



**JUNOS**

## **Channelized IQ Interfaces Feature Guide**

*Release 9.4*

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## **Part 1**

# **Channelized IQ Interfaces**

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## Chapter 1

# Channelized Intelligent Queuing Interfaces Concepts and Reference Material

- Overview of Channelized IQ Interfaces on page 3
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## Overview of Channelized IQ Interfaces

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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, E3, T3, STM1, OC3, or OC12 service, a channelized interface 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.

The original channelized interfaces 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 apply to all channels on these channelized interfaces.

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

- 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 NxDS0 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 (CoS) processing now occurs on the PIC for channelized IQ interfaces rather than in the FPC.

The following M-series and T-series PICs support channelized interfaces with intelligent queuing:

- 1-port Channelized OC12 IQ PIC
- 1-port Channelized OC3 PIC
- 4-port Channelized DS3 IQ PIC
- 10-port Channelized T1 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			20000005dfae3a01	RE-2.0
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	



<b>PIC 0</b>	<b>REV 03</b>	<b>750-005636</b>	<b>BE1826</b>	<b>4x CHDS3 IQ</b>
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# 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
<b>PIC 3</b>	<b>REV 06</b>	<b>750-003009</b>	<b>AM6929</b>	<b>4x CT3</b>

# 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

- Related Topics**
- Channelized IQ Interfaces Solutions Page
  - Roadmap for Configuring Channelized IQ Interfaces on page 11
  - Roadmap for Channelized IQ Interface Configuration Examples on page 20

## Guidelines for Configuring Channelized IQ Interfaces

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 on a channelized OC12 IQ, channelized OC3 IQ, channelized DS3 IQ, or channelized T1 IQ interface are numbered from 1 to 28.
  - E1 channels configured on a channelized STM1 IQ interface are numbered from 1 to 63.
  - NxDS0 time slots configured on a channelized OC12 IQ, channelized OC3 IQ, channelized DS3 IQ, or channelized T1 IQ interface are numbered from 1 to 24.
  - NxDS0 time slots configured on either a channelized STM1 IQ interface or channelized E1 IQ interface are numbered from 2 to 32 (1 is 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.”

- 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 following 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 circuit cross-connect (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 translational cross-connect (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.
- In JUNOS Release 7.5 and later, you can increase the delay buffer for E1, T1, and NxDS0 channels on all Channelized IQ PICs (except the Channelized OC12 IQ PIC) by including the **q-pic-large-buffer** statement at the [edit chassis fpc fpc-slot pic pic-slot] hierarchy level. By doing so, you enable the slower interfaces to handle bursts of traffic from faster upstream neighbors. As a result, any class-of-service (CoS) scheduler that you apply to an interface will inherit the larger delay buffer and the buffer is shared across all four CoS queues. For more information about increasing the delay buffer, see the *JUNOS Class of Service Configuration Guide*.



**NOTE:** If you configure the **q-pic-large-buffer** statement and APS in a multirouter topology, the Channelized IQ PIC resets and causes an APS switchover.

---

- Related Topics**
- Channelized IQ Interfaces Solutions Page
  - Overview of Channelized IQ Interfaces on page 3
  - Roadmap for Configuring Channelized IQ Interfaces on page 11
  - Roadmap for Channelized IQ Interface Configuration Examples on page 20

## Frame Relay DLCI Limitations for Channelized IQ Interfaces

If you use Frame Relay encapsulation on a channelized interface, see Table 7 on page 8 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 7 on page 8. To determine the capabilities of your system, contact Juniper Networks customer support.

**Table 1: 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	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 PICs)	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)

**Table 1: Frame Relay DLCI Limitations for Channelized Interfaces** *(continued)*

Channelized PIC Type		
T1 level channels (Channelized OC12 IQ, Channelized OC3 IQ, Channelized DS3 IQ, and Channelized T1 IQ PICs)	64	1–1022 (0 is reserved for LMI)
DS0 level channels (Channelized OC12 IQ, Channelized OC3 IQ, Channelized DS3 IQ, Channelized T1 IQ, Channelized STM1 IQ, and Channelized E1 IQ PICs)	16	1–1022 (0 is reserved for LMI)

- Related Topics**
- Channelized IQ Interfaces Solutions Page
  - Overview of Channelized IQ Interfaces on page 3
  - Roadmap for Configuring Channelized IQ Interfaces on page 11
  - Roadmap for Channelized IQ Interface Configuration Examples on page 20

## System Requirements for Channelized IQ Interfaces

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

- JUNOS Release 8.0 or later for DLCI-level scheduler support on E1 channels configured on Channelized STM1 IQ PICs
- JUNOS Release 7.6 or later for converting a Channelized OC12 IQ PIC to a channelized STM4 SDH interface
- JUNOS Release 7.5 or later for increased delay buffers on channelized E1 IQ, channelized DS3 IQ, channelized OC3 IQ, channelized STM1 IQ, and channelized T1 IQ interfaces; support for rate limiting on physical interfaces; and support for channelized STM1 IQ interfaces on T-series platforms
- JUNOS Release 7.4 or later for channelized T1 IQ interfaces
- 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 CCC, and extended Frame Relay TCC encapsulation types
- JUNOS Release 6.2 or later for support of E3 IQ interfaces
- 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 T-series routers equipped with an Enhanced Type 1 or Type 2 Flexible PIC Concentrator (FPC)

- Related Topics**
- Channelized IQ Interfaces Solutions Page
  - Overview of Channelized IQ Interfaces on page 3
  - Roadmap for Configuring Channelized IQ Interfaces on page 11
  - Roadmap for Channelized IQ Interface Configuration Examples on page 20

## Terms and Acronyms for Channelized IQ Interfaces

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### P

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<b>Performance Processor (QPP) ASIC</b>	A next-generation processor that provides enhanced capabilities for channelized IQ interfaces.
---	--

## Chapter 2

# Configuring Channelized IQ Interfaces

- Roadmap for Configuring Channelized IQ Interfaces on page 11
- 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
- Configuring Class of Service on a Channelized IQ Interface on page 15

## Roadmap for Configuring Channelized IQ Interfaces

---

To configure a channelized IQ interface, you must perform one or more of the following procedures:

- Configure a clear channel. 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.

See “Configuring a Clear Channel on a Channelized IQ Interface” on page 12.

- Configure single-level channels. By configuring single-level channels, you subdivide a channelized interface into a set of large end channels.

See “Configuring Single-Level Channels on a Channelized IQ Interface” on page 12.

- Configure multilevel channels. You can subdivide a channelized interface and then split these subchannelized interfaces into end channels. Creating small end channels might require you to configure multilevel channels.

See “Configuring Multilevel Channels on a Channelized IQ Interface” on page 13.

- Configure Class of Service. On channelized IQ interfaces, you can apply class of service at the logical interface level for Frame Relay data-link connection identifiers (DLCIs).

See “Configuring a Class-of-Service Scheduler Map” on page 15.

### Related Topics

- Channelized IQ Interfaces Solutions Page
- Overview of Channelized IQ Interfaces on page 3
- Roadmap for Channelized IQ Interface Configuration Examples on page 20

## Configuring a Clear Channel on a Channelized IQ Interface

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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. Include the `interface-type` option to set the channelized interface type. Once the interface is established, you can configure it the same way as a regular interface.

