CONTENTS

CHAPTER 1

Configuring T1/E1 Interfaces on 48-Port T1/E1 Interface Module  1
   Information About T1/E1 Interfaces  1
      Overview of T1/E1 Interfaces  1
      Restrictions for Configuring T1/E1 Interfaces  1
   How to Configure T1/E1 Interfaces  2
      Setting the Card Type  2
      Configuring the Controller  2
         Verifying the Controller Configuration  2
   Configuring Structure-Agnostic TDM over Packet - T1/E1 Interfaces  3
      Verifying CEM Configuration for SAToP  3
      Performance Monitoring  3
   Troubleshooting T1/E1 Controllers  4
      Running Bit Error Rate Testing  4
         Configuring BERT  5
   Loopback on T1/E1 Interfaces  6
      Configuring Loopback  7
   Associated Commands  8
   Additional References for Configuring 48-Port T1/E1 CEM Interface Module  9

CHAPTER 2

Configuring Pseudowire  11
   Information About Pseudowire  11
      Overview of Pseudowire  11
      Overview of Circuit Emulation  11
         Structure-Agnostic TDM over Packet  12
   How to Configure Pseudowire  12
      Configuring CEM for SAToP  12
Configuring T1/E1 Interfaces on 48-Port T1/E1 Interface Module

This chapter provides information about configuring the T1/E1 interfaces on the 48-Port T1/E1 interface module:

Note
Effective Cisco IOS XE Release 16.5.1S, E1 interface is supported.

- Information About T1/E1 Interfaces, on page 1
- How to Configure T1/E1 Interfaces, on page 2
- Troubleshooting T1/E1 Controllers, on page 4
- Associated Commands, on page 8
- Additional References for Configuring 48-Port T1/E1 CEM Interface Module, on page 9

Information About T1/E1 Interfaces

The following sections provide information about T1/E1 interfaces.

Overview of T1/E1 Interfaces

The 48-Port T1/E1 interface module on CEM line card supports generic single or dual-port T1/E1 trunk interfaces for voice, data, and integrated voice or data applications.

Restrictions for Configuring T1/E1 Interfaces

- You can configure CEM to support serial interface configuration.
- The supported BERT patterns are 1s, 2^11, 2^15, 2^20-O153, 2^20-QRSS, and 2^23.
- DS0 level channelization is not supported.
How to Configure T1/E1 Interfaces

This section provides information about configuring T1/E1 interfaces on the 48-Port T1/E1 interface module.

Setting the Card Type

To set the card type for the T1/E1 interfaces, complete these steps:

```
enable
configure terminal
card type t1/e1 0 0
exit
```

Configuring the Controller

To configure T1 interface, use the following commands:

```
enable
configure terminal
controller t1 0/3/0
clock source internal
framing esf
cablelength short 110
linecode b8zs
no shut
exit
```

For T1 interface, the default frame mode is Extended Super Frame (ESF).

To configure E1 interface, use the following commands:

```
enable
configure terminal
controller e1 0/3/0
clock source internal
framing crc4
linecode hdb3
no shut
exit
```

For E1 interface, the default frame mode is Cyclic Redundancy Check 4 (CRC4).

Verifying the Controller Configuration

Use the `show controllers` command to verify the controller configuration:
Configuring Structure-Agnostic TDM over Packet - T1/E1 Interfaces

To configure Structure-Agnostic TDM over Packet (SAToP), use the following commands:

```
enable
configure terminal
controller t1/e1 0/0/0
cem-group 0 unframed
exit
interface CEM 0/0/0
cem 0
xconnect 10.10.10.10 200 encapsulation mpls
exit
```

Note
To configure SAToP, the framing mode for the port is set to unframed.

Verifying CEM Configuration for SAToP

Use the following command to verify the CEM configuration for T1/E1 interfaces:

```
Router# show cem circuit interface CEM 0/0/0
```

```
CEM0/0/0, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x0
Dejitter: 5 (In use: 0)
Payload Size: 192
Framing: Unframed
CEM Defects Set
None
Signalling: No CAS
RTP: No RTP

Ingress Pkts: 475471
Dropped: 0

Egress Pkts: 475471
Dropped: 0

CEM Counter Details
Input Errors: 0
Output Errors: 0
Pkts Missing: 0
Pkts Reordered: 0
Misorder Drops: 0
JitterBuf Underrun: 0
Error Sec: 0
Severly Errored Sec: 0
Unavailable Sec: 0
Failure Counts: 0
Pkts Malformed: 0
JitterBuf Overrun: 0
```

