Overview of the Circuit Emulation over Packet Shared Port Adapter

This chapter provides an overview of the release history, features, overview, and MIB support for the Circuit Emulation over Packet (CEoP) shared port adapters (SPAs) that are available for the Cisco ASR 1000 Series Routers. This chapter includes the following sections:

Release History

Release	Modification
Cisco IOS XE Release 3.3.0S	Support for the 1-Port Channelized OC3/STM-1 ATM and Circuit Emulation SPA was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.
Cisco IOS XE Release 3.4.0S	Added information about the following SPAs: • 2-Port Channelize d T3/E3 ATM CEoP SPA (supporting clear T3 ATM) • 24-Port Channelized T1/E1 ATM CEoP SPA
Cisco IOS XE Release 3.5.0S	Added information about support for the ATM mode on clear-channel E3 for the SPA-2CHT3-CE-ATM.
Cisco IOS XE Release 3.6.0S	Added information about support for the circuit emulation (CEM) mode in the 2-Port Channelized T3/E3 ATM CEoP SPA.

Note For more information pertaining to the restrictions about Circuit Emulation SPAs, see the "SIP and SPA Product Overview" chapter in the *Cisco ASR 1000 Series Hardware Installation Guide*.

Overview

The SPA-1CHOC3-CE-ATM and SPA-24CHT1-CE-ATM are single-width, single-height, cross-platform Circuit Emulation over Packet (CEoP) SPAs for the Cisco ASR 1000 Series Routers. The SPA-2CHT3-CE-ATM is also a single-width, single-height but supports only the ATM.

CEoP SPAs are available in the following models:

- 2-Port Channelized T3/E3 ATM CEoP SPA (SPA-2CHT3-CE-ATM)
- 24-Port Channelized T1/E1 ATM CEoP SPA (SPA-24CHT1-CE-ATM)
- 1-Port Channelized OC-3 STM1 ATM CEoP SPA (SPA-1CHOC3-CE-ATM)

The following table describes the features supported on different types of circuit emulation (CEM) SPAs.

Table 1: Circuit Emulation SPA Types and Feature Compatibility Matrix

Circuit Emulation (CEM) SPA Type	Cisco IOS XE Release in which SPA Introduced	Feature Supported
SPA-1CHOC3-CE-ATM	3.3.0S	Supports only the CEM mode.
SPA-24CHT1-CE-ATM	3.4.0S	Supports only the CEM mode.
SPA-2CHT3-CE-ATM[1]	3.4.0S	Supports only the T3 ATM mode.
SPA-2CHT3-CE-ATM	3.5.0S	Supports the E3 ATM mode.
SPA-2CHT3-CE-ATM	3.6.0S	Supports the CEM mode.

[1] Mixed configuration of the T3 mode and the E3 mode simultaneously on the same SPA-2CHT3-CE-ATM is not supported. However, you can configure one SPA in the T3 mode and another SPA in the E3 mode. For more details regarding restrictions, see Restrictions, page 2-10 .

Either the SPA-1CHOC3-CE-ATM or the SPA-24CHT1-CE-ATM must be installed in ASR-1000-SIP10 or ASR-1000-SIP40 before the SIPs can be used in the Cisco ASR 1000 Series Routers. A maximum of four SPA-1CHOC3-CE-ATM or SPA-24CHT1-CE-ATM can be installed in each SIP; these SPAs can be of different models. You can install a SPA in the SIP either before or after you insert the SIP into the router chassis. This enables you to perform online insertion and removal (OIR) operations either by removing the individual SPAs from the SIP or by removing the entire SIP (and the SPAs it contains) from the chassis.

Pseudowire Emulation over Packet (PWEoP) is one of the key components in the process of migrating customers to a packet-based multiservice network. CEoP, which is a subset of PWEoP, is a technology used to migrate from legacy TDM networks to all-packet networks, and transparently provide transport for legacy applications over a packet network. The SPA-1CHOC3-CE-ATM represents an actual physical connection.

