Configuring the 2-Port and 4-Port Channelized T3 Serial SPAs

This chapter provides information about configuring the 2-Port and 4-Port Channelized T3 SPAs on the Cisco ASR 1000 Series Aggregation Services Routers. It includes the following sections:

- Configuration Tasks, page 16-1
- Verifying the Interface Configuration, page 16-16
- Configuration Examples, page 16-18

For information about managing your system images and configuration files, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide* and *Cisco IOS Configuration Fundamentals Command Reference* publications that corresponds to your Cisco IOS software release.

For more information about the commands used in this chapter, refer to the *Cisco IOS Software Releases Command Reference* for your Cisco IOS release. For more information, see the "Related Documentation" section on page -xxxiii.

Configuration Tasks

This section describes how to configure the 2-Port and 4-Port Channelized T3 Serial SPA for the Cisco ASR 1000 Series Aggregation Services Routers and includes information about verifying the configuration.

It includes the following topics:

- Required Configuration Tasks, page 16-2
- Specifying the Interface Address on a SPA, page 16-7
- Optional Configurations, page 16-8
- Saving the Configuration, page 16-16

Required Configuration Tasks

This section lists the required configuration steps to configure the 2-Port and 4-Port Channelized T3 SPA. Some of the required configuration commands implement default values that might be appropriate for your network.

- Configuring the T3 Controller, page 16-2
- Configuring the Logical T1 Interfaces, page 16-3
- Verifying T3 Controller Configuration, page 16-5
- Verifying Interface Configuration, page 16-6

Note To better understand the address format used to specify the physical location of the SIP, SPA, and interfaces, see the "Specifying the Interface Address on a SPA" section on page 16-7.

Configuring the T3 Controller

To configure the T3 controller for the 2-Port and 4-Port Channelized T3 Serial SPA, complete the following steps:

	Command	Purpose
Step 1	Router# **configure terminal**	Enters global configuration mode.
Step 2	Router(config)# **controller t3** *slot/subslot/port*	Selects the controller to configure and enters controller configuration mode. • *slot/subslot/port*—Specifies the location of the Channelized T3 SPA port. See the "Specifying the Interface Address on a SPA" section on page 16-7.
Step 3	Router(config-controller)# [**no**] **channelized**	(Optional) Specifies the channelization mode. • **channelized**—In channelized mode, the T3 link can be channelized into 28 T1s, and each T1 can be further channelized into 24 DS0s. This is the default. • **no channelized**—In the unchannelized mode, the T3 link provides a single high-speed data channel of 44210 kbps.

	Command	Purpose
Step 4	Router(config-controller)# **framing** {**auto-detect** | **c-bit** | **m23**}	(Optional) Specifies the framing type in channelized mode. • **auto-detect**—Detects the framing type at the device at the end of the line and switches to that framing type. If both devices are set to auto-detect, c-bit framing is used. • **c-bit**—Specifies c-bit parity framing. This is the default. • **m23**—Specifies M23 framing. **Note** To set the framing type for an unchannelized T3, see the "Configuring T3 Framing" section on page 16-13.
Step 5	Router(config-controller)# **clock source** {**internal** | **line**}	(Optional) Specifies the clock source. • **internal**—Specifies that the internal clock source is used. Default for channelized mode. • **line**—Specifies that the network clock source is used. Default for unchannelized mode.
Step 6	Router(config-controller)# **cablelength** {*0 - 450*}	(Optional) Specifies the cable length. • *0-450*—Cable length in feet. The default is 224 ft.

Configuring the Logical T1 Interfaces

If channelized mode is configured for the T3 controller, use the following procedure to configure the logical T1 interfaces:

	Command	Purpose
Step 1	Router# **configure terminal**	Enters global configuration mode.
Step 2	Router(config)# **controller t3** *slot/subslot/port*	Selects the controller to configure and enters controller configuration mode. • *slot/subslot/port*—Specifies the location of the Channelized T3 SPA port. See the "Specifying the Interface Address on a SPA" section on page 16-7.