Performance Monitoring

You can view the statistics or error count generated on the TDM lines for DS1. The performance monitoring result is displayed using the `show controller` command for all the modes. The following snippets display the performance monitoring details when `show controller` command is executed:

```
Router# show controllers t1/e1 0/2/1
T1/E1 0/2/1 is down.
```
Applique type is -48T1E1-CE
Cable length Short less than 225 ft
Receiver has loss of signal.
alarm-trigger is not set
Soaking time: 3, Clearance time: 10
AIS State: Clear LOS State: Clear LOF State: Clear
Framing is ESF, Line Code is B8ZS, Clock Source is Line.
Data in current interval (450 seconds elapsed):
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 449 Unavail Secs
0 Near-end path failures, 0 Far-end path failures, 0 SEF/AIS Secs
Data in Interval 1:
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 900 Unavail Secs
0 Near-end path failures, 0 Far-end path failures, 0 SEF/AIS Secs
Data in Interval 2:
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 0 Fr Loss Secs, 485 Line Err Secs, 0 Degraded Mins
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 897 Unavail Secs
0 Near-end path failures, 0 Far-end path failures, 0 SEF/AIS Secs
Total Data (last 2 15 minute intervals):
0 Line Code Violations, 0 Path Code Violations,
0 Slip Secs, 0 Fr Loss Secs, 485 Line Err Secs, 0 Degraded Mins,
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 1797 Unavail Secs
0 Near-end path failures, 0 Far-end path failures, 0 SEF/AIS Secs

Troubleshooting T1/E1 Controllers

You can use the following methods to troubleshoot the T1/E1 controllers:

Running Bit Error Rate Testing

Bit error rate testing (BERT) is supported on T1/E1 interfaces. You can run BERTs on 16 controllers out of 48 T1/E1 controllers at a time.

The interface module contains onboard BERT circuitry. With this, the interface module software can send and detect a programmable pattern that is compliant with CCITT/ITU O.151, O.152, O.153 pseudo-random and repetitive test patterns. BERT allows you to test cables and signal problems in the field.

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

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

The following keywords list different BERT keywords and their descriptions.

Table 1: BERT Pattern Descriptions

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1s</td>
<td>Repeating pattern of ones (...111...).</td>
</tr>
<tr>
<td>2^11</td>
<td>Pseudo-random test pattern that is 2,048 bits in length.</td>
</tr>
</tbody>
</table>
Pseudo-random test pattern that is 32,768 bits in length.

\[2^{15}\]

Pseudo-random test pattern that is 1,048,575 bits in length.

\[2^{20}\]

Pseudo-random QRSS test pattern that is 1,048,575 bits in length.

\[2^{20}\]

Pseudo-random test pattern that is 8,388,607 bits in length.

\[2^{23}\]

The total number of error bits received, and the total number of bits received are available for analysis. You can select the testing period from 1 minute to 24 hours, and you can also retrieve the error statistics anytime during the BERT test.

BERT is supported in two directions:

- Line - supports BERT in TDM direction
- System - supports BERT in PSN direction

**Note**

Before starting system side BERT, you must configure CEM. When the BERT is configured towards system direction, it internally loopbacks the TDM side.

### Configuring BERT

**Before You Begin**

Before you run BERT test, you must configure card type and controller.

To run a BERT on T1/E1 interface, perform the following tasks in global configuration mode.

```
enable
cconfigure terminal
ccontroller t1/e1 0/1/1
bvert pattern 2^11 interval 5 direction line/system
exit
```

**Note**

To terminate a BERT test during the specified test period, use the **no bvert** command.

### Verifying BERT Configuration for SAToP

Use the following command to verify the BERT configuration for T1/E1 interfaces:

```
Router# show controllers t1/e1 0/1/1
T1/E1 0/1/1 is up.
```
Applique type is -48T1E1-CE
Cable length is short 110
DSX1 BERT pattern : 2^11
DSX1 BERT direction : Line
DSX1 BERT sync : no sync
DSX1 BERT sync count : 0
DSX1 BERT interval : 5
DSX1 BERT time remain : 2
DSX1 BERT total errs : 0
DSX1 BERT total k bits : 0
DSX1 BERT errors (last): 0
DSX1 BERT k bits (last): 0
Last clearing of BERT counters never
No alarms detected.
alarm-trigger is not set
Soaking time: 3, Clearance time: 10
AIS State: Clear LOS State: Clear LOF State: Clear
Framing is unframed, Line Code is B8ZS, Clock Source is Internal.
Data in current interval (320 seconds elapsed):
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
0 Near-end path failures, 0 Far-end path failures, 0 SEF/AIS Secs
Total Data (last 3 15 minute intervals):
0 Line Code Violations, 0 Path Code Violations,
0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
0 Near-end path failures, 0 Far-end path failures, 0 SEF/AIS Secs

You can view the results of a BERT test at the following times:
• After you terminate the test using the no bert command
• After the test runs completely
• Anytime during the test (in real time)

Loopback on T1/E1 Interfaces

Loopback Description
You can use the following loopback on the T1/E1 interfaces.