Many service providers and enterprises operate both packet-switched networks and time-division multiplexing (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 that are capable of transporting Layer 2 and Layer 3 protocols, such as Ethernet, IP, and Frame Relay. While most applications and services have been migrated to the packet-based network, some, including voice and legacy applications, still rely on a circuit or a leased line for transport. The SPA-1CHOC3-CE-ATM and SPA-24CHT1-CE-ATM implement CEoP by transporting circuits over a packet-based network. The SPA-1CHOC3-CE-ATM and SPA-24CHT1-CE-ATM SPAs help service providers and enterprises migrate to one-packet networks that are capable of efficiently delivering both data and circuit services.

CEoP Frame Formats

The SPA-1CHOC3-CE-ATM, SPA-2CHT3-CE-ATM, and SPA-24CHT1-CE-ATM support the structured or Circuit Emulation Services over Packet Switched Networks (CESoPSN) and the Structure-Agnostic TDM over Packet (SAToP) encapsulations.

Circuit Emulation Services over Packet Switched Network Mode

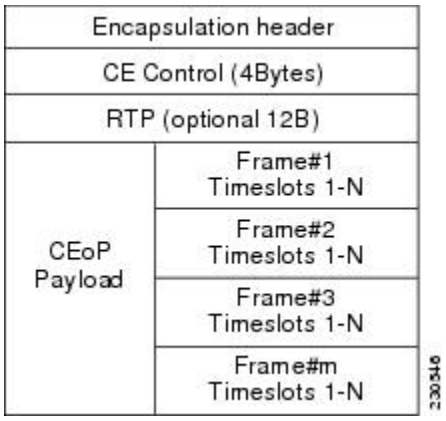
The CESoPSN mode encapsulates the T1/E1 structured (channelized) services over PSN. The structured mode (CESoPSN) identifies framing, and sends only the payload, which can either be channelized T1s within DS3 or DS0s within T1. DS0s can be bundled to the same packet. The CESoPSN mode is based on IETF 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 T1/E1/J1 interface and clear-channel DS3 interface. Effective from Cisco IOS XE Release 3.6.0S, DS3 supports both the CESoPSN and the SAToP. They are supported on the 1-Port Channelized OC-3 STM1 ATM CEoP SPA channelized to T1 or E1 and on the 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 following figure shows the frame format in CESoPSN mode.

Figure 1: Structured Mode Frame Format



The following table shows the payload and jitter for the DS0 lines in the CESoPSN mode.

Table 2: CESoPSN DS0 Lines: Payload and Jitter Limits

DS0	Maximum Payload	Maximum Jitter	Minimum Jitter	Minimum Payload	Maximum Jitter	Minimum Jitter
1	40	320	10	32	256	8
2	80	320	10	32	128	4
3	120	320	10	33	128	4
4	160	320	10	32	64	2
5	200	320	10	40	64	2
6	240	320	10	48	64	2
7	280	320	10	56	64	2
8	320	320	10	64	64	2
9	360	320	10	72	64	2
10	400	320	10	80	64	2
11	440	320	10	88	64	2
12	480	320	10	96	64	2
13	520	320	10	104	64	2
14	560	320	10	112	64	2
15	600	320	10	120	64	2
16	640	320	10	128	64	2
17	680	320	10	136	64	2
18	720	320	10	144	64	2
19	760	320	10	152	64	2
20	800	320	10	160	64	2
21	840	320	10	168	64	2
22	880	320	10	176	64	2
23	920	320	10	184	64	2
24	960	320	10	192	64	2
25	1000	320	10	200	64	2
26	1040	320	10	208	64	2

