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Junos® OS

CoS on SONET/SDH OC48/STM16 IQE PICs Feature Guide for Routing Devices

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Junos® OS CoS on SONET/SDH OC48/STM16 IQE PICs 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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Supported Platforms

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

- T1600
- T640
- M320
- M10i
- M7i
- M120
- MX 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 x defines notice icons used in this guide.

Table 1: Notice Icons

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

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

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the **configure** command: user@host> **configure**
`Fixed-width text like this`	Represents output that appears on the terminal screen.	`user@host>` **show chassis alarms** `No alarms currently active`
Italic text like this	• Introduces or emphasizes important new terms. • Identifies guide names. • Identifies RFC and Internet draft titles.	• A policy *term* is a named structure that defines match conditions and actions. • *Junos OS CLI User Guide* • RFC 1997, *BGP Communities Attribute*
Italic text like this	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# **set system domain-name** *domain-name*

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

Convention	Description	Examples
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	• To configure a stub area, include the **stub** statement at the **[edit protocols ospf area area-id]** hierarchy level. • The console port is labeled **CONSOLE**.
< > (angle brackets)	Encloses optional keywords or variables.	**stub <default-metric *metric*>;**
| (pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	**broadcast | multicast** **(*string1* | *string2* | *string3*)**
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	**rsvp { # Required for dynamic MPLS only**
[ ] (square brackets)	Encloses a variable for which you can substitute one or more values.	**community name members [*community-ids*]**

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

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

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- 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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- 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: http://kb.juniper.net/InfoCenter/
- 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

CoS on SONET/SDH OC48/STM16 IQE PICs

CoS on SONET/SDH OC48/STM16 IQE PIC Overview

The SONET/SDH OC48/STM16 IQE PIC is a clear-channel PIC that is designed to provide better scaling and improved queuing, buffering, and traffic shaping along with clear-channel functionality. Class of service (CoS) on the SONET/SDH OC48/STM16 IQE PIC supports per data-link connection identifier (DLCI) queuing at egress. The SONET/SDH OC48/STM16 IQE PIC can be used in Juniper Networks M320, MX240, MX960, T640, and T1600 routers.

The SONET/SDH OC48/STM16 IQE PIC supports the following CoS features:

- Eight queues per logical interface.

NOTE: **Queue configuration in other modes, such as 4 queues per scheduler, is not supported on the SONET/SDH OC48/STM16 IQE PIC.**

- Two shaping rates: a committed information rate (CIR) and peak information rate (PIR) per data-link connection identifier (DLCI).

- Sharing of excess bandwidth among logical interfaces.
- Five levels of priorities—three priorities for traffic below the guaranteed rate and two priorities for traffic above the guaranteed rate. By default, a strict-high queue gets the excess high priority and all other queues get the excess low priority.
- Ingress behavior aggregate (BA) classification.
- Translation table and egress rewrite.
- Egress delay buffer of 214ms.
- Forwarding class to queue remapping per DLCI.
- Weighted round-robin (WRR), weighted random early detection (WRED).
- Rate limit on all queues to limit the transmission rate.
- Per unit scheduling via DLCI at egress, where each DLCI gets a dedicated set of queues and a scheduler. When per unit scheduling is configured, the shaping can be configured at the logical and physical interface levels.

  NOTE: **Because the SONET/SDH OC48/STM16 IQE PIC is not an oversubscribed PIC, there is no ingress queuing. Therefore, ingress scheduling or shaping is not supported in SONET/SDH OC48/STM16 IQE PIC.**

- Packet or byte statistics are separately collected for ingress and egress queues. The SONET/SDH OC48/STM16 IQE PIC provides the following statistics:
  - Ingress statistics:
    - Per logical interface transmit and drop bytes/packets statistics (based on Layer 3).
    - Per physical interface traffic bytes/packets statistics (based on Layer 2).
  - Egress statistics:
    - Per queue transmit and drop bytes/packets statistics (based on Layer 2).
    - Per queue per color drop bytes/packets statistics (based on Layer 2).
    - Per logical interface transmit and drop bytes/packets statistics (based on Layer 3).
    - Per physical interface traffic bytes/packets statistics (based on Layer 2).

To configure the features mentioned above, include the corresponding class-of-service (CoS) statements at the [**edit class-of-service**] hierarchy level. The CoS configuration statements supported on the SONET/SDH OC48/STM16 IQE PIC are the same as the CoS configuration statements supported on the IQ2E PIC except for the following unsupported statements.

Unsupported configuration statements at the **[edit chassis]** hierarchy level:

- **max-queues-per-interface**
- **no-concatenate**
- **q-pic-large-buffer**
- **red-buffer-occupancy**
- **ingress-shaping-overhead**
- **traffic manager mode**

Unsupported configuration statements at the **[edit class-of-service]** hierarchy level:

- **input-excess-bandwidth-share**
- **input-traffic-control-profile**
- **per-session-scheduler**
- **simple-filter**

Related Documentation

- Egress Rewrite on SONET/SDH OC48/STM16 IQE PICs on page 12
- Scheduling and Shaping on SONET/SDH OC48/STM16 IQE PICs on page 8
- MDRR on SONET/SDH OC48/STM16 IQE PICs on page 12
- WRED on SONET/SDH OC48/STM16 IQE PICs on page 12
- Excess Bandwidth Sharing on SONET/SDH OC48/STM16 IQE PICs on page 12
- Packet Classification on SONET/SDH OC48/STM16 IQE PICs on page 5
- Translation Table on SONET/SDH OC48/STM16 IQE PICs on page 6

Packet Classification on SONET/SDH OC48/STM16 IQE PICs

Packet classification is used to partition the packets into different classes of traffic. You can use three methods to classify a packet:

- Behavior aggregate (BA) classification
- Fixed classification
- Multifield classification

The SONET/SDH OC48/STM16 IQE PIC supports BA classification and fixed classification. It does not do multifield classification. However, multifield classification can be done at the Packet Forwarding Engine level using firewall filters, which overrides the classification done at the PIC level.

The BA classifier maps a class-of-service (CoS) value to a forwarding class and loss priority. The forwarding class determines the output queue. The loss priority is used by schedulers in conjunction with the weighted random early detection (WRED) algorithm to control packet discard during periods of congestion.

The SONET/SDH OC48/STM16 IQE PICs support the following BA classifiers:

- DSCP IP or IP precedence
- DSCP IPv6
- MPLS (EXP)

The fixed classification matches the traffic on a logical interface level. The following example classifies all traffic on logical unit zero to the queue corresponding to assured forwarding.

```
[edit class-of-service interfaces so-0/1/2 unit 0]
forwarding-class af;
```

If the classifiers are not defined explicitly, then the default classifiers are applied as follows:

- All MPLS packets are classified using the MPLS (EXP) classifier. If there is no explicit MPLS (EXP) classifier, then the default MPLS (EXP) classifier is applied.
- All IPv4 packets are classified using the IP precedence or DSCP classifier. If there is no explicit IP precedence or DSCP classifier, then the default IP precedence classifier is applied.
- All IPv6 packets are classified using the DSCP IPv6 classifier. If there is no explicit DSCP IPv6 classifier, then the default DSCP IPv6 classifier is applied.

Related Documentation

- *CoS Packet Classification Based on Behavior Aggregates Feature Guide for Routing Devices*
- Egress Rewrite on SONET/SDH OC48/STM16 IQE PICs on page 12
- Translation Table on SONET/SDH OC48/STM16 IQE PICs on page 6

Translation Table on SONET/SDH OC48/STM16 IQE PICs

On the SONET/SDH OC48/STM16 IQE PIC, the behavior aggregate (BA) translation tables are included for every logical interface (unit) protocol family configured on the logical interface. The proper default translation table is active even if you do not include any explicit translation tables. You can display the current translation table values with the **show class-of-service classifiers** command.

On M320, MX series, T640, and T1600 routers with SONET/SDH OC48/STM16 IQE PICs, you can replace the type-of-service (ToS) or DSCP or MPLS (EXP) bit value on the incoming packet header on a logical interface with a user-defined value. The new value is used for all class-of-service processing and is applied before any other class-of-service or firewall treatment of the packet. On the SONET/SDH OC48/STM16 IQE PIC, the values configured with the **translation-table** statement determines the new ToS bit values.

The SONET/SDH OC48/STM16 IQE PIC supports four types of translation tables: IP precedence, IPv4 DSCP, IPv6 DSCP, and MPLS (EXP). You can configure a maximum of eight tables for each supported type. If a translation table is enabled for a particular type

of traffic, then BA classification of the same type must be configured for that logical interface. That is, if you configure an IPv4 translation table, you must configure IPv4 BA classification on the same logical interface.

You can define many translation tables, as long as they have distinct names. You apply a translation table to a logical interface at the **[edit class-of-service interfaces]** hierarchy level. Translation tables always translate "like to like." For example, a translation table applied to MPLS traffic can translate only from received EXP bit values to new EXP bit values. That is, translation tables cannot translate, for instance, from DSCP bits to INET precedence code points.

With translation table, the original fields in the received packet are overwritten with the new values configured in the translation table and the old values will be lost.

Related Documentation

- Configuring Translation Tables on SONET/SDH OC48/STM16 IQE PICs on page 15
- Example: Configuring Translation Tables on SONET/SDH OC48/STM16 IQE PICs on page 28

Priority Mapping on SONET/SDH OC48/STM16 IQE PICs

The SONET/SDH OC48/STM16 IQE PIC supports three priorities for traffic below the guaranteed rate and two priorities for traffic above the guaranteed rate. The mapping between Junos OS priorities and the SONET/SDH OC48/STM16 IQE PIC hardware priorities below and above the guaranteed rate (CIR) is shown in Table 3 on page 7. By default, a strict-high queue gets the excess high priority and all other queues get the excess low priority.

Table 3: Junos OS Priorities Mapped to SONET/SDH OC48/STM16 IQE PIC Hardware Priorities

Junos OS Priority	SONET/SDH OC48/STM16 IQE PIC Hardware Priority Below Guaranteed Rate For Logical Interfaces	SONET/SDH OC48/STM16 IQE PIC Hardware Priority Above Guaranteed Rate For Logical Interfaces (Excess Priority)
Strict-high	High	High
High	High	Low
Medium-high	Medium	Low
Medium-low	Medium	Low
Low	Low	Low

The SONET/SDH OC48/STM16 IQE PIC internally maps the excess priority and the excess rate to achieve configuration parity with the other IQE PICs.

The queue-level mapping for the excess priority and the excess rate is shown in Table 4 on page 8.

Table 4: Queue-Level Mapping for Excess Priority and Excess Rate

Configured Values				Mapped Values			
Transmit Priority	Transmit Rate %	Excess Rate %	Excess Priority	Transmit Priority	Transmit Rate %	Excess Rate %	Excess Priority
Strict-high	X	Any value	Any value	No mapping	No mapping	Ignored	Ignored
	0	Any value	Any value	No mapping	No mapping	Ignored	Ignored
High or Medium or Low	X	Any value	Any value	No mapping	No mapping	Ignored	Ignored
	0	X	High	Medium	X	Ignored	Low
			Low	Low	X	Ignored	Low
		0	Any value	No mapping	No mapping	Ignored	Ignored

NOTE: The value X is the configured rate.

The SONET/SDH OC48 IQE PIC maps the excess rate and the excess priority based on the following conditions:

- If the transmit priority is not strict-high, the transmit rate is zero, the excess rate is nonzero, and the excess priority is high, then the value of the transmit priority is changed to medium and the value of the excess priority is changed to low.
- If the transmit priority is not strict-high, the transmit rate is zero, the excess rate is nonzero, and the excess priority is low, then the value of the transmit priority is changed to low and the value of the excess priority is changed to low.
- In all the cases other than those mentioned above, the SONET/SDH OC48 IQE PIC ignores the excess rate and the excess priority configurations and generates the system log messages.