<table>
<thead>
<tr>
<th>Loopback</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>loopback diag</td>
<td>Loops the outgoing transmit signal back to the receive signal. This is done using the diagnostic loopback feature in the interface module’s framer. The interface transmits AIS in this mode. Set the clock source command to internal for this loopback mode.</td>
</tr>
<tr>
<td>loopback local</td>
<td>Loops the incoming receive signal back out to the transmitter. You can specify whether to use the line or payload. Loopback local is supported on E1 interface.</td>
</tr>
</tbody>
</table>
### Configuring Loopback

#### Before You Begin

Before you configure loopback, you must configure the controller and the CEM.

To set a loopback local on the T1 interface, perform the following tasks in global configuration mode:

```
enable
configure terminal
controller t1 0/0/1
loopback local line
exit
```

To set a loopback diag on the T1 interface, perform the following tasks in global configuration mode:

```
enable
configure terminal
controller t1 0/0/1
loopback diag
exit
```

To set a loopback local on the E1 interface, perform the following tasks in global configuration mode:

```
enable
configure terminal
controller e1 0/0/1
loopback local
exit
```

To set a loopback network on the E1 interface, perform the following tasks in global configuration mode:

```
enable
configure terminal
controller e1 0/0/1
loopback network line
exit
```
enable
configure terminal
controller el 0/0/1
loopback network line
exit

To remove a loopback, use the **no loopback** command.

## Associated Commands

The commands used to configure T1/E1 Interfaces on 48-Ports T1/E1 Interface Module.

<table>
<thead>
<tr>
<th>Commands</th>
<th>URL</th>
</tr>
</thead>
</table>
### Commands and URL

<table>
<thead>
<tr>
<th>Command</th>
<th>URL</th>
</tr>
</thead>
</table>

### Additional References for Configuring 48-Port T1/E1 CEM Interface Module

#### Related Documents

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
</tr>
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<tr>
<td>Cisco IOS commands</td>
<td>Cisco IOS Master Commands List, All Releases</td>
</tr>
</tbody>
</table>

#### Standards and RFCs

<table>
<thead>
<tr>
<th>Standard/RFC</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>—</td>
<td>There are no standards and RFCs for this feature.</td>
</tr>
</tbody>
</table>

#### MIBs

<table>
<thead>
<tr>
<th>MIB</th>
<th>MIBs Link</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>—</td>
<td>To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:</td>
<td><a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a></td>
</tr>
</tbody>
</table>
Technical Assistance

<table>
<thead>
<tr>
<th>Description</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</td>
<td><a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a></td>
</tr>
</tbody>
</table>
Configuring Pseudowire

Cisco Pseudowire Emulation Edge-to-Edge (PWE3) allows you to transport traffic by using traditional services such as T1/E1 over a packet-based backhaul technology such as MPLS or IP. A pseudowire (PW) consists of a connection between two provider edge (PE) chassis that connects two attachment circuits (ACs), such as T1/E1 or T3/E3 links.

• Information About Pseudowire, on page 11
• How to Configure Pseudowire, on page 12
• Additional References for Configuring Pseudowire, on page 16

Information About Pseudowire

The following sections describe how to configure pseudowire on the interface module of the chassis.

Overview of Pseudowire

Pseudowires manage encapsulation, timing, order, and other operations in order to make it transparent to users. The pseudowire tunnel acts as an unshared link or circuit of the emulated service.

Overview of Circuit Emulation

Circuit Emulation (CEM) is a technology that provides a protocol-independent transport over IP/MPLS networks. It enables proprietary or legacy applications to be carried transparently to the destination, similar to a leased line.

CEM provides a bridge between a Time-Division Multiplexing (TDM) network and Multiprotocol Label Switching (MPLS) network. The chassis encapsulates the TDM data in the MPLS packets and sends the data over a CEM pseudowire to the remote Provider Edge (PE) chassis. As a result, CEM functions as a physical communication link across the packet network.

The chassis supports the pseudowire type that utilizes CEM transport: Structure-Agnostic TDM over Packet (SAToP).