	Command	Purpose
Step 3	Router(config-controller)# **t1** *t1-number* **channel-group** *channel-number* **timeslots** *range* [**speed** {**56** | **64**}]	Specifies the T1 channel and time slots to be mapped to each channel. • *t1-number*—T1 number from 1 to 28. • *channel-number*—Specifies a channel-group mapping (0 to 23) under the designated T1. • *range*—List of time slots under the channel group. Time slots assigned to this T1 can be 1–24 or a combination of subranges within 1–24. You can indicate a range using a hyphen, commas, or a combination of both. One time slot equals one DS0. • **speed**— (Optional) Specifies the speed of a time slot in kilobits per second. Valid values are 56 and 64. The default speed of 64 kbps is not mentioned in the configuration.
Step 4	Router(config-controller)# **t1** *t1-number* **framing** {**esf** | **sf** [**hdlc-idle** {**0x7e** | **0xff**}] [**mode** {**j1**}]}	(Optional) Specifies the T1 framing type using the **framing** command. • **sf**—Specifies Super Frame as the T1 frame type. **Note** If you select sf framing, you should consider disabling yellow alarm detection because the yellow alarm can be incorrectly detected with sf framing. • **esf**—Specifies Extended Super Frame as the T1 frame type. This is the default. • **hdlc-idle**—Allows you to set the idle pattern for the T1 interface to either **0x7e** (the default) or **0xff**. • **mode j1**—(Optional) Specifies the JT-G704 Japanese frame type.

	Command	Purpose
Step 5	Router(config-controller)# **t1** *channel-number* **clock source** {**internal** | **line**}	(Optional) Specifies the T1 clock source. • **internal**—Specifies that the internal clock source is used. This is the default. • **line**—Specifies that the network clock source is used.

Step 6 Configure the serial interfaces.

Note After a T1 channel is configured, it appears to the Cisco IOS software as a serial interface; therefore, all the configuration commands for a serial interface are available. However, not all commands are applicable to the T1 interface. All the encapsulation formats, such as PPP, HDLC, and Frame Relay are applicable to the configured T1. Encapsulation can be set via the serial interface configuration commands.

For detailed interface configuration information, see the *Cisco IOS Interface Configuration Guide* for your Cisco IOS software release.

Verifying T3 Controller Configuration

Use the **show controllers** command to verify the controller configuration:

```
Router# show controller t3 2/0/0
T3 2/0/0 is up.
  Hardware is SPA-2XCT3/DS0
  IO FPGA version: 2.7, HDLC Framer version: 0
  T3/T1 Framer(1) version: 2
  SUBRATE FPGA version: 1.4
  HDLC controller available FIFO buffers 4084
  Applique type is Channelized T3/T1
  No alarms detected.
  MDL transmission is disabled
FEAC code received: No code is being received
  Framing is C-BIT Parity, Line Code is B3ZS, Cablelength is 224
  Clock Source is Internal
  Equipment customer loopback
  Data in current interval (726 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation, 0 P-bit Err Secs
     0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
     0 Unavailable Secs, 0 Line Errored Secs
     0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
     0 Severely Errored Line Secs
     0 Far-End Errored Secs, 0 Far-End Severely Errored Secs
     0 CP-bit Far-end Unavailable Secs
     0 Near-end path failures, 0 Far-end path failures
     0 Far-end code violations, 0 FERF Defect Secs
     0 AIS Defect Secs, 0 LOS Defect Secs
  Data in Interval 1:
     2 Line Code Violations, 6 P-bit Coding Violation
     0 C-bit Coding Violation, 1 P-bit Err Secs
     1 P-bit Severely Err Secs, 1 Severely Err Framing Secs
     0 Unavailable Secs, 1 Line Errored Secs
     1 C-bit Errored Secs, 1 C-bit Severely Errored Secs
     0 Severely Errored Line Secs
     0 Far-End Errored Secs, 0 Far-End Severely Errored Secs
     10 CP-bit Far-end Unavailable Secs
     0 Near-end path failures, 1 Far-end path failures
     0 Far-end code violations, 10 FERF Defect Secs
```

```
     0 AIS Defect Secs, 0 LOS Defect Secs
  Total Data (last 1 15 minute intervals):
     2 Line Code Violations, 6 P-bit Coding Violation,
     0 C-bit Coding Violation, 1 P-bit Err Secs,
     1 P-bit Severely Err Secs, 1 Severely Err Framing Secs,
     0 Unavailable Secs, 1 Line Errored Secs,
     1 C-bit Errored Secs, 1 C-bit Severely Errored Secs
     0 Severely Errored Line Secs
     0 Far-End Errored Secs, 0 Far-End Severely Errored Secs
     10 CP-bit Far-end Unavailable Secs
     0 Near-end path failures, 1 Far-end path failures
     0 Far-end code violations, 10 FERF Defect Secs
     0 AIS Defect Secs, 0 LOS Defect Secs
T1 1 is down
  timeslots: 1-24
  FDL per AT&T 54016 spec.
  Transmitter is sending LOF Indication.
  Receiver is getting AIS.
  Framing is ESF, Clock Source is Internal
  Data in current interval (734 seconds elapsed):
     0 Line Code Violations, 0 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
     733 Unavail Secs, 0 Stuffed Secs
     367 Near-end path failures, 0 Far-end path failures, 0 SEF/AIS Secs
  Data in Interval 1:
     0 Line Code Violations, 0 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
     706 Unavail Secs, 0 Stuffed Secs
     353 Near-end path failures, 0 Far-end path failures, 0 SEF/AIS Secs
  Total Data (last 1 15 minute intervals):
     0 Line Code Violations,0 Path Code Violations,
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
     0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
     706 Unavail Secs, 0 Stuffed Secs
     353 Near-end path failures, 0 Far-end path failures, 0 SEF/AIS Secs
T1 2
    Not configured.
```

