Circuit Emulation Service over UDP

The Circuit Emulation Service over UDP feature extends the implementation of Cisco IOS Circuit Emulation Service (CES) by supporting pseudowire emulation (PWE) function to be performed over an Internet Protocol (IP) network directly.

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 at the end of this module.

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.

Restrictions for Circuit Emulation Service over UDP

- Because CLI on Route Processor (RP) is used to install the Access Control List (ACL) entry, the ACL programming is decoupled from the Layer 2 virtual private network (L2VPN) control plane update. As a result, when a pseudowire circuit goes down, the ACL is still present. Any traffic coming in from the core which matches the ACL is redirected to the egress line card, where it is dropped due to the absence of appropriate entries in the disposition table.
- Pseudowires redundancy is not supported.

- Fragmentation of IP packets is not supported. The Don't Fragment (DF) bit is set when the IP header is inserted.
- Path MTU is not supported.
- Differential synchronization mode is not supported.
- Only the basic Circuit Emulation Service over Packet Switching Networks (CESoPSN) over UDP/IP encapsulation without the optional Real-Time Protocol (RTP) header is supported.

Information About Circuit Emulation Service over UDP

CES Overview

Circuit Emulation Service—Internetworking Function (CES-IWF) is a service based on ATM forum standards that allows communications to occur between Constant Bit Rate (CBR) or AAL1 CES and ATM User Network Interfaces (UNI); that is, between non-ATM telephony devices (such as classic private branch exchange (PBX) or Time Division Multiplexing (TDM) and ATM devices (such as Cisco 3600 or 7200 series routers). Thus, a Cisco 3600 series router equipped with an OC-3/STM-1 ATM CES network module or a Cisco 7200 series router equipped with an ATM-CES port adapter offers a migration path from classic T1/E1 CBR data communications services to emulated CES T1/E1 unstructured (clear channel) services or structured (N x 64) services in an ATM network.

CES allows you to interconnect existing T1 or E1 interfaces and other kinds of CBR equipment. CES includes features such as PBX interconnect, consolidated voice and data traffic, and video conferencing.

With circuit emulation, data received from an external device at the edge of an ATM network is converted to ATM cells, sent through the network, reassembled into a bit stream, and passed out of the ATM network to its destination. T1/E1 circuit emulation does not interpret the contents of the data stream. All the bits flowing into the input edge port of the ATM network are reproduced at one corresponding output edge port.

An emulated circuit is carried across the ATM network on a PVC, which is configured through the network management system or the router command line interface (CLI).

For more information on configuring CES, see the Configuring ATM module.

Pseudowire Emulation over Packet

Pseudowire Emulation over Packet (PWEoP) is one of the key components that you can use to migrate to a packet-based multi-service network. Circuit Emulation over Packet (CEoP) is a subset of PWEoP. It is used to migrate to all-packet networks from legacy TDM networks, yet providing transport for legacy applications transparently over a packet network. CEoP is the imitation of a physical connection. Many service providers and enterprises operate both packet switched networks and TDM networks. These service providers and enterprises have moved many of their data services from the TDM network to their packet network for scalability and efficiency. Cisco provides routing and switching solutions capable of transporting Layer 2 and Layer 3 protocols such as Ethernet, IP, and Frame Relay. Most applications and services have been migrated to the packet-based network, including voice and legacy applications.

Circuit Emulation Services over Packet Switched Network over UDP

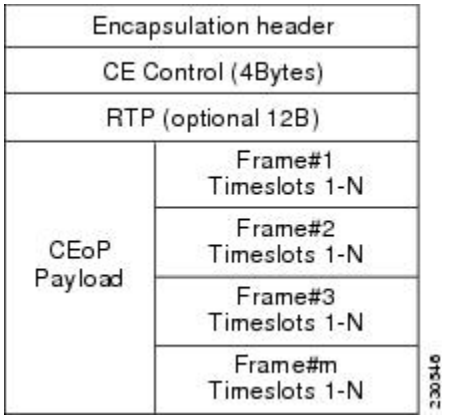
CESoPSN mode is used to encapsulate T1/E1 structured (channelized) services over PSN. Also refered to as structured mode, CESoPSN identifies framing and sends only payload, which can be channelized T1s within DS3 and DS0s within T1. DS0s can be bundled to the same packet. This mode is based on IETF RFC 5086.

SPAs can aggregate individual interfaces and flexibly bundle them together. They can be configured to support either structured or unstructured CES modes of operation per each T1/E1/J1 as well as clear channel DS3 interfaces. Note that DS3 does not support CESoPSN/SAToP currently. It is only supported on 1-Port Channelized OC-3 STM1 ATM CEoP SPA channelized to T1/E1, or on 24-Port Channelized T1/E1 ATM CEoP SPA.

