

Modular CMTS Architecture

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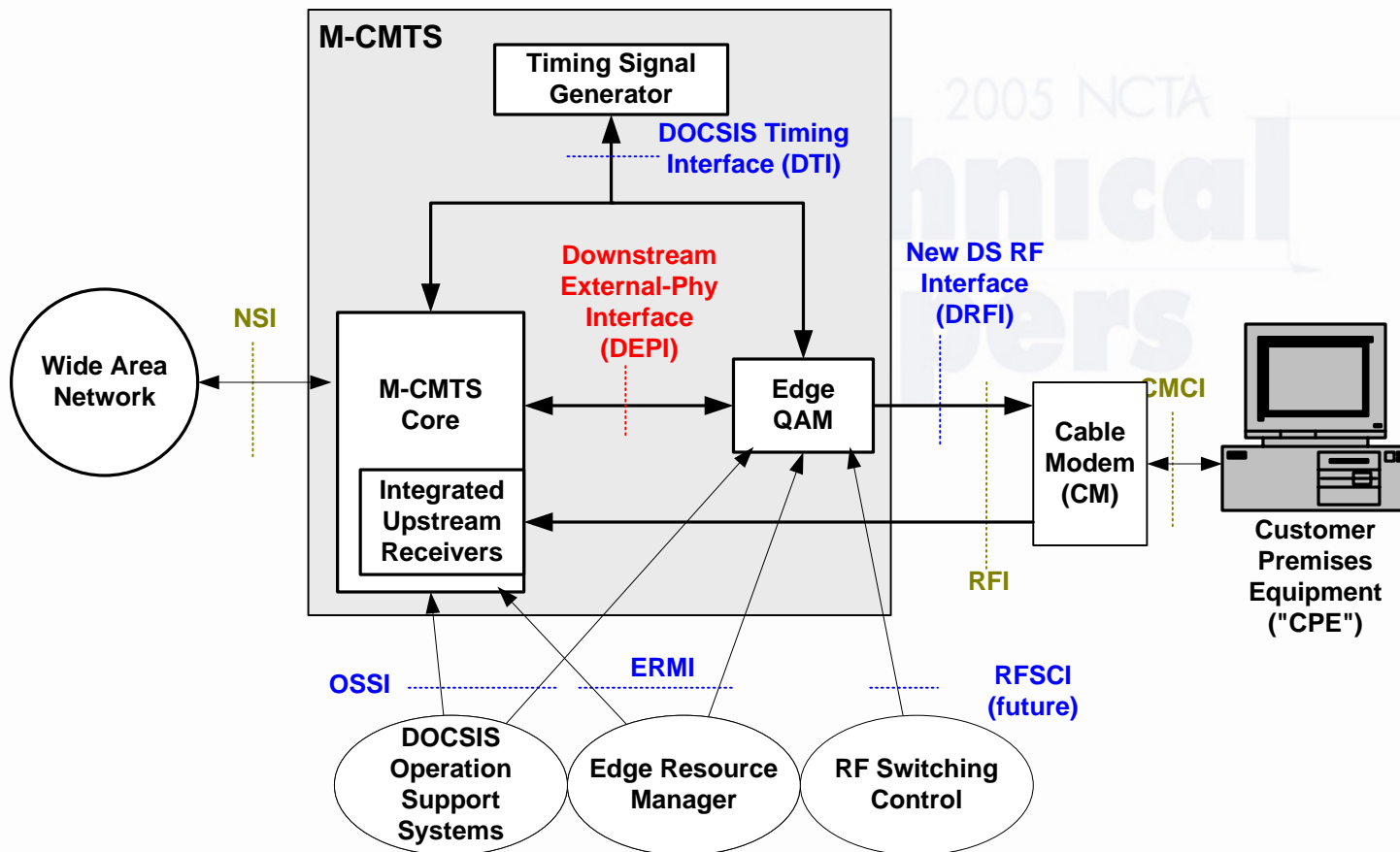
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Cisco Systems

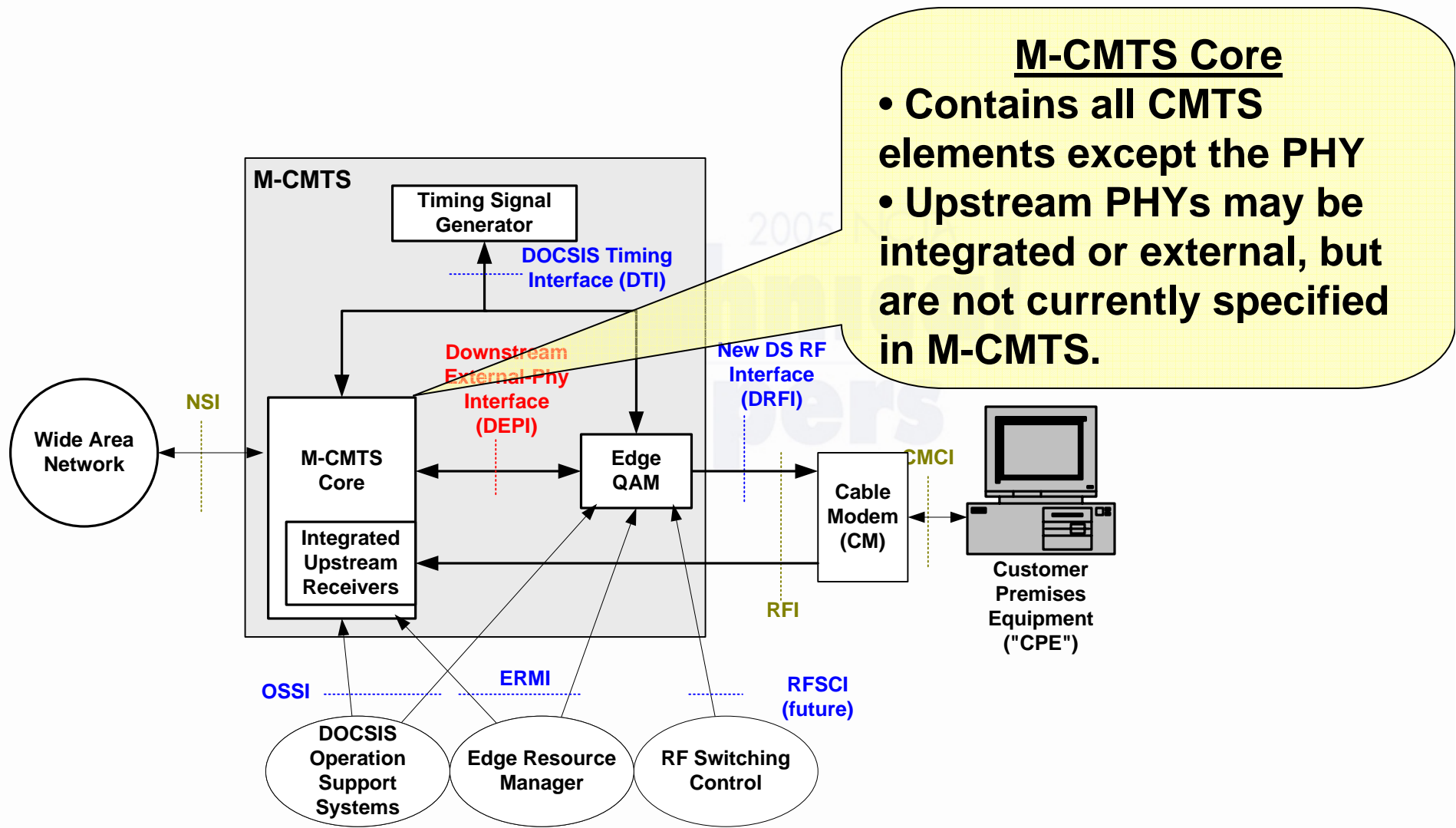
M-CMTS Goals & Objectives

- Goals
 - Lower cost per downstream for the CMTS
 - Enable flexible configuration of upstreams and downstreams, thus allowing more downstream capacity.
 - Share Edge QAM devices between Video and DOCSIS services
- Objectives
 - Split upstreams from downstreams
 - Split MAC from PHY

