Cisco SM-X-1T3/E3 Enhanced Service Module Configuration Guide

Last Updated: September 17, 2014
OL-27148-02

Contents

About the Cisco SM-X-1T3/E3 Enhanced Service Module

The Cisco SM-X-1T3/E3 1-port T3/E3 enhanced service module (SM-X) is a software-configurable T3/E3 product for Second Generation Integrated Services Routers (ISR G2) and the Cisco 4451-X Integrated Services Router. This flexible enhanced service module enables you to switch between T3 and E3 applications with a single Cisco IOS command.

The SM-X-1T3/E3 enhanced service module supports a single-port T3 or E3 with an integrated channel service unit (CSU) and a data service unit (DSU). It supports High-Level Data Link Control (HDLC), PPP, and Frame Relay. The SM-X-1T3/E3 includes the following features:

- Single port—universal T3/E3 version
- Clear and subrate support in both T3 and E3 modes
- Online insertion and removal (OIR) support
- Onboard processing of Cisco Message Definition Language (MDL) and performance monitoring
- Support for scrambling and subrate can be independently or simultaneously enabled in each DSU mode
- Support for full T3 and E3 line rates
- Support for RFC1407–MIB

Americas Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

T3/E3 Applications and Positioning

The SM-X-1T3/E3 enhanced service module provides high-speed performance for advanced, fully converged networks supporting a wide array of applications and services such as security and advanced QoS for voice and video. T3/E3 and subrate T3/E3 connectivity optimizes WAN bandwidth for deploying new applications and service delivery. All supported platforms are capable of supporting full line rate performance but impose varying levels of CPU overhead and therefore affect the overall platform performance. See Table 1 for recommended branch office positioning.

Table 1 SM-X-1T3/E3 Branch Office Positioning and Support Comparison

Supported Platforms	Recommended Type of Service	Recommended Branch Office Sizes
Cisco 2951	Subrate and full-rate T3/E3	Small to medium offices
Cisco 3925/3925E	Subrate and full-rate T3/E3	Large and regional offices
Cisco 3945/3945E	Subrate and full-rate T3/E3	Large and regional offices
Cisco ISR 4451-X	Subrate and full-rate T3/E3	Large and regional offices

Finding Support Information for Platforms and Cisco IOS Software Images

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Requirements for the Cisco SM-X-1T3/E3

Cisco IOS/IOS XE Requirements

Table 2 describes Cisco IOS/IOS XE requirements for operating the Cisco SM-X-1T3/E3.

Table 2 Cisco IOS/IOS XE Requirements

Supported Platform	IOS/IOS XE release
Cisco ISR G2 models	• 15.2(4)M4 or later • 15.3(1)T2 or later • 15.3(2)T1 later
Cisco ISR 4451-X routers	Cisco IOS XE release 3.9.1 or later

Memory Requirements

Table 3 describes the minimum platform memory recommended for operating the Cisco SM-X-1T3/E3.

Table 3 Cisco SM-X-1T3/E3 Minimum Memory Requirements

Supported Platforms	Flash Memory
Cisco 2951	8 Mb
Cisco 3925/3925E	8 Mb
Cisco 3945/3945E	8 Mb
Cisco ISR 4451-X routers	8 Mb

Configuring the SM-1T3/E3 Service Module

The SM-1T3/E3 Service Module can be configured as a T3 interface or an E3 interface. See the following sections for configuration details:

- Configuring DHCP on the Platform, page 3
- Configuring the SM-X-1T3/E3 on Cisco ISR G2 Routers, page 4
- Configuring the Cisco SM-X-1T3/E3 on the Cisco ISR 4451-X, page 26

Configuring DHCP on the Platform

The SM-1T3/E3 Service Module acquires an IP address from the platform upon boot-up. To enable this to occur correctly, configure **service dhcp** in global configuration mode.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip dhcp use vrf connected**
4. **service dhcp**

5. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip dhcp use vrf connected** **Example:** `Router (config)# ip dhcp use vrf connected`	Allocates IP from a DHCP pool specific to the interface.
Step 4	**service dhcp** **Example:** `Router (config)# service dhcp`	Enables DHCP.
Step 5	**exit** **Example:** `Router (config-controller)# exit`	Exits controller configuration mode and returns to privileged EXEC mode.

Configuring the SM-X-1T3/E3 on Cisco ISR G2 Routers

This section describes the tasks required to configure the SM-X-1T3/E3 on Cisco 2900 and 3900 Series ISRs:

Configuring the Card Type and Controller for a T3 Interface

When the SM-X-1T3/E3 is used for the first time, the running configuration does not show the T3/E3 controller and its associated serial interface. You can use the **show version** command to determine whether the router recognized the T3/E3 card and was able to initialize the card properly. After the card type is configured for the slot, the respective controller and serial interface appear in the running configuration. See Use the show version Command, page 21.

After the service module has ascertained that the card has been initialized properly, use the **card type** command to configure the card. If the command is accepted successfully, Cisco IOS software creates a controller and a serial interface for the card.

Perform this task to select and configure a card type and controller as T3 on 2900 and 3900 Series ISRs:

Note The autoconfig/setup utility does not support configuring the card type for the SM-X-1T3/E3.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **card type t3** *slot*
4. **controller t3** *slot/port*
5. **framing** {**c-bit** | **m23** }
6. **cablelength** *feet*
7. **clock source** { **internal** | **line** }
8. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**card type t3** *slot* **Example:** `Router (config)# card type t3 1`	Selects the card type. • Creates a T3 controller and a serial interface. • t3—Selects the T3 controller. • slot—Slot number of the interface. • By default, the T3 controller does not appear in the **show running-config** output.
Step 4	**controller t3** *slot/port* **Example:** `Router(config)# controller t3 1/0`	Specifies the T3 controller and enters controller configuration mode. • *slot/port*—Backplane slot number and port number on the controller.
Step 5	**framing** {**c-bit** | **m23**} **Example:** `Router(config-controller)# framing c-bit`	Specifies the framing type. • **c-bit**—Specifies C-bit framing as the T3 framing type. • **m23**—Specifies M23 framing as the T3 framing type.
Step 6	**cablelength** *feet* **Example:** `Router(config-controller)# cablelength 250`	Specifies the distance from the routers to the network equipment. • *feet*—Number of feet in the range from 0 to 450. • The default value is 224 feet.