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

- Related Topics**
- [Channelized IQ Interfaces Solutions Page](#)
  - [Overview of Channelized IQ Interfaces on page 3](#)
  - [Roadmap for Configuring Channelized IQ Interfaces on page 11](#)
  - [Roadmap for Channelized IQ Interface Configuration Examples on page 20](#)

## 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  $N \times DS0$  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
  }
  so-0/0/0:1 {
    encapsulation ppp;
    unit 0 {
      family inet {
        address 10.255.0.2/30;
      }
    }
  }
}

```

- Related Topics**
- Channelized IQ Interfaces Solutions Page
  - Roadmap for Configuring Channelized IQ Interfaces on page 11
  - Overview of Channelized IQ Interfaces on page 3
  - Roadmap for Channelized IQ Interface Configuration Examples on page 20

## 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 NxDS0 level channels and the **interface-type** option to set the interface type (such as T1 or NxDS0). 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
  }
  t3-0/0/0:2 {
    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 {
    partition 1-28 interface-type t1; # Creates 28 T1 interfaces:
  }
  coc1-0/0/0:4 {
    partition 1 interface-type ct1; # Creates a channelized T1 interface:
  }
  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:
  }
  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;
    }
  }
}
}

```

- Related Topics**
- [Channelized IQ Interfaces Solutions Page](#)
  - [Overview of Channelized IQ Interfaces on page 3](#)
  - [Roadmap for Configuring Channelized IQ Interfaces on page 11](#)
  - [Roadmap for Channelized IQ Interface Configuration Examples on page 20](#)

## Configuring Class of Service on a Channelized IQ Interface

- Configuring a Class-of-Service Scheduler Map on page 15
- Associating the Scheduler with a DLCI on a Channelized IQ Interface on page 15
- Scheduler Limitations for Channelized IQ Interfaces on page 16
- Verifying Class-of-Service Schedulers on Channelized IQ Interfaces on page 17

### 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 `shaping-rate` 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;
        shaping-rate rate;
      }
    }
  }
}
```

If you do not include the `shaping-rate` 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.

#### Related Topics

- Overview of Channelized IQ Interfaces on page 3
- System Requirements for Channelized IQ Interfaces on page 9
- Example: DLCI Class of Service on a Channelized IQ Interface Configuration on page 80
- *JUNOS Network Interfaces Configuration Guide*
- *JUNOS Class of Service Configuration Guide*

### Associating the Scheduler with a DLCI on a Channelized IQ Interface

For channelized OC12 IQ, channelized OC3 IQ, channelized DS3 IQ, channelized T1 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;
  }
}
```

- Related Topics**
- Channelized IQ Interfaces Solutions Page
  - Overview of Channelized IQ Interfaces on page 3
  - Roadmap for Configuring Channelized IQ Interfaces on page 11
  - Example: DLCI Class of Service on a Channelized IQ Interface Configuration on page 80

## Scheduler Limitations for Channelized IQ Interfaces

You can configure logical interface scheduling on up to 16 channelized interfaces per channelized IQ PIC. For channelized IQ interfaces, the number of schedulers you can apply varies by channel level. Table 2 on page 16 shows the number of schedulers you can apply at each channel level.

**Table 2: 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, 63 for T1 channels
Channelized DS3 IQ interfaces	255 for T3 channels
Channelized T1 IQ interfaces	63 for T1 channels
Channelized STM1 IQ interfaces	63 for STM1 channels, 63 for E1 channels
Channelized E1 IQ interfaces	63 for E1 channels

You can associate up to four forwarding classes per physical interface. 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 Configuration Guide*.

- Related Topics**
- Channelized IQ Interfaces Solutions Page
  - Overview of Channelized IQ Interfaces on page 3
  - Roadmap for Configuring Channelized IQ Interfaces on page 11
  - Roadmap for Channelized IQ Interface Configuration Examples on page 20

## Verifying Class-of-Service Schedulers on Channelized IQ Interfaces

**Purpose** To verify the correct operation of class-of-service schedulers on channelized IQ interfaces.

**Action** Verify the correct operation of class-of-service schedulers on channelized interfaces:

- 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
```

- Related Topics**
- Channelized IQ Interfaces Solutions Page
  - Overview of Channelized IQ Interfaces on page 3
  - Roadmap for Configuring Channelized IQ Interfaces on page 11
  - Example: DLCI Class of Service on a Channelized IQ Interface Configuration on page 80



## Chapter 3

# Channelized IQ Interface Configuration Examples

- Merging Examples on page 19
- Roadmap for Channelized IQ Interface Configuration Examples on page 20
- Example: OC12 Clear Channel on a Channelized OC12 IQ Interface on page 21
- Example: Complex Configuration for a Channelized OC12 IQ Interface on page 25
- Example: Converting a Channelized OC12 IQ PIC to a Channelized STM4 IQ Interface on page 47
- Example: Channelized OC3 IQ Interface Configuration on page 52
- Example: Channelized DS3 IQ Interface Configuration on page 59
- Example: Channelized T1 IQ Interface Configuration on page 65
- Example: Channelized STM1 IQ Interface Configuration on page 70
- Example: Channelized E1 IQ Interface Configuration on page 76
- Example: DLCI Class of Service on a Channelized IQ Interface Configuration on page 80

## Merging Examples

---

To merge a full example, follow these steps:

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

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

```
system {
  scripts {
    commit {
      file ex-script.xsl;
    }
  }
}
interfaces {
  fxp0 {
```

```

        disable;
        unit 0 {
            family inet {
                address 10.0.0.1/24;
            }
        }
    }
}

```

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

```

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

```

To merge a snippet, follow these steps:

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

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

```

commit {
    file ex-script-snippet.xml; }

```

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

```

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

```

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

```

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

```

**Related Topics** For more information about the `load` command, see the *JUNOS CLI User Guide*.

## Roadmap for Channelized IQ Interface Configuration Examples

The following examples give typical topologies and configurations for some of the more common channelized IQ interface configurations:

- Example: OC12 Clear Channel on a Channelized OC12 IQ Interface on page 21
- Example: Complex Configuration for a Channelized OC12 IQ Interface on page 25



- Example: Converting a Channelized OC12 IQ PIC to a Channelized STM4 IQ Interface on page 47
- Example: Channelized OC3 IQ Interface Configuration on page 52
- Example: Channelized DS3 IQ Interface Configuration on page 59
- Example: Channelized T1 IQ Interface Configuration on page 65
- Example: Channelized STM1 IQ Interface Configuration on page 70
- Example: Channelized E1 IQ Interface Configuration on page 76
- Example: DLCI Class of Service on a Channelized IQ Interface Configuration on page 80

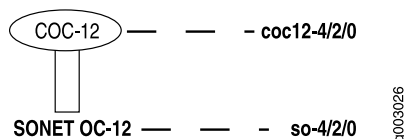
**Related Topics**

- Channelized IQ Interfaces Solutions Page
- Overview of Channelized IQ Interfaces on page 3
- Roadmap for Configuring Channelized IQ Interfaces on page 11

## Example: OC12 Clear Channel on 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 and select the interface type. 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 interface-type so;
            }
            so-4/2/0 {
              unit 0 {
                family inet {
                  address 10.245.1.1/30;
                }
              }
            }
          }
        }
```

## Verifying Your Work

To verify correct operation of a channelized OC12 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` 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           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:
    Queued packets  Transmitted packets  Dropped packets
  0 best-effort      34129              34129            0
  1 expedited-fo         0                0                0
  2 assured-forw        0                0                0

```