M-CMTS Block Diagram



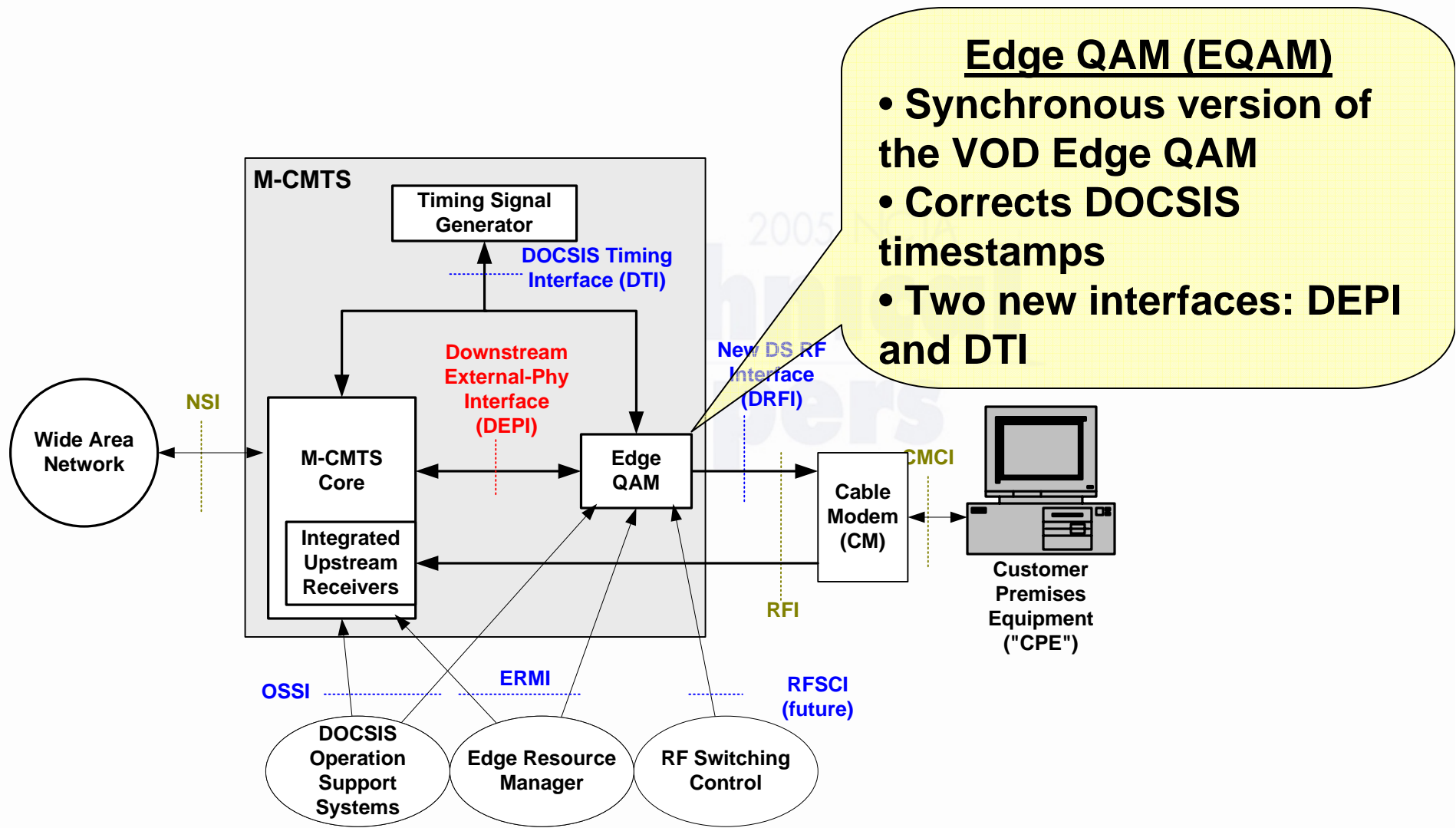
M-CMTS Block Diagram



M-CMTS Core

- Contains all CMTS elements except the PHY
- Upstream PHYs may be integrated or external, but are not currently specified in M-CMTS.

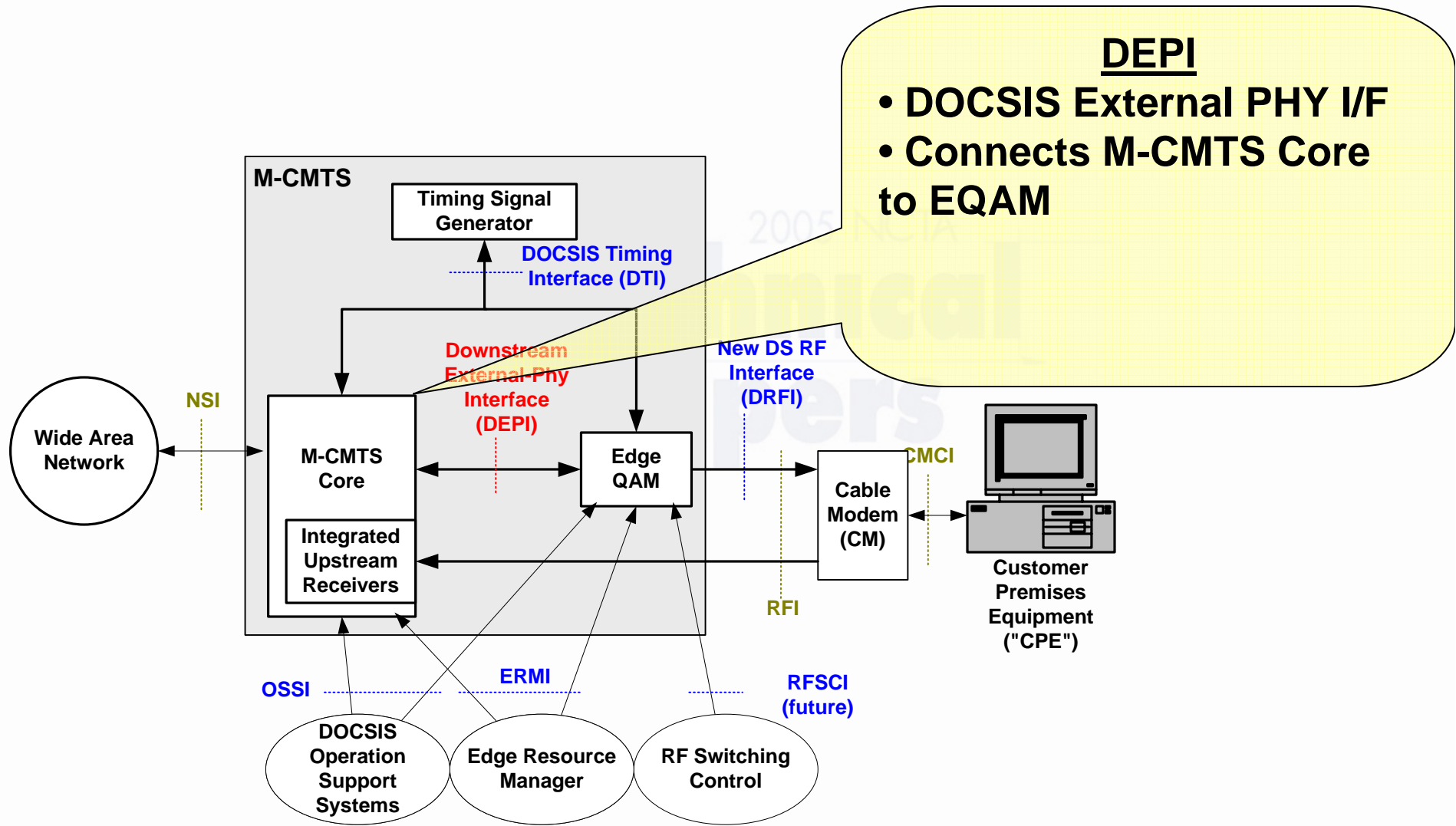
M-CMTS Block Diagram



Edge QAM (EQAM)

