Overview of the POS SPAs

This chapter provides an overview of the release history, and feature and Management Information Base (MIB) support for the Packet over SONET (POS) SPAs on the Cisco 7304 router.

This chapter includes the following sections:

Release History

Release	Modification
Cisco IOS Release 12.2(25)S3	Support for the following hardware was introduced on the Cisco 7304 router: • 2-Port OC-3c/STM-1 POS SPA • 4-Port OC-3c/STM-1 POS SPA • 1-Port OC-12c/STM-4 POS SPA

POS Technology Overview

Packet-over-SONET is a high-speed method of transporting IP traffic between two points. This technology combines the Point-to-Point Protocol (PPP) with SONET and Synchronous Digital Hierarchy (SDH) interfaces.

SONET is an octet-synchronous multiplex scheme defined by the American National Standards Institute (ANSI) standard (T1.1051988) for optical digital transmission at hierarchical rates from 51.840 Mbps to 2.5 Gbps (Synchronous Transport Signal, STS-1 to STS-48) and greater. SDH is an equivalent international standard for optical digital transmission at hierarchical rates from 155.520 Mbps (STM-1) to 2.5 gigabits per second (Gbps) (STM-16) and greater. SONET specifications have been defined for

single-mode fiber and multimode fiber. The 2-Port OC-3c/STM-1 POS SPA, 4-Port OC-3c/STM-1 POS SPA, and 1-Port OC-12c/STM-4 POS SPA allow transmission over single-mode and multimode optical fiber at Optical Carrier 3 and 12 (OC-3, and OC-12) rates.

SONET/SDH transmission rates are integral multiples of 51.840 Mbps. The following transmission multiples are currently specified and used on the POS SPAs on the Cisco 7304 router:

- OC-3c/STM-1c—155.520 Mbps
- OC-12c/STM-4c—622.080 Mbps

The POS specification (RFC 1619) describes the use of PPP encapsulation over SONET/SDH links. Because SONET/SDH is, by definition, a point-to-point circuit, PPP is well-suited for use over these links. PPP treats SONET/SDH transport as octet-oriented full-duplex synchronous links. PPP presents an octet interface to the physical layer. The octet stream is mapped into the SONET/SDH Synchronous Payload Envelope (SPE), with the octet boundaries aligned with the SPE octet boundaries. The PPP frames are located by row within the SPE payload. Because frames are variable in length, the frames are allowed to cross SPE boundaries.

The basic rate for POS is OC-3/STM-1, which is 155.520 Mbps. The available information bandwidth is 149.760 Mbps, which is the OC-3c/STM-1 SPE with section, line, and path overhead removed.

Supported Features

This section provides a list of some of the primary features supported by the POS SPA hardware and software.

- Jumbo frames (up to 9216 bytes)
- Online insertion and removal (OIR) independently of the Cisco 7304 MSC-100, or with the Cisco 7304 MSC-100
- Small form-factor pluggable (SFP) optic OIR
- Field-programmable gate array (FPGA) upgrade support
- IPv4 and IPv6 addressing

The POS SPAs also support the following groups of features:

- SONET/SDH Compliance Features, page 9-2
- SONET/SDH Error, Alarm, and Performance Monitoring Features, page 9-3
- SONET/SDH Synchronization Features, page 9-3
- WAN Protocol Features, page 9-3
- Network Management Features, page 9-4

SONET/SDH Compliance Features

This section lists the SONET/SDH Compliance features supported by the POS SPAs on the Cisco 7304 router:

- Bellcore GR-253-CORE
- ITU-T G.707, G.783, G.957, G.958
- 1+1 SONET Automatic Protection Switching (APS) as per G.783 Annex A
- 1+1 SDH Multiplex Section Protection (MSP) as per G.783 Annex A

SONET/SDH Error, Alarm, and Performance Monitoring Features

This section lists the SONET/SDH error, alarms, and performance monitoring features supported by the POS SPAs on the Cisco 7304 router:

- Signal failure bit error rate (SF-ber)
- Signal degrade bit error rate (SD-ber)
- Signal label payload construction (C2)
- Path trace byte (J1)
- Section:
  - Loss of signal (LOS)
  - Loss of frame (LOF)
  - Error counts for B1
  - Threshold crossing alarms (TCA) for B1
- Line:
  - Line alarm indication signal (LAIS)
  - Line remote defect indication (LRDI)
  - Line remote error indication (LREI)
  - Error counts for B2
  - Threshold crossing alarms (TCA) for B2
- Path:
  - Path alarm indication signal (PAIS)
  - Path remote defect indication (PRDI)
  - Path remote error indication (PREI)
  - Error counts for B3
  - Threshold crossing alarms (TCA) for B3
  - Loss of pointer (LOP)
  - New pointer events (NEWPTR)
  - Positive stuffing event (PSE)
  - Negative stuffing event (NSE)