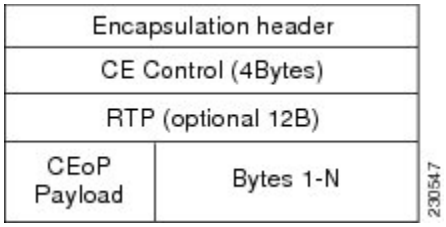
DS0	Maximum Payload	Maximum Jitter	Minimum Jitter	Minimum Payload	Maximum Jitter	Minimum Jitter
27	1080	320	10	216	64	2
28	1120	320	10	224	64	2
29	1160	320	10	232	64	2
30	1200	320	10	240	64	2
31	1240	320	10	248	64	2
32	1280	320	10	256	64	2

Overview of SAToP mode

The SAToP mode encapsulates the T1/E1 or T3/E3 unstructured (unchannelized) services over packet-switched networks. In unstructured (SAToP) mode, bytes are sent out as they arrive on the TDM line. Bytes do not have to be aligned with any framing.

In the 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. The following figure shows the frame format in Unstructured SAToP mode.

Figure 2: Unstructured Mode Frame Format



The following table shows the payload and jitter limits for the T1 lines in the SAToP frame format.

Table 3: SAToP T1 Frame: Payload and Jitter Limits

Maximum Payload	Maximum Jitter	Minimum Jitter	Minimum Payload	Maximum Jitter	Minimum Jitter
960	320	10	192	64	2

The following table shows the payload and jitter limits for the E1 lines in the SAToP frame format.

Table 4: SAToP E1 Frame: Payload and Jitter Limits

Maximum Payload	Maximum Jitter	Minimum Jitter	Minimum Payload	Maximum Jitter	Minimum Jitter
1280	320	10	256	64	2

Supported Features

This section provides a list of the primary features supported by the CEoP SPA hardware and software:

Basic Features

The basic features supported by the SPA-1CHOC3-CE-ATM are:

- Compliant with IETF standards for CESoPSN and SAToP.
- The SPA-1CHOC3-CE-ATM supports VT1.5 SONET channelization, and VC-11 and VC-12 SDH channelizations.
- Facility Data Link (FDL) support (T1/E1).
- Adaptive clock recovery-compliant with G.823 and G.824 traffic interface ITU specification.
- Full channelization of DS3 to DS0 (CEM mode only).
- Bellcore GR-253-CORE SONET/SDH compliance (ITU-T G.707, G.783, G.957, G.958).
- The SPA-1CHOC3-CE-ATM uses small form-factor pluggable (SFP) optical transceivers, allowing the same SPA-1CHOC3-CE-ATM hardware to support multimode (MM), short-reach (SR) fiber, intermediate-reach (IR1) fiber, and long-reach (LR1 and LR2) fiber, depending on the capabilities of the SPA.
- OIR of the individual SPA-1CHOC3-CE-ATM from the SIP that is installed.
- CEM local switching and local switching redundancy.

The basic features supported by the 2-Port Channelized T3/E3 ATM CEoP SPA are:

- It can be deployed for ATM services that deliver high-performance interconnectivity, metro, and intra-POP applications between a service provider's points-of-presence (POP) for IP or Multiprotocol Label Switching (MPLS) transport.
- It can be deployed in the customer-premises equipment (CPE) to provide data components to the service provider networks.
- In Cisco IOS XE Release 3.4.0S, the 2-Port Channelized T3/E3 ATM CEoP SPA supports only the clear-channel T3 ATM mode.
- Effective from Cisco IOS XE Release 3.5.0S, the 2-Port Channelized T3/E3 ATM CEoP SPA supports the clear-channel E3 ATM mode and the clear-channel T3 ATM mode.
- Provision to set the clocking mode to either local timing or loop timing (default) for individual DS3/E3 paths.
- The DS3 and E3 alarms reported are:
    - LOS—Loss Of Signal
    - LOF—Loss Of Frame
    - AIS—Alarm Indication Signal
    - RAI—Remote Alarm Indication
- It supports the ATM AAL0—Cell mode.
- It supports the ATM AAL5—Packet mode.
- It supports the AToM feature, such as Cell Relay.
- It supports the ATM MIBs.
- It supports the Any Transport over MPLS over Generic Routing Encapsulation (ATMoGRE).
- It supports the Any Transport over MPLS Operation, Administration, and Maintenance (AToM OAM) (segment mode or emulation mode).

