

Chapter 1

Channelized Intelligent Queuing Interfaces

In JUNOS Release 5.6 and later, Juniper Networks adds support for enhanced channelized interfaces called channelized intelligent queuing (IQ) interfaces. Formerly known as Channelized Q Performance Processor (QPP) interfaces, the interfaces provide a more flexible way to configure channels than earlier channelized Physical Interface Cards (PICs) and a simplified configuration structure self-contained in the [edit interfaces] hierarchy level. Channelized IQ interfaces also enable class of service at the PIC level rather than the Flexible PIC Concentrator (FPC) level.

This guide highlights the features of the new channelized PICs with intelligent queuing and their similarities to and differences from the original channelized interfaces.

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Overview

Channelized interfaces allow service providers to customize bandwidth to satisfy the needs of their customers. Whether the subscriber needs DS0, T1, fractional T1, E1, fractional E1, T3, STM1, OC3, or OC12 service, a channelized PIC can provide the necessary bandwidth today and can be reconfigured to support the customer's expanding network tomorrow. Standard channelized interfaces have been available on Juniper Networks routing platforms since JUNOS Release 3.4. These original channelized PICs for Juniper Networks M-series routers are available in the following models:

- 1-port Channelized OC12 PIC
- 10-port Channelized E1 PIC
- 1-port Channelized STM1 PIC
- 4-port Channelized DS3 PIC
- 1-port and 2-port multichannel Channelized DS3 PIC

These original channelized interfaces provide a single level of channelization and require configuration at both the `[edit chassis]` and the `[edit interfaces]` hierarchy levels. Most configuration options must be set on channel 0 and they apply to all channels on these channelized PICs.

The new channelized PICs with intelligent queuing offer several advantages over the original channelized PICs:

- Complete configuration tasks for channelized IQ interfaces are now centralized at the `[edit interfaces]` hierarchy level.
- Multiple levels of channelization are now possible with channelized IQ interfaces. For example, a channelized OC12 IQ interface can be divided into channelized OC1 interfaces, then subdivided into channelized T1 interfaces, and further split into $N \times$ DS0 channels.
- You can now configure interface statements, such as **clocking**, on individual channels rather than configuring them on channel 0 for all channels at the same hierarchy level.
- Class-of-service processing now occurs on the PIC for channelized IQ interfaces rather than in the FPC.

Channelized PICs with intelligent queuing come in the following model types:

- 1-port Channelized OC12 IQ PIC
- 1-port Channelized OC3 PIC
- 4-port Channelized DS3 IQ PIC
- 10-port Channelized E1 IQ PIC
- 1-port Channelized STM1 IQ PIC

To determine which PIC is installed, issue the show chassis hardware command:

```

user@RouterA> show chassis hardware
Hardware inventory:
Item          Version  Part number  Serial number  Description
Chassis                               20070         M160
Midplane      REV 03   710-001245  AB4123
FPM CMB       REV 02   710-001642  AB3266
FPM Display   REV 02   710-001647  AB3038
CIP           REV 04   710-001593  AB3276
PEM 0        Rev 03   740-001243  KM28410        DC
PEM 1        Rev 03   740-001243  LF21558        Power Entry Module
PCG 0        REV 03   710-001568  AB3006
PCG 1        REV 02   710-001568  AB2992
Routing Engine 0
MCS 0        REV 04   710-001226  AB3208
MCS 1        REV 04   710-001226  AB3212
SFM 0 SPP    REV 06   710-001228  AB3103
SFM 0 SPR    REV 01   710-002189  AB2936        Internet Processor II
SFM 1 SPP    REV 07   710-001228  AG2634
SFM 1 SPR    REV 03   710-002189  AE3503        Internet Processor II
SFM 2 SPP    REV 06   710-001228  AB2976
SFM 2 SPR    REV 01   710-002189  AB2938        Internet Processor II
SFM 3 SPP    REV 06   710-001228  AB5826
SFM 3 SPR    REV 01   710-002189  AB2917        Internet Processor II
FPC 0        REV 03   710-003947  HE0614        E-FPC Type 1
  CPU        REV 01   710-004600  AT3217
  PIC 0      REV 03   750-005636  BE1826        4x CHDS3 IQ
# This is the Channelized DS3 IQ PIC.
  PIC 1      REV 07   750-003846  HG5572        1x 800M Crypto
  PIC 2      REV 01   750-004507  BA5341        10x CE1-NxDS0
  PIC 3      REV 06   750-003009  AM6929        4x CT3
#This is the original Channelized T3 PIC.
FPC 1        REV 03   710-003309  AD9434        E-FPC Type 2
  CPU        REV 05   710-001217  AH2707
  PIC 2      REV 05   750-001900  AD5738        1x OC-48 SONET, SMSR
  PIC 3      REV 04   750-003737  BC1106        4x G/E, 1000 BASE-SX

```

When you configure channelized IQ interfaces, keep in mind these rules of thumb:

- You normally configure media-related statements and options at the physical interface level (also known as the controller level). This level is indicated by the `[edit interfaces cxx-fpc/pic/port]` hierarchy level.
- You should always configure HDLC-related statements (for example, `bytes`, `fcs`, `idle-cycle-flag`, `mtu`, `receive-bucket`, `start-end-flag`, and `transmit-bucket`) and logical interfaces (for example, `[edit interfaces interface-name unit unit-number]`) on end channels such as DS0 and T1. Never configure these statements at the controller level.

- Pay attention to the channel numbering rules:
 - OC3 data channels configured on channelized OC12 IQ interfaces are numbered from 1 to 4.
 - T3 channels configured on a channelized OC12 IQ or channelized OC3 IQ interface are numbered from 1 to 12.
 - T1 channels configured on a channelized OC12 IQ, channelized OC3 IQ, or channelized DS3 IQ interface are numbered from 1 to 28.
 - E1 channels configured on a channelized STM1 IQ interface are numbered from 1 to 63.
 - NxDS0 timeslots configured on a channelized OC12 IQ, channelized OC3 IQ, or a channelized DS3 IQ interface are numbered from 1 to 24.
 - NxDS0 timeslots configured on either a channelized STM1 IQ interface or channelized E1 IQ interface are numbered from 1 to 31 (0 is reserved), while fractional E1 timeslots range from 2 to 32 (0 and 1 are reserved).
- You can configure Automatic Protection Switching (APS) on channelized OC12 IQ interfaces and Multiplex Section Protection (MSP) on channelized STM1 IQ interfaces. The JUNOS implementation of APS and MSP allows you to protect against circuit failures between a SONET/SDH add/drop multiplexer (ADM) and one or more routers, and between multiple interfaces in the same router. When a device fails, a backup device immediately takes over.

You configure APS and MSP at the controller level only. To configure, include the `working-circuit` and `protect-circuit` statements at the `[edit interfaces coc12-fpc/pic/port sonet-options aps]` or `[edit interfaces coc3-fpc/pic/port sonet-options aps]` hierarchy level for APS and the `[edit interfaces cstm1-fpc/pic/port sonet-options aps]` hierarchy level for MSP.

When you enable the controller-level interface as the working circuit, all partitions under the working circuit are also enabled. This is the default behavior even when APS or MSP is not configured. When the backup circuit interface is disabled, all partitions under this protected circuit are also disabled. If the working circuit fails, the interfaces are switched: The working circuit and all its partitions are disabled, and the protect circuit and all its partitions are enabled. You can verify this behavior by entering the `show interfaces controller` command. The disabled interfaces are shown as “Admin down” and the enabled interfaces are shown as “Admin up”.

- If you use Frame Relay encapsulation on a channelized interface, see Table 5 for the maximum number of data-link connection identifiers (DLCIs) per channel that you can configure at each channel level for various channelized PICs.



NOTE: The actual number of DLCIs you can configure for each channel is determined by the capabilities of your system, such as the number and type of PICs installed. If the number of DLCIs in the configuration exceeds the capabilities of your system, the router might not be able to support the maximum DLCI values shown in Table 5. To determine the capabilities of your system, contact Juniper Networks customer support.

Table 5: Frame Relay DLCI Limitations for Channelized Interfaces

| Channelized PIC Type | | |
|---|---------------------------|--|
| Original Channelized PICs | Number of DLCIs per level | Range |
| T3 and T1 level channels | 64 for regular mode | 0–63 for regular mode |
| | 3 for sparse mode | 1–1022 for sparse mode (0 is reserved for the Local Management Interface or LMI) |
| DS0 level channels | 3 for sparse mode | 1–1022 for sparse mode (0 is reserved for LMI) |
| Channelized IQ PICs | | |
| Channelized IQ PICs | Number of DLCIs per level | Range |
| OC12 level channels (Channelized OC12 IQ PIC) | 64 | 1–1022 (0 is reserved for LMI) |
| OC3 level channels (Channelized OC12 IQ and Channelized OC3 IQ PIC) | 64 | 1–1022 (0 is reserved for LMI) |
| T3 level channel (Channelized OC12 IQ, Channelized OC3 IQ, and Channelized DS3 IQ PICs) | 256 | 1–1022 (0 is reserved for LMI) |
| STM1 level channel (Channelized STM1 IQ PIC) | 64 | 1–1022 (0 is reserved for LMI) |
| E1 level channels (Channelized STM1 IQ and Channelized E1 IQ PICs) | 64 | 1–1022 (0 is reserved for LMI) |
| T1 level channels (Channelized OC12 IQ, Channelized OC3 IQ, and Channelized DS3 IQ PICs) | 64 | 1–1022 (0 is reserved for LMI) |
| DS0 level channels (Channelized OC12 IQ, Channelized OC3 IQ, Channelized DS3 IQ, Channelized STM1 IQ, and Channelized E1 IQ PICs) | 16 | 1–1022 (0 is reserved for LMI) |

- You can delete several channelized interfaces simultaneously by using a single command and regular expressions. To delete sequential channelized interfaces, issue the **wildcard** command with the **delete** option at the **[edit]** hierarchy level. Specify the hierarchy level and the channelized interfaces to be summarized with a regular expression. For example, to delete channelized interfaces in the range of **ds-0/0/0:0:0** through **ds-0/0/0:0:23**, issue the command:

```
user@router# wildcard delete interfaces ds-0/0/0:0:.*
```

In JUNOS Release 6.2 and later, additional Frame Relay encapsulation types on physical interfaces and channels of channelized IQ interfaces are available:

- Extended Frame Relay CCC—Allows you to assign any DLCI number from 1 to 1022 on Frame Relay CCC logical interfaces. To configure, include the **extended-frame-relay-ccc** statement at the [edit interfaces *interface-name* encapsulation] hierarchy level.
- Extended Frame Relay TCC—Allows you to assign any DLCI number from 1 to 1022 on Frame Relay TCC logical interfaces. To configure, include the **extended-frame-relay-tcc** statement at the [edit interfaces *interface-name* encapsulation] hierarchy level.
- Flexible Frame Relay—Allows you to configure any DLCI number from 1 to 1022 and any combination of Frame Relay encapsulation types on logical interfaces. To configure, include the **flexible-frame-relay** statement at the [edit interfaces *interface-name* encapsulation] hierarchy level.

When you configure clocking, bit error rate testing (BERT), C-bit parity, and loopback statements on T3, T1, or DS0 channels on channelized IQ interfaces, you must follow these guidelines:

- If you include the statements at both the [edit interfaces *ct3-fpc/pic/port:channel t3-options*] and [edit interfaces *t3-fpc/pic/port:channel t3-options*] hierarchy levels, channelized T3-level statements are operational and T3-level statements are ignored.
- If you include the statements at both the [edit interfaces *ct3-fpc/pic/port:channel t3-options*] and [edit interfaces *t1-fpc/pic/port:channel t1-options*] hierarchy levels, the channelized T3-level statements are operational for the T3 connections and the T1-level statements are operational for the T1 connections.
- Because DS0 channels do not have a valid clocking option, you must configure clocking for all *NxDS0s* at the [edit interfaces *ct1-fpc/pic/port:channel t1-options*] hierarchy level.
- You configure BERT at the [edit interfaces *ct3-fpc/pic/port:channel t3-options*] hierarchy level or on any partitioned subchannel of the channelized T3 interface. There are 12 BERT patterns available for DS0 channels and 28 BERT patterns for T1, channelized T1, T3, and channelized T3 channels within channelized IQ interfaces.
- For Channelized OC3 IQ PICs, if you need a remote loopback on a far-end *NxDS0* interface, and you are running a BERT test from the local *NxDS0* interface, you must configure a remote loopback on the associated channelized T1 interface (*ct1*) for the far-end routing platform. To do this, include the **loopback remote** statement at the [edit interfaces *ct1-fpc/pic/port t1-options*] hierarchy level.

- You can configure loopbacks at the [edit interfaces ct3-fpc/pic/port:channel t3-options] hierarchy level. Local loopbacks recirculate framing information within the local router. Remote loopbacks resend entire frames back to the remote sender. A new loopback called a *payload loopback* is similar to a remote loopback, but it resends only the data portion of a frame back to the remote sender.
- You can configure C-bit parity at the [edit interfaces ct3-fpc/pic/port:channel t3-options] hierarchy level or on any partitioned subchannel of the channelized T3 interface.

For more details on channelized interface options, see the *JUNOS Network Interfaces and Class of Service Configuration Guide*.

System Requirements

To implement channelized IQ interfaces, your system must meet these requirements:

- JUNOS Release 7.1 or later for channelized OC3 IQ interfaces
- JUNOS Release 6.3 or later for configuration of 256 DLCIs at the T3 channel level for channelized OC12 IQ interfaces
- JUNOS Release 6.2 or later for configuration of 64 DLCIs at the T1 channel level for channelized OC12 IQ interfaces, 64 DLCIs at the E1 channel level for channelized STM1 IQ interfaces, and 256 DLCIs at the T3 channel level for channelized DS3 IQ interfaces
- JUNOS Release 6.2 or later for configuration of flexible Frame Relay, extended Frame Relay circuit cross-connect (CCC), and extended Frame Relay translational cross-connect (TCC) encapsulation types
- JUNOS Release 6.0 or later for logical interface-level class of service on channelized STM1 IQ interfaces, and APS/MSP on channelized OC12 IQ and channelized STM1 IQ interfaces
- JUNOS Release 5.7 or later for channelized STM1 IQ interfaces
- JUNOS Release 5.7 or later for logical interface-level class of service on the channelized DS3 IQ, channelized E1 IQ, and channelized OC12 IQ interfaces
- JUNOS Release 5.6 or later for channelized DS3 IQ, channelized E1 IQ, and channelized OC12 IQ interfaces
- Two Juniper Networks M-series or T320 routers equipped with an Enhanced Type 1 or Type 2 Flexible PIC Concentrator (FPC)

Terms and Acronyms

- **Q Performance Processor (QPP) ASIC**—A next-generation processor that provides enhanced capabilities for channelized IQ interfaces.

Configuring Channelized IQ Interfaces

To enable channelized IQ interfaces, you can configure channels as described in the following sections:

- Configuring a Clear Channel on a Channelized IQ Interface on page 12
- Configuring Single-Level Channels on a Channelized IQ Interface on page 12
- Configuring Multilevel Channels on a Channelized IQ Interface on page 13

To apply your knowledge, see these sections:

- Example: Clear Channel Configuration for a Channelized OC12 IQ Interface on page 16
- Checking Your Work on page 16
- Example: Complex Configuration for a Channelized OC12 IQ Interface on page 20
- Checking Your Work on page 27
- Example: Channelized OC3 IQ Interface Configuration on page 44
- Checking Your Work on page 47
- Example: Channelized E1 IQ Interface Configuration on page 52
- Checking Your Work on page 53
- Example: Channelized DS3 IQ Interface Configuration on page 57
- Checking Your Work on page 59
- Example: Channelized STM1 IQ Interface Configuration on page 63
- Checking Your Work on page 66

Configuring a Clear Channel on a Channelized IQ Interface

A clear channel consolidates the entire bandwidth of a channelized interface into a single unpartitioned stream that looks like a standard interface. For example, a channelized OC12 IQ interface configured as a clear channel appears to have an OC12 SONET interface. To configure a clear channel on a channelized IQ interface, include the `no-partition` statement at the `[edit interfaces cxx-fpc/pic/port]` hierarchy level. Once the interface is established, you can configure it the same way as a regular interface.

```
[edit]
interfaces {
  coc12-1/1/0 {
    no-partition;          # This creates a SONET OC12 interface: so-1/1/0.
  }
  so-1/1/0 {
    unit 0 {
      family inet {
        address 10.245.1.1/30;
      }
    }
  }
}
```

Configuring Single-Level Channels on a Channelized IQ Interface

You can subdivide a channelized interface directly into a set of large end channels. To configure part of a channelized IQ interface as a channel, include the `partition` statement at the `[edit interfaces cxx-fpc/pic/port]` hierarchy level. On a channelized OC12 IQ interface, use the `oc-slice` option to create slice sizes corresponding to the desired bandwidth. On a channelized E1 IQ interface, use the `timeslots` option to define `NxDS0` channels or channel groups. On all channelized IQ interfaces, use the `interface-type` option to set the interface type (such as SONET OC3 or T3). Once the channel interfaces are established, you can configure them the same way as regular interfaces.