Related Documentation

- Example: Priority Mapping on SONET/SDH OC48/STM16 IQE PICs on page 26

Scheduling and Shaping on SONET/SDH OC48/STM16 IQE PICs

The SONET/SDH OC48/STM16 IQE PIC supports the following scheduling and the shaping behavior:

- Per unit scheduling via data-link connection identifier (DLCI) at egress, where each DLCI gets a dedicated set of queues and a scheduler.

NOTE: Because the SONET/SDH OC48/STM16 IQE PIC is not an oversubscribed PIC, there is no ingress queuing. therefore, the ingress scheduling or shaping is not supported in SONET/SDH OC48/STM16 IQE PIC.

- When a per unit scheduling is configured , the shaping can be configured at the logical and the physical interface levels.
- In both guaranteed and excess regions, the traffic on queues at the same priority is scheduled in weighted-round-robin (WRR) discipline and there is no shaping at queue-level.

On SONET/SDH OC48/STM16 IQE interfaces, you can configure a CIR (guaranteed rate) and a PIR (shaping rate) per data-link connection identifier (DLCI). The configured rates are gathered into a traffic control profile. If you configure a traffic control profile with a CIR (guaranteed rate) only, the PIR (shaping rate) is set to the physical interface (port) rate.

The computation of CIR and PIR on logical interfaces is shown in Table 5 on page 9. X and Y are values configured from the command-line interface.

Table 5: Computation of CIR and PIR on the Logical Interfaces

Port Mode	JUNOS OS CLI Configuration		SONET/SDH OC48/STM16 IQE PIC	
	Configured CIR	Configured PIR	Computed CIR	Computed PIR
Default (no CIR or PIR configured on logical interface)	Not configured	Not configured	Port speed	Port speed
Both CIR and PIR are configured on logical interface	X	Y	X	Y
CIR Mode (CIR is configured on at least one logical interface)	X	Not configured	X	Port speed
	Not configured	Y	50 Kbps	Y
	Not configured	Not configured	50 Kbps	Port speed
PIR Mode (PIR is configured on at least one logical interface)	Not configured	Y	Y	Y
	Not configured	Not configured	Remaining (port speed minus sum of PIRs of other logical interfaces) bandwidth is equally divided.	Port speed

The SONET/SDH OC48/STM16 IQE PIC supports rate limit on all queues. The computation of rate limit is shown in Table 6 on page 10.

Table 6: Computation of Rate for the Rate Limit Configured on the Queue with Transmit Rate Percentage

Scenario	Configured CIR Value for the Logical Interface or DLCI	Configured PIR Value for the Logical Interface or DLCI	SONET/SDH OC48/STM16 IQE PIC
1	No	No	Port value
2	Yes	No	CIR value
3	No	Yes	PIR value
4	Yes	Yes	CIR value

NOTE: When the queue transmission rates are oversubscribed, the rate-limit option configured on any of the queues uses the configured rate limit values, although the transmission rates are oversubscribed.

Transmit Rate Adding Up to More than 100 Percent

The SONET/SDH OC48/STM16 IQE PIC supports the maximum bandwidth optimization by overconfiguring the bandwidth up to 300 percent.

When the sum of transmission rates for all queues exceeds 100 percent, the interface is in an oversubscribed state. At the time of oversubscription, the queues are split into three priority groups. :

- Strict-High
- High, Medium-High, and Medium-Low
- Low

This computation is done after the internal mapping of the excess priority or the excess rate.

The sum of transmission rates for all queues in each of the priority groups is less than or equal to 100 percent, thereby allowing the SONET/SDH OC48/STM16 IQE PICs to support the maximum bandwidth optimization by overconfiguring the available bandwidth up to 300 percent.

NOTE:

- The remainder option is not supported on an oversubscribed SONET/SDH OC48/STM16 IQE PIC. When the sum of transmission rates for all queues exceeds 100 percent, and if one or more queues are configured with the remainder option, a syslog error message is generated and the configuration is ignored.
- When the sum of transmission rates of all queues in any of the priority groups exceeds 100 percent, the commit fails and an error message is displayed.

Related Documentation

- Example: Configuring a CIR and a PIR on SONET/SDH OC48/STM16 IQE Interfaces on page 39
- Example: Transmit Rate Adding Up to More than 100 Percent on page 25

Scaling for SONET/SDH OC48/STM16 IQE PICs

The scaling parameters for the SONET/SDH OC48/STM16 IQE PIC are defined in the Table 7 on page 11

Table 7: Scaling for SONET/SDH OC48/STM16 IQE PIC

Scaling Parameter on SONET/SDH OC48/STM16 IQE PIC	Value
Number of physical interfaces per PIC	4
Maximum queues per physical interface	8176
Maximum queues per PIC	16000
Maximum logical interface (DLCI) per PIC without per-unit scheduling	4083
Maximum logical interface (DLCI) per PIC with per-unit scheduling	2000

Related Documentation

- Configuring Scheduling, Shaping, and Priority Mapping on SONET/SDH OC48/STM16 IQE PICs on page 16
- Example: Configuring Rate Limits on SONET/SDH OC48/STM16 IQE PICs on page 38
- CoS on SONET/SDH OC48/STM16 IQE PIC Overview on page 3
- *CoS on SONET/SDH OC48/STM16 IQE PICs Feature Guide for Routing Devices*
- Configuring Rewrite Rules on SONET/SDH OC48/STM16 IQE PIC on page 22

MDRR on SONET/SDH OC48/STM16 IQE PICs

The guaranteed rate (committed information rate) is implemented using modified deficit round-robin (MDRR). MDRR configuration on the SONET/SDH OC48/STM16 IQE PIC is the same as the MDRR configuration on the Enhanced Queuing DPC. For more information about MDRR configuration on the Enhanced Queuing DPC, see *Configuring MDRR on Enhanced Queuing DPCs*.

WRED on SONET/SDH OC48/STM16 IQE PICs

Weighted random early detection (WRED) is done at the queue level in the SONET/SDH OC48/STM16 IQE PIC. With WRED, the decision to drop or send the packet is made before the packet is placed in the queue.

WRED configuration on the SONET/SDH OC48/STM16 IQE PIC is the same as the WRED configuration on the Enhanced Queuing DPC. For more information about WRED configuration on the Enhanced Queuing DPC, see *Configuring WRED on Enhanced Queuing DPCs*.

Related Documentation

- Configuring WRED on SONET/SDH OC48/STM16 IQE PICs on page 22
- Example: Configuring WRED on SONET/SDH OC48/STM16 IQE PICs on page 40

Excess Bandwidth Sharing on SONET/SDH OC48/STM16 IQE PICs

Excess bandwidth sharing configuration on SONET/SDH OC48/STM16 IQE PIC is the same as the excess bandwidth sharing on Enhanced Queuing DPC. For more information about excess bandwidth sharing configuration, see *Configuring Excess Bandwidth Sharing*.

Egress Rewrite on SONET/SDH OC48/STM16 IQE PICs

The egress rewrite on **inet-precedence**, **dscp**, **dscp-ipv6**, and **exp** is done by the packet forwarding engine (PFE) based on the features supported by the PFE.

Related Documentation

- *Applying Rewrite Rules to Output Logical Interfaces*
- Packet Classification on SONET/SDH OC48/STM16 IQE PICs on page 5
- Configuring Translation Tables on SONET/SDH OC48/STM16 IQE PICs on page 15

Forwarding Class to Queue Mapping on SONET/SDH OC48/STM16 IQE PICs

Forwarding class to queue mapping is done per data-link connection identifier. For information about configuring forwarding classes and queues, see *Configuring Forwarding Classes*.

Related Documentation

- *Classifying Packets by Egress Interface*

PART 2

Configuration

CHAPTER 2

Configuration Tasks

Configuring Translation Tables on SONET/SDH OC48/STM16 IQE PICs

The SONET/SDH OC48/STM16 IQE PIC supports four types of translation tables: IP precedence, IPv4 DSCP, IPv6 DSCP, and MPLS (EXP). You can configure a maximum of eight tables for each supported type. If a translation table is enabled for a particular type of traffic, then behavior aggregate (BA) classification of the same type must be configured for that logical interface. That is, if you configure an IPv4 translation table, you must configure IPv4 BA classification on the same logical interface.

To configure ToS translation on the SONET/SDH OC48/STM16 IQE PIC:

1. Access the class-of-service hierarchy:

```
[edit]
user@host# edit class-of-service
```

2. Define the type of translation table:

```
[edit class-of-service]
translation-table {
  (to-dscp-from-dscp | to-dscp-ipv6-from-dscp-ipv6 | to-exp-from-exp |
    to-inet-precedence-from-inet-precedence) table-name {
    to-code-point value from-code-points (* | [ values ]);
  }
```

```
}
```

On the SONET/SDH OC48/STM16 IQE PIC, incoming ToS bit translation is subject to the following rules:

- Locally generated traffic is not subject to translation.
- The **to-dscp-from-dscp** translation table type is not supported if an Internet precedence classifier is configured.
- The **to-inet-precedence-from-inet-precedence** translation table type is not supported if a DSCP classifier is configured.
- The **to-dscp-from-dscp** and **to-inet-precedence-from-inet-precedence** translation table types cannot be configured on the same unit.
- The **to-dscp-from-dscp** and **to-inet-precedence-from-inet-precedence** translation table types are supported for IPv4 packets.
- Only the **to-dscp-ipv6-from-dscp-ipv6** translation table type is supported for IPv6 packets.
- Only the **to-exp-from-exp** translation table type is supported for MPLS packets.

  The **from-code-points** statement establishes the values to match on the incoming packets. The **default** option is used to match all values not explicitly listed, and, as a single entry in the translation table, to mark all incoming packets on an interface the same way. The **to-code-point** statement establishes the target values for the translation. If an incoming packet header ToS bit configuration is not covered by the translation table list and a * option is not specified, the ToS bits in the incoming packet header are left unchanged.

NOTE: **Translation tables are not supported if fixed classification is configured on the logical interface.**

Related Documentation

- Translation Table on SONET/SDH OC48/STM16 IQE PICs on page 6
- Example: Configuring Translation Tables on SONET/SDH OC48/STM16 IQE PICs on page 28

Configuring Scheduling, Shaping, and Priority Mapping on SONET/SDH OC48/STM16 IQE PICs

To configure shaping, scheduling, and priority mapping on the SONET/SDH OC48/STM16 IQE PIC, include the following statements at the **[edit class-of-service]** and **[edit interfaces]** hierarchy levels of the configuration:

```
[edit class-of-service]
traffic-control-profiles profile-name {
  guaranteed-rate (percent percentage | rate);
  scheduler-map map-name;
  shaping-rate (percent percentage | rate);
```

```
}
interfaces {
  interface-name {
    unit logical-unit-number {
      dlci dlci-identifier;
      output-traffic-control-profile profile-name ;
    }
  }
schedulers {
  scheduler-name {
    buffer-size (seconds | percent percentage | remainder | temporal microseconds);
    excess-priority value ;
    excess-rate percent percentage
    priority priority-level;
    transmit-rate (percent percentage | rate | remainder) < rate-limit>;
  }
}

[edit interfaces interface-name]
per-unit-scheduler;
```

NOTE:

- As indicated in the configuration, the **scheduler-map** and **shaping-rate** statements can be included at the **[edit class-of-service interfaces** *interface-name* **unit** *logical-unit-number***]** hierarchy level. However, we do not recommend this configuration. Include the **output-traffic-control-profile** statement instead.
- The **excess-rate** or the **excess-priority** statements are mapped for a specific configuration and are ignored otherwise. These two statements are enabled only for the configuration similarity with the other IQE PICs configuration statements.