- Synchronous version of the VOD Edge QAM
- Corrects DOCSIS timestamps
- Two new interfaces: DEPI and DTI

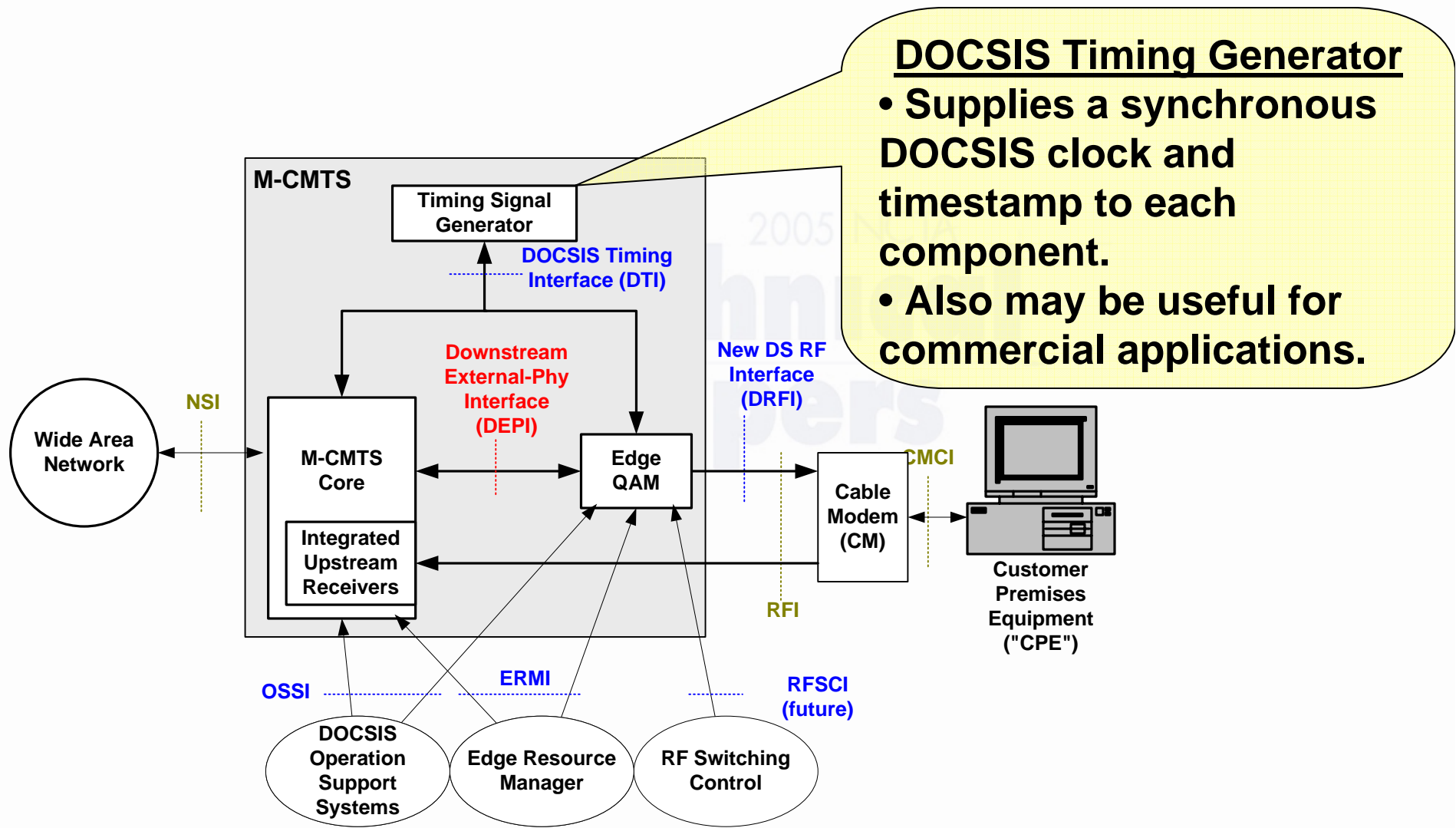
M-CMTS Block Diagram



DEPI

- DOCSIS External PHY I/F
- Connects M-CMTS Core to EQAM

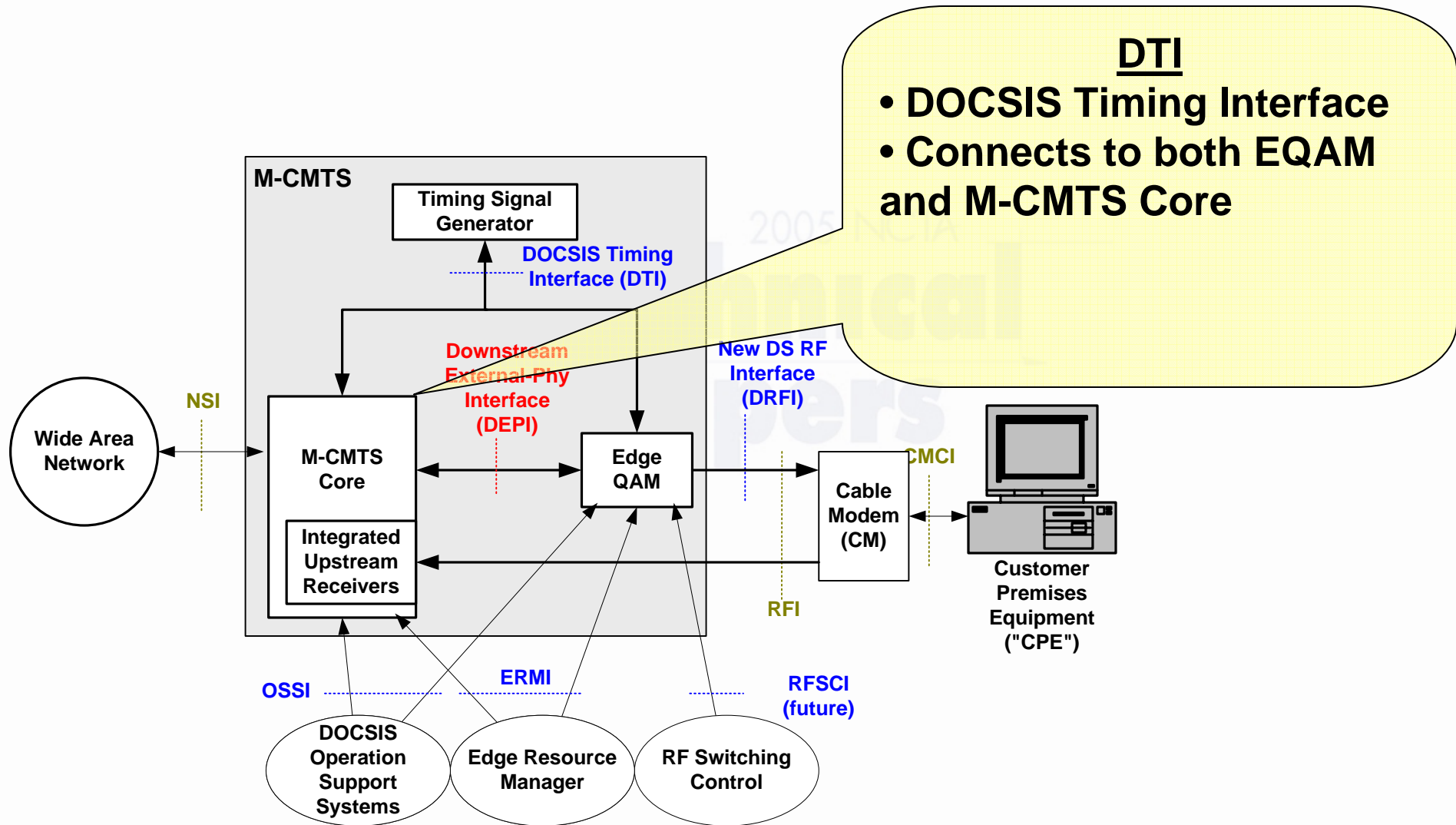
M-CMTS Block Diagram



DOCSIS Timing Generator

- Supplies a synchronous DOCSIS clock and timestamp to each component.
- Also may be useful for commercial applications.