```

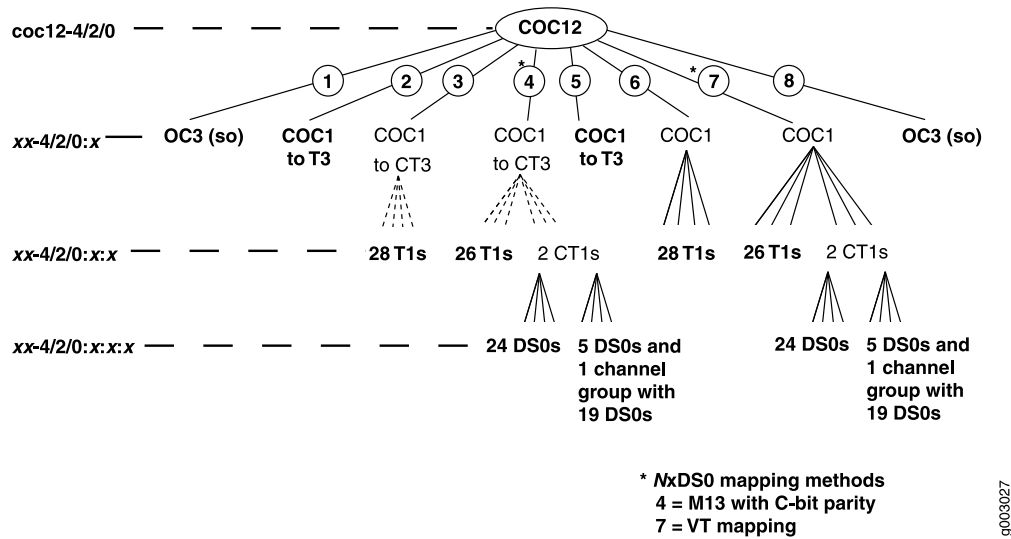
3 network-cont          0          0          0
SONET alarms   : None
SONET defects  : None
SONET path:
  BIP-B3        0          0
  REI-P         0          0
  LOP-P         0          0 OK
  AIS-P         0          0 OK
  RDI-P         0          0 OK
  UNEQ-P        0          0 OK
  PLM-P         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

```

- Related Topics**
- Channelized IQ Interfaces Solutions Page
  - Roadmap for Channelized IQ Interface Configuration Examples on page 20
  - Roadmap for Configuring Channelized IQ Interfaces on page 11

## Example: Complex Configuration for a Channelized OC12 IQ Interface

**Figure 2: Complex Configuration for a Channelized OC12 IQ Interface**



**Table 3: Complex Channelization for a Channelized OC12 IQ Interface**

Partition	Slices	Interface Type	Interface Level 2	Interface Level 3
<b>1</b>	1–3	OC3	–	–
<b>2</b>	4	Channelized OC1 converted to T3	–	–
<b>3</b>	5	Channelized OC1 converted to channelized T3	28 T1s	–
<b>4</b>	6	Channelized OC1 converted to channelized T3	26 T1s	–
–	–	–	2 CT1s	24 DS0s
–	–	–	–	5 DS0s and 1 channel group of 19 DS0s
<b>5</b>	7	Channelized OC1 converted to T3	–	–
<b>6</b>	8	Channelized OC1	28 T1s	–
<b>7</b>	9	Channelized OC1	26 T1s	–
–	–	–	2 CT1s	24 DS0s

**Table 3: Complex Channelization for a Channelized OC12 IQ Interface** (continued)

Partition	Slices	Interface Type	Interface Level 2	Interface Level 3
–	–	–	–	5 DS0s and 1 channel group of 19 DS0s
<b>8</b>	10–12	OC3	–	–

Figure 2 on page 25 and Table 3 on page 25 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 time slots, whereas 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 DS0 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; # NxDS0 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 DS0s 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; # NxDS0 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 DS0s 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;
        }
    }
}
}

```

## Verifying Your Work

To verify correct operation of a channelized OC12 IQ interface configured for complex channelization, use the following commands:

- `show interfaces controller`
- `show interfaces`
- `show interfaces interval` (for OC12, channelized OC12, OC3, T3, channelized T3, T1, and channelized T1 channels)

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

```

user@RouterA> show interfaces controller
Controller
coc12-4/2/0
  so-4/2/0:1
  t3-4/2/0:2
  ct3-4/2/0:3
    t1-4/2/0:3:1
    t1-4/2/0:3:2
    t1-4/2/0:3:3
    t1-4/2/0:3:4
    t1-4/2/0:3:5
    t1-4/2/0:3:6
    t1-4/2/0:3:7
    t1-4/2/0:3:8
    t1-4/2/0:3:9
    t1-4/2/0:3:10
    t1-4/2/0:3:11
    t1-4/2/0:3:12
    t1-4/2/0:3:13
    t1-4/2/0:3:14
    t1-4/2/0:3:15
    t1-4/2/0:3:16
    t1-4/2/0:3:17
    t1-4/2/0:3:18
    t1-4/2/0:3:19
    t1-4/2/0:3:20
    t1-4/2/0:3:21
    t1-4/2/0:3:22
    t1-4/2/0:3:23
    t1-4/2/0:3:24
    t1-4/2/0:3:25
    t1-4/2/0:3:26
    t1-4/2/0:3:27
    t1-4/2/0:3:28
  ct3-4/2/0:4
    ct1-4/2/0:4:1
      ds-4/2/0:4:1:1
      ds-4/2/0:4:1:2
      ds-4/2/0:4:1:3
      ds-4/2/0:4:1:4
      ds-4/2/0:4:1:5
      ds-4/2/0:4:1:6
      ds-4/2/0:4:1:7
      ds-4/2/0:4:1:8
      ds-4/2/0:4:1:9
      ds-4/2/0:4:1:10
      ds-4/2/0:4:1:11
      ds-4/2/0:4:1:12
      ds-4/2/0:4:1:13
      ds-4/2/0:4:1:14
      ds-4/2/0:4:1:15
      ds-4/2/0:4:1:16
      ds-4/2/0:4:1:17
      ds-4/2/0:4:1:18
      ds-4/2/0:4:1:19
      ds-4/2/0:4:1:20
      ds-4/2/0:4:1:21

```

	Admin	Link
coc12-4/2/0	up	up
so-4/2/0:1	up	up
t3-4/2/0:2	up	up
ct3-4/2/0:3	up	up
t1-4/2/0:3:1	up	up
t1-4/2/0:3:2	up	up
t1-4/2/0:3:3	up	up
t1-4/2/0:3:4	up	up
t1-4/2/0:3:5	up	up
t1-4/2/0:3:6	up	up
t1-4/2/0:3:7	up	up
t1-4/2/0:3:8	up	up
t1-4/2/0:3:9	up	up
t1-4/2/0:3:10	up	up
t1-4/2/0:3:11	up	up
t1-4/2/0:3:12	up	up
t1-4/2/0:3:13	up	up
t1-4/2/0:3:14	up	up
t1-4/2/0:3:15	up	up
t1-4/2/0:3:16	up	up
t1-4/2/0:3:17	up	up
t1-4/2/0:3:18	up	up
t1-4/2/0:3:19	up	up
t1-4/2/0:3:20	up	up
t1-4/2/0:3:21	up	up
t1-4/2/0:3:22	up	up
t1-4/2/0:3:23	up	up
t1-4/2/0:3:24	up	up
t1-4/2/0:3:25	up	up
t1-4/2/0:3:26	up	up
t1-4/2/0:3:27	up	up
t1-4/2/0:3:28	up	up
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 sections provide sample **show interfaces** output for each of the major interface types configured in this example:

- Channelized OC12 on page 35
- SONET OC3 on page 36
- T3 on page 37
- Channelized T3 on page 39
- Channelized OC1 on page 41
- Channelized T1 on page 43
- T1 on page 44
- DS0 on page 46

## 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, mpls: 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 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 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
CES 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.lU'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    /lBS!E]HtZ]e.>ge
e7 f2 94 71 f1 d7 d7 86 98 83 d5 e2 ec 67 1d db    gr.qqWw...Ub1g.[
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&gt; 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		
ES	1		
SES	2		
SEFS	2		
BES	0		
UAS	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, mpls: 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
ES           17
SES          34
SEFS         34
BES          0
UAS          14
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

```

**DS0**

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
```

**Related Topics** ■ [Channelized IQ Interfaces Solutions Page](#)

- Roadmap for Channelized IQ Interface Configuration Examples on page 20
- Roadmap for Configuring Channelized IQ Interfaces on page 11

### Example: Converting a Channelized OC12 IQ PIC to a Channelized STM4 IQ Interface

The JUNOS software allows you to convert a Channelized OC12 IQ PIC into a channelized STM4 IQ interface. The conversion process enables the Channelized OC12 IQ PIC to interconnect with European SDH telecommunications equipment at the STM4 and STM1 levels, then channelize the data into North American T3, T1, and NxDS0 interfaces. To place the Channelized OC12 IQ PIC in SDH mode, include the `sdh` option at the `[edit chassis fpc slot-number pic pic-number framing]` hierarchy level.