Related Documentation

- Example: Priority Mapping on SONET/SDH OC48/STM16 IQE PICs on page 26

Configuring Transmission Rate with Intelligent Oversubscription on SONET/SDH OC48/STM16 IQE PICs Overview

Junos OS class of service (CoS) enables you to treat traffic differently by providing a minimum bandwidth guarantee, low latency, low packet loss, or a combination of these properties for categories of traffic, called forwarding classes. When traffic reaches an outbound interface, traffic is queued for transmission on the physical media. The forwarding class determines the queuing of traffic and other functions of processing class of service, such as rewriting behavior aggregate markers.

You can control the way the system services queues by configuring schedulers and scheduler maps. After traffic is placed in the appropriate queues, a scheduler defines how an interface should process this traffic from each queue. A scheduler is associated with a particular queue and a forwarding class through a scheduler map.

The parameters in a scheduler that define how to service a queue include transmission rate, transmission priority, buffer size, and a random early detection (RED) algorithm. You can define the order in which packets transmit a queue by configuring a priority and transmission rate for each queue. The buffer size and RED configuration define the storage and dropping of packets for each queue.

Junos OS supports multiple levels of transmission priority, with higher-priority queues being serviced before lower-priority queues, as long as the higher-priority forwarding classes retain enough bandwidth credit. The priority levels are Strict-High, High, Medium-High, Medium-Low, and Low. The priority scheduling of forwarding classes determines the order in which an outbound interface transmits traffic from the queues.

The transmission rate, on the other hand, controls how much bandwidth the traffic associated with a given forwarding class can consume. By default, all queues can exceed their assigned transmission rate if other queues are not fully utilizing their assigned rates, unless you configure the transmission rate with the **exact** option.

The transmission rate can be a fixed value, such as 1 megabit per second (Mbps), a percentage of the total available bandwidth, or the rest of the available bandwidth. You can limit the transmission bandwidth to the exact value you configure, or allow it to exceed the configured rate if additional bandwidth is available from other queues. This property enables you to ensure that each queue receives the amount of bandwidth appropriate to its level of service.

The SONET/SDH OC48/STM16 IQE PIC is a clear-channel PIC that is designed to provide better scaling and improved queuing, buffering, and traffic shaping along with clear-channel functionality. The PIC is preconfigured with five levels of priorities with three priorities for traffic below the guaranteed rate (CIR) and two priorities for traffic above the guaranteed rate (PIR).

Oversubscription is a state where the transmission rate of the incoming packet is much higher than the rate the Packet Forwarding Engine and system can handle, causing important packets to be dropped. If an oversubscribed link or service experiences an excess of traffic—either bursty or non-bursty—it can result in traffic loss or delay that could potentially affect other services and links. To reduce the risks of oversubscription, the SONET/SDH OC48/STM16 IQE PIC ensures prioritization and allows mission-critical services to be protected during congestion with intelligent dropping of packets. In addition to dropping low priority packets during congestion, the PIC prevents quality deterioration in periods of high traffic with intelligent sharing of excess bandwidth, providing bandwidth optimization.

Previously, the SONET/SDH OC48/STM16 IQE PIC supported a maximum bandwidth optimization by oversubscribing the available bandwidth up to 200 percent. This optimization was achieved by excluding the transmission rate percentage specified for the Strict-High queue from the total 100 percent transmission rate. Therefore, the transmission rate percentage for all the non-Strict-High queues added up to 100 percent. This computation was done after the internal mapping of the excess priority or the excess rate.

At the time of oversubscription, the queues were split into two priority groups:

- Strict-High
- High, Medium-High, Medium-Low, and Low

As an enhancement to the intelligent oversubscription feature on SONET/SDH OC48/STM16 IQE PICs, support for maximum bandwidth optimization is increased to 300 percent with an additional priority group being created for all queues marked with low priority.

When the sum of transmission rates for all queues exceeds 100 percent, the interface is in an oversubscribed state. At the time of oversubscription, the queues are split into three priority groups with the intelligent oversubscription feature enhancement:

- Strict-High
- High, Medium-High, and Medium-Low
- Low

The sum of transmission rates for all queues in each of the priority groups is less than or equal to 100 percent, thereby allowing the SONET/SDH OC48/STM16 IQE PICs to support the maximum bandwidth optimization by overconfiguring the available bandwidth up to 300 percent.

NOTE: When the sum of transmission rates of all queues in any of the priority groups exceeds 100 percent, the commit fails and an error message is displayed.

When the sum of transmission rates for all queues exceeds 100 percent, the configured transmission rates are scaled down to 100 percent. This is called rebasing and is required for accurate mapping of transmission rates to the weights assigned to each queue. Weights are assigned to a queue based on the queue properties and are used to determine the distribution of available bandwidth and flow of traffic from each queue.

Configuring any of the queues with the **remainder** option on an oversubscribed SONET/SDH OC48/STM16 IQE PIC is not allowed. When a queue is configured with the **remainder** option, and the sum of transmission rates for all non-remainder queues is less than or equal to 100 percent, rebasing is not required. However, calculating the remainder transmission rate for a queue configured with the **remainder** option differs.

NOTE: The remainder option is not supported on an oversubscribed SONET/SDH OC48/STM16 IQE PIC. When the sum of transmission rates for all queues exceeds 100 percent, and if one or more queues are configured with the remainder option, a syslog error message is generated and the configuration is ignored.

Previously, the remainder calculation on a SONET/SDH OC48/STM16 IQE PIC did not include the queues specified for Strict-High priority. The remainder transmission rate was calculated by taking into consideration transmission rates for all other queues excluding the sum of transmission rates of all Strict-High queues. With the enhancement to the intelligent oversubscription on a SONET/SDH OC48/STM16 IQE PIC, the remainder transmission rate is calculated by taking into consideration the transmission rates of all other queues irrespective of the priority specified.

The rebased values are only used for assigning weights to queues, which affect the order in which the queues are serviced. If any queue that qualifies for rebasing is configured with the rate-limit option, weights are assigned to queues after applying the configured value of rate-limit for that particular queue.

As an example, sample configurations A and B in Table 8 on page 20 display the need for rebasing transmission rates and **remainder** calculation.

Table 8: Rebasing Transmission Rates and remainder Calculation

Queue	Priority	Transmission rate
Configuration A		
q0	Strict-High	100%
q1	High	30%
q2	Medium-High	30%
q3	Medium-Low	30%
q4	Low	20%
q5	Low	20%
q6	Low	20%
q7	Low	remainder
Configuration B		
q0	Strict-High	30%
q1	Medium	20%
q2	Low	40%
q3	Low	remainder

In Configuration A, the sum of transmission rates of non-remainder queues (q0, q1, q2, q3, q4, q5, and q6) exceeds 100 percent, leaving the interface in an oversubscribed state. Because configuring the **remainder** option is not supported on an oversubscribed PIC,

and q7 is a remainder queue, Configuration A is ignored, although all the queues qualify for rebasing.

However, if the sum of transmission rates for all the queues exceeded 300 percent, or if the sum of transmission rates for all queues in any of the priority groups exceeded 100 percent, the configuration is ignored.

In Configuration B, the sum of transmission rates of non-remainder queues (q0, q1, and q2) is less than 100 percent. Therefore, rebasing of transmission rates is not required. Remainder calculation for q3 is done by deducting the sum of transmission rates of non-remainder queues from 100, irrespective of the priority specified. In this example, the transmission rate for q3 is (100 - 30 - 20 - 40) 10%.

The support for oversubscribing the bandwidth on a SONET/SDH OC48/STM16 IQE PIC up to 300 percent increases the efficiency of networks and reduces CapEx for network operators. Large service providers have exacting performance requirements, and the impact of traffic disruptions due to congestion on an oversubscribed interface can be significant. The SONET/SDH OC48/STM16 IQE PIC virtually eliminates this risk with intelligent oversubscription capabilities that enable carriers to ensure the performance of mission-critical services on oversubscribed interfaces and routers.

Related Documentation

- Example: Configuring Transmission Rate with Intelligent Oversubscription on SONET/SDH OC48/STM16 IQE PICs on page 31

Configuring Rate Limits on SONET/SDH OC48/STM16 IQE PICs

You can rate-limit all queues on SONET/SDH OC48/STM16 IQE PICs. However, overall you can have only 256 distinct policed rates. Without this limiting, traffic in higher-priority queues can block the transmission of lower-priority packets. If you do not rate-limit queues, higher-priority traffic is always sent before lower-priority traffic, causing the lower-priority queues to “starve,” which in turn leads to timeouts and unnecessary resending of packets.

On the SONET/SDH OC48/STM16 IQE PICs, you can rate-limit queues before the packets are queued for output (analogous to policing). All packets exceeding the configured rate limit are dropped, so care is required when establishing this limit. The rate-limit can be configured on the non strict-high queues also.

NOTE: When the queue transmission rates are oversubscribed, the rate-limit option configured on any of the queues uses the configured rate limit values, although the transmission rates are oversubscribed.

To rate-limit queues, include the **transmit-rate** statement with the **rate-limit** option at the **[edit class-of-service schedulers *scheduler-name*]** hierarchy level:

```
[edit class-of-service schedulers scheduler-name]
transmit-rate percent percentage rate rate-limit;
Priority priority-level
```

Related Documentation

- Example: Configuring Rate Limits on SONET/SDH OC48/STM16 IQE PICs on page 38

Configuring MDRR on SONET/SDH OC48/STM16 IQE PICs

MDRR configuration on the SONET/SDH OC48/STM16 IQE PIC is the same as the MDRR configuration on the Enhanced Queuing DPC. For more information about MDRR configuration on the Enhanced Queuing DPC, see *Configuring MDRR on Enhanced Queuing DPCs*.

Configuring WRED on SONET/SDH OC48/STM16 IQE PICs

WRED configuration on the SONET/SDH OC48/STM16 IQE PIC is the same as the WRED configuration on the Enhanced Queuing DPC. For more information about WRED configuration on the Enhanced Queuing DPC, see *Configuring WRED on Enhanced Queuing DPCs*.

Configuring Excess Bandwidth Sharing on SONET/SDH OC48/STM16 IQE PICs

Excess bandwidth sharing configuration on SONET/SDH OC48/STM16 IQE PIC is the same as the excess bandwidth sharing on Enhanced Queuing DPC. For more information about excess bandwidth sharing configuration, see *Configuring Excess Bandwidth Sharing*

Configuring Rewrite Rules on SONET/SDH OC48/STM16 IQE PIC

To configure a rewrite rules mapping and associate it with the appropriate forwarding class and code-point alias or bit set, include the **rewrite-rules** statement at the **[edit class-of-service]** hierarchy level:

```
[edit class-of-service]
rewrite-rules {
   (dscp | dscp-ipv6 | exp | inet-precedence) rewrite-name {
      import (rewrite-name | default);
      forwarding-class class-name {
         loss-priority level code-point (alias | bits);
      }
   }
}
```

NOTE: The egress rewrite on the dscp, dscp-ipv6, exp, or inet-precedence field is done by the Packet Forwarding Engine based on the features it supports.