- It supports the Any Transport over MPLS Pseudowire (AToM PW) redundancy.
- It supports the ATM MPLS encapsulation and Internet Engineering Task Force (IETF) RFC and drafts.
- It is compliant with the IETF standards for CESoPSN and SAToP.
- It provisions full channelization of DS3 to DS0 (CEM mode only).

The basic features supported by the 24-Port Channelized T1/E1 ATM CEoP SPA are:

- It supports T1 or E1, both of which can be channelized from DS3 to DS0 for CEM mode.
- It supports T1 or E1 alarms—LOS, LOF, AIS, and RDI.
- It supports internal or line clocking.
- It supports adaptive, differential, and out-of-band (OOB) clocking.
- It supports the following loopbacks:
  - Local
  - Diagnostic
  - Remote ESF line
  - Remote ESF payload
  - Remote IBOC
- It supports BERT patterns on T1 and E1 interfaces.
- It is compliant with IETF standards for CESoPSN and SAToP.
- It supports VT1.5 SONET channelization, VC-11 and VC-12 SDH channelizations
- It supports Facility Data Link (FDL) (T1 and E1).
- It is adaptive clock recovery-compliant with G.823 and G.824 traffic interface ITU specifications.
- It provisions full channelization of DS3 to DS0 (CEM mode only).
- It enables bellcore GR-253-CORE SONET/SDH compliance (ITU-T G.707, G.783, G.957, G.958).
- It supports OIR of individual 24-Port Channelized T1/E1 ATM CEoP SPA in the SIP.

SONET/SDH Error, Alarm, and Performance Monitoring

The subfeatures that are related to SONET, SDH, alarm, and performance monitoring for a SPA-1CHOC3-CE-ATM are as follows:

- Fiber removed and reinserted
- Signal failure bit error rate (SF-BER)
- Signal degrade bit error rate (SD-BER)
- Signal label payload construction (C2)
- Path trace byte (J1)
- Section diagnostics:
  - Loss of signal (SLOS)
  - Loss of frame (SLOF)
  - Error counts for B1
  - Threshold-crossing alarms (TCA) for B1 (B1-TCA)
- Line diagnostics:
  - Line alarm indication signal (LAIS)
  - Line remote defect indication (LRDI)
  - Line remote error indication (LREI)
  - Error counts for B2

    - Threshold-crossing alarms for B2 (B2-TCA)
- Path diagnostics:
    - Path alarm indication signal (PAIS)
    - Path remote defect indication (PRDI)
    - Path remote error indication (PREI)
    - Error counts for B3
    - Threshold-crossing alarms for B3 (B3-TCA)
    - Loss of pointer (PLOP)
    - New pointer events (NEWPTR)
    - Positive stuffing event (PSE)
    - Negative stuffing event (NSE)
- The following loopback tests are supported:
    - Network (line) loopback
    - Internal (diagnostic) loopback
    - SONET/SDH loopbacks
    - T1/E1 loopbacks
- The channelization that is supported:
    - Framed or unframed T1s or E1s, which can be further channelized to DS0s.
- Supported SONET/SDH synchronization:
    - Local (internal) timing, for inter-router connections over dark fiber or wave division multiplexing (WDM) equipment.
    - Loop (line) timing, for connecting to the SONET/SDH equipment.
    - +/– 4.6 ppm clock accuracy over the full range of the operating temperature.