	Command or Action	Purpose
Step 7	**clock source** {**internal** | **line**} **Example:** `Router(config-controller)# clock source line`	Selects the clock source. • **internal**—Specifies that the internal clock source is used. This is the default for T3. • **line**—Specifies that the network clock source is used. This is the default for E3.
Step 8	**exit** **Example:** `Router(config-controller)# exit`	Exits controller configuration mode and returns to privileged EXEC mode.

Configuring the Card Type and Controller for an E3 Interface

Perform this task to configure the card type and controller for an E3 interface on 2900 and 3900 Series ISRs:

Note The autoconfig/setup utility does not support configuring the card type for the T3/E3 service module.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **card type e3** *slot*
4. **controller e3** *slot*/*port*
5. **framing** {**bypass** | **g751**}
6. **clock source** {**internal** | **line**}
7. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**card type e3** *slot* **Example:** `Router(config)# card type e3 1`	Selects the card type and creates E3 controller and serial interfaces. • **e3**—Specifies the E3 transmission scheme predominantly used in Europe. Provides 34010 kbps. • *slot*—Slot number of the interface. • By default, the E3 controller does not appear in the **show running config** output.
Step 4	**controller e3** *slot/port* **Example:** `Router(config)# controller e3 1/0`	Specifies the E3 controller and enters controller configuration mode. *slot/port*—Backplane slot number and port number on the controller.
Step 5	**framing** {**bypass** | **g751**} **Example:** `Router(config-controller)# framing bypass`	Specifies the framing type. • **bypass**—Specifies that the G.751 framing be bypassed. • **g751**—Specifies G.751 as the E3 framing type. • Default is **g751**.
Step 6	**clock source** {**internal** | **line**} **Example:** `Router(config-controller)# clock source line`	Selects the clock source. • **internal**—Specifies that the internal clock source is used. This is the default for T3. • **line**—Specifies that the network clock source is used. This is the default for E3.
Step 7	**exit** **Example:** `Router(config-controller)# exit`	Exits controller configuration mode and returns to privileged EXEC mode.

Configuring DSU Mode and Bandwidth

Perform this task to specify the interoperability mode and maximum allowable bandwidth used by a T3 or E3 controller on 2900 and 3900 Series ISRs:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface serial** *slot/port*
4. **dsu mode** {**0** | **1** | **2** | **3** | **4** }
5. **dsu bandwidth** *kbps*
6. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface serial** *slot/port* **Example:** `Router(config)# interface serial 1/0`	Specifies the serial interface created on the controller.
Step 4	**T3** **dsu mode** {**0** | **1** | **2** | **3** | **4**} **E3** **dsu mode** {**0** | **1** } **Example:** `Router(config-if)# dsu mode 0`	**T3** Specifies the interoperability mode used by a T3 controller. • **0**—Connects a T3 controller to another T3 controller or to a Digital Link DSU (DL3100). 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 35000/44210 kbps. **Note** If the bandwidth is set to greater than 35000 kbps, it defaults to 44210 kbps. • **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. **E3** Specifies the interoperability mode used by an E3 controller. • **0**—Connects an E3 controller to another E3 controller or to a Digital Link DSU (DL3100). Bandwidth range is from 300 to 44210 kbps. This is the default. • **1**—Connects an E3 controller to a Kentrox DSU. Bandwidth range is from 1500 to 35000/44210 kbps. **Note** If the bandwidth is set to greater than 35000 kbps, it defaults to 44210 kbps.

	Command or Action	Purpose
Step 5	**dsu bandwidth** *kbps* **Example:** `Router(config-if)# dsu bandwidth 44210`	Specifies the maximum allowable bandwidth in the range from 1 to 44210 kbps. • The real (actual) vendor-supported bandwidth is in the range from 75 to 44210 kbps.
Step 6	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to privileged EXEC mode.

Configuring the Primary IP Address

Perform this task to specify the primary IP address used by the SM interface on 2900 and 3900 Series ISRs:

1. **enable**
2. **configure terminal**
3. **interface serial** *slot/port*
4. **ip address** *ip-address mask*
5. **no shut**
6. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface serial** *slot/port* **Example:** `Router(config)# interface serial 1/0`	Enters interface configuration mode.
Step 4	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 100.100.100.2 255.255.255.0`	Sets a primary IP address for an interface. • *ip-address*—IP address. • *mask*—Mask for the associated IP subnet.

	Command or Action	Purpose
Step 5	**no shut** **Example:** `Router(config-if)# no shut`	Enables the interface IP address.
Step 6	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to privileged EXEC mode.

Enabling the Backplane

The SM-X-1T3/E3 communicates with the host router through an internal Gigabit Ethernet (GE) interface. This GE interface connects to the multi-gigabit fabric (MGF). For the SM to function, the GE interface must be enabled.

Perform this task to enable the GE interface on 2900 and 3900 Series ISRs:

1. **enable**
2. **configure terminal**
3. **interface sm** *slot*/*port*

Note The backplane is always port 1. */port* should always be set to 1.

4. **no shut**
5. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**interface sm** *slot/port* **Example:** `Router(config)# interface sm 1/1`	Enters interface configuration mode to configure the interface between the router and the enhanced service module or between the enhanced service module and Multi-Gigabit Fabric (MGF). • *slot*—Router slot in which the enhanced service module is installed. Range: 1 to 4. • */ port*—Port number of the module interface. The slash mark (/) is required. **Note** The backplane is always port 1. */port* should always be set to 1.
Step 4	**no shut** **Example:** `Router(config-if)# no shut`	Enables the GE interface.
Step 5	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to privileged EXEC mode.

Configuring Scrambling

Perform this task to enable payload encryption on 2900 and 3900 Series ISRs:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface serial** *slot*/*port*
4. **scramble**
5. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**interface serial** *slot/port* **Example:** `Router(config)# interface serial 1/0`	Enters interface configuration mode.
Step 4	**scramble** **Example:** `Router(config-if)# scramble`	Enables the scrambling of the payload. • Default is off.
Step 5	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to privileged EXEC mode.