Related Documentation

- *CoS Inputs and Outputs Overview*
- Egress Rewrite on SONET/SDH OC48/STM16 IQE PICs on page 12

Configuring Forwarding Classes on SONET/SDH OC48/STM16 IQE PIC

To configure the forwarding class, you assign each forwarding class to an internal queue number by including the **forwarding-classes** statement at the **[edit class-of-service]** hierarchy level:

To configure CoS forwarding classes, include the **forwarding-classes** statement at the **[edit class-of-service]** hierarchy level:

```
[edit class-of-service]
forwarding-classes {
   class class-name queue-num queue-number priority (high | low);
   queue queue-number class-name priority (high | low);
}
forwarding-class-map forwarding-class-map-name {
   class class-name queue-num queue-number [ restricted-queue queue-number ];
}
interfaces {
   interface-name {
      unit logical-unit-number {
         forwarding-class class-name;
         forwarding-class-map forwarding-class-map-name;
      }
   }
}
restricted-queues {
   forwarding-class class-name queue queue-number;
}
```

You cannot commit a configuration that assigns the same forwarding class to two different queues.

Related Documentation

- *Configuring Forwarding Classes*

CHAPTER 3

Examples

Example: Transmit Rate Adding Up to More than 100 Percent

In the following example, **ef** is an expedited forwarding traffic queue; **nc** is a network control traffic queue; **af_01**, **af_02**, **af_03**, and **af_04** are assured forwarding traffic queues; and **be** is a best effort forwarding queue. **so-2/2/0 unit 0** is the logical interface.

```
[edit class-of-service]
  traffic-control profiles tcp {
    shaping-rate 300M;
  }
  interfaces {
    so-2/2/0 {
      unit 0 {
        output-traffic-control-profiles tcp;
      }
    }
    schedulers {
    ef {
      transmit-rate percent 50 rate-limit;
      priority strict-high;
    }
    nc {
      transmit-rate percent 5;
      priority high;
    }
```

```
    af_04 {
      transmit-rate percent 20;
      priority medium;
    }
    af_03 {
      transmit-rate percent 35;
      priority low;
    }
    af_02 {
      transmit-rate percent 30;
      priority low;
    }
    af_01 {
      transmit-rate percent 9;
      priority low;
    }
    be {
      transmit-rate percent 1;
      priority low;
    }
  }
```

The **ef** and the **nc** queues are at the same priority. Therefore, both these queues take precedence over all the other queues. The **ef** queue consumes 100 Mbps (50 percent of the CIR; that is, 50 percent of 200 Mpbs) bandwidth. The remaining 200 Mbps is rate limited. The **nc** queue continues to consume the bandwidth till the logical interface reaches its CIR of 200 Mbps. Therefore, the **nc** queue gets 100 Mbps bandwidth. When the logical interface reaches its CIR, all queues transition into the excess region and the scheduler allocates the remaining bandwidth to the non-expedited forwarding queues based on their default excess priorities and default excess rates (same as the transmit rates).

As per the priority mapping table in "MDRR on SONET/SDH OC48/STM16 IQE PICs" on page 12, all the non-strict-high queues are in the same excess priority (in this case, low priority), these non-strict-high queues get the bandwidth out of the remaining 100 Mbps in the ratio of 5: 20:35:30:9:1 till the logical interface consumes its shaping rate of 300 Mbps. Thus, the non-strict-high queues add up to 100 percent of bandwidth utilization to optimize the bandwidth usage.

Related Documentation

- CoS on SONET/SDH OC48/STM16 IQE PIC Overview on page 3
- Scheduling and Shaping on SONET/SDH OC48/STM16 IQE PICs on page 8

Example: Priority Mapping on SONET/SDH OC48/STM16 IQE PICs

In the following example, **ef** is an expedited forwarding traffic queue; **af_01**, **af_02**, **af_03**, and**af_04** are assured forwarding traffic queues; **be** is a best effort forwarding queue; and **nc** is a network control traffic queue.

```
[edit class-of-service]
traffic-control profiles tcp {
  shaping-rate 300M;
}
```

```
[edit class-of-service]
interfaces {
  so-2/2/0 {
    unit 0 {
      output-traffic-control-profiles tcp;
    }
  }
  schedulers {
  ef {
    transmit-rate percent 50 rate-limit;
    buffer-size percent 5;
    priority strict-high;
  }
  nc {
    transmit-rate percent 0;
    excess-rate percent 5;
    buffer-size percent 5;
    priority low;
    excess-priority high;
  }
  af_01 {
    transmit-rate percent 0;
    excess-rate percent 20;
    buffer-size percent 18;
    priority low;
    excess-priority low;
  }
  af_02 {
    transmit-rate percent 0;
    excess-rate percent 35;
    buffer-size percent 18;
    priority low;
    excess-priority low;
  }
  af_03 {
    transmit-rate percent 0;
    excess-rate percent 30;
    buffer-size percent 18;
    priority low;
    excess-priority low;
  }
  af_04 {
    transmit-rate percent 0;
    excess-rate percent 9;
    buffer-size percent 18;
    priority low;
    excess-priority low;
  }
  be {
    transmit-rate percent 0;
    excess-rate percent 1;
    buffer-size percent 18;
    priority low;
    excess-priority low;
  }
}
```

Table 9: Priority Mapping and Output Calculation for Different Queues on the SONET/SDH OC48/STM16 IQE PIC

Queue	Priority	Transmit Rate	Excess Priority on the SONET/SDH OC48/STM16 IQE PIC (Mapped to Guaranteed Priority)	Excess Rate on the SONET/SDH OC48/STM16 IQE PIC (Mapped to Transmit Rate)	Input (Mbps)	Output (Mbps)
ef	Strict-high	50 (50% of PIR=150 Mbps)	Not applicable	Not applicable	300	150
nc	Low	0	Excess high	5	300	150
af_01	Low	0	Excess low	20	300	0
af_02	Low	0	Excess low	35	300	0
af_03	Low	0	Excess low	30	300	0
af_04	Low	0	Excess low	9	300	0
be	Low	0	Excess low	1	300	0

As shown in Table 9 on page 28, the **ef** queue takes precedence over all queues and consumes 150 Mbps (50 percent of the PIR; that is, half of 300 Mpbs) bandwidth. The remaining 150 Mbps is rate limited. The **af_01**, **af_02**, **af_03**, **af_04** and the **be** queues do not get any bandwidth.

Because the rate limit is not configured on the **nc** queue, and it has the excess high priority, the **nc** queue consumes the remaining bandwidth of 150 Mbps.

Related Documentation

- CoS on SONET/SDH OC48/STM16 IQE PIC Overview on page 3
- *Configuring MDRR on Enhanced Queuing DPCs*

Example: Configuring Translation Tables on SONET/SDH OC48/STM16 IQE PICs

The following example translates incoming DSCP values to the new values listed in the translation table. All incoming DSCP values other than **111111**, **111110**, **000111**, and **100111** are translated to **000111**.

```
[edit class-of-service]
translation-table {
  to-dscp-from-dscp dscp-trans-table {
    to-code-point 000000 from-code-points 111111;
    to-code-point 000001 from-code-points 111110;
    to-code-point 111000 from-code-points [ 000111 100111 ];
    to-code-point 000111 from-code-points *;
  }
}
```

You must apply the translation table to the logical interface input on the SONET/SDH OC48/STM16 IQE PIC:

```
[edit class-of-service interfaces so-1/0/0 unit 0]
translation-table to-dscp-from-dscp dscp-trans-table;
```

If you try to configure mutually exclusive translation tables on the same interface unit, you get a warning message when you display or commit the configuration:

```
so-0/1/1 {
    unit 0 {
        translation-table {
            ##
            ## Warning: to-dscp-from-dscp and
to-inet-precedence-from-inet-precedence not allowed on same unit
            ##
            to-inet-precedence-from-inet-precedence inet-trans-table;
            to-dscp-from-dscp dscp-trans-table;
        }
    }
}
```

You can issue the following operational mode commands to verify your configuration:

- **show class-of-service translation-table**
- **show class-of-service interface** *interface-name*

To verify that the correct values are configured, use the **show class-of-service translation-table** command. The **show class-of-service translation-table** command displays the code points of all translation tables configured. All values are displayed, not just those configured:

```
user@host> show class-of-service translation-table
Translation Table: dscp-trans-table, Translation table type: dscp-to-dscp, Index:
 6761
  From Code point    To Code Point
  000000                     000111
  000001                     000111
  000010                     000111
  000011                     000111
  000100                     000111
  000101                     000111
  000110                     000111
  000111                     111000
  001000                     000111
  001001                     000111
  001010                     000111
  001011                     000111
  001100                     000111
  001101                     000111
  001110                     000111
  001111                     000111
  010000                     000111
  010001                     000111
  010010                     000111
  010011                     000111
  010100                     000111
  010101                     000111
  010110                     000111
```

```
  010111                    000111
  011000                    000111
  011001                    000111
  011010                    000111
  011011                    000111
  011100                    000111
  011101                    000111
  011110                    000111
  011111                    000111
  100000                    000111
  100001                    000111
  100010                    000111
  100011                    000111
  100100                    000111
  100101                    000111
  100110                    000111
  100111                    111000
  101000                    000111
  101001                    000111
  101010                    000111
  101011                    000111
  101100                    000111
  101101                    000111
  101110                    000111
  101111                    000111
  110000                    000111
  110001                    000111
  110010                    000111
  110011                    000111
  110100                    000111
  110101                    000111
  110110                    000111
  110111                    000111
  111000                    000111
  111001                    000111
  111010                    000111
  111011                    000111
  111100                    000111
  111101                    000111
  111110                    000001
  111111                    000000
```

To verify that the configured translation table is applied to the correct interface, use the **show class-of-service interface** ***interface-name*** command. The **show class-of-service interface** ***interface-name*** command displays the translation tables applied to the IQE interface:

```
user@host> show class-of-service interface so-2/3/0
  Logical interface: so-2/3/0.0, Index: 68
    Object                 Name                  Type                  Index

    Rewrite                exp-default           exp (mpls-any)           29

    Classifier             dscp-default          dscp                      7

    Classifier             exp-default           exp                      10

    Translation Table      exp-trans-table       EXP_TO_EXP            61925
```


ToS translation on the SONET/SDH OC48/STM16 IQE PIC is a form of behavior aggregate (BA) classification. The SONET/SDH OC48/STM16 IQE PIC does not support multifield classification of packets at the PIC level. For more information about multifield classification, see *Multifield Classifier Overview*.

Related Documentation

- Configuring Translation Tables on SONET/SDH OC48/STM16 IQE PICs on page 15

Example: Configuring Transmission Rate with Intelligent Oversubscription on SONET/SDH OC48/STM16 IQE PICs

This example shows how to configure transmission rates on a sonet interface for eight forwarding classes with transmission rate values that exceed 100 percent, causing the interface to be in an oversubscribed state.

Requirements

This example requires the following hardware and software components:

- Networking devices using a SONET/SDH OC48/STM16 IQE PIC.
- Junos OS Release 12.2 or later running on the devices.

Before you begin:

1. Configure the device interfaces.
2. Enable class-of-service (CoS) queuing, scheduling, and shaping on the device interfaces.

Overview and Topology

Junos OS Release 12.2 and later support oversubscribing the available bandwidth on a SONET/SDH OC48/STM16 IQE PIC up to 300 percent. This optimization is achieved by creating an additional priority group for all queues specified for low priority, and the sum of transmission rates for all the low priority queues adding up to 100 percent, independent of the transmission rate configured for all other queues.

