



Have your TDM and Ethernet too!

A White Paper from Telco Systems

The need:

Who would believe that Telecommunications Service Providers, Utilities, Government entities and Transportation companies would still be using TDM and SONET today? But they are!

There are still end-users that require T-1 or Fractional T-1 for their communications. Utilities and Transportation companies still have low speed requirements for SCADA, 4 wire E&M etc. State, local and the federal government may not have the budget to upgrade. The technicians know the equipment inside and out and it is still functioning with no need to replace it.

Although all of the above are legitimate reasons for keeping their equipment and networks as they are, and not upgrading to Carrier Ethernet or MPLS networks. These packet switching-based networks provide more cost-effective communications in comparison with traditional TDM based networks (PDH, SDH), especially for Internet services. As you can see by the challenges listed below it may be time to make that decision to upgrade either fully or gradually over time.

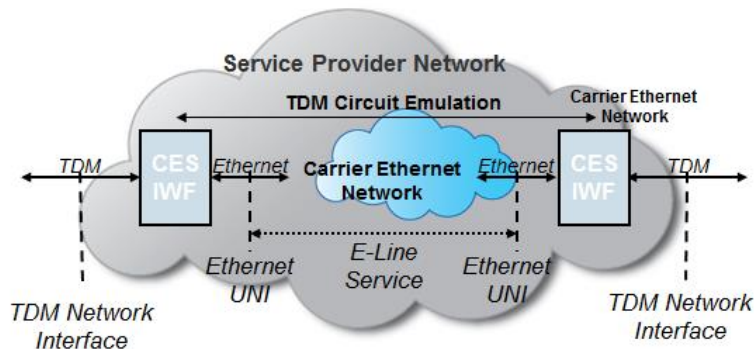
What are the challenges?

- The cost of T-1/E1's & DS-3/E3's are increasing
- The carriers are telling you that they are moving away from offering TDM and will only provide an Ethernet connection
- There aren't only T-1/E1's and DS-3/E3's but there are also SONET OC-3/STM1's and OC-12/STM4's to transport as well
- End-users have older PBX's and don't want to spend the money to upgrade
- The older legacy equipment is still working and the technicians understand it well, but need to upgrade their networks as fewer vendors are supporting this equipment
- What can be done to maintain the older legacy equipment while gradually upgrading to Carrier Ethernet or an MPLS network?
- Do I have to hire someone that knows Ethernet? It is not within our budget.
- What about timing if I have multiple sources how do I deal with this?

The solution:

Telco Systems CES (Circuit Emulation Service) "Family of Products." CES technology makes it possible for the service provider to leverage the modern network technologies like MPLS or Carrier Ethernet. This allows the service provider options for the end-user such as; maintaining their Legacy equipment while migrating to the packet based network, or keeping their legacy equipment and connecting into the packet based network. We at Telco Systems' provide several individual solutions that can work together as one complete solution. The Telco Systems Family of CES products support the following; MEF2.0 Carrier Ethernet, MPLS, Layer3VPN and include smart SFP's. The CES solution supports ANSI, T-1, DS-3, OC-3, OC-12 over L2 or L3 and ETSI, E1, E3, STM1, and STM4. With Telco Systems CES supported products and solutions there are no stranded assets as they support multiple technologies within the same equipment. As a manager, making the decision to upgrade you can be sure that you will be spending your money wisely because once you move away from TDM or SONET you don't have to remove equipment just plug into a different port and re-configure.

Telco Systems' CES Technology & Standards



- Support both CESoPSN structured mode (RFC 5086) and SAToP structured agnostic mode (RFC4553)
- CES encapsulation support Carrier Ethernet CESoE (MEF-8, MEF-18), VPLS or MPLS TDMoMPLS (MFA-8, BBF-248)
- Timing options – CES-ACR, Enhance ACR and RTP support, SyncE, PTP, (IEEE-1588v2), BIT's clock (in/out interfaces), Internal (Stratum 3/3E) holdover, looped time
- Telco Systems Circuit Emulation ecosystem
- Telco Systems has been a longtime participant EANTC's Annual Multi-Vendor Interoperability Showcase
- Interop demonstrated with multiple vendors for CESoPSN, SAToP, 1588v2, SyncE, Carrier Ethernet, and MPLS
- Installed base interoperating with Cisco at many carriers
- Broadcom chose to embed Telco System's CES technology into it's BCM56440 chipset

Telco Systems' CES Feature



- Alarm Support Remote Alarm Indication, Loss of Frame, Loss of Signal, Alarm Indication Signal
- Operation, Administration and Management (OAM)
- Jitter-buffer size and frame aggregation level specification
- Local loopback, the incoming CES packet stream is looped back to the PSN, per E1/T1 port (used for testing)
- Remote loopback, the incoming T1/E1 TDM stream is looped back including the clock, (used for testing)
- Generate and display MIB-II statistics for T1/E1 virtual channel connections to remote CES devices
- Perform IP or MEF OAM pinging to the remote device

