Configuring the 2-Port and 4-Port T3/E3 Clear Channel Serial SPA

This chapter provides information about configuring the 2-Port, 4-Port, and 8-Port Clear-Channel T3/E3 Serial SPAs on the Cisco ASR 1000 Series Aggregation Services Routers. It includes the following sections:

- Configuration Tasks, page 17-1
- Verifying the Interface Configuration, page 17-17
- Configuration Examples, page 17-19

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

For more information, see the "Related Documentation" section on page xxxiii.

Configuration Tasks

This section describes how to configure the 2-Port, 4-Port, and 8-Port Clear-Channel T3/E3 Serial SPAs 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 17-2
- Specifying the Interface Address on a SPA, page 17-5
- Optional Configurations, page 17-5
- Saving the Configuration, page 17-17

Required Configuration Tasks

This section lists the required configuration steps to configure the 2-Port and 4-Port T3/E3 Clear Channel Serial SPA. Some of the required configuration commands implement default values that might be appropriate for your network. If the default value is correct for your network, then you do not need to configure the command.

- Setting the Card Type, page 17-2
- Setting the IP Address, page 17-3
- Verifying Controller Configuration, page 17-3
- Verifying the Interface Configuration, page 17-4

✎ **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 17-5.

Setting the Card Type

The SPA is not functional until the card type is set. Information about the SPA is not indicated in the output of any **show** commands until the card type has been set. There is no default card type.

✎ **Note**   The **card type** command is not required to set the serial mode for the 8-Port Clear-Channel T3/E3 SPA. Therefore, this command is not supported in the 8-Port Clear-Channel T3/E3 SPA. This SPA supports both T3 and E3 configurations at the port level, which can be changed without reloading the SPA. The framing type that is configured determines whether a port is in the T3 mode or E3 mode. During first time initialization, by default, all the ports of the 8-Port Clear Channel T3/E3 SPA come up in the T3 mode and C-bit framing. For subsequent reloads, the ports come up in the modes they were configured and saved in. For more information on mixed interface types, see the "Configuring Framing" section on page 17-11.

To set the card type for the 2-Port and 4-Port T3/E3 Clear-Channel Serial SPAs, complete these steps:

	Command	Purpose
Step 1	Router# **configure terminal**	Enters global configuration mode.
Step 2	Router(config)# **card type** {**t3** | **e3**} *slot subslot*	Sets the serial mode for the SPA: • **t3**—Specifies T3 connectivity of 44210 kbps through the network, using B3ZS coding. • **e3**—Specifies a wide-area digital transmission scheme used predominantly in Europe that carries data at a rate of 34010 kbps. • *slot subslot*—Specifies the location of the SPA. See the "Specifying the Interface Address on a SPA" section on page 17-5.
Step 3	Router(config)# **exit**	Exits configuration mode and returns to the EXEC command interpreter prompt.

Setting the IP Address

To set the IP address for the 2-Port and 4-Port T3/E3 Clear Channel Serial SPA, complete these steps:

	Command	Purpose
Step 1	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 the "Specifying the Interface Address on a SPA" section on page 17-5.
Step 2	Router(config-if)# **ip address** *address mask*	Sets the IP address and subnet mask. • *address*—IP address. • *mask*—Subnet mask.
Step 3	Router(config-if)# **clock source** {**internal** | **line**}	Sets the clock source. • **internal**—Specifies that the internal clock source is used. • **line**—Specifies that the network clock source is used. This is the default.
Step 4	Router(config-if)# **no shut**	Enables the interface.
Step 5	Router(config)# **exit**	Exits interface configuration mode and returns to the EXEC command interpreter prompt.

Verifying Controller Configuration

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

```
Router# show controllers serial 2/0/0
Serial2/0/0 -
   Framing is c-bit, Clock Source is Line
   Bandwidth limit is 44210, DSU mode 0, Cable length is 10
   rx FEBE since last clear counter 2, since reset 0
   Data in current interval (546 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
  Data in Interval 1:
     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
Data in Interval 44:
     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
     560 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
   Total Data (last 44 15 minute intervals):
     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,
```

```
        24750 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs

    Transmitter is sending AIS.

    Receiver has loss of signal.

      40434 Sev Err Line Secs, 0 Far-End Err Secs, 0 Far-End Sev Err Secs
      0 P-bit Unavailable Secs, 0 CP-bit Unavailable Secs
      0 CP-bit Far-end Unavailable Secs
      0 Near-end path failures, 0 Far-end path failures

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

Use the **show controllers brief** command to view a subset of the **show controllers** output:

```
Router# show controllers serial 2/0/2 brief
Serial2/0/2 -
   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 22

   No alarms detected.