### Figure 3: Channelized OC12 IQ Interface in SDH Mode Example

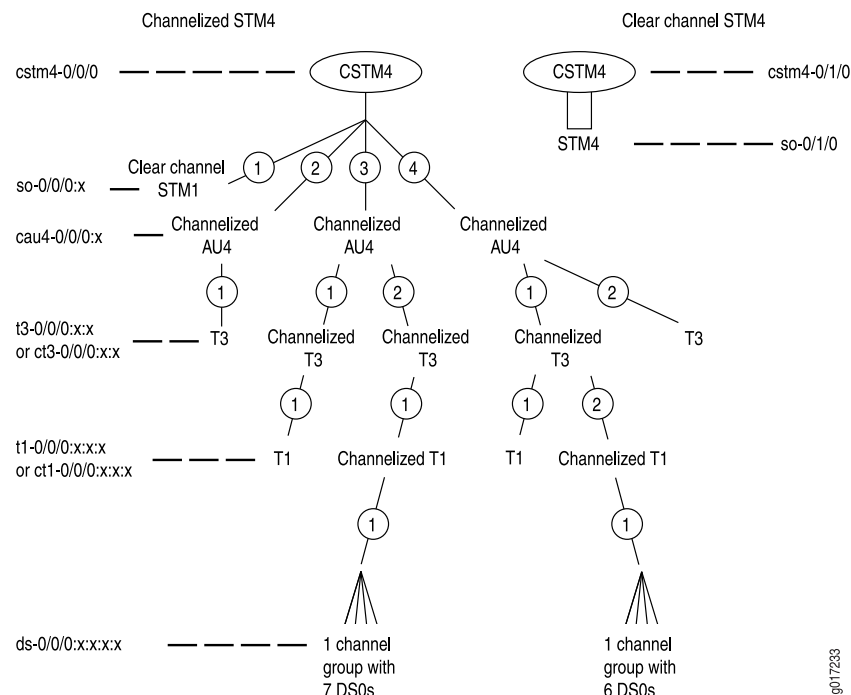


Figure 3 on page 47 and the following configuration example show how the converted channelized STM4 IQ interface can be turned into a clear channel STM4 (VC4-4c) SDH interface, or further subdivided into STM1 (VC4) interfaces and channelized administrative unit 4 (CAU4) interfaces, T3 and channelized T3 interfaces, T1 and channelized T1 interfaces, and NxDS0 channels.

```

Router A      [edit]
              chassis {
                fpc 0 {
                  pic 0 {
                    framing sdh; # Converts the Channelized OC12 IQ PIC

```

```

    } # into a channelized STM4 SDH interface.
  }
}
interfaces {
  cstm4-0/0/0 {
    partition 1 oc-slice 1-3 interface-type so; # Creates an STM1 SDH interface.
    partition 2 oc-slice 4-6 interface-type cau4; # Partitions 2, 3, and 4 create
    partition 3 oc-slice 7-9 interface-type cau4; # three channelized AU4 channels.
    partition 4 oc-slice 10-12 interface-type cau4;
  }
  so-0/0/0:1 { # A clear channel STM1 SDH (VC4) interface.
    encapsulation frame-relay;
    unit 0 {
      dlci 16;
      family inet {
        address 10.0.0.1/30;
      }
      family inet6 {
        address abcd::10.0.0.1/126;
      }
    }
  }
  cau4-0/0/0:2 {
    partition 1 interface-type t3; # Creates a T3 interface from the
    } # channelized AU4 interface.
  t3-0/0/0:2:1 {
    encapsulation frame-relay;
    unit 0 {
      dlci 16;
      family inet {
        address 10.0.0.5/30;
      }
      family inet6 {
        address abcd::10.0.0.5/126;
      }
    }
  }
  cau4-0/0/0:3 {
    partition 1 interface-type ct3; # Creates channelized T3 interfaces from the
    partition 2 interface-type ct3; # second channelized AU4.
  }
  ct3-0/0/0:3:1 {
    partition 1 interface-type t1; # Creates a T1 interface from the channelized T3.
  }
  t1-0/0/0:3:1:1 {
    encapsulation frame-relay;
    unit 0 {
      dlci 16;
      family inet {
        address 10.0.0.9/30;
      }
      family inet6 {
        address abcd::10.0.0.9/126;
      }
    }
  }
}

```

```

ct3-0/0/0:3:2 {
    partition 1 interface-type ct1; # Creates a channelized T1 interface
}
    # from the channelized T3.
ct1-0/0/0:3:2:1 {
    partition 1 timeslots 1,3-7,24 interface-type ds; # Creates an NxDS0 channel
}
    # group with seven time slots.
ds-0/0/0:3:2:1:1 {
    encapsulation frame-relay;
    unit 0 {
        dlci 16;
        family inet {
            address 10.0.0.13/30;
        }
        family inet6 {
            address abcd::10.0.0.13/126;
        }
    }
}
}
cau4-0/0/0:4 {
    partition 2 interface-type t3; # Creates a T3 interface.
    partition 1 interface-type ct3; # Creates a channelized T3 interface
}
    # from the channelized AU4.
ct3-0/0/0:4:1 {
    partition 1 interface-type t1; # Creates a T1 interface.
    partition 2 interface-type ct1; # Creates a channelized T1 interface
}
    # from the channelized T3.
t1-0/0/0:4:1:1 {
    encapsulation frame-relay;
    unit 0 {
        dlci 16;
        family inet {
            address 10.0.0.21/30;
        }
        family inet6 {
            address abcd::10.0.0.21/126;
        }
    }
}
}
ct1-0/0/0:4:1:2 {
    partition 1 timeslots 6,8-11,7 interface-type ds; # Creates an NxDS0 channel
}
    # group with six time slots.
ds-0/0/0:4:1:2:1 {
    encapsulation frame-relay;
    unit 0 {
        dlci 16;
        family inet {
            address 10.0.0.25/30;
        }
        family inet6 {
            address abcd::10.0.0.25/126;
        }
    }
}
}
t3-0/0/0:4:2 {
    encapsulation frame-relay;
    unit 0 {