NOTE: One `oc-slice` in a channelized OC12 IQ interface partition is equivalent to one OC1/DS3-sized channel. If you add three slices together in sequence as a triplet, these pieces become an OC3-sized interface. However, you can configure triplets only with the following sequential slices: 1 - 3, 4 - 6, 7 - 9, 10 - 12.

```
[edit]
interfaces {
  coc12-0/0/0 {
    partition 1 oc-slice 1-3 interface-type so; # Creates an OC3 SONET
  }                                             # interface: so-0/0/0:1.
  so-0/0/0:1 {
    encapsulation ppp;
    unit 0 {
      family inet {
        address 10.255.0.2/30;
      }
    }
  }
}
```

Configuring Multilevel Channels on a Channelized IQ Interface

You can subdivide a channelized interface and then split these subchannelized interfaces into end channels. Creating small end channels might require multiple levels of channelization.

To configure a subdivided channelized interface within a partition of a channelized IQ interface, include the `partition` statement at the `[edit interfaces cxx-fpc/pic/port]` hierarchy level. On a channelized OC12 IQ interface, use the `oc-slice` option to create slice sizes corresponding to the desired bandwidth. On all channelized IQ interfaces, use the `interface-type` option to set the channelized interface type (such as channelized OC1).

On a channelized OC12 IQ interface, you can convert a subdivided channelized OC1 interface into a T3 or channelized T3 interface. To configure, include the `no-partition` statement at the `[edit interfaces coc1-fpc/pic/port:channel]` hierarchy level and set the `interface-type` to `ct3`. A `ct3-fpc/pic/port:channel` interface is the result. Such a conversion is known as M13 with C-bit parity mapping. T1 and DS0 channels created directly from a `coc-1` interface use VT mapping.

To further split your channelized interfaces into even smaller channelized interfaces, use the `partition` and `interface-type` statements at the `[edit interfaces cxx-fpc/pic/port:channel]` hierarchy level. You can create channelized OC1, channelized T3, and channelized T1 interfaces, depending on the PIC type.

Finally, you configure these “channels of channels” as end channels. To configure end channels on a segmented channelized IQ interface, include the `partition` statement at the `[edit interfaces cxx-fpc/pic/port:channel]` hierarchy level. The number of channels in the hierarchy depends on how finely you partition the channelized IQ interface. Use the `timeslots` option to select $N \times DS0$ level channels and the `interface-type` option to set the interface type (such as T1 or $N \times DS0$). Once the resulting channels have been established, you can configure them as regular interfaces.

```
[edit]
interfaces {
  coc12-0/0/0 {
    partition 2 oc-slice 4 interface-type coc1; # Creates channelized OC1
    partition 3 oc-slice 5 interface-type coc1; # interfaces: coc1-0/0/0:2,
    partition 4 oc-slice 6 interface-type coc1; # :3, and :4.
  }
  coc1-0/0/0:2 {
    no-partition interface-type t3; # Converts a channelized OC1 to
    # T3 interface: t3-0/0/0:2.
  }
  t3-0/0/0:2 {
    encapsulation ppp;
    unit 0 {
      family inet {
        address 10.255.0.6/30;
      }
    }
  }
}
```

```

coc1-0/0/0:3 {
  no-partition interface-type ct3; # Creates a channelized T3 interface:
}                                     # ct3-0/0/0:3.
ct3-0/0/0:3 {
  partition 1-28 interface-type t1; # Creates 28 T1 interfaces:
}                                     # t1-0/0/0:3:1 - 28.
coc1-0/0/0:4 {
  partition 1 interface-type ct1;   # Creates a channelized T1 interface:
}                                     # t1-0/0/0:4:1.
ct1-0/0/0:4:1 {
  partition 1 timeslots 1 interface-type ds; # Creates a 1xDS0 interface:
  ...                                         # ds-0/0/0:4:1:1.
  partition 24 timeslots 24 interface-type ds; # Creates a 1xDS0 interface:
}                                             # ds-0/0/0:4:1:24.
t1-0/0/0:3:1 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.0.26/30;
    }
  }
}
...
}
ds-0/0/0:4:1:24 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.0.214/30;
    }
  }
}
}
}

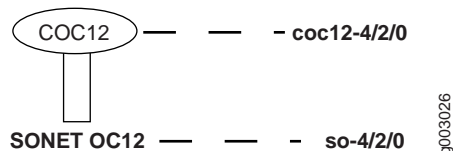
```

A useful operational command you can use with all channelized IQ interfaces is the `show interfaces interval` command. It shows a summary of alarms, status indicators, and performance monitoring statistics in 15-minute increments over the past 24 hours. More detail on each of these indicators can be seen with the `show interfaces extensive` command:

```
user@router> show interfaces interval cstm1-0/0/0
Physical interface: cstm1-0/0/0, SNMP ifIndex: 32
17:23-current:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
17:08-17:23:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
16:53-17:08:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
16:38-16:53:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
16:23-16:38:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
16:08-16:23:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
15:53-16:08:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
15:38-15:53:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
15:23-15:38:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
15:08-15:23:
  RS-ES: 33, RS-SES: 33, RS-SEFS: 32, MS-ES: 32, MS-SES: 32, MS-UAS: 4
14:53-15:08:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
14:38-14:53:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
14:23-14:38:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
14:08-14:23:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
13:53-14:08:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
13:38-13:53:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
13:23-13:38:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
13:08-13:23:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
12:53-13:08:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
12:38-12:53:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
12:23-12:38:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
12:08-12:23:
  RS-ES: 0, RS-SES: 0, RS-SEFS: 0, MS-ES: 0, MS-SES: 0, MS-UAS: 0
11:53-12:08:
  RS-ES: 11, RS-SES: 11, RS-SEFS: 11, MS-ES: 11, MS-SES: 11, MS-UAS: 1
Interval Total:
  RS-ES: 44, RS-SES: 44, RS-SEFS: 43, MS-ES: 43, MS-SES: 43, MS-UAS: 5
```

Example: Clear Channel Configuration for a Channelized OC12 IQ Interface

Figure 1: OC12 Clear Channel on a Channelized OC12 IQ Interface



The key to this simple example is to remove all partitions from the channelized interface. To configure a clear channel on a channelized IQ interface, include the `no-partition` statement at the `[edit interfaces coc12-fpc/pic/0]` hierarchy level. After you commit this part of the configuration, the clear channel is set and you can configure the resulting SONET interface normally.

```

Router A [edit]
interfaces {
  coc12-4/2/0 {
    no-partition;
  }
  so-4/2/0 {
    unit 0 {
      family inet {
        address 10.245.1.1/30;
      }
    }
  }
}
    
```

Checking Your Work

To verify correct operation of a channelized IQ interface configured as a clear channel, use the following commands:

- `show interfaces`
- `show interfaces controller`

To view the interface names of the physical channelized OC12 IQ interface and the clear channel OC12 interface configured on the channelized IQ interface, use the `show interfaces controller` command:

```

user@RouterA> show interfaces controller
Controller                               Admin Link
coc12-4/2/0                               up      up

# This is the physical channelized OC12 IQ interface.

so-4/2/0                                   up      up

# This is the resulting SONET OC12 interface.
    
```

To view information about the physical channelized interface, include the *cxx-fpc/pic/O* (interface name) option with the `show interfaces` command:

```

user@RouterA> show interfaces extensive coc12-4/2/0
Physical interface: coc12-4/2/0, Enabled, Physical link is Up
  Interface index: 74, SNMP ifIndex: 1269, Generation: 73
  Link-level type: Controller, MTU: 4474, Clocking: Internal, SONET mode, Speed: OC12, Loopback: None,
  FCS: 16, Payload scrambler: Disabled, Parent: None
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Hold-times    : Up 0 ms, Down 0 ms
  Last flapped  : 2002-10-09 10:56:45 PDT (05:14:39 ago)
  Statistics last cleared: Never
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Giants: 0, Bucket drops: 0, Policed discards: 0,
    L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0, HS link CRC errors: 0,
    HS link FIFO overflows: 0
  Output errors:
    Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0, HS link FIFO underflows: 0
  SONET alarms   : None
  SONET defects  : None
  SONET PHY:
    Seconds      Count  State
    PLL Lock     0      0 OK
    PHY Light    0      0 OK
  SONET section:
    BIP-B1       10      55
    SEF          0      0 OK
    LOS          0      0 OK
    LOF          0      0 OK
    ES-S         10
    SES-S        0
    SEFS-S       0
  SONET line:
    BIP-B2       10      144
    REI-L        0
    RDI-L        3      1 OK
    AIS-L        0      0 OK
    BERR-SF      0      0 OK
    BERR-SD      1      1 OK
    ES-L         10
    SES-L        0
    UAS-L        0
    ES-LFE       3
    SES-LFE      3
    UAS-LFE      0
  Received SONET overhead:
    F1          : 0x00, J0          : 0x00, K1          : 0x00, K2          : 0x00
    S1          : 0x00
  Transmitted SONET overhead:
    F1          : 0x00, J0          : 0x01, K1          : 0x00, K2          : 0x00
    S1          : 0x00

```

To view information about the clear channel SONET interface, include the `so-fpc/pic/0` (interface name) option with the `show interfaces` command:

```

user@RouterA> show interfaces extensive so-4/2/0
Physical interface: so-4/2/0, Enabled, Physical link is Up
  Interface index: 261, SNMP ifIndex: 2000, Generation: 260
  Link-level type: PPP, MTU: 4474, Clocking: Internal, SONET mode,
Speed: OC12, Loopback: None, FCS: 16,
  Payload scrambler: Enabled, Parent: coc12-4/2/0 (Index 74)
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Hold-times    : Up 0 ms, Down 0 ms
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive statistics:
    Input : 37 (last seen 00:00:04 ago)
    Output: 36 (last sent 00:00:09 ago)
  LCP state: Opened
  NCP state: inet: Opened, inet6: Not-configured, iso: Not-configured, mpls: Not-configured
  CHAP state: Not-configured
  Last flapped   : 2002-10-09 16:04:18 PDT (00:07:26 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes   :           80461791           7435000 bps
    Output bytes  :           81637408           7502352 bps
    Input packets :           34017           275 pps
    Output packets:           34298           278 pps
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Giants: 0,
  Bucket drops: 0, Policed discards: 0,
    L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0, HS link CRC errors: 0,
    HS link FIFO overflows: 0
  Output errors:
    Carrier transitions: 1, Errors: 0, Drops: 0, Aged packets: 0, HS link FIFO underflows: 0
  Queue counters:


| Queue          | Queued packets | Transmitted packets | Dropped packets |
|----------------|----------------|---------------------|-----------------|
| 0 best-effort  | 34129          | 34129               | 0               |
| 1 expedited-fo | 0              | 0                   | 0               |
| 2 assured-forw | 0              | 0                   | 0               |
| 3 network-cont | 0              | 0                   | 0               |


  SONET alarms   : None
  SONET defects  : None
  SONET path:


|         |   |      |
|---------|---|------|
| BIP-B3  | 0 | 0    |
| REI-P   | 0 | 0    |
| LOP-P   | 0 | 0 OK |
| AIS-P   | 0 | 0 OK |
| RDI-P   | 0 | 0 OK |
| UNEQ-P  | 0 | 0 OK |
| PLM-P   | 0 | 0 OK |
| ES-P    | 0 |      |
| SES-P   | 0 |      |
| UAS-P   | 0 |      |
| ES-PFE  | 0 |      |
| SES-PFE | 0 |      |
| UAS-PFE | 0 |      |


  Received SONET overhead:


|    |                            |            |        |
|----|----------------------------|------------|--------|
| C2 | : 0xcf, C2(cmp) : 0xcf, F2 | : 0x00, Z3 | : 0x00 |
| Z4 | : 0x00, S1(cmp) : 0x00     |            |        |


  Transmitted SONET overhead:


|    |            |            |            |        |
|----|------------|------------|------------|--------|
| C2 | : 0xcf, F2 | : 0x00, Z3 | : 0x00, Z4 | : 0x00 |
|----|------------|------------|------------|--------|


```

```

Received path trace: RouterB so-2/2/0
 61 72 6d 61 67 6e 61 63 20 73 6f 2d 32 2f 32 2f RouterB so-2/2/0
 30 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0d 0a .....
Transmitted path trace: RouterA so-4/2/0
 74 69 6d 6d 65 73 73 71 75 61 72 65 20 73 6f 2d RouterA so-4/2/0
 34 2f 32 2f 30 00 00 00 00 00 00 00 00 00 00 00 .....
 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
HDLC configuration:
  Policing bucket: Disabled
  Shaping bucket : Disabled
  Giant threshold: 0, Runt threshold: 0
Packet Forwarding Engine configuration:
  Destination slot: 4, PLP byte: 4 (0x00)
  CoS transmit queue      Bandwidth      Buffer Priority  Limit
                           %      bps      %      bytes
  0 best-effort           95    590976000 95      0      low   none
  3 network-control       5     31104000  5      0      low   none
Logical interface so-4/2/0.0 (Index 7) (SNMP ifIndex 2001) (Generation 12)
  Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
  Protocol inet, MTU: 4470, Generation: 18, Route table: 0
  Flags: None
  Addresses, Flags: Is-Preferred Is-Primary
    Destination: 10.245.1.0/30, Local: 10.245.1.1, Broadcast: Unspecified, Generation: 21

```

Example: Complex Configuration for a Channelized OC12 IQ Interface

Figure 2: Complex Configuration for a Channelized OC12 IQ Interface

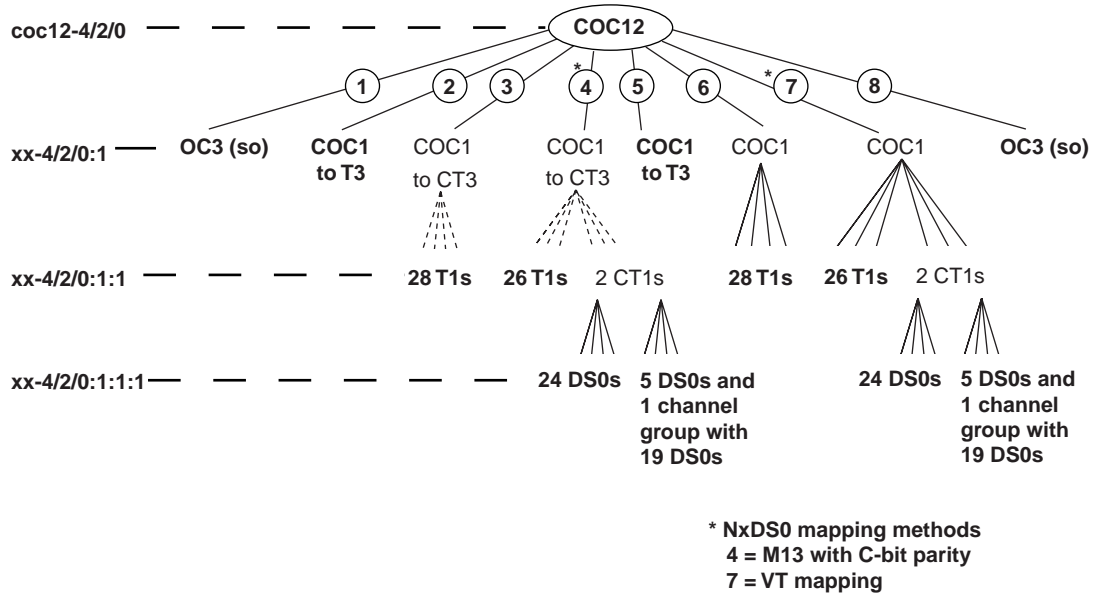


Table 6: Complex Channelization for a Channelized OC12 IQ Interface

| Partition | Slices | Interface Type | Interface Level 2 | Interface Level 3 |
|-----------|---------|---|-------------------|---------------------------------------|
| 1 | 1 - 3 | OC3 | n/a | n/a |
| 2 | 4 | Channelized OC1 converted to T3 | n/a | n/a |
| 3 | 5 | Channelized OC1 converted to channelized T3 | 28 T1s | n/a |
| 4 | 6 | Channelized OC1 converted to channelized T3 | 26 T1s | n/a |
| - | - | - | 2 CT1s | 24 DS0s |
| - | - | - | - | 5 DS0s and 1 channel group of 19 DS0s |
| 5 | 7 | Channelized OC1 converted to T3 | n/a | n/a |
| 6 | 8 | Channelized OC1 | 28 T1s | n/a |
| 7 | 9 | Channelized OC1 | 26 T1s | n/a |
| - | - | - | 2 CT1s | 24 DS0s |
| - | - | - | - | 5 DS0s and 1 channel group of 19 DS0s |
| 8 | 10 - 12 | OC3 | n/a | n/a |

Figure 2 on page 20 and Table 6 on page 20 show a complex channelization structure that you might encounter if you use the full capabilities of a channelized OC12 IQ interface. Partitions 1 and 8 create an OC3 interface, while Partitions 2 and 5 create T3 interfaces out of channelized OC1 interfaces. Partition 3 (channelized OC1 converted to channelized T3) and Partition 6 (channelized OC1) are channelized interfaces that each subdivide into 28 T1 interfaces. Finally, Partition 4 (channelized OC1 converted to channelized T3) and Partition 7 (channelized OC1) are channelized interfaces that each split into 2 channelized T1 interfaces and 26 T1 interfaces. The first channelized T1 splits into 24 DS0 timeslots, while the second channelized T1 subdivides into 5 DS0 channels and 1 channel group comprised of 19 DS0 channels.

This example shows two NxDS0 mapping methods. Partition 4 uses M13 mapping for North American T-carrier equipment and Partition 7 uses VT mapping for SONET/SDH equipment.