Previously, the SONET/SDH OC48/STM16 IQE PIC supported a maximum bandwidth optimization by oversubscribing the available bandwidth up to 200 percent, by excluding the transmission rate percentage specified for the Strict-High queue from the total 100 percent transmission rate. Therefore, the transmission rate percentage for all the non-Strict-High queues added up to 100 percent. This computation was done after the internal mapping of the excess priority or the excess rate.

As an enhancement to the intelligent oversubscription feature on SONET/SDH OC48/STM16 IQE PICs, support for maximum bandwidth optimization is increased to 300 percent.

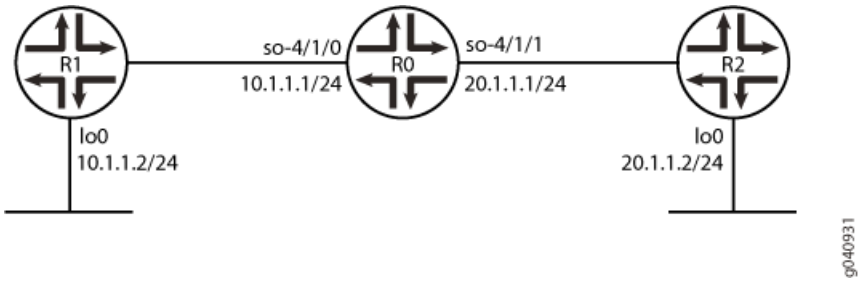
When the sum of transmission rates for all queues exceeds 100 percent, the interface is in an oversubscribed state. At the time of oversubscription, the queues are split into three priority groups with the intelligent oversubscription feature enhancement:

- Strict-High
- High, Medium-High, and Medium-Low
- Low

Each of the above priority groups can be configured to have a transmission rate oversubscription up to 100 percent. The transmission rate oversubscription value can be expressed as a percentage of the CIR or PIR value or as an absolute value.

NOTE: The remainder option is not supported on an oversubscribed SONET/SDH OC48/STM16 IQE PIC. When the sum of the transmission rates for all queues exceeds 100 percent, and if one or more queues are configured with the remainder option, a syslog error message is generated and the configuration is ignored.

In this example, Router R0 is the route on which the CoS options are configured. Routers R1 and R2 are directly connected to R0 and send traffic to R0.



Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

R0

```
set class-of-service classifiers inet-precedence inet_classy forwarding-class fc0
    loss-priority low code-points 000
set class-of-service classifiers inet-precedence inet_classy forwarding-class fc1
    loss-priority low code-points 001
set class-of-service classifiers inet-precedence inet_classy forwarding-class fc2
    loss-priority low code-points 010
set class-of-service classifiers inet-precedence inet_classy forwarding-class fc3
    loss-priority low code-points 011
```

```
set class-of-service classifiers inet-precedence inet_classy forwarding-class fc4
  loss-priority low code-points 100
set class-of-service classifiers inet-precedence inet_classy forwarding-class fc5
  loss-priority low code-points 101
set class-of-service classifiers inet-precedence inet_classy forwarding-class fc6
  loss-priority low code-points 110
set class-of-service classifiers inet-precedence inet_classy forwarding-class fc7
  loss-priority low code-points 111
set class-of-service forwarding-classes class fc0 queue-num 0
set class-of-service forwarding-classes class fc1 queue-num 1
set class-of-service forwarding-classes class fc2 queue-num 2
set class-of-service forwarding-classes class fc3 queue-num 3
set class-of-service forwarding-classes class fc4 queue-num 4
set class-of-service forwarding-classes class fc5 queue-num 5
set class-of-service forwarding-classes class fc6 queue-num 6
set class-of-service forwarding-classes class fc7 queue-num 7
set class-of-service traffic-control-profiles TCP scheduler-map map_ifls
set class-of-service traffic-control-profiles TCP shaping-rate 1g
set class-of-service interfaces so-4/1/0 unit 0 classifiers inet-precedence inet_classy
set class-of-service interfaces so-4/1/1 unit 0 output-traffic-control-profile TCP
set class-of-service schedulers s0 transmit-rate percent 25
set class-of-service schedulers s0 priority strict-high
set class-of-service schedulers s1 transmit-rate percent 20
set class-of-service schedulers s1 priority high
set class-of-service schedulers s2 transmit-rate percent 15
set class-of-service schedulers s2 priority high
set class-of-service schedulers s3 transmit-rate percent 35
set class-of-service schedulers s3 priority medium-high
set class-of-service schedulers s4 transmit-rate percent 10
set class-of-service schedulers s4 priority medium-low
set class-of-service schedulers s5 transmit-rate percent 15
set class-of-service schedulers s5 priority low
set class-of-service schedulers s6 transmit-rate percent 15
set class-of-service schedulers s6 priority low
set class-of-service schedulers s7 transmit-rate percent 15
set class-of-service schedulers s7 priority low
set class-of-service scheduler-maps map_ifls forwarding-class fc0 scheduler s0
set class-of-service scheduler-maps map_ifls forwarding-class fc1 scheduler s1
set class-of-service scheduler-maps map_ifls forwarding-class fc2 scheduler s2
set class-of-service scheduler-maps map_ifls forwarding-class fc3 scheduler s3
set class-of-service scheduler-maps map_ifls forwarding-class fc4 scheduler s4
set class-of-service scheduler-maps map_ifls forwarding-class fc5 scheduler s5
set class-of-service scheduler-maps map_ifls forwarding-class fc6 scheduler s6
set class-of-service scheduler-maps map_ifls forwarding-class fc7 scheduler s7
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode*. To configure the R0 router:

1. Configure an IP Precedence classifier to classify incoming packets based on the code point values.

   ```
   [edit class-of-service classifiers]
   user@R0# set inet-precedence inet_classy
   ```

2. Define the classification of code point values to a forwarding class, and configure code point values to classify to loss priority Low.

```
[edit class-of-service classifiers inet-precedence inet_classy]
user@R0# set fc0 loss-priority low code-points 000
user@R0# set fc1 loss-priority low code-points 001
user@R0# set fc2 loss-priority low code-points 010
user@R0# set fc3 loss-priority low code-points 011
user@R0# set fc4 loss-priority low code-points 100
user@R0# set fc5 loss-priority low code-points 101
user@R0# set fc6 loss-priority low code-points 110
user@R0# set fc7 loss-priority low code-points 111
```

3. Define mapping of forwarding classes to queue numbers.

```
[edit class-of-service forwarding-classes class]
user@R0# set fc0 queue-num 0
user@R0# set fc1 queue-num 1
user@R0# set fc2 queue-num 2
user@R0# set fc3 queue-num 3
user@R0# set fc4 queue-num 4
user@R0# set fc5 queue-num 5
user@R0# set fc6 queue-num 6
user@R0# set fc7 queue-num 7
```

4. Configure traffic shaping and scheduling profiles.

```
[edit class-of-service traffic-control-profiles]
user@R0# set TCP scheduler-map map_ifls
user@R0# set TCP shaping-rate 1g
```

5. Apply the class-of-service options to interfaces.

```
[edit class-of-service interfaces]
user@R0# set so-4/1/0 unit 0 classifiers inet-precedence inet_classy
user@R0# set so-4/1/1 unit 0 output-traffic-control-profile TCP
```

6. Configure eight packet schedulers with scheduling priority and transmission rates.

```
[edit class-of-service schedulers]
user@R0# set s0 transmit-rate percent 25
user@R0# set s0 priority strict-high
user@R0# set s1 transmit-rate percent 20
user@R0# set s1 priority high
user@R0# set s2 transmit-rate percent 15
user@R0# set s2 priority high
user@R0# set s3 transmit-rate percent 35
user@R0# set s3 priority medium-high
user@R0# set s4 transmit-rate percent 0
user@R0# set s4 priority medium-low
user@R0# set s5 transmit-rate percent 15
user@R0# set s5 priority low
user@R0# set s6 transmit-rate percent 15
user@R0# set s6 priority low
user@R0# set s7 transmit-rate percent 15
user@R0# set s7 priority low
```

7. Define mapping of forwarding classes to packet schedulers.

```
[edit class-of-service scheduler-maps]
```



```
user@R0# set map_ifls forwarding-class fc0 scheduler s0
user@R0# set map_ifls forwarding-class fc1 scheduler s1
user@R0# set map_ifls forwarding-class fc2 scheduler s2
user@R0# set map_ifls forwarding-class fc3 scheduler s3
user@R0# set map_ifls forwarding-class fc4 scheduler s4
user@R0# set map_ifls forwarding-class fc5 scheduler s5
user@R0# set map_ifls forwarding-class fc6 scheduler s6
user@R0# set map_ifls forwarding-class fc7 scheduler s7
```

Results

From configuration mode, confirm your configuration by entering the **show class-of-service** command. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
class-of-service {
  classifiers {
    inet-precedence inet_classy {
      forwarding-class fc0 {
        loss-priority low code-points 000;
      }
      forwarding-class fc1 {
        loss-priority low code-points 001;
      }
      forwarding-class fc2 {
        loss-priority low code-points 010;
      }
      forwarding-class fc3 {
        loss-priority low code-points 011;
      }
      forwarding-class fc4 {
        loss-priority low code-points 100;
      }
      forwarding-class fc5 {
        loss-priority low code-points 101;
      }
      forwarding-class fc6 {
        loss-priority low code-points 110;
      }
      forwarding-class fc7 {
        loss-priority low code-points 111;
      }
    }
  }
  forwarding-classes {
    class fc0 queue-num 0;
    class fc1 queue-num 1;
    class fc2 queue-num 2;
    class fc3 queue-num 3;
    class fc4 queue-num 4;
    class fc5 queue-num 5;
    class fc6 queue-num 6;
    class fc7 queue-num 7;
  }
  traffic-control-profiles {
```

```
    TCP {
      scheduler-map map_ifls;
      shaping-rate 1g;
    }
  }
  interfaces {
    so-4/1/0 {
      unit 0 {
        classifiers {
          inet-precedence inet_classy;
        }
      }
    }
    so-4/1/1 {
      unit 0 {
        output-traffic-control-profile TCP;
      }
    }
  }
  schedulers {
    s0 {
      transmit-rate percent 25;
      priority strict-high;
    }
    s1 {
      transmit-rate percent 20;
      priority high;
    }
    s2 {
      transmit-rate percent 15;
      priority high;
    }
    s3 {
      transmit-rate percent 35;
      priority medium-high;
    }
    s4 {
      transmit-rate percent 10;
      priority medium-low;
    }
    s5 {
      transmit-rate percent 15;
      priority low;
    }
    s6 {
      transmit-rate percent 15;
      priority low;
    }
    s7 {
      transmit-rate percent 15;
      priority low;
    }
  }
  scheduler-maps {
    map_ifls {
      forwarding-class fc0 scheduler s0;
```

```
            forwarding-class fc1 scheduler s1;
            forwarding-class fc2 scheduler s2;
            forwarding-class fc3 scheduler s3;
            forwarding-class fc4 scheduler s4;
            forwarding-class fc5 scheduler s5;
            forwarding-class fc6 scheduler s6;
            forwarding-class fc7 scheduler s7;
        }
    }
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly.

- Verifying Queue Transmission Rate Oversubscription on page 37

Verifying Queue Transmission Rate Oversubscription

Purpose Verify that the SONET/SDH OC48/STM16 IQE PIC supports 300 percent oversubscription.

Action Configure the queue transmission rates such that they are oversubscribed up to 300 percent.

The sum of transmission rates of all queues can be less than or equal to 300 percent. The sum of transmission rates of all queues in each priority group should be less than or equal to 100 percent.

In this example, Router R0 interfaces have been oversubscribed by 150 percent of the available bandwidth. The sum of transmission rates of all the queues in each of the priority groups are:

- Strict-High—(q0) 25%
- High, Medium-High, Medium-Low—(q1, q2, q3, and q4) 80%
- Low—(q5, q6, and q7) 45%

When the sum of transmission rates of all queues in any of the priority groups exceeds 100 percent, the commit fails.

For example, if the transmission rate of q1 is 30 percent, the sum of the transmission rates of all queues (q1, q2, q3, and q4) in the High-Medium priority group is 110 percent. At the time of commit, the following error is displayed:

```
Total bandwidth allocation for high-med priority queues exceeds 100 percent for
scheduler-map map_ifls
error: configuration check-out failed
```

Meaning When the sum of transmission rates of all queues exceeds 100 percent, a new priority group is created for all Low priority queues. The queue transmission rates in the Low priority group can add up to 100 percent.

Related Documentation

- Configuring Transmission Rate with Intelligent Oversubscription on SONET/SDH OC48/STM16 IQE PICs Overview on page 17

Example: Configuring Rate Limits on SONET/SDH OC48/STM16 IQE PICs

This example limits the transmit rate of a strict-high expedited forwarding queue to 1 megabit per second (Mbps). The scheduler and scheduler map are defined and then applied to the traffic at the **[edit interfaces]** and **[edit class-of-service]** hierarchy levels:

```
[edit class-of-service]
schedulers {
   scheduler-1 {
      transmit-rate 1m rate-limit; # This establishes the limit
      priority strict-high;
   }
}
scheduler-maps {
   scheduler-map-1 {
      forwarding-class expedited-forwarding scheduler scheduler-1;
   }
}

[edit interfaces]
s0-2/1/0 {
   per-unit-scheduler;
   encapsulation frame-relay;
   unit 0 {
      dlci 1;
   }
}

[edit class-of-service]
interfaces {
   so-2/1/0 {
      unit 0 {
         scheduler-map scheduler-map-1;
         shaping-rate 2m;
      }
   }
}
```

You can issue the following operational mode commands to verify your configuration (the first shows the rate limit in effect):

- **show class-of-service scheduler-map** *scheduler-map-name*
- **show class-of-service interface** *interface-name*

Related Documentation

- Configuring Rate Limits on SONET/SDH OC48/STM16 IQE PICs on page 21

Example: Configuring a CIR and a PIR on SONET/SDH OC48/STM16 IQE Interfaces

On SONET/SDH OC48/STM16 IQE interfaces, you can configure a CIR (guaranteed rate) and a PIR (shaping rate) on a single logical interface. The configured rates are gathered into a traffic control profile. If you configure a traffic control profile with a CIR (guaranteed rate) only, the PIR (shaping rate) is set to the physical interface (port) rate.

NOTE: CIR and PIR are not supported at the queue level.

In the following example, logical unit **0** has a CIR equal to 30 Mbps and a PIR equal to 200 Mbps. Logical unit **1** has a PIR equal to 300 Mbps. Logical unit **2** has a CIR equal to 100 Mbps and a PIR that is unspecified. For logical unit **2**, the software gives the PIR the value of 1 Gbps (equal to the physical interface rate) because the PIR must be equal to or greater than the CIR.

In this example, bandwidth is shared proportionally to the guaranteed rate because at least one logical interface has a guaranteed rate.

