-string | vlan | 2octet | rfc-2685-vpn-id);
      protect-maintenance-association protect-ma-name;
      remote-maintenance-association remote-ma-name;
      continuity-check {
        hold-interval minutes;
        interval (10m | 10s | 1m | 1s | 100ms);
        loss-threshold number;
      }
      maintenance-association ma-name {
      mip-half-function (none | default | explicit);
      mep mep-id {
        auto-discovery;
        direction (up | down);
        interface interface-name (working |protect);
        priority number;
        remote-mep mep-id {
          action-profile profile-name;
          sla-iterator-profile profile-name {
            data-tlv-size bytes;
            iteration-count frames;
            priority priority-value;
          }
        }
      }
    }
  }
  performance-monitoring {
    hardware-assisted-timestamping;
    sla-iterator-profiles {
      profile-name {
        disable;
        calculation-weight {
          delay delay-weight;
          delay-variation delay-variation-weight;
```

```
            }
            cycle-time milliseconds;
            iteration-period connections;
            measurement-type (loss | statistical-frame-loss | two-way-delay);
          }
        }
      }
    }
    link-fault-management {
      action-profile profile-name {
        action {
          syslog;
          link-down;
          send-critical-event;
        }
        event {
          link-adjacency-loss;
          link-event-rate {
            frame-error count;
            frame-period count;
            frame-period-summary count;
            symbol-period count;
          }
          protocol-down;
        }
      }
      interface interface-name {
        apply-action-profile profile-name;
        event-thresholds {
          frame-error count;
          frame-period count;
          frame-period-summary count;
          symbol-period count;
        }
        link-discovery (active | passive);
        negotiation-options {
          allow-remote-loopback;
          no-allow-link-events;
        }
        pdu-interval interval;
        pdu-threshold threshold-value;
        remote-loopback;
      }
    }
    fnp {
      interval <100ms | 1s | 10s | 1m | 10m>;
      loss-threshold number
      interface interface name {
          domain-id domain-id
      }
    }
  }
```

Related Documentation

- *Junos OS Hierarchy and RFC Reference*
- *Ethernet Interfaces*

- *Junos OS Network Interfaces Library for Routing Devices*

CHAPTER 6

Statement Summary

cesopsn-options

Syntax

```
cesopsn-options {
  excessive-packet-loss-rate {
    sample-period milliseconds;
    threshold percentile;
  }
  idle-pattern pattern;
  jitter-buffer-latency milliseconds;
  jitter-buffer-packets packets;
  packetization-latency microseconds;
}
```

Hierarchy Level [edit interfaces *interface-name*]

Release Information Statement introduced in Junos OS Release 12.2R1.
Statement introduced in Junos OS Release 12.3R1 for ACX Series Universal Access Routers.

Description Set Circuit Emulation Service over Packet-Switched Network (CESoPSN) protocol options.

Options You can configure the following CESoPSN options:

- **idle-pattern**—An 8-bit hexadecimal pattern to replace TDM data in a lost packet (from 0 through 255).
- **jitter-buffer-packets**—Number of packets in the jitter buffer (from 1 through 64 packets).
- **jitter-buffer-latency**—Time delay in the jitter buffer (from 1 through 1000 milliseconds).
- **packetization-latency**—Time required to create packets (from 1000 through 8000 microseconds).
- **excessive-packet-loss-rate**—Set packet loss options. The option is **sample-period**.
  - **sample-period**—Time required to calculate the excessive packet loss rate (from 1000 through 65535 milliseconds.
  - **threshold**—Percentile designating the threshold of excessive packet loss rate (1–100 percent).

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Setting the CESoPSN Options on page 57

event (CFM)

Syntax

```
event {
    adjacency-loss;
    interface-status-tlv [lower-layer-down down];
    port-status-tlv blocked;
    rdi;
  }
}
```

Hierarchy Level [edit protocols oam ethernet connectivity-fault-management action-profile]

Release Information Statement introduced in Junos OS Release 10.1

Description Configure threshold values for connectivity fault management events in an action profile.

Options

adjacency-loss—Connectivity is lost

interface-status-tlv [down lower-layer-down]—Values that need to be monitored in interface status TLV

port-status-tlv—Values that need to be monitored in port status TLV

rdi—RDI received from some MEP

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring a Connectivity Fault Management Action Profile*
- *interface-status-tlv*
- *port-status-tlv*

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 and EX Series switches) Reduce the Automatic Protection Switching (APS) switchover time in Layer 2 circuits.

NOTE:

- 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*

payload-size

Syntax payload-size *bytes* ;

Hierarchy Level [edit interfaces *interface-name* satop-options]

Release Information Option introduced in Junos OS Release 9.3.

Description Specify the **satop-options** payload-size in integer number of bytes.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- ATM Support on Circuit Emulation PICs Overview on page 10
- satop-options on page 120

satop-options

Syntax

```
satop-options {
  excessive-packet-loss-rate {
    apply-groups group-name
    apply-groups-except group-name
    groups group-name
    sample-period milliseconds
    threshold percentile
  )
  idle-pattern pattern
  jitter-buffer-auto-adjust
  jitter-buffer-latency milliseconds
  jitter-buffer-packets packets
  payload-size bytes;
}
```

Hierarchy Level [edit interfaces *interface-name*]

Release Information Statement introduced in Junos OS Release 9.3.
Statement introduced in Junos OS Release 12.2 for the ACX Series Universal Access Routers.

Description Set Structure-Agnostic TDM over Packet (SAToP) protocol options.

On ACX Series routers, the following statements are not supported:

```
apply-groups group-name
apply-groups-except group-name
groups group-name
jitter-buffer-auto-adjust
```

Options **excessive-packet-loss-rate options**—Set packet loss options.

- **apply-groups *group-name***—Groups from which to inherit configuration data.
- **apply-groups-except *group-name***—Don't inherit configuration data from these groups.
- **groups *group-name***—Specify groups.
- **sample-period *milliseconds***—Number of milliseconds over which excessive packet loss rate is calculated.
- **threshold *percentile***—Percentile designating the threshold of excessive packet loss rate (from 1 to 100).

idle-pattern *pattern*—An 8–bit hexadecimal pattern to replace TDM data in a lost packet (from 0 to 255).

jitter-buffer-auto-adjust—Automatically adjust the jitter buffer.

NOTE: This option is not applicable on MX Series routers.

jitter-buffer-latency *milliseconds*—Number of milliseconds delay in jitter buffer (from 1 to 1000 milliseconds).

jitter-buffer-packets *packets*—Number of packets in jitter buffer (from 1 to 64).

payload-size *bytes*—Payload size in integer number of bytes.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring SAToP on 4-Port Channelized OC3/STM1 Circuit Emulation PICs on page 26
- Configuring SAToP Emulation on T1/E1 Interfaces on Circuit Emulation PICs on page 29
- Configuring SAToP on Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP on page 33
- Configuring SAToP Encapsulation on T1/E1 Interfaces on Channelized OC3/STM1 (Multi-Rate) Circuit Emulation MIC with SFP on page 39
- Configuring SAToP on Channelized E1/T1 Circuit Emulation MIC on page 43
- ATM Support on Circuit Emulation PICs Overview on page 10

ima-group-options

Syntax