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

Verifying the Interface Configuration

Use the **show interfaces** command to verify the interface configuration:

```
Router# show interfaces serial 2/0/0
Serial2/0/0 is up, line protocol is up
  Hardware is SPA-4T3E3
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
     reliability 255/255, txload 12/255, rxload 56/255
  Encapsulation FRAME-RELAY, crc 16, loopback not set
  Keepalive set (10 sec)
  LMI enq sent  13477, LMI stat recvd 13424, LMI upd recvd 0, DTE LMI up
  LMI enq recvd 19, LMI stat sent  0, LMI upd sent  0
  LMI DLCI 1023  LMI type is CISCO  frame relay DTE
  FR SVC disabled, LAPF state down
  Broadcast queue 0/256, broadcasts sent/dropped 0/0, interface broadcasts 0
  Last input 00:00:09, output 00:00:09, output hang never
  Last clearing of "show interface" counters 1d13h
  Input queue: 0/75/3/3891 (size/max/drops/flushes); Total output drops: 5140348
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 9716000 bits/sec, 28149 packets/sec
  5 minute output rate 2121000 bits/sec, 4466 packets/sec
     14675957334 packets input, 645694448563 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
     14562482078 packets output, 640892196653 bytes, 0 underruns
     0 output errors, 0 applique, 4 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
   rxLOS inactive, rxLOF inactive, rxAIS inactive
   txAIS inactive, rxRAI inactive, txRAI inactive
Serial2/0/0.16 is up, line protocol is up
  Hardware is SPA-4T3E3
```

```
Internet address is 110.1.1.2/24
MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
   reliability 255/255, txload 11/255, rxload 53/255
Encapsulation FRAME-RELAY
```

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 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 17-5
- Configuring Maintenance Data Link, page 17-7
- Configuring Scramble, page 17-9
- Configuring Framing, page 17-11
- Configuring Encapsulation, page 17-13
- Configuring Cable Length, page 17-14
- Configuring Invert Data, page 17-15
- Configuring the Trace Trail Buffer, page 17-16
- Configuring QoS Features on Serial SPAs, page 17-17

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 and bandwidth, use the following commands:

Command	Purpose
Router# **configure terminal**	Enters global configuration mode.
Router(config)# **interface serial s**_lot/subslot/port_	Selects the interface to configure and enters interface configuration mode. • _slot/subslot/port_—Specifies the location of the interface. See the "Specifying the Interface Address on a SPA" section on page 17-5.
T3 Router(config-if)# **dsu mode** {**0** | **1** | **2** | **3** | **4**} **E3** Router(config-if)# **dsu mode** {**0** | **1**}	Specifies the interoperability mode used by a T3 controller. • **0**—Connects a T3/E3 controller to another T3/E3 controller or to a Digital Link DSU (DL3100 in T3 mode and DL3100E in E3 mode). This is the default. • **1**—Connects a T3/E3 controller to a Kentrox DataSMART T3/E3 IDSU. • **2**—Connects a T3 controller to a Larscom Access-T45 DS3 DSU. • **3**—Connects a T3 controller to an Adtran T3SU 300. • **4**—Connects a T3 controller to a Verilink HDM 2182.

Router(config-if)# **dsu bandwidth** _kbps_	Specifies the allowable bandwidth.
	
	 • _kbps_—The bandwidth range and increment values are based on the specific DSU. Default for T3 mode is 44010 kbps and 34010 kbps for E3 mode.
	
	   – Digital Link DL3100 bandwidth range is 300 to 44210 kbps.
	
	   – Digital Link DL3100E bandwidth range is 358 to 34010 kbps.
	
	   – Kentrox DataSMART T3/E3 IDSU bandwidth range is 1000 to 34000 kbps for E3 mode and 1500 to 44210 kbps for T3 mode.
	
	   – Larscom Access-T45 DS3 bandwidth range is 3100 to 44210 kbps.
	
	   – Adtran T3SU 300 bandwidth range is 80 to 44210 kbps.
	
	   – Verilink HDM 2182 bandwidth range is 1600 to 31600 kbps.

Command	Purpose
Router(config-if)# **remote** {**accept**	**fullrate**}	Specifies where the DSU bandwidth is set. • **accept**—Accepts incoming remote requests to reset the DSU bandwidth. • **fullrate**—Sets far end DSU to its fullrate bandwidth.