L2VPN over IP/MPLS is also supported on the interface modules.
Structure-Agnostic TDM over Packet

Structure-Agnostic TDM over Packet (SAToP) encapsulates Time Division Multiplexing (TDM) bit-streams as pseudowires over public switched networks. It disregards any structure that may be imposed on streams, in particular the structure imposed by the standard TDM framing.

The protocol used for emulation of these services does not depend on the method in which attachment circuits are delivered to the Provider Edge (PE) chassis. For example, a T1 attachment circuit is treated the same way for all delivery methods, including copper, multiplex in a T3 circuit, a virtual tributary of a SONET circuit, or unstructured Circuit Emulation Service (CES).

In SAToP mode, the interface is considered as a continuous framed bit stream. The packetization of the stream is done according to IETF RFC 4553. All signaling is carried out transparently as a part of a bit stream.

How to Configure Pseudowire

The following sections describe how to configure pseudowire.

Configuring CEM for SAToP

This section provides information about how to configure CEM. CEM provides a bridge between a Time Division Multiplexing (TDM) network and a packet network, MPLS. The chassis encapsulates the TDM data in the MPLS packets and sends the data over a CEM pseudowire to the remote Provider Edge (PE) chassis.

The following sections describe how to configure CEM.

Configuring CEM Restriction

- Not all combinations of payload size and dejitter buffer size are supported. If you apply an incompatible payload size or dejitter buffer size configuration, the chassis rejects it and reverts to the previous configuration.
- The dummy-pattern command is *not* supported.

Note

CEM interface does not support idle-cas parameter.

Configuring CEM Group for SAToP for T1 Interfaces

The following section describes how to configure a CEM group for SAToP.

```
enable
configure terminal
controller t1 0/4/0
cem-group 0 unframed
end
```

To configure a CEM group for Framed SAToP:

```
enable
configure terminal
```
controller t1 0/4/0
cem-group 0 framed
end

Note
You need metroaggservices license to configure CEM group on the Interface Module.

Configuring CEM Classes

A CEM class allows you to create a single configuration template for multiple CEM pseudowires. Follow these steps to configure a CEM class:

• The CEM parameters can be configured either by using CEM class or on CEM interface directly.
• The CEM parameters at the local and remote ends of a CEM circuit must match; otherwise, the pseudowire between the local and remote PE chassis does not come up.

enable
configure terminal
class cem mycemclass
payload-size 512
dejitter-buffer 12
exit
interface cem 0/0/1
cem 0
cem class mycemclass
xconnect 10.10.10.10 200 encapsulation mpls
exit

Configuring CEM Parameters

The following sections describe the parameters you can configure for CEM circuits.

Configuring Payload Size

To specify the number of bytes encapsulated into a single IP packet, use the `payload-size` command. The size argument specifies the number of bytes in the payload of each packet. The range is from 32 to 1312 bytes.

Default payload sizes for an unstructured CEM channel are as follows:

• T1 = 192 bytes
• E1 = 256 bytes
• DS0 = 32 bytes

Default payload sizes for a structured CEM channel depend on the number of time slots that constitute the channel. Payload size (L in bytes), number of time slots (N), and packetization delay (D in milliseconds) have the following relationship: \( L = 8*N*D \). The default payload size is selected in such a way that the packetization delay is always 1 millisecond. For example, a structured CEM channel of 16xDS0 has a default payload size of 128 bytes.
Both payload-size and dejitter-buffer must be configured simultaneously.

**Setting the Dejitter Buffer Size**

To specify the size of the dejitter-buffer used to compensate for the network filter, use the `dejitter-buffer` command. The configured dejitter-buffer size is converted from milliseconds to packets and rounded up to the next integral number of packets. Use the size argument to specify the size of the buffer, in milliseconds. The range is from 1 to 32; the default is 5.

**Shutting Down a CEM Channel**

To shut down a CEM channel, use the `shutdown` command in CEM configuration mode. The `shutdown` command is supported only under CEM mode and not under the CEM class.

**Configuring CEM Parameter on CEM Interface**

The CEM parameters can be configured directly on CEM interface. Follow these steps to configure CEM parameters:

```
enable
configure terminal
interface cem 0/0/1
cem 0
payload-size 512 dejitter-buffer 12
xconnect 10.10.10.10 200 encapsulation mpls
exit
```

**Verifying CEM Statistics for SAToP**

Use the following commands to verify the pseudowire configuration for SAToP:

- `show cem circuit` — Displays information about the circuit state, administrative state, the CEM ID of the circuit, and the interface on which it is configured. If cross connect is configured under the circuit, the command output also includes information about the attachment circuit status.

```
Router# show cem circuit
0-32000 CEM ID
detail Detailed information of cem ckt(s)
interface CEM Interface
summary Display summary of CEM ckt(s)
| Output modifiers
```

```
Router# show cem circuit
CEM Int. ID Line Admin Circuit AC
----------------- ------- ------- --------- -------
CEM0/1/0 1 UP UP ACTIVE --/--
CEM0/1/0 2 UP UP ACTIVE --/--
CEM0/1/0 3 UP UP ACTIVE --/--
CEM0/1/0 4 UP UP ACTIVE --/--
CEM0/1/0 5 UP UP ACTIVE --/--
```

- `show cem circuit cem-id` — Displays the detailed information about that particular circuit.

```
Router# show cem circuit 0
```
CEM0/1/2, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x0
Dejitter: 5 (In use: 0)
Payload Size: 192
Framing: Unframed
CEM Defects Set: None

Signalling: No CAS
RTP: No RTP

<table>
<thead>
<tr>
<th>Ingress Pkts: 11060</th>
<th>Dropped: 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egress Pkts: 11061</td>
<td>Dropped: 0</td>
</tr>
</tbody>
</table>

CEM Counter Details
- Input Errors: 0
- Pkts Missing: 0
- Misorder Drops: 0
- Error Sec: 0
-Unavailable Sec: 0
-Pkts Malformed: 0
- Output Errors: 0
- Pkts Reordered: 0
- JitterBuf Underrun: 0
- JitterBuf Overrun: 0

• show cem circuit summary — Displays the number of circuits which are up or down per interface basis.

Router# **show cem circuit summary**

<table>
<thead>
<tr>
<th>CEM Int.</th>
<th>Total Active</th>
<th>Inactive</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEM0/1/0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Associated Commands**

The following commands are used to configure pseudowire:

<table>
<thead>
<tr>
<th>Commands</th>
<th>URL</th>
</tr>
</thead>
</table>
# Additional References for Configuring Pseudowire

## Related Documents

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## MIBs

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## Technical Assistance

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</tr>
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<tbody>
<tr>
<td>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</td>
<td><a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a></td>
</tr>
</tbody>
</table>
CHAPTER 3

Alarm History

Alarm history or alarm persistence feature enables the maintenance of the history of the port and the path alarms of 48-Port T1/E1 CEM Interface Module.

History of the port-level and path-level alarms are saved into a file and is retained for monitoring network events.

- Alarm History Restrictions, on page 17
- Configuring Alarm History, on page 18
- Verification of Alarm History Configuration, on page 18
- Associated Commands, on page 19
- Additional References for Alarm History, on page 19

Alarm History Restrictions

The following restrictions apply for the alarm history feature:

- Only port and path level alarm history or alarm persistency is supported.
- Persistence of T1/E1 alarms on a Channelized T3/E3 port is not supported.
- Two new files are created after each reboot.
- The primary and secondary log file are created during feature initialization. The primary log file saves 10000 alarms. When the threshold of 10000 alarms in the primary log file is crossed, the subsequent 10000 alarms are saved in the secondary log file. After crossing the threshold of 10000 alarms in the secondary log file, the content of primary log file is cleared and is replaced with the subsequent alarms.
- When a primary file switches to a secondary file and vice versa, the following happens:
  - An information level syslog message is displayed.
  - An informative message is written in the file where subsequent alarms are stored.
- When RSP switchover happens, the alarm history files are not copied to the new active RSP. Two new files are created in the new active RSP.
- When you re-configure alarm history or alarm persistence feature, two new files are created.
Configuring Alarm History

The configuration of alarm history helps in defining the periodicity or the interval at which the alarm entries are saved in the designated file. To configure alarm history:

```bash
enable
configure terminal
service alarm persistency interval <20-600>
end
```

When alarm history is configured, two log files are created in bootflash:\tracelogs in the following format:

```plaintext
<persistent_alarm[1/2][TIME_STAMP(DD_MMMM_YYYY_HH_MM_SSS)].log>
```

The syslog message is displayed as the following after configuration:

```plaintext
*Jun 15 10:16:51.270: %ALARM_PERSISTENCY-6-ALARM_INFO_PROCESS_CREATE: created mcrpr_spa_persistence_logger process:292
*Jun 15 10:16:51.270: %ALARM_PERSISTENCY-6-ALARM_CHUNK_INFO_CREATED: chunk pool creation for alarm info is successful
*Jun 15 10:16:51.270: %ALARM_PERSISTENCY-6-ALARM_CHUNK_QUEUE_CREATED: chunk pool for alarm queue is successful
*Jun 15 10:16:51.283: %ALARM_PERSISTENCY-6-ALARM_INFO_FILE_CREATED: successfully created /bootflash/tracelogs/persistent_alarm_1.15_June_2016_10_16__270.log file
Router# *Jun 15 10:16:51.295: %ALARM_PERSISTENCY-6-ALARM_INFO_FILE_CREATED: successfully created /bootflash/tracelogs/persistent_alarm_2.15_June_2016_10_16__270.log file
*Jun 15 10:16:51.295: %SYS-5-CONFIG_I: Configured from console by console
Router#
```