** Note: Not all features are supported in each device (see product matrix below)

CES supported devices and features matrix

CES/ETHERNET/MPLS/L3 VPN SUPPORTED DEVICES

Key Features	T-Marc 254P/H	T-Marc 280	T-Marc 340/380WD	T-Marc 3308	T-Marc 3312/SH/WD	T-Marc 3208SH	T-Marc 3348S/SH/WD	T-Metro 200	T-Metro 7124
T1/E1 CES Ports - Transparent & Structured	4	-	-	-	8	8/16	-	-	-
OC3 or DS3 Module	-	-	-	-	-	-	-	OC3 or DS3	-
T1/E1 CES Smart SFP - Transparent & Structured (or transparent only)	Y	Y	Y	Y	Y	Y	Y	Y	Y
T3/E3 CES Smart SFP - Transparent only	Y	Y	Y	Y	Y	Y	Y	Y	Y
OC3/STM1 CES Smart SFP - Transparent	Y	Y	Y	Y	Y	Y	Y	Y	Y
OC12/STM4 CES Smart SFP - Transparent	Y	Y	Y	Y	Y	Y	Y	Y	Y
CES Over IP Services (SATOP, CES, oPSN)	Y (H only)	-	-	-	-	-	-	Y	-
CES Over Ethernet Services (MEF, 8)	Y	-	-	-	-	-	-	Y	-
Number of CES Services 10/10 per E1/T1 Interface Device	-	-	-	-	-	10/20	-	10/20	-
Number of CES Services 10/10 per E3/T3 Interface Device	-	-	-	-	-	-	-	128	-
Fast Ethernet Ports	4	-	-	-	-	-	-	20	-
SyncE (Synchronous Ethernet)	-	-	-	-	-	Y	-	-	Y
1588v2 for CES sync	Y (H only)	-	-	-	-	Y	-	-	-
ACR (Adaptive Clock Recovery) on CES	Y	-	-	-	-	Y	-	Y	-
1GE Ports	2	4	6/10	8	12	12	12	4	24
10GE Ports	-	-	-	-	-	-	2/4	-	2
Layer 2 Transport	Y	Y	Y	Y	Y	Y	Y	Y	Y
Layer 3VPN	-	-	-	Y	Y	Y	Y	-	Y
MPLS Transport	-	-	-	Y	Y	Y	Y	Y	Y
MPLS PE	-	-	-	-	-	-	-	-	Y
QoS/HQoS	QoS	QoS	HQoS	HQoS	HQoS	HQoS	HQoS	HQoS	HQoS
OAM	Y	-	-	-	-	-	-	Y	-
High Performance OAM	-	Y	Y	Y	Y	Y	Y	-	Y
Embedded Test Head	-	Y	Y	Y	Y	Y	Y	-	Y
xSTP, G.8032 & G.8031	xSTP only	Y	Y	Y	Y	Y	Y	Y	Y
Extended Temperature	Y (H only)	-	Y (340/WD only)	-	Y (SH/WD only)	Y	Y (SH/WD only)	-	Y
Power - AC/-48VDC/Wide Range	Y	Y	Y	AC/-48VDC	Y	Y	Y	AC/-48VDC	Y

** Not all devices have built in CES ports and may require a smart SFP

** Multiple smart SFP's can be used in the same device



T-Marc 254P/H - Telco Systems' T-Marc® 250 is a family of cost-effective, fully-managed Carrier Ethernet demarcation devices that provide service termination and demarcation over service providers' packet-based networks. As a multi-port customer-located intelligent demarcation device, the T-Marc delivers managed converged services (voice, video and data) over virtual Ethernet in a metro Ethernet network. The T-Marc 254 only supports T1 CES. 4x T1/E1 ports, can support both transparent and structured T1/E1 to be transported as L2 (MEF8) or L3 payload and can also work in Internal, Loopback and ACR.



T-Marc 280 - Telco Systems' T-Marc™ 280 is a cost-effective, fully-managed Carrier Ethernet demarcation device that provides service termination and demarcation over service providers' packet-based networks. As a customer-located intelligent demarcation device, the T-Marc 280 delivers managed converged services (voice, video and data) over virtual Ethernet in metro Ethernet networks. Advanced Layer 2 networking using Telco Systems' Access Ethernet allows total flexibility in deployment and delivery of Ethernet services, while physical and logical channel networking capabilities provide bandwidth profiles, advanced traffic classes, and complete control over how subscriber traffic is transported and managed across a service provider's network. Different applications are prioritized over different traffic-engineered paths, multi-level operations, administration and maintenance (OAM) is used to measure and ensure provisioned service level agreements (SLA).