T1/E1 Errors and Alarms

The 24-Port Channelized T1/E1 ATM CEoP SPA reports the following types of T1/E1 errors and alarms:

- Cyclic redundancy check (CRC) errors
- Far end block error (FEBE)
- Alarm indication signal (AIS)
- Remote alarm indication (RAI)
- Loss of signal (LOS)
- Out of frame (OOF)
- Failed seconds
- Bursty seconds
- Bipolar violations
- Error events
- Failed signal rate
- Line and Path diagnostics:
    - Errored Second–Line (ES-L)
    - Severely Errored Second–Line (SES-L)
    - Coding Violation–Line (CV-L)

- Failure Count–Path (FC-P)
- Errored Second–Path (ES-P)
- Severely Errored Second–Path (SES-P)
- Unavailable Seconds–Path (UAS-P)

T3/E3 Errors and Alarms

The 2-Port Channelized T3/E3 ATM CEoP SPA reports the following errors and alarms:

-
  - Alarm Indication Signal (AIS)
  - Far end block error (FEBE)
  - Far end receive failure (FERF)
  - Frame error
  - Out of frame (OOF)
  - Path parity error
  - Parity bit (P-bit) disagreements
  - Receive Alarm Indication Signal (RAIS)
  - Yellow alarm bit (X-bits) disagreements

High-Availability Features

The components that provide high-availability features for the SPA-1CHOC3-CE-ATM are as follows:

- Route Processor Redundancy (RPR)
- In-Service Software Upgrade (ISSU)
- OSPF Nonstop Forwarding (NSF)

Unsupported Features

The features that are not supported by the SPA-1CHOC3-CE-ATM in Cisco IOS XE Release 3.3.0S are as follows:

- VT alarms
- APS for channelized SONET SPA
- SONET Data Communication Channel (SDCC)
- Circuit Emulation Services over Packet Switched Network (CESoPSN) over L2TPv3
- SAToP over L2TPv3
- CEM Access Circuit Redundancy
- BERT patterns on the SONET controller
- ATM and Inverse Multiplexing over ATM (IMA)
- Circuit Emulation Services over User Datagram Protocol (CESoUDP)

The features that are not supported by the 2-Port Channelized T3/E3 ATM CEoP SPA in Cisco IOS XE Release 3.4.0S are as follows:

- Inverse ARP
- Inter Local Management Interface (ILMI)
- ATM Signalling

- Auto VC
- Broadband features
- ILMI 1.0
- IETF RFC 2364 and RFC 2516 for Point-to-Point Protocol (PPP) over ATM
- IETF RFC 1577 support for classical IP and Address Resolution Protocol (ARP) over ATM
- ATM Forum UNI 3.0, 3.1, and 4.0

The features that are not supported by the 2-Port Channelized T3/E3 ATM CEoP SPA in Cisco IOS XE Release 3.6.0S are as follows:

- Network clocking
- Differential clock recovery
- Out-of-band clock recovery

Restrictions

The restrictions pertaining to CEM local switching in Cisco IOS XE Release 3.3.0S are as follows:

- Out-of-band signaling is not supported with local switching interfaces.
- Port mode local switching is not supported on the CEM interface.
- Same CEM circuit cannot be used for both local switching and Xconnect.

The restrictions pertaining to the SPA-2CHT3-CE-ATM in Cisco IOS XE Release 3.4.0S are as follows:

- SPA-2CHT3-CE-ATM does not support port channelization for ATM.
- NLPID encapsulation type is not supported.
- Maximum permanent virtual circuits (PVC) supported per SPA are 1,024.
- The SPA-2CHT3-CE-ATM does not support the CBIT Physical Layer Convergence Protocol (PLCP) framing.
- Only the clear T3 mode is supported in Cisco IOS XE Release 3.4.0S.
- The IMA mode is not supported on SPA-2CHT3-CE-ATM CEoP in Cisco IOS XE Release 3.4.0S.
- POS and HDLC capabilities are not supported.
- Inverse Multiplexing over ATM (IMA) is not supported.
- ATM Local Switching is supported only from Cisco IOS XE Release 3.5.0S.
- Layer 2 permanent virtual circuit (PVC) and Layer 2 permanent virtual path (PVP) traffic shaping is not supported. Switched virtual circuit (SVC) is not supported.
- The SPA-2CHT3-CE-ATM does not support the **network-clocking** commands for sourcing in Cisco IOS XE Release 3.4.0S because the T3 standard does not specify the clocking quality that can be sourced.