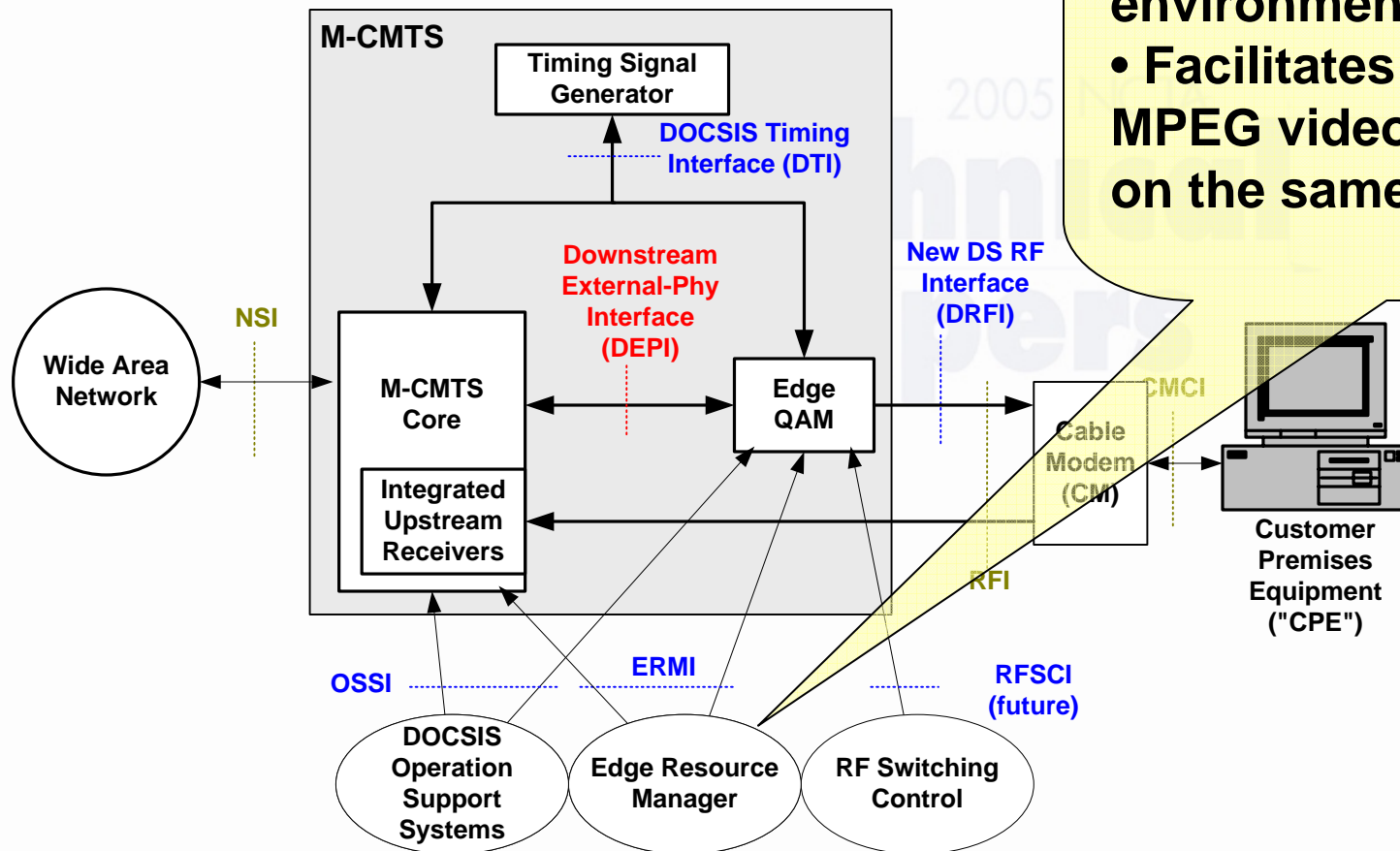
M-CMTS Block Diagram



DTI

- DOCSIS Timing Interface
- Connects to both EQAM and M-CMTS Core

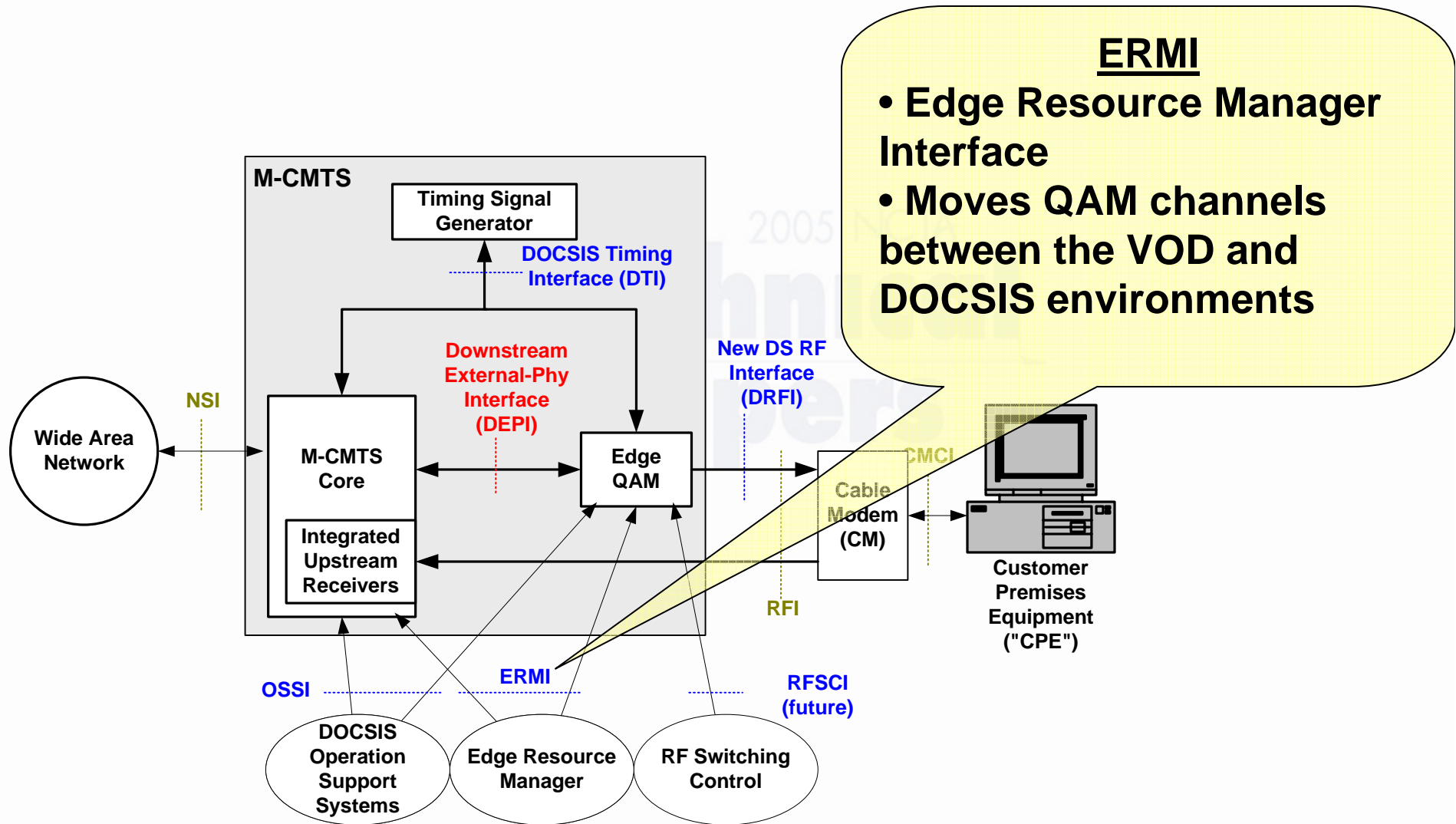
M-CMTS Block Diagram



Edge Resource Manager

- Part of the VOD environment.