Configuring a BERT for T3

Perform this task to configure a bit error rate test (BERT) test pattern on a T3 controller.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller t3** *slot*/*port*
4. **bert pattern** {**2^23** | **2^20** | **2^15** | **1s** | **0s** | **alt-0-1**} **interval** *time*
5. **no bert**
6. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**controller t3** *slot*/*port* **Example:** `Router(config)# controller t3 1/0`	Selects theT3 controller and enters controller configuration mode. • *slot*/*port*—Backplane slot number and port number on the controller.

	Command or Action	Purpose
Step 4	**bert pattern** {**2^23** | **2^20** | **2^15** | **1s** | **0s** | **alt-0-1**} **interval** *time* **Example:** `Router(config-if)# bert pattern 0s interval 30`	Configures a bit error rate test pattern. • Acceptable values are: – **2^23**—Pseudorandom 0.151 test pattern that is 8,388,607 bits in length. – **2^20**—Pseudorandom 0.153 test pattern that is 1,048,575 bits in length. – **2^15**—Pseudorandom 0.151 test pattern that is 32,768 bits in length. – **1s**—Repeating pattern of ones (...111...). – **0s**—Repeating pattern of zeros (...000...). – **alt-0-1**—Repeating pattern of alternating zeros and ones (...01010...). – **interval** *time*—Specifies the duration (in minutes) of the BER test. The interval can be a value from 1 to 14400. There is no default.
Step 5	**no bert** **Example:** `Router(config-if)# no bert`	Disables the BERT test pattern.
Step 6	**exit** **Example:** `Router(config-if)# exit`	Exits controller configuration mode and returns to privileged EXEC mode.

Configuring the BERT for E3

Perform this task to configure a bit error rate test (BERT) test pattern on an E3 controller.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller e3** *slot/port*
4. **bert pattern** {**2^23** | **2^20** | **2^15** | **1s** | **0s** | **alt-0-1**} **interval** *time*
5. **no bert**
6. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**controller e3** *slot/port* **Example:** `Router(config)# controller t3 1/0`	Selects theE3 controller and enters controller configuration mode. • *slot*/*port*—Backplane slot number and port number on the controller.
Step 4	**bert pattern** {**2^23** | **2^20** | **2^15** | **1s** | **0s** | **alt-0-1**} **interval** *time* **Example:** `Router(config-if)# bert pattern 0s interval 30`	Configures a bit error rate test pattern. • Acceptable values are: – **2^23**—Pseudorandom 0.151 test pattern that is 8,388,607 bits in length. – **2^20**—Pseudorandom 0.153 test pattern that is 1,048,575 bits in length. – **2^15**—Pseudorandom 0.151 test pattern that is 32,768 bits in length. – **1s**—Repeating pattern of ones (...111...). – **0s**—Repeating pattern of zeros (...000...). – **alt-0-1**—Repeating pattern of alternating zeros and ones (...01010...). – **interval** *time*—Specifies the duration (in minutes) of the BER test. The interval can be a value from 1 to 14400. There is no default.
Step 5	**no bert** **Example:** `Router(config-if)# no bert`	Disables the BERT test pattern.
Step 6	**exit** **Example:** `Router(config-if)# exit`	Exits controller configuration mode and returns to privileged EXEC mode.

Configuring Loopback for T3

Perform this task to loop an entire T3 line toward the line and back toward the router.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller t3** *slot/port*
4. **loopback** {**local** | **network** {**line** | **payload**} | **remote**}
5. **no loopback**
6. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**controller t3** *slot/port* **Example:** `Router(config)# controller t3 1/0`	Selects the T3 controller and enters controller configuration mode. • *slot/port*—Backplane slot number and port number on the controller.
Step 4	**loopback** {**local** | **network** {**line** | **payload**} | **remote**} **Example:** `Router(config-controller)# loopback local`	Loops the T3 line toward the line and back toward the router, • **local**—Loops the data back toward the router and sends an AIS signal out toward the network. • **network** {**line** | **payload**}—Sets the loopback toward the network before going through the framer (**line**) or after going through the framer (**payload**). • **remote**—Sends a far-end alarm control (FEAC) request to the remote end requesting that it enter into a network line loopback. FEAC requests (and therefore remote loopbacks) are possible only when the T3 is configured for C-bit framing. M23 format does not support remote loopbacks.
Step 5	**no loopback** **Example:** `Router(config-controller)# no loopback`	Removes the loop.
Step 6	**exit** **Example:** `Router(config-controller)# exit`	Exits controller configuration mode and returns to privileged EXEC mode.

Configuring Loopback for E3

Perform this task to loop an entire E3 line toward the line and back toward the router.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller e3** *slot/port*
4. **loopback** {**local** | **network** {**line** | **payload**} }
5. **no loopback**
6. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**controller t3** *slot/port* **Example:** `Router(config)# controller t3 1/0`	Selects the T3 controller and enters controller configuration mode. • *slot/port*—Backplane slot number and port number on the controller.
Step 4	**loopback** {**local** | **network** {**line** | **payload**} | **remote**} **Example:** `Router(config-controller)# loopback local`	Loops the T3 line toward the line and back toward the router. • **local**—Loops the data back toward the router and sends an AIS signal out toward the network. • **network** {**line** | **payload**}—Sets the loopback toward the network before going through the framer (**line**) or after going through the framer (**payload**).
Step 5	**no loopback** **Example:** `Router(config-controller)# no loopback`	Removes the loop.
Step 6	**exit** **Example:** `Router(config-controller)# exit`	Exits controller configuration mode and returns to privileged EXEC mode.

Configuring the T3 Maintenance Data Link

Perform this task to configure the maintenance data link (MDL) message.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller t3** *slot/port*
4. **mdl** {**transmit** {**path** | **idle-signal** | **test-signal**} | **string** {**eic** | **lic** | **fic** | **unit** | **pfi** | **port** | **generator**} *string*}
5. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**controller t3** *slot/port* **Example:E** `Router(config)# controller t3 1/0`	Selects the T3 controller and enters controller configuration mode. • *slot/port*—Backplane slot number and port number on the controller.