```
ima-group-options {
  differential-delay number;
  frame-length (32 |64 |128 |256);
  frame-synchronization {
    alpha number;
    beta number;
    gamma number;
  }
  minimum-links number;
  symmetry (symmetrical-config-and-operation |
    symmetrical-config-asymmetrical-operation);
  test-procedure {
    ima-test-start;
    ima-test-stop;
    interface name;
    pattern number;
    period number;
  }
  transmit-clock (common |independent);
  version (1.0 |1.1);
}
```

Hierarchy Level [edit interfaces (t1-*fpc/pic/port*:*m*:*n* | e1-*fpc/pic/port*:*n* | t1|e1-*fpc/pic/port*)]

Release Information Statement introduced in Junos OS Release 10.0.
Statement introduced in Junos OS Release 12.2 for the ACX Series Universal Access Routers.

Description Specify IMA group options.

Options

differential-delay *msec*—Maximum differential delay among links in msec.

Range: 1 through 56

Default: The default value is 25

frame-length (32 |64 |128 |256)—IMA frame length in number of cells.

Default: The default value is **128**

frame-synchronization—IMA group frame synchronization selection.

alpha *number*—Number of consecutive invalid ICP cells for IFSM.

Range: 1 through 2

Default: The default value is 2

beta *number*—Number of consecutive errored ICP cells for IFSM.

Range: 1 through 2

Default: The default value is 2

gamma *number*—Number of consecutive valid ICP cells for IFSM.

Range: 1 through 5

Default: The default value is 1

minimum-links ***number***—IMA group minimum active links.
Range: 1 through 8
Default: The default value is 1

symmetry (symmetrical-config-and-operation |
symmetrical-config-asymmetrical-operation)—IMA group symmetry mode selection.

test-procedure—Specify an IMA link interface test.

ima-test-start—Start IMA group test.

ima-test-stop—Stop IMA group test.

interface ***name***—Interface name of the IMA link to test.

pattern ***number***—IMA test pattern.
Range: 1 through 254
Default: The default value is 170

period ***seconds***—Length of IMA pattern test in seconds.
Range: 1 through 4294967294.
Default: The default value is 10

transmit-clock (common |independent)—Transmit clock configuration.
Default: The default value is common

version (1.0 |1.1)—IMA specification version.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- ATM Support on Circuit Emulation PICs Overview on page 10
- ima-link-options on page 124
- *Inverse Multiplexing for ATM (IMA) Overview*

ima-link-options

Syntax ima-link-options group *g*

Hierarchy Level [edit interfaces (t1-*fpc/pic/port*:*m*:*n* | e1-*fpc/pic/port*:*n* | t1|e1-*fpc/pic/port*)]

Release Information Statement introduced in Junos OS Release 10.0.
Statement introduced in Junos OS Release 12.2 for the ACX Series Universal Access Routers.

Description Specify an interface as a member of an IMA group.

Options **group *g***—Implying **at-*x/y/g***.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- ATM Support on Circuit Emulation PICs Overview on page 10
- ima-group-options on page 122
- *Inverse Multiplexing for ATM (IMA) Overview*

no-vpivci-swapping

Syntax no-vpivci-swapping;

Hierarchy Level [edit interfaces at-*fpc/pic/port* unit *logical-unit-number*]

Release Information Statement introduced in Junos OS Release 12.1.

Description (MX Series routers) Disable the swapping of VPI and VCI values in ATM CCC cell-relay mode on ATM MICs. The VPI and VCI values are not modified on ingress or egress. This statement is compatible with the ATM policing feature.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- *Configuring ATM Cell-Relay Promiscuous Mode*

psn-vci (ATM CCC Cell-Relay Promiscuous Mode VPI/VCI Swapping)

Syntax psn-vci *psn-vci-identifier*;

Hierarchy Level [edit interfaces at-*fpc/pic/port* unit *logical-unit-number*]

Release Information Statement introduced in Junos OS Release 12.1.
Statement introduced in Junos OS Release 12.2 for the ACX Series Universal Access Routers.

Description (MX Series routers) Swap both the VPI and VCI values on both egress and ingress in ATM CCC cell-relay mode on ATM MICs. This statement is not compatible with the ATM policing feature.

Options ***psn-vci-identifier***—ATM PSN virtual circuit identifier.
Range: 0 through 255

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- *Configuring ATM Cell-Relay Promiscuous Mode*

psn-vpi (ATM CCC Cell-Relay Promiscuous Mode VPI/VCI Swapping)

Syntax psn-vpi *psn-vpi-identifier*;

Hierarchy Level [edit interfaces at-*fpc/pic/port* unit *logical-unit-number*]

Release Information Statement introduced in Junos OS Release 12.1.
Statement introduced in Junos OS Release 12.2 for the ACX Series Universal Access Routers.

Description (MX Series routers) Swap only the VPI values on both egress and ingress in ATM CCC cell-relay mode on ATM MICs. This statement is not compatible with the ATM policing feature.

Options ***psn-vpi-identifier***—ATM PSN virtual path identifier.
Range: 0 through 255

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- *Configuring ATM Cell-Relay Promiscuous Mode*

PART 3

Administration

CHAPTER 7

Monitoring Commands

show interfaces (ATM)

Syntax
show interfaces at-*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 ATM interface.

Options
at-*fpc/pic/port*—Display standard information about the specified ATM 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 the SNMP index of the interface.

statistics—(Optional) Display static interface statistics.

Required Privilege Level
view

List of Sample Output
show interfaces (ATM, IMA Group) on page 145
show interfaces extensive (ATM IMA Group) on page 146
show interfaces (ATM1, SONET Mode) on page 147
show interfaces brief (ATM1, SONET Mode) on page 148
show interfaces detail (ATM1, SONET Mode) on page 148
show interfaces extensive (ATM1, SONET Mode) on page 149
show interfaces (ATM2, SDH Mode) on page 151
show interfaces brief (ATM2, SDH Mode) on page 152
show interfaces detail (ATM2, SDH Mode) on page 153
show interfaces extensive (ATM2, SDH Mode) on page 154
show interfaces (ATM2, SONET Mode) on page 157
show interfaces brief (ATM2, SONET Mode) on page 158
show interfaces detail (ATM2, SONET Mode) on page 159
show interfaces extensive (ATM2, SONET Mode) on page 161

Output Fields
Table 10 on page 130 lists the output fields for the **show interfaces** (ATM) command. Output fields are listed in the approximate order in which they appear.

Table 10: ATM show interfaces Output Fields

Field Name	Field Description	Level of Output
Physical Interface		

Table 10: ATM 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
Description	Configured interface 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: • **ATM-CCC-CELL-RELAY**—ATM cell relay for CCC. • **ATM-CCC-VC-MUX**—ATM virtual circuit (VC) for CCC. • **ATM-CISCO-NLPID**—Cisco-compatible ATM NLPID encapsulation. • **ATM-MIPP-LLC**—ATM MLPPP over ATM Adaptation Layer 5 (AAL5)/logical link control (LLC). • **ATM-NLPID**—ATM NLPID encapsulation. • **ATM-PPP-LLC**—ATM PPP over AAL5/LLC. • **ATM-PPP-VC-MUX**—ATM PPP over raw AAL5. • **ATM-PVC**—ATM permanent virtual circuits. • **ATM-SNAP**—ATM LLC/SNAP encapsulation. • **ATM-TCC-SNAP**—ATM LLC/SNAP for translational cross-connection. • **ATM-TCC-VC-MUX**—ATM VC for translational cross-connection. • **ATM-VC-MUX**—ATM VC multiplexing. • **ETHER-OVER-ATM-LLC**—Ethernet over ATM (LLC/SNAP) encapsulation. • **ETHER-VPLS-OVER-ATM-LLC**—Ethernet VPLS over ATM (bridging) encapsulation.	All levels
MTU	MTU size on the physical interface.	All levels
Clocking	Reference clock source: **Internal** or **External**.	All levels
***framing* Mode**	Framing mode: **SONET** or **SDH**.	All levels
Speed	Speed at which the interface is running as represented by the interface type (for example, **OC3**, **ADSL2+**, and **SHDSL(2-wire)**.	All levels
Loopback	Whether loopback is enabled and the type of loopback (**local** or **remote**).	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

Table 10: ATM show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output
Link flags	Information about the link. Possible values are described in the "Link Flags" section under *Common Output Fields Description*.	All levels
CoS queues	Number of CoS queues configured.	**detail extensive** none
Hold-times	Current interface hold-time up and hold-time down, in milliseconds.	**detail extensive**
Current address	Ethernet MAC address for this interface for Ethernet over ATM encapsulation.	**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	Statistics for traffic on the interface. • **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 frame check sequence (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 random early detection (RED) mechanism. • **Invalid VCs**—Number of cells that arrived for a nonexistent VC. • **Framing errors**—Sum of AAL5 packets that have FCS errors, reassembly timeout errors, and length errors. • **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. • **Resource errors**—Sum of transmit drops.	**extensive**

Table 10: ATM 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, increasing only when the cable is unplugged, the far-end system is powered down and then up, or another problem occurs. If it increments quickly (perhaps once every 10 seconds), the cable, the far-end system, or the PIC or PIM 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 so long in shared packet SDRAM 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. • **MTU errors**—Number of packets larger than the MTU threshold. • **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. NOTE: Physical interface queue counters of ATM2 PICs displayed by the **show interfaces at-*fpc/pic/port* detail** command show the packet forwarding stream statistics associated with the ATM2 ports. Since multiple ports of the ATM2 PICs (except for the ATM2 dual-port OC12) share one packet forwarding stream, the physical interface queue counters reflect the aggregate of ATM2 port statistics.	**detail extensive**
SONET alarms **SONET defects**	SONET media-specific defects that 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: **SONET PHY**, **SONET section**, **SONET line**, and **SONET path**.	**detail extensive** none

Table 10: ATM 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 10: ATM 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 10: ATM 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 10: ATM 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. This byte is 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. This bye is 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**—These bytes are 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 10: ATM show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output
ATM Status	ATM state information: • **HCS State**—Status of the header check sequence. ATM uses the HCS field in the cell header in the cell delineation process to frame ATM cell boundaries. The HCS is an FCS-8 calculation over the first four octets of the ATM cell header. • **LOC**—Current loss of cell (LOC) delineation state. **OK** means that no LOC is currently asserted.	**extensive**

Table 10: ATM show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output
ATM Statistics	ATM statistics for the interface: • **Uncorrectable HCS errors**—Number of cells dropped because the cell delineation failed. These errors most likely indicate that a SONET/SDH layer problem has occurred. • **Correctable HCS errors**—Number of correctable HCS errors that occurred. The cell delineation process can recover from these errors and locate the ATM cell boundary, although the framing process is not quite stable. The ATM cell is not dropped. This counter increases when the cell delineation process changes its state from **present** to **sync** (for example, when a cable is plugged into the interface). The following error statistics are from the framer: • **Tx cell FIFO overruns**—Number of overruns in the transmit FIFO. • **Rx cell FIFO overruns**—Number of overruns in the receive FIFO. • **Rx cell FIFO underruns**—Number of underruns in the receive FIFO. • **Input cell count**—Number of ATM cells received by the interface (not including idle cells). • **Output cell count**—Number of ATM cells transmitted by the interface (including idle cells). • **Output idle cell count**—Number of idle cells sent by the port. When ATM has nothing to send, it sends idle cells to fill the time slot. • **Output VC queue drops**—Number of packets dropped by a port on the PIC. Packets are dropped because of queue limits on the VCs. The following error statistics are from the SAR: • **Input no buffers**—Number of AAL5 packets dropped because no channel blocks or buffers were available to handle them. • **Input length errors**—Number of AAL5 packets dropped because their length was incorrect. Usually, these errors occur because a cell has been corrupted or lost, or because the length field was corrupted. They can also mean the AAL5 length field was zero. • **Input timeouts**—Number of AAL5 packets dropped because of a reassembly timeout. • **Input invalid VCs**—Number of AAL5 packets dropped because the header was unrecognized (because the VC was not correct or not configured). • **Input bad CRCs**—Number of AAL5 packets dropped because of frame check sequence errors. • **Input OAM cell no buffers**—Number of received OAM cells or raw cells dropped because no buffers were available to handle them. • **L2 circuit out-of-sequence packets**—(Layer 2 AAL5 mode) Number of AAL5 packets that are out of sequential order. • **Denied packets count**—The number of packets dropped due to VLAN priority deny packets or due to an error forwarding configuration that might cause a negative frame length, that is, the stripping size is larger than the packet size.	**extensive**
Packet Forwarding Engine configuration	Information about the configuration of the Packet Forwarding Engine: • **Destination slot**—FPC slot number.	**extensive**

Table 10: ATM show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output
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**

Table 10: ATM show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output

VPI	(ATM2) Virtual path identifier information:
	• **Flags**—VPI flags can be one or more of the following:
	  • **Active** (virtual path is up)
	  • **OAM** (operation and maintenance is enabled)
	  • **Shaping** (shaping is configured)
	• **CBR, Peak**
	• **OAM, Period**—Interval at which OAM F4 loopback cells are sent.
	• **Up count**—Number of F4 OAM cells required to consider the virtual path up; the range is **1** through **255**.
	• **Down count**—Number of F4 OAM cells required to consider the virtual path down; the range is **1** through **255**.
	• **Total down time**—Total number of seconds the VPI has been down since it was opened, using the format **Total down time:** ***hh*:*mm*:*ss*** or **Never.**
	• **Last down**—Time of last **Down** transition, using the format **Last down:** ***hh*:*mm*:*ss*** **ago** or **Never**.
	• **OAM F4 cell statistics**—(Nonpromiscuous mode) OAM F4 statistics:
	  • **Total received**—Number of OAM F4 cells received.
	  • **Total sent**—Number of OAM F4 cells sent.
	  • **Loopback received**—Number of OAM F4 loopback cells received.
	  • **Loopback sent**—Number of OAM F4 loopback cells sent.
	  • **Last received**—Time at which the last OAM F4 cell was received.
	  • **Last sent**—Time at which the last OAM F4 cell was sent.
	  • **RDI received**—Number of OAM F4 cells received with the remote defect indication bit set.
	  • **RDI sent**—Number of OAM F4 cells sent with the RDI bit set.
	  • **AIS received**—Number of OAM F4 cells received with the alarm indication signal bit set.
	  • **AIS sent**—Number of OAM F4 cells sent with the AIS bit set.
	Traffic statistics:
	• **Input bytes**—Number of bytes received on the VPI.
	• **Output bytes**—Number of bytes transmitted on the VPI.
	• **Input packets**—Number of packets received on the VPI.
	• **Output packets**—Number of packets transmitted on the VPI.
		detail extensive none

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**

Table 10: ATM show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output
Flags	Information about the logical interface. Possible values are described in the "Logical Interface Flags" section under *Common Output Fields Description*.	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
Encapsulation	Encapsulation on the logical interface.	All levels
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 a while (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 a while (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 a while (generally, less than 1 second) for this counter to stabilize.	**detail extensive**
Input packets	Number of packets received on the logical interface.	None specified
Output packets	Number of packets transmitted on the logical interface.	None specified
protocol-family	Protocol family configured on the logical interface. If the protocol is **inet**, the IP address of the interface is also displayed.	**brief**
Protocol	Protocol family configured on the logical interface.	**detail extensive** none
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
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 10: ATM 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**

VCI	Virtual circuit identifier number and information:
	• **Flags**—VCI flags:
	  • **Active**—VCI is up and in working condition.
	  • **CCC down**—VCI CCC is not in working condition.
	  • **Closed**—VCI is closed because the user disabled the logical or physical interface from the CLI.
	  • **Configured**—VCI is configured.
	  • **Down**—VCI is not in working condition. The VCI might have alarms, defects, F5 AIS/RDI, or no response to OAM loopback cells.
	  • **ILMI**—VCI is up and in working condition.
	  • **OAM**—OAM loopback is enabled.
	  • **Multicast**—VCI is a multicast VCI or DLCI.
	  • **Multipoint destination**—VCI is configured as a multipoint destination.
	  • **None**—No VCI flags.
	  • **Passive-OAM**—Passive OAM is enabled.
	  • **Shaping**—Shaping is enabled.
	  • **Sustained**—Shaping rate is set to **Sustained**.
	  • **Unconfigured**—VCI is not configured.
	• **Total down time**—Total number of seconds the VCI has been down, using the format **Total down time: *hh:mm:ss*** or**Never**.
	• **Last down**—Time of last **Down** transition, using the format **Last down: *hh:mm:ss***.
	• **EPD threshold**—(ATM2 only) Threshold at which a packet is dropped when the queue size (in number of cells) exceeds the early packet-discard (EPD) value.
		All levels

Table 10: ATM show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output

VCI (continued)	• **Transmit weight cells**—(ATM2 only) Amount of bandwidth assigned to this queue.
	• **ATM per-VC transmit statistics**:
	  • **Tail queue packet drops**—Number of packets dropped because of bandwidth constraints. This value indicates that packets are queued to send out at a rate faster than allowed.
	• **OAM F4 cell statistics**—(Nonpromiscuous mode) OAM F4 statistics:
	  • **Total received**—Number of OAM F4 cells received.
	  • **Total sent**—Number of OAM F4 cells sent.
	  • **Loopback received**—Number of OAM F4 loopback cells received.
	  • **Loopback sent**—Number of OAM F4 loopback cells sent.
	  • **Last received**—Time at which the last OAM F4 cell was received.
	  • **Last sent**—Time at which the last OAM F4 cell was sent.
	  • **RDI received**—Number of OAM F4 cells received with the remote defect indication bit set.
	  • **RDI sent**—Number of OAM F4 cells sent with the RDI bit set.
	  • **AIS received**—Number of OAM F4 cells received with the alarm indication signal bit set.
	  • **AIS sent**—Number of OAM F4 cells sent with the AIS bit set.
	• **Traffic statistics**—Number and rate of bytes and packets received and transmitted on the physical interface.
	  • **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.
		All levels

IMA group properties	• **Version**—The specified IMA specification version, either IMA 1.0 or IMA 1.1.
	• **Frame length**—The specified frame size, which can be 32, 64, 128, or 256.
	• **Differential delay**—Maximum differential delay among links in milliseconds.
	• **Symmetry**—Either Common Transmit Clock or Independent Transmit Clock timing mode.
	• **Transmit clock**—The specified IMA clock mode, either common or independent.
	• **Minimum links**—The number of minimum active links specified in both transmit and receive directions.
	  • **Transmit**—The per-PIC limit on the number of minimum active links in the transmit direction.
	  • **Receive**—The per-PIC limit on the number of minimum active links in the receive direction.
	• **Frame synchronization**—The specified IMA frame synchronization state transition variables (Alpha, Beta, and Gamma) and their specified values.
	  • **Alpha**—The number of consecutive invalid ICP cells for IFSM.
	  • **Beta**—The number of consecutive errored ICP cells for IFSM.
	  • **Gamma**—The number of consecutive valid ICP cells for IFSM.
	• **Links**—The number of IMA links assigned to the IMA group.
		detail extensive none

Table 10: ATM show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output
IMA group alarms	• **Start-up-FE**—Far-end group alarm status • **Config-Aborted**—Near-end configuration aborted group alarm status • **Config-Aborted-FE**—Far-end configuration aborted group alarm status • **Insufficient-Links**—Near-end insufficient links group alarm status • **Insufficient-Links-FE**—Far-end insufficient links group alarm status • **Blocked-FE**—Far-end blocked group alarm status • **GR-Timing-Mismatch**—Group timing mismatch alarm status	**detail extensive** none
IMA group defects	• **Start-up-FE**—Far-end group defect status • **Config-Aborted**—Near-end configuration aborted group defect status • **Config-Aborted-FE**—Far-end configuration aborted group defect status • **Insufficient-Links**—Near-end insufficient links group defect status • **Insufficient-Links-FE**—Far-end insufficient links group defect status • **Blocked-FE**—Far-end blocked group defect status • **GR-Timing-Mismatch**—Group timing mismatch defect status	**detail extensive** none
IMA Group state	Near-end and far-end group status	**detail extensive** none
IMA group media	IMA group media status, including seconds, count and state for the following media parameters: • **FC** • **FC-FE** • **Addr-Mismatch** • **Running** • **UAS**	**detail extensive** none

Sample Output

show interfaces (ATM, IMA Group)

```
user@host> show interfaces at-1/0/0
Physical interface: at-1/0/0, Enabled, Physical link is Up
  IMA group properties:
    Version              : 1.1
    Frame length         : 128
    Differential delay   : 25 milliseconds
    Symmetry             : Symmetrical Configuration and Operation
    Transmit clock       : Common
    Minimum links        : Transmit: 1, Receive: 1
    Frame synchronization: Alpha: 2, Beta: 2, Gamma: 1
    Links                : None
  IMA group alarms  : Start-up-FE Config-Aborted Config-Aborted-FE
Insufficient-Links Insufficient-Links-FE Blocked-FE GR-Timing-Mismatch
  IMA group defects : Start-up-FE Config-Aborted Config-Aborted-FE
Insufficient-Links Insufficient-Links-FE Blocked-FE GR-Timing-Mismatch
  IMA Group state:
    Near end : Start up
    Far  end : Start up
  IMA group media:         Seconds        Count  State
```

```
    FC                                          0
    FC-FE                                       0
    Addr-Mismatch                               0
    Running                     0
    UAS                         0
```

show interfaces extensive (ATM IMA Group)

```
user@host> show interfaces at-0/0/10 extensive
Physical interface: at-0/0/10, Enabled, Physical link is Up
   Interface index: 178, SNMP ifIndex: 540, Generation: 531
  Link-level type: ATM-PVC, MTU: 2048, Speed: Unspecified, Loopback: None, Payload
 scrambler: Enabled
   Device flags   : Present Running
   Link flags     : None
   CoS queues     : 8 supported, 4 maximum usable queues
   Hold-times     : Up 0 ms, Down 0 ms
   Current address: 84:18:88:c0:33:0a
   Last flapped   : 2012-03-16 16:49:15 PDT (2d 07:12 ago)
   Statistics last cleared: 2012-03-16 16:56:58 PDT (2d 07:05 ago)
   Traffic statistics:
    Input  bytes  :                   0                   0 bps
    Output bytes  :                   0                   0 bps
    Input  packets:                   0                   0 pps
    Output packets:                   0                   0 pps
    IPv6 transit statistics:
     Input  bytes  :                  0
     Output bytes  :                  0
     Input  packets:                  0
     Output packets:                  0
   Input errors:
     Errors: 0, Drops: 0, Invalid VCs: 0, Framing errors: 0, Policed discards:
0, L3 incompletes: 0, L2 channel errors: 0,
     L2 mismatch timeouts: 0, Resource errors: 0
   Output errors:
     Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0, MTU errors:
0, Resource errors: 0
   IMA group properties:
     Version              : 1.1
     Frame length         : 128
     Differential delay   : 25 milliseconds
     Symmetry             : Symmetrical Configuration and Operation
     Transmit clock       : Common
     Minimum links        : Transmit: 1, Receive: 1
     Frame synchronization: Alpha: 2, Beta: 2, Gamma: 1
     Link #1              : t1-0/0/4             up
   IMA Group alarms   : None
   IMA Group defects  : None

   IMA Group state:
     Near end : Operational
     Far  end : Operational
   IMA group media:         Seconds        Count  State
     FC                                        0
     FC-FE                                     0
     Addr-Mismatch                             0
     Running                 198306
     UAS                          0
   ATM status:
     HCS state:     Sync
     LOC      :       OK
```

```
  ATM Statistics:
   Uncorrectable HCS errors: 0, Correctable HCS errors: 0, Tx cell FIFO overruns:
0, Rx cell FIFO overruns: 0,
    Rx cell FIFO underruns: 0, Input cell count: 0, Output cell count: 0, Output
idle cell count: 0,
    Output VC queue drops: 0, Input no buffers: 0, Input length errors: 0, Input
timeouts: 0, Input invalid VCs: 0,
    Input bad CRCs: 0, Input OAM cell no buffers: 0
  Packet Forwarding Engine configuration:
    Destination slot: 0
    VPI 2
      Flags: Active
      Total down time: 0 sec, Last down: Never
        Traffic statistics:
         Input  bytes  :                   0
         Output bytes  :                   0
         Input  packets:                   0
         Output packets:                   0

  Logical interface at-0/0/10.602 (Index 71) (SNMP ifIndex 1057) (Generation
17226)
    Flags: Point-To-Point SNMP-Traps CCC-Down 0x0 Encapsulation:
ATM-CCC-Cell-Relay
    L2 circuit cell bundle size: 1, bundle timeout: 125 usec, timeout count: 0
    L2 circuit out-of-sequence count: 0, denied packets count: 0
```

show interfaces (ATM1, SONET Mode)

```
user@host> show interfaces at-1/0/0
Physical interface: at-1/0/0, Enabled, Physical link is Up
  Interface index: 300, SNMP ifIndex: 194
  Description: to allspice at-1/0/0
  Link-level type: ATM-PVC, MTU: 4482, Clocking: Internal, SONET mode,
  Speed: OC3, Loopback: None, Payload scrambler: Enabled
  Device flags   : Present Running
  Link flags     : None
  CoS queues     : 4 supported, 4 maximum usable queues
  Current address: 00:05:85:02:38:7e
  Last flapped   : 2006-02-24 14:28:12 PST (6d 01:51 ago)
  Input rate     : 0 bps (0 pps)
  Output rate    : 0 bps (0 pps)
  SONET alarms   : None
  SONET defects  : None

  Logical interface at-1/0/0.0 (Index 64) (SNMP ifIndex 204)
    Flags: Point-To-Point SNMP-Traps Encapsulation: ATM-SNAP
    Input packets : 0
    Output packets: 0
    Protocol inet, MTU: 4470
      Flags: None
      Addresses, Flags: Is-Preferred Is-Primary
        Destination: 192.168.220.24/30, Local: 192.168.220.26,
        Broadcast: 192.168.220.27
    Protocol iso, MTU: 4470
      Flags: None
    VCI 0.128
      Flags: Active
      Total down time: 0 sec, Last down: Never
```

```
        Input packets : 0
        Output packets: 0
```

show interfaces brief (ATM1, SONET Mode)

```
user@host> show interfaces at-1/0/0 brief
Physical interface: at-1/0/0, Enabled, Physical link is Up
  Description: to allspice at-1/0/0
  Link-level type: ATM-PVC, MTU: 4482, Clocking: Internal, SONET mode,
  Speed: OC3, Loopback: None, Payload scrambler: Enabled
  Device flags   : Present Running
  Link flags     : None