- Facilitates the sharing of MPEG video and DOCSIS on the same QAMs

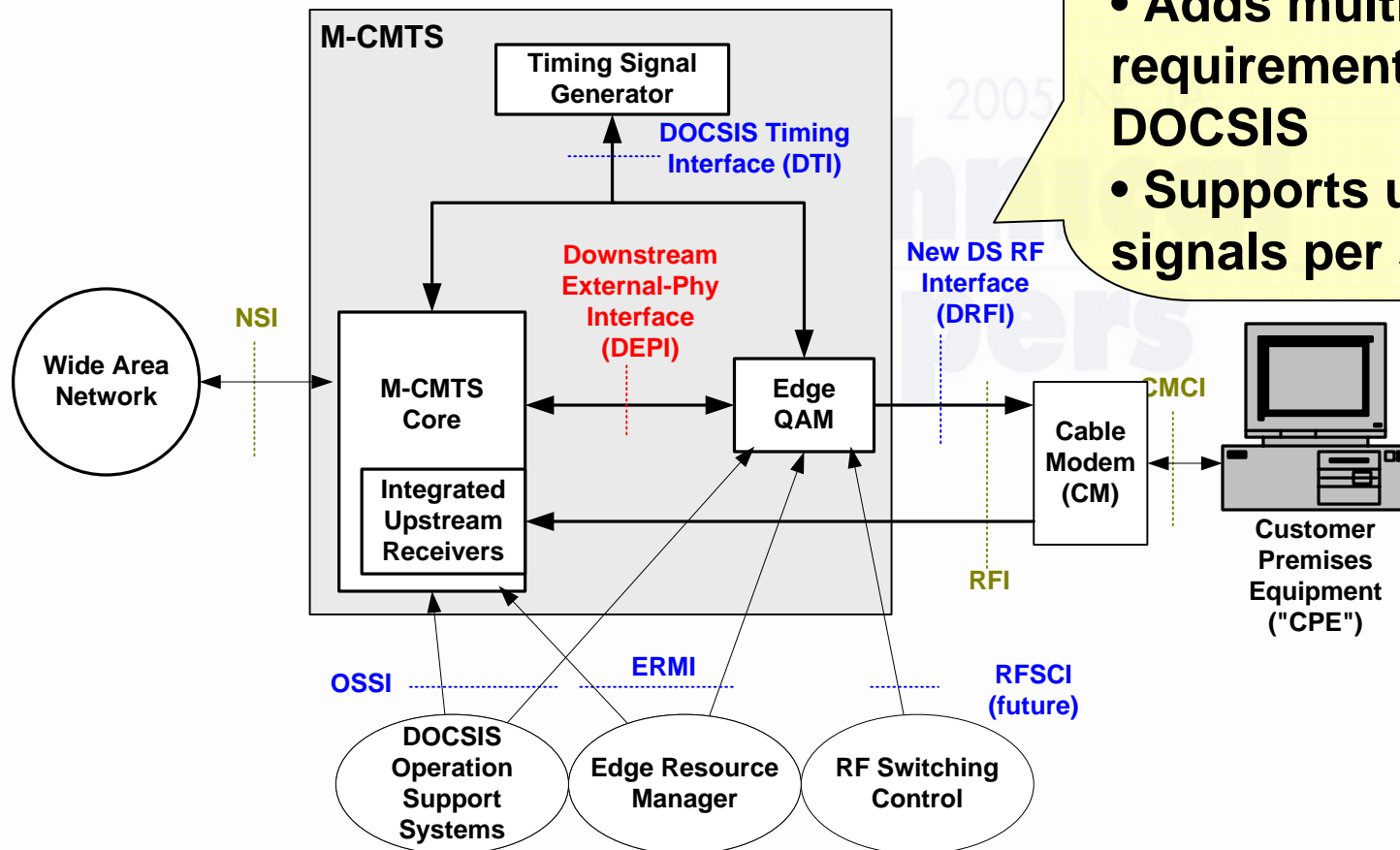
M-CMTS Block Diagram



ERMI

- Edge Resource Manager Interface
- Moves QAM channels between the VOD and DOCSIS environments