	Command or Action	Purpose
Step 4	**mdl** {**transmit** {**path** | **idle-signal** | **test-signal**} | **string** {**eic** | **lic** | **fic** | **unit** | **pfi** | **port** | **generator**} *string*} **Example:** `Router(config-controller)# mdl transmit path`	Configures the MDL message. • **transmit path**—Enables transmission of the MDL Path message. • **transmit idle-signal**—Enables transmission of the MDL idle signal message. • **transmit test-signal**—Enables transmission of the MDL test signal message. • **string eic** *string*—Specifies the equipment identification code (EIC); can be up to 10 characters. • **string lic** *string*—Specifies the location identification code (LIC); can be up to 11 characters. • **string fic** *string*—Specifies the frame identification code (FIC); can be up to 10 characters. • **string unit** *string*—Specifies the unit identification code (UIC); can be up to 6 characters. • **string pfi** *string*—Specifies the facility identification code (PFI) sent in the MDL path message; can be up to 38 characters. • **string port** *string*—Specifies the port number string sent in the MDL idle signal message; can be up to 38 characters. • **string generator** *string*—Specifies the generator number string sent in the MDL test signal message; can be up to 38 characters.
Step 5	**exit** **Example:** `Router(config-controller)# exit`	Exits controller configuration mode and returns to privileged EXEC mode.

Configuring National Bit for E3

Perform this task to set the E3 national bit in the G.751 frame used by the E3 controller. This configuration is used to set the bit when the E3 line crosses national boundaries.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller e3** *slot*/*port*
4. **national bit** {**1** | **0**}
5. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**controller e3** *slot/port* **Example:** `Router(config)# controller e3 1/1`	Selects the E3 controller and enters controller configuration mode. • *slot*/*port*—Backplane slot number and port number on the controller.
Step 4	**national bit** {**1** | **0**} **Example:** `Router(config-controller)# national bit 1`	Sets the E3 national bit in the G.751 frame used by the E3 controller. • **1** | **0**—Specifies the E3 national bit in the G.751 frame. • The default is 1.
Step 5	**exit** **Example:** `Router(config-controller)# exit`	Exits controller configuration mode and returns to privileged EXEC mode.

Verifying the T3 or E3 Configuration on 2900 and 3900 Series ISRs

Perform this task to verify that the T3 or E3 controller is configured correctly on 2900 and 3900 Series ISRs. Enter the s**how running-config**, **show controllers**, or **show interfaces serial** privileged EXEC command to display the command settings for the router.

Troubleshooting Tips

You can use the methods described in this section to troubleshoot the T3/E3 service module using Cisco IOS software.

Set Loopbacks

The T3/E3 local loopback can be used to ensure that the router and the T3/E3 service module are working properly. The controller clock source should be configured to “internal.”

Use T3/E3 network loopback and remote loopback to diagnose problems with cables between the T3/E3 controller and the central switching office at the link level. For this diagnostic setup to work, if the service module is looped toward the network, the service module must be configured with the clock source as “line.”

Run Bit Error Rate Test

The service module contains onboard BERT circuitry. With this circuitry present, the software can send and detect a programmable pattern that is compliant with CCITT/ITU pseudorandom and repetitive test patterns. BERT allows you to test cables and signal problems in the field.

When a BERT is running, your system expects to receive the same pattern that it is sending. To help ensure this, two common options are available.

- Use a loopback somewhere in the link or network.
- Configure remote testing equipment to send the same BERT pattern at the same time.

See the **bert pattern (t3/e3)** command in *Cisco IOS Master Commands List, All Releases* for instructions on how to run BERT and check the results.

Use the show version Command

Use the **show version** command to determine whether the router recognized the T3/E3 card and was able to initialize the card properly. The **show version** command lists the hardware interfaces and controllers present in the router. You should find "1 Subrate T3/E3 port(s)" as shown in the following example.

```
Router# show version
Cisco IOS Software, C3900 Software (C3900-UNIVERSALK9-M), Experimental Version
15.2(20120331:222138) [adamodha-april02 132]
Copyright (c) 1986-2012 by Cisco Systems, Inc.
Compiled Sun 01-Apr-12 00:24 by adamodha

ROM: System Bootstrap, Version 15.0(1r)M1, RELEASE SOFTWARE (fc1)

Router uptime is 11 hours, 11 minutes
System returned to ROM by reload at 17:02:15 UTC Thu Apr 5 2012
System restarted at 17:04:11 UTC Thu Apr 5 2012
System image file is "flash0:c3900-universalk9-mz.SSA.0401"
Last reload type: Normal Reload
Last reload reason: Reload Command



This product contains cryptographic features and is subject to United
States and local country laws governing import, export, transfer and
use. Delivery of Cisco cryptographic products does not imply
third-party authority to import, export, distribute or use encryption.
Importers, exporters, distributors and users are responsible for
compliance with U.S. and local country laws. By using this product you
agree to comply with applicable laws and regulations. If you are unable
to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html

If you require further assistance please contact us by sending email to
export@cisco.com.

Cisco CISCO3925-CHASSIS (revision 1.0) with C3900-SPE100/K9 with 999424K/49152K bytes of
memory.
Processor board ID FCZ140770XT
3 Gigabit Ethernet interfaces
1 Serial interface
2 terminal lines
1 Virtual Private Network (VPN) Module
```

```
1 Subrate T3/E3 port
DRAM configuration is 72 bits wide with parity enabled.
255K bytes of non-volatile configuration memory.
248472K bytes of ATA System CompactFlash 0 (Read/Write)


License Info:

License UDI:

-------------------------------------------------
Device#   PID                   SN
-------------------------------------------------
*0        C3900-SPE100/K9       FOC140336FC



Technology Package License Information for Module:'c3900'

-----------------------------------------------------------------
Technology    Technology-package           Technology-package
              Current       Type           Next reboot
-----------------------------------------------------------------
ipbase        ipbasek9      Permanent      ipbasek9
security      securityk9    Permanent      securityk9
uc            None          None           None
data          datak9        Permanent      datak9

Configuration register is 0x0
```