This example also assumes corresponding interfaces. For example, for every sublevel T1 interface you configure on Router A, assume you have configured a matching sublevel or physical T1 interface on a neighboring router.

```

Router A [edit]
interfaces {
  coc12-4/2/0 {
    partition 1 oc-slice 1-3 interface-type so; # Creates OC3 interface so-4/2/0:1.
    partition 2 oc-slice 4 interface-type coc1; # Creates interface coc1-4/2/0:2.
    partition 3 oc-slice 5 interface-type coc1; # Creates interface coc1-4/2/0:3.
    partition 4 oc-slice 6 interface-type coc1; # Creates interface coc1-4/2/0:4.
    partition 5 oc-slice 7 interface-type coc1; # Creates interface coc1-4/2/0:5.
    partition 6 oc-slice 8 interface-type coc1; # Creates interface coc1-4/2/0:6.
    partition 7 oc-slice 9 interface-type coc1; # Creates interface coc1-4/2/0:7.
    partition 8 oc-slice 10-12 interface-type so;# Creates an OC3 SONET interface:
    } # so-4/2/0:8.
  so-4/2/0:1 {
    encapsulation ppp;
    unit 0 {
      family inet {
        address 10.255.0.2/30;
      }
    }
  }
  coc1-4/2/0:2 {
    no-partition interface-type t3; # This converts the coc1 interface into a
    } # T3 interface: t3-4/2/0:2.
  t3-4/2/0:2 {
    encapsulation ppp;
    unit 0 {
      family inet {
        address 10.255.0.6/30;
      }
    }
  }
  coc1-4/2/0:3 {
    no-partition interface-type ct3; # This converts the coc1 interface into a
    } # channelized T3 interface: ct3-4/2/0:3.
  }
}

```

```

ct3-4/2/0:3 {
    partition 1-28 interface-type t1; # This converts the channelized T3 interface
} # into 28 T1 channels: t1-4/2/0:3:1 through t1-4/2/0:3:28.
coc1-4/2/0:4 {
    no-partition interface-type ct3; # This converts the coc1 interface into a
} # channelized T3 interface: ct3-4/2/0:4.
ct3-4/2/0:4 {
    partition 1-2 interface-type ct1; #This creates ct1-4/2/0:4:1 and ct1-4/2/0:4:2.
    partition 3-28 interface-type t1; #This creates t1-4/2/0:4:3 through
} # t1-4/2/0:4:28.
coc1-4/2/0:5 {
    no-partition interface-type t3; # This converts the coc1 interface to a T3:
} # t3-4/2/0:5.
t3-4/2/0:5 {
    encapsulation ppp;
    unit 0 {
        family inet {
            address 10.255.1.90/30;
        }
    }
}
coc1-4/2/0:6 {
    partition 1-28 interface-type t1; # This converts the channelized OC1 interface
} # into 28 T1s: t1-4/2/0:6:1 through t1-4/2/0:6:28.
coc1-4/2/0:7 {
    partition 1-2 interface-type ct1; #This creates ct1-4/2/0:7:1 and :2.
    partition 3-28 interface-type t1; #This creates t1-4/2/0:7:3 through :28.
}
so-4/2/0:8 {
    encapsulation ppp;
    unit 0 {
        family inet {
            address 10.255.2.174/30;
        }
    }
}
t1-4/2/0:3:1 {
    encapsulation ppp;
    unit 0 {
        family inet {
            address 10.255.0.10/30;
        }
    }
}
...
t1-4/2/0:3:28 {
    encapsulation ppp;
    unit 0 {
        family inet {
            address 10.255.0.118/30;
        }
    }
}

```

```

ct1-4/2/0:4:1 {
    partition 1 timeslots 1 interface-type ds; # This creates 24 DSO channels:
    partition 2 timeslots 2 interface-type ds; # ds-4/2/0:4:1:1 through
    partition 3 timeslots 3 interface-type ds; # ds-4/2/0:4:1:24.
    partition 4 timeslots 4 interface-type ds;
    partition 5 timeslots 5 interface-type ds;
    partition 6 timeslots 6 interface-type ds;
    partition 7 timeslots 7 interface-type ds;
    partition 8 timeslots 8 interface-type ds;
    partition 9 timeslots 9 interface-type ds;
    partition 10 timeslots 10 interface-type ds;
    partition 11 timeslots 11 interface-type ds;
    partition 12 timeslots 12 interface-type ds;
    partition 13 timeslots 13 interface-type ds;
    partition 14 timeslots 14 interface-type ds;
    partition 15 timeslots 15 interface-type ds;
    partition 16 timeslots 16 interface-type ds;
    partition 17 timeslots 17 interface-type ds;
    partition 18 timeslots 18 interface-type ds;
    partition 19 timeslots 19 interface-type ds;
    partition 20 timeslots 20 interface-type ds;
    partition 21 timeslots 21 interface-type ds;
    partition 22 timeslots 22 interface-type ds;
    partition 23 timeslots 23 interface-type ds;
    partition 24 timeslots 24 interface-type ds;
}
ds-4/2/0:4:1:1 {
    encapsulation ppp;
    unit 0 {
        family inet {
            address 10.255.0.122/30;
        }
    }
}
...
ds-4/2/0:4:1:24 {
    encapsulation ppp;
    unit 0 {
        family inet {
            address 10.255.0.214/30;
        }
    }
}
ct1-4/2/0:4:2 {
    partition 1 timeslots 1-19 interface-type ds; # This creates a channel group.
    partition 2 timeslots 20 interface-type ds; # ds-4/2/0:4:2:2 through
    partition 3 timeslots 21 interface-type ds; # ds-4/2/0:4:2:6 are single 64-kbps
    partition 4 timeslots 22 interface-type ds; # NxDSO channels.
    partition 5 timeslots 23 interface-type ds;
    partition 6 timeslots 24 interface-type ds;
}

```

```

ds-4/2/0:4:2:1 {          # This is a channel group with 19 DSOs bundled as one.
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.0.218/30;
    }
  }
}
ds-4/2/0:4:2:2 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.120.0.222/30;
    }
  }
}
...
ds-4/2/0:4:2:6 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.120.0.238/30;
    }
  }
}
t1-4/2/0:4:3 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.120.0.242/30;
    }
  }
}
...
t1-4/2/0:4:28 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.1.86/30;
    }
  }
}
t1-4/2/0:6:1 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.1.94/30;
    }
  }
}
...

```

```

t1-4/2/0:6:28 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.1.202/30;
    }
  }
}
}
ct1-4/2/0:7:1 {
  partition 1 timeslots 1 interface-type ds; #This creates 24 DS0 channels:
  partition 2 timeslots 2 interface-type ds; # ds-4/2/0:7:1:1 through
  partition 3 timeslots 3 interface-type ds; # ds-4/2/0:7:1:24.
  partition 4 timeslots 4 interface-type ds;
  partition 5 timeslots 5 interface-type ds;
  partition 6 timeslots 6 interface-type ds;
  partition 7 timeslots 7 interface-type ds;
  partition 8 timeslots 8 interface-type ds;
  partition 9 timeslots 9 interface-type ds;
  partition 10 timeslots 10 interface-type ds;
  partition 11 timeslots 11 interface-type ds;
  partition 12 timeslots 12 interface-type ds;
  partition 13 timeslots 13 interface-type ds;
  partition 14 timeslots 14 interface-type ds;
  partition 15 timeslots 15 interface-type ds;
  partition 16 timeslots 16 interface-type ds;
  partition 17 timeslots 17 interface-type ds;
  partition 18 timeslots 18 interface-type ds;
  partition 19 timeslots 19 interface-type ds;
  partition 20 timeslots 20 interface-type ds;
  partition 21 timeslots 21 interface-type ds;
  partition 22 timeslots 22 interface-type ds;
  partition 23 timeslots 23 interface-type ds;
  partition 24 timeslots 24 interface-type ds;
}
ds-4/2/0:7:1:1 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.1.206/30;
    }
  }
}
}
...
ds-4/2/0:7:1:24 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.2.42/30;
    }
  }
}
}

```

```

ct1-4/2/0:7:2 {
  partition 1 timeslots 1-19 interface-type ds; # This is a channel group.
  partition 2 timeslots 20 interface-type ds; # ds-4/2/0:7:2:2 through
  partition 3 timeslots 21 interface-type ds; # ds-4/2/0:7:2:6 are single 64-kbps
  partition 4 timeslots 22 interface-type ds; # NxDSO channels.
  partition 5 timeslots 23 interface-type ds;
  partition 6 timeslots 24 interface-type ds;
}
ds-4/2/0:7:2:1 {          # This is a channel group with 19 DSOs bundled as one.
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.2.46/30;
    }
  }
}
ds-4/2/0:7:2:2 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.2.50/30;
    }
  }
}
...
ds-4/2/0:7:2:6 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.2.66/30;
    }
  }
}
t1-4/2/0:7:3 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.2.70/30;
    }
  }
}
...
t1-4/2/0:7:28 {
  encapsulation ppp;
  unit 0 {
    family inet {
      address 10.255.2.170/30;
    }
  }
}
}

```



```

ct3-4/2/0:4                                up    up
  ct1-4/2/0:4:1                            up    up
    ds-4/2/0:4:1:1                         up    up
    ds-4/2/0:4:1:2                         up    up
    ds-4/2/0:4:1:3                         up    up
    ds-4/2/0:4:1:4                         up    up
    ds-4/2/0:4:1:5                         up    up
    ds-4/2/0:4:1:6                         up    up
    ds-4/2/0:4:1:7                         up    up
    ds-4/2/0:4:1:8                         up    up
    ds-4/2/0:4:1:9                         up    up
    ds-4/2/0:4:1:10                        up    up
    ds-4/2/0:4:1:11                        up    up
    ds-4/2/0:4:1:12                        up    up
    ds-4/2/0:4:1:13                        up    up
    ds-4/2/0:4:1:14                        up    up
    ds-4/2/0:4:1:15                        up    up
    ds-4/2/0:4:1:16                        up    up
    ds-4/2/0:4:1:17                        up    up
    ds-4/2/0:4:1:18                        up    up
    ds-4/2/0:4:1:19                        up    up
    ds-4/2/0:4:1:20                        up    up
    ds-4/2/0:4:1:21                        up    up
    ds-4/2/0:4:1:22                        up    up
    ds-4/2/0:4:1:23                        up    up
    ds-4/2/0:4:1:24                        up    up
  ct1-4/2/0:4:2                            up    up
    ds-4/2/0:4:2:1                         up    up
    ds-4/2/0:4:2:2                         up    up
    ds-4/2/0:4:2:3                         up    up
    ds-4/2/0:4:2:4                         up    up
    ds-4/2/0:4:2:5                         up    up
    ds-4/2/0:4:2:6                         up    up
  t1-4/2/0:4:3                             up    up
  t1-4/2/0:4:4                             up    up
  t1-4/2/0:4:5                             up    up
  t1-4/2/0:4:6                             up    up
  t1-4/2/0:4:7                             up    up
  t1-4/2/0:4:8                             up    up
  t1-4/2/0:4:9                             up    up
  t1-4/2/0:4:10                            up    up
  t1-4/2/0:4:11                            up    up
  t1-4/2/0:4:12                            up    up
  t1-4/2/0:4:13                            up    up
  t1-4/2/0:4:14                            up    up
  t1-4/2/0:4:15                            up    up
  t1-4/2/0:4:16                            up    up
  t1-4/2/0:4:17                            up    up
  t1-4/2/0:4:18                            up    up
  t1-4/2/0:4:19                            up    up
  t1-4/2/0:4:20                            up    up
  t1-4/2/0:4:21                            up    up
  t1-4/2/0:4:22                            up    up
  t1-4/2/0:4:23                            up    up
  t1-4/2/0:4:24                            up    up
  t1-4/2/0:4:25                            up    up
  t1-4/2/0:4:26                            up    up
  t1-4/2/0:4:27                            up    up
  t1-4/2/0:4:28                            up    up

```

| | | |
|-----------------|----|----|
| t3-4/2/0:5 | up | up |
| coc1-4/2/0:6 | up | up |
| t1-4/2/0:6:1 | up | up |
| t1-4/2/0:6:2 | up | up |
| t1-4/2/0:6:3 | up | up |
| t1-4/2/0:6:4 | up | up |
| t1-4/2/0:6:5 | up | up |
| t1-4/2/0:6:6 | up | up |
| t1-4/2/0:6:7 | up | up |
| t1-4/2/0:6:8 | up | up |
| t1-4/2/0:6:9 | up | up |
| t1-4/2/0:6:10 | up | up |
| t1-4/2/0:6:11 | up | up |
| t1-4/2/0:6:12 | up | up |
| t1-4/2/0:6:13 | up | up |
| t1-4/2/0:6:14 | up | up |
| t1-4/2/0:6:15 | up | up |
| t1-4/2/0:6:16 | up | up |
| t1-4/2/0:6:17 | up | up |
| t1-4/2/0:6:18 | up | up |
| t1-4/2/0:6:19 | up | up |
| t1-4/2/0:6:20 | up | up |
| t1-4/2/0:6:21 | up | up |
| t1-4/2/0:6:22 | up | up |
| t1-4/2/0:6:23 | up | up |
| t1-4/2/0:6:24 | up | up |
| t1-4/2/0:6:25 | up | up |
| t1-4/2/0:6:26 | up | up |
| t1-4/2/0:6:27 | up | up |
| t1-4/2/0:6:28 | up | up |
| coc1-4/2/0:7 | up | up |
| ct1-4/2/0:7:1 | up | up |
| ds-4/2/0:7:1:1 | up | up |
| ds-4/2/0:7:1:2 | up | up |
| ds-4/2/0:7:1:3 | up | up |
| ds-4/2/0:7:1:4 | up | up |
| ds-4/2/0:7:1:5 | up | up |
| ds-4/2/0:7:1:6 | up | up |
| ds-4/2/0:7:1:7 | up | up |
| ds-4/2/0:7:1:8 | up | up |
| ds-4/2/0:7:1:9 | up | up |
| ds-4/2/0:7:1:10 | up | up |
| ds-4/2/0:7:1:11 | up | up |
| ds-4/2/0:7:1:12 | up | up |
| ds-4/2/0:7:1:13 | up | up |
| ds-4/2/0:7:1:14 | up | up |
| ds-4/2/0:7:1:15 | up | up |
| ds-4/2/0:7:1:16 | up | up |
| ds-4/2/0:7:1:17 | up | up |
| ds-4/2/0:7:1:18 | up | up |
| ds-4/2/0:7:1:19 | up | up |
| ds-4/2/0:7:1:20 | up | up |
| ds-4/2/0:7:1:21 | up | up |
| ds-4/2/0:7:1:22 | up | up |
| ds-4/2/0:7:1:23 | up | up |
| ds-4/2/0:7:1:24 | up | up |

```

ct1-4/2/0:7:2          up    up
  ds-4/2/0:7:2:1      up    up
  ds-4/2/0:7:2:2      up    up
  ds-4/2/0:7:2:3      up    up
  ds-4/2/0:7:2:4      up    up
  ds-4/2/0:7:2:5      up    up
  ds-4/2/0:7:2:6      up    up
t1-4/2/0:7:3          up    up
t1-4/2/0:7:4          up    up
t1-4/2/0:7:5          up    up
t1-4/2/0:7:6          up    up
t1-4/2/0:7:7          up    up
t1-4/2/0:7:8          up    up
t1-4/2/0:7:9          up    up
t1-4/2/0:7:10         up    up
t1-4/2/0:7:11         up    up
t1-4/2/0:7:12         up    up
t1-4/2/0:7:13         up    up
t1-4/2/0:7:14         up    up
t1-4/2/0:7:15         up    up
t1-4/2/0:7:16         up    up
t1-4/2/0:7:17         up    up
t1-4/2/0:7:18         up    up
t1-4/2/0:7:19         up    up
t1-4/2/0:7:20         up    up
t1-4/2/0:7:21         up    up
t1-4/2/0:7:22         up    up
t1-4/2/0:7:23         up    up
t1-4/2/0:7:24         up    up
t1-4/2/0:7:25         up    up
t1-4/2/0:7:26         up    up
t1-4/2/0:7:27         up    up
t1-4/2/0:7:28         up    up
so-4/2/0:8            up    up

```

To verify that your channelized IQ interfaces are working as expected, use the **show interfaces** command. Use the **show interfaces controller** command to find the name of the channelized interface you want to view; then include this channelized name (for example, **ct3-4/2/0:4**) as an option with the **show interfaces** command.