```

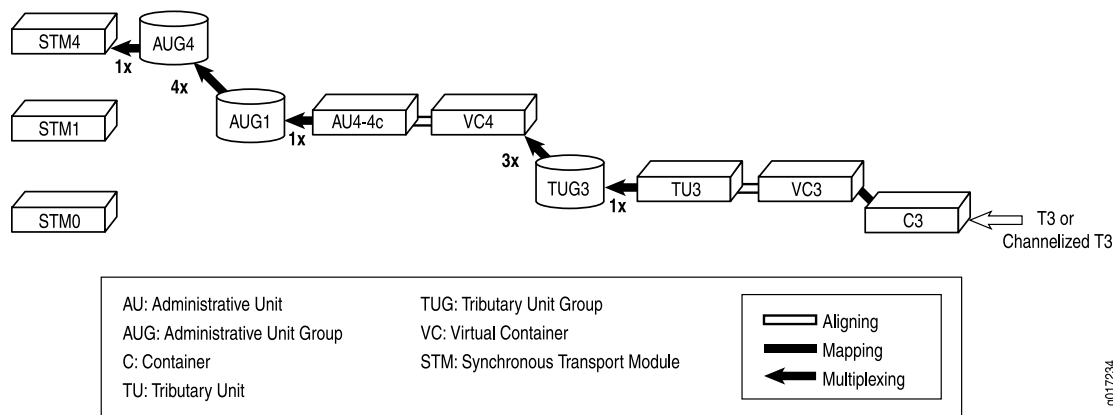
```

dlsi 16;
family inet {
    address 10.0.0.17/30;
}
family inet6 {
    address abcd::10.0.0.17/126;
}
}
}
}
cstm4-0/1/0 {
    no-partition interface-type so; # Creates a clear channel SDH STM4 interface.
}
so-0/1/0 { # This is the clear channel SDH STM4 (VC4-4c) interface so-0/1/0.
    unit 0 {
        family inet {
            address 10.22.22.1/30;
        }
    }
}
}
}

```

Figure 4 on page 50 shows a visual representation of the T3/channelized T3-to-STM4 SDH mapping method used by the JUNOS software for channelized OC12 IQ interfaces configured in SDH mode.

**Figure 4: Converted Channelized OC12 IQ Interface SDH Mapping Method**



## Verifying Your Configuration

To verify correct operation of a Channelized OC12 IQ PIC converted to a channelized STM4 IQ interface, use the following commands:

- `show interfaces`
- `show interfaces controller`

To view the interface names of the physical channelized STM4 IQ interface and the resulting interfaces configured on the channelized IQ interface, use the **show interfaces controller** and **show interfaces terse** commands:

```
user@host> show interfaces controller cstm4-0/0/0
```

Controller	Admin	Link
cstm4-0/0/0	up	up
so-0/0/0:1	up	up
cau4-0/0/0:2	up	up
t3-0/0/0:2:1	up	up
cau4-0/0/0:3	up	up
ct3-0/0/0:3:1	up	up
t1-0/0/0:3:1:1	up	up
ct3-0/0/0:3:2	up	up
ct1-0/0/0:3:2:1	up	up
ds-0/0/0:3:2:1:1	up	up
cau4-0/0/0:4	up	up
ct3-0/0/0:4:1	up	up
t1-0/0/0:4:1:1	up	up
ct1-0/0/0:4:1:2	up	up
ds-0/0/0:4:1:2:1	up	up
t3-0/0/0:4:2	up	up

```
user@host> show interfaces terse *-0/0/0*
```

Interface	Admin	Link	Proto	Local	Remote
cstm4-0/0/0	up	up			
so-0/0/0:1	up	up			
so-0/0/0:1.0	up	up	inet inet6	10.0.0.1/30 abcd::a00:1/126 fe80::2a0:a5ff:fe5c:15a6/64	
cau4-0/0/0:2	up	up			
t3-0/0/0:2:1	up	up			
t3-0/0/0:2:1.0	up	up	inet inet6	10.0.0.5/30 abcd::a00:5/126 fe80::2a0:a5ff:fe5c:15a6/64	
cau4-0/0/0:3	up	up			
ct3-0/0/0:3:1	up	up			
t1-0/0/0:3:1:1	up	up			
t1-0/0/0:3:1:1.0	up	up	inet inet6	10.0.0.9/30 abcd::a00:9/126 fe80::2a0:a5ff:fe5c:15a6/64	
ct3-0/0/0:3:2	up	up			
ct1-0/0/0:3:2:1	up	up			
ds-0/0/0:3:2:1:1	up	up			
ds-0/0/0:3:2:1:1.0	up	up	inet inet6	10.0.0.13/30 abcd::a00:d/126 fe80::2a0:a5ff:fe5c:15a6/64	
cau4-0/0/0:4	up	up			
ct3-0/0/0:4:1	up	up			
t1-0/0/0:4:1:1	up	up			
t1-0/0/0:4:1:1.0	up	up	inet inet6	10.0.0.21/30 abcd::a00:15/126 fe80::2a0:a5ff:fe5c:15a6/64	
ct1-0/0/0:4:1:2	up	up			
ds-0/0/0:4:1:2:1	up	up			
ds-0/0/0:4:1:2:1.0	up	up	inet inet6	10.0.0.25/30 abcd::a00:19/126	

```

t3-0/0/0:4:2          up    up    fe80::2a0:a5ff:fe5c:15a6/64
t3-0/0/0:4:2.0        up    up    inet  10.0.0.17/30
                        up    up    inet6  abcd::a00:11/126
                                         fe80::2a0:a5ff:fe5c:15a6/64

```

- Related Topics**
- Channelized IQ Interfaces Solutions Page
  - Roadmap for Channelized IQ Interface Configuration Examples on page 20
  - Roadmap for Configuring Channelized IQ Interfaces on page 11

## Example: Channelized OC3 IQ Interface Configuration

**Figure 5: Channelized OC3 IQ Interface Example**

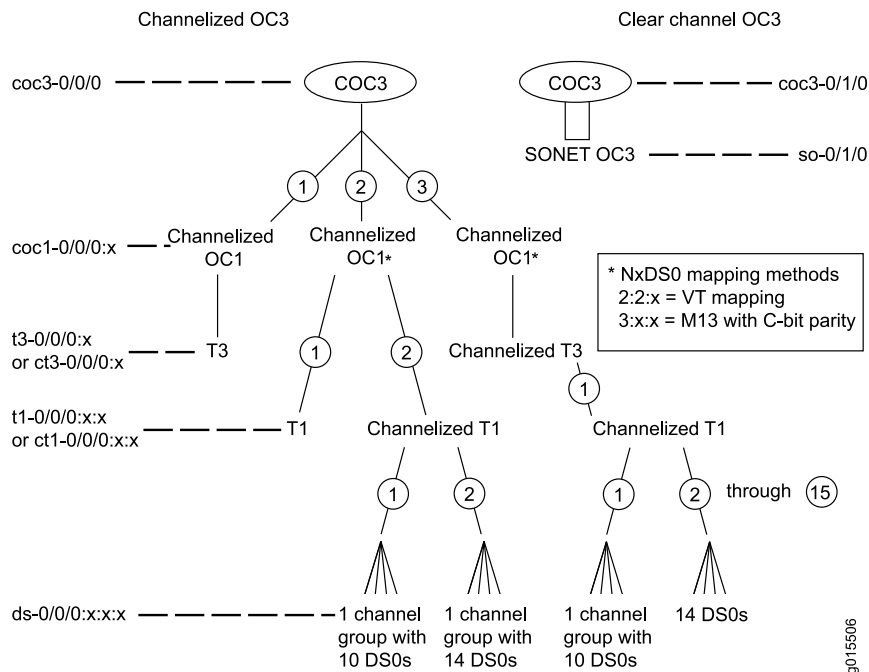


Figure 5 on page 52 shows a sample channelization structure for a channelized OC3 IQ interface. Top-level partitions 1, 2, and 3 create channelized OC1 interfaces. The first channelized OC1 interface, `coc1-0/0/0:1`, is converted directly into the T3 interface `t3-0/0/0:1`. The second channelized OC1 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 three 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 { # 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;
    }
}
coc3-0/1/0 {
    no-partition interface-type so; # Creates a clear channel SONET OC3 interface.
}
so-0/1/0 { # This is the clear channel SONET OC3 interface so-0/1/0.
    dce;
    encapsulation frame-relay;
    unit 1 {
        dlci 11;
        family inet {
            address 10.22.22.1/30;
        }
    }
}
}

```

## Verifying Your Work

To verify correct operation of a channelized OC3 IQ interface, use the following commands:

- `show interfaces`
- `show interfaces controller`
- `show interfaces interval` (for channelized OC3, OC3, T3, channelized T3, T1, and channelized T1 channels)

To view the interface names of the physical channelized OC3 IQ interface and the resulting interfaces configured on the channelized IQ interface, use the `show interfaces controller` command:

```

user@host> show interfaces controller coc3-0/0/0
Controller
coc3-0/0/0
coc1-0/0/0:1
t3-0/0/0:1
coc1-0/0/0:2
t1-0/0/0:2:1
ct1-0/0/0:2:2
ds-0/0/0:2:2:1
ds-0/0/0:2:2:2
coc1-0/0/0:3
ct3-0/0/0:3
ct1-0/0/0:3:1
ds-0/0/0:3:1:1
ds-0/0/0:3:1:2
ds-0/0/0:3:1:3
ds-0/0/0:3:1:4
ds-0/0/0:3:1:5
ds-0/0/0:3:1:6
ds-0/0/0:3:1:7
ds-0/0/0:3:1:8

```

Admin	Link
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up

ds-0/0/0:3:1:9	up	up
ds-0/0/0:3:1:10	up	up
ds-0/0/0:3:1:11	up	up
ds-0/0/0:3:1:12	up	up
ds-0/0/0:3:1:13	up	up
ds-0/0/0:3:1:14	up	up
ds-0/0/0:3:1:15	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, **ct3-0/0/0:3**) as an option with the **show interfaces** command.

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

- Channelized OC3 on page 56
- Channelized OC1 on page 56
- T3 on page 57
- Channelized T3 on page 57
- T1 on page 57
- Channelized T1 on page 58
- NxDS0 on page 58
- Clear Channel SONET OC3 on page 59

## 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

```

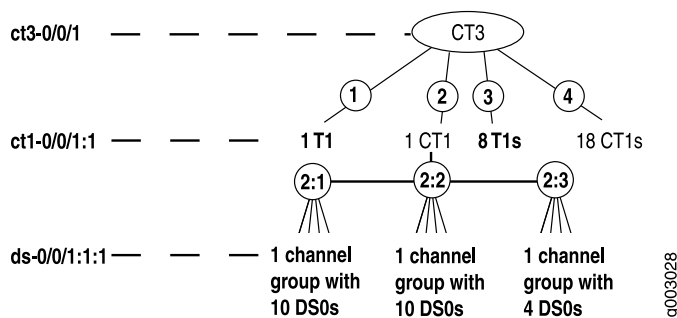
user@host> show interfaces so-0/1/0
Physical interface: so-0/1/0, Enabled, Physical link is Down
Interface index: 128, SNMP ifIndex: 15684
Link-level type: Cisco-HDLC, MTU: 4474, Clocking: Internal, SONET mode, Speed:
OC3, Loopback: None, FCS: 16,
Payload scrambler: Enabled
Parent: coc3-0/1/0 Interface 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

```

- Related Topics**
- Channelized IQ Interfaces Solutions Page
  - Roadmap for Channelized IQ Interface Configuration Examples on page 20
  - Roadmap for Configuring Channelized IQ Interfaces on page 11

## Example: Channelized DS3 IQ Interface Configuration

**Figure 6: Channelized DS3 IQ Interface Example**



This example shows how to configure a channelized DS3 IQ interface. Figure 6 on page 59 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 25). This method breaks the channelized DS3 IQ interface into channelized T1s before additional splits create DS0 time slots.

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 NxDS0s.
    unit 0 {
      family inet {
        address 10.25.1.2/24;
      }
    }
  }
  ds-0/0/1:2:2 { # This channel group contains 10 NxDS0s.
    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 {
    ...
}
}
}

```

## Verifying 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
ct3-0/0/1
# This is the physical channelized DS3 (channelized T3) IQ interface.
  t1-0/0/1:1
# Channel 1 is a channelized T1 interface.
  ct1-0/0/1:2
    ds-0/0/1:2:1
    ds-0/0/1:2:2
    ds-0/0/1:2:3
  t1-0/0/1:3
  t1-0/0/1:4
  t1-0/0/1:5
  t1-0/0/1:6
  t1-0/0/1:7
  t1-0/0/1:8
  t1-0/0/1:9

```

Admin	Link
up	up
up	up
up	up
up	up
up	down
up	up
up	up
up	up
up	up
up	up

```

    t1-0/0/1:10                                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` 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
CES                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` 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
ES                 355
SES                355
SEFS               355
BES                0
UAS                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` option with the `show interfaces` command. In this case, the speed is 640 Kbps because this channel contains 10 DS0s (64 x 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:

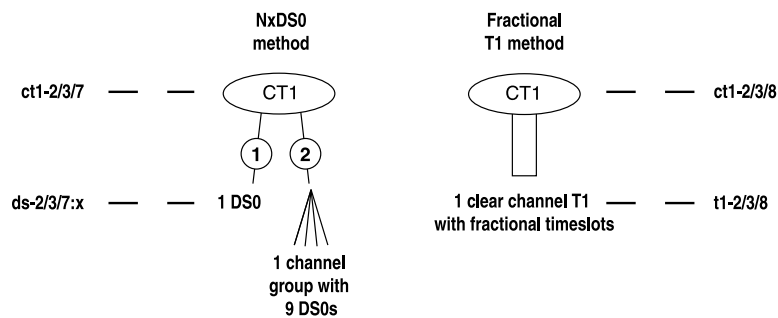
Destination slot: 0, PLP byte: 4 (0x10)

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

- Related Topics**
- Channelized IQ Interfaces Solutions Page
  - Roadmap for Channelized IQ Interface Configuration Examples on page 20
  - Roadmap for Configuring Channelized IQ Interfaces on page 11

## Example: Channelized T1 IQ Interface Configuration

**Figure 7: Channelized T1 IQ Interface Example**



The following example shows two ways to configure a channelized T1 IQ interface. Figure 7 on page 65 shows a fractional T1 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 25). The NxDS0 method breaks the channelized T1 IQ interface into discrete DS0 blocks, whereas the fractional method creates a clear channel T1 that is segmented by time slots.

To configure NxDS0 channels, include the `partition` statement at the `[edit interfaces ct1-fpc/pic/port]` hierarchy level. Include the `timeslots` and `interface-type ds` options to create the desired number of NxDS0 interfaces in time slots 1 through 24.

To configure a clear channel T1 on a channelized T1 IQ interface, include the `no-partition` statement with the `interface-type t1` option at the `[edit interfaces ct1-fpc/pic/port]` hierarchy level. After you commit this configuration, you can create

a fractional T1 on the clear channel T1 interface. To do so, include the **timeslots** statement at the **[edit interfaces t1-fpc/pic/port t1-options]** hierarchy level and specify the number of DS0 blocks to be allowed in the fractional T1 interface. The minimum number of 64-Kbps DS0 blocks you can configure is 1 and the maximum is 24.

Usually, you configure loopback statements at the controller level for all IQ-based channelized interfaces. One exception for channelized T1 IQ interfaces is that you must configure a payload loopback on a T1 IQ interface instead of the controller-level channelized T1 IQ interface. To configure, include the **payload** option at the **[edit interfaces t1-fpc/pic/port t1-options loopback]** hierarchy level.