Verifying Interface Configuration

Use the **show interface serial** command to verify the interface configuration. The following example shows the output for the serial interface for an unchannelized T3:

```
Router# show interface serial3/0/0
Serial3/0/0 is down, line protocol is down
  Hardware is SPA-4XCT3/DS0
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicast)
     0 runts, 0 giants, 0 throttles
```

```
          0 parity
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 applique, 2 interface resets
     0 output buffer failures, 0 output buffers swapped out
     1 carrier transitions alarm present
  DSU mode 0, bandwidth 44210 Kbit, scramble 0, VC 0
```

The following example shows the output for a serial interface for the first T1 on a channelized T3:

```
Router# show interface serial2/0/1/1:0
serial2/0/1/1:0 is administratively down, line protocol is down
  Hardware is SPA-4XCT3/DS0
  MTU 1500 bytes, BW 832 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicast)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions alarm present
  VC 1: timeslot(s): 2-14, Transmitter delay 0, non-inverted data
```

Specifying the Interface Address on a SPA

SPA interface ports begin numbering with “0” from left to right. Single-port SPAs use only the port number 0. To configure or monitor SPA interfaces, you need to specify the physical location of the SIP, SPA, and interface in the CLI. The interface address format is *slot/subslot/port*, where:

- *slot*—Specifies the chassis slot number in the Cisco ASR 1000 Series Aggregation Services Routers where the SIP is installed.
- *subslot*—Specifies the slot of the SIP where the SPA is installed.
- *port*—Specifies the number of the individual interface port on a SPA.

The following example shows how to specify the first interface (0) on a SPA installed in the first subslot of a SIP (0) installed in chassis slot 2:

```
Router(config)# interface serial 2/0/0
```

This command shows a serial SPA as a representative example, however the same *slot/subslot/port* format is similarly used for other SPAs (such as ATM and POS) and other non-channelized SPAs.

For the 4-Port Channelized T3 SPA, the interface address format is *slot/subslot/port*/**t1-number:channel-group**, where:

- **t1-number**—Specifies the logical T1 number in channelized mode.
- *channel-group*—Specifies the logical channel group assigned to the time slots within the T1 link.

For more information about identifying slots and subslots, see the "Identifying Slots and Subslots for the SIPs and SPAs" section on page 4-1.

Optional Configurations

There are several standard, but optional, configurations that might be necessary to complete the configuration of your serial SPA.