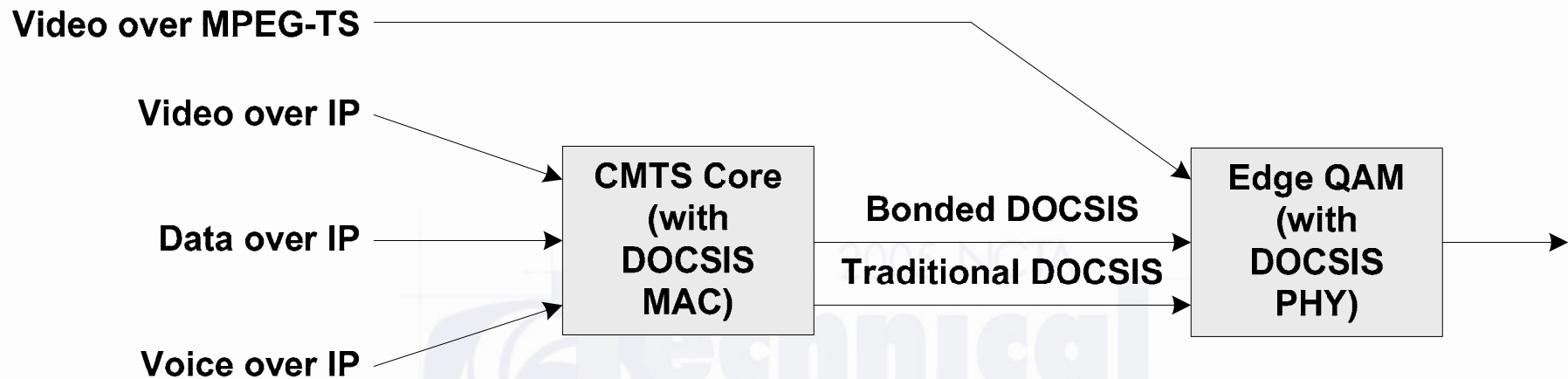
M-CMTS Block Diagram



DRFI

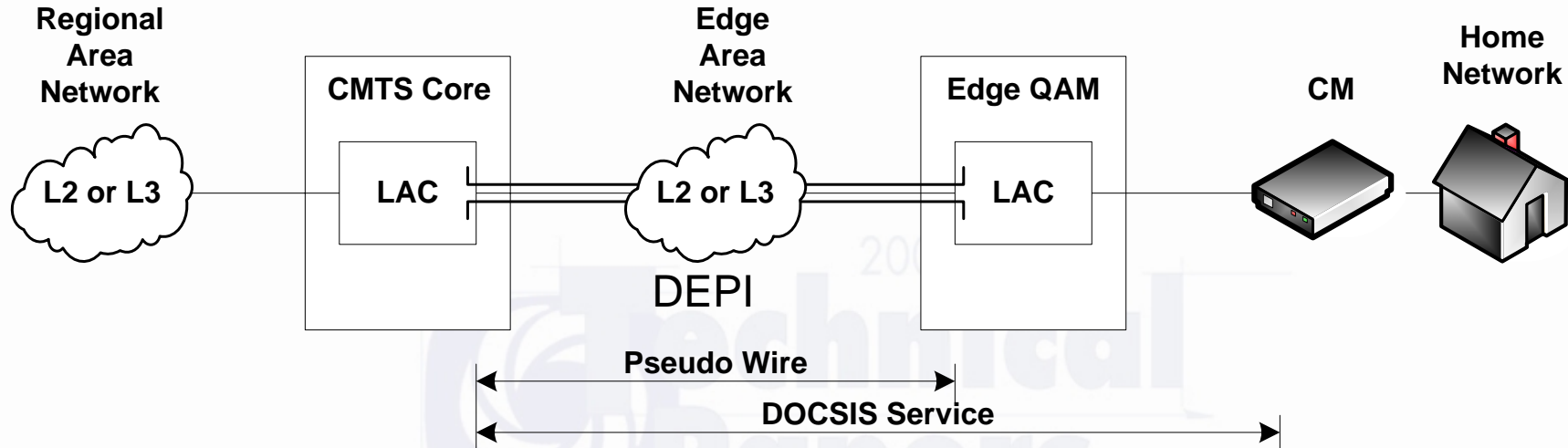
- Downstream RF Interface
- Adds multi-channel RF requirements for Video and DOCSIS
- Supports up to 119 digital signals per spectrum.

M-CMTS and Integrated Services



- The Edge QAM will multiplex legacy MPEG services such as VOD and Switched Broadcast along with the new DOCSIS 2.0 traditional and DOCSIS 3.0 bonded transports.
- The M-CMTS Core provides the IP transport and would provide the triple play data, voice, and video over IP services.

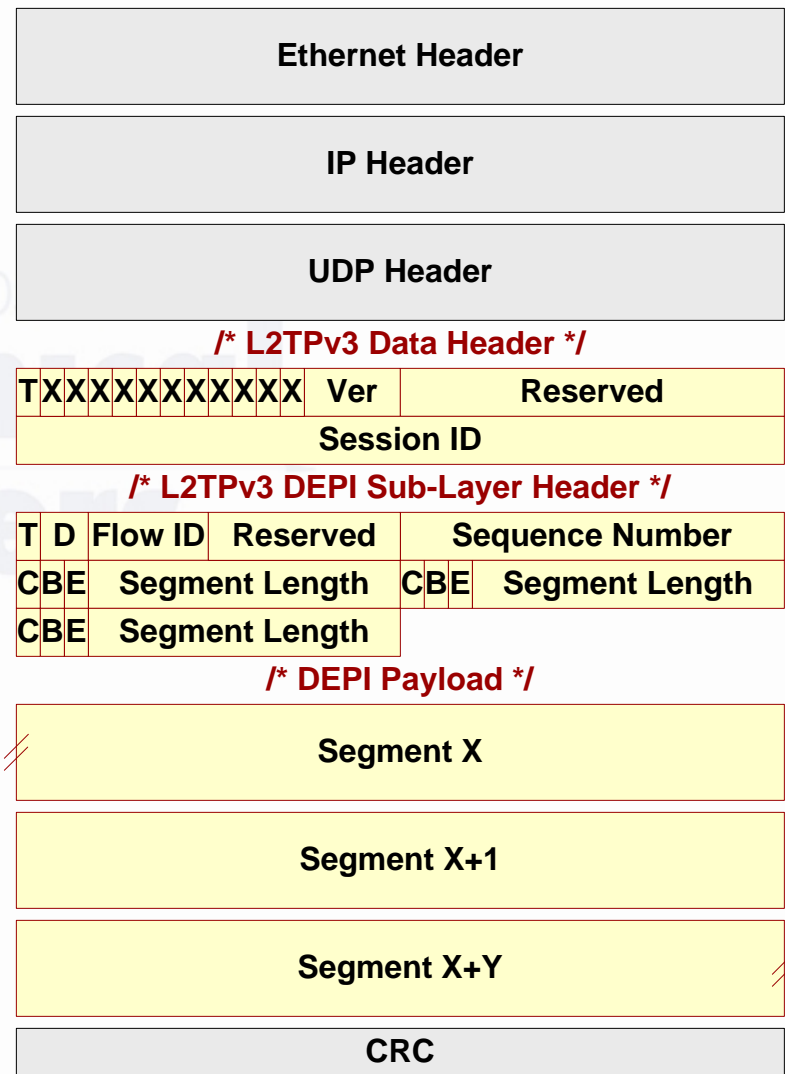
DEPI Interface with L2TPv3



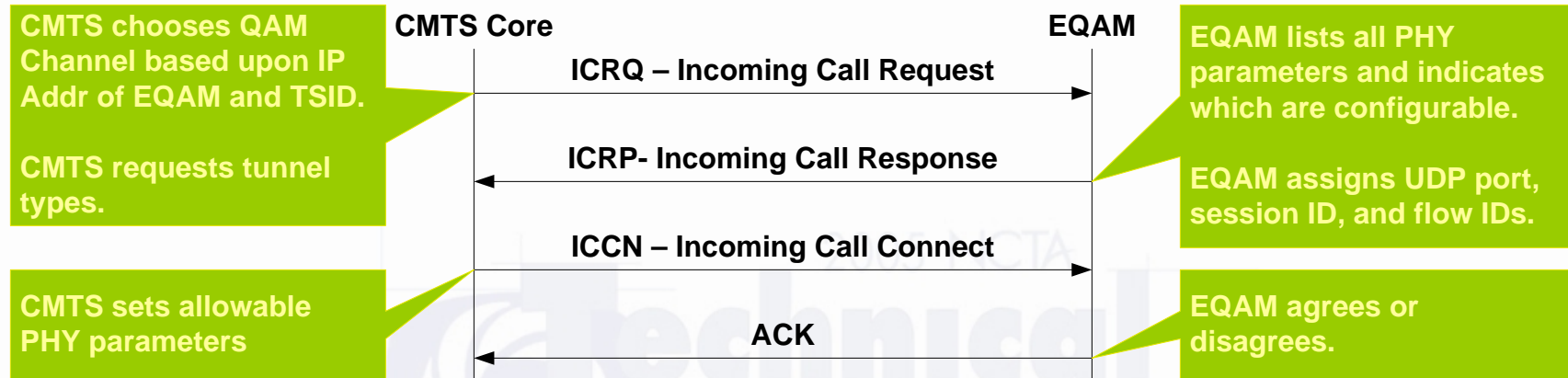
- DEPI uses version 3 of the IETF Layer 2 Tunneling Protocol (L2TPv3).
- L2TPv3 provides both a data transport and a control protocol for managing the connection.
- A Pseudowire is an emulated circuit as it traverses an IP network.