```
class-of-service {
  traffic-control-profiles {
    profile1 {
      shaping-rate 200m;
      guaranteed-rate 30m;
      delay-buffer-rate 150m;
      scheduler-map sched-map;
    }
    profile2 {
      shaping-rate 300m;
      delay-buffer-rate 500k;
      scheduler-map sched-map;
    }
    profile3 {
      guaranteed-rate 100m;
      scheduler-map sched-map;
    }
  }
  interfaces {
    se-3/0/0 {
      unit 0 {
        output-traffic-control-profile profile1;
      }
      unit 1 {
        output-traffic-control-profile profile2;
      }
      unit 2 {
        output-traffic-control-profile profile3;
      }
    }
  }
}
```

Related Documentation

- Excess Bandwidth Sharing on SONET/SDH OC48/STM16 IQE PICs on page 12

Example: Configuring MDRR on SONET/SDH OC48/STM16 IQE PICs

MDRR configuration on the SONET/SDH OC48/STM16 IQE PIC is same as the MDRR configuration on the Enhanced Queuing DPC. For more information about MDRR configuration on the Enhanced Queuing DPC, see *Configuring MDRR on Enhanced Queuing DPCs*.

Example: Configuring WRED on SONET/SDH OC48/STM16 IQE PICs

WRED configuration on the SONET/SDH OC48/STM16 IQE PIC is same as the WRED configuration on the Enhanced Queuing DPC. For more information about WRED configuration on the Enhanced Queuing DPC, see *Configuring WRED on Enhanced Queuing DPCs*.

CHAPTER 4

Configuration Statements

buffer-size (Schedulers)

Syntax buffer-size (percent *percentage* | remainder | temporal *microseconds*);

Hierarchy Level [edit class-of-service schedulers *scheduler-name*]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 12.1X48 for PTX Series Packet Transport Routers.
Statement introduced in Junos OS Release 12.2 for ACX Series Routers.

Description Specify buffer size.

NOTE: On PTX Series Packet Transport Routers, buffer-size cannot be configured on rate-limited queues.

Default If you do not include this statement, the default scheduler transmission rate and buffer size percentages for queues 0 through 7 are 95, 0, 0, 5, 0, 0, 0, and 0 percent, respectively.

Options **percent *percentage***—Buffer size as a percentage of the total buffer.

Range: 0 through 100The minimum buffer allocated to any queue is 18,432 bytes. If a queue is configured to have a buffer size less than 18K, the queue retains a buffer size of 18,432 bytes.

remainder—Remaining buffer available.

temporal *microseconds*—Buffer size as a temporal value. The queuing algorithm starts dropping packets when it queues more than a computed number of bytes. This maximum is computed by multiplying the logical interface speed by the configured temporal value.

Range: The ranges vary by platform.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring the Scheduler Buffer Size*
- *Buffer Size Temporal Value Ranges by Router Type*

delay-buffer-rate

Syntax delay-buffer-rate (percent *percentage* | *rate*);

Hierarchy Level [edit class-of-service traffic-control-profiles *profile-name*]

Release Information Statement introduced in Junos OS Release 7.6.

Description For Gigabit Ethernet IQ, Channelized IQ PICs, and FRF.15 and FRF.16 LSQ interfaces only, base the delay-buffer calculation on a delay-buffer rate.

Default If you do not include this statement, the delay-buffer calculation is based on the guaranteed rate if one is configured, or the shaping rate if no guaranteed rate is configured. For more information, see *Oversubscribing Interface Bandwidth*.

Options

percent *percentage*—For LSQ interfaces, delay-buffer rate as a percentage of the available interface bandwidth.

Range: 1 through 100 percent

rate—For IQ and IQ2 interfaces, delay-buffer rate, in bits per second (bps). You can specify a value in bits per second either as a complete decimal number or as a decimal number followed by the abbreviation **k** (1000), **m** (1,000,000), or **g** (1,000,000,000).

Range: 1000 through 160,000,000,000 bps

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Oversubscribing Interface Bandwidth*
- *Providing a Guaranteed Minimum Rate*
- *Configuring Traffic Control Profiles for Shared Scheduling and Shaping*
- output-traffic-control-profile on page 51

egress-policer-overhead

Syntax egress-policer-overhead *bytes*;

Hierarchy Level [edit chassis fpc *slot-number* pic *pic-number*]

Release Information Statement introduced before Junos OS Release 11.1.

Description Add the specified number of bytes to the actual length of an Ethernet frame when determining the actions of Layer 2 policers, MAC policers, or queue rate limits applied to output traffic on the line card. You can configure egress policer overhead to account for egress *shaping* overhead bytes added to output traffic on the line card.

On M Series and T Series routers, this statement is supported on Gigabit Ethernet Intelligent Queuing 2 (IQ2) PICs and Enhanced IQ2 (IQ2E) PICs. On MX Series routers, this statement is supported for interfaces configured on Dense Port Concentrators (DPCs).

NOTE: **This statement is not supported on Modular Interface Cards (MICs) or Modular Port Concentrators (MPCs) in MX Series routers.**

Options ***bytes***—Number of bytes added to a packet exiting an interface.

Range: 0–255 bytes

Default: 0

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *egress-shaping-overhead*
- *Policer Overhead to Account for Rate Shaping Overview*
- *Example: Configuring Policer Overhead to Account for Rate Shaping*
- *Configuring a Policer Overhead*
- *CoS on Enhanced IQ2 PICs Overview*

excess-priority

Syntax excess-priority [low | medium-low | medium-high | high | none];

Hierarchy Level [edit class-of-service schedulers *scheduler-name*]

Release Information Statement introduced in Junos OS Release 9.3.
Option **none** introduced in Junos OS Release 11.4.

Description Determine the priority of excess bandwidth traffic on a scheduler.

NOTE: For Link Services IQ (LSQ) PICs or Multiservices PIC (MS-PICs), the **excess-priority** statement is allowed for consistency, but ignored. If an explicit priority is not configured for these interfaces, a default low priority is used. This default priority is also used in the excess region.

Options **low**—Excess traffic for this scheduler has low priority.

medium-low—Excess traffic for this scheduler has medium-low priority.

medium-high—Excess traffic for this scheduler has medium-high priority.

high—Excess traffic for this scheduler has high priority.

none—System does not demote the priority of guaranteed traffic when the bandwidth exceeds the shaping rate or the guaranteed rate.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring Excess Bandwidth Sharing on IQE PICs*
- *Bandwidth Sharing on Nonqueuing Packet Forwarding Engines Overview*
- *Managing Excess Bandwidth Distribution on Static Interfaces on MICs and MPCs*

excess-rate

Syntax excess-rate (percent *percentage* | proportion *value*);

Hierarchy Level [edit class-of-service schedulers *scheduler-name*],
[edit class-of-service traffic-control-profiles *traffic-control-profile-name*]

Release Information Statement introduced in Junos OS Release 9.3.
Application to the Multiservices PIC added in Junos OS Release 9.5.
Application to the MIC and MPC interfaces added in Junos OS Release 10.1.
Statement introduced in Junos OS Release 12.1X48R2 for PTX Series Packet Transport Routers.

Description For an Enhanced IQ PIC interfaces, Multiservices PIC interfaces, or MX Series router interfaces on MPCs or MICs, and T4000 router interfaces on Type 5 FPCs and EX Series switches, determine the percentage or proportion of excess bandwidth traffic to share.

NOTE: The proportion option provides a greater range of values over the percent option and hence influences the priorities assigned to the queues.

Options ***percentage***—Percentage of the excess bandwidth to share.

Range: 0 through 100 percent

Default: Excess bandwidth is shared in proportion to the configured transmit rate of each queue.

value—(M Series, MX Series, T Series routers and EX Series switches only) Proportion of the excess bandwidth to share. Option available at the **[edit class-of-service traffic-class-profiles *traffic-control-profile-name*]** hierarchy level only.

Range: 0 through 1000

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring Scheduler Transmission Rate*
- *Configuring Excess Bandwidth Sharing on IQE PICs*
- *Allocating Excess Bandwidth Among Frame Relay DLCIs on Multiservices PICs*
- *Managing Excess Bandwidth Distribution on Static Interfaces on MICs and MPCs*

guaranteed-rate

Syntax guaranteed-rate (percent *percentage* | *rate*) <burst-size *bytes*>;

Hierarchy Level [edit class-of-service traffic-control-profiles *profile-name*]

Release Information Statement introduced in Junos OS Release 7.6.
Option **burst-size** introduced for Enhanced Queuing (EQ) DPC interfaces in Junos OS Release 9.4.
Option **burst-size** introduced for MIC and MPC interfaces in Junos OS Release 11.4.
Option **burst-size** introduced for IQ2 and IQ2E interfaces in Junos OS Release 12.3

Description For Gigabit Ethernet IQ, Channelized IQ PICs, AS PIC FRF.16 LSQ interfaces, and EQ DPCs only, configure a guaranteed minimum rate. You can also configure an optional burst size for a logical interface on EQ DPCs and on IQ2 and IQ2E PICs. This can help to ensure that higher priority services do not starve lower priority services.

Default If you do not include this statement and you do not include the **delay-buffer-rate** statement, the logical interface receives a minimal delay-buffer rate and minimal bandwidth equal to 2 MTU-sized packets.

Options

percent *percentage*—For LSQ interfaces, guaranteed rate as a percentage of the available interface bandwidth.

Range: 1 through 100 percent

rate—For IQ and IQ2 interfaces, guaranteed rate, in bits per second (bps). You can specify a value in bits per second either as a complete decimal number or as a decimal number followed by the abbreviation **k** (1000), **m** (1,000,000), or **g** (1,000,000,000).

Range: 1000 through 160,000,000,000 bps

burst-size *bytes*—(Optional) Maximum burst size, in bytes.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Providing a Guaranteed Minimum Rate*
- *Configuring Traffic Control Profiles for Shared Scheduling and Shaping*
- output-traffic-control-profile on page 51

input-scheduler-map

Syntax input-scheduler-map *map-name*;

Hierarchy Level [edit class-of-service interfaces *interface-name*],
[edit class-of-service interfaces *interface-name* unit *logical-unit-number*]

Release Information Statement introduced in Junos OS Release 7.6.

Description Associate a scheduler map with a physical or logical input interface. The **input-scheduler-map** and **input-traffic-control-profile** statements are mutually exclusive at the same hierarchy level.

input-scheduler-map is supported on the following Ethernet interfaces:

- IQ2 and IQ2E PICs
- DPCs and MPCs that support Enhanced Queuing (Q/EQ)
- MX80 with support for per-VLAN queuing

Options *map-name*—Name of scheduler map that you define at the **[edit class-of-service scheduler-maps]** hierarchy level.

default—The default scheduler mapping.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring a Separate Input Scheduler for Each Interface*
- *Configuring Ingress Hierarchical CoS on Enhanced Queuing DPCs*
- *input-traffic-control-profile*

input-shaping-rate (Logical Interface)

Syntax input-shaping-rate (percent *percentage* | *rate*);

Hierarchy Level [edit class-of-service interfaces *interface-name* unit *logical-unit-number*]

Release Information Statement introduced in Junos OS Release 7.6.

Description For Gigabit Ethernet IQ2, Enhanced Queuing DPC, MIC, and MPC interfaces, configure input traffic shaping by specifying the amount of bandwidth to be allocated to the logical interface. You can configure hierarchical shaping, meaning you can apply an input shaping rate to both the physical interface and the logical interface.

Default If you do not include this statement, logical interfaces share a default scheduler. This scheduler has a committed information rate (CIR) that equals 0. (The CIR is the guaranteed rate.) The default scheduler has a peak information rate (PIR) that equals the physical interface shaping rate.

Options **percent *percentage***—Shaping rate as a percentage of the available interface bandwidth.

Range: 0 through 100 percent

rate—Peak rate, in bits per second (bps). You can specify a value in bits per second either as a complete decimal number or as a decimal number followed by the abbreviation **k** (1000), **m** (1,000,000), or **g** (1,000,000,000).

Range: 1000 through 160,000,000,000 bps

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring Ingress Hierarchical CoS on MIC and MPC Interfaces*
- *Configuring Hierarchical Input Shapers*
- *Configuring Ingress Hierarchical CoS on Enhanced Queuing DPCs*
- *input-traffic-control-profile*

input-shaping-rate (Physical Interface)

Syntax input-shaping-rate *rate*;

Hierarchy Level [edit class-of-service interfaces *interface-name*]

Release Information Statement introduced in Junos OS Release 7.6.

Description For Gigabit Ethernet IQ2, Enhanced Queuing DPC, MIC, and MPC interfaces, configure input traffic shaping by specifying the amount of bandwidth to be allocated to the physical interface. You can configure hierarchical shaping, meaning you can apply an input shaping rate to both the physical interface and the logical interface.

Options *rate*—Peak rate, in bits per second (bps). You can specify a value in bits per second either as a complete decimal number or as a decimal number followed by the abbreviation **k** (1000), **m** (1,000,000), or **g** (1,000,000,000).

Range: 1000 through 160,000,000,000 bps

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring Hierarchical Input Shapers*
- *Configuring Ingress Hierarchical CoS on Enhanced Queuing DPCs*
- *input-traffic-control-profile*

output-traffic-control-profile

Syntax output-traffic-control-profile *profile-name* shared-instance *instance-name*;

Hierarchy Level [edit class-of-service interfaces *interface-name*],
[edit class-of-service interfaces *interface-name* unit *logical-unit-number*],
[edit class-of-service interfaces *interface-name* interface-set *interface-set-name*]

Release Information Statement introduced in Junos OS Release 7.6.
interface-set option added for Enhanced Queuing DPCs on MX Series routers in Junos OS Release 8.5.
interface-set option added for MIC and MPC interfaces on MX Series routers in Junos OS Release 10.2.
Support on GRE tunnel interfaces configured on physical and logical interfaces on MICs or MPCs in MX Series routers added in Junos OS Release 13.3.

Description Apply the specified CoS traffic control profile (traffic scheduling and shaping configuration objects) to the output traffic at the physical interface, logical interface, or interface set.

The statement is supported on the following interfaces:

- Channelized IQ PIC interfaces
- Gigabit Ethernet IQ, Gigabit Ethernet IQ2, and IQ2E PIC interfaces
- Link services IQ (LSQ) interfaces on AS PICs
- Enhanced Queuing DPC, MIC, and MPC interfaces on MX Series routers
- GRE tunnel interfaces configured on physical or logical interfaces hosted on MIC or MPC line cards in MX Series routers.

NOTE: **Interface sets (sets of interfaces used to configure hierarchical CoS schedulers on supported Ethernet interfaces) are not supported on GRE tunnel interfaces.**

The **shared-instance** statement is supported on Gigabit Ethernet IQ2 PICs only.

Options ***profile-name***—Name of the traffic-control profile to be applied to this interface

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Oversubscribing Interface Bandwidth*
- *Configuring Traffic Control Profiles for Shared Scheduling and Shaping*
- *Configuring Hierarchical Schedulers for CoS* (Enhanced Queuing DPC, MIC, and MPC interfaces on MX Series routers)

- *Configuring Interface Sets* (Enhanced Queuing DPC, MIC, and MPC interfaces on MX Series routers)
- *output-traffic-control-profile-remaining*
- traffic-control-profiles on page 60

per-unit-scheduler

Syntax per-unit-scheduler;

Hierarchy Level [edit interfaces *interface-name*]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 13.2 on 16x10GE MPC and MPC3E line cards.
Statement introduced in Junos OS Release 13.2 on PTX Series Packet Transport Routers.
Statement introduced in Junos OS Release 13.3 on MPC4E line cards.

Description For Channelized OC3 IQ, Channelized OC12 IQ, Channelized STM1 IQ, Channelized T3 IQ, Channelized E1 IQ, E3 IQ, link services IQ interfaces (lsq-), link services (ls-) on J Series routers, Gigabit Ethernet IQ, Gigabit Ethernet IQ2 and IQ2-E, and 10-, 40-, and 100-Gigabit Ethernet interfaces (including the 16x10GE MPC), enable the association of scheduler map names with logical interfaces.

NOTE: Per-unit scheduling is not supported on T1 interfaces configured on the Channelized OC12 IQ PIC.

NOTE: On Gigabit Ethernet IQ2 and IQ2-E PICs without the **per-unit-scheduler** statement, the entire PIC supports 4071 VLANs and the user can configure all the VLANs on the same port.

On Gigabit Ethernet IQ2 and IQ2-E PICs with the **per-unit-scheduler** statement, the entire PIC supports 1024 – 2 * number of ports (1024 minus two times the number of ports), because each port is allocated two default schedulers.

When including the **per-unit-scheduler** statement, you must also include the **vlan-tagging** statement or the **flexible-vlan-tagging** statement (to apply scheduling to VLANs) or the **encapsulation frame-relay** statement (to apply scheduling to DLCIs) at the **[edit interfaces *interface-name*]** hierarchy level.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Applying Scheduler Maps and Shaping Rate to DLCIs and VLANs*
- *vlan-tagging*
- *flexible-vlan-tagging*
- *Applying Scheduling and Shaping to VLANs*
- *Configuring Virtual LAN Queuing and Shaping on PTX Series Packet Transport Routers*

priority (Schedulers)

Syntax priority *priority-level*;

Hierarchy Level [edit class-of-service schedulers *scheduler-name*]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 12.1X48 for PTX Series Packet Transport Routers.
Statement introduced in Junos OS Release 12.2 for ACX Series Routers.

Description Specify the packet-scheduling priority value.

Options ***priority-level*** can be one of the following:

- **low**—Scheduler has low priority.
- **medium-low**—Scheduler has medium-low priority.
- **medium-high**—Scheduler has medium-high priority.
- **high**—Scheduler has high priority. Assigning high priority to a queue prevents the queue from being underserved.
- **strict-high**—Scheduler has strictly high priority. Configure a **high** priority queue with unlimited transmission bandwidth available to it. As long as it has traffic to send, the **strict-high** priority queue receives precedence over **low**, **medium-low**, and **medium-high** priority queues, but not **high** priority queues. You can configure **strict-high** priority on only one queue per interface.

NOTE: The strict-high priority level is the only priority level supported on ACX Series Routers. However, multiple strict-high priority queues can be configured per interface on ACX Series Routers.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring Schedulers for Priority Scheduling*

schedulers (Class of Service)

Syntax