Configuration Examples for the Cisco SM-X-1T3/E3 on 2900 and 3900 Series ISRs

show running-config

The following is sample output from the **show running-config** command for a T3 controller:

```
Router# show running-config
Building configuration...

Current configuration : 1875 bytes
!
! No configuration change since last restart
version 15.2
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname Router
!
boot-start-marker
boot-end-marker
!
!
card type t3 1
!card type command needed for slot 2
!
no aaa new-model
!
no ipv6 cef
!
```

```
!
!
!
!
ip cef
multilink bundle-name authenticated
!
!
crypto pki token default removal timeout 0
!
!
license udi pid CISCO2951 sn FHK1312F30K
hw-module pvdm 0/0
!
hw-module sm 1
!
hw-module sm 2
!
!
!
!
!
controller T3 1/0
 cablelength 50
!
!
!
!
!
interface Embedded-Service-Engine0/0
 no ip address
 shutdown
!
interface GigabitEthernet0/0
 no ip address
 shutdown
 duplex auto
 speed auto
!
interface GigabitEthernet0/1
 no ip address
 shutdown
 duplex auto
 speed auto
!
interface GigabitEthernet0/2
 no ip address
 shutdown
 duplex auto
 speed auto
!
interface Serial1/0
 ip address 100.100.100.2 255.255.255.0
 dsu bandwidth 44210
!
interface SM1/1
 ip address 192.168.2.1 255.255.255.240
 no ip proxy-arp
 no keepalive
!
interface SM2/1
 ip address 192.168.3.1 255.255.255.240
 no ip proxy-arp
 no keepalive
```

```
!
ip forward-protocol nd
!
no ip http server
no ip http secure-server
!
!
!
!
tftp-server flash:/firmware/sm_1t3e3/sm_1t3e3_fw.img
!
control-plane
!
!
!
line con 0
line aux 0
line 2
 no activation-character
 no exec
 transport preferred none
 transport input all
 transport output pad telnet rlogin lapb-ta mop udptn v120 ssh
 stopbits 1
line 68
 no activation-character
 no exec
 transport preferred none
 transport input all
 transport output pad telnet rlogin lapb-ta mop udptn v120 ssh
 stopbits 1
line 132
 no activation-character
 no exec
 transport preferred none
 transport input all
 transport output pad telnet rlogin lapb-ta mop udptn v120 ssh
 stopbits 1
line vty 0 4
 login
 transport input all
!
scheduler allocate 20000 1000
!
end
```

show controller t3

The following is sample output from the **show controller** command for a T3 controller:

```
Router# show controller t3 4/0
T3 4/0 is up.
  Applique type is Subrate T3
  No alarms detected.
  MDL transmission is disabled

  FEAC code received: No code is being received
  Framing is C-BIT Parity, Line Code is B3ZS, Clock Source is Internal
  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 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
```

show controller serial

The following is sample output from the **show controller serial** command for a T3 controller:

```
Router# show controller serial 4/0
Interface Serial4/0
Hardware is SM-1T3/E3
idb at 0x14D2FCBC, driver data structure at 0x29DD780

FPGA Info:

Mode = T3 Subrate = ON Mode = 0 BW = 146 Scramble = OFF
FPGA Registers
------------------
FPGA revision = 0x20
LED's = 0xfe, Port Type = 0x08
Framer GPIO = 0xff, OE = 0x00
TE3 Status = 0x00, LIU Config = 0x20
T3 Subrate Mode = 0x81
T3 Subrate BW-1 = 0x92, BW-2 = 0x00 BW-3 = 0x00
E3 Subrate Mode = 0x00
E3 Subrate BW-1 = 0x00, BW-2 = 0x00, BW-3 = 0x001
Serial FIFO = 0x00, ICR = 0x00, rx_intr = 0x00


Serial Info:

QE ucce 00000000
QE uccm 009e0000
QE enabled_tx 1 stopped_tx 0
QE enabled_rx 1 stopped_rx 0
0 input aborts on receiving flag sequence
580375 throttles, 580375 enables, 0 throttled, 0 bytes_in_tx
0 overruns
0 transmitter underruns
0 transmitter CTS losts
18594020 rxintr, 30097368 txintr, 0 rxerr, 0 txerr
30097368 tx, 1414447429 tx_bytes, 30532217 rx, 1800840750 rx_bytes, 334466 rx_drops
0 tx_drops, 0 tx_drop_bytes
0 rx_flv, 0 rx_cdlost, 0 crc, 0 noa, 1602 nobuffers
216 TxBDs Head,  251 RxBDs Head
216 TxBDs Tail,  0 RxBDs Tail

UCC2 HDLC PRAM
-----------------
riptr = 0x2220 tiptr = 0x2240 mrblr = 0x600  rstate = 0x30000000
rbase = 0xba41800 rbdstat = 0x9000 rbdlen = 0x0 rdptr = 0xbb5e200
tstate = 0x3004001c tbase = 0xba41000 tbdstat = 0x1c00 tbdlen = 0x76
tdptr = 0xd944060 rbptr = 0xba41fd8 tbptr = 0xba416c0  rcrc = 0x3ae0
tcrc = 0x0 c_mask = 0xf0b8 c_pers = 0xffff disfc = 0x732e
crcec = 0x0 abtsc = 0x0 nmarc = 0x0 max_cnt = 0x1f80
mflr = 0x2580 rfthr = 0x1 rfcnt = 0x1 hmask = 0x0
haddr1 = 0x0 haddr2 = 0x0 haddr3 = 0x0 haddr4 = 0x0
ts_tmp = 0x0 tmp_mb = 0x0

Framer Info:
```

```
Port is Enabled
Port is in T3 Mode
Clock Source is Internal
Framing is C-BIT Parity
MDL is Disabled value 0
Cablelength is Long
```

Configuring the Cisco SM-X-1T3/E3 on the Cisco ISR 4451-X

The section describes the commands used to configure the Cisco SM-X-1T3/E3 on Cisco ISR 4451-X routers:

Setting the Card Type for T3/E3

The Cisco SM-X-1T3/E3 is not functional until the card type is set. Information about the Cisco SM-X-1T3/E3 is not indicated in the output of any **show** commands until the card type has been set. There is no default card type.