  Logical interface at-1/0/0.0
    Flags: Point-To-Point SNMP-Traps Encapsulation: ATM-SNAP
    inet  192.168.220.26/30
    iso
    VCI 0.128
      Flags: Active
      Total down time: 0 sec, Last down: Never
```

show interfaces detail (ATM1, SONET Mode)

```
user@host> show interfaces at-1/0/0 detail
Physical interface: at-1/0/0, Enabled, Physical link is Up
  Interface index: 300, SNMP ifIndex: 194, Generation: 183
  Description: to allspice at-1/0/0
  Link-level type: ATM-PVC, MTU: 4482, Clocking: Internal, SONET mode,
  Speed: OC3, Loopback: None, Payload scrambler: Enabled
  Device flags   : Present Running
  Link flags     : None
  CoS queues     : 4 supported, 4 maximum usable queues
  Hold-times     : Up 0 ms, Down 0 ms
  Current address: 00:05:85:02:38:7e
  Last flapped   : 2006-02-24 14:28:12 PST (6d 01:55 ago)
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :                    0                    0 bps
   Output bytes  :                    0                    0 bps
   Input  packets:                    0                    0 pps
   Output packets:                    0                    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                   0                    0                    0

  SONET alarms   : None
  SONET defects  : None

  Logical interface at-1/0/0.0 (Index 64) (SNMP ifIndex 204) (Generation 5)
    Flags: Point-To-Point SNMP-Traps Encapsulation: ATM-SNAP
    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: 13, Route table: 0
    Flags: None
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: 192.168.220.24/30, Local: 192.168.220.26,
      Broadcast: 192.168.220.27, Generation: 14
  Protocol iso, MTU: 4470, Generation: 14, Route table: 0
    Flags: None
  VCI 0.128
    Flags: Active
    Total down time: 0 sec, Last down: Never
    ATM per-VC transmit statistics:
     Tail queue packet drops: 0
    Traffic statistics:
     Input  bytes  :                   0
     Output bytes  :                   0
     Input  packets:                   0
     Output packets:                   0
```

show interfaces extensive (ATM1, SONET Mode)

```
user@host> show interfaces at-1/0/0 extensive
Physical interface: at-1/0/0, Enabled, Physical link is Up
  Interface index: 300, SNMP ifIndex: 194, Generation: 183
  Description: to allspice at-1/0/0
  Link-level type: ATM-PVC, MTU: 4482, Clocking: Internal, SONET mode,
  Speed: OC3, Loopback: None, Payload scrambler: Enabled
  Device flags   : Present Running
  Link flags     : None
  CoS queues     : 4 supported, 4 maximum usable queues
  Hold-times     : Up 0 ms, Down 0 ms
  Current address: 00:05:85:02:38:7e
  Last flapped   : 2006-02-24 14:28:12 PST (6d 01:56 ago)
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :                   0                    0 bps
   Output bytes  :                   0                    0 bps
   Input  packets:                   0                    0 pps
   Output packets:                   0                    0 pps
  Input errors:
    Errors: 0, Drops: 0, Invalid VCs: 0, Framing errors: 0, Policed discards: 0,

    L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0,
    Resource errors: 0
  Output errors:
    Carrier transitions: 1, Errors: 0, Drops: 0, Aged packets: 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                0                 0                 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                    1            1  OK
  PLM-P                     0            0  OK
  ES-P                      1
  SES-P                     1
  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      : 0x13, C2(cmp) : 0x13, F2      : 0x00
  Z3      : 0x00, Z4      : 0x00, S1(cmp) : 0x00
Transmitted SONET overhead:
  F1      : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0x13, F2      : 0x00, Z3      : 0x00
  Z4      : 0x00
ATM status:
  HCS state:     Sync
  LOC      :       OK
ATM Statistics:
  Uncorrectable HCS errors: 0, Correctable HCS errors: 0,
```

```
  Tx cell FIFO overruns: 0, Rx cell FIFO overruns: 0,
  Rx cell FIFO underruns: 0, Input cell count: 0, Output cell count: 0,
  Output idle cell count: 0, Output VC queue drops: 0, Input no buffers: 0,
  Input length errors: 0, Input timeouts: 0, Input invalid VCs: 0,
  Input bad CRCs: 0, Input OAM cell no buffers: 0
Packet Forwarding Engine configuration:
  Destination slot: 1
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 at-1/0/0.0 (Index 64) (SNMP ifIndex 204) (Generation 5)
  Flags: Point-To-Point SNMP-Traps Encapsulation: ATM-SNAP
  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: 13, Route table: 0
    Flags: None
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: 192.168.220.24/30, Local: 192.168.220.26,
      Broadcast: 192.168.220.27, Generation: 14
  Protocol iso, MTU: 4470, Generation: 14, Route table: 0
    Flags: None
  VCI 0.128
    Flags: Active
    Total down time: 0 sec, Last down: Never
    ATM per-VC transmit statistics:
     Tail queue packet drops: 0
    Traffic statistics:
     Input  bytes  :                 0
     Output bytes  :                 0
     Input  packets:                 0
     Output packets:                 0
```

show interfaces (ATM2, SDH Mode)

```
user@host> show interfaces at-0/2/1
Physical interface: at-0/2/1, Enabled, Physical link is Up
  Interface index: 154, SNMP ifIndex: 42
  Link-level type: ATM-PVC, MTU: 4482, Clocking: Internal, SDH mode, Speed: OC3,

  Loopback: None, Payload scrambler: Enabled
  Device flags   : Present Running
  Link flags     : None
  CoS queues     : 4 supported, 4 maximum usable queues
  Current address: 00:05:85:8f:30:3f
  Last flapped   : 2006-03-24 13:29:58 PST (00:04:48 ago)
```

```
  Input rate     : 0 bps (0 pps)
  Output rate    : 0 bps (0 pps)
  SDH   alarms   : None
  SDH   defects  : None
    VPI 0
      Flags: Active
      Total down time: 0 sec, Last down: Never
  Traffic statistics:
         Input  packets:                  0
         Output packets:                  0

  Logical interface at-0/2/1.0 (Index 75) (SNMP ifIndex 51)
    Flags: Point-To-Point SNMP-Traps 0x4000 Encapsulation: ATM-SNAP
    Input packets : 0
    Output packets: 0
    Protocol inet, MTU: 4470
      Flags: None
      Addresses, Flags: Is-Preferred Is-Primary
        Destination: 10.0.12.6, Local: 10.0.12.5
    Protocol iso, MTU: 4470
      Flags: None
    VCI 0.128
      Flags: Active
      Total down time: 0 sec, Last down: Never
      EPD threshold: 2129, Transmit weight cells: 0
        Input packets : 0
        Output packets: 0

  Logical interface at-0/2/1.32767 (Index 76) (SNMP ifIndex 50)
    Flags: Point-To-Multipoint No-Multicast SNMP-Traps 0x4000
    Encapsulation: ATM-VCMUX
    Input packets : 0
    Output packets: 0
    VCI 0.4
      Flags: Active
      Total down time: 0 sec, Last down: Never
      EPD threshold: 0, Transmit weight cells: 0
        Input packets : 0
        Output packets: 0
```

show interfaces brief (ATM2, SDH Mode)

```
user@host> show interfaces at-0/2/1 brief
Physical interface: at-0/2/1, Enabled, Physical link is Up
  Link-level type: ATM-PVC, MTU: 4482, Clocking: Internal, SDH mode,
  Speed: OC3, Loopback: None, Payload scrambler: Enabled
  Device flags   : Present Running
  Link flags     : None
  Logical interface at-0/2/1.0
    Flags: Point-To-Point SNMP-Traps 0x4000 Encapsulation: ATM-SNAP
    inet  10.0.12.5        --> 10.0.12.6
    iso
    VCI 0.128
      Flags: Active
      Total down time: 0 sec, Last down: Never
      EPD threshold: 2129, Transmit weight cells: 0

  Logical interface at-0/2/1.32767
    Flags: Point-To-Multipoint No-Multicast SNMP-Traps 0x4000
    Encapsulation: ATM-VCMUX
    VCI 0.4
```



```
    Flags: Active
    Total down time: 0 sec, Last down: Never
    EPD threshold: 0, Transmit weight cells: 0
```

show interfaces detail (ATM2, SDH Mode)

```
user@host> show interfaces at-0/2/1 detail
Physical interface: at-0/2/1, Enabled, Physical link is Up
  Interface index: 154, SNMP ifIndex: 42, Generation: 40
  Link-level type: ATM-PVC, MTU: 4482, Clocking: Internal, SDH mode, Speed: OC3,

  Loopback: None, Payload scrambler: Enabled
  Device flags   : Present Running
  Link flags     : None
  CoS queues     : 4 supported, 4 maximum usable queues
  Hold-times     : Up 0 ms, Down 0 ms
  Current address: 00:05:85:8f:30:3f
  Last flapped   : 2006-03-24 13:29:58 PST (00:05:10 ago)
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :                   0                   0 bps
   Output bytes  :                   0                   0 bps
   Input  packets:                   0                   0 pps
   Output packets:                   0                   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                  0                   0                   0

  SDH   alarms   : None
  SDH   defects  : None
    VPI 0
      Flags: Active
      Total down time: 0 sec, Last down: Never
        Traffic statistics:
         Input  bytes  :                  0
         Output bytes  :                  0
         Input  packets:                  0
         Output packets:                  0

  Logical interface at-0/2/1.0 (Index 75) (SNMP ifIndex 51) (Generation 25)
    Flags: Point-To-Point SNMP-Traps 0x4000 Encapsulation: ATM-SNAP
    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: 62, Route table: 0
    Flags: None
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: 10.0.12.6, Local: 10.0.12.5, Broadcast: Unspecified,
      Generation: 58
  Protocol iso, MTU: 4470, Generation: 63, Route table: 0
    Flags: None
  VCI 0.128
    Flags: Active
    Total down time: 0 sec, Last down: Never
    EPD threshold: 2129, Transmit weight cells: 0
    ATM per-VC transmit statistics:
     Tail queue packet drops: 0
    Traffic statistics:
     Input  bytes  :                   0
     Output bytes  :                   0
     Input  packets:                   0
     Output packets:                   0
Logical interface at-0/2/1.32767 (Index 76) (SNMP ifIndex 50) (Generation 26)
  Flags: Point-To-Multipoint No-Multicast SNMP-Traps 0x4000
  Encapsulation: ATM-VCMUX
  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
  VCI 0.4
    Flags: Active
    Total down time: 0 sec, Last down: Never
    EPD threshold: 0, Transmit weight cells: 0
    ATM per-VC transmit statistics:
     Tail queue packet drops: 0
    Traffic statistics:
     Input  bytes  :                   0
     Output bytes  :                   0
     Input  packets:                   0
     Output packets:                   0
```

show interfaces extensive (ATM2, SDH Mode)

```
user@host> show interfaces at-0/2/1 extensive
Physical interface: at-0/2/1, Enabled, Physical link is Up
  Interface index: 154, SNMP ifIndex: 42, Generation: 40
  Link-level type: ATM-PVC, MTU: 4482, Clocking: Internal, SDH mode, Speed: OC3,

  Loopback: None, Payload scrambler: Enabled
  Device flags   : Present Running
  Link flags     : None
  CoS queues     : 4 supported, 4 maximum usable queues
  Hold-times     : Up 0 ms, Down 0 ms
  Current address: 00:05:85:8f:30:3f
  Last flapped   : 2006-03-24 13:29:58 PST (00:06:49 ago)
  Statistics last cleared: Never
  Traffic statistics:
```

```
 Input  bytes  :                    0                    0 bps
 Output bytes  :                    0                    0 bps
 Input  packets:                    0                    0 pps
 Output packets:                    0                    0 pps
Input errors:
  Errors: 0, Drops: 0, Invalid VCs: 0, Framing errors: 0, Policed discards: 0,

  L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0,
  Resource errors: 0
Output errors:
  Carrier transitions: 3, Errors: 0, Drops: 0, Aged packets: 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                  0                    0                    0

SDH   alarms   : None
SDH   defects  : None
SDH PHY:              Seconds        Count  State
  PLL Lock                  0            0  OK
  PHY Light                 1            1  OK
SDH regenerator section:
  RS-BIP8                   2         8828
  OOF                       2            2  OK
  LOS                       2            1  OK
  LOF                       2            1  OK
  RS-ES                     4
  RS-SES                    3
  RS-SEFS                   2
SDH multiplex section:
  MS-BIP24                  2          771
  MS-FEBE                   1        17476
  MS-FERF                   2            1  OK
  MS-AIS                    2            1  OK
  BERR-SF                   0            0  OK
  BERR-SD                   0            0  OK
  MS-ES                     4
  MS-SES                    2
  MS-UAS                    0
  MS-ES-FE                  3
  MS-SES-FE                 2
  MS-UAS-FE                 0
SDH path:
  HP-BIP8                   1            6
  HP-FEBE                   1          251
  HP-LOP                    0            0  OK
  HP-AIS                    2            1  OK
  HP-FERF                   3            2  OK
  HP-UNEQ                   1            1  OK
  HP-PLM                    2            1  OK
  HP-ES                     4
  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      : 0x13, C2(cmp) : 0x13, F2      : 0x00
  Z3      : 0x00, Z4      : 0x00, S1(cmp) : 0x00
Transmitted SDH overhead:
  F1      : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0x13, F2      : 0x00, Z3      : 0x00
  Z4      : 0x00
ATM status:
  HCS state:     Sync
  LOC      :       OK
ATM Statistics:
  Uncorrectable HCS errors: 0, Correctable HCS errors: 0,
  Tx cell FIFO overruns: 0, Rx cell FIFO overruns: 0,
  Rx cell FIFO underruns: 0, Input cell count: 0, Output cell count: 0,
  Output idle cell count: 0, Output VC queue drops: 0, Input no buffers: 0,
  Input length errors: 0, Input timeouts: 0, Input invalid VCs: 0,
  Input bad CRCs: 0, Input OAM cell no buffers: 0
Packet Forwarding Engine configuration:
  Destination slot: 0
  VPI 0
    Flags: Active
    Total down time: 0 sec, Last down: Never
      Traffic statistics:
       Input  bytes  :                   0
       Output bytes  :                   0
       Input  packets:                   0
       Output packets:                   0

Logical interface at-0/2/1.0 (Index 75) (SNMP ifIndex 51) (Generation 25)
  Flags: Point-To-Point SNMP-Traps 0x4000 Encapsulation: ATM-SNAP
  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: 62, Route table: 0
    Flags: None
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: 10.0.12.6, Local: 10.0.12.5, Broadcast: Unspecified,
      Generation: 58
  Protocol iso, MTU: 4470, Generation: 63, Route table: 0
    Flags: None
  VCI 0.128
    Flags: Active
    Total down time: 0 sec, Last down: Never
    EPD threshold: 2129, Transmit weight cells: 0
    ATM per-VC transmit statistics:
```

```
      Tail queue packet drops: 0
    Traffic statistics:
     Input  bytes  :                   0
     Output bytes  :                   0
     Input  packets:                   0
     Output packets:                   0
Logical interface at-0/2/1.32767 (Index 76) (SNMP ifIndex 50) (Generation 26)
  Flags: Point-To-Multipoint No-Multicast SNMP-Traps 0x4000
  Encapsulation: ATM-VCMUX
  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
  VCI 0.4
    Flags: Active
    Total down time: 0 sec, Last down: Never
    EPD threshold: 0, Transmit weight cells: 0
    ATM per-VC transmit statistics:
     Tail queue packet drops: 0
    Traffic statistics:
     Input  bytes  :                   0
     Output bytes  :                   0
     Input  packets:                   0
     Output packets:                   0
```

show interfaces (ATM2, SONET Mode)

```
user@host> show interfaces at-0/3/1
Physical interface: at-0/3/1, Enabled, Physical link is Up
  Interface index: 139, SNMP ifIndex: 67
  Link-level type: ATM-PVC, MTU: 4482, Clocking: Internal, SONET mode,
  Speed: OC3, Loopback: None, Payload scrambler: Enabled
  Device flags   : Present Running
  Link flags     : None
  CoS queues     : 4 supported, 4 maximum usable queues
  Current address: 00:14:f6:22:58:5e
  Last flapped   : 2006-03-13 17:46:36 PST (16:01:12 ago)
  Input rate     : 0 bps (0 pps)
  Output rate    : 0 bps (0 pps)
  SONET alarms   : None
  SONET defects  : None
    VPI 0
      Flags: Active, OAM, Shaping
      CBR, Peak: 50kbps
      OAM, Period 30 sec, Up count: 10, Down count: 10
      Total down time: 0 sec, Last down: Never
     OAM F4 cell statistics:
      Total received: 4, Total sent: 4
      Loopback received: 4, Loopback sent: 4
      RDI received: 0, RDI sent: 0
      AIS received: 0
  Traffic statistics:
         Input  packets:                  4
         Output packets:                 30
    VPI 10
```