Verifying DSU Mode

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

```
Router# show controllers serial 2/0/0
Serial2/0/0 -
  Framing is c-bit, Clock Source is Line
  Bandwidth limit is 44210, DSU mode 0, Cable length is 10
  rx FEBE since last clear counter 2, since reset 0
  Data in current interval (546 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
  Data in Interval 1:
    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
```

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.

Note   C-bit framing must be enabled in order to transport MDL messages between source and destination T3 ports.

To configure Maintenance Data Link (MDL), 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. • *slot/subslot/port*—Specifies the location of the interface. See the "Specifying the Interface Address on a SPA" section on page 17-5.

Command	Purpose
Router(config-if)# **mdl** [**string** {**eic**	**fic**	**generator**	**lic**	**pfi**	**port**	**unit**} *string*}]	[**transmit** {**idle-signal**	**path**	**test-signal**}]	Configures the Maintenance Data Link (MDL) message. • **eic** *string*—Specifies the Equipment Identification Code (up to 10 characters), which is a value used to describe a specific piece of equipment according to ANSI T1.107-1995. • **fic** *string*—Specifies the Frame Identification Code (up to 10 characters), which is a value used to identify where the equipment is located within a building at a given location according to ANSI T1.107-1995. • **generator** *string*—Specifies the Generator number string sent in the MDL Test Signal message; can be up to 38 characters. • **lic** *string*—Specifies the Location Identification Code (up to 11 characters), which is a value used to describe a specific location according to ANSI T1.107-1995. • **pfi** *string*—Specifies the Path Facility Identification Code sent in the MDL Path message; can be up to 38 characters. • **port** *string*—Specifies the port number string sent in the MDL Idle Signal message; can be up to 38 characters. • **unit** *string*—Specifies the Unit Identification Code (up to 6 characters), which is a value that identifies the equipment location within a subslot according to ANSI T1.107-1995. • **transmit idle-signal**—Enables transmission of the MDL Idle-Signal message. An MDL Idle-Signal message, as defined by ANSI T1.107, is distinguished from path and test signal messages in that it contains a port number as its final data element. • **transmit path**—Enables transmission of the MDL Path message. An MDL Path message, as defined by ANSI T1.107, is distinguished from idle and test signal messages in that it contains a facility identification code as its final data element. • **transmit test-signal**—Enables transmission of the MDL Test-Signal message. An MDL Test-Signal message, as defined by ANSI T1.107, is distinguished from path and idle signal messages in that it contains a generator number as its final data element.

Verifying MDL

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

```
Router# show controllers serial 2/0/0
Serial2/0/0 -
  Framing is c-bit, Clock Source is Line
  Bandwidth limit is 44210, DSU mode 0, Cable length is 10
  rx FEBE since last clear counter 2, since reset 0
  Data in current interval (546 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
  Data in Interval 1:
    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

  Data in Interval 96:
    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
  Total Data (last 24 hours)
    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

  No alarms detected.

   0 Sev Err Line Secs, 1 Far-End Err Secs, 0 Far-End Sev Err Secs
   0 P-bit Unavailable Secs, 0 CP-bit Unavailable Secs
   0 CP-bit Far-end Unavailable Secs
   0 Near-end path failures, 0 Far-end path failures

No FEAC code is being received
  MDL transmission is enabled
    EIC: tst, LIC: 67,
    Test Signal GEN_NO: test
  Far-End MDL Information Received
    EIC: tst, LIC: 67,
    Test Signal GEN_NO: test
```

Configuring Scramble

T3/E3 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 the "Specifying the Interface Address on a SPA" section on page 17-5.
Router(config-if)# [**no**] **scramble**	Enables scrambling. Scrambling is disabled by default. • **scramble**—Enables scramble. • **no scramble**—Disables scramble. **Note** When using framing bypass, **no scrambling** must be configured.