T-Marc 340/F/WD-380 - This series of devices allows service providers to deliver multiple services on separate customer interfaces, including multiple services over a single customer interface. Since each service is isolated, providers can not only troubleshoot each individual service without impacting the others, but also have the ability to provide service extension, and remote management. Using operations, administration, and maintenance (OAM) tools, service providers can measure and ensure provisioned service level agreements (SLA). The devices' embedded security controls ensure protection against denial of service attacks. The unique combination of OAM features, QoS features and embedded test heads, together with large resiliency mechanisms for protected services, including G.8031/G.8032, xSTP, Fast Ring and Resilient Link, makes these field-proven products a perfect fit for specific applications.



T-Marc 3312SC/SCH/WD - Telco Systems' T-Marc 3312SC/SCH/WD NextGen Ethernet/MPLS/ IP Mobile Backhaul Demarcation device offers an all-in-one solution that meets the increasing challenge of mobile operators, and mobile backhaul wholesale and service providers to cost effectively connect base stations and controller sites combining 2G/3G and 4G infrastructures. The T-Marc 3312SC/SCH/WD provides multiple types of services to allow mobile operators to deliver backhaul and business services while standardizing one product. T-Marc 3312SC/SCH/WD supports IEEE802.1q, Q-in-Q and MPLS transport technologies, providing high flexibility in network design and future proofing the network with no additional software licenses. 8x T1/E1 ports can, support both transparent and structured T1/E1 to be transported as L2 (MEF8) or L3 payload. Can work in Internal, Loopback, Adaptive Clock Recovery (ACR) or by using SyncE and PTP (1588v2) for its internal clock.



T-Marc 3208SH - The T-Marc 3208SH mobile backhaul demarcation device supports Carrier Ethernet/MPLS demarcation allowing service providers and mobile operators to backhaul multiple 2G, 3G and 4G cell sites. It offers future-proof and flexible deployment by implementing multiple transport technologies, including Carrier Ethernet (IEEE802.1Q and TLS) and IP/MPLS L2VPN to provide data services such as Virtual Private Wire Services (VPWS), Virtual Private LAN Services (VPLS) and Hierarchical VPLS (HVPLS) with no licensing fees, allowing for better transport technology utilization that fits providers' needs today and in the future. It supports Synchronous Ethernet (SyncE), IEEE 1588v2 client and transparent clock, adaptive clock recovery (using CES), external clock, and phase source via BITS interface.



T-Marc 3348S/SH/WD - 10GE Ethernet/MPLS demarcation device offers an all-in-one solution that meets the increasing challenges of mobile operators, mobile backhaul wholesalers, and service providers to cost effectively connects base stations and controller sites running LTE and LTE Advanced. The T-Marc 3348S/T-Marc 3348SH also offers enterprises 10GE connectivity for heavy duty cloud applications. The device supports IEEE 802.1q, Q-in-Q, and MPLS transport technologies with no licensing fees, increasing network flexibility and future-proofing the network while reducing technological risks.



T-Metro 200 - The T-Metro 200 is a feature-rich multiservice access device designed to increase service provider revenues and deliver a complete portfolio of voice, data and video services. The T-Metro family of products supports a wide variety of technologies including Ethernet, circuit emulation services (CES), MPLS, OAM (operations, administration and maintenance) tools and hierarchical quality of service (HQoS). This rich combination of technologies allows service providers to deliver an enhanced service offering while maintaining competitive pricing.



T-Metro 7124S – The T-Metro 7124S pre-aggregation and demarcation device is a member of Telco Systems' field-proven T-Metro family of Carrier Ethernet switches. The T-Metro 7124S supports both Carrier Ethernet and MPLS transport technologies with a diverse set of OAM (operations, administration and maintenance) tools and extensive QoS and resiliency capabilities. This rich combination of technologies allows service providers to deliver assured differentiated service offerings while maintaining competitive pricing.



High-Quality Transceivers - Telco Systems offers an impressive portfolio of pluggable transceivers to match all your network applications using: • SFP (SM, MM, BiDi) and CSFP • SFP+ • XFP • QSFP and QSFP28 • CWDM and DWDM • **“Smart” transceiver, like Packet over TDM and TDM over Packet** • DWDM tunable C-band XFP/SFP+. Our certified 1Gb, 10Gb, 40Gb and 100Gb transceivers comply with stringent quality standards and demanding network reliability requirements. Available in both industrial and commercial temperature ranges, they range in speeds from 100Mbps to 100GE and distances from 100m up to 200km.



EdgeGenie Orchestrator™ CE 2.0 & SDN/NFV Management System offers a modular and complete solution for the full life cycle of network deployment, from planning to managing, monitoring and maintaining Ethernet services. With a modular approach, EdgeGenie Orchestrator enables service providers to future-proof their networks as they transition from CE 2.0 to SDN and distributed NFV technologies. EdgeGenie Orchestrator's modules include a Carrier Ethernet/MPLS end-to-end service management system with an SDN controller (TelcoController) module that manages OpenFlow switches, and an NFV Orchestrator (TelcoOrchestrator) module that directs distributed NFV deployments, including TelcoApps VM initiation, configuration and maintenance, service attachment and chaining, and VNF resiliency.

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