Packet-Over-SONET (POS)
A Technical Primer

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What is POS?

Packet-over-SONET (POS) is a standardized way for mapping IP packets into SONET/SDH frames.
Overview

• Network Model
• Encapsulation
• SONET Overhead Usage
• Performance Monitoring
• Synchronization
• Jitter Requirements
• OC-192 PHYs
POS Deployment

- First deployed in 1996 (OC-3c)
- Used in 100s of networks worldwide
- Over 15,000 POS interfaces deployed
- Defacto for building large IP backbones
- Available for OC-3c, OC-12c, and OC-48c today
- OC-192c demonstrated last week!
- Standards based: IETF, Bellcore, ITU, ANSI
Network Model - POS

POS - Packet over SONET/SDH
- OC-3c (155.52 Mbps)
- OC-12c (622.08 Mbps)
- OC-48c (2488.32 Mbps)
- OC-192c (9953.28 Mbps)
Packet-over-SONET/SDH (PoS)

- Point-to-Point Protocol, IETF RFC 1661
- PPP in HDLC- Like Framing, IETF RFC 1662
- PPP over SONET/SDH, IETF RFC 1619/2615
POS Packet Flow

Standard PPP Encapsulation
- Magic Number Recommended
- No Address and Control Compression
- No Protocol Field Compression

Special Data Scrambler
- \(1 + x^{43}\) Polynomial
- Protects Against Transmitted Frames Containing Synch Bytes Or Insufficient Ones Density

Standard CRC Computation
- OC3 May Use CRC-16
- Other Speeds Use CRC-32

SONET Framing
- OC3, OC12, OC48, OC192 Defined
- C2 Byte = 0x16 With Scrambling
- C2 Byte = 0xCF Without (OC-3)
Performance Monitoring & Fault Management

- **Performance Monitoring (Proactive)**
  
  - Error counts B1, B2, B3
  - Errors counts Line (M1) and Path (G1) REI
  - Threshold crossing alerts (TCA) for B1, B2, B3

- **Alarm Reporting (Reactive)**
  
  - LOS, LOF, LAIS, LRDI
  - PLOP, PAIS, PRDI
  - SF, SD based on B2 with selectable threshold

- **Signal Label (C2: CF or 16)**

- **Path Trace (J1) insertion and monitoring**

- **Sync Status (S1) set to ‘don’t use for sync’**

**Alarm Hierarchy**

```
LOS
  |  LOF
  |
LAIS => LRDI
  |  |
PAIS => PRDI
  |  |
  LOP
```
POS - Synchronization

20 ppm. Standby Osc.

Lock to worst case SONET clock (20ppm)

Traffic
Timing
Oscillator
POS Jitter Requirements

- Jitter Generation (Tx)
- Jitter Tolerance (Rx)
- Jitter Transfer

POS Interfaces are SONET/SDH Jitter Compliant
OC-192 POS LC Architecture

Fabric I/F

L3 Forwarding Engine

OC-192 POS Framer

OC-192 Optics

Mux → Laser

Dmx → Rec

SONET Framed
16 x 622 Mb/s
LVDS
(OIF 99.102)
POS OC-192 Interface Options

**OC-192 SR/IR**

- 16x622M
- 1x9.95G

**OC-192 Framer** → **Mux** → **E/O** → **O/E** → **Dmx** → **O/E** → **E/O** → **OC-192 Framer**

- Single strand SMF
- < 80km

**OC-192 VSR**

- 12x1.24G

**OC-192 Framer** → **Conv ASIC** → **E/O (12)** → **E/O (12)** → **O/E (12)** → **O/E (12)** → **Conv ASIC** → **OC-192 Framer**

- 12 strand MMF
- < 500m
Summary

- POS is a widely deployed, standardized mapping of IP into SONET/SDH
- The HSSG could draw upon the experience of POS to speed up the definition of the 10GE WAN PHY.