SONET/SDH Synchronization Features

This section lists the SONET/SDH synchronization features supported by the POS SPAs on the Cisco 7304 router:

- Local (internal) timing (for inter-router connections over dark fiber or WDM equipment)
- Loop (line) timing (for connecting to SONET/SDH equipment)
- +/- 20 ppm clock accuracy over full operating temperature

WAN Protocol Features

This section lists the WAN protocols supported by the POS SPAs on the Cisco 7304 router:

- IETF RFC 1661, Point-to-Point Protocol (PPP)
- IETF RFC 1662, PPP in HDLC framing
- IETF RFC 2615, PPP over SONET/SDH with 1+x43 self-synchronous payload scrambling
- Cisco Protect Group Protocol over UDP/IP (Port 172) for APS and MSP
- Multiprotocol Label Switching (MPLS)
- Ethernet over Multiprotocol Label Switching (EoMPLS)
- Frame Relay

Network Management Features

This section lists the network management features supported by the POS SPAs on the Cisco 7304 router:

- Simple Network Management Protocol (SNMP) Management Information Base (MIB) counters
- Local (diagnostic) loopback
- Network loopback
- NetFlow Data Export
- IP over the Data Communications Channel (DCC)
- RFC 1595 performance statistics for timed intervals (current, 15 minute, multiple 15 minute, and 1-day intervals):
  - Regenerator section
  - Multiplex section
  - Path errored seconds
  - Severely errored seconds
  - Severely errored framed seconds

Restrictions

As of Cisco IOS Release 12.2(25)S3, the following features are not supported by the POS SPAs:

- Dynamic Packet Transport (DPT)
- Bridge Control Protocol (BCP)

As of Cisco IOS Release 12.2(25)S3, the 4-Port OC-3c/STM-1 POS SPA has the following restriction:

- Section Data Communications Channel (SDCC) is supported on only two ports on the 4-Port OC-3c/STM-1 POS SPA.

Supported MIBs

The following MIBs are supported in Cisco IOS Release 12.2(25)S3 for the 2-Port and 4-Port OC-3 POS SPA and the 1-Port OC-12c/STM-4 POS SPA on the Cisco 7304 router:

- CISCO-APS-MIB
- CISCO-ENTITY-ASSET-MIB
- CISCO-ENTITY-FRU-CONTROL-MIB
- CISCO-ENVMON-MIB (For NPEs, NSEs, line cards, and MSCs only)
- CISCO-EXTENDED-ENTITY-MIB
- CISCO-OPTICAL-MIB
- ENTITY-MIB
- OLD-CISCO-CHASSIS-MIB
- IF-MIB
- SONET-MIB RFC 2558

For more information about MIB support on the Cisco 7304 router, refer to the *Cisco 7304 Router MIB Specifications Guide* found at the following URL:

http://www.cisco.com/univercd/cc/td/doc/product/core/cis7300/7304mibs/

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

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

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

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

To access 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 that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions found at this URL:

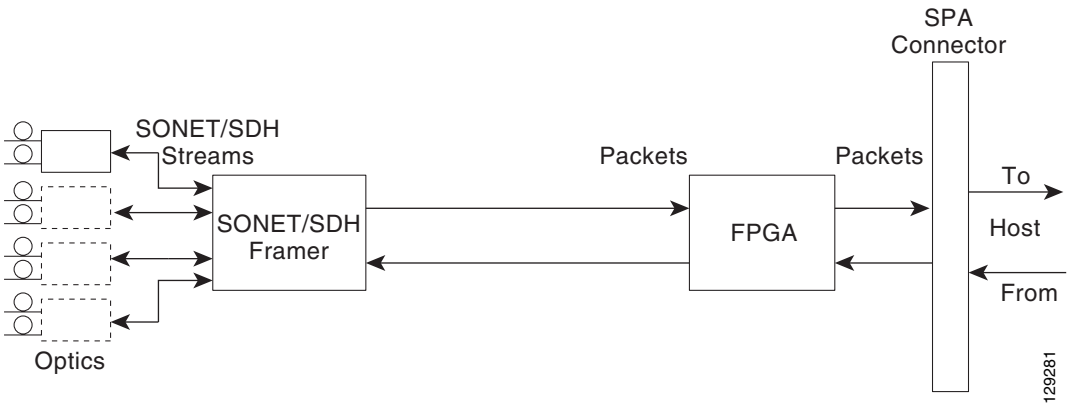
http://www.cisco.com/register

SPA Architecture

This section provides an overview of the architecture of the POS SPAs and describes the path of a packet in the ingress and egress directions. Some of these areas of the architecture are referenced in the SPA software and can be helpful to understand when troubleshooting or interpreting some of the SPA CLI and **show** command output.