- Configuring Data Service Unit Mode, page 16-8
- Configuring Maintenance Data Link, page 16-9
- Configuring Encapsulation, page 16-12
- Configuring T3 Framing, page 16-13
- Configuring FDL, page 16-14
- Configuring Scramble, page 16-15

Configuring Data Service Unit Mode

Configure the SPA to connect with customer premises Data Service Units (DSUs) by setting the DSU mode. Subrating a T3 or E3 interface reduces the peak access rate by limiting the data transfer rate. To configure the DSU mode, use the following commands:

	Command	Purpose
Step 1	Router# **configure terminal**	Enters global configuration mode.
Step 2	Router(config)# **interface serial** *slot/subslot/port*	Selects the interface to configure and enters interface configuration mode. • *slot/subslot/port*—Specifies the location of the interface. See also the "Specifying the Interface Address on a SPA" section on page 16-7.

	Command	Purpose
Step 3	Router(config-if)# **dsu mode** {**0** | **1** | **2** | **3** | **4**}	Specifies the interoperability mode used by the T3 controller. • **0**—Connects a T3 controller to another T3 controller or to a Digital Link DSU. Bandwidth range is from 300 to 44210 kbps. This is the default. • **1**—Connects a T3 controller to a Kentrox DSU. Bandwidth range is from 1500 to 35000, or 44210 kbps. **Note** If the bandwidth is set between 35000 and 44210 kbps, an error message is displayed. • **2**—Connects a T3 controller to a Larscom DSU. Bandwidth range is from 3100 to 44210 kbps. • **3**—Connects a T3 controller to an Adtran T3SU 300. Bandwidth range is from 75 to 44210 kbps. • **4**—Connects a T3 controller to a Verilink HDM 2182. Bandwidth range is from 1500 to 44210 kbps.
Step 4	Router(config-if)# **dsu bandwidth** *kbps*	Specifies the maximum allowable bandwidth. • *kbps*—Bandwidth range is from 1 to 44210 kbps.

Verifying DSU Mode

Use the **show controllers serial** command to display the DSU mode of the controller:

```
Router# show controllers serial
Serial2/1/0 -
   Framing is c-bit, Clock Source is Internal
   Bandwidth limit is 44210, DSU mode 0, Cable length is 10
   rx FEBE since last clear counter 0, since reset 0
   Data in current interval (0 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
     0 Severely Errored Line Secs
     0 Far-End Errored Secs, 0 Far-End Severely Errored Secs
     0 CP-bit Far-end Unavailable Secs
     0 Near-end path failures, 0 Far-end path failures
     0 Far-end code violations, 0 FERF Defect Secs
     0 AIS Defect Secs, 0 LOS Defect Secs
Transmitter is sending AIS.
```

Configuring Maintenance Data Link

MDL messages are used to communicate identification information between local and remote ports. The type of information included in MDL messages includes the equipment identification code (EIC), location identification code (LIC), frame identification code (FIC), unit, Path Facility Identification (PFI), port number, and Generator Identification numbers.

To configure Maintenance Data Link (MDL), use the following commands:

Command	Purpose
Router# **configure terminal**	Enters global configuration mode.
Router(config)# **controller t3** *slot/subslot/port*	Selects the controller to configure and enters controller configuration mode. • *slot/subslot/port*—Specifies the location of the controller. See also the "Specifying the Interface Address on a SPA" section on page 16-7.
Router(config-controller)# **mdl** [**string** {**eic** | **fic** | **generator** | **lic** | **pfi** | **port** | **unit**} *string*}] | [**transmit** {**idle-signal** | **path** | **test-signal**}]	Configures the MDL message. • **string eic**—Specifies the Equipment Identification Code; can be up to 10 characters. • **string fic**—Specifies the Frame Identification Code; can be up to 10 characters. • **string generator**—Specifies the Generator number string sent in the MDL Test Signal message; can be up to 38 characters. • **string lic**— Specifies the Location Identification Code; can be up to 11 characters. • **string pfi**—Specifies the Path Facility Identification Code sent in the MDL Path message; can be up to 38 characters. • **string port**—Specifies the port number string sent in the MDL Idle Signal message; can be up to 38 characters. • **string unit**—Specifies the Unit Identification Code. • *string*—Specifies the length of the Unit Identification Code, up to 6 characters. • **transmit idle-signal**—Enables MDL Idle-Signal message transmission. • **transmit path**—Enables MDL Path message transmission. • **transmit test-signal**—Enables MDL Test-Signal message transmission.

