Experience. Outcomes.

DATA SHEET

Channelized SONET/SDH over Packet Transceiver

T1/E1

Ciena's Channelized SONET/SDH over Packet Transceiver enables cost-effective transport of T1/E1 or low-fill SONET/SDH streams over packet.

The Small Form-factor Pluggable (SFP) module converts an OC3/STM-1 stream from its user port into circuit-emulated packets for transmission over a Packet-Switched Network (PSN). Each T1/E1 channel within the stream can be processed individually to create a high-density gateway between a TDM and an Ethernet or IP/MPLS network. Packets are transmitted via a 1 Gigabit Ethernet (GbE) port on the host device through one or more PSNs (in the case of multiple operators, for example). At the remote end, packets are converted back to TDM traffic for handoff as TDM services.

TDM to packet modernization

With many network operators transforming their networks to all-packet transport, TDM over packet emerges as a key enabler to efficiently migrate legacy services to the new packet-based infrastructure. Using a single unified network for both data and TDM transport can streamline operations and reduce capital and operational expenditures.

The packet-based network allows for greater economies of scale for multiple service types (video, voice, mobile, etc.) while accommodating the need to reliably carry legacy traffic from TDM interfaces, which are likely still in use in many enterprise and industrial scenarios. Whether servicing traditional PBX units, utility teleprotection relays, digitized voice equipment, or Supervisory Control and Data Acquisition (SCADA) systems, TDM end-points will remain common interfaces into the modernized network for decades to come. These services will need to be accommodated within the same infrastructure as the growing data network to remain cost-effective while not sacrificing the highest reliability these systems require.

Features and Benefits

- Integrates structure-agnostic TDM over packet (SAToP) technology into a cost-effective module, reducing system and network complexity while offering lower carbon footprint for significant CAPEX and OPEX savings
- Aggregates T1/E1 into channelized SAToP links and enables each T1/E1 to be processed individually to provide a high-density gateway function between TDM and Ethernet or IP/MPLS networks
- Provides a duplex fiber interface using 1310nm FP laser for 15km intermediate reach via single-mode fiber
- Operates at industrial temperature range (-40°C to 85°)
- Eliminates TDM leased-line costs
- Delivers plug-and-play operation with SAToP equipment, including SFPs, in Ciena's Pluggable Transceiver Family

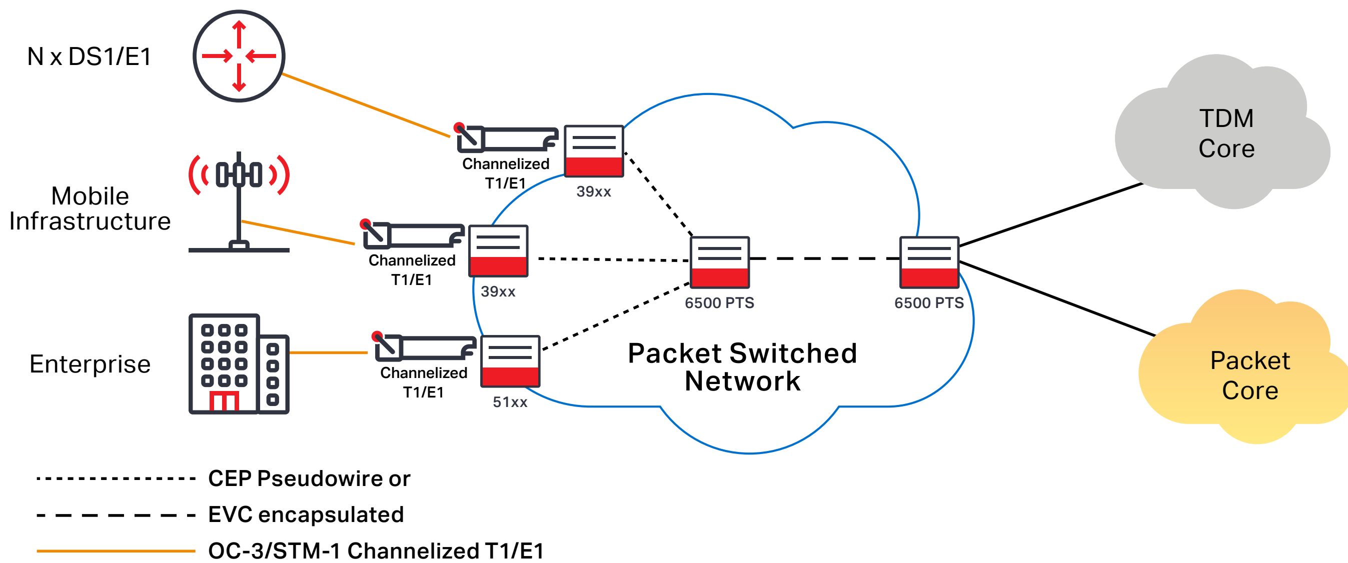

Figure 1 Aggregation of DS1/E1s with SAToP

Cost-effective yet reliable TDM migration

The T1/E1 transceiver provides a LC duplex fiber interface using 1310nm FP laser for 15km intermediate reach via single mode fiber. Individual T1/E1 channels are mapped into pseudowire streams using RFC 4553 Structure-Agnostic TDM over Packet Technology (SAToP) to be transported across an Ethernet network.