The next section provides sample **show interfaces** output for each of the major interface types configured in this example:

- Channelized OC12 on page 31
- SONET OC3 on page 32
- T3 on page 34
- Channelized T3 on page 36
- Channelized OC1 on page 38
- Channelized T1 on page 40
- T1 on page 41
- DS0 on page 43

Channelized OC12

```

user@RouterA> show interfaces extensive coc12-4/2/0
Physical interface: coc12-4/2/0, Enabled, Physical link is Up
Interface index: 266, SNMP ifIndex: 1269, Generation: 601
Link-level type: Controller, MTU: 4474, Clocking: Internal, SONET mode, Speed: OC12, Loopback: None,
FCS: 16, Payload scrambler: Disabled, Parent: None
Device flags   : Present Running
Interface flags: Point-To-Point SNMP-Traps
Link flags     : None
Hold-times    : Up 0 ms, Down 0 ms
Last flapped  : 2002-10-09 17:45:15 PDT (00:14:38 ago)
Statistics last cleared: Never
Input errors:
  Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Giants: 0, Bucket drops: 0, Policed discards: 0,
  L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0, HS link CRC errors: 0,
  HS link FIFO overflows: 0
Output errors:
  Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0, HS link FIFO underflows: 0
SONET alarms   : None
SONET defects  : None
SONET PHY:
  Seconds      Count  State
  PLL Lock     0      0 OK
  PHY Light    0      0 OK
SONET section:
  BIP-B1       14     83
  SEF          0      0 OK
  LOS          0      0 OK
  LOF          0      0 OK
  ES-S        14
  SES-S        0
  SEFS-S       0
SONET line:
  BIP-B2       14     162
  REI-L        0      0
  RDI-L        3      1 OK
  AIS-L        0      0 OK
  BERR-SF      0      0 OK
  BERR-SD      0      0 OK
  ES-L        14
  SES-L        0
  UAS-L        0
  ES-LFE       3
  SES-LFE      3
  UAS-LFE      0
Received SONET overhead:
  F1          : 0x00, J0      : 0x00, K1      : 0x00, K2      : 0x00
  S1          : 0x00
Transmitted SONET overhead:
  F1          : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
  S1          : 0x00

```

SONET OC3

```

user@RouterA> show interfaces extensive so-4/2/0:8
Physical interface: so-4/2/0:8, Enabled, Physical link is Up
  Interface index: 440, SNMP ifIndex: 2640, Generation: 787
  Link-level type: PPP, MTU: 4474, Clocking: Internal, SONET mode, Speed: OC3, Loopback: None, FCS: 16,
  Payload scrambler: Enabled, Parent: coc12-4/2/0 (Index 266)
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Hold-times    : Up 0 ms, Down 0 ms
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive statistics:
    Input : 0 (last seen: never)
    Output: 0 (last sent: never)
  LCP state: Conf-ack-sent
  NCP state: inet: Down, inet6: Not-configured, iso: Not-configured, mpl: Not-configured
  CHAP state: Not-configured
  Last flapped   : 2002-10-09 17:45:18 PDT (00:11:45 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes   :           5967           56 bps
    Output bytes  :          12672          128 bps
    Input packets :           351           0 pps
    Output packets:           704           0 pps
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Giants: 0, Bucket drops: 0, Policed discards: 0,
    L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0, HS link CRC errors: 0,
    HS link FIFO overflows: 0
  Output errors:
    Carrier transitions: 1, Errors: 0, Drops: 0, Aged packets: 0, HS link FIFO underflows: 0
  Queue counters:
    Queued packets  Transmitted packets  Dropped packets
  0 best-effort      704                0                0
  1 expedited-fo     0                  0                0
  2 assured-forw     0                  0                0
  3 network-cont     0                  0                0
  SONET alarms      : None
  SONET defects     : None
  SONET path:
    BIP-B3          0                0
    REI-P           0                0
    LOP-P           0                0 OK
    AIS-P           0                0 OK
    RDI-P           0                0 OK
    UNEQ-P          0                0 OK
    PLM-P           0                0 OK
    ES-P            0
    SES-P           0
    UAS-P           0
    ES-PFE         0
    SES-PFE        0
    UAS-PFE        0
  Received SONET overhead:
    C2      : 0xcf, C2(cmp) : 0xcf, F2      : 0x00, Z3      : 0x00
    Z4      : 0x00, S1(cmp) : 0x00
  Transmitted SONET overhead:
    C2      : 0xcf, F2      : 0x00, Z3      : 0x00, Z4      : 0x00
  Received path trace: RouterB so-2/2/0:8
    61 72 6d 61 67 6e 61 63 20 73 6f 2d 32 2f 32 2f RouterB so-2/2/
    30 3a 38 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
    00 00 00 00 00 00 00 00 00 00 00 00 00 00 0d 0a .....
  
```

```

Transmitted path trace: RouterA so-4/2/0:8
 74 69 6d 6d 65 73 73 71 75 61 72 65 20 73 6f 2d RouterA so-
 34 2f 32 2f 30 3a 38 00 00 00 00 00 00 00 00 00 4/2/0:8.....
 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
HDLC configuration:
  Policing bucket: Disabled
  Shaping bucket : Disabled
  Giant threshold: 0, Runt threshold: 0
Packet Forwarding Engine configuration:
  Destination slot: 4, PLP byte: 4 (0x2a)
  CoS transmit queue      Bandwidth      Buffer Priority  Limit
                           %      bps      %      bytes
  0 best-effort            95    147744000 95      0      low  none
  3 network-control       5     7776000  5      0      low  none

Logical interface so-4/2/0:8.0 (Index 180) (SNMP ifIndex 2641) (Generation 512)
  Flags: Hardware-Down Point-To-Point SNMP-Traps Encapsulation: PPP
  Protocol inet, MTU: 4470, Generation: 519, Route table: 0
  Flags: Protocol-Down
  Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
    Destination: 10.255.2.172/30, Local: 10.255.2.174, Broadcast: Unspecified, Generation: 1029

```

T3

```

user@RouterA> show interfaces extensive t3-4/2/0:2
Physical interface: t3-4/2/0:2, Enabled, Physical link is Up
  Interface index: 274, SNMP ifIndex: 1982, Generation: 609
  Link-level type: PPP, MTU: 4474, Clocking: Internal, Speed: T3, Loopback:None,
  FCS: 16,
  Mode: C/Bit parity, Parent: coc12-4/2/0 (Index 266)
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Hold-times    : Up 0 ms, Down 0 ms
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive statistics:
    Input : 85 (last seen 00:00:00 ago)
    Output: 82 (last sent 00:00:01 ago)
  LCP state: Opened
  NCP state: inet: Opened, inet6: Not-configured, iso: Not-configured, mpls: Not-configured
  CHAP state: Not-configured
  Last flapped   : 2002-10-09 17:45:15 PDT (00:13:24 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes   :           2546           56 bps
    Output bytes  :           2732           56 bps
    Input packets :            170            0 pps
    Output packets:            171            0 pps
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Bucket drops: 0, Policed discards: 0, L3 incompletes: 0,
    L2 channel errors: 0, L2 mismatch timeouts: 0, HS link CRC errors: 0, SRAM errors: 0
  Output errors:
    Carrier transitions: 1, Errors: 0, Drops: 0, Aged packets: 0
  Queue counters:
    Queued packets  Transmitted packets  Dropped packets
  0 best-effort      171                171                0
  1 expedited-fo     0                  0                  0
  2 assured-forw     0                  0                  0
  3 network-cont     0                  0                  0
  Active alarms   : None
  Active defects  : None
  DS3 media:
    Seconds      Count  State
  PLL Lock       0      0 OK
  Reframing      0      0 OK
  AIS            0      0 OK
  LOF            0      0 OK
  LOS            0      0 OK
  IDLE          0      0 OK
  YELLOW        0      0 OK
  BPV           0      0
  EXZ           0      0
  LCV           0      0
  PCV           1     6827
  CCV           0      0
  LES           0
  PES           1
  PSES         1
  CES           0
  CSES         0
  SEFS         0
  UAS          0
  HDLC configuration:
    Policing bucket: Disabled
    Shaping bucket : Disabled
    Giant threshold: 4484, Runt threshold: 0

```

```

DSU configuration:
  Compatibility mode: None, Scrambling: Disabled, Subrate: Disabled
  FEAC loopback: Inactive, Response: Disabled, Count: 0
DS-3 BERT configuration:
  BERT time period: 10 seconds, Elapsed: 0 seconds
  Algorithm: 2^3 - 1, Pseudorandom (1), Induced error rate: 10e-0
SONET alarms : None
SONET defects : None
SONET path:
  BIP-B3          0          0
  REI-P           0          0
  LOP-P           0          0 OK
  AIS-P           0          0 OK
  RDI-P           0          0 OK
  UNEQ-P          0          0 OK
  PLM-P           0          0 OK
  ES-P            0
  SES-P           0
  UAS-P           0
  ES-PFE          0
  SES-PFE         0
  UAS-PFE         0
Received SONET overhead:
  C2 : 0x04, C2(cmp) : 0x04, F2 : 0x00, Z3 : 0x00
  Z4 : 0x00, S1(cmp) : 0x00
Transmitted SONET overhead:
  C2 : 0x04, F2 : 0x00, Z3 : 0x00, Z4 : 0x00
Received path trace:
  5d 14 d6 ef 81 93 78 71 98 ec 55 27 35 84 3a 2c ] .Vo..xq.1U'5.:
Transmitted path trace: t3-4/2/0:2
  74 33 2d 34 2f 32 2f 30 3a 32 00 00 00 00 00 00 t3-4/2/0:2.....
Packet Forwarding Engine configuration:
  Destination slot: 4, PLP byte: 4 (0x00)
  CoS transmit queue      Bandwidth      Buffer Priority  Limit
                           %      bps      %      bytes
  0 best-effort           95      42499200 95      0      low  none
  3 network-control       5       2236800  5       0      low  none

Logical interface t3-4/2/0:2.0 (Index 10) (SNMP ifIndex 1983) (Generation 340)
  Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
  Bandwidth: 0
  Protocol inet, MTU: 4470, Generation: 347, Route table: 0
  Flags: None
  Addresses, Flags: Is-Preferred Is-Primary
    Destination: 10.255.0.4/30, Local: 10.255.0.6, Broadcast: Unspecified, Generation: 685

```

Channelized T3

```

user@RouterA> show interfaces extensive ct3-4/2/0:4
Physical interface: ct3-4/2/0:4, Enabled, Physical link is Up
Interface index: 304, SNMP ifIndex: 2409, Generation: 639
Link-level type: Controller, MTU: 4474, Clocking: Internal, Speed: T3, Loopback: None, FCS: 16,
Mode: C/Bit parity, Parent: coc12-4/2/0 (Index 266)
Device flags   : Present Running
Interface flags: Point-To-Point SNMP-Traps
Link flags     : None
Hold-times     : Up 0 ms, Down 0 ms
Last flapped   : 2002-10-09 17:45:16 PDT (00:12:56 ago)
Statistics last cleared: Never
Traffic statistics:
  Input bytes   :                0                0 bps
  Output bytes  :                0                0 bps
  Input packets :                0                0 pps
  Output packets:                0                0 pps
Input errors:
  Errors: 0, Drops: 0, Framing errors: 0, Bucket drops: 0, Policed discards: 0, L3 incompletes: 0,
  L2 channel errors: 0, L2 mismatch timeouts: 0, HS link CRC errors: 0, SRAM errors: 0
Output errors:
  Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0
Active alarms   : None
Active defects  : None
DS3 media:
  Seconds      Count  State
  PLL Lock     0      0 OK
  Reframing    0      0 OK
  AIS          0      0 OK
  LOF         0      0 OK
  LOS         0      0 OK
  IDLE        0      0 OK
  YELLOW      0      0 OK
  BPV         0      0
  EXZ         0      0
  LCV         0      0
  PCV         1      1
  CCV         1      1
  LES         0
  PES         1
  PSES        0
  CES         1
  CSES        0
  SEFS        0
  UAS         0
HDLC configuration:
  Policing bucket: Disabled
  Shaping bucket : Disabled
  Giant threshold: 0, Runt threshold: 0
DSU configuration:
  Compatibility mode: None, Scrambling: Disabled, Subrate: Disabled
  FEAC loopback: Inactive, Response: Disabled, Count: 0
DS-3 BERT configuration:
  BERT time period: 10 seconds, Elapsed: 0 seconds
  Algorithm: 2^3 - 1, Pseudorandom (1), Induced error rate: 10e-0
SONET alarms   : None
SONET defects  : None
SONET PHY:
  Seconds      Count  State
  PLL Lock     0      0 OK
  PHY Light    0      0 OK
  
```

```

SONET section:
  BIP-B1          14          83
  SEF             0          0 OK
  LOS            0          0 OK
  LOF            0          0 OK
  ES-S           14
  SES-S          0
  SEFS-S         0
SONET line:
  BIP-B2          14          162
  REI-L           0          0
  RDI-L           3          1 OK
  AIS-L           0          0 OK
  BERR-SF        0          0 OK
  BERR-SD        0          0 OK
  ES-L           14
  SES-L           0
  UAS-L           0
  ES-LFE         3
  SES-LFE        3
  UAS-LFE        0
SONET path:
  BIP-B3          0          0
  REI-P           0          0
  LOP-P           0          0 OK
  AIS-P           0          0 OK
  RDI-P           0          0 OK
  UNEQ-P         0          0 OK
  PLM-P           0          0 OK
  ES-P            0
  SES-P           0
  UAS-P           0
  ES-PFE         0
  SES-PFE        0
  UAS-PFE        0
Received SONET overhead:
  F1      : 0x00, J0      : 0x00, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0x04, C2(cmp) : 0x04, F2      : 0x00
  Z3      : 0x00, Z4      : 0x00, S1(cmp) : 0x00
Transmitted SONET overhead:
  F1      : 0x00, J0      : 0x00, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0x04, F2      : 0x00, Z3      : 0x00
  Z4      : 0x00
Received path trace:
  39 b8 27 50 44 b6 5f c3 f3 de 27 9a a0 31 40 5c 98'PD6-Cs^'. 1@\
Transmitted path trace: RouterA ct3-4/2/0:4
  74 69 6d 6d 65 73 73 71 75 61 72 65 20 63 74 33 RouterA ct3
Packet Forwarding Engine configuration:
Destination slot: 0 (0x00)
CoS transmit queue      Bandwidth      Buffer Priority  Limit
                        %      bps      %      bytes
0 best-effort           95      42499200 95      0      low  none
3 network-control       5       2236800  5       0      low  none

```

Channelized OC1

```

user@RouterA> show interfaces extensive coc1-4/2/0:7
Physical interface: coc1-4/2/0:7, Enabled, Physical link is Up
Interface index: 381, SNMP ifIndex: 2524, Generation: 728
Link-level type: Controller, MTU: 4474, Clocking: Internal, SONET mode, Speed: 51840kbps, Loopback:
None,
FCS: 16, Payload scrambler: Disabled, Parent: coc12-4/2/0 (Index 266)
Device flags   : Present Running
Interface flags: Point-To-Point SNMP-Traps
Link flags     : None
Hold-times    : Up 0 ms, Down 0 ms
Last flapped  : 2002-10-09 17:45:31 PDT (00:12:11 ago)
Statistics last cleared: Never
Traffic statistics:
Input bytes   :                0                0 bps
Output bytes  :                0                0 bps
Input packets :                0                0 pps
Output packets:                0                0 pps
Input errors:
Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Giants: 0, Bucket drops: 0, Policed discards: 0,
L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0, HS link CRC errors: 0,
HS link FIFO overflows: 0
Output errors:
Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0, HS link FIFO underflows: 0
SONET alarms   : None
SONET defects  : None
SONET section:
  BIP-B1          14          83
  SEF             0           0 OK
  LOS            0           0 OK
  LOF            0           0 OK
  ES-S           14
  SES-S          0
  SEFS-S         0
SONET line:
  BIP-B2          14         162
  REI-L           0           0
  RDI-L           3           1 OK
  AIS-L           0           0 OK
  BERR-SF         0           0 OK
  BERR-SD         0           0 OK
  ES-L           14
  SES-L           0
  UAS-L           0
  ES-LFE         3
  SES-LFE        3
  UAS-LFE        0
SONET path:
  BIP-B3          0           0
  REI-P           0           0
  LOP-P           0           0 OK
  AIS-P           0           0 OK
  RDI-P           0           0 OK
  UNEQ-P         3           1 OK
  PLM-P           3           1 OK
  ES-P            3
  SES-P           3
  UAS-P           0
  ES-PFE         0
  SES-PFE        0
  UAS-PFE        0

```

Received SONET overhead:

```

F1      : 0x00, J0      : 0x00, K1      : 0x00, K2      : 0x00
S1      : 0x00, C2      : 0x00, C2(cmp) : 0x00, F2      : 0x00
Z3      : 0x00, Z4      : 0x00, S1(cmp) : 0x00

```

Transmitted SONET overhead:

```

F1      : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
S1      : 0x00, C2      : 0x00, F2      : 0x00, Z3      : 0x00
Z4      : 0x00

```

Received path trace:

```

a0 6a b2 b6 97 aa 25 5e 54 e3 59 2a 80 84 dd fa      j26.*%^TcY*..]z
af ec 42 d3 21 45 5d 48 f4 5a dd e5 1c be e7 65      /!BS!E]HtZ]e.>ge
e7 f2 94 71 f1 d7 d7 86 98 83 d5 e2 ec 67 1d db      gr.qqWW...Ublg.[
5b 72 29 b3 b9 97 98 c9 c1 a3 af e2 ab db d0 be      [r]39..IA#/b+[P>

```

Transmitted path trace: RouterA coc1-4/2/0:7

```

74 69 6d 6d 65 73 73 71 75 61 72 65 20 63 6f 63      RouterA coc
31 2d 34 2f 32 2f 30 3a 37 00 00 00 00 00 00 00      1-4/2/0:7.....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....