**Router A—NxDS0  
Method**

```
[edit]
interfaces {
  ct1-2/3/7 {
    partition 1 timeslots 10 interface-type ds; # Creates NxDS0 channel ds-2/3/7:1.
    partition 2 timeslots 1-9 interface-type ds; # Creates a channel group with
  }          # 9 NxDS0s.
  ds-2/3/7:1 {
    unit 0 {
      family inet {
        address 10.25.1.2/24;
      }
    }
  }
  ds-2/3/7:2 {
    unit 0 {
      family inet {
        address 10.25.2.2/24;
      }
    }
  }
}
```

**Router A—Fractional T1  
Method**

```
[edit]
interfaces {
  ct1-2/3/8 {
    no-partition interface-type t1; # This creates a single T1 channel: t1-2/3/8.
  }
  t1-2/3/8 {
    t1-options {
      timeslots 1-2; # This statement enables only 2 of the 24 NxDS0 time slots
    }          # available on t1-2/3/8.
    unit 0 {
      family inet {
        address 10.255.126.2/24;
      }
    }
  }
}
```

## Verifying Your Work

To verify correct operation of a channelized T1 IQ interface, use the following commands:

- `show interfaces`
- `show interfaces controller`

To view the interface names of the physical channelized T1 IQ interface and the resulting interfaces configured on the channelized IQ interface, use the `show interfaces controller` command:

```
user@RouterA> show interfaces controller ct1-2/3/7
Controller
ct1-2/3/7
    ds-2/3/7:1
    ds-2/3/7:2
# ct1-2/3/7 is the physical channelized T1 IQ interface, and ds-2/3/7:1 and
ds-2/3/7:2 are the resulting N xDS0 interfaces.
user@RouterA> show interfaces controller ct1-2/3/8
Controller
ct1-2/3/8
t1-2/3/8
# ct1-2/3/8 is the physical channelized T1 IQ interface, and t1-2/3/8 is the
resulting T1 interface.
```

To view information about the physical channelized interface, include the `ct1-fpc/pic/port` option with the `show interfaces` command:

```
user@RouterA> show interfaces ct1-2/3/7
Physical interface: ct1-2/3/7, Enabled, Physical link is Up
  Interface index: 18, SNMP ifIndex: 1128, Generation: 27
  Link-level type: Controller, Clocking: Internal, Speed: T1,
  Loopback: None, Framing: ESF, Parent: None
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps 16384
  Link flags     : None
  Hold-times    : Up 0 ms, Down 0 ms
  CoS queues    : 4 supported
  Last flapped  : 2005-08-01 18:00:12 PDT (1d 00:31 ago)
  Input rate    : 0 bps (0 pps)
  Output rate   : 0 bps (0 pps)
  Statistics last cleared: Never
  DS1 alarms   : None
  DS1 defects  : None
  Line encoding: B8ZS
user@RouterA> show interfaces ct1-2/3/8
Physical interface: ct1-2/3/8, Enabled, Physical link is Up
  Interface index: 25, SNMP ifIndex: 1134, Generation: 28
  Link-level type: Controller, Clocking: Internal, Speed: T1,
  Loopback: None, Framing: ESF, Parent: None
  FCS: 16, Framing: G704, Parent: None
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps 16384
  Link flags     : None
  Hold-times    : Up 0 ms, Down 0 ms
  CoS queues    : 4 supported
```

```

Last flapped   : 2005-08-01 18:00:11 PDT (1d 00:30 ago)
Input rate     : 0 bps (0 pps)
Output rate    : 0 bps (0 pps)
Statistics last cleared: Never
DS1 alarms     : None
DS1 defects    : None
Line encoding   : B8ZS

```

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

```
user@RouterA> show interfaces ds-2/3/7:1 detail
```

```

Physical interface: ds-2/3/7:1, 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: ct1-2/3/7 Interface index 18
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps 16384
  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
  CoS queues   : 4 supported
  Last flapped : 2005-08-03 12:30:37 PDT (00:10:26 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-2/3/7:1.0 (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: 10.25.1.255,
      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 a T1 or fractional T1 interface, include the `t1-fpc/pic /port` option with the `show interfaces` command. The **Speed:** field shows if the interface is a full T1(T1) or a fractional T1 (increments of 64 Kbps). In this case, `t1-2/3/8` is a fractional T1 using two 64-Kbps time slots for a total speed of 128 Kbps.

```
user@RouterA> show interfaces t1-2/3/8 detail
Physical interface: t1-2/3/8, Enabled, Physical link is Up
  Interface index: 89, SNMP ifIndex: 1278, Generation: 341
  Link-level type: PPP, MTU: 1504, Clocking: Internal, Speed: 128kbps,
  Loopback: None, FCS: 16, Parent: ct1-2/3/8 Interface index 25
  Device flags   : Present Running
  Interface flags: Point-To-Point SNMP-Traps 16384
  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
  CoS queues   : 4 supported
  Last flapped : 2005-08-03 12:30:37 PDT (01:17:36 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

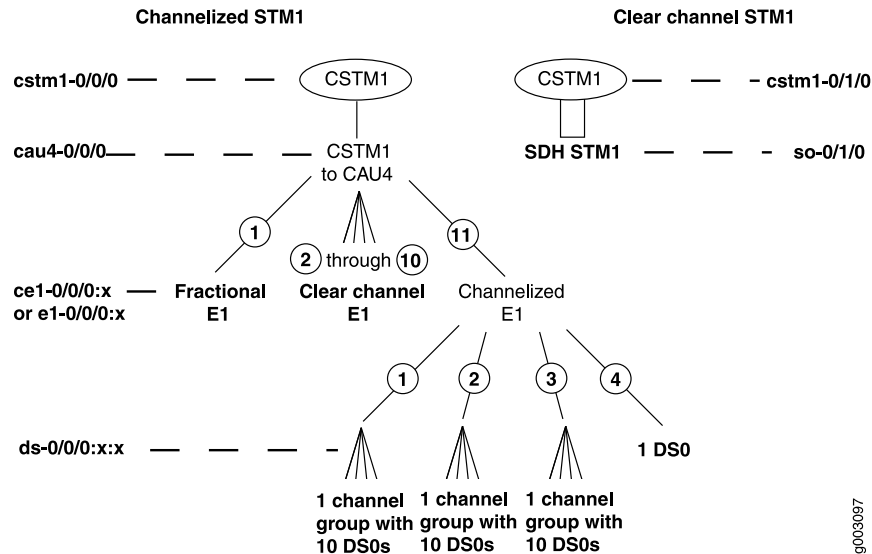
    0 best-effort          28             28             0
    1 expedited-fo         0              0             0
    2 assured-forw         0              0             0
    3 network-cont         0              0             0

  DS1  alarms   : None
  DS1  defects  : None
  Logical interface t1-2/3/8.0 (Index 52) (SNMP ifIndex 1279) (Generation 169)
    Flags: Point-To-Point SNMP-Traps Encapsulation: PPP
    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: 10.255.126.255, Generation: 525
```

- Related Topics**
- Channelized IQ Interfaces Solutions Page
  - Roadmap for Channelized IQ Interface Configuration Examples on page 20
  - Roadmap for Configuring Channelized IQ Interfaces on page 11

## Example: Channelized STM1 IQ Interface Configuration

**Figure 8: Channelized STM1 IQ Interface Example**



This example shows how to configure a channelized STM1 IQ interface on M-series or T-series routing platforms. Figure 8 on page 70 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 time slots.

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 NxDS0 channels. To create the desired number of NxDS0 channels, include the `partition` statement with the `timeslots` and `interface-type ds` options at the `[edit interfaces ce1-fpc/pic/port:channel]` hierarchy level. Time slot 1 is reserved in an NxDS0-based channelized E1 channel, so you can use time slots 2 through 32. To create an NxDS0 channel group, include a range of time slots 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. Time slot 1 is reserved in a fractional E1 channel, so you can use time slots 2 through 32.

In the second interface shown in Figure 8 on page 70, 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 time slots on an E1 channel makes 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 2-11 interface-type ds; # These statements
    partition 2 timeslots 12-21 interface-type ds; # create channel groups.
    partition 3 timeslots 22-31 interface-type ds;
  }
}
```