Verification of Alarm History Configuration

Use the `show process | include persis` command to verify the validity of the process.

```bash
Router#show process | include persis
292 Mei 13F0D4AC 0 49 010328/12000 0 mcrpr_spa_persis
Router#
```

Verify the contents of the persistent alarm log files using the following commands:

```bash
Router#dir bootflash:\tracelogs/*persistent*
Directory of bootflash:\tracelogs/*persistent*
394172 -rw- 1606 Jun 15 2016 07:50:39 +00:00 persistent_alarm_1.15_June_2016_07_46__158.log
394173 -rw- 6299 Jun 15 2016 07:50:38 +00:00 persistent_alarm_2.15_June_2016_07_46__158.log
618506976 bytes total (4867022848 bytes free)
Router#
```

```bash
Router#more bootflash:\tracelogs/persistent_alarm_1.15_June_2016_07_46__158.log
At:15_June_2016_07_50__916 contents of persistent_alarm_2.15_June_2016_07_46__158.log are full, so switched to this file
*07:50:19.360 UTC Wed Jun 15 2016|SLOT_0 |BAY_3 |PORT_0 |2 |1 |6 |4 |SONET_SDH_PATH_VT/TU_ALARM|MAJOR|VT_UNEQUIPPED|CLEARED
*07:50:19.360 UTC Wed Jun 15 2016|SLOT_0 |BAY_3 |PORT_0 |2 |1 |6 |4 |SONET_SDH_PATH_VT/TU_ALARM|MAJOR|VT_PATH_LOP|RAISED
*07:50:19.360 UTC Wed Jun 15 2016|SLOT_0 |BAY_3 |PORT_0 |2 |1 |7 |1 |SONET_SDH_PATH_VT/TU_ALARM|MAJOR|VT_UNEQUIPPED|CLEARED
*07:50:19.360 UTC Wed Jun 15 2016|SLOT_0 |BAY_3 |PORT_0 |2 |1 |7 |1 |SONET_SDH_PATH_VT/TU_ALARM|MAJOR|VT_PATH_LOP|RAISED
*07:50:19.360 UTC Wed Jun 15 2016|SLOT_0 |BAY_3 |PORT_0 |2 |1 |7 |1 |SONET_SDH_PATH_VT/TU_ALARM|MAJOR|VT_UNEQUIPPED|CLEARED
*07:50:19.360 UTC Wed Jun 15 2016|SLOT_0 |BAY_3 |PORT_0 |2 |1 |7 |1 |SONET_SDH_PATH_VT/TU_ALARM|MAJOR|VT_PATH_LOP|RAISED
```

48-Port T1/E1 CEM Interface Module Configuration Guide, Cisco IOS XE Everest 16.6.1 (Cisco ASR 900 Series)
**Associated Commands**

The following commands are used to configure alarm history:

<table>
<thead>
<tr>
<th>Commands</th>
<th>Links</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>interface/command/ir-cr-book/</td>
</tr>
<tr>
<td></td>
<td>ir-s1.html#wp3501057143</td>
</tr>
<tr>
<td></td>
<td>interface/command/ir-cr-book/</td>
</tr>
<tr>
<td></td>
<td>ir-s5.html#wp9298909580</td>
</tr>
</tbody>
</table>

**Additional References for Alarm History**

**Related Documents**

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco IOS commands</td>
<td>Cisco IOS Master Commands List, All Releases</td>
</tr>
</tbody>
</table>

**Standards**

<table>
<thead>
<tr>
<th>Standards</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>---</td>
<td>There are no standards for this feature.</td>
</tr>
</tbody>
</table>
### MIBs

<table>
<thead>
<tr>
<th>MIB</th>
<th>MIBs Link</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>To locate and download MIBs for selected platforms, Cisco IOS releases,</td>
</tr>
<tr>
<td></td>
<td>and feature sets, use Cisco MIB Locator found at the following URL:</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a></td>
</tr>
</tbody>
</table>

### RFCs

<table>
<thead>
<tr>
<th>RFCs</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>There are no RFCs for this feature.</td>
</tr>
</tbody>
</table>

### Technical Assistance

<table>
<thead>
<tr>
<th>Description</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</td>
<td><a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a></td>
</tr>
<tr>
<td>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</td>
<td></td>
</tr>
<tr>
<td>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 4

Clock Recovery System for SAToP

The Clock Recovery System recovers the service clock using Adaptive Clock Recovery (ACR) and Differential Clock Recovery (DCR).