Note Mixing of interface types is not supported. All ports on a Cisco SM-X-1T3/E3 must be of the same type.

To set the card type for the Cisco SM-X-1T3/E3 Service Module on Cisco ISR 4451-X routers, complete these steps:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **card type {t3 | e3 }** *slot port*
4. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

Step 3	**T3**
	card type t3 *slot port*
	
	Example:
	`Router (config)# card type t3 1 0`
	
	E3
	card type e3 *slot port*
	
	Example:
	`Router (config)# card type e3 1 0`
		T3
		Selects the card type.
		• Creates a T3 controller and a serial interface.
		• t3—Selects the T3 controller.
		• slot—Slot number of the interface.
		• port—port number of the interface.
		Note Port is always 0.
		• By default, the T3 controller does not appear in the **show running-config** output.
		
		E3
		Selects the card type.
		• Creates an E3 controller and a serial interface.
		• e3—Selects the E3 controller.
		• slot—Slot number of the interface.
		• port—port number of the interface.
		Note Port is always 0.
		• By default, the E3 controller does not appear in the **show running-config** output.

Step 4	**exit** **Example:** `Router(config)# exit`	Exits configuration mode and returns to the EXEC command interpreter prompt.

Setting the IP Address for T3/E3

To set the IP address for the Cisco SM-X-1T3/E3 Service Module on a Cisco ISR 4451-X router, complete these steps:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface serial** *slot/subslot/port*
4. **ip address** *ip-address mask*
5. **clock source {internal | line}**
6. **no shut**
7. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface serial** *slot/subslot/port* **Example:** `Router(config)# interface serial 1/0/0`	Enters interface configuration mode. **Note** On the Cisco SM-X-1T3/E3, both the subslot and port are 0.
Step 4	**ip address** *ip-address mask* **Example:** `Router(config-if)# ip address 100.100.100.2 255.255.255.0`	Sets a primary IP address for an interface. • *ip-address*—IP address. • *mask*—Mask for the associated IP subnet.
Step 5	**clock source** {**internal** | **line**} **Example:** `Router(config-if)# clock source internal`	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.

	Command	Purpose
Step 6	**no shut** **Example:** `Router(config-if)# no shut`	Enables the interface.
Step 7	**exit** **Example:** `Router(config)# exit`	Exits interface configuration mode and returns to the EXEC command interpreter prompt.

Specifying the Interface Address on a Cisco SM-X-1T3/E3 Service Module

The Cisco SM-X-1T3/E3 features an interface port: port 0. To configure or monitor the Cisco SM-X-1T3/E3, specify the interface in the CLI. The interface address format is *slot/subslot/port*, where:

- *slot*—Specifies the chassis slot number where the enhanced service module is installed.
- *subslot*—Specifies the slot where the enhanced service module is installed.

Note Specify “0” for the subslot.

- *port*—Specifies the number of the individual interface port on the enhanced service module.

Note Specify “0” for the port.

The following example shows how to specify interface 0 in the first subslot 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.

Configuring DSU Mode and Bandwidth

Perform this task to specify the interoperability mode and maximum allowable bandwidth used by a T3 or E3 controller on Cisco ISR 4451-X routers:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface serial** *slot/subslot/port*
4. **dsu mode** {**0** | **1** | **2** | **3** | **4** }
5. **dsu bandwidth** *kbps*
6. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface serial** *slot/subslot/port* **Example:** `Router(config)# interface serial 1/0/0`	Enters interface configuration mode. **Note** On the Cisco SM-X-1T3/E3, both the subslot and port are 0.
Step 4	**T3** **dsu mode** {**0** | **1** | **2** | **3** | **4**} **E3** **dsu mode** {**0** | **1** } **Example:** `Router(config-if)# dsu mode 0`	**T3** Specifies the interoperability mode used by a T3 controller. • **0**—Connects a T3 controller to another T3 controller or to a Digital Link DSU (DL3100). 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 35000/44210 kbps. **Note** If the bandwidth is set to greater than 35000 kbps, it defaults to 44210 kbps. • **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. **E3** Specifies the interoperability mode used by an E3 controller. • **0**—Connects an E3 controller to another E3 controller or to a Digital Link DSU (DL3100). Bandwidth range is from 300 to 44210 kbps. This is the default. • **1**—Connects an E3 controller to a Kentrox DSU. Bandwidth range is from 1500 to 35000/44210 kbps. **Note** If the bandwidth is set to greater than 35000 kbps, it defaults to 44210 kbps.

	Command or Action	Purpose
Step 5	**dsu bandwidth** *kbps* **Example:** `Router(config-if)# dsu bandwidth 44210`	Specifies the maximum allowable bandwidth in the range from 1 to 44210 kbps. • The real (actual) vendor-supported bandwidth is in the range from 75 to 44210 kbps.
Step 6	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to privileged EXEC mode.

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:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface serial** *slot/subslot/port*
4. **mdl** [**string** {**eic** | **fic** | **generator** | **lic** | **pfi** | **port** | **unit**} *string*}] | [**transmit** {**idle-signal** | **path** | **test-signal**}]

DETAILED STEPS

	Command	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command	Purpose
Step 3	**interface serial** *slot/subslot/port* **Example:** `Router(config)# interface serial 1/0/0`	Enters interface configuration mode. **Note** On the Cisco SM-X-1T3/E3, both the subslot and port are 0.

Step 4	Router(config-if)#**mdl** {**transmit** {**path** | **idle-signal** | **test-signal**} | **string** {**eic** | **lic** | **fic** | **unit** | **pfi** | **port** | **generator**} *string*}
	
	Example:
	`Router(config-if)# mdl string eic ID`
	
	`Router(config-if)# mdl string fic Building B`
	
	`Router(config-if)# mdl string unit ABC`
	
	`Router(config-if)# mdl string pfi Facility Z`
	
	`Router(config-if)# mdl string port Port 7`
	
	`Router(config-if)# mdl transmit path`
	
	`Router(config-if)# mdl transmit idle-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.