Each supported interface can be configured individually to any supported mode. The supported services comply with IETF and ITU drafts and standards.

The figure below shows the frame format in CESoPSN mode.

Figure 1: Structured Mode Frame Format



How to Configure Circuit Emulation Service over UDP

Perform the following task to configure Circuit Emulation Service over UDP:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface loopback** *interface-number*
4. **ip address** *ip-address mask* [**secondary**]
5. **mls cemoudp reserve slot** *slot-number*
6. **pseudowire-class** *pseudowire-class-name*
7. **encapsulation udp**
8. **ip local interface loopback** *interface-number*
9. **ip tos value** *number*
10. **ip ttl** *number*
11. **exit**
12. **controller** {e1 | t1} *slot* / *subslot* / *port*
13. **clock source** {**internal** | **line** | **loop**}
14. **cem-group** *number* **timeslots** *number*
15. **exit**
16. **interface cem** *slot* / *subslot* / *port*
17. **cem** *group-number*
18. **xconnect** *peer-router-id vcid* **pseudowire-class** *name*
19. **udp port local** *local-udp-port* **remote** *remote-udp-port*
20. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface loopback** *interface-number* **Example:** `Router(config)# interface loopback 1`	Enables the loopback interface and enters interface configuration mode.

	Command or Action	Purpose
Step 4	**ip address** *ip-address mask* [**secondary**] **Example:** `Router(config)# ip address 10.1.1.1 255.255.255.255`	Specifies the IP address and subnet mask for this loopback interface.
Step 5	**mls cemoudp reserve slot** *slot-number* **Example:** `Router(config-if)# mls cemoudp reserve slot 1`	Reserves a loopback interface used as source for the CESoPSN circuit for a particular line card. • Slot number refers to the module number of the line card where the CEoP SPA resides.
Step 6	**pseudowire-class** *pseudowire-class-name* **Example:** `Router(config-if)# psuedowire-class PS1`	Creates a new pseudowire class and enters pseudowire-class configuration mode.
Step 7	**encapsulation udp** **Example:** `Router(config-pw-class)# encapsulation udp`	Specifies the UDP transport protocol.
Step 8	**ip local interface loopback** *interface-number* **Example:** `Router(config-pw-class)# ip local interface loopback 1`	Configures the IP address of the provider edge (PE) router interface as the source IP address for sending tunneled packets.
Step 9	**ip tos value** *number* **Example:** `Router(config-pw-router)# ip tos value 23`	Specifies the type of service (ToS) level for IP traffic in the pseudowire.
Step 10	**ip ttl** *number* **Example:** `Router(config-pw-class)# ip ttl 32`	Specifies a value for the time-to-live (TTL) byte in the IP headers of Layer 2 tunneled packets.
Step 11	**exit** **Example:** `Router(config-pw-class)# exit`	Exits pseudowire-class configuration mode.

	Command or Action	Purpose
Step 12	**controller** {e1 | t1} *slot* / *subslot* / *port* **Example:** `Router(config)# controller ethernet 2/0/0`	Enters E1/T1 controller configuration mode.
Step 13	**clock source** {**internal** | **line** | **loop**} **Example:** `Router(config-controller)# clock source internal`	Enters controller configuration mode and sets the clock source on the interface to: • Internal–The system clock selection process does not select clock source as the interface but it uses the system clock for TX. • Line–The system clock selection process selects the clock source line as the interface and uses the system clock for TX. • Loop–The system clock selection process selects the clock source line as the interface. For TX clock the interface uses the clock source received on the same interface. **Note** By default, the clock source on the interface is set to internal.
Step 14	**cem-group** *number* **timeslots** *number* **Example:** `Router(config-controller)# cem-group 5 timeslots 12`	Assigns channels on the T1/E1 circuit to the circuit emulation (CEM) channel.
Step 15	**exit** **Example:** `Router(config-controller)# exit`	Exits controller configuration.
Step 16	**interface cem** *slot* / *subslot* / *port* **Example:** `Router(config)# interface cem 2/0/0`	Selects the CEM interface where the CEM circuit (group) is located (where slot/subslot is the SPA slot and subslot and port is the SPA port where the interface exists) and enters CEM interface mode.
Step 17	**cem** *group-number* **Example:** `Router(config-if-cem)# cem 5`	Defines a CEM channel.