The restrictions pertaining to the SPA-2CHT3-CE-ATM in Cisco IOS XE Release 3.5.0S are:

- The SPA-2CHT3-CE-ATM does not support E3 channelization to E1.
- Mixed configuration of the T3 mode and the E3 mode simultaneously on the same SPA is not supported.
- MDL is supported only for DS3-C-bit framing.

The restrictions pertaining to the SPA-24CHT1-CE-ATM in Cisco IOS XE Release 3.4.0S are:

- The SPA-24CHT1-CE-ATM does not support ATM and IMA.
- CESoPSN over L2TPv3 is not supported.
- SAToP over L2TPv3 is not supported.
- CEM Access Circuit Redundancy is not supported.

The restrictions pertaining to the SPA-2CHT3-CE-ATM in Cisco IOS XE Release 3.6.0S are:

- CESoPSN over L2TPv3 is not supported.
- SAToP over L2TPv3 is not supported.
- Network clocking is not supported.
- Differential clock recovery is not supported.
- Out-of-band clock recovery is not supported.

Scalability

The scalability details pertaining to the permanent virtual circuits (PVCs) supported by the SPA-2CHT3-CE-ATM are as follows:

- A maximum of 1024 PVCs on a CEoP card.
- A maximum of 255 PVPs per port on a CEoP card.
- ATM interfaces on the 2-port T3 CEoP (in the clear-channel mode).

The scalability details of the SPA-24CHT1-CE-ATM are as follows:

- Maximum number of DS0s configurable on a 24-port T1/E1 SPA are as follows:
  - 24 T1 x 24 DS0s = 576
  - 24 E1 x 31 DS0s = 744
- T1 can support a maximum of 24 possible CEM groups.
- E1 can support a maximum of 31 possible CEM groups.
- Total number of CEM groups that can be configured per SPA-24CHT1-CE-ATM are 191.

The scalability details of the SPA-2CHT3-CE-ATM are as follows:

- Maximum number of DS0s configurable on a 2-port T3/E3 SPA are as follows:
  - 2 T3 x 28 T1 x 24 DS0 = 1344
  - 2 T3 x 21 E1 x 31 DS0 = 1302
- Total number of CEM groups that can be configured per SPA-2CHT3-CE-ATM are 576.

Supported MIBs

Effective from Cisco IOS XE Release 3.3.0S, the following MIBs are supported for the SPA-1CHOC3-CE-ATM on the Cisco ASR 1000 Series Routers:

- ENTITY-MIB
- CISCO-ENTITY-SENSOR-MIB
- ENTITY-SENSOR-MIB
- CISCO-ENTITY-FRU-CONTROL-MIB
- CISCO-ENTITY-ALARM-MIB
- IF-MIB
- CISCO-IF-EXTENSION-MIB
- CISCO-IETF-PW-MPLS-MIB
- SONET-MIB

- CISCO-SONET-MIB
- CISCO-ENTITY-PERFORMANCE-MIB
- CISCO-CLASS-BASED-QOS-MIB
- CISCO-IETF-PW-MIB
- CISCO-ENTITY-VENDORTYPE-OID-MIB
- ENTITY-STATE-MIB

Effective from Cisco IOS XE Release 3.4.0S, the following MIBs are supported for the SPA-2CHT3-CE-ATM on the Cisco ASR 1000 Series Routers:

- ENTITY-MIB
- DS3-MIB
- IF-MIB
- CISCO-CLASS-BASED-QOS-MIB
- MIB II
- CISCO-ENTITY-ASSET-MIB
- CISCO-EXTENDED-ENTITY-MIB
- CISCO-IETF-PW-MIB
- CISCO-IETF-PW-MPLS-MIB

Effective from Cisco IOS XE Release 3.4.0S, the following MIBs are supported for the SPA-24CHT1-CE-ATM on the Cisco ASR 1000 Series Routers:

- ENTITY-MIB
- ENTITY-SENSOR-MIB
- ENTITY-STATE-MIB
- CISCO-CLASS-BASED-QOS-MIB
- CISCO-ENTITY-SENSOR-MIB
- CISCO-ENTITY-FRU-CONTROL-MIB
- CISCO-ENTITY-VENDORTYPE-OID-MIB
- IF-MIB
- CISCO-IF-EXTENSION-MIB
- CISCO-IETF-PW-MIB
- CISCO-IETF-PW-MPLS-MIB
- CISCO-ENTITY-ALARM-MIB
- DS1-MIB

To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use the Cisco MIB Locator found at the following URL:

http://tools.cisco.com/ITDIT/MIBS/servlet/index

If the Cisco MIB Locator does not support the MIB information that you need, you can also obtain a list of the supported MIBs and download the MIBs from the Cisco MIBs page at:

http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

To access the Cisco MIB Locator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to cco-locksmith@cisco.com . An automatic check will verify if your e-mail address is registered with Cisco.com. If the check is successful, an e-mail containing your account details and a new random password will be sent to you. Qualified users can establish an account on Cisco.com by following the directions found at:

https://tools.cisco.com/RPF/register/register.do

Displaying the SPA Hardware Type

To verify the SPA hardware type that is installed in your Cisco ASR 1000 Series Routers, use either the **show interfaces** command or the **show diag**command. A number of other **show** commands also provide information about the SPA hardware.

The following table shows the hardware description that appears in the **show** command output for each type of Circuit Emulation SPA that is supported on the Cisco ASR 1000 Series Routers:

Table 5: Circuit Emulation SPA Hardware Descriptions in show Commands

SPA	Description in the show interfaces Command
SPA-1CHOC3-CE-ATM	"Hardware is SPA-1CHOC3-CE-ATM"
SPA-2CHT3-CE-ATM	"Hardware is SPA-2CHT3-CE-ATM"
SPA-24CHT1-CE-ATM	"Hardware is SPA-24CHT1-CE-ATM"

Examples of the show interfaces cem Command

The following example shows an output of the **show interfaces cem** command on a Cisco ASR 1000 Series Routers with the SPA-1CHOC3-CE-ATM installed in the first subslot of a SIP that is installed in slot 0:

```
Router# show interfaces cem 5/3/0
CEM5/3/0 is up, line protocol is up
  Hardware is Circuit Emulation Interface
  MTU 1500 bytes, BW 155520 Kbit/sec, DLY 0 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation CEM, loopback not set
  Keepalive not supported
  Last input never, output never, output hang never
  Last clearing of "show interface" counters 1w6d
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/0 (size/max)
  5 minute input rate 192000 bits/sec, 500 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     113110734268 packets input, 5429315244864 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     836046248 packets output, 40130219904 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 unknown protocol drops
     0 output buffer failures, 0 output buffers swapped out
```

The following example shows an output of the **show interfaces cem** command on a Cisco ASR 1000 Series Routers with the SPA-24CHT1-CE-ATM installed in the first subslot of a SIP that is installed in slot 2 for a T1 link:

```
Router# show interfaces cem 2/0/0
CEM2/0/0 is up, line protocol is up
```

```
  Hardware is Circuit Emulation Interface
  MTU 1500 bytes, BW 1544 Kbit/sec, DLY 0 usec,
     reliability 255/255, txload 1/255, rxload 253/255
  Encapsulation CEM, loopback not set
  Keepalive not supported
  Last input never, output never, output hang never
  Last clearing of "show interface" counters 5d18h
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/0 (size/max)
  5 minute input rate 1536000 bits/sec, 1000 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     498511041 packets input, 95714119872 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 unknown protocol drops
     0 output buffer failures, 0 output buffers swapped out
```