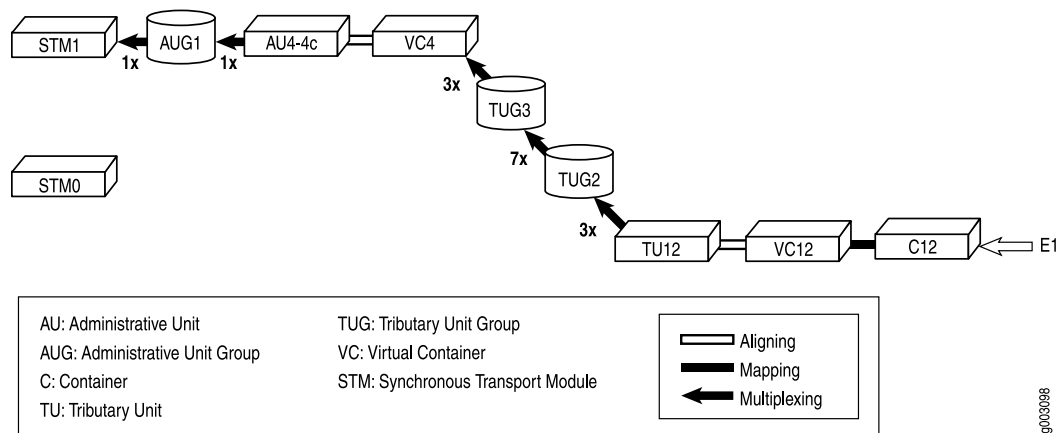
```

    partition 4 timeslots 32 interface-type ds; # This statement creates a single
    NXDS0 channel.
}
ds-0/0/0:11:1 { # This channel group contains 10 DS0s.
    unit 0 {
        family inet {
            address 10.134.1.1/30;
        }
    }
}
ds-0/0/0:11:2 { # This channel group contains 10 DS0s.
    unit 0 {
        family inet {
            address 10.134.2.1/30;
        }
    }
}
ds-0/0/0:11:3 { # This channel group contains 10 DS0s.
    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 DS0 interface.
    unit 0 {
        family inet {
            address 10.134.4.1/30;
        }
    }
}
}
}

```

Figure 9 on page 72 shows a visual representation of the E1-to-STM1 SDH mapping method used by Juniper Networks in its channelized STM1 IQ interface.

**Figure 9: Channelized STM1 IQ Interface SDH Mapping Method**



## Verifying Your Work

To verify correct operation of a channelized STM1 IQ interface, use the following commands:

- `show interfaces`
- `show interfaces controller`
- `show interfaces interval` (for channelized STM1, E1, and channelized E1 channels)

To view the interface names of the physical channelized STM1 IQ interface and the channels configured on this interface, use the `show interfaces controller` command:

```
user@router> show interfaces controller cstm1-0/0/0
Controller
cstm1-0/0/0
cau4-0/0/0
  e1-0/0/0:1
  e1-0/0/0:2
  e1-0/0/0:3
  e1-0/0/0:4
  e1-0/0/0:5
  e1-0/0/0:6
  e1-0/0/0:7
  e1-0/0/0:8
  e1-0/0/0:9
  e1-0/0/0:10
  ce1-0/0/0:11
    ds-0/0/0:11:1
    ds-0/0/0:11:2
    ds-0/0/0:11:3
    ds-0/0/0:11:4
```

Admin	Link
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up
up	up

To view information about the physical channelized interface, include the `cstm1-fpc/pic/port` 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` 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` 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 time slots, 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* 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* 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 x 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)
  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-0/0/0:11:1.0 (Index 77) (SNMP ifIndex 290)
  Flags: Hardware-Down Point-To-Point SNMP-Traps Encapsulation: PPP
  Bandwidth: 0

```

```

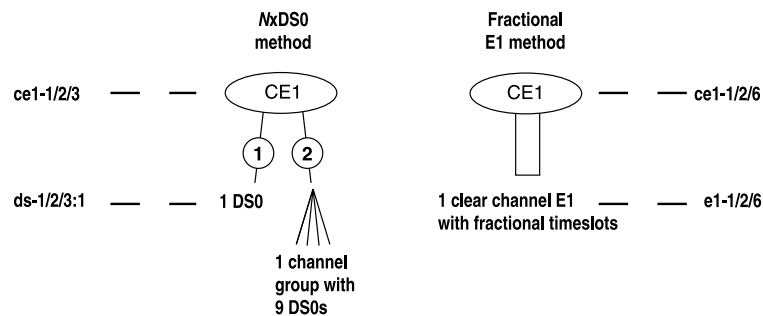
Protocol inet, MTU: 1500
Flags: Protocol-Down
Addresses, Flags: Dest-route-down Is-Preferred Is-Primary
Destination: 10.134.1.0/30, Local: 10.134.1.1
user@router> show interfaces ds-0/0/0:11:4
Physical interface: ds-0/0/0:11:4, Enabled, Physical link is Up
Interface index: 173, SNMP ifIndex: 295
Link-level 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, mpls:
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

```

- Related Topics**
- Channelized IQ Interfaces Solutions Page
  - Roadmap for Channelized IQ Interface Configuration Examples on page 20
  - Roadmap for Configuring Channelized IQ Interfaces on page 11

## Example: Channelized E1 IQ Interface Configuration

**Figure 10: Channelized E1 IQ Interface Example**



g003029



This example shows two ways to configure a channelized E1 IQ interface. Figure 10 on page 76 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 25). The NxDS0 method breaks the channelized E1 IQ interface into discrete DS0 blocks, whereas the fractional method creates a clear channel E1 that is segmented by time slots.

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 time slots 2 through 32.

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. Time slot 1 is reserved; use time slots 2 through 32.

**Router A—NxDS0  
Method**

```
[edit]
interfaces {
  ce1-1/2/3 {
    partition 1 timeslots 11 interface-type ds; # Creates NxDS0 channel ds-1/2/3:1.
    partition 2 timeslots 2-10 interface-type ds; # Creates a channel group with
    }                                     # 9 NxDS0s.
    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 E1  
Method**

```
[edit]
interfaces {
  ce1-1/2/6 {
    no-partition interface-type e1; # 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 NxDS0 time slots
    }               # available on e1-1/2/6. You can use time slots 2 through 32.
    unit 0 {
      family inet {
        address 10.255.126.2/24;
      }
    }
  }
}
```

## Verifying 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
ce1-1/2/3
# This is the physical channelized E1 IQ interface.
    ds-1/2/3:1
    ds-1/2/3:2
# These are the resulting N xDS0 interfaces.
user@RouterA> show interfaces controller ce1-1/2/6
Controller
ce1-1/2/6
# This is the physical channelized E1 IQ interface.
e1-1/2/6
# This is the resulting E1 interface.
```

	Admin	Link
	up	up
	up	up
	up	up

To view information about the physical channelized interface, include the `ce1-fpc/pic/port` 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* 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, mppls: 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* 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, mpls:
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

```

- Related Topics**
- Channelized IQ Interfaces Solutions Page
  - Roadmap for Channelized IQ Interface Configuration Examples on page 20
  - Roadmap for Configuring Channelized IQ Interfaces on page 11

## 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 59.)

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 **shaping-rate** statements at the [edit class-of-service interfaces *interface-name* unit *unit-number*] hierarchy level. These statements specify which 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
  }
  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.
        shaping-rate 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.
        shaping-rate 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;
    }
}
}

```

## Verifying 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

```







## **Part 2**

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