Circuit Emulation and Packet-Based Clock Synchronization

TDM Installed Base

Since the 1960's when TDM was first developed for wide area networks, a huge installed-base of TDM circuits and equipment ports (T1/E1, T3/E3 etc.) has emerged throughout the world supporting both voice communications and data networking.

With the advent of the Internet, packet-based networking (Carrier Ethernet, IP, MPLS) for both data networking and voice communications has overtaken TDM, becoming the primary approach to digital networking in wide area networks.

The original purpose of TDM was to enable multiplexed voice calls over a single physical circuit. Voice calls require minimum end-to-end delay (latency) and delay variation to achieve reasonable voice quality. This was achieved by designing TDM in such a way that clock synchronization between both ends of the circuit could be achieved via the TDM circuit, as well as guaranteed and permanent transmission and receipt of TDM frames based on the synchronized clocks – whether or not actual traffic is contained within the TDM frames. This translates into low latency and delay variation at the expense of bandwidth and flexibility.

Packet-based networking originally provided cost effective networking with high bandwidth capabilities and flexibility, but without the guarantee of low latency and delay variation required for voice calls and some data applications. With the advent of Carrier Ethernet, and the improvement of the underlying transport infrastructures, it is now feasible to guarantee low latency and delay variation in packet-based networks enabling the transport of all types of applications including voice and clock synchronization.

With almost 50 years of deployment of equipment with TDM-ports (e.g. PBXs, telephone switching centers, mobile backhaul equipment), there is still a need to connect TDM equipment, albeit over packet-based networks rather than TDM circuits.

Carrier Emulation Services over Ethernet (CESoETH) enables users of TDM equipment and clock synchronization to use cost effective Carrier Ethernet services to transport TDM and clock traffic together with all other applications over a single packet-based network.

CESoETH “tunnels” TDM traffic through a CEN where the packet network “emulates” a circuit-switched network, re-creating the TDM circuit at the far end such that the CEN is invisible to TDM source and destination equipment. CESoETH runs on a standard Ethernet point-to-point service (E-Line). CESoETH can be referred to as TDM emulation over packet network.

This section describes CESoETH and techniques for clock synchronization over a packet network. CESoETH is documented in MEF8. MEF 8 gives precise instructions for implementing interoperable CES solutions that reliably transport TDM circuits across CENs while meeting the required performance of circuit emulated TDM services as defined in ITU-T and ANSI TDM standards.

Reference: MEF 8

The Wiki pages shown below:

- Explain the concept of emulated TDM circuits over Ethernet
- Present the MEF 8 model
- Detail the components required for the service
- Detail the specific UNI and EVC attributes of CES over Ethernet
- Explain the concept of packet-based synchonization and its implementation over Carrier Ethernet

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