```
    Flags: Active
    Total down time: 0 sec, Last down: Never
  Traffic statistics:
       Input  packets:                    0
       Output packets:                    0
Logical interface at-0/3/1.0 (Index 78) (SNMP ifIndex 77)
  Flags: Point-To-Point Copy-PLP-To-CLP SNMP-Traps 0x4000
  Encapsulation: ATM-SNAP
  Input packets : 0
  Output packets: 0
  Protocol inet, MTU: 4470
    Flags: None
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: 10.0.59.5, Local: 10.0.59.6
  Protocol iso, MTU: 4470
    Flags: None
  VCI 0.128
    Flags: Active
    Total down time: 0 sec, Last down: Never
    EPD threshold: 2129, Transmit weight cells: 10
      Input packets : 0
      Output packets: 0

Logical interface at-0/3/1.32767 (Index 79) (SNMP ifIndex 76)
  Flags: Point-To-Multipoint Copy-PLP-To-CLP No-Multicast SNMP-Traps 0x4000
  Encapsulation: ATM-VCMUX
  Input packets : 4
  Output packets: 30
  VCI 0.16
    Flags: Active, ILMI
    Total down time: 0 sec, Last down: Never
    EPD threshold: 0, Transmit weight cells: 0
      Input packets : 0
      Output packets: 26
  VCI 0.4
    Flags: Active, OAM
    OAM, Period 30 sec, Up count: 10, Down count: 10
    Total down time: 0 sec, Last down: Never
    EPD threshold: 2129, Transmit weight cells: 0
      Input packets : 4
      Output packets: 4
   OAM F4 cell statistics:
    Total received: 4, Total sent: 4
    Loopback received: 4, Loopback sent: 4
    RDI received: 0, RDI sent: 0
    AIS received: 0, AIS sent: 0
```

show interfaces brief (ATM2, SONET Mode)

```
user@host> show interfaces at-0/3/1 brief
Physical interface: at-0/3/1, Enabled, Physical link is Up
  Link-level type: ATM-PVC, MTU: 4482, Clocking: Internal, SONET mode,
  Speed: OC3, Loopback: None, Payload scrambler: Enabled
  Device flags   : Present Running
  Link flags     : None

  Logical interface at-0/3/1.0
    Flags: Point-To-Point Copy-PLP-To-CLP SNMP-Traps 0x4000
    Encapsulation: ATM-SNAP
    inet  10.0.59.6        --> 10.0.59.5
    iso
```

```
    VCI 0.128
      Flags: Active
      Total down time: 0 sec, Last down: Never
      EPD threshold: 2129, Transmit weight cells: 10

  Logical interface at-0/3/1.32767
    Flags: Point-To-Multipoint Copy-PLP-To-CLP No-Multicast SNMP-Traps 0x4000
    Encapsulation: ATM-VCMUX
    VCI 0.16
      Flags: Active, ILMI
      Total down time: 0 sec, Last down: Never
      EPD threshold: 0, Transmit weight cells: 0
    VCI 0.4
      Flags: Active, OAM
      Total down time: 0 sec, Last down: Never
      EPD threshold: 2129, Transmit weight cells: 0
```

show interfaces detail (ATM2, SONET Mode)

```
user@host> show interfaces at-0/3/1 detail
Physical interface: at-0/3/1, Enabled, Physical link is Up
  Interface index: 139, SNMP ifIndex: 67, Generation: 22
  Link-level type: ATM-PVC, MTU: 4482, Clocking: Internal, SONET mode,
  Speed: OC3, Loopback: None, Payload scrambler: Enabled
  Device flags   : Present Running
  Link flags     : None
  CoS queues     : 4 supported, 4 maximum usable queues
  Hold-times     : Up 0 ms, Down 0 ms
  Current address: 00:14:f6:22:58:5e
  Last flapped   : 2006-03-13 17:46:36 PST (16:02:39 ago)
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :                 312                    0 bps
   Output bytes  :                2952                    0 bps
   Input  packets:                   6                    0 pps
   Output packets:                  50                    0 pps
  Egress queues: 4 supported, 4 in use
  Queue counters:       Queued packets  Transmitted packets      Dropped packets

    0 best-effort                   44                   44                    0

    1 expedited-fo                   0                    0                    0

    2 assured-forw                   0                    0                    0

    3 network-cont                   6                    6                    0

  SONET alarms   : None
  SONET defects  : None
    VPI 0
      Flags: Active, OAM, Shaping
      CBR, Peak: 50kbps
      OAM, Period 30 sec, Up count: 10, Down count: 10
      Total down time: 0 sec, Last down: Never
     OAM F4 cell statistics:
      Total received: 6, Total sent: 6
      Loopback received: 6, Loopback sent: 6
      Last received: 00:00:29, Last sent: 00:00:29
      RDI received: 0, RDI sent: 0
      AIS received: 0
        Traffic statistics:
```

```
      Input  bytes  :                  312
      Output bytes  :                 2952
      Input  packets:                    6
      Output packets:                   50
  VPI 10
    Flags: Active
    Total down time: 0 sec, Last down: Never
      Traffic statistics:
       Input  bytes  :                    0
       Output bytes  :                    0
       Input  packets:                    0
       Output packets:                    0

Logical interface at-0/3/1.0 (Index 78) (SNMP ifIndex 77) (Generation 20)
  Flags: Point-To-Point Copy-PLP-To-CLP SNMP-Traps 0x4000
  Encapsulation: ATM-SNAP
  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: 38, Route table: 0
    Flags: None
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: 10.0.59.5, Local: 10.0.59.6, Broadcast: Unspecified,
      Generation: 44
  Protocol iso, MTU: 4470, Generation: 39, Route table: 0
    Flags: None
  VCI 0.128
    Flags: Active
    Total down time: 0 sec, Last down: Never
    EPD threshold: 2129, Transmit weight cells: 10
    ATM per-VC transmit statistics:
     Tail queue packet drops: 0
    Traffic statistics:
     Input  bytes  :                    0
     Output bytes  :                    0
     Input  packets:                    0
     Output packets:                    0
Logical interface at-0/3/1.32767 (Index 79) (SNMP ifIndex 76) (Generation 21)
  Flags: Point-To-Multipoint Copy-PLP-To-CLP No-Multicast SNMP-Traps 0x4000
  Encapsulation: ATM-VCMUX
  Traffic statistics:
   Input  bytes  :                  360
   Output bytes  :                 3302
   Input  packets:                    6
   Output packets:                   50
  Local statistics:
   Input  bytes  :                  360
   Output bytes  :                 3302
   Input  packets:                    6
```

```
   Output packets:                  50
  VCI 0.16
    Flags: Active, ILMI
    Total down time: 0 sec, Last down: Never
    EPD threshold: 0, Transmit weight cells: 0
    ATM per-VC transmit statistics:
     Tail queue packet drops: 0
    Traffic statistics:
     Input  bytes  :                   0
     Output bytes  :                2640
     Input  packets:                   0
     Output packets:                  44
  VCI 0.4
    Flags: Active, OAM
    OAM, Period 30 sec, Up count: 10, Down count: 10
    Total down time: 0 sec, Last down: Never
    EPD threshold: 2129, Transmit weight cells: 0
    ATM per-VC transmit statistics:
     Tail queue packet drops: 0
    Traffic statistics:
     Input  bytes  :                 312
     Output bytes  :                 312
     Input  packets:                   6
     Output packets:                   6
   OAM F4 cell statistics:
    Total received: 6, Total sent: 6
    Loopback received: 6, Loopback sent: 6
    Last received: 00:00:29, Last sent: 00:00:29
    RDI received: 0, RDI sent: 0
    AIS received: 0, AIS sent: 0
```

show interfaces extensive (ATM2, SONET Mode)

```
user@host> show interfaces at-0/3/1 extensive
Physical interface: at-0/3/1, Enabled, Physical link is Up
  Interface index: 139, SNMP ifIndex: 67, Generation: 22
  Link-level type: ATM-PVC, MTU: 4482, Clocking: Internal, SONET mode,
  Speed: OC3, Loopback: None, Payload scrambler: Enabled
  Device flags   : Present Running
  Link flags     : None
  CoS queues     : 4 supported, 4 maximum usable queues
  Hold-times     : Up 0 ms, Down 0 ms
  Current address: 00:14:f6:22:58:5e
  Last flapped   : 2006-03-13 17:46:36 PST (16:04:12 ago)
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :                  520                    0 bps
   Output bytes  :                 4240                    0 bps
   Input  packets:                   10                    0 pps
   Output packets:                   72                    0 pps
  Input errors:
    Errors: 0, Drops: 0, Invalid VCs: 0, Framing errors: 0, Policed discards: 0,

    L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0,
    Resource errors: 0
  Output errors:
    Carrier transitions: 1, Errors: 0, Drops: 0, Aged packets: 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                  62                  62                  0

  1 expedited-fo                  0                   0                  0

  2 assured-forw                  0                   0                  0

  3 network-cont                 10                  10                  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                     1            1  OK
  PLM-P                      0            0  OK
  ES-P                       1
  SES-P                      1
  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      : 0x13, C2(cmp) : 0x13, F2      : 0x00
  Z3      : 0x00, Z4      : 0x00, S1(cmp) : 0x00
Transmitted SONET overhead:
  F1      : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0x13, F2      : 0x00, Z3      : 0x00
  Z4      : 0x00
ATM status:
  HCS state:     Sync
  LOC      :       OK
ATM Statistics:
```

```
  Uncorrectable HCS errors: 0, Correctable HCS errors: 0,
  Tx cell FIFO overruns: 0, Rx cell FIFO overruns: 0,
  Rx cell FIFO underruns: 0, Input cell count: 0, Output cell count: 0,
  Output idle cell count: 0, Output VC queue drops: 0, Input no buffers: 0,
  Input length errors: 0, Input timeouts: 0, Input invalid VCs: 0,
  Input bad CRCs: 0, Input OAM cell no buffers: 0
Packet Forwarding Engine configuration:
  Destination slot: 0
  VPI 0
    Flags: Active, OAM, Shaping
    CBR, Peak: 50kbps
    OAM, Period 30 sec, Up count: 10, Down count: 10
    Total down time: 0 sec, Last down: Never
   OAM F4 cell statistics:
    Total received: 10, Total sent: 10
    Loopback received: 10, Loopback sent: 10
    Last received: 00:00:02, Last sent: 00:00:02
    RDI received: 0, RDI sent: 0
    AIS received: 0
      Traffic statistics:
       Input  bytes  :                  520
       Output bytes  :                 4240
       Input  packets:                   10
       Output packets:                   72
  VPI 10
    Flags: Active
    Total down time: 0 sec, Last down: Never
      Traffic statistics:
       Input  bytes  :                    0
       Output bytes  :                    0
       Input  packets:                    0
       Output packets:                    0

Logical interface at-0/3/1.0 (Index 78) (SNMP ifIndex 77) (Generation 20)
  Flags: Point-To-Point Copy-PLP-To-CLP SNMP-Traps 0x4000
  Encapsulation: ATM-SNAP
  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: 38, Route table: 0
    Flags: None
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: 10.0.59.5, Local: 10.0.59.6, Broadcast: Unspecified,
      Generation: 44
  Protocol iso, MTU: 4470, Generation: 39, Route table: 0
    Flags: None
  VCI 0.128
    Flags: Active
    Total down time: 0 sec, Last down: Never
```

```
    EPD threshold: 2129, Transmit weight cells: 10
    ATM per-VC transmit statistics:
     Tail queue packet drops: 0
    Traffic statistics:
     Input  bytes  :                   0
     Output bytes  :                   0
     Input  packets:                   0
     Output packets:                   0