- Finding Feature Information, on page 21
- Information About Clock Recovery, on page 21
- Prerequisites for Clock Recovery, on page 23
- Restrictions for Clock Recovery, on page 23
- How to Configure ACR and DCR, on page 23
- Associated Commands, on page 26
- Additional References for Clock Recovery, on page 27

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About Clock Recovery

Adaptive Clock Recovery (ACR)

Adaptive Clock Recovery (ACR) is an averaging process that negates the effect of random packet delay variation and captures the average rate of transmission of the original bit stream. ACR recovers the original clock for a synchronous data stream from the actual payload of the data stream. In other words, a synchronous clock is derived from an asynchronous packet stream. ACR is a technique where the clock from the TDM domain is mapped through the packet domain, but is most commonly used for Circuit Emulation (CEM). ACR is supported on unframed and framed modes of SAToP.

Effective Cisco IOS XE Everest 16.5.1, ACR is supported on the 8-port T1/E1 interface module.
Differential Clock Recovery (DCR)

Differential Clock Recovery (DCR) is another technique used for Circuit Emulation (CEM) to recover clocks based on the difference between PE clocks. TDM clock frequency are tuned to receive differential timing messages from the sending end to the receiving end. A traceable clock is used at each end, which ensures the recovered clock is not affected by packet transfer. DCR is supported on unframed and framed modes of SAToP.

Benefits of Clock Recovery

- Customer-edge devices (CEs) can have different clock from that of the Provide-edge devices (PEs).

Scaling Information

<table>
<thead>
<tr>
<th>IM Card</th>
<th>Pseudowires Supported (Number of Clocks Derived)</th>
</tr>
</thead>
<tbody>
<tr>
<td>48-Port T1/E1 CEM Interface Module</td>
<td>48</td>
</tr>
</tbody>
</table>
Prerequisites for Clock Recovery

- The clock of interface modules must be used as service clock.
- CEM must be configured before configuring the global clock recovery.
- RTP must be enabled for DCR in CEM, as the differential clock information is transferred in the RTP header.

Restrictions for Clock Recovery

- The reference clock source is used and locked to a single clock.
- The clock ID should be unique for a particular interface module for ACR or DCR configuration.
- ACR clock configuration under each controller should be performed before configuring CEM group.

How to Configure ACR and DCR

Configuring ACR for T1/E1

Configuring Adaptive Clock Recovery of T1/E1 Interfaces for SAToP

Before You Begin

Before configuring Adaptive Clock Recovery, CEM must be configured. Below are the guidelines to configure clock recovery:

- The node (chassis) on which the DS1 is configured for ACR, must have its own clock derived from BITS/GPS/Stratum clock.
- The minimum packet size of CEM pseudowires on the network that delivers robust clock recovery is 64 bytes.

To configure the clock on T1/E1 interfaces for SAToP in controller mode, use the following commands:

```
enable
configure terminal
controller t1 0/0/1
clock source recovered 1
cem-group 0 unframed
exit
```

To configure the clock recovery on T1/E1 interfaces in global configuration mode, use the following commands:

```
recovered-clock 0 0
clock recovered 1 adaptive cem 1 0
exit
```
The clock configuration on controller must be done before configuring the clock recovery on global configuration mode.

To remove the clock configuration in ACR and DCR, you must remove the recovery clock configuration in global configuration mode and then remove the controller configuration.

**Verifying the Adaptive Clock Recovery Configuration of T1/E1 Interfaces for SAToP**

Use the `show recovered-clock` command to verify the adaptive clock recovery of T1/E1 interfaces for SAToP:

```
Router# show recovered-clock

Recovered clock status for subslot 0/4
--------------------------------------
Clock Type Mode CEM Status Frequency Offset (ppb) Circuit-No
0 DS1 ADAPTIVE 0 ACQUIRED n/a 0 (Port)
```

Use the `show running-config` command to verify the configuration of adaptive clock of T1/E1 interfaces:

```
Router# show running-config | section 0/0/1
controller T1/E1 0/0/1
  framing unframed
  clock source recovered 1
  linecode h8zs
  cablelength long 0db
  cem-group 0 unframed
  interface CEM0/0/1
  no ip address
  cem 0
```