Verifying Scramble Configuration

Use the **show controllers serial** command to display the scrambling setting:

```
Router# show controllers serial 2/0/0
Serial2/0/0 -
  Framing is c-bit, Clock Source is Line
  Bandwidth limit is 44210, DSU mode 0, Cable length is 10
  rx FEBE since last clear counter 2, since reset 0
  Scrambling is enabled
  Data in current interval (356 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
 Data in Interval 1:
    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
```

Configuring Framing

Framing is used to synchronize data transmission on the line. Framing allows the hardware to determine when each packet starts and ends. To configure framing, 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 T3/E3 interface. See the "Specifying the Interface Address on a SPA" section on page 17-5.
T3 Router(config-if)# **framing** {**bypass** | **c-bit** | **m13**} **E3** Router(config-if)# **framing** {**bypass** | **g751** | **g832**} **8-Port Clear-Channel T3/E3 SPA** Router(config-if)# **framing** {**bypass-ds3** | **bypass-e3** | **c-bit** | **m13** | **g751** | **g832**}	Sets the framing on the interface. • **bypass**—Configures framing bypass to use the full T3 or E3 bandwidth. • **bypass-ds3**—Configures framing bypass to use the full T3 bandwidth. • **bypass-e3**—Configures framing bypass to use the full E3 bandwidth. • **c-bit**—Specifies C-bit parity framing. This is the default for T3. • **m13**—Specifies M13 framing. • **g751**— Specifies G751 framing. This is the default for E3. • **g832**—Specifies G832 framing.

The following table determines the T3 or E3 mode of the interface based on the framing type configured:

Table 17-1   Framing Type and the Interface T3/E3 Mode

Framing Type	Interface T3/E3 Mode
bypass-ds3	T3
c-bit	T3
m13	T3
bypass-e3	E3
g751	E3
g832	E3

Verifying Framing Configuration

Use the **show controllers serial** command to display the framing method:

```
Router# show controllers serial 2/0/0
Serial2/0/0 -
   Framing is c-bit, Clock Source is Line
   Bandwidth limit is 44210, DSU mode 0, Cable length is 10
   rx FEBE since last clear counter 2, since reset 0
   Data in current interval (546 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
   Data in Interval 1:
     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
```

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.
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 the "Specifying the Interface Address on a SPA" section on page 17-5.
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**—PPP (for serial interface). • **frame-relay**—Frame Relay (for serial interface).

Verifying Encapsulation

Use the **show interfaces serial** command to verify encapsulation on the interface:

```
Router# show interfaces serial 2/0/1
Serial2/0/1 is up, line protocol is up
  Hardware is SPA-4T3E3
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
     reliability 255/255, txload 223/255, rxload 222/255
  Encapsulation FRAME-RELAY, crc 16, loopback not set
  Keepalive set (10 sec)
  LMI enq sent  13076, LMI stat recvd 13076, LMI upd recvd 0, DTE LMI up
  LMI enq recvd 0, LMI stat sent  0, LMI upd sent  0
  LMI DLCI 0  LMI type is ANSI Annex D  frame relay DTE
  FR SVC disabled, LAPF state down
  Broadcast queue 0/256, broadcasts sent/dropped 0/0, interface broadcasts 0
  Last input 00:00:04, output 00:00:04, output hang never
  Last clearing of "show interface" counters 1d12h
  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 38579000 bits/sec, 109611 packets/sec
  5 minute output rate 38671000 bits/sec, 109852 packets/sec
     14374551065 packets input, 632486376132 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
     14408526130 packets output, 633974757440 bytes, 0 underruns
     0 output errors, 0 applique, 0 interface resets
```

```
        0 output buffer failures, 0 output buffers swapped out
        0 carrier transitions
    rxLOS inactive, rxLOF inactive, rxAIS inactive
    txAIS inactive, rxRAI inactive, txRAI inactive
```

Configuring Cable Length

The **cablelength** command compensates for the loss in decibels based on the distance from the device to the first repeater in the circuit. A longer distance from the device to the repeater requires that the signal strength on the circuit be boosted to compensate for loss over that distance. To configure cable length, 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 the "Specifying the Interface Address on a SPA" section on page 17-5.
Router(config-if)# **cablelength** *length*	Sets the cable length. • *length*—Range is 0 to 450 feet. The default is 10 feet.

Verifying Cable Length Setting

Use the **show interfaces serial** command to verify the cable length setting:

```
Router# show interfaces serial 2/0/0
Serial2/0/0 -
  Framing is c-bit, Clock Source is Internal
  Bandwidth limit is 44210, DSU mode 0, Cable length is 200
  rx FEBE since last clear counter 0, since reset 22
  Data in current interval (446 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
  Data in Interval 1:
    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
  Data in Interval 2:
    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
```

Configuring Invert Data

Delays between the terminal equipment (TE) clock and data transmission indicate that the transmit clock signal might not be appropriate for the interface rate and length of cable being used. Different ends of the wire may have variances that differ slightly. Invert the clock signal to compensate for these factors. To configure invert data, 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 the "Specifying the Interface Address on a SPA" section on page 17-5.
Router(config-if)# **invert data**	Inverts the data stream.