Verifying MDL

Use the **show controllers t3** command to display the MDL settings:

```
Router# show controllers t3 3/0/0
T3 3/0/0 is down. Hardware is 2 ports CT3 SPA
  ATLAS FPGA version: 0, FREEDM336 version: 0
  TEMUX84(1) version: 0, TEMUX84(1) version: 0
  SUBRATE FPGA version: 0
  Applique type is Subrate T3
  Receiver has loss of signal.
  MDL transmission is enabled
     EIC: new, LIC: US, FIC: 23, UNIT: myunit
     Path FI: test pfi
     Idle Signal PORT_NO: New-port
     Test Signal GEN_NO: test-message
  FEAC code received: No code is being received
  Framing is C-BIT Parity, Line Code is B3ZS, Clock Source is Line
  Equipment customer loopback
  Data in current interval (869 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation, 0 P-bit Err Secs
     0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
     869 Unavailable Secs, 0 Line Errored Secs
     0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
     0 Severely Errored Line Secs
     0 Far-End Errored Secs, 0 Far-End Severely Errored Secs
     869 CP-bit Far-end Unavailable Secs
     0 Near-end path failures, 0 Far-end path failures
     0 Far-end code violations, 0 FERF Defect Secs
     0 AIS Defect Secs, 870 LOS Defect Secs
```

Configuring Encapsulation

When traffic crosses a WAN link, the connection needs a Layer 2 protocol to encapsulate traffic. To set the encapsulation method, use the following commands:

Command	Purpose
Router# **configure terminal**	Enters global configuration mode.
Channelized Router(config)# **interface serial** *slot/subslot/port/t1-number:channel-group* **Unchannelized** Router(config)# **interface serial** *slot/subslot/port*	Selects the interface to configure and enters interface configuration mode. • Channelized: *slot/subslot/port/t1-number:channel-group*—Specifies the location of the interface. See also the "Specifying the Interface Address on a SPA" section on page 16-7. • Unchannelized: *slot/subslot/port*—Specifies the location of the interface. See also the "Specifying the Interface Address on a SPA" section on page 16-7.
Router(config-if)# **encapsulation** *encapsulation-type* {**hdlc** | **ppp** | **frame-relay**}	Sets the encapsulation type on the interface: • **hdlc**—High-Level Data Link Control (HDLC) protocol for serial interface. This encapsulation method provides the synchronous framing and error detection functions of HDLC without windowing or retransmission. This is the default for synchronous serial interfaces. • **ppp**—Point-to-Point Protocol (PPP) (for serial interface). • **frame-relay**—Frame Relay (for serial interface).

Verifying Encapsulation

Use the **show interfaces serial** command to display the encapsulation method:

```
Router# show interfaces serial2/0/0
Serial3/0/0 is down, line protocol is down
  Hardware is SPA-2XCT3/DS0
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
```

```
     Received 0 broadcasts (0 IP multicast)
     0 runts, 0 giants, 0 throttles 0 parity
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 applique, 2 interface resets
     0 output buffer failures, 0 output buffers swapped out
     1 carrier transitions alarm present
  DSU mode 0, bandwidth 44210 Kbit, scramble 0, VC 0
```

Configuring T3 Framing

To set the T3 framing type, use the following commands:

Command	Purpose
Router# **configure terminal**	Enters global configuration mode.
Router(config)# **interface serial** *slot/subslot/port*	Selects the interface to configure and enters interface configuration mode. • *slot/subslot/port*—Specifies the location of the interface. See also the "Specifying the Interface Address on a SPA" section on page 16-7.
Router(config-if)# **framing** {**c-bit** | **m13**}	Specifies the framing type in unchannelized mode. • **c-bit**—Specifies C-bit parity framing. This is the default. • **m13**—Specifies DS3 Framing M13 (same as M23).