The following example shows an output of the **show interfaces cem** command on a Cisco ASR 1000 Series Routers with the SPA-24CHT1-CE-ATM installed in the first subslot of a SIP that is installed in slot 1 for a E1 link:

```
Router# show interfaces cem 0/1/0
CEM0/1/0 is up, line protocol is up
  Hardware is Circuit Emulation Interface
  MTU 1500 bytes, BW 2048 Kbit/sec, DLY 0 usec,
     reliability 255/255, txload 1/255, rxload 4/255
  Encapsulation CEM, loopback not set
  Keepalive not supported
  Last input never, output never, output hang never
  Last clearing of "show interface" counters 01:13:27
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/0 (size/max)
  5 minute input rate 34000 bits/sec, 17 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     8439 packets input, 2092872 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 unknown protocol drops
     0 output buffer failures, 0 output buffers swapped out
```

The following example shows an output of the **show interfaces cem** command on a Cisco ASR 1000 Series Routers with the SPA-2CHT3-CE-ATM installed in the third subslot of a SIP that is installed in slot 0 for a DS3 link:

```
Router# show interfaces cem 0/3/0
CEM0/3/0 is up, line protocol is up
  Hardware is Circuit Emulation Interface
  MTU 1500 bytes, BW 45000 Kbit/sec, DLY 0 usec,
     reliability 255/255, txload 2/255, rxload 8/255
  Encapsulation CEM, loopback not set
  Keepalive not supported
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
```

```
  Queueing strategy: fifo
  Output queue: 0/0 (size/max)
  5 minute input rate 1536000 bits/sec, 1000 packets/sec
  5 minute output rate 425000 bits/sec, 278 packets/sec
     4708356 packets input, 904004352 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     100747 packets output, 19343424 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 unknown protocol drops
     0 output buffer failures, 0 output buffers swapped out
```

Example of the show interfaces atm Command

The following example shows an output of the **show interfaces atm** command on a Cisco ASR 1000 Series Routers with the SPA-2CHT3-CE-ATM configured as clear-channel ATM T3 and installed in the second subslot of a SIP that is installed in slot 0:

```
Router# show interfaces atm 0/2/0
ATM0/2/0 is up, line protocol is up
  Hardware is SPA-2CHT3-CE-ATM, address is 0024.975c.1f20 (bia 0024.975c.1f20)
  MTU 4470 bytes, sub MTU 4470, BW 44209 Kbit/sec, DLY 0 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ATM, loopback not set
  Keepalive not supported
  Encapsulation(s): AAL5 AAL0
  2047 maximum active VCs, 1 current VCCs
  VC Auto Creation Disabled.
  VC idle disconnect time: 300 seconds
  1 carrier transitions
  Last input never, output 02:42:10, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     30 packets input, 3240 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     29 packets output, 3132 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 unknown protocol drops
     0 output buffer failures, 0 output buffers swapped out
```

The following example shows an output for the SPA-2CHT3-CE-ATM, configured as clear-channel ATM E3 and installed in the first slot of a SIP that is installed in slot 0:

```
Router# show interface ATM 0/1/0
ATM0/1/0 is up, line protocol is up
  Hardware is SPA-2CHT3-CE-ATM, address is 000c.862c.4d40 (bia 000c.862c.4d40)
MTU 4470 bytes, sub MTU 4470, BW 33791 Kbit/sec, DLY 0 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ATM, loopback not set
  Keepalive not supported
  Encapsulation(s): AAL5 AAL0
  2047 maximum active VCs, 0 current VCCs
  VC Auto Creation Disabled.
  VC idle disconnect time: 300 seconds
```

```
1 carrier transitions
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue: 0/40 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
   0 packets input, 0 bytes, 0 no buffer
   Received 0 broadcasts (0 IP multicasts)
   0 runts, 0 giants, 0 throttles
   0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
   0 packets output, 0 bytes, 0 underruns
   0 output errors, 0 collisions, 1 interface resets
   0 unknown protocol drops
   0 output buffer failures, 0 output buffers swapped out
```