Verifying Invert Data Setting

Use the **show running configuration** command to verify that invert data was set on the interface:

```
Router# show running configuration
interface Serial2/0/0
 ip address 51.1.1.1 255.255.255.0
 logging event link-status
 dsu bandwidth 44210
 framing c-bit
 cablelength 10
 clock source internal
 invert data
 mdl string eic tst
 mdl string lic 67
 mdl string generator test
 mdl transmit path
 mdl transmit test-signal
 no cdp enable
!
```

Configuring the Trace Trail Buffer

Configure Trace Trail Buffer (TTB) to send messages to the remote device. The TTB messages check for the continued presence of the transmitter. To configure TTB, 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 the "Specifying the Interface Address on a SPA" section on page 17-5.
Router(config-if)# **ttb** {**country** | **rnode** | **serial** | **snode** | **soperator** | **x**} *string*	Sends a Trace Trail Buffer message in E3 g.832 framing mode. • **country**—Two character country code. • **rnode**—Receive node code. • **serial**—M.1400 serial. • **snode**—Sending location/Node ID code. • **soperator**—Sending operator code (must be numeric). • **x**—X0. • *string*—TTB message.

Verifying TTB Settings

Use the **show controllers serial** command to display the TTB settings for the interface:

```
Router# show controllers serial 2/0/0
Serial2/0/0 -
  Framing is c-bit, Clock Source is Line
  Bandwidth limit is 44210, DSU mode 0, Cable length is 10
  rx FEBE since last clear counter 2, since reset 0
  Data in current interval (546 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
  Data in Interval 1:
    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
No alarms detected.
TTB transmission is disabled
TTB Rx: country: us soperator: s snode: sn rnode: rn x: x serial: 1
```

Configuring QoS Features on Serial SPAs

The SIPs and SPAs support many QoS features using modular QoS CLI (MQC) configuration. Since there are no serial SPA-specific QoS features, refer to your network processor documentation for QoS configuration information.

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 image and configuration files, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide* and *Cisco IOS Configuration Fundamentals Command Reference* publications for your Cisco IOS software release.

Verifying the Interface Configuration

Besides using the **show running-configuration** command to display the configuration settings of your Cisco ASR 1000 Series Aggregation Services Routers, use the **show interfaces serial** command and the **show controllers serial** command to get detailed information on a per-port basis for your 2-Port and 4-Port T3/E3 Clear Channel Serial SPA.

Verifying the Per-Port Interface Status

To find detailed interface information on a per-port basis for the 2-Port and 4-Port T3/E3 Clear Channel Serial SPA, use the **show interfaces serial** command.

The following example provides sample output for interface port 1 on the SPA located in the first subslot of the SIP installed in slot 2 of a Cisco ASR 1000 Series Aggregation Services Routers:

```
Router# show interface serial 2/0/1
Serial2/0/1 is up, line protocol is up
  Hardware is SPA-4T3E3
  Internet address is 120.1.1.1/24
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
     reliability 255/255, txload 234/255, rxload 234/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:00, output 00:00:01, 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 40685000 bits/sec, 115627 packets/sec
  5 minute output rate 40685000 bits/sec, 115624 packets/sec
     4652915554 packets input, 204728203496 bytes, 0 no buffer
     Received 4044 broadcasts (0 IP multicast)
     130 runts, 0 giants, 0 throttles
```

```
             0 parity
     1595 input errors, 543 CRC, 0 frame, 0 overrun, 0 ignored, 922 abort
     4653081242 packets output, 204735493748 bytes, 0 underruns
     0 output errors, 0 applique, 4 interface resets
     0 output buffer failures, 0 output buffers swapped out
     2 carrier transitions
```

Monitoring the Per-Port Interface Statistics

To find detailed status and statistical information on a per-port basis for the 2-Port and 4-Port T3/E3 Clear Channel Serial SPA, use the **show controllers serial** command.