	Command or Action	Purpose
Step 18	**xconnect** *peer-router-id vcid* **pseudowire-class** *name* **Example:** `Router(config-if-cem)# xconnect 10.30.30.1 12 PS1`	Binds an attachment circuit to the CEM interface to create a pseudowire. This example creates a pseudowire by binding the CEM circuit 5 to the remote peer 30.30.30.2. **Note** When creating IP routes for a pseudowire configuration, we recommend that you build a route from the cross-connect address (LDP router-ID or loopback address) to the next hop IP address, such as **ip route 10.30.30.2 255.255.255.255 1.2.3.4**.
Step 19	**udp port local** *local-udp-port* **remote** *remote-udp-port* **Example:** `Router(config-if-cem)# udp port local 49154 remote 50201`	Specifies a local and remote UDP port for the connection.
Step 20	**exit** **Example:** `Router(config-if-cem)# exit`	Exits the CEM interface.

Configuration Examples for Circuit Emulation Service over UDP

Example Configuring Circuit Emulation Service over UDP

```
Router> enable
Router# configure terminal
Router(config)# interface loopback 0
Router(config-if)# ip address 10.2.2.8 255.255.255.255
Router(config-if)# mls cemoudp reserve slot 2
Router(config)# pseudowire-class udpClass
Router(config-pw-class)# encapsulation udp
Router(config-pw-class)# ip local interface loopback 0
Router(config-pw-class)# ip tos value 100
Router(config-pw-class)# ip ttl 100
Router(config-pw-class)# exit
Router(config)# controller ethernet 2/0/0
Router(config-controller)# clock source internal
Router(config-controller)# cem-group 5 timeslots 1-24
Router(config-controller)# exit
Router(config)# interface cem 2/0/0
Router(config-if)# cem 5
Router(config-if-cem)# xconnect 10.30.30.2 305 pw-class udpClass
Router(config-if-cem)# udp port local 50000 remote 55000
Router(config-if-cem)# exit
```

Example Verifying the Configuration of Circuit Emulation Service over UDP

```
Router# show xconnect all
Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up       DN=Down            AD=Admin Down      IA=Inactive
  SB=Standby  HS=Hot Standby     RV=Recovering      NH=No Hardware

XC ST  Segment 1                         S1 Segment 2                          S2
------+---------------------------------+--+---------------------------------+--
UP     ac   CE3/0/0:1(CESoPSN Basic)     UP udp  66.66.66.66:180               UP
UP     ac   CE3/0/0:6(CESoPSN Basic)     UP udp  66.66.66.66:181               UP
Router# show pw vc
Local intf     Local circuit              VC ID      Status
-------------- -------------------------- ---------- --------
CE3/0/0        CESoPSN Basic              180        established
  LAddr: 55.55.55.55     LPort: 50002
  RAddr: 66.66.66.66     RPort: 50002
CE3/0/0        CESoPSN Basic              181        established
  LAddr: 55.55.55.55     LPort: 50004
  RAddr: 66.66.66.66     RPort: 50004
```

Additional References

The following sections provide references related to the MPLS High Availability feature.

Related Documents

Related Topic	Document Title
MPLS VPNs Non Stop Forwarding	NSF/SSO—MPLS VPN
MPLS LDP Non Stop Forwarding	*NSF/SSO—MPLS LDP and LDP Graceful Restart*
AToM Non Stop Forwarding	NSF/SSO: Any Transport over MPLS and Graceful Restart
Cisco Express Forwarding	Cisco Express Forwarding: Command Changes
MIBs	• MPLS VPN: SNMP MIB Support • MPLS Label Distribution Protocol MIB Version 8 Upgrade • MPLS Label Switching Router MIB • MPLS Enhancements to Interfaces MIB • MPLS Traffic Engineering (TE) MIB
NSF/SSO	Cisco Nonstop Forwarding MPLS High Availability: Command Changes

Standards

Standard	Title
draft-ietf-mpls-bgp-mpls-restart.txt	Graceful Restart Mechanism for BGP with MPLS
draft-ietf-mpls-idr-restart.txt	Graceful Restart Mechanism for BGP

MIBs

MIB	MIBs Link
• MPLS VPN MIB • MPLS Label Distribution Protocol MIB Version 8 Upgrade	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 3478	Graceful Restart Mechanism for Label Distribution

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register on Cisco.com.	http://www.cisco.com/techsupport

Feature Information for Circuit Emulation Service over UDP

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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.

Table 1: Feature Information for Circuit Emulation Service over UDP

Feature Name	Releases	Feature Information
Circuit Emulation Service over UDP	15.1(2)S	The Circuit Emulation Service over UDP feature extends the implementation of Cisco IOS CES by supporting PWE function to be performed over an IP network directly.