Configuring Scrambling

Perform this task to enable payload encryption on Cisco ISR 4451-X routers:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface serial** *slot/subslot/port*
4. **scramble**
5. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface serial** *slot/subslot/port* **Example:** `Router(config)# interface serial 1/0/0`	Enters interface configuration mode. **Note** On the Cisco SM-X-1T3/E3, both the subslot and port are 0.
Step 4	**scramble** **Example:** `Router(config-if)# scramble`	Enables the scrambling of the payload. • Default is off. • **scramble**—Enables scramble. • **no scramble**—Disables scramble. **Note** When using framing bypass, **no scrambling** must be configured.
Step 5	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to privileged EXEC mode.

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:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface serial** *slot/subslot/port*
4. **framing** {**bypass** | **c-bit** | **m13** | **g751**}

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface serial** *slot/subslot/port* **Example:** `Router(config)# interface serial 1/0/0`	Enters interface configuration mode. **Note** On the Cisco SM-X-1T3/E3, both the subslot and port are 0.
Step 4	**framing {bypass | c-bit | m13 | g751}** **Example:** `Router(config-if)# framing g751`	Sets the framing on the interface. • **bypass**—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 for T3. • **g751**— Specifies g751 framing. This is the default for E3.

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:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface serial** *slot/subslot/port*
4. **encapsulation** *encapsulation-type* {**hdlc** | **ppp** | **frame-relay**}

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface serial** *slot/subslot/port* **Example:** `Router(config)# interface serial 1/0/0`	Enters interface configuration mode. **Note** On the Cisco SM-X-1T3/E3, both the subslot and port are 0.
Step 4	**encapsulation** *encapsulation-type* {**hdlc** | **ppp** | **frame-relay**} **Example:** `Router(config-if)# encapsulation ppp`	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).

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:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface serial** *slot/subslot/port*
4. **cablelength** *length*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter the password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface serial** *slot/subslot/port* **Example:** `Router(config)# interface serial 1/0/0`	Enters interface configuration mode. **Note** On the Cisco SM-X-1T3/E3, both the subslot and port are 0.
Step 4	**cablelength** *length* **Example:** `Router(config-if)# cablelength 75`	Sets the cable length. • *length*—Range is 0 to 450 feet. The default is 10 feet.

Verifying the T3 or E3 Configuration on Cisco ISR 4451-X routers

Perform this task to verify that the T3 or E3 controller is configured correctly on Cisco ISR 4451-X routers. Enter the s**how platform software iomd** or **show controller serial** privileged EXEC command to display the command settings for the router.

Verifying Configuration

Use the following command to verify the Cisco SM-X-1T3/E3 configuration on Cisco 4400 Series ISRs:

```
show platform software iomd <slot/subslot>  interface <slot> controller
```