DEPI Data Message

- DEPI data message includes a UDP header for EQAM use.
- Data header is stock L2TPv3 and includes a Session ID
- Sub-layer header is DEPI specific
 - Allows packets or MPEG
 - Provides concatenation and fragmentation
- Payload is MPEG packets or fragments of DOCSIS frames



DEPI Session Establishment

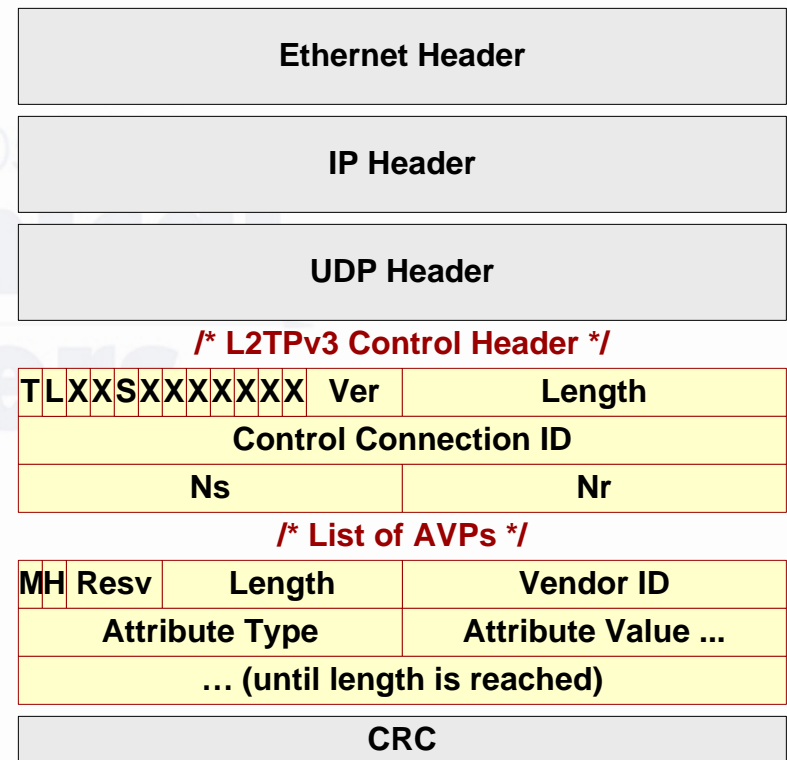


- L2TPv3 establishes a control connection between the M-CMTS Core and the EQAM
- L2TPv3 establishes a session per QAM Channel
- Each QAM Channel may have one or more Flows.
- If one side disagrees with the setup, it kills the session setup with a CDN – Call-Disconnect-Notify and reports an error code.

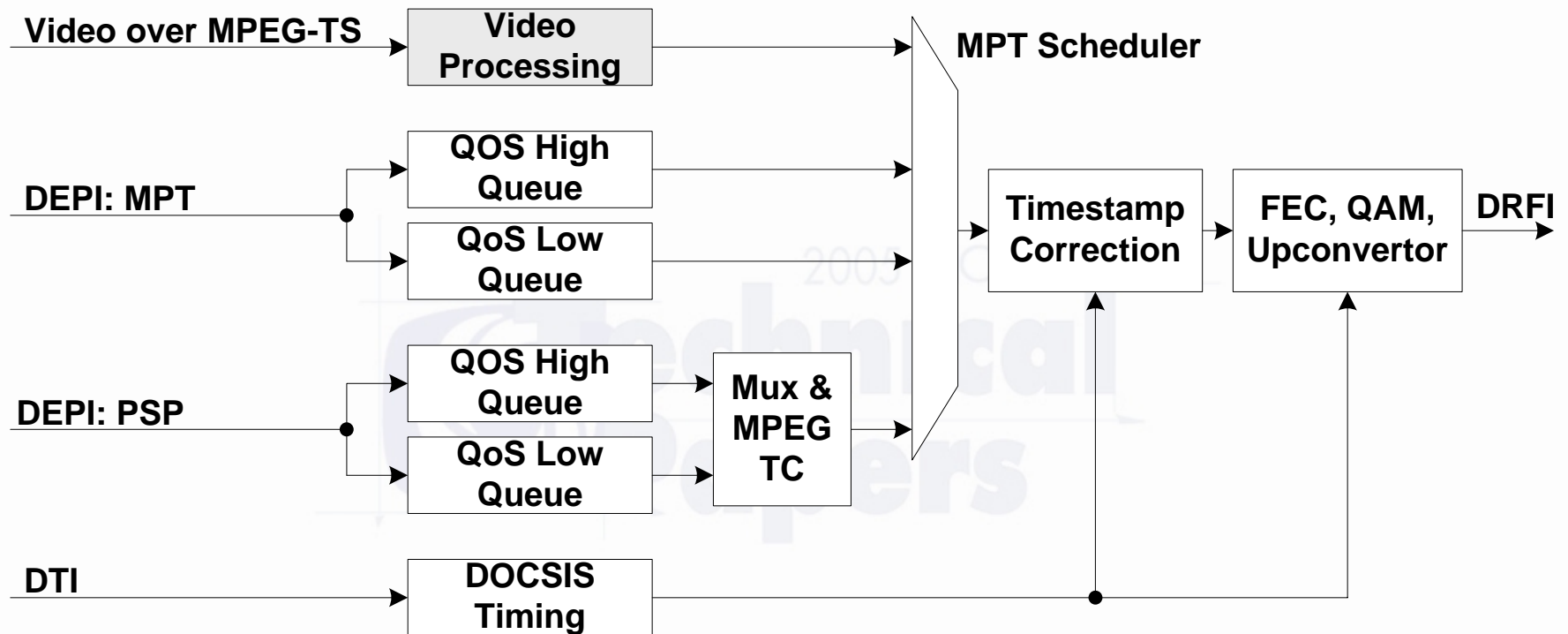


DEPI Control Message

- Control messages typically go to port 1701.
- Session messages are linked to the Control Connection through an ID.
- Each message carries an ACK. The ACK message is control message with no other parameters.
- Control messages contain a list of Attribute Value Pairs (AVPs) which contain interface specific details.