Verifying Framing

Use the **show controller** command to display the framing type:

```
Router# show controller t3 3/0/0
T3 3/0/0 is down.  Hardware is 2 ports CT3 SPA
  ATLAS FPGA version: 0, FREEDM336 version: 0
  TEMUX84(1) version: 0, TEMUX84(1) version: 0
  SUBRATE FPGA version: 0
  Applique type is Subrate T3
  Receiver has loss of signal.
  Framing is M13, Line Code is B3ZS, Clock Source is Line
  Equipment customer loopback
  Data in current interval (656 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation, 0 P-bit Err Secs
     0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
     666 Unavailable Secs, 0 Line Errored Secs
     0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
     0 Severely Errored Line Secs
     0 Far-End Errored Secs, 0 Far-End Severely Errored Secs
     0 CP-bit Far-end Unavailable Secs
     0 Near-end path failures, 0 Far-end path failures
     0 Far-end code violations, 0 FERF Defect Secs
     0 AIS Defect Secs, 666 LOS Defect Secs
```

Configuring FDL

Facility Data Link (FDL) is a far-end performance reporting tool. In ANSI mode, you can enable one-second transmissions of performance reports on both ends of the T1 connection. To configure FDL, use the following commands:

Command	Purpose
Router# **configure terminal**	Enters global configuration mode.
Router(config)# **controller t3** *slot/subslot/port*	Selects the controller to configure and enters interface configuration mode. • *slot/subslot/port*—Specifies the location of the controller. See also the "Specifying the Interface Address on a SPA" section on page 16-7.
Router(config-controller)# **t1** *number* **fdl** {**ansi**}	(Optional) Enables FDL. • *number*—Specifies the T1 channel number. • **ansi**—Specifies the FDL bit per the ANSI T1.403 specification.

Verifying FDL

Use the **show controller** command to display the FDL setting:

```
Router# show controller t3 3/0/1/1
T3 3/0/1 is down.  Hardware is 2 ports CT3 SPA
  ATLAS FPGA version: 0, FREEDM336 version: 0
  TEMUX84(1) version: 0, TEMUX84(1) version: 0
  SUBRATE FPGA version: 0
  Applique type is Channelized T3
  Receiver has loss of signal.
  Framing is M23, Line Code is B3ZS, Clock Source is Internal
  Equipment customer loopback
  Data in current interval (456 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation, 0 P-bit Err Secs
     0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
     456 Unavailable Secs, 0 Line Errored Secs
     0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
     0 Severely Errored Line Secs
     0 Far-End Errored Secs, 0 Far-End Severely Errored Secs
     0 CP-bit Far-end Unavailable Secs
     0 Near-end path failures, 0 Far-end path failures
     0 Far-end code violations, 0 FERF Defect Secs
     0 AIS Defect Secs, 456 LOS Defect Secs
T1 1 is down
  timeslots: 2-14
  FDL per ANSI T1.403 and AT&T 54016 spec.
  Configured for FDL remotely line looped (bell)
  Transmitter is sending LOF Indication.
  Receiver is getting AIS.
  Framing is ESF, Clock Source is Line
  BERT running on timeslots 2,3,4,5,6,7,8,9,10,11,12,13,14,
  BERT test result (running)
     Test Pattern : All 1's, Status : Not Sync, Sync Detected : 0
     Interval : 2 minute(s), Time Remain : 2 minute(s)
```

```
    Bit Errors (since BERT started): 0 bits,
    Bits Received (since BERT started): 0 Kbits
    Bit Errors (since last sync): 0 bits
    Bits Received (since last sync): 0 Kbits
  Data in current interval (703 seconds elapsed):
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs
    713 Unavail Secs, 0 Stuffed Secs
    357 Near-end path failures, 0 Far-end path failures, 0 SEF/AIS Secs
```

Configuring Scramble

T3 scrambling is used to assist clock recovery on the receiving end. Scrambling is designed to randomize the pattern of 1s and 0s carried in the physical layer frame. Randomizing the digital bits can prevent continuous, nonvariable bit patterns—in other words, long strings of all 1s or all 0s. Several physical layer protocols rely on transitions between 1s and 0s to maintain clocking.