The following example provides sample output for interface port 1 on the SPA located in the first subslot of the SIP that is installed in slot 2 of the Cisco ASR 1000 Series Router:

```
Router# show controllers serial 2/0/2
Serial2/0/2 -
  Framing is c-bit, Clock Source is Line
  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 (807 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, 306 Unavailable Secs
    500 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  Data in Interval 1:
    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
    564 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  Data in Interval 2:
    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
    564 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  Data in Interval 3:
    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
    562 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
  Data in Interval 4:
    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
    560 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
   Total Data (last 44 15 minute intervals):
       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,
       24750 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs

     Transmitter is sending AIS.

     Receiver has loss of signal.

      40434 Sev Err Line Secs, 0 Far-End Err Secs, 0 Far-End Sev Err Secs
```

```
         0 P-bit Unavailable Secs, 0 CP-bit Unavailable Secs
         0 CP-bit Far-end Unavailable Secs
         0 Near-end path failures, 0 Far-end path failures

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

Configuration Examples

This section includes the following configuration examples:

DSU Configuration Example

The following example configures DSU on interface port 0 on slot 2, subslot:

```
! Specify the serial interface and enter interface configuration mode
!
Router(config)# interface serial 2/1/0
!
! Specify the DSU mode
!
Router(config-if)# dsu mode 0
!
! Specify the DSU bandwidth
!
Router(config-if)# dsu bandwidth 10000
!
! Set the DSU bandwidth to accept or reject the incoming remote requests
!
Router(config-if)# dsu remote accept
```

MDL Configuration Example

The following example configures the MDL strings on interface port 0 on slot 2, subslot 1:

```
! Specify the serial interface and enter interface configuration mode
!
Router(config)# interface serial 2/1/0
!
! Specify the MDL strings
!
Router(config-if)# mdl string eic beic
Router(config-if)# mdl string lic beic
Router(config-if)# mdl string fic bfix
```

```
Router(config-if)# mdl string unit bunit
Router(config-if)# mdl string pfi bpfi
Router(config-if)# mdl string port bport
Router(config-if)# mdl string generator bgen
Router(config-if)# mdl transmit path
Router(config-if)# mdl transmit idle-signal
Router(config-if)# mdl transmit test-signal
```

Scrambling Configuration Example

The following example shows how to configure scrambling on the T3/E3 interface:

```
! Enter global configuration mode
!
Router# configure terminal
!
! Specify the serial interface and enter interface configuration mode
!
Router(config)# interface serial 2/1/3
!
! Enable scrambling
!
Router(config-if)# scramble
```

Framing Configuration Example

The following example shows how to configure framing on interface port 1 on slot 2, subslot 1:

```
Specify the serial interface and enter interface configuration mode
!
Router(config)# interface serial 2/1/1
!
Specify the framing method
!
Router(config-if)# framing m13
```

The following example shows how to configure the Port 0 of the 8-Port Clear-Channel T3/E3 SPA to be a T3 port with m13 framing:

```
Router(config)# interface serial 2/1/0
Router(config-if)# framing m13
```

The following example shows how to configure the Port 1 of the 8-Port Clear-Channel T3/E3 SPA to be a E3 port with g832 framing:

```
Router(config)# interface serial 2/1/1
Router(config-if)# framing g832
```

Encapsulation Configuration Example

The following example shows how to configure encapsulation on interface port 1 on slot 2, subslot 1:

```
! Specify the serial interface and enter interface configuration mode
!
Router(config)# interface serial 2/1/1
!
! Specify the encapsulation method
!
Router(config-if)# encapsulation PPP
```

Cable Length Configuration Example

The following example shows how to set the cable length to 200 feet:

```
! Enter global configuration mode
!
Router# configure terminal
!
! Specify the serial interface and enter interface configuration mode
!
Router(config)# interface serial 2/1/3
!
! Specify the cable length
!
Router(config-if)# cablelength 200
```

Invert Data Configuration Example

The following example shows how to enable invert data:

```
! Enter global configuration mode
!
Router# configure terminal
!
! Specify the serial interface and enter interface configuration mode
!
Router(config)# interface serial 2/1/3
!
! Enable invert data
!
Router(config-if)# invert data
```

Trace Trail Buffer Configuration Example

The following example shows how to configure the TTB attributes:

```
! Enter global configuration mode
!
Router# configure terminal
!
! Specify the serial interface and enter interface configuration mode
!
Router(config)# interface serial 2/1/3
!
! Specify the TTB attributes
!
```

```
Router(config-if)# ttb country ab
Router(config-if)# ttb soperator 56
Router(config-if)# ttb snode 34
Router(config-if)# ttb rnode cd
Router(config-if)# ttb x 7
Router(config-if)# ttb serial 12
```