```

HDLC configuration:

```

Policing bucket: Disabled
Shaping bucket : Disabled
Giant threshold: 0, Runt threshold: 0

```

Packet Forwarding Engine configuration:

```
Destination slot: 0 (0x00)
```

| CoS transmit queue | | Bandwidth | | Buffer | Priority | Limit |
|--------------------|----|-----------|----|--------|----------|-------|
| | % | bps | % | bytes | | |
| 0 best-effort | 95 | 49248000 | 95 | 0 | low | none |
| 3 network-control | 5 | 2592000 | 5 | 0 | low | none |

Channelized T1

```

user@RouterA> show interfaces extensive ct1-4/2/0:4:1
Physical interface: ct1-4/2/0:4:1, Enabled, Physical link is Up
  Interface index: 305, SNMP ifIndex: 2410, Generation: 640
  Link-level type: Controller, MTU: 1504, Clocking: Internal, Speed: T1, Loopback: None, FCS: 16,
  Framing: ESF, Parent: ct3-4/2/0:4 (Index 304)
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Hold-times    : Up 0 ms, Down 0 ms
  Last flapped  : 2002-10-09 17:45:19 PDT (00:16:49 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes   :                0                0 bps
    Output bytes  :                0                0 bps
    Input packets :                0                0 pps
    Output packets:                0                0 pps
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Policed discards: 0,
  L3 incompletes:0, L2 channel errors: 0,
    L2 mismatch timeouts: 0, HS link CRC errors: 0, SRAM errors: 0
  Output errors:
    Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0
  DS1 alarms   : None
  DS1 defects  : None
  T1 media:
    Seconds      Count  State
    SEF          1       1 OK
    BEE          1       1 OK
    AIS          0       0 OK
    LOF          1       1 OK
    LOS          0       0 OK
    YELLOW       0       0 OK
    BPV          0       0
    EXZ          0       0
    LCV          0       0
    PCV          0       0
    CS           0       0
    LES          1       1
    ES           1       1
    SES          2       2
    SEFS         2       2
    BES          0       0
    UAS          0       0
  HDLC configuration:
    Policing bucket: Disabled
    Shaping bucket : Disabled
    Giant threshold: 0, Runt threshold: 0
    Timeslots      : All active
    Line encoding: B8ZS, Byte encoding: Nx64K
    Buildout       : 0 to 132 feet
    Data inversion: Disabled
  DS1 BERT configuration:
    BERT time period: 10 seconds, Elapsed: 0 seconds
    Induced Error rate: 10e-0, Algorithm: 2^15 - 1, 0.151, Pseudorandom (9)
  Packet Forwarding Engine configuration:
    Destination slot: 0 (0x00)
    CoS transmit queue
    Bandwidth      Buffer Priority Limit
    %              bps   %      bytes
    0 best-effort  95    1459200 95    0    low  none
    3 network-control 5     76800  5     0    low  none
  
```

T1

```

user@RouterA> show interfaces extensive t1-4/2/0:7:3
Physical interface: t1-4/2/0:7:3, Enabled, Physical link is Up
  Interface index: 414, SNMP ifIndex: 2587, Generation: 761
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: T1, Loopback: None, FCS: 16, Framing:ESF,
  Parent: coc1-4/2/0:7 (Index 381)
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Hold-times    : Up 0 ms, Down 0 ms
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive statistics:
    Input : 0 (last seen: never)
    Output: 0 (last sent: never)
  LCP state: Conf-ack-sent
  NCP state: inet: Down, inet6: Not-configured, iso: Not-configured, mpl: Not-configured
  CHAP state: Not-configured
  Last flapped   : 2002-10-09 17:45:34 PDT (00:10:33 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes   :           10778           112 bps
    Output bytes  :           11412           128 bps
    Input packets :             634             0 pps
    Output packets:             634             0 pps
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Policed discards: 0,
  L3 incompletes: 0, L2 channel errors: 0,
    L2 mismatch timeouts: 0, HS link CRC errors: 0, SRAM errors: 0
  Output errors:
    Carrier transitions: 1, Errors: 0, Drops: 0, Aged packets: 0
  Queue counters:
    Queued packets  Transmitted packets  Dropped packets
  0 best-effort      633                633                0
  1 expedited-fo     0                  0                  0
  2 assured-forw     0                  0                  0
  3 network-cont     0                  0                  0
  DS1 alarms       : None
  DS1 defects      : None
  T1 media:
    Seconds      Count  State
  SEF            1      1 OK
  BEE            1      1 OK
  AIS            3      1 OK
  LOF           17      1 OK
  LOS            0      0 OK
  YELLOW         0      0 OK
  BPV            0      0
  EXZ            0      0
  LCV            0      0
  PCV            0      0
  CS             0      0
  LES           17      0
  ES            17      0
  SES           34      0
  SEFS          34      0
  BES            0      0
  UAS           14      0

```

HDLC configuration:

Policing bucket: Disabled
 Shaping bucket : Disabled
 Giant threshold: 1514, Runt threshold: 0
 Timeslots : All active
 Line encoding: B8ZS, Byte encoding: Nx64K
 Buildout : 0 to 132 feet
 Data inversion: Disabled

DS1 BERT configuration:

BERT time period: 10 seconds, Elapsed: 0 seconds
 Induced Error rate: 10e-0, Algorithm: 2^15 - 1, 0.151, Pseudorandom (9)

SONET alarms : None

SONET defects : None

SONET vt:

| | | | |
|----------|-----|---|---------------|
| BIP-BIP2 | 648 | 0 | |
| REI-V | 651 | 1 | |
| LOP-V | 0 | 0 | OK |
| AIS-V | 0 | 0 | OK |
| RDI-V | 651 | 1 | Defect Active |
| UNEQ-V | 0 | 0 | OK |
| PLM-V | 0 | 0 | OK |
| ES-V | 651 | | |
| SES-V | 3 | | |
| UAS-V | 0 | | |
| ES-VFE | 0 | | |
| SES-VFE | 0 | | |
| UAS-VFE | 0 | | |

Received SONET overhead:

V5 : 0x02, V5(cmp) : 0x02

Transmitted SONET overhead:

V5 : 0x02

Packet Forwarding Engine configuration:

Destination slot: 4, PLP byte: 4 (0x24)

| CoS transmit queue | Bandwidth | | Buffer | Priority | Limit |
|--------------------|-----------|---------|--------|----------|-------|
| | % | bps | % | bytes | |
| 0 best-effort | 95 | 1459200 | 95 | 0 low | none |
| 3 network-control | 5 | 76800 | 5 | 0 low | none |

Logical interface t1-4/2/0:7:3.0 (Index 152) (SNMP ifIndex 2588)
(Generation 484)

Flags: Hardware-Down Point-To-Point SNMP-Traps Encapsulation: PPP

Bandwidth: 0

Protocol inet, MTU: 1500, Generation: 491, Route table: 0

Flags: Protocol-Down

Addresses, Flags: Dest-route-down Is-Preferred Is-Primary

Destination: 10.255.2.68/30, Local: 10.255.2.70, Broadcast: Unspecified, Generation: 973

DSO

```

user@RouterA> show interfaces extensive ds-4/2/0:4:1:1
Physical interface: ds-4/2/0:4:1:1, Enabled, Physical link is Up
  Interface index: 306, SNMP ifIndex: 2411, Generation: 641
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: 64kbps, Loopback: None, FCS: 16,
  Parent: ct1-4/2/0:4:1 (Index 305)
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Hold-times    : Up 0 ms, Down 0 ms
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive statistics:
    Input : 98 (last seen 00:00:01 ago)
    Output: 100 (last sent 00:00:00 ago)
  LCP state: Opened
  NCP state: inet: Opened, inet6: Not-configured, iso: Not-configured, mpls: Not-configured
  CHAP state: Not-configured
  Last flapped   : 2002-10-09 17:45:15 PDT (00:16:20 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes   :          3013          0 bps
    Output bytes  :          3228          0 bps
    Input packets :           201          0 pps
    Output packets:           202          0 pps
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Policed discards: 0,
  L3 incompletes: 0, L2 channel errors: 0,
    L2 mismatch timeouts: 0, HS link CRC errors: 0
  Output errors:
    Carrier transitions: 1, Errors: 0, Drops: 0, Aged packets: 0
  Queue counters:
    Queued packets  Transmitted packets  Dropped packets
  0 best-effort    202                202                0
  1 expedited-fo   0                  0                  0
  2 assured-forw   0                  0                  0
  3 network-cont   0                  0                  0
  Interface transmit queues:
    B/W  WRR    Packets    Bytes    Drops    Errors
  Queue0  0  0        0         0         0         0
  Queue1  0  0        0         0         0         0
  HDLC configuration:
    Giant threshold: 0, Runt threshold: 0
    Timeslots      : 1
    Byte encoding: Nx64K, Data inversion: Disabled
    Idle cycle flag: flags, Start end flag: shared
  Packet Forwarding Engine configuration:
    Destination slot: 4, PLP byte: 4 (0x07)
    CoS transmit queue      Bandwidth      Buffer Priority  Limit
                             %      bps  %      bytes
  0 best-effort             95      60800  95      0      low  none
  3 network-control         5       3200   5       0      low  none

Logical interface ds-4/2/0:4:1:1.0 (Index 39) (SNMP ifIndex 2412)
(Generation 369)
  Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
  Bandwidth: 0
  Protocol inet, MTU: 1500, Generation: 376, Route table: 0
  Flags: None
  Addresses, Flags: Is-Preferred Is-Primary
    Destination: 10.255.0.120/30, Local: 10.255.0.122, Broadcast: Unspecified, Generation: 743

```

Example: Channelized OC3 IQ Interface Configuration

Figure 3: Channelized OC3 IQ Interface Example

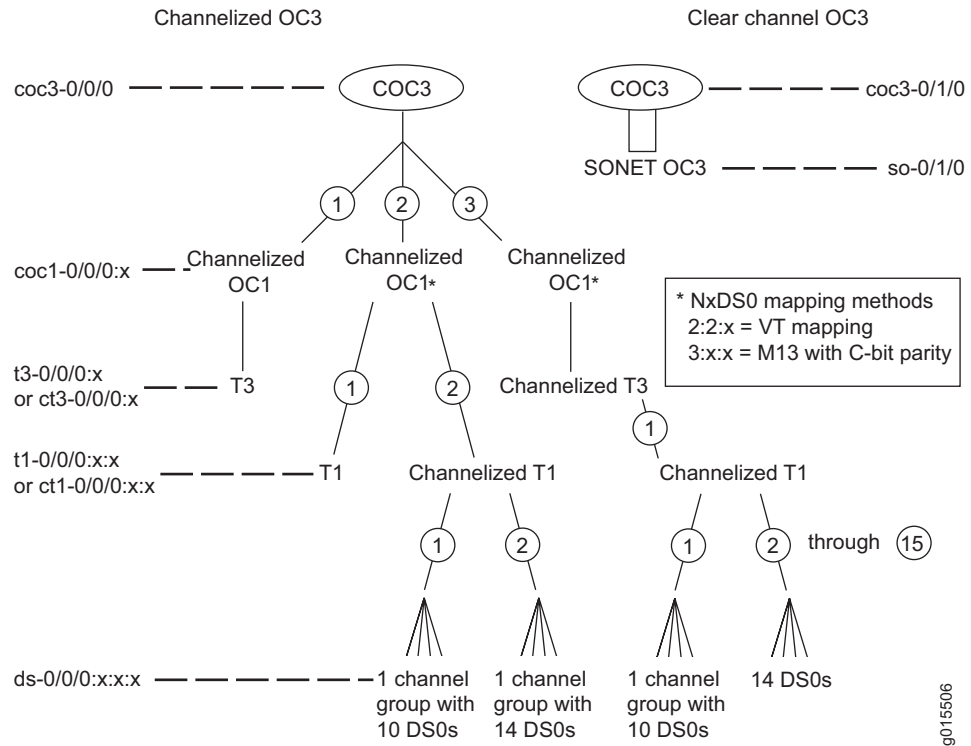


Figure 3 shows a sample channelization structure for a channelized OC3 IQ interface. Top-level partitions 1, 2, and 3 create channelized OC1 interfaces. The first channelized OC1 interface, `coc1-0/0/0:1`, is converted directly into the T3 interface `t3-0/0/0:1`. The second channelized OC1 interface, `coc1-0/0/0:2`, is partitioned into a T1 interface and a channelized T1 interface. The channelized T1 interface, `t1-0/0/0:2:2`, is then further subdivided into two *NxDS0* channel groups: `ds-0/0/0:2:2:1` and `ds-0/0/0:2:2:2`.

The remaining channelized OC1 interface, `coc1-0/0/0:3`, is converted to a channelized T3 interface, then to a channelized T1 interface, and ultimately to 14 individual *NxDS0* channels and a channel group containing 10 *NxDS0* channels. Additionally, channelized OC3 IQ interface `coc3-0/1/0` uses the `no-partition` statement at the `[edit interface interface-name]` hierarchy level to create a clear channel SONET OC3 interface `so-0/1/0`. This example shows two *NxDS0* mapping methods. Partition `2:x:x` uses VT mapping for SONET/SDH equipment, while partition `3:x:x` uses M13 mapping for North American T-carrier equipment.

This example also assumes corresponding interfaces. For example, for every sublevel T1 interface you configure on Router A, assume you have configured a matching sublevel or physical T1 interface on a neighboring router.

```

Router A [edit]
interfaces {
  coc3-0/0/0 {
    partition 1 oc-slice 1 interface-type coc1; # Creates 3 channelized OC1
    partition 2 oc-slice 2 interface-type coc1; # interfaces: coc1-0/0/0:1 through
    partition 3 oc-slice 3 interface-type coc1; # coc1-0/0/0:3.
  }
  coc1-0/0/0:1 {
    no-partition interface-type t3; # This converts the COC1 interface into
    # T3 interface t3-0/0/0:1.
  }
  t3-0/0/0:1 {
    no-keepalives;
    encapsulation cisco-hdlc;
    t3-options {
      fcs 32;
      feac-loop-respond;
    }
    unit 0 {
      family inet {
        address 10.21.21.2/30;
      }
    }
  }
  coc1-0/0/0:2 {
    partition 1 interface-type t1; # Creates the T1 interface t1-0/0/0:2:1.
    partition 2 interface-type ct1; # Creates the channelized T1 interface
    # ct1-0/0/0:2:2.
  }
  t1-0/0/0:2:1 {
    no-keepalives;
    encapsulation cisco-hdlc;
    t1-options {
      fcs 32;
    }
    unit 0 {
      family inet {
        address 10.12.12.2/30;
      }
    }
  }
  ct1-0/0/0:2:2 {
    partition 1 timeslots 1-10 interface-type ds; # This converts the channelized T1
    partition 2 timeslots 11-24 interface-type ds; # interface into two channel
    # groups: ds-0/0/0:2:2:1 and ds-0/0/0:2:2:2.
    ds-0/0/0:2:2:1 { # This is a channel group with 10 NxDSOs bundled as one.
      no-keepalives;
      encapsulation cisco-hdlc;
      unit 0 {
        family inet {
          address 10.13.13.2/30;
        }
      }
    }
  }
}

```

```

ds-0/0/0:2:2:2 { # This is a channel group with 14 NxDSOs bundled as one.
  encapsulation frame-relay;
  unit 0 {
    dlci 10;
    family inet {
      address 10.14.14.2/30;
    }
  }
}
coc1-0/0/0:3 {
  partition 1 interface-type ct3; # Creates the channelized T3 interface
  # ct3-0/0/0:3.
}
ct1-0/0/0:3:1 {
  partition 1 timeslots 1-10 interface-type ds; # Creates a channel group.
  partition 2 timeslots 11 interface-type ds; # Creates single NxDSO channels.
  partition 3 timeslots 12 interface-type ds;
  partition 4 timeslots 13 interface-type ds;
  partition 5 timeslots 14 interface-type ds;
  partition 6 timeslots 15 interface-type ds;
  partition 7 timeslots 16 interface-type ds;
  partition 8 timeslots 17 interface-type ds;
  partition 9 timeslots 18 interface-type ds;
  partition 10 timeslots 19 interface-type ds;
  partition 11 timeslots 20 interface-type ds;
  partition 12 timeslots 21 interface-type ds;
  partition 13 timeslots 22 interface-type ds;
  partition 14 timeslots 23 interface-type ds;
  partition 15 timeslots 24 interface-type ds;
}
ds-0/0/0:3:1:1 { # This is a channel group with 10 NxDSOs bundled as one.
  no-keepalives;
  encapsulation cisco-hdlc;
  unit 0 {
    family inet {
      address 10.31.31.2/30;
    }
  }
}
ds-0/0/0:3:1:2 { # ds-0/0/0:3:1:2 through :15 are single NxDSOs channels.
  encapsulation frame-relay;
  unit 0 {
    dlci 10;
    family inet {
      address 10.32.32.2/30;
    }
  }
}
## Assume ds-0/0/0:3:1:3 through :14 are configured here...
ds-0/0/0:3:1:15 { # ds-0/0/0:3:1:2 through :15 are single NxDSOs channels.
  encapsulation frame-relay;
  unit 0 {
    dlci 10;
    family inet {
      address 10.45.45.2/30;
    }
  }
}
}

```


To verify that your channelized IQ interfaces are working as expected, use the **show interfaces** command. Use the **show interfaces controller** command to find the name of the channelized interface you want to view; then include this channelized name (for example, **ct3-0/0/0:3**) as an option with the **show interfaces** command.