Logical interface at-0/3/1.32767 (Index 79) (SNMP ifIndex 76) (Generation 21)
  Flags: Point-To-Multipoint Copy-PLP-To-CLP No-Multicast SNMP-Traps 0x4000
  Encapsulation: ATM-VCMUX
  Traffic statistics:
   Input  bytes  :                 660
   Output bytes  :                5473
   Input  packets:                  11
   Output packets:                  83
  Local statistics:
   Input  bytes  :                 660
   Output bytes  :                5473
   Input  packets:                  11
   Output packets:                  83
  VCI 0.16
    Flags: Active, ILMI
    Total down time: 0 sec, Last down: Never
    EPD threshold: 0, Transmit weight cells: 0
    ATM per-VC transmit statistics:
     Tail queue packet drops: 0
    Traffic statistics:
     Input  bytes  :                   0
     Output bytes  :                4320
     Input  packets:                   0
     Output packets:                  72
  VCI 0.4
    Flags: Active, OAM
    OAM, Period 30 sec, Up count: 10, Down count: 10
    Total down time: 0 sec, Last down: Never
    EPD threshold: 2129, Transmit weight cells: 0
    ATM per-VC transmit statistics:
     Tail queue packet drops: 0
    Traffic statistics:
     Input  bytes  :                 572
     Output bytes  :                 572
     Input  packets:                  11
     Output packets:                  11
   OAM F4 cell statistics:
    Total received: 11, Total sent: 11
    Loopback received: 11, Loopback sent: 11
    Last received: 00:00:18, Last sent: 00:00:18
    RDI received: 0, RDI sent: 0
    AIS received: 0, AIS sent: 0
```

show interfaces (T1, E1, or DS)

Syntax

show interfaces *interface-type*
<brief | detail | extensive | terse>
<descriptions>
<media>
<snmp-index *snmp-index*>
<statistics>

Release Information

Command introduced before Junos OS Release 7.4.

Description

Display status information about the specified T1, E1, or DS interface.

Options

interface-type—On ACX Series, M Series, MX Series, and T Series routers, the T1 interface type is **t1-*fpc/pic/port***, whereas the E1 interface type is **e1-*fpc/pic/port***, and DS interface type is **ds-*fpc/pic/port*:<channel>**. On the J Series routers, the T1 interface type is **t1-*pim*/0/*port***, whereas the E1 interface type is **e1-*pim*/0/*port***.

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

- *Understanding Interfaces on ACX Series Universal Access Routers*

List of Sample Output

show interfaces (T1, IMA Link) on page 177
show interfaces (T1, PPP) on page 178
show interfaces detail (T1, PPP) on page 178
show interfaces extensive (T1 CRC Errors) on page 179
show interfaces extensive (T1, PPP) on page 179
show interfaces (E1, Frame Relay) on page 181
show interfaces detail (E1, Frame Relay) on page 182
show interfaces extensive (E1, Frame Relay) on page 183
show interfaces (E1, IMA Link) on page 185
show interfaces extensive (T1, TDM-CCC-SATOP) on page 186
show interfaces extensive (DS, TDM-CCC-CESoPSN) on page 187

Output Fields

Table 11 on page 166 lists the output fields for the **show interfaces** (T1 or E1) command. Output fields are listed in the approximate order in which they appear.

Table 11: T1 or E1 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	Reference clock source: **Internal** or **External**.	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
Framing	Physical layer framing format used for the E1 interface on the link: **G704**, **G704-NO-CRC4**, or **Unframed**. The default is **G704**. Physical layer framing format used for the T1 interface on the link: **SF** and **ESF**. The default is **ESF**.	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
Link flags	Information about the link. Possible values are described in the "Link Flags" section under *Common Output Fields Description*.	All levels
Hold-times	Current interface hold-time up and hold-time down, in milliseconds.	**detail extensive**

Table 11: T1 or E1 show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output
IMA Link alarms	Current active IMA link alarms, including the following: • **LIF** • **LODS** • **RFI-IMA** • **Tx-Mis-Connected** • **Tx-Unusable-FE** • **Rx-Unusable-FE** • **Link Fault**	**detail extensive** none
IMA Link defects	Current active IMA link defects, including the following: • **LIF** • **LODS** • **RFI-IMA** • **Tx-Mis-Connected** • **Tx-Unusable-FE** • **Rx-Unusable-FE** • **Link Fault**	**detail extensive** none

IMA Link state	Current active IMA link status, including the following:
	• **Line:** synchronized or not synchronized
	• **Near end:**—Status of near-end receive and transmit links
	  ◦ **Rx:** Usable or Unusable
	  ◦ **Tx:** Usable or Unusable
	• **Far end:**—Status of far-end receive and transmit links
	  ◦ **Rx:** Usable or Unusable
	  ◦ **Tx:** Usable or Unusable
		detail extensive none

Table 11: T1 or E1 show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output
IMA link media	IMA Link Media Status, which provides the seconds and count state for the following link media parameters: • LIF • LODS • Err-ICP • IV • Rx-FC • Tx-FC • FE-Defects • FE-Rx-FC • FE-Tx-FC • Rx-ICP • Rx-Stuff • Tx-ICP • Tx-Stuff • Rx-SES • Rx-UAS • Rx-UUS • Tx-UUS • FE-Rx-SES • FE-Rx-UAS • FE-Rx-UUS • FE-Tx-UUS	**detail extensive** none
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**.	**detail extensive** none

Keepalive statistics	(PPP and HDLC) Information about keepalive packets. (When no level of output is specified, the word **statistics** is not part of the field name and the **last seen** text is not displayed.)
	• **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***.
		detail extensive none

Table 11: T1 or E1 show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output
LMI settings	(Frame Relay) Settings for Local Management Interface (LMI) which can be either ANSI LMI settings or ITU LMI settings. ANSI LMI settings is the default. 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)	**detail extensive** none
LMI	(Frame Relay) Local Management Interface (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** none
DTE statistics	(Frame Relay) Statistics about messages transmitted from the data terminal equipment (DTE) to the data communications 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 11: T1 or E1 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 Local Management Interface (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** none
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
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) State of the Challenge Handshake Authentication Protocol (CHAP) during its transaction. • **Chap-Chal-received**—Challenge was received but response is 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. • **Down**—CHAP authentication is incomplete (not yet completed or has failed). • **Not-configured**—CHAP is not configured on the interface. • **Opened**—CHAP authentication was successful.	**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

Table 11: T1 or E1 show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output
CoS Queues	Number of CoS queues configured.	**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 and rate of bytes and packets received and transmitted on the physical interface. • **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. The following paragraphs explain the counters whose meaning might not be obvious: • **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). • **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. • **SRAM errors**—Number of hardware errors that occurred in the static RAM (SRAM) on the PIC or PIM. If the value of this field increments, the PIC or PIM is malfunctioning. • **Resource errors**—Sum of transmit drops.	**extensive**

Table 11: T1 or E1 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 or PIM 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. • **MTU errors**—Number of packets whose size exceeded the MTU of the interface. • **Resource errors**—Sum of transmit drops.	**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.	**detail extensive**
DS1 alarms **DS1 defects**	E1 media-specific defects that can prevent the interface from passing packets. When a defect persists for a certain amount of time, 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 turn on the red or yellow alarm LED on the craft interface. The following lists all possible alarms and defects. For complete explanations of most of these alarms and defects, see *Bellcore Telcordia GR-499-CORE*. • **AIS**—Alarm indication signal. • **LOF**—Loss of frame. • **LOS**—Loss of signal. • **YLW**—Yellow alarm. Indicates errors at the remote site receiver.	**detail extensive** none

Table 11: T1 or E1 show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output
T1 media or **E1 media**	Counts of T1 or E1 media-specific errors. • **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. The T1 or E1 media-specific error types are: • **SEF**—Severely errored framing • **BEE**—Bit error • **AIS**—Alarm indication signal • **LOF**—Loss of frame • **LOS**—Loss of signal • **YELLOW**—Errors at the remote site receiver • **CRC Major**—Cyclic redundancy check major alarm threshold exceeded • **CRC Minor**—Cyclic redundancy check minor alarm threshold exceeded • **BPV**—Bipolar violation • **EXZ**—Excessive zeros • **LCV**—Line code violation • **PCV**—Pulse code violation • **CS**—Carrier state • **CRC**—Cyclic redundancy check • **FEBE**—Far-end block error (E1 only) • **LES**—Line error seconds • **ES**—Errored seconds • **BES**—Bursty errored seconds • **SES**—Severely errored seconds • **SEFS**—Severely errored framing seconds • **UAS**—Unavailable seconds	**extensive**
SAToP Configuration	Information about the SAToP configuration. • **payload-size**—Configure the payload size, in bytes (from 32 through 1024 bytes). • **idle-pattern**—An 8-bit hexadecimal pattern to replace TDM data in a lost packet (from 0 through 255). • **jitter-buffer-packets**—Number of packets in the jitter buffer (from 1 through 64 packets). • **jitter-buffer-latency**—Time delay in the jitter buffer (from 1 through 1000 milliseconds). • **excessive-packet-loss-rate**—Set packet loss options. The options are **groups**, **sample-period**, and **threshold**. • **sample-period**—Time required to calculate excessive packet loss rate (from 1000 through 65,535 milliseconds). • **threshold**—Percentile designating the threshold of excessive packet loss rate (1–100 percent).	**extensive**

Table 11: T1 or E1 show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output
CESoPSN Configuration	Information about the CESoPSN configuration. • **packetization-latency**—Time required to create packets (from 1000 through 8000 microseconds). • **idle-pattern**—An 8-bit hexadecimal pattern to replace TDM data in a lost packet (from 0 through 255). • **jitter-buffer-packets**—Number of packets in the jitter buffer (from 1 through 64 packets). • **jitter-buffer-latency**—Time delay in the jitter buffer (from 1 through 1000 milliseconds). • **excessive-packet-loss-rate**—Set packet loss options. The options are **sample-period** and **threshold**. • **sample-period**—Time required to calculate excessive packet loss rate (from 1000 through 65,535 milliseconds). • **threshold**—Percentile designating the threshold of excessive packet loss rate (1–100 percent).	**extensive**
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. • **Timeslots**—Time slots configured on the interface. • **Buildout**—(T1 only) Buildout setting: 0-132, 133-265, 266-398, 399-531, or 532-655 feet. • **Timeslots**—Configured time slots for the interface. • **Byte encoding**—(T1 only) Byte encoding used: **Nx64K** or **Nx56K**. • **Line encoding**—Line encoding used. For T1, the value can be **B8ZS** or **AMI**. For E1, the value is **HDB3**. • **Data inversion**—HDLC data inversion setting: **Enabled** or **Disabled**. • **Idle cycle flag**—Idle cycle flags. • **Start end flag**—Start and end flag.	**extensive**
DS1 BERT configuration	BERT (bit error rate test) checks the quality of the line. This output appears only when a BERT is run on the interface. • **BERT time period**—Configured total time period that the BERT is to run. • **Elapsed**—Actual time elapsed since the start of the BERT (in seconds). • **Induced error rate**—Configured rate at which the bit errors are induced in the BERT pattern. • **Algorithm**—Type of algorithm selected for the BERT.	**detail extensive** none
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**

Table 11: T1 or E1 show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output
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**
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 interface. Possible values are described in the "Interface Flags" section under *Common Output Fields Description*.	All levels
Encapsulation	Encapsulation on the logical interface.	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	(Frame Relay) Number and rate of bytes and packets received and transmitted on the logical interface. • **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**
Local statistics	(Frame Relay) 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 a while (generally, less than 1 second) for this counter to stabilize.	**detail extensive**

Table 11: T1 or E1 show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output
Transit statistics	(Frame Relay) 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. This counter normally stabilizes in less than 1 second.	**detail extensive**
Protocol	Protocol family configured on the logical interface, such as **iso**, **inet6**, **mlfr**, or **mpls**.	**detail extensive** none
Multilink bundle	Interface name for the multilink bundle, if configured.	**detail extensive** none
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
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.	**detail extensive** none
Generation	Unique number for use by Juniper Networks technical support only.	**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** or (**Input packets, Output packets**). **Flags** can be 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. • **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** none
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

Table 11: T1 or E1 show interfaces Output Fields *(continued)*

Field Name	Field Description	Level of Output
CE Info	Information related to the circuit emulation statistics. • **CE Tx**—Number of transmitted packets and bytes (TDM to PSN flow). • **CE Rx**—Number of received packets and bytes and forward bytes (PSN to TDM flow). • **CE Rx Forwarded**—Number of forwarded bytes. • **CE Strayed**—Number of stray packets. • **CE Lost**—Number of lost packets. • **CE Malformed**—Number of malformed packets • **CE Misinserted**—Number of misinserted packets. • **CE AIS dropped**—Number of dropped bytes due to buffer overrun (PSN to TDM). • **CE Dropped**—Number of dropped packets during resynchronization • **CE Overrun Events**—Number of overrun events. • **CE Underrun Events**—Number of underrun events.	**extensive**

Sample Output

show interfaces (T1, IMA Link)

```
user@host> show interfaces t1-1/0/0
  IMA Link alarms   : None
  IMA Link defects  : LIF, LODS
  IMA Link state:
    Line     : Not synchronized
    Near end : Rx: Unusable, Tx: Usable
    Far  end : Rx: Unusable, Tx: Usable
  IMA link media:          Seconds        Count  State
    LIF                                       0  OK
    LODS                                      0  OK
    Err-ICP                                   0  OK
    IV                                        0  OK
    Rx-FC                                     0  OK
    Tx-FC                                     0  OK
    FE-Defects                                0
    FE-Rx-FC                                  0
    FE-Tx-FC                                  0
    Rx-ICP                                    0
    Rx-Stuff                                  0
    Tx-ICP                                   11
    Tx-Stuff                                  0
    Rx-SES                    0
    Rx-UAS                    0
    Rx-UUS                    1
    Tx-UUS                    0
    FE-Rx-SES                 0
    FE-Rx-UAS                 0
    FE-Rx-UUS                 0
    FE-Tx-UUS                 0
```

show interfaces (T1, PPP)

```
user@host> show interfaces t1-1/1/0
Physical interface: t1-1/1/0, Enabled, Physical link is Up
  Interface index: 149, SNMP ifIndex: 45
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: T1,
  Loopback: None, FCS: 16, Framing: ESF
  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: 0 (never), Output: 0 (never)
  LCP state: Opened
  NCP state: Opened
  CHAP state: Opened
  CoS queues     : 4 supported, 4 in use
  Last flapped   : 2005-12-05 08:43:06 PST (02:13:35 ago)
  Input rate     : 0 bps (0 pps)
  Output rate    : 72 bps (0 pps)
  DS1   alarms   : None
  DS1   defects  : None

  Logical interface t1-1/1/0.0 (Index 66) (SNMP ifIndex 51)
    Flags: Hardware-Down Point-To-Point SNMP-Traps Encapsulation: PPP
    Protocol inet, MTU: 1500
      Flags: Protocol-Down
      Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
        Destination: 1.1.1/24, Local: 1.1.1.1, Broadcast: 1.1.1.255
```

show interfaces detail (T1, PPP)

```
user@host> show interfaces t1-1/1/0 detail
Physical interface: t1-1/1/0, Enabled, Physical link is Up
  Interface index: 149, SNMP ifIndex: 45, Generation: 32
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: T1,
  Loopback: None, FCS: 16, Framing: ESF
  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 : 0 (last seen: never)
    Output: 0 (last sent: never)
  LCP state: Opened
  NCP state: Opened
  CHAP state: Opened
  CoS queues     : 4 supported, 4 in use
  Last flapped   : 2005-12-05 08:43:06 PST (02:13:52 ago)
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :                    0                    0 bps
   Output bytes  :                  798                    0 bps
   Input  packets:                    0                    0 pps
   Output packets:                   42                    0 pps
  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                40                40                 0

  DS1   alarms   : None
  DS1   defects  : None
  DS1 BERT configuration:
    BERT time period: 10 seconds, Elapsed: 0 seconds
    Induced Error rate: 10e-0, Algorithm: 2^15 - 1
  Logical interface t1-1/1/0.0 (Index 66) (SNMP ifIndex 51) (Generation 5)
    Flags: Hardware-Down Point-To-Point SNMP-Traps Encapsulation: PPP
    Protocol inet, MTU: 1500, Generation: 14, Route table: 0
      Flags: Protocol-Down
      Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
        Destination: 1.1.1/24, Local: 1.1.1.1, Broadcast: 1.1.1.255,
        Generation: 18
```

show interfaces extensive (T1 CRC Errors)

```
user@host> show interfaces t1-3/2/0:1:1 extensive
Physical interface: t1-3/2/0:1:1, Enabled, Physical link is Down
  Interface index: 179, SNMP ifIndex: 79, Generation: 180
  :
  :
  DS1   alarms   : AIS, LOF, CRC Major, CRC Minor
  DS1   defects  : AIS, LOF, CRC Major, CRC Minor
  T1  media:            Seconds        Count  State
    SEF                       1            1  OK
    BEE                       1            1  OK
    AIS                    1128            1  Defect Active
    LOF                    1128            1  Defect Active
    LOS                       0            0  OK
    YELLOW                    0            0  OK
    CRC Major               154            1  Defect Active
    CRC Minor               154            1  Defect Active
    BPV                       0            0
    EXZ                       0            0
    LCV                       0            0
    PCV                       0            0
    CS                        0            0
    CRC                     154        15400
    ...
```

show interfaces extensive (T1, PPP)

```
user@host> show interfaces t1-1/1/0 extensive
Physical interface: t1-1/1/0, Enabled, Physical link is Up
  Interface index: 149, SNMP ifIndex: 45, Generation: 32
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: T1,
  Loopback: None, FCS: 16, Framing: ESF
  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 : 0 (last seen: never)
    Output: 0 (last sent: never)
  LCP state: Down
  NCP state: inet: Not-configured, inet6: Not-configured, iso: Not-configured,
  mpls: Not-configured
```

```
CHAP state: Closed
CoS queues     : 4 supported, 4 in use
Last flapped   : 2005-12-05 08:43:06 PST (02:13:54 ago)
Statistics last cleared: Never
Traffic statistics:
 Input  bytes  :                    0                    0 bps
 Output bytes  :                  817                   72 bps
 Input  packets:                    0                    0 pps
 Output packets:                   43                    0 pps
Input errors:
  Errors: 0, Drops: 0, Framing errors: 0, Policed discards: 0,
  L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0,
  HS link CRC errors: 0, SRAM errors: 0, Resource errors: 0
Output errors:
  Carrier transitions: 1, Errors: 0, Drops: 0, Aged packets: 0, MTU errors: 0,

  Resource errors: 0
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                 42                   42                    0

DS1   alarms   : None
DS1   defects  : None
T1  media:            Seconds        Count  State
  SEF                       1            1  OK
  BEE                       0            0  OK
  AIS                       0            0  OK
  LOF                       1            1  OK
  LOS                       0            0  OK
  YELLOW                    1            1  OK
  BPV                       1            1
  EXZ                       1            1
  LCV                       1        65535
  PCV                       1         1023
  CS                        0            0
  LES                       1
  ES                        1
  SES                       1
  SEFS                      1
  BES                       0
  UAS                       0
HDLC configuration:
  Policing bucket: Disabled
  Shaping bucket : Disabled
  Giant threshold: 1514, Runt threshold: 3
  Timeslots      : All active
  Line encoding: B8ZS
  Buildout       : 0 to 132 feet
  Byte encoding: Nx64K, Data inversion: Disabled, Idle cycle flag: flags,
  Start end flag: shared
DS1 BERT configuration:
  BERT time period: 10 seconds, Elapsed: 0 seconds
  Induced Error rate: 10e-0, Algorithm: 2^15 - 1
Packet Forwarding Engine configuration:
  Destination slot: 1, PLP byte: 1 (0x00)
```

```
  CoS information:
    CoS transmit queue       Bandwidth          Buffer   Priority    Limit
                          %          bps     %     usec
    0 best-effort        95      1459200    95        0        low    none
    3 network-control     5        76800     5        0        low    none

  Logical interface t1-1/1/0.0 (Index 66) (SNMP ifIndex 51) (Generation 5)
    Flags: Hardware-Down Point-To-Point SNMP-Traps Encapsulation: PPP
    Protocol inet, MTU: 1500, Generation: 14, Route table: 0
      Flags: Protocol-Down
      Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
        Destination: 1.1.1/24, Local: 1.1.1.1, Broadcast: 1.1.1.255,
        Generation: 18
```

show interfaces (E1, Frame Relay)

```
user@host> show interfaces e1-3/0/0
Physical interface: e1-3/0/0, Enabled, Physical link is Up
  Interface index: 146, SNMP ifIndex: 37
  Link-level type: Frame-Relay, MTU: 1504, Clocking: Internal, Speed: E1,
  Loopback: None, FCS: 16, Framing: G704
  Device flags   : Present Running
  Interface flags: Link-Layer-Down Point-To-Point SNMP-Traps 16384
  Link flags     : Keepalives DTE
  ANSI LMI settings: n391dte 6, n392dte 3, n393dte 4, t391dte 10 seconds
  LMI: Input: 0 (never), Output: 11 (00:00:05 ago)
  DTE statistics:
    Enquiries sent                      : 10
    Full enquiries sent                 : 1
    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        : 1
  CoS queues     : 8 supported
  Last flapped   : 2005-11-30 14:50:34 PST (4d 20:33 ago)
  Input rate     : 0 bps (0 pps)
  Output rate    : 0 bps (0 pps)
  DS1   alarms   : None
  DS1   defects  : None
  Logical interface e1-3/0/0.0 (Index 72) (SNMP ifIndex 32)
    Flags: Device-Down Point-To-Point SNMP-Traps Encapsulation: FR-NLPID
  Input packets : 0
  Output packets: 0
    Protocol inet, MTU: 1500
      Flags: None
      Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
        Destination: 10.1.3/24, Local: 10.1.3.1, Broadcast: 10.1.3.255
    DLCI 100
      Flags: Down, DCE-Unconfigured
      Total down time: 00:01:13 sec, Last down: 00:01:13 ago
      Input packets : 0
      Output packets: 0
```