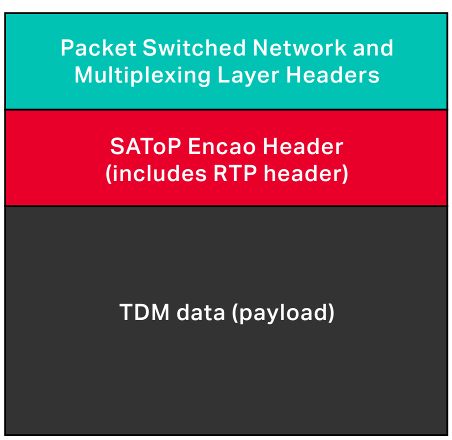

Figure 2 Basic SAToP Packet

To transport TDM circuits through a packet-oriented network, the user payload is broken into fragments, and a SAToP encapsulation header is prepended to each fragment. In this method of encapsulating TDM, only structure- agnostic transport is addressed—that is, the protocol completely disregards any structure that may be imposed on these signals, in particular the structure imposed by standard TDM framing. SAToP is used over packet-switched networks, where the Provider Edge (PE) devices do not need to interpret TDM data or participate in the TDM signaling. TDM endpoints connect over TDM E1/T1 circuits, but the circuits physically terminate at each packet device capable of SAToP. Ciena's device transports TDM frames across the PSN core via pseudowires to the remote SAToP endpoint, so the TDM endpoints can communicate as if they were directly connected by physical circuits.

Compared to classic TDM transport, this sort of solution makes sense when a PSN core is available , and in preparation for the TDM endpoints to eventually migrate to PSN connections.

SAToP sender and receiver functions

The device supports the following functions in the direction from client port to PSN (sender):

- SONET/SDH layer processing
- Packetize each T1/E1 into fixed-size data blocks (256 octets) using SAToP
- Encapsulate the data blocks with packet headers, RTP header, and FCS, which are configurable per pseudowire channel
- Transmit packets via electrical GbE interface toward the PSN
- Ethernet physical layer frequency of outgoing packets is recovered from the incoming optical stream

The device supports the following functions in the direction from the PSN to the client interface:

- Reception and validation of packets from the PSN via the electrical GbE interface

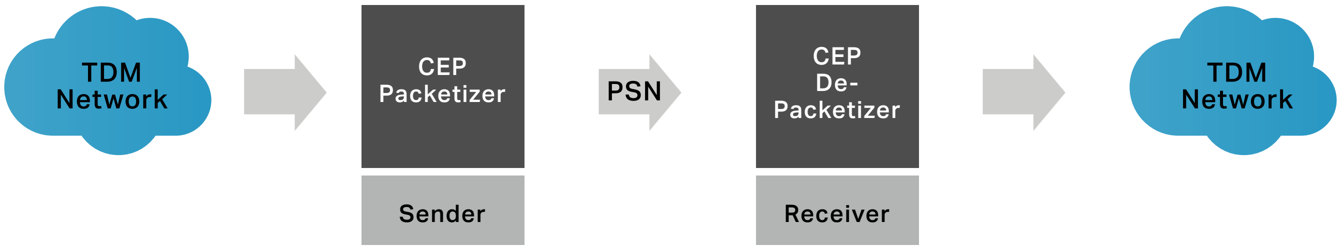

Figure 3 Sender and Receiver functions

- Validation can be configured per channel
- SDH layer processing and muxing
- Decap the packet streams into T1/E1 streams
- Delay buffer management, packet sequencing, clock recovery derived from RTP header
- Generate the T1/E1 bit stream using Differential Clock Recovery (DCR) or re-timing synchronization methods
- Transport the signal on the fiber interface

Clocking function

The clock recovery algorithm in DCR uses Real-time Transport Protocol (RTP) timestamps. The sending side uses a high-accuracy clock to generate timestamps that identify when each packet is transmitted. The receiving side must have access to the same/common clock and use the difference between each received RTP timestamp to regenerate the T1/E1 timing. DCR timing recovery is primarily influenced by the accuracy of the common clock. As long as the common clock is a high-quality source (for example, a Stratum 3 clock or better), DCR will provide better timing recovery than Adaptive Clock Recovery (ACR).

If used for re-timing purposes, the T1/E1 frequency is derived from a network recovered clock. The network clock may be recovered from an external reference (e.g., GNSS, BITS), or a packet network method (e.g., PTP, SyncE).

An RTP timestamp provides a 32-bit value used by the DCR technique, and indicates the relative timing between successively transmitted packets. The RTP timestamp also indicates when a packet is transmitted. This method excludes the packet delay variation that results as a packet is forwarded though a network.

Technical Information

Specifications	
Interface	155Mb/s, 15km, duplex STM-1 over GbE
Header formats	MEF8 and MPLS frame header format with optional VLAN tag
Channel mapping	ITU-T G.707
Management and Support	Management via Service Aware Operating System (SAOS)
Host device compatibility	3904, 3905, 3926m, 3928, 3930-930, 3932, 5142, 5160
Mechanical	Conforms to SFP pluggable 20-pin Multi Source Agreement (MSA)
Physical Dimensions in Millimeters	Length= 60.05 , Width= 13.7 , Height = 8.53
Operating temperature	-40°C to 85°C (industrial)
Jitter	16 ms Compliant to ITU-T G.8261, G.824, and GR-253

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