The next section provides sample **show interfaces** output for each of the major interface types configured in this example:

- Channelized OC3 on page 48
- Channelized OC1 on page 48
- T3 on page 49
- Channelized T3 on page 49
- T1 on page 50
- Channelized T1 on page 50
- NxDS0 on page 51
- Clear Channel SONET OC3 on page 51

Channelized OC3

```
user@host> show interfaces coc3-0/0/0
Physical interface: coc3-0/0/0, Enabled, Physical link is Up
  Interface index: 128, SNMP ifIndex: 1954
  Link-level type: Controller, Clocking: Internal, SONET mode,
  Speed: OC3, Loopback: None, Parent: None
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps 16384
  Link flags     : None
  CoS queues    : 4 supported
  Last flapped  : 2005-02-15 20:35:24 PST (22:10:54 ago)
  SONET alarms  : None
  SONET defects : None
```

Channelized OC1

```
user@host> show interfaces coc1-0/0/0:1
Physical interface: coc1-0/0/0:1, Enabled, Physical link is Up
  Interface index: 226, SNMP ifIndex: 1957
  Link-level type: Controller, Clocking: Internal, SONET mode, Speed: 51840kbps,
  Loopback: None,
  Parent: coc3-0/0/0 Interface index 138
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps 16384
  Link flags     : None
  CoS queues    : 4 supported
  Last flapped  : 2004-11-04 10:55:50 PST (05:38:36 ago)
  SONET alarms  : None
  SONET defects : None
```

T3

```

user@host> show interfaces t3-0/0/0:1
Physical interface: t3-0/0/0:1, Enabled, Physical link is Up
  Interface index: 227, SNMP ifIndex: 43
  Link-level type: Cisco-HDLC, MTU: 4474, Clocking: Internal, Speed: T3,
Loopback: None, FCS: 16, Mode: C/Bit parity,
  Parent: coc1-0/0/0:1 Interface index 226
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps 16384
  Link flags     : No-Keepalives
  CoS queues     : 4 supported
  Last flapped   : Never
  Input rate     : 0 bps (0 pps)
  Output rate    : 0 bps (0 pps)
  Active alarms  : None
  Active defects : None
  DS3 BERT configuration:
    BERT time period: 10 seconds, Elapsed: 0 seconds
    Algorithm: 2^15 - 1, 0.151, Pseudorandom (9), Induced error rate: 10e-0

Logical interface t3-0/0/0:1.0 (Index 69) (SNMP ifIndex 1960)
  Flags: Point-To-Point SNMP-Traps Encapsulation: Cisco-HDLC
  Protocol inet, MTU: 4470
  Flags: None
  Addresses, Flags: Is-Preferred Is-Primary
    Destination: 10.21.21.0/30, Local: 10.21.21.2, Broadcast: 10.21.21.3

```

Channelized T3

```

user@host> show interfaces ct3-0/0/0:3
Physical interface: ct3-0/0/0:3, Enabled, Physical link is Up
  Interface index: 234, SNMP ifIndex: 2218
  Link-level type: Controller, Clocking: Internal, Speed: T3, Loopback: None,
Mode: C/Bit parity,
  Parent: coc1-0/0/0:3 Interface index 233
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps 16384
  Link flags     : None
  CoS queues     : 4 supported
  Last flapped   : Never
  Active alarms  : None
  Active defects : None
  DS3 BERT configuration:
    BERT time period: 10 seconds, Elapsed: 0 seconds
    Algorithm: 2^15 - 1, 0.151, Pseudorandom (9), Induced error rate: 10e-0

```

T1

```

user@host> show interfaces t1-0/0/0:2:1
Physical interface: t1-0/0/0:2:1, Enabled, Physical link is Up
  Interface index: 229, SNMP ifIndex: 2091
  Link-level type: Cisco-HDLC, MTU: 1504, Clocking: Internal, Speed: T1,
  Loopback: None, FCS: 32, Framing: ESF,
  Parent: coc1-0/0/0:2 Interface index 228
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps 16384
  Link flags     : No-Keepalives
  CoS queues     : 4 supported
  Last flapped   : Never
  Input rate     : 0 bps (0 pps)
  Output rate    : 0 bps (0 pps)
  DS1 alarms    : None
  DS1 defects   : None
  SONET alarms  : None
  SONET defects : None

Logical interface t1-0/0/0:2:1.0 (Index 70) (SNMP ifIndex 2092)
  Flags: Point-To-Point SNMP-Traps Encapsulation: Cisco-HDLC
  Protocol inet, MTU: 1500
  Flags: None
  Addresses, Flags: Is-Preferred Is-Primary
    Destination: 10.12.12.0/30, Local: 10.12.12.2, Broadcast: 10.12.12.3

```

Channelized T1

```

user@host> show interfaces ct1-0/0/0:2:2
Physical interface: ct1-0/0/0:2:2, Enabled, Physical link is Up
  Interface index: 230, SNMP ifIndex: 13985
  Link-level type: Controller, Clocking: Internal, Speed: T1, Loopback: None,
  Framing: ESF,
  Parent: coc1-0/0/0:2 Interface index 228
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps 16384
  Link flags     : None
  CoS queues     : 4 supported
  Last flapped   : Never
  DS1 alarms    : None
  DS1 defects   : None
  SONET alarms  : None
  SONET defects : None

```

NxDSO

```

user@host> show interfaces ds-0/0/0:2:2:1
Physical interface: ds-0/0/0:2:2:1, Enabled, Physical link is Up
  Interface index: 231, SNMP ifIndex: 14016
  Link-level type: Cisco-HDLC, MTU: 1504, Clocking: Internal, Speed: 640kbps,
Loopback: None, FCS: 16,
  Parent: ct1-0/0/0:2:2 Interface index 230
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps 16384
  Link flags     : No-Keepalives
  CoS queues    : 4 supported
  Last flapped  : Never
  Input rate    : 0 bps (0 pps)
  Output rate   : 0 bps (0 pps)
  DSO BERT configuration:
    BERT time period: 10 seconds, Elapsed: 0 seconds
    Induced Error rate: 10e-0, Algorithm: 2^15 - 1, 0.151, Pseudorandom (9)

Logical interface ds-0/0/0:2:2:1.0 (Index 71) (SNMP ifIndex 20889)
  Flags: Point-To-Point SNMP-Traps Encapsulation: Cisco-HDLC
  Protocol inet, MTU: 1500
  Flags: None
  Addresses, Flags: Is-Preferred Is-Primary
    Destination: 10.13.13.0/30, Local: 10.13.13.2, Broadcast: 10.13.13.3

```

Clear Channel SONET OC3

```

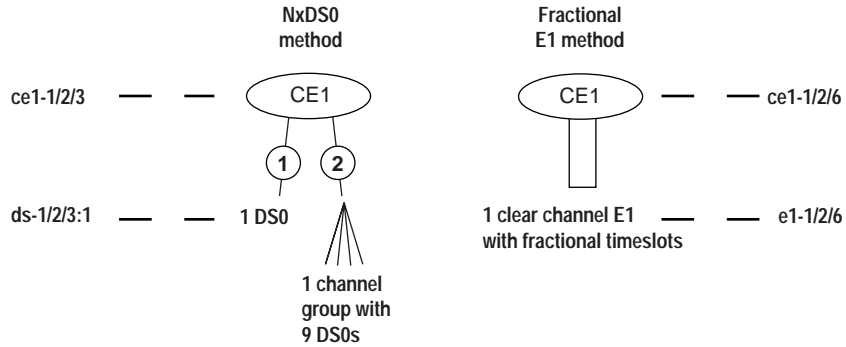
user@host> show interfaces so-0/1/0
Physical interface: so-0/1/0, Enabled, Physical link is Down
  Interface index: 128, SNMP ifIndex: 15684
  Link-level type: Cisco-HDLC, MTU: 4474, Clocking: Internal, SONET mode, Speed:
OC3, Loopback: None, FCS: 16,
  Payload scrambler: Enabled
  Parent: coc3-0/1/0 Interface index 142
  Device flags   : Present Running Down
  Interface flags: Hardware-Down Point-To-Point SNMP-Traps 16384
  Link flags     : Keepalives
  CoS queues    : 4 supported
  Last flapped   : 2004-11-04 10:53:54 PST (05:51:04 ago)
  Input rate     : 0 bps (0 pps)
  Output rate    : 0 bps (0 pps)
  SONET alarms  : PLM-P
  SONET defects  : PLM-P

Logical interface so-0/1/0.0 (Index 67) (SNMP ifIndex 15686)
  Flags: Device-Down Point-To-Point SNMP-Traps Encapsulation: Cisco-HDLC
  Protocol inet, MTU: 4470
  Flags: None
  Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
    Destination: 10.22.22.0/30, Local: 10.22.22.1, Broadcast: 10.22.22.3

```

Example: Channelized E1 IQ Interface Configuration

Figure 4: Channelized E1 IQ Interface Example



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The next example shows two ways to configure a channelized E1 IQ interface. Figure 4 shows a fractional E1 method and the NxDS0 method seen previously in the complex OC12 configuration example (see “Example: Complex Configuration for a Channelized OC12 IQ Interface” on page 20). The NxDS0 method breaks the channelized E1 IQ interface into discrete DS0 blocks, while the fractional method creates a clear channel E1 that is segmented by timeslots.

To configure NxDS0 channels, include the `partition` statement at the `[edit interfaces ce1-fpc/pic/port]` hierarchy level. Include the `timeslots` and `interface-type ds` options to create the desired number of NxDS0 interfaces in timeslots 1 through 31.

To configure a fractional E1 on a channelized E1 IQ interface, include the `no-partition` statement at the `[edit interfaces ce1-fpc/pic/port]` hierarchy level. After you commit this configuration, configure standard E1 options on the clear channel E1 interface. Include the `timeslots` statement at the `[edit interfaces e1-fpc/pic/port e1-options]` hierarchy level. Timeslot 1 is reserved, so use timeslots 2 through 32.

```

Router A - NxDS0 Method
[edit]
interfaces {
  ce1-1/2/3 {
    partition 1 timeslots 10 interface-type ds; # Creates NxDS0 channel ds-1/2/3:1
    partition 2 timeslots 1-9 interface-type ds; # Creates a channel group with
                                                # 9 NxDS0s: ds-1/2/3:2.
  }
  ds-1/2/3:1 {
    unit 0 {
      family inet {
        address 10.25.1.2/24;
      }
    }
  }
  ds-1/2/3:2 {
    unit 0 {
      family inet {
        address 10.25.2.2/24;
      }
    }
  }
}

```

```

Router A - Fractional [edit]
E1 Method interfaces {
    ce1-1/2/6 {
        no-partition; # This creates a single E1 channel: e1-1/2/6.
    }
    e1-1/2/6 {
        e1-options {
            timeslots 2-3; # This statement enables only 2 of the 31 NxDSO timeslots
                           # available on e1-1/2/6. You can use timeslots 2 through 32.
        }
        unit 0 {
            family inet {
                address 10.255.126.2/24;
            }
        }
    }
}

```

Checking Your Work

To verify correct operation of a channelized E1 IQ interface, use the following commands:

- show interfaces
- show interfaces controller
- show interfaces interval (for E1 and channelized E1 channels)

To view the interface names of the physical channelized E1 IQ interface and the resulting interfaces configured on the channelized IQ interface, use the `show interfaces controller` command:

```

user@RouterA> show interfaces controller ce1-1/2/3
Controller                               Admin Link
ce1-1/2/3                                up      up

```

This is the physical channelized E1 IQ interface.

```

ds-1/2/3:1                               up      up
ds-1/2/3:2                               up      up

```

These are the resulting NxDSO interfaces.

```

user@RouterA> show interfaces controller ce1-1/2/6
Controller                               Admin Link
ce1-1/2/6                                up      up

```

This is the physical channelized E1 IQ interface.

```

e1-1/2/6                                  up      up

```

This is the resulting E1 interface.

To view information about the physical channelized interface, include the `ce1-fpc/pic/port` (interface name) option with the `show interfaces` command:

```

user@RouterA> show interfaces ce1-1/2/3
Physical interface: ce1-1/2/3, Enabled, Physical link is Up
  Interface index: 18, SNMP ifIndex: 1128
  Link-level type: Controller, MTU: 1504, Clocking: Internal, Speed: E1,
  Loopback: None, FCS: 16, Framing: G704, Parent: None
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Last flapped  : 2002-10-04 17:52:51 PDT (00:32:57 ago)
  Input rate    : 0 bps (0 pps)
  Output rate   : 0 bps (0 pps)
  DS1 alarms   : None
  DS1 defects   : None

user@RouterA> show interfaces ce1-1/2/6
Physical interface: ce1-1/2/6, Enabled, Physical link is Up
  Interface index: 25, SNMP ifIndex: 1134
  Link-level type: Controller, MTU: 1504, Clocking: Internal, Speed: E1,
  Loopback: None,
  FCS: 16, Framing: G704, Parent: None
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Last flapped  : 2002-10-04 17:52:51 PDT (00:34:49 ago)
  Input rate    : 0 bps (0 pps)
  Output rate   : 0 bps (0 pps)
  DS1 alarms   : None
  DS1 defects   : None

```

To view information about an NxDS0 interface, include the *ds-fpc/pic/port/channel* (interface name) option with the `show interfaces` command:

```
user@RouterA> show interfaces ds-1/2/3:1 detail
Physical interface: ds-1/2/3:1, Enabled, Physical link is Up
  Interface index: 73, SNMP ifIndex: 1202, Generation: 325
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: 64kbps, Loopback: None,
  FCS: 16, Parent: ce1-1/2/3 (Index 18)
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Hold-times    : Up 0 ms, Down 0 ms
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive statistics:
    Input : 11 (last seen 00:00:02 ago)
    Output: 10 (last sent 00:00:06 ago)
  LCP state: Opened
  NCP state: inet: Opened, inet6: Opened, iso: Opened, mpls: Not-configured
  CHAP state: Not-configured
  Last flapped   : 2002-10-04 18:24:32 PDT (00:01:46 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes :          559          56 bps
    Output bytes :          656          56 bps
    Input packets:           33           0 pps
    Output packets:          36           0 pps
  Queue counters:      Queued packets  Transmitted packets  Dropped packets
    0 best-effort           40             40                 0
    1 expedited-fo           0              0                 0
    2 assured-forw           0              0                 0
    3 network-cont           0              0                 0

Logical interface ds-1/2/3:1.0 (Index 36) (SNMP ifIndex 1266) (Generation 153)
  Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
  Protocol inet, MTU: 1500, Generation: 352, Route table: 0
    Flags: None
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: 10.25.1/24, Local: 10.25.1.2, Broadcast: Unspecified,
      Generation: 445
  Protocol iso, MTU: 1500, Generation: 353, Route table: 0
    Flags: Is-Primary
  Protocol inet6, MTU: 1500, Generation: 354, Route table: 0
    Flags: Is-Primary
    Addresses, Flags: Is-Preferred
      Destination: fe80::/64, Local: fe80::2a0:a5ff:fe3d:ac6, Broadcast: Unspecified,
      Generation: 446
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: feee::10:25:1:0/126, Local: feee::10:25:1:2,
      Broadcast: Unspecified, Generation: 448
```

To view information about the fractional E1 interface, include the *e1-fpc/pic/port* (interface name) option with the `show interfaces` command:

```

user@RouterA> show interfaces e1-1/2/6 detail
Physical interface: e1-1/2/6, Enabled, Physical link is Up
  Interface index: 89, SNMP ifIndex: 1278, Generation: 341
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: E1, Loopback:None,

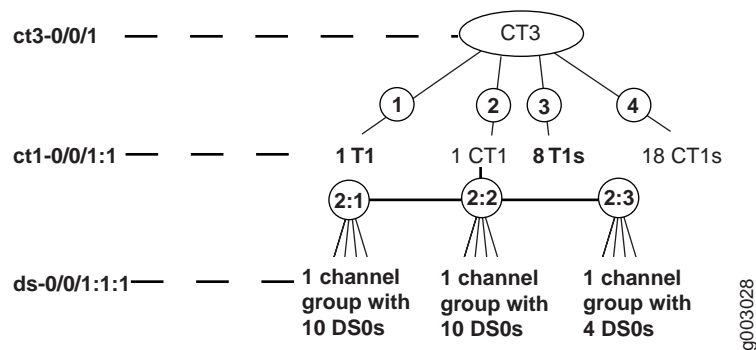
  FCS: 16, Framing: G704, Parent: ce1-1/2/6 (Index 25)
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Hold-times    : Up 0 ms, Down 0 ms
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive statistics:
    Input : 4 (last seen 00:00:05 ago)
    Output: 3 (last sent 00:00:09 ago)
  LCP state: Opened
  NCP state: inet: Opened, inet6: Not-configured, iso: Not-configured, mp1s:
  Not-configured
  CHAP state: Not-configured
  Last flapped   : 2002-10-04 18:28:27 PDT (00:01:07 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes   :                189                0 bps
    Output bytes  :                478                0 bps
    Input packets :                 13                0 pps
    Output packets:                 28                0 pps
  Queue counters:
    Queued packets  Transmitted packets  Dropped packets
    0 best-effort   28                28                0
    1 expedited-fo  0                 0                0
    2 assured-forw  0                 0                0
    3 network-cont  0                 0                0
  DS1 alarms      : None
  DS1 defects     : None
  DS1 BERT configuration:
    BERT time period: 10 seconds, Elapsed: 0 seconds
    Induced Error rate: 10e-0, Algorithm: Unknown (0)

  Logical interface e1-1/2/6.0 (Index 52) (SNMP ifIndex 1279) (Generation 169)
  Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
  Bandwidth: 0
  Protocol inet, MTU: 1500, Generation: 401, Route table: 0
  Flags: None
  Addresses, Flags: Is-Preferred Is-Primary
    Destination: 10.255.126/24, Local: 10.255.126.2, Broadcast: Unspecified,
    Generation: 525

```

Example: Channelized DS3 IQ Interface Configuration

Figure 5: Channelized DS3 IQ Interface Example



This example shows how to configure a channelized DS3 IQ interface. Figure 5 shows the breakdown of a DS3 interface into a variety of channels. The path that leads to NxDS0 channels is similar to the M13 with C-bit parity method seen previously in the complex OC12 configuration example (see “Example: Complex Configuration for a Channelized OC12 IQ Interface” on page 20). This method breaks the channelized DS3 IQ interface into channelized T1s before additional splits create DS0 timeslots.