Scrambling can prevent some bit patterns from being mistakenly interpreted as alarms by switches placed between the Data Service Units (DSUs).

To configure scrambling, use the following commands:

Command	Purpose
Router# **configure terminal**	Enters global configuration mode.
Router(config)# **interface serial** *slot/subslot/port*	Selects the interface to configure and enters interface configuration mode. • *slot/subslot/port*—Specifies the location of the interface. See also the "Specifying the Interface Address on a SPA" section on page 16-7.
Router(config-if)# **scramble** [**0** | **1**]	Enables scrambling. Scrambling is disabled by default. • **1**—Enabled. • **0**—Disabled.

Verifying Scramble Configuration

Use the **show interface serial** command to display the scramble setting:

```
Router# show interface serial3/0/0
Serial3/0/0 is down, line protocol is down
  Hardware is SPA-2XCT3/DS0
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
```

```
    Received 0 broadcasts (0 IP multicast)
    0 runts, 0 giants, 0 throttles
             0 parity
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    0 packets output, 0 bytes, 0 underruns
    0 output errors, 0 applique, 4 interface resets
    0 output buffer failures, 0 output buffers swapped out
    1 carrier transitions alarm present
  DSU mode 0, bandwidth 44210 Kbit, scramble 1, VC 0
```

Saving the Configuration

To save your running configuration to nonvolatile random-access memory (NVRAM), use the following command in privileged EXEC configuration mode:

Command	Purpose
Router# **copy running-config startup-config**	Writes the new configuration to NVRAM.

For information about managing your system images and configuration files, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide* and *Cisco IOS Configuration Fundamentals Command Reference* publications that corresponds to your Cisco IOS software release.

Verifying the Interface Configuration

Besides using the **show running-configuration** command to display your Cisco ASR 1000 Series Aggregation Services Routers configuration settings, you can use the **show interfaces serial** and the **show controllers serial** commands to get detailed information on a per-port basis for your 2-Port and 4-Port Channelized T3 Serial SPA.

Verifying Per-Port Interface Status

To find detailed interface information on a per-port basis for the 2-Port and 4-Port Channelized T3 Serial SPA, use the **show interfaces serial** command.

The following example provides sample output for the serial interface on an unchannelized T3:

```
Router# show interfaces serial3/0/0
Serial3/0/0 is down, line protocol is down
  Hardware is SPA-2XCT3/DS0
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicast)
     0 runts, 0 giants, 0 throttles 0 parity
```

```
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 applique, 4 interface resets
     0 output buffer failures, 0 output buffers swapped out
     1 carrier transitions alarm present
  DSU mode 0, bandwidth 44210 Kbit, scramble 1, VC 0
```

The following example provides sample output for the serial interface on a channelized T3:

```
Router# show interfaces serial2/0/1/1:0
serial2/0/1/1:0 is down, line protocol is down
  Hardware is SPA-2XCT3/DS0
  MTU 1500 bytes, BW 832 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicast)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 2 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions alarm present
  VC 1: timeslot(s): 2-14, Transmitter delay 0, non-inverted data
```

To find detailed status and statistical information on a per-port basis for the 2-Port and 4-Port Channelized T3 Serial SPA, use the **show controllers serial** command:

```
Router# show controllers serial 0/2/0
Serial0/2/0 - (SPA-4XT3/E3) is up
   Current mode is T3
Framing is c-bit, Clock Source is Line
   Bandwidth limit is 44210, DSU mode 0, Cable length is 10 feet
   rx FEBE since last clear counter 0, since reset 0
   Data in current interval (30 seconds elapsed):
     1 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 1 Unavailable Secs
     1 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
     0 Severely Errored Line Secs
     0 Far-End Errored Secs, 0 Far-End Severely Errored Secs
     10 CP-bit Far-end Unavailable Secs
     0 Near-end path failures, 0 Far-end path failures
     0 Far-end code violations, 10 FERF Defect Secs
     0 AIS Defect Secs, 0 LOS Defect Secs

   No alarms detected.

   No FEAC code is being received
   MDL transmission is disabled
```