Example

```
Router#show platform software iomd 2/0 interface 0 controller

FPGA Info:

Mode = T3 Subrate = ON Mode = 0 BW = 146 Real BW = 44210 Scramble = OFF
FPGA Registers
------------------
FPGA revision = 0xd5
LED's = 0x3e, Port Type = 0x08
Framer GPIO = 0xff, OE = 0x00
TE3 Status = 0x00, LIU Config = 0x20
T3 Subrate Mode = 0x81
T3 Subrate BW-1 = 0x92, BW-2 = 0x00 BW-3 = 0x00
E3 Subrate Mode = 0x00
E3 Subrate BW-1 = 0x00, BW-2 = 0x00, BW-3 = 0x00
Serial FIFO = 0x00, ICR = 0x00, rx_intr = 0x00
FPGA Image: upgrade, validation passed
Bootloader Image: secondary, validation passed
Bootloader Secondary Revision: 0x01
Bootloader Primary Revision: 0x01

Serial Info:

QE ucce 00000200
QE uccm 009e0000
QE enabled_tx 1 stopped_tx 0
QE enabled_rx 1 stopped_rx 0
UHDLC enabled_tx 1 enabled_rx 1 QE resets 4
0 input aborts on receiving flag sequence

QUIIC HDLC driver stats:
0 overruns
0 transmitter underruns
0 transmitter CTS losts
113 rxintr, 0 txintr, 0 rxerr, 0 txerr
0 tx, 0 tx_bytes, 113 rx, 35934 rx_bytes
0 tx_drops, 0 tx_drop_bytes
0 rx_drops, 0 rx_drop_bytes
0 rx_flv, 0 rx_cdlost, 0 crc, 0 noa, 0 nobuffers
0 rx_bogus_pkts, rx_bogus_flag FALSE rx_error_flag FALSE
0 TxBDs Head,  113 RxBDs Head
0 TxBDs Tail,  0 RxBDs Tail
UCC2 HDLC PRAM
------------------
riptr = 0x31a0 tiptr = 0x31c0 mrblr = 0x600  rstate = 0x30000000
rbase = 0xf41d000 rbdstat = 0x8000 rbdlen = 0x0 rdptr = 0xb56c820
tstate = 0x30040000 tbase = 0xf41a000 tbdstat = 0x0 tbdlen = 0x0
tdptr = 0x0 rbptr = 0xf41d388 tbptr = 0xf41a000  rcrc = 0x710f
tcrc = 0x0 c_mask = 0xf0b8 c_pers = 0xffff disfc = 0x0
crcec = 0x0 abtsc = 0x0 nmarc = 0x0 max_cnt = 0x1f80
mflr = 0x2580 rfthr = 0x10 rfcnt = 0xf hmask = 0x0
haddr1 = 0x0 haddr2 = 0x0 haddr3 = 0x0 haddr4 = 0x0
ts_tmp = 0x0 tmp_mb = 0x0
UCC2 Fast registers:
--------------------------
Base address: 0xd111e200
gumr  : addr=0xd111e200, val=0x21802030
upsmr : addr=0xd111e204, val=0x0c000000
utodr : addr=0xd111e208, val=0x0000
udsr  : addr=0xd111e20c, val=0x7e7e
ucce  : addr=0xd111e210, val=0x00000200
uccm  : addr=0xd111e214, val=0x009e0000
```

```
uccs  : addr=0xd111e218, val=0x04
urfb  : addr=0xd111e220, val=0x00001080
urfs  : addr=0xd111e224, val=0x0100
urfet : addr=0xd111e228, val=0x0080
urfset: addr=0xd111e22a, val=0x0120
utfb  : addr=0xd111e22c, val=0x00001000
utfs  : addr=0xd111e230, val=0x0080
utfet : addr=0xd111e234, val=0x0040
utftt : addr=0xd111e238, val=0x0040
utpt  : addr=0xd111e23c, val=0x0100
urtry : addr=0xd111e240, val=0x00000000
guemr : addr=0xd111e290, val=0x13

HQF queue stats             LP            HP1            HP2
       Throttles             0              0              0
         Enables             0              0              0
Throttle refresh             0              0              0
  Enable refresh          1193           1193           1193
       Throttled             0              0              0
      Tx Packets             0              0              0
        Tx bytes             0              0              0
        Tx Drops             0              0              0
   Tx Drop bytes             0              0              0
     Input drops             0              0              0
   Queue maxsize            64            128            256
      Queue size             0              0              0
      Tx Pending             0              0              0

QE Mux Registers
--------------------
cmxgcr = 0x0 cmxsi1cr_l = 0x0 cmxsi1cr_h = 0x0 cmxsi1syr = 0x0 cmxupcr = 0x0
cmxucr[0] = 0x67 cmxucr[1] = 0x0 cmxucr[2] = 0x0 cmxucr[3] = 0x0
QE Interrupt Controller Registers
-------------------------------------
qipxcc = 0x5309770 qipycc = 0x5309770 qimr = 0x20000000 qrimr = 0x0 qicnr = 0x0
qiprtb = 0x5309770 qricr = 0x0 qhivec = 0x0 qiprta = 0x5309770
QE Baud rate generator Registers
---------------------------------
brgc0=0x0 brgc1=0x0 brgc2=0x0 brgc3=0x0
brgc4=0x0 brgc5=0x0 brgc6=0x0 brgc7=0x0
brgc8=0x0 brgc9=0x0 brgc10=0x0 brgc11=0x0
brgc12=0x0 brgc13=0x0 brgc14=0x0 brgc15=0x0
Framer info:

Port is Enabled
Port is in T3 Mode
Clock Source is Line
Framing is C-BIT Parity
Line Code is B3ZS
MDL is Disabled value 0
Cablelength is Short
Alarm: none
Line state is Up
Line status: No alarms detected.
FEAC code received: No code is being received

Firmware Info:

OS: Linux, Node: 10.100.0.2, Rel: 2.6.32.36.cge
Ver: #1 SMP Tue Oct 30 16:49:29 PDT 2012, CPU: ppc
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	*Cisco IOS Master Commands List, All Releases*
Information on connecting the service module	*Connecting Cisco T3 and E3 Service Modules to the Network*
Regulatory Compliance and Safety Information	*Cisco Network Modules and Interface Cards Regulatory Compliance and Safety Information*
Overview of Cisco Network Modules and Service Modules for Cisco Access Routers	*Overview of Cisco Network Modules and Service Modules for Cisco Access Routers*
Installing Cisco Network Modules and Service Modules in Cisco Access Routers	*Installing Cisco Network Modules and Service Modules in Cisco Access Routers*
Cisco 3900 Series and Cisco 2900 Series Hardware Installation Guide	*Cisco 3900 Series and Cisco 2900 Series Hardware Installation Guide*
Cisco 4451-X Integrated Services Router Hardware Installation Guide	*Hardware Installation Guide for the Cisco 4451-X Integrated Services Router*

MIBs

MIB	MIBs Link
RFC1407–MIB	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Glossary

backplane—The physical connection between an interface processor or card and the data buses and the power distribution buses inside a chassis.

BER—Bit error rate. Ratio of received bits that contain errors.

CSU—Channel service unit. Digital interface device that connects end-user equipment to the local digital telephone loop. Often referred to together with DSU as CSU/DSU.

DS-3—Digital signal level 3. Framing specification used for sending digital signals at 44.736 Mbps on a T3 facility.

DSU—Data service unit. Device used in digital transmission that adapts the physical interface on a DTE device to a transmission facility, such as T1 or E1. The DSU also is responsible for such functions as signal timing. Often referred to together with CSU as CSU/DSU.

E3—Wide-area digital transmission scheme used predominantly in Europe that carries data at a rate of 34.368 Mbps. E3 lines can be leased for private use from common carriers.

FEAC—far-end alarm code.

Frame Relay—industry-standard, switched data link layer protocol that handles multiple virtual circuits using HDLC encapsulation between connected devices. Frame Relay is more efficient than X.25, the protocol for which it generally is considered a replacement.

HDLC—High-Level Data Link Control. Bit-oriented synchronous data link layer protocol developed by ISO. Derived from SDLC, HDLC specifies a data encapsulation method on synchronous serial links using frame characters and checksums.

MDL—Maintenance Data Link message defined in the ANSI T1.107a-1990 specification. Also, the Cisco Message Definition Language

MDL—A high-level language used to specify protocols and protocol conversion operations on the VSC.

OIR—Online insertion and removal. Feature that permits the addition, the replacement, or the removal of cards without interrupting the system power, entering console commands, or causing other software or interfaces to shut down.

PPP—Point-to-Point Protocol. Successor to SLIP that provides router-to-router and host-to-network connections over synchronous and asynchronous circuits. Whereas SLIP was designed to work with IP, PPP was designed to work with several network layer protocols, such as IP, IPX, and ARA. PPP also has built-in security mechanisms, such as CHAP and PAP. PPP relies on two protocols: LCP and NCP.

Subrate—Less than the standard rate of transmission, which is defined at the voice-grade rate of 64 kbps.

T3—Digital WAN carrier facility. T3 sends DS3-formatted data at 44.736 Mbps through the telephone switching network.

TDM—Time-division multiplexing. Technique in which information from multiple channels can be allocated bandwidth on a single wire based on preassigned time slots. Bandwidth is allocated to each channel regardless of whether the station has data to send.