```
schedulers {
  scheduler-name {
    adjust-minimum rate;
    adjust-percent percentage;
    buffer-size (seconds | percent percentage | remainder | temporal microseconds);
    drop-profile-map loss-priority (any | low | medium-low | medium-high | high) protocol
      (any | non-tcp | tcp) drop-profile profile-name;
    excess-priority [ low | medium-low | medium-high | high | none];
    excess-rate (percent percentage | proportion value);
    priority priority-level;
    shaping-rate (percent percentage | rate);
    transmit-rate (percent percentage | rate | remainder) <exact | rate-limit>;
  }
}
```

Hierarchy Level [edit class-of-service]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 12.1X48 for PTX Series routers.

Description Specify the scheduler name and parameter values.

Options ***scheduler-name***—Name of the scheduler to be configured.

The remaining statements are explained separately.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Schedulers Overview*
- *Default Schedulers Overview*
- *Configuring Schedulers*
- *Configuring a Scheduler*

shaping-rate (Applying to an Interface)

Syntax shaping-rate *rate*;

Hierarchy Level [edit class-of-service interfaces *interface-name*],
[edit class-of-service interfaces *interface-name* unit *logical-unit-number*]

Release Information Statement introduced before Junos OS Release 7.4.
[edit class-of-service interfaces *interface-name*] hierarchy level added in Junos OS Release 7.5.
Statement introduced in Junos OS Release 13.2 on PTX Series Packet Transport Routers.

Description For logical interfaces on which you configure packet scheduling, configure traffic shaping by specifying the amount of bandwidth to be allocated to the logical interface.

For physical interfaces on IQ PICs and T4000 routers with Type 5 FPCs only, configure traffic shaping based on the rate-limited bandwidth of the total interface bandwidth.

Logical and physical interface traffic shaping rates are mutually exclusive. This means you can include the **shaping-rate** statement at the **[edit class-of-service interfaces *interface-name*]** hierarchy level or the **[edit class-of-service interfaces *interface-name* unit *logical-unit-number*]** hierarchy level, but not both.

NOTE: For MX Series routers and for EX Series switches, the shaping rate value for the physical interface at the **[edit class-of-service interfaces *interface-name*]** hierarchy level must be a minimum of 160 Kbps. If the value is less than the sum of the logical interface guaranteed rates, the user is not allowed to apply the shaping rate to a physical interface.

For T4000 routers with Type 5 FPCs, the shaping rate value for the physical interface must be a minimum of 292 Kbps. The maximum value of **shaping-rate** is limited by the maximum transmission rate of the interface.

Alternatively, you can configure a shaping rate for a logical interface and oversubscribe the physical interface by including the **shaping-rate** statement at the **[edit class-of-service traffic-control-profiles]** hierarchy level. With this configuration approach, you can independently control the delay-buffer rate, as described in *Oversubscribing Interface Bandwidth*.

For FRF.15 and FRF.16 bundles on link services interfaces, only shaping rates based on percentage are supported.

Default If you do not include this statement at the **[edit class-of-service interfaces *interface-name* unit *logical-unit-number*]** hierarchy level, the default logical interface bandwidth is the average of unused bandwidth for the number of logical interfaces that require default bandwidth treatment. If you do not include this statement at the **[edit class-of-service interfaces *interface-name*]** hierarchy level, the default physical interface bandwidth is the

average of unused bandwidth for the number of physical interfaces that require default bandwidth treatment.

Options

rate—Peak rate, in bits per second (bps). You can specify a value in bits per second either as a complete decimal number or as a decimal number followed by the abbreviation **k** (1000), **m** (1,000,000), or **g** (1,000,000,000).

Range: For logical interfaces, 1000 through 32,000,000,000 bps. For physical interfaces, 1000 through 160,000,000,000 bps.

NOTE: For all MX Series and EX series interfaces, the rate can be from 65,535 through 160,000,000,000 bps.

NOTE: For T4000 physical interfaces, the rate can be from 1000 through 160,000,000,000 bps.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Applying Scheduler Maps Overview*
- *Configuring Virtual LAN Queuing and Shaping on PTX Series Packet Transport Routers*

shaping-rate (Limiting Excess Bandwidth Usage)

Syntax shaping-rate (percent *percentage* | *rate*) <burst-size *bytes*>;

Hierarchy Level [edit class-of-service schedulers *scheduler-name*]

Release Information Statement introduced before Junos OS Release 7.4.
The **burst-size** option added for MIC and MPC interfaces on MX Series routers in Junos OS Release 11.4.
Statement introduced in Junos OS Release 12.2 for ACX Series Routers.

Description Define a limit on excess bandwidth usage for J Series routers and for MIC and MPC interfaces on MX Series routers.

The **transmit-rate** statement at the **[edit class-of-service schedulers *scheduler-name*]** hierarchy level configures the minimum bandwidth allocated to a queue. The transmission bandwidth can be configured as an exact value or allowed to exceed the configured rate if additional bandwidth is available from other queues. For J Series routers only, you limit the excess bandwidth usage with this statement.

You should configure the shaping rate as an absolute maximum usage and not the additional usage beyond the configured transmit rate.

Default If you do not include this statement, the default shaping rate is 100 percent, which is the same as no shaping at all.

Options **percent *percentage***—Shaping rate as a percentage of the available interface bandwidth.

Range: 0 through 100 percent

rate—Peak rate, in bits per second (bps). You can specify a value in bits per second either as a complete decimal number or as a decimal number followed by the abbreviation **k** (1000), **m** (1,000,000), or **g** (1,000,000,000).

Range: 3200 through 32,000,000,000 bps

burst-size *bytes*—Maximum burst size, in bytes. The burst value determines the number of rate credits that can accrue when the queue or scheduler node is held in the inactive round robin.

Range: 0 through 1,000,000,000

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Applying Scheduler Maps Overview*

shared-instance

Syntax shared-instance *instance-name*;

Hierarchy Level [edit class-of-service interfaces *interface-name* unit *logical-unit-number* input-traffic-control-profile],
[edit class-of-service interfaces *interface-name* unit *logical-unit-number* output-traffic-control-profile]

Release Information Statement introduced in Junos OS Release 7.6.

Description For Gigabit Ethernet IQ2 and IQ2E PICs only, apply a shared traffic scheduling and shaping profile to the logical interface.

Options ***instance-name***—Name of the shared scheduler and shaper to be applied to this interface

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring Shaping on 10-Gigabit Ethernet IQ2 PICs*
- traffic-control-profiles on page 60

traffic-control-profiles

Syntax

```
traffic-control-profiles profile-name {
  adjust-minimum rate;
  atm-service (cbr | rtvbr | nrtvbr);
  delay-buffer-rate (percent percentage | rate);
  excess-rate (percent percentage  | proportion value );
  excess-rate-high (percent percentage | proportion value);
  excess-rate-low (percent percentage | proportion value);
  guaranteed-rate (percent percentage | rate) <burst-size bytes>;
  max-burst-size cells;
  overhead-accounting (frame-mode | cell-mode | frame-mode-bytes | cell-mode-bytes)
    <bytes (byte-value)>;
  peak-rate rate;
  scheduler-map map-name;
  shaping-rate (percent percentage | rate) <burst-size bytes>;
  shaping-rate-excess-high rate [ burst-size bytes ];
  shaping-rate-excess-low rate [ burst-size bytes ];
  shaping-rate-priority-high rate [ burst-size bytes ];
  shaping-rate-priority-low rate [ burst-size bytes ];
  shaping-rate-priority-medium rate [ burst-size bytes ];
  strict-priority-scheduler;
  sustained-rate rate;
}
```

Hierarchy Level [edit class-of-service]

Release Information Statement introduced in Junos OS Release 7.6.

Description For Gigabit Ethernet IQ, Channelized IQ PICs, FRF.15 and FRF.16 LSQ interfaces, Enhanced Queuing (EQ) DPCs, and PTX Series routers only, configure traffic shaping and scheduling profiles. For Enhanced EQ PICs, EQ DPCs, and PTX Series routers only, you can include the **excess-rate** statement.

Options ***profile-name***—Name of the traffic-control profile.

The remaining statements are explained separately.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Oversubscribing Interface Bandwidth*
- *Understanding Scheduling on PTX Series Routers*
- output-traffic-control-profile on page 51

translation-table

Syntax

```
translation-table {
  (to-dscp-from-dscp | to-dscp-ipv6-from-dscp-ipv6 | to-exp-from-exp |
    to-inet-precedence-from-inet-precedence) table-name {
    to-code-point value from-code-points (* | [ values ]);
  }
}
```

Hierarchy Level [edit class-of-service]

Release Information Statement introduced in Junos OS Release 9.3.
Support on Multiservices PIC added in Junos OS Release 9.5.

Description For an Enhanced IQ PIC or Multiservices PIC, specify the input translation tables. You must also apply the translation table to a logical interface on the Enhanced IQ PIC or Multiservices PIC.

Default If you do not include this statement, the ToS bit values in received packet headers are not changed by the PIC.

Options

to-dscp-from-dscp—(Optional) Translate incoming IPv4 DSCP values to new values. You must also configure and apply a DSCP classifier.

to-dscp-ipv6-from-dscp-ipv6—(Optional) Translate incoming IPv6 DSCP values to new values. You must also configure and apply an IPv6 DSCP classifier.

to-inet-precedence-from-inet-precedence—(Optional) Translate incoming INET precedence values to new values.

to-exp-from-exp—(Optional) Translate incoming MPLS EXP values to new values.

table-name—The name of the translation table.

value—The bit string to which to translate the incoming bit value.

value(s)—The bit string(s) from which the incoming bit value(s) are translated.

*****—(Optional) This translation matches all bit patterns not explicitly listed.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring ToS Translation Tables*
- *Multiservices PIC ToS Translation*

transmit-rate (Schedulers)

Syntax transmit-rate (*rate* | percent *percentage* | remainder) <exact | rate-limit>;

Hierarchy Level [edit class-of-service schedulers *scheduler-name*]

Release Information Statement introduced before Junos OS Release 7.4.
rate-limit option introduced in Junos OS Release 8.3. Applied to the Multiservices PICs in Junos OS Release 9.4.
Statement introduced in Junos OS Release 12.1X48 for PTX Series Packet Transport Routers.
Statement introduced in Junos OS Release 12.2 for ACX Series Routers.

Description Specify the transmit rate or percentage for a scheduler.

Default If you do not include this statement, the default scheduler transmission rate and buffer size percentages for queues 0 through 7 are 95, 0, 0, 5, 0, 0, 0, and 0 percent, respectively.

Options

exact—(Optional) Enforce the exact transmission rate. Under sustained congestion, a rate-controlled queue that goes into negative credit fills up and eventually drops packets. This value should never exceed the rate-controlled amount. For PTX Series Packet Transport Routers, this option is allowed only on the non-strict-high (high, medium-high, medium-low, or low) queues.

percent *percentage*—Percentage of transmission capacity. A percentage of zero drops all packets in the queue.

Range: 0 through 100 percent for M, MX and T Series routers and EX Series switches; 1 through 100 percent for PTX Series Packet Transport Routers; 0 through 200 percent for the SONET/SDH OC48/STM16 IQE PIC

NOTE:

- On M Series Multiservice Edge Routers, for interfaces configured on 4-port E1 and 4-port T1 PICs only, you can configure a ***percentage*** value only from 11 through 100. These two PICs do not support transmission rates less than 11 percent.
- The configuration of the **transmit-rate percent 0 exact** statement at the **[edit class-of-service schedules *scheduler-name*]** hierarchy is ineffective on T4000 routers with Type 5 FPC.
- On MIC and MPC interfaces on MX Series routers, when the transmit rate is configured as a percentage and **exact** or **rate-limit** is enabled on a queue, the shaping rate of the parent node is used to compute the transmit rate. If **exact** or **rate-limit** is not configured, the guaranteed rate of the parent node is used to compute the transmit rate.

rate—Transmission rate, in bps. You can specify a value in bits per second either as a complete decimal number or as a decimal number followed by the abbreviation **k** (1000), **m** (1,000,000), or **g** (1,000,000,000).

Range: 3200 through 160,000,000,000 bps

NOTE: For all MX Series interfaces, the rate can be from 65,535 through 160,000,000,000 bps.

rate-limit—(Optional) Limit the transmission rate to the rate-controlled amount by applying a policing action to the queue. Packets are hard-dropped when traffic exceeds the specified maximum transmission rate.

NOTE: For PTX Series Packet Transport Routers, this option is allowed only on the strict-high queue. We recommend that you configure rate limit on strict-high queues because the other queues may not meet their guaranteed bandwidths. The **rate-limit** option cannot rate limit the queue if strict-priority scheduling is configured with the *strict-priority-scheduler* statement.

NOTE: The configuration of the **rate-limit** statement is supported on T4000 routers only with a Type 5 FPC.

remainder—Use the remaining rate available.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring Schedulers*
- *Configuring Scheduler Transmission Rate*
- *Understanding Scheduling on PTX Series Routers*

PART 3

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