Use the `show running-config | section recovered-clock` command to verify the recovery of adaptive clock of T1/E1 interfaces:

```
Router# show running-config | section recovered-clock
recovered-clock 0 0
  clock recovered 1 adaptive cem 1 0
```

**Configuring DCR for T1/E1**

**Configuring Differential Clock Recovery of T1/E1 Interfaces for SAToP**

**Before You Begin**

Before configuring Differential Clock Recovery, CEM must be configured. Below are the guidelines to configure Differential clock recovery:

- Before you start configuring DCR, RTP must be enabled on the CEM interface. The RTP is used to carry the differential time.
- The minimum packet size of CEM pseudowires on the network that delivers robust clock recovery is 64 bytes.
To configure the clock on T1/E1 interfaces for SAToP in controller mode, use the following commands:

```
enable
configure terminal
controller t1/e1 0/0/1
cem-group 0 unframed
clock source recovered 1
exit
```

To configure RTP header on T1/E1 interfaces in global configuration mode, use the following commands:

```
interface cem 0/0/1
cem 0
rtp-present
```

To configure Differential clock recovery of T1/E1 interfaces, use the following commands in global configuration mode:

```
recovered-clock 0 0
clock recovered 1 differential cem 1 0
exit
```

**Note**
The clock configuration on controller must be done before configuring the clock recovery on global configuration mode.

---

**Verifying the Differential Clock Recovery Configuration of T1/E1 Interfaces for SAToP**

Use the `show recovered-clock` command to verify the differential clock recovery of T1/E1 interfaces for SAToP:

```
Router# show recovered-clock
```

```
Recovered clock status for subslot 0/4
------------------------------------------
Clock  Type   Mode       CEM  Status  Frequency Offset(ppb)  Circuit-No
0      DS1  DIFFERENTIAL 0  ACQUIRED  n/a  0  (Port)
```

Use the `show running-config | section` command to verify the configuration of differential clock of T1/E1 interfaces for SAToP:

```
Router# show running-config | section 0/0/1
controller T1/E1 0/0/1
framing unframed
clock source recovered 1
linecode b8zs
cablelength long 0db
cem-group 0 unframed
interface CEM 0/0/1
no ip address
cem 0
rtp-present
```

Use the `show running-config | section recovered-clock` command to verify the recovery of differential clock of T1/E1 interfaces:

```
```
Router# show running-config | section recovered-clock
recovered-clock 0 0
clock recovered 1 differential cem 1 0

Configuring Network Clock

To configure a network clock, use the following commands:

```bash
enable
configure terminal
controller E1/T1 0/5/0
clock source line
cem-group 0 unframed
exit
enable
configure terminal
network-clock input-source 1 controller E1/T1 0/5/0
exit
```

Verifying Network Clocking Configuration

Use `show run | sec network-cl` command to verify the network clocking configuration.

```bash
network-clock synchronization automatic
network-clock synchronization mode QL-enabled
network-clock input-source 1 controller E1 0/1/0
network-clock wait-to-restore 10 global
rtr1#sh netw synchronization
Symbols: En - Enable, Dis - Disable, Adis - Admin Disable
        NA - Not Applicable
        # - Synchronization source selected
        & - Synchronization source manually switched

Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Enable
ESMC : Enabled
SSM Option : 1
T0 : E1 0/1/0
Hold-off (global) : 300 ms
Wait-to-restore (global) : 10 sec
Tsm Delay : 180 ms
Revertive : No

Nominated Interfaces

<table>
<thead>
<tr>
<th>Interface</th>
<th>SigType</th>
<th>Mode/QL</th>
<th>Prio</th>
<th>QL_IN</th>
<th>ESMC Tx</th>
<th>ESMC Rx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>NA</td>
<td>NA/Dis</td>
<td>251</td>
<td>QL-SEC</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>*E1 0/1/0</td>
<td>NA</td>
<td>NA/Dis</td>
<td>1</td>
<td>QL-SEC</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

rtr1#
```

Associated Commands

The commands used to configure adaptive clock recovery and differential clock recovery on 48-Ports T1/E1 Interface Module.
### Additional References for Clock Recovery

#### Related Documents

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco IOS commands</td>
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</tbody>
</table>

#### Standards and RFCs

<table>
<thead>
<tr>
<th>Standard/RFC</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITU - T G.8261</td>
<td>Timing and synchronization aspects in packet networks</td>
</tr>
</tbody>
</table>
MIBs

<table>
<thead>
<tr>
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<th>MIBs Link</th>
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Technical Assistance

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<tr>
<td>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</td>
<td><a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a></td>
</tr>
</tbody>
</table>