Configuration Examples

This section includes the following configuration examples:

- DSU Configuration Example, page 16-18
- MDL Configuration Example, page 16-18
- Encapsulation Configuration Example, page 16-19
- Framing in Unchannelized Mode Configuration Example, page 16-19
- Facility Data Link Configuration Example, page 16-19
- Scrambling Configuration Example, page 16-19
- Creating a Multilink Bundle Configuration Example, page 16-20
- Assigning a T1 Interface to a Multilink Bundle Configuration Example, page 16-20

DSU Configuration Example

The following example sets the DSU mode on interface port 0 on slot 4, subslot 1:

```
! Specify the interface and enter interface configuration mode.
!
Router(config-int)# interface t3 4/1/0
!
!Specifies the interoperability mode used by the T3 interface.
!
Router(config-int)# dsu mode 2
!
!Specifies the maximum allowable bandwidth.

Router(config-int)# dsu bandwidth 23000
```

MDL Configuration Example

The following example configures the MDL strings on controller port 0 on slot 4, subslot 1:

```
! Enter controller configuration mode.
!
Router(config)# controller t3 4/1/0
!
! Specify the mdl strings.
!
Router(config-controller)# mdl string eic beic
Router(config-controller)# mdl string lic beic
Router(config-controller)# mdl string fic bfix
Router(config-controller)# mdl string unit bunit
Router(config-controller)# mdl string pfi bpfi
Router(config-controller)# mdl string port bport
Router(config-controller)# mdl string generator bgen
Router(config-controller)# mdl transmit path
Router(config-controller)# mdl transmit idle-signal
Router(config-controller)# mdl transmit test-signal
```

Encapsulation Configuration Example

The following example configures encapsulation on a channelized T1 interface:

```
! Specify the interface to configure and enter interface configuration mode.
!
Router(config)# interface serial 4/1/1/1:0
!
! Specify the encapsulation method.
!
Router(config-if)# encapsulation ppp
```

The following example configures encapsulation and framing on a unchannelized T3 interface:

```
! Specify the interface to configure and enter interface configuration mode.
!
Router(config)# interface serial 4/1/1
!
! Specify the encapsulation method.
!
Router(config-if)# encapsulation ppp
```

Framing in Unchannelized Mode Configuration Example

The following example configures framing on an unchannelized T3 interface:

```
! Specify the interface to configure and enter interface configuration mode.
!
Router(config)# interface serial 4/1/1
!
! Specify the framing type.
!
Router(config-if)# framing m13
```

Facility Data Link Configuration Example

The following example configures FDL on a channelized T1 interface:

```
! Specify the controller to configure and enter controller configuration mode.
!
Router(config)# controller t3 3/1/0
!
! Specify the T1 controller and set the FDL bit.
!
Router(config-controller)# t1 1 fdl ansi
```

Scrambling Configuration Example

The following example configures scrambling on the T3 interface:

```
! Enter global configuration mode.
!
Router# configure terminal
!
! Specify the interface to configure and enter interface configuration mode.
!
Router(config)# interface serial 4/1/3
!
```

```
! Enable scrambling.
!
Router(config-if)# scramble
```

Creating a Multilink Bundle Configuration Example

The following example configures multilink bundle 1 on the T3 interface:

```
! ! Enter global configuration mode.
!
Router# configure terminal
!
! Create a multilink interface and enter interface configuration mode.
!
Router(config)# interface multilink 1
!
! Specify the IP address for the interface.
!
Router(config-if)# ip address 123.1.1.1 255.255.255.0
!
```

Assigning a T1 Interface to a Multilink Bundle Configuration Example

The following example assigns a T1 interface to multilink group 1:

```
! ! Enter global configuration mode.
!
Router# configure terminal
!
! Specify the T1 interface and enter interface configuration mode.
!
Router(config)# interface serial 1/0/1/1:0
!
! Specify PPP encapsulation.
!
Router(config-if)# encapsulation ppp
!
! Specify the multilink bundle the T1 will belong to.
!
Router(config-if)# ppp multilink group 1
!
```