Figure 9-1 identifies some of the hardware devices that are part of the POS SPA architecture. The figure shows the four ports that are supported by the 4-Port OC-3c/STM-1 POS SPA only.

Figure 9-1 4-Port OC-3c/STM-1 POS SPA Architecture



Every incoming and outgoing packet on the 4-Port OC-3c/STM-1 POS SPA goes through the SONET/SDH framer, and field programmable gate array (FPGA) devices.

Path of a Packet in the Ingress Direction

The following steps describe the path of an ingress packet through the 4-Port OC-3c/STM-1 POS SPA:

1. The framer receives SONET/SDH streams from the SFP optics, extracts clocking and data, and processes the section, line, and path overhead.
2. The framer extracts the POS frame payload and verifies the frame size and frame check sequence (FCS).
3. The framer passes valid frames to the field-programmable gate array (FPGA) on the SPA.
4. The FPGA on the SPA transfers frames to the host through the SPI4.2 bus for further processing and switching.

Path of a Packet in the Egress Direction

The following steps describe the path of an egress packet through the 4-Port OC-3c/STM-1 POS SPA:

1. The host sends packets to the FPGA on the SPA using the SPI4.2 bus.
2. The FPGA on the SPA stores the data in the appropriate channel's first-in first-out (FIFO) queue.
3. The FPGA on the SPA passes the packet to the framer.
4. The framer accepts the data and stores it in the appropriate channel queue.
5. The framer adds the FCS and SONET/SDH overhead.
6. The framer sends the data to the SFP optic for transmission onto the network.

Displaying the SPA Hardware Type

To verify the SPA hardware type that is installed in your Cisco 7304 router, you can use the **show interfaces** command or the **show controllers** command. There are several other commands on the Cisco 7304 router that also provide SPA hardware information. For more information about these commands, see the "Command Summary for POS SPAs" and the "Command Reference" chapters in this guide.

Table 9-1 shows the hardware description that appears in the **show** command output for each type of SPA that is supported on the Cisco 7304 router.

Table 9-1 SPA Hardware Descriptions in show Commands

SPA	Description in show interfaces and show controllers commands
2-Port OC-3c/STM-1 POS SPA	Hardware is Packet over Sonet
4-Port OC-3c/STM-1 POS SPA	Hardware is Packet over Sonet
1-Port OC-12c/STM-4 POS SPA	Hardware is Packet over Sonet

Example of the show interfaces Command

The following example shows output from the **show interfaces pos** command on a Cisco 7304 router with a 4-Port OC-3c/STM-1 POS SPA installed in slot 5:

```
Router# show interfaces pos 5/0/1
POS5/0/1 is up, line protocol is up
  Hardware is Packet over Sonet
  Internet address is 10.5.5.5/8
  MTU 4470 bytes, BW 155000 Kbit, DLY 100 usec,
     reliability 96/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive not set
  Scramble disabled
  Last input 00:00:11, output 00:00:11, output hang never
  Last clearing of ''show interface'' counters 00:00:23
  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
  5 packets input, 520 bytes
     Received 0 broadcasts (0 IP multicast)
     0 runts, 0 giants, 0 throttles
     0 parity
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  5 packets output, 520 bytes, 0 underruns
     0 output errors, 0 applique, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
```

Example of the show controllers Command

The following example shows output from the **show controllers pos** command on a Cisco 7304 router with a 4-Port OC-3c/STM-1 POS SPA installed in slot 5:

```
Router# show controllers pos 5/0/1
POS5/0/1
SECTION
  LOF = 0 LOS = 0 BIP(B1) = 0
LINE
  AIS = 0 RDI = 0 FEBE = 0 BIP(B2) = 0
PATH
  AIS = 0 RDI = 0 FEBE = 0 BIP(B3) = 0
  LOP = 0 NEWPTR = 0 PSE = 0 NSE = 0

Active Defects: None
Active Alarms: None
Alarm reporting enabled for: SF SLOS SLOF B1-TCA B2-TCA PLOP B3-TCA

BER thresholds: SF = 10e-3, SD = 10e-6
TCA thresholds: B1 = 10e-6, B2 = 10e-6, B3 = 10e-6
APS
  COAPS = 0 PSBF = 0
  State: PSBF_state = False
  Rx(K1/K2): 00/00 Tx(K1/K2): 00/00
  S1S0 = 00, C2 = CF
CLOCK RECOVERY
  RDOOL = 0
  State: RDOOL_state = False
PATH TRACE BUFFER: STABLE
  Remote hostname : c7600-1
  Remote interface: POS7/1/3
  Remote IP addr : 10.5.5.4
  Remote Rx(K1/K2): 00/00 Tx(K1/K2): 00/00

BER thresholds: SF = 10e-3 SD = 10e-6
TCA thresholds: B1 = 10e-6 B2 = 10e-6 B3 = 10e-6

Clock source: internal
```