```
  DLCI statistics:
    Active DLCI  :0  Inactive DLCI  :1
```

show interfaces detail (E1, Frame Relay)

```
user@host> show interfaces e1-3/0/0 detail
Physical interface: e1-3/0/0, Enabled, Physical link is Up
  Interface index: 146, SNMP ifIndex: 37, Generation: 69
  Link-level type: Frame-Relay, MTU: 1504, Clocking: Internal, Speed: E1,
  Loopback: None, FCS: 16, Framing: G704
  Device flags   : Present Running
  Interface flags: Link-Layer-Down Point-To-Point SNMP-Traps 16384
  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 : 0 (last seen: never)
    Output: 12 (last sent 00:00:02 ago)
  DTE statistics:
    Enquiries sent                      : 10
    Full enquiries sent                 : 2
    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        : 1
  CoS queues     : 8 supported
  Last flapped   : 2005-11-30 14:50:34 PST (4d 20:33 ago)
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :                   0                   0 bps
   Output bytes  :                 225                  56 bps
   Input  packets:                   0                   0 pps
   Output packets:                  15                   0 pps
  Queue counters:       Queued packets  Transmitted packets      Dropped packets

    0 limited                       0                   0                   0

    1 expedited-fo                  0                   0                   0

    2 real-plus                     0                   0                   0

    3 network-cont                 15                  15                   0

  DS1   alarms   : None
  DS1   defects  : None
  DS1 BERT configuration:
    BERT time period: 10 seconds, Elapsed: 0 seconds
    Induced Error rate: 10e-0, Algorithm: 2^15 - 1, O.151, Pseudorandom (9)
  Logical interface e1-3/0/0.0 (Index 72) (SNMP ifIndex 32) (Generation 26)
    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: 1500, Generation: 32, Route table: 0
    Flags: None
    Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
      Destination: 10.1.3/24, Local: 10.1.3.1, Broadcast: 10.1.3.255,
      Generation: 42
  DLCI 100
    Flags: Down, DCE-Unconfigured
    Total down time: 00:01:18 sec, Last down: 00:01:18 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 (E1, Frame Relay)

```
user@host> show interfaces e1-3/0/0 extensive
Physical interface: e1-3/0/0, Enabled, Physical link is Up
  Interface index: 146, SNMP ifIndex: 37, Generation: 69
  Link-level type: Frame-Relay, MTU: 1504, Clocking: Internal, Speed: E1,
  Loopback: None, FCS: 16, Framing: G704
  Device flags   : Present Running
  Interface flags: Link-Layer-Down Point-To-Point SNMP-Traps 16384
  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 : 0 (last seen: never)
    Output: 12 (last sent 00:00:05 ago)
  DTE statistics:
    Enquiries sent                     : 10
    Full enquiries sent                : 2
    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       : 1
  CoS queues     : 8 supported
  Last flapped   : 2005-11-30 14:50:34 PST (4d 20:33 ago)
  Statistics last cleared: Never
```

```
Traffic statistics:
 Input  bytes  :                    0                    0 bps
 Output bytes  :                  225                    0 bps
 Input  packets:                    0                    0 pps
 Output packets:                   15                    0 pps
Input errors:
  Errors: 0, Drops: 0, Framing errors: 0, Policed discards: 0,
  L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0,
  HS link CRC errors: 0, SRAM errors: 0, Resource errors: 0
Output errors:
  Carrier transitions: 17, Errors: 0, Drops: 0, Aged packets: 0,
  MTU errors: 0, Resource errors: 0
Queue counters:       Queued packets  Transmitted packets      Dropped packets

  0 limited                        0                    0                    0

  1 expedited-fo                   0                    0                    0

  2 real-plus                      0                    0                    0

  3 network-cont                  15                   15                    0

DS1   alarms   : None
DS1   defects  : None
E1  media:            Seconds        Count  State
  SEF                       0            0  OK
  BEE                       5            5  OK
  AIS                       0            0  OK
  LOF                     245           15  OK
  LOS                     245            4  OK
  YELLOW                    0           11  OK
  BPV                       0            0
  EXZ                       9            9
  LCV                       0            0
  PCV                       0            0
  CS                        0            0
  FEBE                      0            0
  LES                       0
  ES                        0
  SES                       0
  SEFS                      0
  BES                       0
  UAS                     271
HDLC configuration:
  Policing bucket: Disabled
  Shaping bucket : Disabled
  Giant threshold: 1506, Runt threshold: 0
  Timeslots      : All active
  Line encoding: HDB3, Data inversion: Disabled, Idle cycle flag: flags,
  Start end flag: shared
DS1 BERT configuration:
  BERT time period: 10 seconds, Elapsed: 0 seconds
  Induced Error rate: 10e-0, Algorithm: 2^15 - 1, O.151, Pseudorandom (9)
Packet Forwarding Engine configuration:
  Destination slot: 3, PLP byte: 1 (0x00)
CoS information:
  CoS transmit queue       Bandwidth          Buffer   Priority    Limit
                         %          bps     %     usec
  0 limited             95      1945600    95        0        low     none
  3 network-control      5       102400     5        0        low     none
Logical interface e1-3/0/0.0 (Index 72) (SNMP ifIndex 32) (Generation 26)
```

```
  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: 1500, Generation: 32, Route table: 0
    Flags: None
    Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
      Destination: 10.1.3/24, Local: 10.1.3.1, Broadcast: 10.1.3.255,
      Generation: 42
  DLCI 100
    Flags: Down, DCE-Unconfigured
    Total down time: 00:01:21 sec, Last down: 00:01:21 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 (E1, IMA Link)

```
user@host> show interfaces e1-1/0/0
  IMA Link alarms   : None
  IMA Link defects  : LIF, LODS
  IMA Link state:
    Line     : Not synchronized
    Near end : Rx: Unusable, Tx: Usable
    Far  end : Rx: Unusable, Tx: Usable
  IMA link media:          Seconds        Count  State
    LIF                                       0
    LODS                                      0
    Err-ICP                                   0
    IV                                        0
    Rx-FC                                     0
    Tx-FC                                     0
    FE-Defects                                0
    FE-Rx-FC                                  0
    FE-Tx-FC                                  0
    Rx-ICP                                    0
    Rx-Stuff                                  0
    Tx-ICP                                   11
    Tx-Stuff                                  0
    Rx-SES                      0
    Rx-UAS                      0
    Rx-UUS                      1
    Tx-UUS                      0
    FE-Rx-SES                   0
    FE-Rx-UAS                   0
```

```
    FE-Rx-UUS                   0
    FE-Tx-UUS                   0
```

show interfaces extensive (T1, TDM-CCC-SATOP)

```
user@host>show interfaces t1-1/0/0:1:1 extensive
Physical interface: t1-1/0/0:1:1, Enabled, Physical link is Down
  Interface index: 153, SNMP ifIndex: 579, Generation: 817
  Link-level type: TDM-CCC-SATOP, MTU: 1504, Clocking: Internal, Speed: T1,
Loopback: None, FCS: 16, Framing: ESF,
  Parent: coc1-1/0/0:1 Interface index 152
  Device flags   : Present Running Down
  Interface flags: Hardware-Down Point-To-Point SNMP-Traps Internal: 0x0
  Link flags     : None
  Hold-times     : Up 0 ms, Down 0 ms
  CoS queues     : 8 supported, 8 maximum usable queues
  Last flapped   : 2012-10-28 02:12:40 PDT (22:32:13 ago)
  Statistics last cleared: 2012-10-29 00:44:52 PDT (00:00:01 ago)
  Egress queues: 8 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                  0                   0                   0

  Queue number:         Mapped forwarding classes
    0                   best-effort
    1                   expedited-forwarding
    2                   assured-forwarding
    3                   network-control
  DS1   alarms   : None
  DS1   defects  : None
  T1  media:            Seconds        Count  State
    SEF                         0            0  OK
    BEE                         0            0  OK
    AIS                         0            0  OK
    LOF                         0            0  OK
    LOS                         0            0  OK
    YELLOW                      0            0  OK
    CRC Major                   0            0  OK
    CRC Minor                   0            0  OK
    BPV                         0            0
    EXZ                         0            0
    LCV                         0            0
    PCV                         0            0
    CS                          0            0
    CRC                         0            0
    LES                         0
    ES                          0
    SES                         0
    SEFS                        0
    BES                         0
    UAS                         0
  SAToP configuration:
    Payload size: 192
    Idle pattern: 0xFF
    Octet aligned: Disabled
```

```
    Jitter buffer: packets: 8, latency: 7 ms, auto adjust: Disabled
    Excessive packet loss rate: sample period: 10000 ms, threshold: 30%
  DS1 BERT configuration:
    BERT time period: 10 seconds, Elapsed: 0 seconds
    Induced Error rate: 0, Algorithm: 2^15 - 1, O.151, Pseudorandom (9)
  SONET alarms    : None
  SONET defects   : AIS-V, RDI-V
  SONET vt:
    BIP-BIP2                      0            0
    REI-V                         0            0
    LOP-V                         0            0  OK
    AIS-V                         2            0  Defect Active
    RDI-V                         2            0  Defect Active
    UNEQ-V                        0            0  OK
    PLM-V                         0            0  OK
    ES-V                          0
    SES-V                         0
    UAS-V                         2
    ES-VFE                        0
    SES-VFE                       0
    UAS-VFE                       0
  Received SONET overhead:
V5      : 0x07
V5(cmp) : 0x02
  Transmitted SONET overhead:
V5      : 0x02
  Packet Forwarding Engine configuration:
    Destination slot: 1
  CoS information:
    Direction : Output
    CoS transmit queue               Bandwidth               Buffer Priority
Limit
                               %           bps     %           usec
    0 best-effort             95       1459200    95              0      low
none
    3 network-control          5         76800     5              0      low
none

  Logical interface t1-1/0/0:1:1.0 (Index 69) (SNMP ifIndex 580) (Generation 525)

    Flags: Device-Down Point-To-Point SNMP-Traps Encapsulation: TDM-CCC-SATOP
  CE info               Packets        Bytes  Count
    CE Tx                  1005       192960
    CE Rx                  1004       192768
    CE Rx Forwarded                       0
    CE Strayed                0
    CE Lost                   0
    CE Malformed              0
    CE Misinserted            0
    CE AIS dropped            0
    CE Dropped             1005       192960
    CE Overrun Events                      0
    CE Underrun Events                     0
    Protocol ccc, MTU: 1504, Generation: 814, Route table: 0
      Flags: Is-Primary
```

show interfaces extensive (DS, TDM-CCC-CESoPSN)

```
user@host>show interfaces ds-1/0/0:1:1:1 extensive
Physical interface: ds-1/0/0:1:1:1, Enabled, Physical link is Down
  Interface index: 154, SNMP ifIndex: 597, Generation: 819
```

```
  Link-level type: TDM-CCC-CESoPSN, MTU: 1504, Speed: 1536kbps, Loopback: None,
FCS: 16, Parent: ct1-1/0/0:1:1 Interface index 153
  Device flags   : Present Running Down
  Interface flags: Hardware-Down Point-To-Point SNMP-Traps Internal: 0x0
  Link flags     : None
  Hold-times     : Up 0 ms, Down 0 ms
  CoS queues     : 8 supported, 8 maximum usable queues
  Last flapped   : 2012-10-29 00:49:03 PDT (00:00:35 ago)
  Statistics last cleared: Never
  Egress queues: 8 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                  0                   0                   0

  Queue number:         Mapped forwarding classes
    0                   best-effort
    1                   expedited-forwarding
    2                   assured-forwarding
    3                   network-control
  CESoPSN configuration:
    Packetization latency: 1000 us
    Idle pattern: 0xFF
    Jitter buffer: packets: 8, latency: 8 ms, auto adjust: Disabled
    Excessive packet loss rate: sample period: 10000 ms, threshold: 30%
  DS0 BERT configuration:
    BERT time period: 10 seconds, Elapsed: 0 seconds
    Induced Error rate: 0, Algorithm: 2^15 - 1, O.151, Pseudorandom (9)
  Packet Forwarding Engine configuration:
    Destination slot: 1
  CoS information:
    Direction : Output
    CoS transmit queue              Bandwidth              Buffer Priority
Limit
                                %           bps     %           usec
    0 best-effort              95       1459200    95              0      low
none
    3 network-control           5         76800     5              0      low
none

  Logical interface ds-1/0/0:1:1:1.0 (Index 69) (SNMP ifIndex 598) (Generation
549)
    Flags: Device-Down Point-To-Point SNMP-Traps Encapsulation: TDM-CCC-CESoPSN
  CE info               Packets        Bytes  Count
    CE Tx                     0            0
    CE Rx                 35712       6856704
    CE Rx Forwarded                        0
    CE Strayed                0
    CE Lost                   0
    CE Malformed              0
    CE Misinserted            0
    CE AIS dropped            0
    CE Dropped                0            0
    CE Overrun Events                         0
    CE Underrun Events                        1
```

```
Protocol ccc, MTU: 1504, Generation: 857, Route table: 0
  Flags: Is-Primary
```

show interfaces extensive

Syntax show interfaces extensive

Release Information Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 12.1x48 for PTX Series Packet Transport Routers.

Description Display extensive information about all interfaces configured on the router.

NOTE:

- At some times, the cumulative byte counters displayed with the **show interfaces extensive** command on the 10-Gigabit Ethernet MPC with SFP+ is not always increasing and cumulative and does not give the correct results. There is a time lag in collecting these statistics, during which the display might decrease or go from a nonzero number to zero. Eventually, the counter will display the correct result.
- When the **show interfaces extensive** command is executed on a router with an MPC or a T4000 Type 5 FPC, the *Input packet rejects* counter of the *Filter statistics* field also displays statistics related to the following packet errors:
  - Invalid VLAN range
  - Tagged packet received on an untagged interface
- When the **show interfaces extensive** command is executed on an interface that is configured on a T4000 Type 5 FPC, the *IPv6 transit statistics* field displays:
  - Total statistics (sum of transit and local statistics) at the physical interface level
  - Transit statistics at the logical interface level
- When the **show interfaces extensive** command is executed on an aggregate interface in a T1600 Core Router, the IPv6 *Input bytes* is displayed for an aggregate interface. However, the IPv6 *Input bytes* is always zero on a member link of an aggregated bundle even when there are IPv6 transit traffic on the member link. This is because the logical interface index of the aggregate logical interface is updated but not the logical interface of the member links in the channel lookup table.

Options This command has no options.

Required Privilege Level view

List of Sample Output

Output Fields

For more information, see the output fields table for the particular interface type in which you are interested. For information about destination class and source class statistics, see the "Destination Class Field" section and the "Source Class Field" section under *Common Output Fields Description*. For sample output for specific interfaces, see the other topics in this collection.

Sample Output

show interfaces extensive (Circuit Emulation)

If a Circuit Emulation (CE) PIC is configured for SAToP pseudowire, then pseudowire statistics are displayed in the CE information section of the show interface extensive output. If SAToP pseudowire is not configured on the CE PIC, then all the CE information counters will be displayed as 0 (zero).