To create T1 channels, include the `partition` statement at the `[edit interfaces ct3-fpc/pic/port]` hierarchy level with the `interface-type t1` option. To create channelized T1 channels, include the `partition` statement at the `[edit interfaces ct3-fpc/pic/port]` hierarchy level with the `interface-type ct1` option.

After you have established a channelized T1 channel, you can split it into a maximum of 24 NxDS0 channels. To configure NxDS0 channels, include the `partition` statement at the `[edit interfaces ct1-fpc/pic/port:channel]` hierarchy level with the `timeslots` and `interface-type ds` options to create the desired number of NxDS0 channels or channel groups.

Although it is not part of the example shown, you can also create a clear channel T3 or a fractional T3 interface on a channelized DS3 IQ interface. To configure a clear channel T3 or fractional T3 interface, include the `no-partition` statement at the `[edit interfaces ct3-fpc/pic/port]` hierarchy level. After you commit this part of the configuration, a clear channel T3 interface is established. You can configure standard T3 options on this interface. To fractionalize the T3 interface, include the `timeslots` statement at the `[edit interfaces t3-fpc/pic/port t3-options]` hierarchy level.

```

Router A [edit]
interfaces {
  ct3-0/0/1 { # This is the controller level for the channelized DS3 IQ interface.
    partition 1 interface-type t1; # This creates the t1-0/0/1:1 channel.
    partition 2 interface-type ct1; # This creates the ct1-0/0/1:2 channel.
    partition 3-10 interface-type t1; # This creates channels t1-0/0/1:3 through :10.
    partition 11-28 interface-type ct1; # This creates channels ct1-0/0/1:11 to :28.
  }
  t1-0/0/1:1 {
    ...
  }
  ct1-0/0/1:2 {
    partition 1 timeslots 1-10 interface-type ds; # These statements create
    partition 2 timeslots 11-20 interface-type ds; # three channel groups.
    partition 3 timeslots 21-24 interface-type ds;
  }
  ds-0/0/1:2:1 { # This channel group contains 10 NxDSOs.
    unit 0 {
      family inet {
        address 10.25.1.2/24;
      }
    }
  }
  ds-0/0/1:2:2 { # This channel group contains 10 NxDSOs.
    unit 0 {
      family inet {
        address 10.25.2.2/24;
      }
    }
  }
  ds-0/0/1:2:3 { # This channel group contains 4 NxDSOs.
    unit 0 {
      family inet {
        address 10.25.3.2/24;
      }
    }
  }
  t1-0/0/1:3 {
    ...
  }
  t1-0/0/1:10 {
    ...
  }
  ct1-0/0/1:11 {
    ...
  }
  ct1-0/0/1:28 {
    ...
  }
}

```

Checking Your Work

To verify correct operation of a channelized DS3 IQ interface, use the following commands:

- `show interfaces`
- `show interfaces controller`
- `show interfaces interval` (for T3, channelized T3, T1, and channelized T1 channels)

To view the interface names of the physical channelized DS3 IQ interface and the channels configured on this interface, use the `show interfaces controller` command:

```
user@RouterA> show interfaces controller ct3-0/0/1
Controller                               Admin Link
ct3-0/0/1                                up     up
```

This is the physical channelized DS3 (channelized T3) IQ interface.

```
ct1-0/0/1:1                               up     up
```

Channel 1 is a channelized T1 interface.

```
ct1-0/0/1:2                               up     up
  ds-0/0/1:2:1                             up     up
  ds-0/0/1:2:2                             up     up
  ds-0/0/1:2:3                             up     up
ct1-0/0/1:3                               up     down
ct1-0/0/1:4                               up     up
ct1-0/0/1:5                               up     up
ct1-0/0/1:6                               up     up
ct1-0/0/1:7                               up     up
ct1-0/0/1:8                               up     up
ct1-0/0/1:9                               up     up
ct1-0/0/1:10                              up     up
```

Channels 3 through 10 are T1 interfaces.

```
ct1-0/0/1:11                              up     up
ct1-0/0/1:12                              up     up
ct1-0/0/1:13                              up     up
ct1-0/0/1:14                              up     up
ct1-0/0/1:15                              up     up
ct1-0/0/1:16                              up     up
ct1-0/0/1:17                              up     up
ct1-0/0/1:18                              up     up
ct1-0/0/1:19                              up     up
ct1-0/0/1:20                              up     up
ct1-0/0/1:21                              up     up
ct1-0/0/1:22                              up     up
ct1-0/0/1:23                              up     up
ct1-0/0/1:24                              up     up
ct1-0/0/1:25                              up     up
ct1-0/0/1:26                              up     up
ct1-0/0/1:27                              up     up
ct1-0/0/1:28                              up     up
```

Channels 11 through 28 are channelized T1 interfaces.

To view information about the physical channelized interface, include the `ct3-fpc/pic/port` (interface name) option with the `show interfaces` command:

```

user@RouterA> show interfaces extensive ct3-0/0/1
Physical interface: ct3-0/0/1, Enabled, Physical link is Up
Interface index: 30, SNMP ifIndex: 317, Generation: 29
Link-level type: Controller, MTU: 4474, Clocking: Internal, Speed: T3,
Loopback: None, FCS: 16, Mode: C/Bit parity, Parent: None
Device flags   : Present Running
Interface flags: Point-To-Point SNMP-Traps
Link flags     : None
Hold-times     : Up 0 ms, Down 0 ms
Last flapped   : 2002-10-04 10:24:18 PDT (01:40:40 ago)
Statistics last cleared: 2002-10-04 11:47:27 PDT (00:17:31 ago)
Traffic statistics:
Input bytes   :                0          0 bps
Output bytes  :                0          0 bps
Input packets :                0          0 pps
Output packets:                0          0 pps
Input errors:
Errors: 0, Drops: 0, Framing errors: 0, Bucket drops: 0,
Policed discards: 0, L3 incompletes: 0, L2 channel errors: 0,
L2 mismatch timeouts: 0, HS link CRC errors: 0, SRAM errors: 0
Output errors:
Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0
Active alarms : None
Active defects : None
DS3 media:
Seconds      Count  State
PLL Lock    0      0 OK
Reframing  0      0 OK
AIS         0      0 OK
LOF         0      0 OK
LOS         0      0 OK
IDLE        0      0 OK
YELLOW      0      0 OK
BPV         0      0
EXZ         0      0
LCV         0      0
PCV         0      0
CCV         0      0
LES         0
PES         0
PSES        0
CES         0
CSES        0
SEFS        0
HDLC configuration:
Policing bucket: Disabled
Shaping bucket : Disabled
Giant threshold: 0, Runt threshold: 0
DSU configuration:
Compatibility mode: None, Scrambling: Disabled, Subrate: Disabled
FEAC loopback: Inactive, Response: Disabled, Count: 0
DS-3 BERT configuration:
BERT time period: 10 seconds, Elapsed: 0 seconds
Algorithm: 2^3 - 1, Pseudorandom (1), Induced error rate: 10e-0
Packet Forwarding Engine configuration:
Destination slot: 0 (0x00)
CoS transmit queue      Bandwidth      Buffer Priority  Limit
                        %          bps  %          bytes
0 best-effort           95    42499200 95          0    low    none
3 network-control       5     2236800   5          0    low    none

```

To view information about a channelized T1 channel, include the `ct1-fpc/pic/port:channel` (interface name) option with the `show interfaces` command:

```

user@RouterA> show interfaces extensive ct1-0/0/1:2
Physical interface: ct1-0/0/1:2, Enabled, Physical link is Up
  Interface index: 175, SNMP ifIndex: 1505, Generation: 174
  Link-level type: Controller, MTU: 1504, Clocking: Internal, Speed: T1,
  Loopback: None, FCS: 16, Framing: ESF, Parent: ct3-0/0/1 (Index 32)
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Hold-times    : Up 0 ms, Down 0 ms
  Last flapped  : 2002-10-04 12:08:23 PDT (00:05:57 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes   :                0          0 bps
    Output bytes  :                0          0 bps
    Input packets :                0          0 pps
    Output packets:                0          0 pps
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Policed discards: 0,
    L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0,
    HS link CRC errors: 0, SRAM errors: 0
  Output errors:
    Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0
  DS1 alarms   : None
  DS1 defects  : AIS, LOF
  T1 media:
    Seconds      Count  State
    SEF          0       0 OK
    BEE          1       1 OK
    AIS         355       1 Defect Active
    LOF         355       1 Defect Active
    LOS          0       0 OK
    YELLOW       0       0 OK
    BPV          0       0
    EXZ          0       0
    LCV          0       0
    PCV          0       0
    CS           0       0
    LES         355       0
    ES          355       0
    SES         355       0
    SEFS        355       0
    BES          0       0
    UAS          0       0
  HDLC configuration:
    Policing bucket: Disabled
    Shaping bucket : Disabled
    Giant threshold: 1514, Runt threshold: 0
    Timeslots      : All active
    Line encoding: B8ZS, Byte encoding: Nx64K
    Buildout       : 0 to 132 feet
    Data inversion: Disabled
  DS1 BERT configuration:
    BERT time period: 10 seconds, Elapsed: 0 seconds
    Induced Error rate: 10e-0, Algorithm: 2^15 - 1, 0.151, Pseudorandom (9)
  Packet Forwarding Engine configuration:
    Destination slot: 0 (0x00)
    CoS transmit queue
    %          Bandwidth          Buffer Priority  Limit
              bps %              bytes
    0 best-effort  95  1459200 95  0 low none
    3 network-control  5  76800 5  0 low none

```

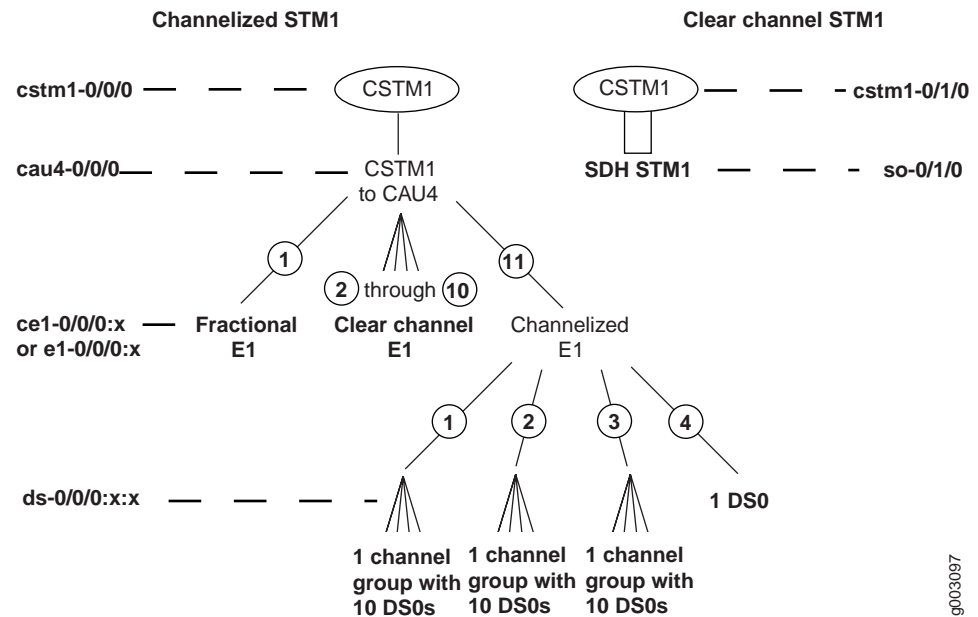
To view information about an NxDS0 interface, include the `ds-fpc/pic/port/channel` (interface name) option with the `show interfaces` command. In this case, the speed is 640 Kbps because this channel contains 10 DS0s ($64 \times 10 = 640$).

```

user@RouterA> show interfaces extensive ds-0/0/1:2:1
Physical interface: ds-0/0/1:2:1, Enabled, Physical link is Up
  Interface index: 176, SNMP ifIndex: 1563, Generation: 175
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: 640kbps,
  Loopback: None, FCS: 16, Parent: ct1-0/0/1:2 (Index 175)
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Hold-times    : Up 0 ms, Down 0 ms
  Last flapped  : 2002-10-04 12:09:06 PDT (00:05:54 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes :                0                0 bps
    Output bytes:                0                0 bps
    Input packets:                0                0 pps
    Output packets:                0                0 pps
  Input errors:
    Errors: 0, Drops: 0, Framing errors: 0, Policed discards: 0,
    L3 incompletes: 0, L2 channel errors: 0, L2 mismatch timeouts: 0,
    HS link CRC errors: 0
  Output errors:
    Carrier transitions: 1, Errors: 0, Drops: 0, Aged packets: 0
  Queue counters:
    Queued packets  Transmitted packets  Dropped packets
    0 best-effort           0                0                0
    1 expedited-fo         0                0                0
    2 assured-forw         0                0                0
    3 network-cont         0                0                0
  Interface transmit queues:
    B/W  WRR    Packets    Bytes    Drops    Errors
    Queue0  0  0      0        0        0        0
    Queue1  0  0      0        0        0        0
  HDLC configuration:
    Giant threshold: 0, Runt threshold: 0
    Timeslots      : 1-10
    Byte encoding: Nx64K, Data inversion: Disabled
  Packet Forwarding Engine configuration:
    Destination slot: 0, PLP byte: 4 (0x10)
    CoS transmit queue      Bandwidth      Buffer Priority  Limit
                             %      bps  %      bytes
    0 best-effort           95      608000  95      0      low  none
    3 network-control       5       32000   5       0      low  none
  
```

Example: Channelized STM1 IQ Interface Configuration

Figure 6: Channelized STM1 IQ Interface Example



The next example shows how to configure a channelized STM1 IQ interface. Figure 6 shows the breakdown of one channelized STM1 IQ interface into a variety of channels and the conversion of the second interface into a clear channel STM1.

For the first interface, you must first convert the STM1 interface into a channelized Administrative Unit 4 (AU-4) interface with the `no-partition` and `interface-type cau-4` statements at the `[edit interfaces cstm1-fpc/pic/port]` hierarchy level. You must specify KLM or ITU-T AU-4 formatting with the `vtmapping` statement at the `[edit interfaces cau4-fpc/pic/port sonet-options]` hierarchy level. From the channelized AU-4 interface, you can create E1 channels or channelized E1 channels. The channelized E1 channels can be further broken into DS0 timeslots.

To create E1 channels, include the `partition` statement at the `[edit interfaces cau4-fpc/pic/port]` hierarchy level with the `interface-type e1` option. To create channelized E1 channels, include the `partition` statement at the `[edit interfaces cau4-fpc/pic/port]` hierarchy level with the `interface-type ce1` option.

After you have established a channelized E1 channel, you can split it into a maximum of 31 $N \times$ DS0 channels. To create the desired number of $N \times$ DS0 channels, include the `partition` statement with the `timeslots` and `interface-type ds` options at the `[edit interfaces ce1-fpc/pic/port:channel]` hierarchy level. Timeslot 0 is reserved in an $N \times$ DS0-based channelized E1 channel, so you can use timeslots 1 through 31. To create an $N \times$ DS0 channel group, include a range of timeslots after the `timeslots` option.

You can also create fractional E1 interfaces on a channelized STM1 IQ interface. To configure a fractional E1 interface, include the `partition` statement at the `[edit interfaces cau4-fpc/pic/port]` hierarchy level and select the `interface-type e1` option. After you commit this part of the configuration, a clear channel E1 interface is established. You can configure standard E1 options on this interface. To fractionalize the E1 interface, include the `timeslots` statement at the `[edit interfaces e1-fpc/pic/port e1-options]` hierarchy level. Timeslot 1 is reserved in a fractional E1 channel, so you can use timeslots 2 through 32.