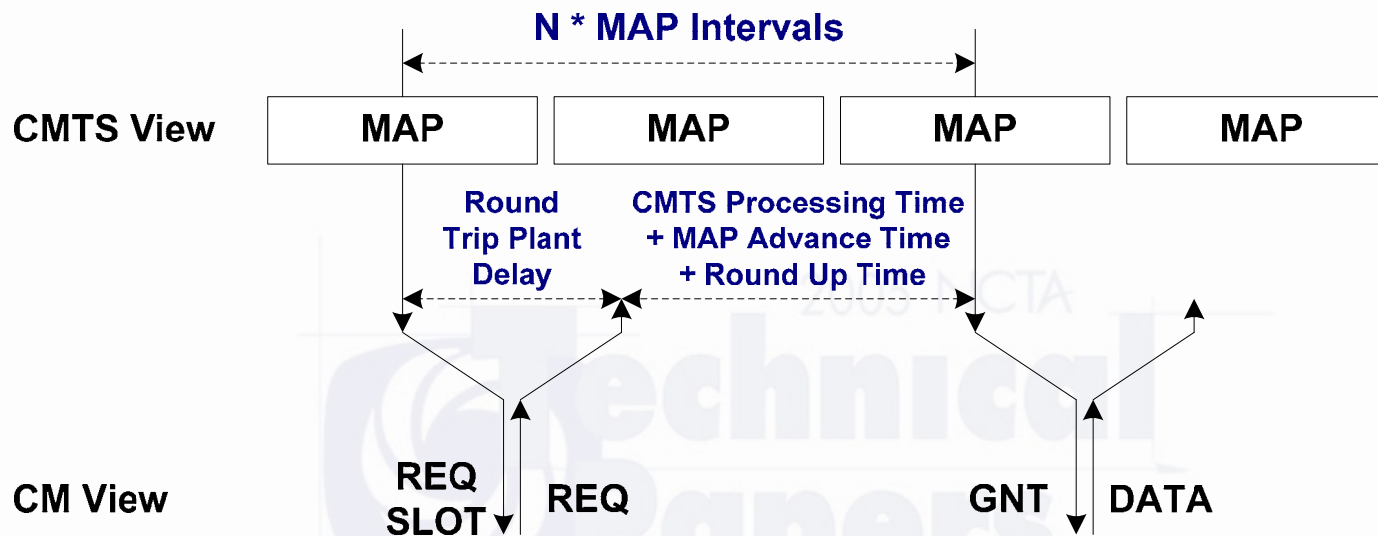


M-CMTS Edge QAM Block Diagram



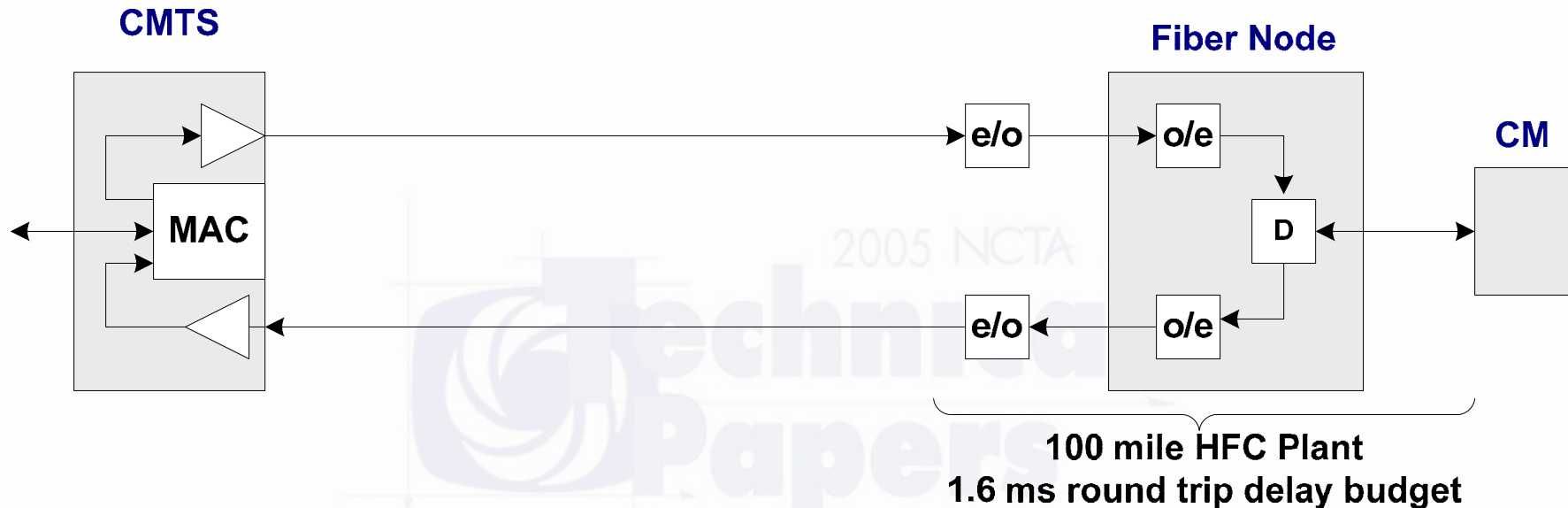
- MPT (MPEG Transport) is the native mode of the EQAM
 - Transparent MPT (T-MPT) and DOCSIS MPT (D-MPT)
- PSP (Packet Streaming Protocol) has a continuous stream of DOCSIS frames
- QoS is available across the DEPI interface

DOCSIS REQ-GNT Delay



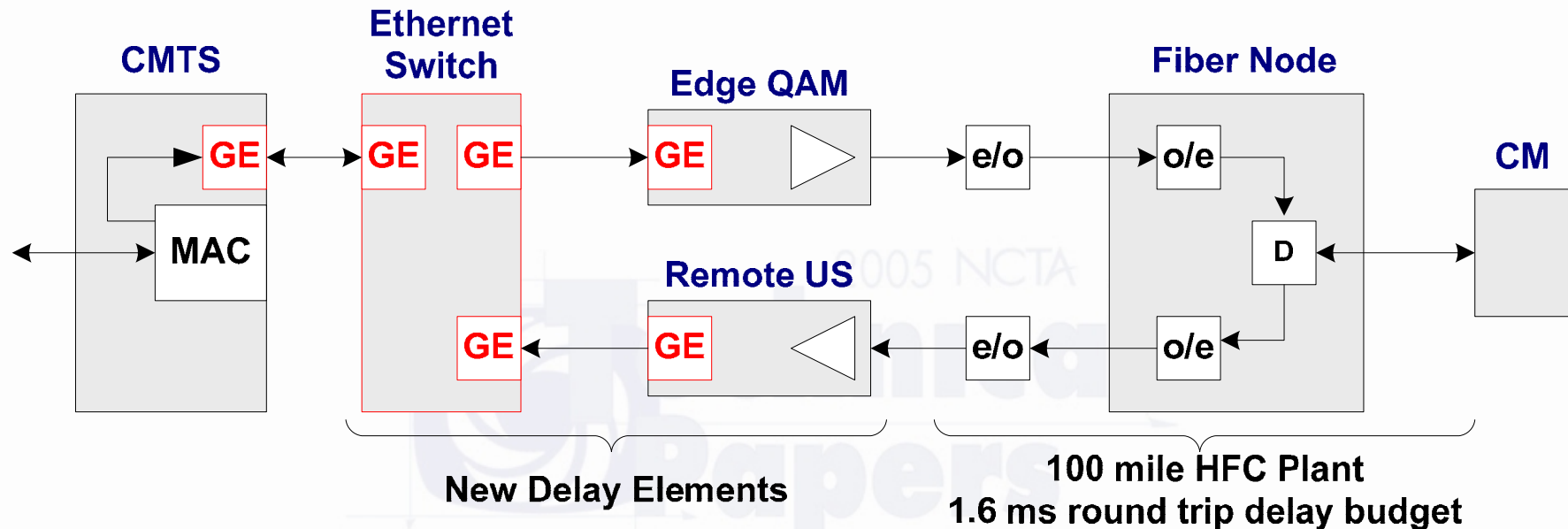
- One of the biggest design concerns for the M-CMTS was the impact on the REQ-GNT delay.
- Typical MAPs today are a minimum of 2 ms. With a GNT occurring a maximum of every other MAP, this allows a maximum of 250 PPS (packets per second) in the upstream.

HFC Plant Delay with Integrated DOCSIS



- The current DOCSIS specification allows a 100 mile plant which has a round trip delay of 1.6 ms
- CMTSs usually round this up to 1.8 or 2 ms for initial ranging opportunities
- Impact of actual delays are rounded off to MAP boundaries

HFC Plant Delay with Modular DOCSIS



- Additional delay elements add about 10% - 15% more delay.
 - This reduces the peak transfer rate from about 25 Mbps to 22 Mbps. This is still above normal usage.
- It is generally agreed that this effect is not noticed and that this cost is outweighed by the gain of the architecture.

Summary

- The Modular CMTS will provide the foundation for the next generation CMTS which will provide:
 - significantly more flexibility in configuration
 - significantly lower transport cost per bit
 - significantly higher data capacities than anything out there today.
 - These new machines will require multiple 1 gigabit or 10 gigabit backhails rather than the 100 baseT backhails in use with today's CMTS.
- The Modular CMTS architecture will allow DOCSIS to competitively provide the triple-play services of data, voice and video over IP.