```
user@host> show interface t1-0/0/0 extensive
Physical interface :t1-0/0/0, Enabled, Physical Link : Up
        Interface index:61441
        Speed : 1.54 Mbps, Loopback: Disabled
        Operational state : Enabled,    Encapsulation : Trans
        Encoding : b8zs,        Framing    : unframe,   Build-out : 0-30
        Inversion    : enable,  Clock source : master
        Description :
        Traffic statistics:
        T1 media:       Seconds
        ES              1643
        SES             1643

        CE Info         Packets             Bytes
        CE Rx     :     2395529             306627712
        CE Tx     :     2396259             306721152
        CE Rx Drop:     0                   0
        CE Tx Drop:     0                   0

        CE Overrun  Events: 0
        CE Underrun Events: 0
```

Sample Output

show interfaces extensive (Fast Ethernet)

```
user@host> show interfaces fe-0/2/1 extensive
Physical interface: fe-0/2/0, Enabled, Physical link is Up
  Interface index: 129, SNMP ifIndex: 23, Generation: 130
  Link-level type: Ethernet, MTU: 1514, Speed: 100mbps, Loopback: Disabled,
  Source filtering: Disabled, Flow control: Enabled
  Device flags   : Present Running
```

```
Interface flags: SNMP-Traps Internal: 0x4000
CoS queues      : 4 supported, 4 maximum usable queues
Hold-times      : Up 0 ms, Down 0 ms
Current address: 00:90:69:91:c4:3e, Hardware address: 00:90:69:91:c4:3e
Last flapped    : 2006-04-16 23:00:41 PDT (02:08:05 ago)
Statistics last cleared: 2006-04-16 21:42:00 PDT (03:26:46 ago)
Traffic statistics:
 Input  bytes  :                17539                 152 bps
 Output bytes  :                92968                 224 bps
 Input  packets:                  348                   0 pps
 Output packets:                 1349                   0 pps
Input errors:
  Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Policed discards: 0,
  L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0,
  FIFO errors: 0, Resource errors: 0
Output errors:
  Carrier transitions: 3, Errors: 0, Drops: 0, Collisions: 0, Aged packets: 0,

  FIFO errors: 0, HS link CRC errors: 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                   66                   66                    0

  1 expedited-fo                   0                    0                    0

  2 assured-forw                   0                    0                    0

  3 network-cont                1283                 1283                    0

Active alarms  : None
Active defects : None
MAC statistics:                      Receive         Transmit
  Total octets                         24721           105982
  Total packets                          348             1349
  Unicast packets                        347              430
  Broadcast packets                        1               37
  Multicast packets                        0              882
  CRC/Align errors                         0                0
  FIFO errors                              0                0
  MAC control frames                       0                0
  MAC pause frames                         0                0
  Oversized frames                         0
  Jabber frames                            0
  Fragment frames                          0
  VLAN tagged frames                       0
  Code violations                          0
Filter statistics:
  Input packet count                     348
  Input packet rejects                     0
  Input DA rejects                         0
  Input SA rejects                         0
  Output packet count                             1349
  Output packet pad count                            0
  Output packet error count                          0
  CAM destination filters: 3, CAM source filters: 0
Autonegotiation information:
  Negotiation status: Complete
  Link partner:
      Link mode: Full-duplex, Flow control: None, Remote fault: OK
Packet Forwarding Engine configuration:
```

```
  Destination slot: 0
CoS information:
  CoS transmit queue                 Bandwidth      Buffer    Priority    Limit

                                 %           bps   %   usec
  0 best-effort                 95      95000000  95    0            low    none
  3 network-control              5       5000000   5    0            low    none
Logical interface fe-0/2/0.0 (Index 66) (SNMP ifIndex 46) (Generation 133)
  Flags: SNMP-Traps Encapsulation: ENET2
  Protocol inet, MTU: 1500, Generation: 142, Route table: 0
    Flags: DCU, SCU-out
                                              Packets                 Bytes
    Destination class              (packet-per-second)    (bits-per-second)
                       silv1_new                      0                    0
                                  (                   0) (                 0)
                       silv2_new                      0                    0
                                  (                   0) (                 0)
                       silv_misc                      0                    0
                                  (                   0) (                 0)
                         silver0                      0                    0
                                  (                   0) (                 0)
                         silver2                      0                    0
                                  (                   0) (                 0)
                         silver3                      0                    0
                                  (                   0) (                 0)
                         silver4                      0                    0
                                  (                   0) (                 0)
                         silver5                      0                    0
                                  (                   0) (                 0)
                         silver6                      0                    0
                                  (                   0) (                 0)
                         silver7                      0                    0
                                  (                   0) (                 0)
                         silver9                      0                    0
                                  (                   0) (                 0)
                                              Packets                 Bytes
    Source class                   (packet-per-second)    (bits-per-second)
                           gold1                      0                    0
                                  (                   0) (                 0)
                           gold2                  16600              1062400
                                  (                   0) (                 0)
                           gold3                      0                    0
                                  (                   0) (                 0)
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: 12.1.1/24, Local: 12.1.1.1, Broadcast: 12.1.1.255,
      Generation: 150
```

Sample Output

show interfaces extensive (Gigabit Ethernet)

```
user@host> show interfaces ge-5/0/0.0 extensive

  Logical interface ge-5/0/0.0 (Index 71) (SNMP ifIndex 1930) (Generation 139)
    Flags: SNMP-Traps 0x4000 Encapsulation: ENET2
    Traffic statistics:
     Input  bytes  :                   0
     Output bytes  :                  42
     Input  packets:                   0
     Output packets:                   1
    Local statistics:
```

```
    Input  bytes  :                    0
    Output bytes  :                   42
    Input  packets:                    0
    Output packets:                    1
   Transit statistics:
    Input  bytes  :                    0                    0 bps
    Output bytes  :                    0                    0 bps
    Input  packets:                    0                    0 pps
    Output packets:                    0                    0 pps
   Output Filters: f-any
   Protocol inet, MTU: 1500, Generation: 155, Route table: 0
     Output Filters: f-inet,
     Addresses, Flags: Is-Preferred Is-Primary
       Destination: 10.11.1/24, Local: 10.11.1.1, Broadcast: 10.11.1.255,
       Generation: 170
   Protocol multiservice, MTU: Unlimited, Generation: 156, Route table: 0
     Flags: Is-Primary
     Policer: Input: __default_arp_policer__
```

Sample Output

show interfaces extensive (10-Gigabit Ethernet)

```
user@host> show interfaces xe-2/1/0 extensive

Physical interface: xe-2/1/0, Enabled, Physical link is Up
  Interface index: 258, SNMP ifIndex: 762, Generation: 2046
  Link-level type: Ethernet, MTU: 1514, LAN-PHY mode, Speed: 10Gbps, BPDU Error:
 None, Loopback: None, Source filtering: Disabled,
  Flow control: Enabled
  Device flags   : Present Running
  Interface flags: SNMP-Traps Internal: 0x4000
  Link flags     : None
  CoS queues     : 8 supported, 8 maximum usable queues
  Hold-times     : Up 0 ms, Down 0 ms
  Current address: 00:1d:b5:f8:6d:eb, Hardware address: 00:1d:b5:f8:6d:eb
  Last flapped   : 2011-12-17 00:19:02 PST (07:36:37 ago)
  Statistics last cleared: 2011-12-17 07:55:24 PST (00:00:15 ago)
  Traffic statistics:
   Input  bytes  :               110000                    0 bps
   Output bytes  :                    0                    0 bps
   Input  packets:                 1000                    0 pps
   Output packets:                    0                    0 pps
   IPv6 transit statistics:
    Input  bytes  :               110000
    Output bytes  :                    0
    Input  packets:                 1000
    Output packets:                    0
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Policed discards: 0, L3
incompletes: 0, L2 channel errors: 0,
    L2 mismatch timeouts: 0, FIFO errors: 0, Resource errors: 0
  Output errors:
    Carrier transitions: 0, Errors: 0, Drops: 0, Collisions: 0, Aged packets: 0,
 FIFO errors: 0, HS link CRC errors: 0,
    MTU errors: 0, Resource errors: 0
  Egress queues: 8 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                  0                   0                   0

  Queue number:         Mapped forwarding classes
    0                   best-effort
    1                   expedited-forwarding
    2                   assured-forwarding
    3                   network-control
  Active alarms  : None
  Active defects : None
  PCS statistics                      Seconds
    Bit errors                             0
    Errored blocks                         0
  MAC statistics:                     Receive         Transmit
    Total octets                       128000                0
    Total packets                        1000                0
    Unicast packets                      1000                0
    Broadcast packets                       0                0
    Multicast packets                       0                0
    CRC/Align errors                        0                0
    FIFO errors                             0                0
    MAC control frames                      0                0
    MAC pause frames                        0                0
    Oversized frames                        0
    Jabber frames                           0
    Fragment frames                         0
    VLAN tagged frames                      0
    Code violations                         0
  Filter statistics:
    Input packet count                   1000
    Input packet rejects                    0
    Input DA rejects                        0
    Input SA rejects                        0
    Output packet count                                      0
    Output packet pad count                                  0
    Output packet error count                                0
    CAM destination filters: 0, CAM source filters: 0
  Packet Forwarding Engine configuration:
    Destination slot: 2
  CoS information:
    Direction : Output
    CoS transmit queue               Bandwidth               Buffer Priority
Limit
                              %            bps     %           usec
    0 best-effort            95     9500000000    95              0      low
none
    3 network-control         5      500000000     5              0      low
none
  Interface transmit statistics: Disabled

  Logical interface xe-2/1/0.0 (Index 83) (SNMP ifIndex 1677) (Generation 10082)

    Flags: SNMP-Traps 0x4004000 Encapsulation: ENET2
    Traffic statistics:
     Input  bytes  :               110000
     Output bytes  :                    0
     Input  packets:                 1000
```

```
     Output packets:                    0
     IPv6 transit statistics:
      Input  bytes  :               55000
      Output bytes  :                   0
      Input  packets:                 500
      Output packets:                   0
    Local statistics:
     Input  bytes  :                55000
     Output bytes  :                    0
     Input  packets:                  500
     Output packets:                    0
    Transit statistics:
     Input  bytes  :                55000                    0 bps
     Output bytes  :                    0                    0 bps
     Input  packets:                  500                    0 pps
     Output packets:                    0                    0 pps
     IPv6 transit statistics:
      Input  bytes  :               55000
      Output bytes  :                   0
      Input  packets:                 500
      Output packets:                   0
    Protocol inet6, MTU: 1500, Generation: 23739, Route table: 0
      Addresses, Flags: Is-Preferred Is-Primary
        Destination: 2001:1000:abcd:2312:1432:abcd:1234:0/112, Local:
2001:1000:abcd:2312:1432:abcd:1234:1234
    Generation: 506
      Addresses, Flags: Is-Preferred
        Destination: fe80::/64, Local: fe80::21d:b5ff:fef8:6deb
    Protocol multiservice, MTU: Unlimited, Generation: 508
    Generation: 23740, Route table: 0
      Policer: Input: __default_arp_policer__
```

Sample Output

show interfaces extensive (IQ2 and IQ2E)

```
user@host> show interfaces ge-3/2/2 extensive
    Physical interface: ge-3/2/2, Enabled, Physical link is Up
      Interface index: 156, SNMP ifIndex: 548, Generation: 159
      Link-level type: Ethernet, MTU: 1518, Speed: 1000mbps, BPDU Error: None,
MAC-REWRITE Error: None, Loopback: Disabled, Source filtering: Disabled,
      Flow control: Enabled, Auto-negotiation: Enabled, Remote fault: Online
      Device flags   : Present Running
      Interface flags: SNMP-Traps Internal: 0x4000
      CoS queues     : 8 supported, 8 maximum usable queues
      Schedulers     : 128
      Hold-times     : Up 0 ms, Down 0 ms
      Current address: 00:14:f6:12:86:fa, Hardware address: 00:14:f6:12:86:fa
      Last flapped   : 2010-03-17 04:03:11 PDT (00:45:30 ago)
      Statistics last cleared: Never
      Traffic statistics:
       Input  bytes  :              1716096                    0 bps
       Output bytes  :              1716448                    0 bps
       Input  packets:                13407                    0 pps
       Output packets:                13411                    0 pps
       IPv6 total statistics:
        Input  bytes  :              1716096
        Output bytes  :              1716096
        Input  packets:                13407
        Output packets:                13407
      Ingress traffic statistics at Packet Forwarding Engine:
```

```
       Input  bytes  :              1716096                 0 bps
       Input  packets:                13407                 0 pps
       Drop   bytes  :                    0                 0 bps
       Drop   packets:                    0                 0 pps
      Input errors:
        Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Policed discards: 0,
L3 incompletes: 0, L2 channel errors: 1, L2 mismatch timeouts: 0, FIFO errors:
0,
        Resource errors: 0
      Output errors:
       Carrier transitions: 1, Errors: 0, Drops: 0, Collisions: 0, Aged packets:
 0, FIFO errors: 0, HS link CRC errors: 0, MTU errors: 0, Resource errors: 0
      Ingress queues: 8 supported, 4 in use
      Queue counters:       Queued packets  Transmitted packets      Dropped
packets
        0 best-effort                13407               13407
   0
        1 expedited-fo                   0                   0
   0
        2 assured-forw                   0                   0
   0
        3 network-cont                   0                   0
   0
      Egress queues: 8 supported, 4 in use
      Queue counters:       Queued packets  Transmitted packets      Dropped
packets
        0 best-effort                13407               13407
   0
        1 expedited-fo                   0                   0
   0
        2 assured-forw                   0                   0
   0
        3 network-cont                   4                   4
   0
      Active alarms  : None
      Active defects : None
      MAC statistics:                      Receive         Transmit
        Total octets                       1716096          1716448
        Total packets                        13407            13411
        Unicast packets                      13407            13407
        Broadcast packets                        0                0
        Multicast packets                        0                4
        CRC/Align errors                         0                0
        FIFO errors                              0                0
        MAC control frames                       0                0
        MAC pause frames                         0                0
        Oversized frames                         0
        Jabber frames                            0
        Fragment frames                          0
        VLAN tagged frames                       0
        Code violations                          0
      Filter statistics:
        Input packet count                   13407
        Input packet rejects                     0
        Input DA rejects                         0
        Input SA rejects                         0
        Output packet count                                   13411
        Output packet pad count                                   0
        Output packet error count                                 0
        CAM destination filters: 0, CAM source filters: 0
      Autonegotiation information:
```

```
        Negotiation status: Complete
        Link partner:
            Link mode: Full-duplex, Flow control: None, Remote fault: OK
        Local resolution:
            Flow control: Symmetric, Remote fault: Link OK
      Packet Forwarding Engine configuration:
        Destination slot: 3
      CoS information:
        Direction : Output
        CoS transmit queue               Bandwidth               Buffer Priority
   Limit
                                  %            bps     %           usec
        0 best-effort            95      950000000    95              0      low
    none
        3 network-control         5       50000000     5              0      low
    none
        Direction : Input
        CoS transmit queue               Bandwidth               Buffer Priority
   Limit
                                  %            bps     %           usec
        0 best-effort            95      950000000    95              0      low
    none
        3 network-control         5       50000000     5              0      low
    none

      Logical interface ge-3/2/2.0 (Index 83) (SNMP ifIndex 6080) (Generation
148)
        Flags: SNMP-Traps 0x4000 VLAN-Tag [ 0x8100.100 ]  Encapsulation: ENET2
        Traffic statistics:
         Input  bytes  :                   0
         Output bytes  :                 336
         Input  packets:                   0
         Output packets:                   4
         IPv6 total statistics:
          Input  bytes  :             1716096
          Output bytes  :             1716096
          Input  packets:               13407
          Output packets:               13407
        Local statistics:
         Input  bytes  :                   0
         Output bytes  :                 336
         Input  packets:                   0
         Output packets:                   4
        Transit statistics:
         Input  bytes  :                   0                   0 bps
         Output bytes  :                   0                   0 bps
         Input  packets:                   0                   0 pps
         Output packets:                   0                   0 pps
         IPv6 total statistics:
          Input  bytes  :             1716096
          Output bytes  :             1716096
          Input  packets:               13407
          Output packets:               13407
        Protocol inet6, MTU: 1500, Generation: 159, Route table: 0
          Flags: Is-Primary
          Addresses, Flags: Is-Default Is-Primary
            Destination: Unspecified, Local: 2000::2
        Generation: 146
          Addresses, Flags: Is-Preferred
            Destination: fe80::/64, Local: fe80::214:f600:6412:86fa
        Protocol multiservice, MTU: Unlimited, Generation: 148
```

```
        Generation: 160, Route table: 0
          Policer: Input: __default_arp_policer__

     Logical interface ge-3/2/2.32767 (Index 84) (SNMP ifIndex 6081) (Generation
149)
        Flags: SNMP-Traps 0x4000 VLAN-Tag [ 0x0000.0 ]  Encapsulation: ENET2
        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 multiservice, MTU: Unlimited, Generation: 161, Route table: 0
          Flags: None
          Policer: Input: __default_arp_policer__
```

Sample Output

show interfaces extensive (100-Gigabit Ethernet Type 4 PIC with CFP)

```
user@host> show interfaces et-0/0/0:0 extensive
Physical interface: et-0/0/0:0, Enabled, Physical link is Down
  Interface index: 156, SNMP ifIndex: 516, Generation: 163
  Link-level type: Ethernet, MTU: 9192, Speed: 50000mbps, BPDU Error: None,
MAC-REWRITE Error: None,
  Loopback: Disabled, Source filtering: Disabled, Flow control: Enabled
  Device flags   : Present Running Down
  Interface flags: Hardware-Down SNMP-Traps Internal: 0x4000
  Link flags     : None
  CoS queues     : 8 supported, 8 maximum usable queues
  Hold-times     : Up 0 ms, Down 0 ms
  Current address: 00:aa:aa:aa:aa:00, Hardware address: 00:21:59:5c:48:00
  Last flapped   : 2010-01-07 16:36:49 PST (18:02:35 ago)
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :                   0                    0 bps
   Output bytes  :                   0                    0 bps
   Input  packets:                   0                    0 pps
   Output packets:                   0                    0 pps
   IPv6 transit statistics:
    Input  bytes  :                   0
    Output bytes  :                   0
    Input  packets:                   0
    Output packets:                   0
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Policed discards: 0, L3
incompletes: 0,
    L2 channel errors: 0, L2 mismatch timeouts: 0, FIFO errors: 0, Resource errors:
 0
  Output errors:
    Carrier transitions: 0, Errors: 0, Drops: 0, Collisions: 0, Aged packets: 0,
 FIFO errors: 0,
```