In the second interface shown in Figure 6 on page 63, you convert the channelized STM1 IQ interface into a clear channel STM1 interface. To configure, include the `no-partition` and `interface-type` so statements at the `[edit interfaces cstm1-fpc/pic/port]` hierarchy level.

```
[edit]
interfaces {
  cau4-0/0/0 {
    partition 1-10 interface-type e1; # Creates interfaces e1-0/0/0:1 through :10.
    partition 11 interface-type ce1; # Creates a single channelized E1 interface:
    sonet-options { # e1-0/0/0:11.
      vtmapping itu-t; # This selects ITU-T as the VT mapping frame format.
    }
  }
  cstm1-0/0/0 {
    no-partition interface-type cau4; # Creates a channelized AU-4 interface:
    # cau4-0/0/0.
  }
  e1-0/0/0:1 { # Channel e1-0/0/0:1 is a fractional E1 interface.
    encapsulation ppp;
    e1-options {
      timeslots 2-21; # Setting timeslots on an E1 channel creates a fractional E1.
    }
    unit 0 {
      family inet {
        address 10.133.0.1/30;
      }
    }
  }
  e1-0/0/0:2 { # Channels e1-0/0/0:2 through :10 are standard E1 interfaces.
    encapsulation ppp;
    unit 0 {
      family inet {
        address 10.133.0.5/30;
      }
    }
  }
  ...
  e1-0/0/0:10 {
    encapsulation ppp;
    unit 0 {
      family inet {
        address 10.133.0.37/30;
      }
    }
  }
}
```

```

ce1-0/0/0:11 { # Channel ce1-0/0/0:11 is a channelized E1 interface.
  partition 1 timeslots 1-10 interface-type ds; # These statements create
  partition 2 timeslots 11-20 interface-type ds; # channel groups.
  partition 3 timeslots 21-30 interface-type ds;
  partition 4 timeslots 31 interface-type ds; # This statement creates a
} # single NxDSO channel.
ds-0/0/0:11:1 { # This channel group contains 10 DSOs.
  unit 0 {
    family inet {
      address 10.134.1.1/30;
    }
  }
}
ds-0/0/0:11:2 { # This channel group contains 10 DSOs.
  unit 0 {
    family inet {
      address 10.134.2.1/30;
    }
  }
}
ds-0/0/0:11:3 { # This channel group contains 10 DSOs.
  unit 0 {
    family inet {
      address 10.134.3.1/30;
    }
  }
}
ds-0/0/0:11:4 { # Channel ds-0/0/0:11:4 is a standard DSO interface.
  unit 0 {
    family inet {
      address 10.134.4.1/30;
    }
  }
}
}

```


To view information about the physical channelized interface, include the *cstm1-fpc/pic/port* (interface name) option with the `show interfaces` command:

```
user@router> show interfaces cstm1-0/0/0
Physical interface: cstm1-0/0/0, Enabled, Physical link is Up
  Interface index: 146, SNMP ifIndex: 35
  Link-level type: Controller, Clocking: Internal, SDH mode, Speed: OC3,
Loopback: None, Parent: None
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Last flapped   : 2003-02-06 15:01:56 PST (07:15:06 ago)
  SDH alarms     : None
  SDH defects    : None
```

To view information about the channelized AU-4 channel, include the *cau4-fpc/pic/port* (interface name) option with the `show interfaces` command:

```
user@router> show interfaces cau4-0/0/0
Physical interface: cau4-0/0/0, Enabled, Physical link is Up
  Interface index: 147, SNMP ifIndex: 36
  Link-level type: Controller, Clocking: Internal, SDH mode, Speed: OC3,
Loopback: None, Parent: cstm1-0/0/0 Interface index 146
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : None
  Last flapped   : 2003-02-06 19:36:31 PST (02:40:42 ago)
  SDH alarms     : None
  SDH defects    : None
```

To view information about an E1 channel, include the `e1-fpc/pic/port:channel` (interface name) option with the `show interfaces` command. In this case, the fractional E1 appears as channel `e1-0/0/0:1` and the normal E1 appears as channel `e1-0/0/0:2`.

```
user@router> show interfaces e1-0/0/0:1
Physical interface: e1-0/0/0:1, Enabled, Physical link is Up
  Interface index: 148, SNMP ifIndex: 33
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: 1280kbps,
```

Because the fractional E1 uses 20 timeslots, 20 x 64 Kbps = 1280 Kbps.

```
Loopback: None, FCS: 16, Framing: G704,
Parent: cau4-0/0/0 Interface index 147
Device flags   : Present Running
Interface flags: Point-To-Point SNMP-Traps
Link flags     : Keepalives
Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
Keepalive: Input: 1055 (00:00:03 ago), Output: 1059 (00:00:06 ago)
LCP state: Opened
NCP state: inet: Opened, inet6: Not-configured, iso: Not-configured,
mpls: Not-configured
CHAP state: Not-configured
Last flapped   : Never
Input rate     : 16 bps (0 pps)
Output rate    : 16 bps (0 pps)
DS1  alarms   : None
DS1  defects  : None
SDH  alarms   : None
SDH  defects  : None
```

```
Logical interface e1-0/0/0:1.0 (Index 67) (SNMP ifIndex 169)
Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
Bandwidth: 0
Protocol inet, MTU: 1500
  Flags: None
  Addresses, Flags: Is-Preferred Is-Primary
    Destination: 10.133.0.0/30, Local: 10.133.0.1
```

```
user@router> show interfaces e1-0/0/0:2
Physical interface: e1-0/0/0:2, Enabled, Physical link is Up
  Interface index: 149, SNMP ifIndex: 34
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: E1,
Loopback: None, FCS: 16, Framing: G704,
Parent: cau4-0/0/0 Interface index 147
Device flags   : Present Running
Interface flags: Point-To-Point SNMP-Traps
Link flags     : Keepalives
Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
Keepalive: Input: 917 (00:00:05 ago), Output: 915 (00:00:01 ago)
LCP state: Opened
NCP state: inet: Opened, inet6: Not-configured, iso: Not-configured,
mpls: Not-configured
CHAP state: Not-configured
Last flapped   : Never
Input rate     : 16 bps (0 pps)
Output rate    : 16 bps (0 pps)
DS1  alarms   : None
DS1  defects  : None
SDH  alarms   : None
SDH  defects  : None
```

```

Logical interface e1-0/0/0:2.0 (Index 68) (SNMP ifIndex 170)
Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
Bandwidth: 0
Protocol inet, MTU: 1500
  Flags: None
Addresses, Flags: Is-Preferred Is-Primary
  Destination: 10.133.0.4/30, Local: 10.133.0.5

```

To view information about a CE1 channel, include the `ce1-fpc/pic/port:channel` (interface name) option with the `show interfaces` command:

```

user@router> show interfaces ce1-0/0/0:11
Physical interface: ce1-0/0/0:11, Enabled, Physical link is Up
  Interface index: 169, SNMP ifIndex: 288
  Link-level type: Controller, Clocking: Internal, Speed: E1, Loopback: None,
Framing: G704, Parent: cau4-0/0/0 Interface index 147
Device flags   : Present Running
Interface flags: Point-To-Point SNMP-Traps
Link flags     : None
Last flapped   : 2003-02-06 22:05:23 PST (00:13:45 ago)
DS1 alarms    : None
DS1 defects   : None
SDH alarms    : None
SDH defects   : None

```

To view information about an NxDS0 interface, include the `ds-fpc/pic/port:channel:channel` (interface name) option with the `show interfaces` command. For channel group `ds-0/0/0:11:1`, the speed of the link is 640 Kbps because it contains 10 DS0s ($64 \times 10 = 640$). For single DS0 channel `ds-0/0/0:11:4`, the speed of the link is the standard 64 Kbps.

```

user@router> show interfaces ds-0/0/0:11:1
Physical interface: ds-0/0/0:11:1, Enabled, Physical link is Up
  Interface index: 170, SNMP ifIndex: 289
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: 640kbps,
Loopback: Illegal, FCS: 16,
  Parent: ce1-0/0/0:11 Interface index 169
Device flags   : Present Running
Interface flags: Point-To-Point SNMP-Traps
Link flags     : Keepalives
Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
Keepalive: Input: 0 (never), Output: 0 (never)
LCP state: Conf-req-sent
NCP state: inet: Down, inet6: Not-configured, iso: Not-configured, mpls:
Not-configured
CHAP state: Not-configured
Last flapped   : Never
Input rate     : 0 bps (0 pps)
Output rate    : 0 bps (0 pps)
DS0 BERT configuration:
  BERT time period: 10 seconds, Elapsed: 0 seconds
  Induced Error rate: 10e-0, Algorithm: 2^15 - 1, 0.151, Pseudorandom (9)

Logical interface ds-0/0/0:11:1.0 (Index 77) (SNMP ifIndex 290)
Flags: Hardware-Down Point-To-Point SNMP-Traps Encapsulation: PPP
Bandwidth: 0
Protocol inet, MTU: 1500
  Flags: Protocol-Down
Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
  Destination: 10.134.1.0/30, Local: 10.134.1.1

```

```

user@router> show interfaces ds-0/0/0:11:4
Physical interface: ds-0/0/0:11:4, Enabled, Physical link is Up
  Interface index: 173, SNMP ifIndex: 295
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: 64kbps, Loopback:
  Illegal, FCS: 16,
  Parent: ce1-0/0/0:11 Interface index 169
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps
  Link flags     : Keepalives
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive: Input: 0 (never), Output: 0 (never)
  LCP state: Conf-req-sent
  NCP state: inet: Down, inet6: Not-configured, iso: Not-configured, mp1s:
  Not-configured
  CHAP state: Not-configured
  Last flapped   : Never
  Input rate     : 0 bps (0 pps)
  Output rate    : 0 bps (0 pps)
  DSO BERT configuration:
    BERT time period: 10 seconds, Elapsed: 0 seconds
    Induced Error rate: 10e-0, Algorithm: 2^15 - 1, 0.151, Pseudorandom (9)

Logical interface ds-0/0/0:11:4.0 (Index 80) (SNMP ifIndex 296)
  Flags: Hardware-Down Point-To-Point SNMP-Traps Encapsulation: PPP
  Bandwidth: 0
  Protocol inet, MTU: 1500
  Flags: Protocol-Down
  Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
    Destination: 10.134.4.0/30, Local: 10.134.4.1

```

Configuring Class of Service for Channelized IQ Interfaces

On channelized IQ interfaces, you can apply class of service at the logical interface level on Frame Relay data-link connection identifiers (DLCIs). To configure class-of-service schedulers at the DLCI level, see the following:

- Configuring a Class-of-Service Scheduler Map on page 71
- Associating the Scheduler with a DLCI on a Channelized IQ Interface on page 71
- Example: DLCI Class of Service on a Channelized IQ Interface Configuration on page 73
- Checking Your Work on page 75

Configuring a Class-of-Service Scheduler Map

To configure a class-of-service scheduler map, include the `scheduler-map` statement at the `[edit class-of-service interfaces interface-name unit logical-unit-number]` hierarchy level.

To specify the amount of bandwidth allocated to the logical interface, you must also include the `bandwidth` statement at the `[edit class-of-service interfaces interface-name unit logical-unit-number]` hierarchy level. You can specify a peak bandwidth rate in bits per second (bps), 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). The range is 1000 through 32,000,000,000 bps.

```
[edit]
class-of-service {
  interfaces {
    interface-name {
      unit logical-unit-number {
        scheduler-map map-name;
        bandwidth rate;
      }
    }
  }
}
```

If you do not include the `bandwidth` statement in the configuration, the logical interface might not be able to transmit traffic unless surplus bandwidth is available on the physical interface. The sum of the bandwidth you allocate to all the logical interfaces on a physical interface should not exceed the bandwidth of the physical interface.

Associating the Scheduler with a DLCI on a Channelized IQ Interface

For channelized OC12 IQ, channelized OC3 IQ, channelized DS3 IQ, channelized STM1 IQ, and channelized E1 IQ interfaces with Frame Relay encapsulation, you can associate a scheduler map name with a logical interface. To activate transmission scheduling on a DLCI, include the `per-unit-scheduler` statement at the `[edit interfaces interface-name]` hierarchy level.

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

For channelized IQ interfaces, the number of schedulers you can apply varies by channel level. Table 7 shows the number of schedulers you can apply at each channel level.

Table 7: Scheduler Limitations for Channelized IQ Interfaces

| Channelized IQ Interfaces | Number of Schedulable DLCIs per Level |
|----------------------------------|--|
| Channelized OC12 IQ interfaces | 63 for OC3 and OC12 channels, 255 for T3 channels |
| Channelized OC3 IQ interfaces | 63 for OC3 channels, 255 for T3 channels |
| Channelized DS3 IQ interfaces | 255 for T3 channels |
| Channelized STM1 IQ interfaces | 63 for STM1 channels |
| Channelized E1 IQ interfaces | 63 for E1 channels |

You can associate up to four forwarding classes per physical interface. You can configure logical interface scheduling on up to 16 physical interfaces per channelized IQ PIC. Keep in mind that you can configure either a physical interface scheduler or a logical interface scheduler, but not both on the same interface simultaneously.

If you use a Gigabit Ethernet IQ interface, you can apply schedulers on up to 768 VLANs per PIC. For more information on class of service for VLANs on a Gigabit Ethernet IQ interface, see the *JUNOS Network Interfaces and Class of Service Configuration Guide*.

Example: DLCI Class of Service on a Channelized IQ Interface Configuration

This example applies class of service at the logical interface level on a clear channel T3 interface derived from a channelized DS3 IQ interface. (For more information on configuring a channelized DS3 IQ interface, see “Example: Channelized DS3 IQ Interface Configuration” on page 57.)

Configure a scheduler map, complete with the desired transmit rates, buffer sizes, and service classes. Once the scheduler map is ready, enable logical interface-level class of service with the `per-unit-scheduler` statement at the `[edit interfaces interface-name]` hierarchy level. Also, configure a DLCI for each logical interface with the `dcli dcli-number` statement at the `[edit interfaces interface-name unit unit-number]` hierarchy level. Finally, configure the logical interfaces for class of service with the `scheduler-map` and `bandwidth` statements at the `[edit class-of-service interfaces interface-name unit unit-number]` hierarchy level. These statements specify the scheduler map to associate with each logical interface and how much bandwidth to reserve for the DLCI queues.

```
[edit]
interfaces {
  ct3-3/1/0 {
    no-partition interface-type t3; # This converts the channelized DS3 IQ
    }                               # interface to a T3.
  t3-3/1/0 {
    per-unit-scheduler; # This enables scheduling at the logical interface level.
    encapsulation frame-relay;
    unit 0 { # The logical interface where scheduler map sched-0 takes effect.
      dcli 100; # The DLCI affected by scheduler map sched-0.
      family inet {
        address 10.40.1.1/30;
      }
    }
    unit 1 { # The logical interface where scheduler map sched-1 takes effect.
      dcli 101; # The DLCI affected by scheduler map sched-1.
      family inet {
        address 10.40.2.1/30;
      }
    }
  }
}
class-of-service {
  interfaces {
    t3-3/1/0 { # This specifies the channel where the scheduled DLCI is located.
      unit 0 { # This specifies the logical interface for the first scheduled DLCI.
        scheduler-map sched-0; # This applies a scheduler map to the first DLCI.
        bandwidth 10m; # This reserves bandwidth for scheduler map sched-0.
      }
      unit 1 { # This specifies the logical interface for the second scheduled DLCI.
        scheduler-map sched-1; # Applies a scheduler map to the second DLCI.
        bandwidth 10m; # This reserves bandwidth for scheduler map sched-1.
      }
    }
  }
}
```

```

scheduler-maps {
  sched-0 { # This is where classes of service are associated with a scheduler.
    forwarding-class assured-forwarding scheduler af;
    forwarding-class best-effort scheduler be;
    forwarding-class expedited-forwarding scheduler ef;
  }
  sched-1 { # This is where classes of service are associated with a scheduler.
    forwarding-class assured-forwarding scheduler af-1;
    forwarding-class best-effort scheduler be-1;
    forwarding-class expedited-forwarding scheduler ef-1;
  }
}
schedulers {
  af {
    transmit-rate percent 10;
    buffer-size percent 10;
  }
  be {
    transmit-rate percent 20;
    buffer-size percent 20;
  }
  ef {
    transmit-rate percent 70;
    buffer-size percent 70;
  }
  af-1 {
    transmit-rate percent 10;
    buffer-size percent 10;
  }
  be-1 {
    transmit-rate percent 30;
    buffer-size percent 30;
  }
  ef-1 {
    transmit-rate percent 60;
    buffer-size percent 60;
  }
}
}

```

Checking Your Work

To verify correct operation of class-of-service schedulers on a channelized IQ interface, use the following commands:

- `show class-of-service forwarding-table`
- `show class-of-service interface`

```
user@router> show class-of-service interface t3-3/1/0
```

```
Physical interface: t3-3/1/0, Index: 169
```

```
Scheduler map: <default>, Index: 1
```

```
Logical interface: t3-3/1/0.0, Index: 68
```

| Object | Name | Type | Index |
|---------------|----------------------|------|-------|
| Scheduler-map | sched-0 | | 11204 |
| Rewrite | exp-default | exp | 2 |
| Classifier | ipprec-compatibility | ip | 5 |

```
Logical interface: t3-3/1/0.1, Index: 69
```

| Object | Name | Type | Index |
|---------------|----------------------|------|-------|
| Scheduler-map | sched-1 | | 7038 |
| Rewrite | exp-default | exp | 2 |
| Classifier | ipprec-compatibility | ip | 5 |

For More Information

For additional information about channelized IQ interfaces (including BERT support, M13 C-bit parity, VT mapping, and other topics) or the original channelized interfaces, see the following:

- *JUNOS Network Interfaces and Class of Service Configuration Guide*
- *JUNOS System Basics Configuration Guide*
- *JUNOS Interfaces Command Reference*

Revision History

- 13 June 2005—7.3R1 Release. Richard Hendricks.
- 5 April 2005—7.2R1 Release. Richard Hendricks.
- 2 February 2005—Added the Channelized OC3 IQ PIC example, 7.1R1 Release. Richard Hendricks.
- 6 October 2004—7.0R1 Release. Richard Hendricks.
- 6 July 2004—6.4R1 Release. Richard Hendricks.
- 5 April 2004—Revised DLCI support for T3 channels on channelized OC12 IQ interfaces and included information on the **wildcard delete** command, 6.3R1 Release. Richard Hendricks.
- 21 January 2004—Updated DLCI tables, 6.2R1 update. Richard Hendricks.
- 22 December 2003—Added revised DLCI support for T1 and E1 channels on channelized IQ interfaces and added new Frame Relay encapsulation types, 6.2R1 Release. Richard Hendricks.
- 22 September 2003—6.1R1 Release. Richard Hendricks.
- 30 June 2003—Added class of service for channelized STM1 IQ interfaces and APS/MSP for channelized OC12 IQ and channelized STM1 IQ interfaces, 6.0R1 Release. Elizabeth Lichtenberg.
- 2 April 2003—Added the Channelized STM1 IQ PIC and DLCI-level class of service, 5.7R1 Release. Richard Hendricks.
- 27 December 2002—5.6R1 Release. Richard Hendricks.
- 11 November 2002—Initial document written. Richard Hendricks.