```
  HS link CRC errors: 0, MTU errors: 0, Resource errors: 0
Egress queues: 8 supported, 8 in use
Queue counters:       Queued packets  Transmitted packets      Dropped packets

  0 DEFAULT, NC-                   0                    0                    0

  1 REALTIME                       0                    0                    0

  2 PRIVATE, NC-                   0                    0                    0

  3 CONTROL                     1253                 1253                    0

  4 BC-H, CLASS_                   0                    0                    0

  5 BC-M, CLASS_                   0                    0                    0

  6 IA, CLASS_V_                   0                    0                    0

  7 CLASS_S_OUTP                   0                    0                    0

Queue       Mapped Forwarding Class
0        DEFAULT, NC-Q0
  1        REALTIME
  2        PRIVATE, NC-Q1
  3        CONTROL
  4        BC-H, CLASS-Q4
  5        BC-M, CLASS-Q5
  6        IA, CLASS_V_OUTPUT
  7        CLASS_S_OUTPUT
Active alarms  : None
Active defects : None
MAC statistics:                       Receive         Transmit
  Total octets                              0                0
  Total packets                             0                0
  Unicast packets                           0                0
  Broadcast packets                         0                0
  Multicast packets                         0                0
  CRC/Align errors                          0                0
  FIFO errors                               0                0
  MAC control frames                        0                0
  MAC pause frames                          0                0
  Oversized frames                          0
  Jabber frames                             0
  Fragment frames                           0
  VLAN tagged frames                        0
  Code violations                           0
Packet Forwarding Engine configuration:
  Destination slot: 0
CoS information:
  Direction : Output
  CoS transmit queue               Bandwidth              Buffer Priority Limit

                              %            bps     %           usec
  0 best-effort              95    47500000000    95              0      low none

  3 network-control           5     2500000000     5              0      low none


Logical interface et-0/0/0:0.0 (Index 68) (SNMP ifIndex 546) (Generation 161)
  Flags: Deviet-Down SNMP-Traps Encapsulation: ENET2
  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: 9178, Generation: 220, Route table: 0
      Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
        Destination: 210.160.0/24, Local: 210.160.0.1, Broadcast: 210.160.0.255,
 Generation: 192
    Protocol mpls, MTU: 9166, Maximum labels: 3, Generation: 221, Route table: 0

    Protocol multiservice, MTU: Unlimited, Generation: 222, Route table: 0
      Policer: Input: __default_arp_policer
```

Sample Output

show interfaces extensive (PTX5000 Packet Transport Router)

```
user@host> show interfaces et-7/0/0 extensive
Physical interface: et-7/0/0, Enabled, Physical link is Up
  Interface index: 168, SNMP ifIndex: 501, Generation: 171
  Link-level type: Ethernet, MTU: 1514, Speed: 10Gbps, BPDU Error: None,
MAC-REWRITE Error: None,
  Loopback: Disabled, Source filtering: Disabled, Flow control: Enabled
  Device flags   : Present Running
  Interface flags: SNMP-Traps Internal: 0x4000
  Link flags     : None
  CoS queues     : 8 supported, 8 maximum usable queues
  Hold-times     : Up 0 ms, Down 0 ms
  Current address: 88:e0:f3:3b:de:43, Hardware address: 88:e0:f3:3b:de:43
  Last flapped   : 2012-01-18 11:48:24 PST (01:47:08 ago)
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :              3583014                    0 bps
   Output bytes  :               758050                    0 bps
   Input  packets:                17740                    0 pps
   Output packets:                 3418                    0 pps
   IPv6 transit statistics:
    Input  bytes  :                   0
    Output bytes  :                   0
    Input  packets:                   0
    Output packets:                   0
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Policed discards: 0, L3
incompletes: 0,
    L2 channel errors: 0, L2 mismatch timeouts: 0, FIFO errors: 0, Resource errors:
 0
  Output errors:
    Carrier transitions: 1, Errors: 0, Drops: 0, Collisions: 0, Aged packets: 0,
 FIFO errors: 0,
    HS link CRC errors: 0, MTU errors: 0, Resource errors: 0
  Egress queues: 8 supported, 4 in use
```

```
  Queue counters:       Queued packets  Transmitted packets      Dropped packets

    0 best-effort                 252                  252                    0

    1 expedited-fo                  0                    0                    0

    2 assured-forw                  0                    0                    0

    3 network-cont               6196                 6196                    0

  Queue number:         Mapped forwarding classes
    0                   best-effort
    1                   expedited-forwarding
    2                   assured-forwarding
    3                   network-control
  Active alarms  : None
  Active defects : None
  MAC statistics:                      Receive         Transmit
    Total octets                        4108825          1159686
    Total packets                         21166             6448
    Unicast packets                       14824             3255
    Broadcast packets                         3                0
    Multicast packets                      6339             3193
    CRC/Align errors                          0                0
    FIFO errors                               0                0
    MAC control frames                        0                0
    MAC pause frames                          0                0
    Oversized frames                          0
    Jabber frames                             0
    Fragment frames                           0
    VLAN tagged frames                    16091
    Code violations                           0
  Filter statistics:
    Input packet count                        9
    Input packet rejects                      9
    Input DA rejects                          9
    Input SA rejects                          0
    Output packet count                                        0
    Output packet pad count                                    0
    Output packet error count                                  0
    CAM destination filters: 0, CAM source filters: 0
  Autonegotiation information:
    Negotiation status: Incomplete
  Packet Forwarding Engine configuration:
    Destination slot: 7
  CoS information:
    Direction : Output
    CoS transmit queue               Bandwidth               Buffer Priority
Limit
                               %           bps     %           usec
    0 best-effort             95     9500000000    95              0      low
none
    3 network-control          5      500000000     5              0      low
none
  Interface transmit statistics: Disabled
```

Sample Output

show interfaces extensive (T4000 Routers with Type 5 FPCs)

The output fields for the **show interfaces *interface* extensive** command remains the same for 12-port 10-Gigabit Ethernet LAN/WAN PIC with SFP+ (PF-12XGE-SFPP), 24-port 10-Gigabit Ethernet LAN/WAN PIC with SFP+ (PF-24XGE-SFPP), and 100-Gigabit Ethernet Type 5 PIC with CFP (PF-1CGE-CFP).

```
user@host> show interfaces xe-4/0/0 extensive
Physical interface: xe-4/0/0, Enabled, Physical link is Up
  Interface index: 200, SNMP ifIndex: 592, Generation: 203
  Link-level type: Ethernet, MTU: 1514, LAN-PHY mode, Speed: 10Gbps, BPDU Error:
 None, Loopback: None, Source filtering: Disabled, Flow control: Enabled
  Device flags   : Present Running
  Interface flags: SNMP-Traps Internal: 0x4000
  Link flags     : None
  CoS queues     : 8 supported, 8 maximum usable queues
  Hold-times     : Up 0 ms, Down 0 ms
  Current address: 00:12:1e:37:53:f8, Hardware address: 00:12:1e:37:53:f8
  Last flapped   : 2013-06-03 16:01:56 PDT (06:04:07 ago)
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :                   0                   0 bps
   Output bytes  :                   0                   0 bps
   Input  packets:                   0                   0 pps
   Output packets:                   0                   0 pps
   IPv6 transit statistics:
    Input  bytes  :                  0
    Output bytes  :                  0
    Input  packets:                  0
    Output packets:                  0
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Policed discards: 0, L3
incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0, FIFO errors: 0,
Resource errors: 0
  Output errors:
    Carrier transitions: 1, Errors: 0, Drops: 0, Collisions: 0, Aged packets: 0,
 FIFO errors: 0, HS link CRC errors: 0, MTU errors: 0, Resource errors: 0
  Egress queues: 8 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                  0                   0                   0

  Queue number:         Mapped forwarding classes
    0                   best-effort
    1                   expedited-forwarding
    2                   assured-forwarding
    3                   network-control
  Active alarms  : None
  Active defects : None
  PCS statistics                      Seconds
    Bit errors                             0
    Errored blocks                         0
```

```
  MAC statistics:                      Receive         Transmit
    Total octets                             0                0
    Total packets                            0                0
    Unicast packets                          0                0
    Broadcast packets                        0                0
    Multicast packets                        0                0
    CRC/Align errors                         0                0
    FIFO errors                              0                0
    MAC control frames                       0                0
    MAC pause frames                         0                0
    Oversized frames                         0
    Jabber frames                            0
    Fragment frames                          0
    VLAN tagged frames                       0
    Code violations                          0
  Filter statistics:
    Input packet count                       0
    Input packet rejects                     0
    Input DA rejects                         0
    Input SA rejects                         0
    Output packet count                                       0
    Output packet pad count                                   0
    Output packet error count                                 0
    CAM destination filters: 0, CAM source filters: 0
  Packet Forwarding Engine configuration:
    Destination slot: 0 (0x00)
  CoS information:
    Direction : Output
    CoS transmit queue             Bandwidth             Buffer Priority  Limit
                                 %          bps     %         usec
    0 best-effort           95   9500000000    95            0      low    none
    3 network-control        5    500000000     5            0      low    none
  Preclassifier statistics:
   Traffic Class      Received Packets   Transmitted Packets     Dropped Packets

   real-time                        0                   0                   0
   network-control                  0                   0                   0
   best-effort                      0                   0                   0
  Interface transmit statistics: Disabled
```

Sample Output

show interfaces extensive (Aggregated Ethernet)

```
user@host> show interfaces ae0 extensive
Physical interface: ae0, Enabled, Physical link is Up
  Interface index: 199, SNMP ifIndex: 570, Generation: 202
  Link-level type: Ethernet, MTU: 1514, Speed: 2Gbps, BPDU Error: None,
  MAC-REWRITE Error: None, Loopback: Disabled, Source filtering: Disabled,
  Flow control: Disabled, Minimum links needed: 1, Minimum bandwidth needed: 0
  Device flags   : Present Running
  Interface flags: SNMP-Traps Internal: 0x4000
  Current address: 2c:6b:f5:d1:0f:c0, Hardware address: 2c:6b:f5:d1:0f:c0
  Last flapped   : 2012-06-06 23:33:03 PDT (00:00:58 ago)
  Statistics last cleared: Never
  Traffic statistics:
   Input  bytes  :                18532                 1984 bps
   Output bytes  :                    0                    0 bps
   Input  packets:                  158                    2 pps
   Output packets:                    0                    0 pps
   IPv6 transit statistics:
```

```
   Input  bytes  :                   0
   Output bytes  :                   0
   Input  packets:                   0
   Output packets:                   0
 Dropped traffic statistics due to STP State:
  Input  bytes  :                   0
  Output bytes  :                   0
  Input  packets:                   0
  Output packets:                   0
 Input errors:
   Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Giants: 0, Policed discards:
0,
    Resource errors: 0
 Output errors:
   Carrier transitions: 0, Errors: 0, Drops: 0, MTU errors: 0, Resource errors:
0
 Ingress queues: 8 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                   0                    0                    0

 Egress queues: 8 supported, 4 in use
 Queue counters:       Queued packets  Transmitted packets      Dropped packets

   0 best-effort                   57                   57                    0

   1 expedited-fo                   0                    0                    0

   2 assured-forw                   0                    0                    0

   3 network-cont               63605                63605                    0

 Queue number:         Mapped forwarding classes
   0                   best-effort
   1                   expedited-forwarding
   2                   assured-forwarding
   3                   network-control

 Logical interface ae0.0 (Index 331) (SNMP ifIndex 583) (Generation 142)
   Flags: SNMP-Traps 0x4004000 Encapsulation: ENET2
   Statistics        Packets        pps         Bytes          bps
   Bundle:
       Input :           149          2         17416         1984
       Output:             0          0             0            0
   Link:
     ge-3/2/5.0
       Input :            90          1         10100          992
       Output:             0          0             0            0
     ge-3/3/9.0
       Input :            59          1          7316          992
       Output:             0          0             0            0
   LACP info:        Role             System             System         Port
    Port  Port
                           priority         identifier  priority       number
     key
```

```
    ge-3/2/5.0     Actor           100   00:00:00:00:00:01        127       1
  1
    ge-3/2/5.0   Partner        127  00:24:dc:98:67:c0       127       1     1

    ge-3/3/9.0     Actor          100  00:00:00:00:00:01       127       2
1
    ge-3/3/9.0   Partner        127  00:24:dc:98:67:c0       127       2     1

  LACP Statistics:       LACP Rx     LACP Tx   Unknown Rx   Illegal Rx
    ge-3/2/5.0                38         137            0            0
    ge-3/3/9.0                36         139            0            0
  Marker Statistics:   Marker Rx     Resp Tx   Unknown Rx   Illegal Rx
    ge-3/2/5.0                 0           0            0            0
    ge-3/3/9.0                 0           0            0            0
  Protocol inet, MTU: 1500, Generation: 169, Route table: 0
    Flags: Sendbcast-pkt-to-re
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: 1.1.1/24, Local: 1.1.1.2, Broadcast: 1.1.1.255, Generation:
153
  Protocol multiservice, MTU: Unlimited, Generation: 170, Route table: 0
    Flags: Is-Primary
    Policer: Input: __default_arp_policer__
```


CHAPTER 8

Command Summary

PART 4

Troubleshooting

CHAPTER 9

Interface Diagnostics

Interface Diagnostics

You can use two diagnostic tools to test the physical layer connections of interfaces: loopback testing and bit error rate test (BERT) testing. Loopback testing enables you to verify the connectivity of a circuit. BERT testing enables you to identify poor signal quality on a circuit. This section contains the following topics:

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 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.

There are several types of loopback testing supported by the Junos OS, as follows:

- DCE local—Loops packets back on the local 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 12 on page 212 shows the loopback modes supported on the various interface types.

Table 12: 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 Channelized E1 IQ and IQE Interfaces*, *Configuring T1 and NxDS0 Interfaces*, *Configuring Channelized OC12/STM4 IQ and IQE Interfaces (SONET Mode)*, *Configuring Channelized STM1 IQ and IQE Interfaces*, and *Configuring Channelized T3 IQ Interfaces*
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*

Table 12: Loopback Modes by Interface Type *(continued)*

Interface	Loopback Modes	Usage Guidelines
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:

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]**

Interface Diagnostics

BERT allows you to troubleshoot problems by checking the quality of links. You can configure any of the following interfaces to execute a BERT when the interface receives a request to run this test: E1, E3, T1, T3; the channelized DS3, OC3, OC12, and STM1 interfaces; and the channelized DS3 IQ, E1 IQ, and OC12 IQ interfaces.

A BERT test requires a line loop to be in place on either the transmission devices or the far-end router. The local router generates a known bit pattern and sends it out the transmit path. The received pattern is then verified against the sent pattern. The higher the bit error rate of the received pattern, the worse the noise is on the physical circuit. As you move the position of the line loop increasingly downstream toward the far-end router, you can isolate the troubled portion of the link.

To configure BERT, you must configure the duration of the test, the bit pattern to send on the transmit path, and the error rate to monitor when the inbound pattern is received.

To configure the duration of the test, the pattern to send in the bit stream, and the error rate to include in the bit stream, include the **bert-period**, **bert-algorithm**, and **bert-error-rate** statements, respectively, at the **[edit interfaces** *interface-name interface-type*-**options]** hierarchy level:

[edit interfaces *interface-name interface-type*-options]
bert-algorithm *algorithm*;
bert-error-rate *rate*;
bert-period *seconds*;

By default, the BERT period is 10 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.

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).

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 4-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 0.153 standard)
pseudo-2e11-o152              Pattern is 2^11 - 1 (per 0.152 standard)
pseudo-2e15-o151              Pattern is 2^15 - 1 (per 0.151 standard)
pseudo-2e20-o151              Pattern is 2^20 - 1 (per 0.151 standard)
pseudo-2e20-o153              Pattern is 2^20 - 1 (per 0.153 standard)
pseudo-2e23-o151              Pattern is 2^23 (per 0.151 standard)
```

Table 13 on page 216 shows the BERT capabilities for various interface types.

Table 13: 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	N/A	Yes (channel 0–11)	• Single channel at a time • Limited algorithms • No bit count
Channelized STM1	Yes (channel 0–62)	N/A	• 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 wish 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 *Junos OS Operational Mode Commands*.

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.

Example: Configuring Bit Error Rate Testing

Configure a BERT test on a T3 interface. In this example, the run duration lasts for 120 seconds. The configured error rate is 0, which corresponds to a bit error rate of 10^{-0} (1 error per bit). The configured bit pattern of **all-ones-repeating** means that every bit the interface sends is a set to a value of 1.

```
[edit interfaces]
t3-1/2/0 {
    t3-options {
        bert algorithm all-ones-repeating;
        bert-error-rate 0;
        bert-period 120;
```

```
    }
}
```

PART 5

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