M-CMTS & DOCSIS 3.0
Standards Overview

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1 INTRODUCTION

The next generation cable network is defined by two standards: M-CMTS and DOCSIS 3.0.

The modular cable modem termination system (M-CMTS) standard defines architecture that splits the components of a traditional cable modem termination system (CMTS) into an M-CMTS core that is connected via an interface to an edge QAM (EQAM).

DOCSIS 3.0 provides a number of enhancements to the existing DOCSIS standard, most notably, channel bonding, support for IPv6, and support for IPTV. Channel bonding provides cable operators with a flexible way to significantly increase downstream speeds to a minimum of 160 Mbps, and upstream throughput up to a minimum rate of 120 Mbps to customers.

2 M-CMTS OVERVIEW

-- The following M-CMTS information originates from CableLabs® --

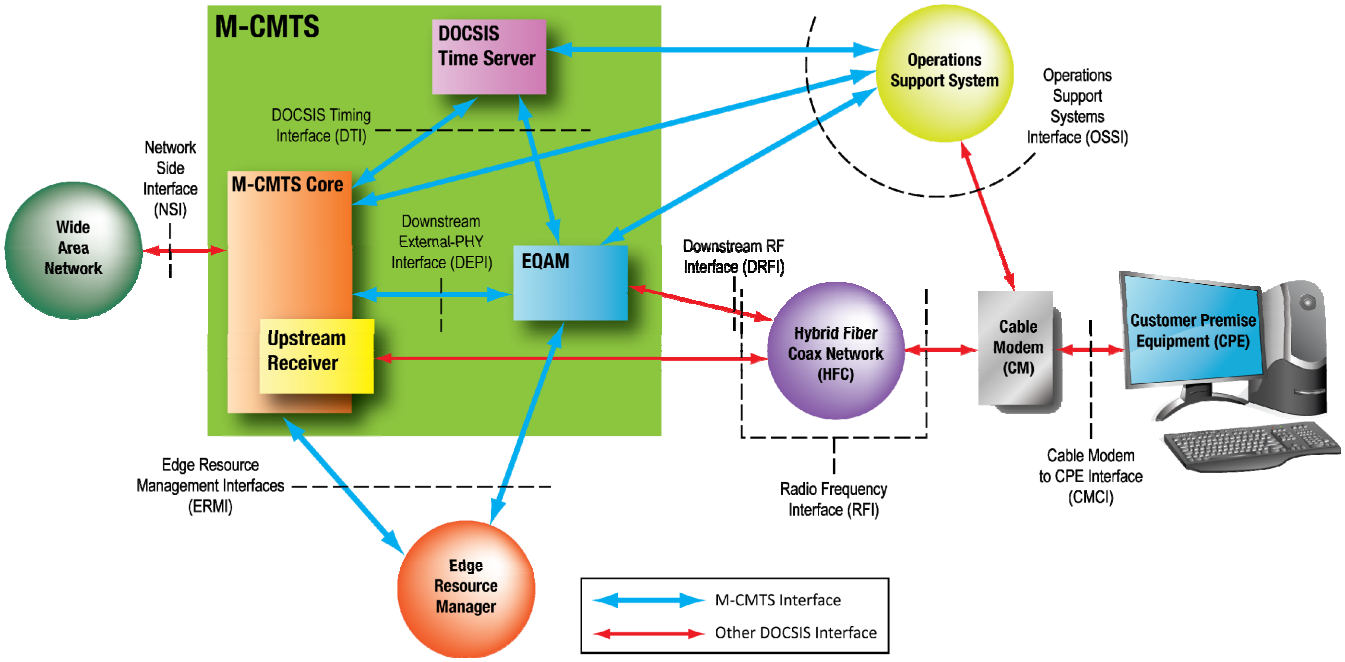

Figure 1: M-CMTS Reference Architecture

As shown in Figure 1, the M-CMTS architecture separates the conventional CMTS into two parts. The first part is the downstream physical (PHY) component (known as a DOCSIS EQAM) and the second part consists of the IP networking and DOCSIS MAC functions of the CMTS (known as the M-CMTS Core). The M-CMTS Core contains all the functions found in a current DOCSIS CMTS, including MAC timing and framing, packet classification, service flow management, and security. The EQAM device performs the RF transmission functions such as modulation and frequency up-conversion for the transmission of Data packets over the HFC.

The M-CMTS architecture includes a DOCSIS Timing server to maintain a consistent timing reference between the M-CMTS core and EQAM, as well as to mitigate the propagation delay differences of these two components. The DOCSIS Timing Interface (DTI) runs between the DTI Server and the M-CMTS and EQAM devices.

The EQAM device, as specified by the DOCSIS M-CMTS Interface specifications, is an adaptation of the Video QAM devices used for VOD service. To optimize the resource allocation of DOCSIS QAM channels for DOCSIS and VOD services, the M-CMTS architecture defines a Resource Manager to control the reservation of those QAM (Edge) resources. The Edge Resource Manager (ERM) provides reliable and optimized access to EQAM device resources The ERM interface is designed to manage the resource allocation of various EQAM resources for DOCSIS and VoD activities. In addition, the EQAM device supports a Registration Interface to ERM with the purpose of maintaining an accurate inventory of resources availability in the EQAM devices.

In the absence of ERM, or in a transition from VOD EQAMs only to VOD and DOCSIS QAMs, the M-CMTS architecture offers the option to configure and allocate EQAM resources via the M-CMTS core by using the Downstream External PHY Interface (DEPI). DEPI is basically a Layer 2 encapsulation of the DOCSIS traffic for the purpose of transport from the M-CMTS core to the EQAM device.

The DRFI is defined by the M-CMTS architecture for the purpose of gathering all the RF specification requirements from DOCSIS into a standalone specification to be referenced in the future for Modular or integrated CMTS implementations.

The Operations Support Systems requirements of the M-CMTS architecture consist of the Management Information Base (MIB), residing in the M-CMTS modules such as M-CMTS core, EQAM device and DTI Server, with the purpose of providing configuration, monitoring, and troubleshooting management functions of the M-CMTS interface specifications.

2.1 M-CMTS OBJECTIVES

The M-CMTS architecture was created to accomplish the following:

- Allow operators to deploy independently scalable numbers of downstream DOCSIS channels without changing the MAC (media access control) domain or the number of upstream DOCSIS channels.
- Lower the cost to deliver video over DOCSIS service to be competitive with current MPEG VOD (video on demand) by implementing a new generation of downstream-only cards on existing CMTS units. Current CMTS line cards combine downstream & upstream channels, forcing operators to add one upstream channel for every downstream channel they deploy; M-CMTS architecture removes this necessity.

In the near term, operators will focus on achieving the above objectives and In the future, when a significant portion of DOCSIS downstream throughput becomes IPTV and data rate requirements grow beyond what can be met by an integrated CMTS, an M-CMTS architecture could provide the flexibility to meet growing throughput demands.

3 DOCSIS 3.0 OVERVIEW

DOCSIS 3.0 represents a significant evolution of the DOCSIS standard by enabling new features that will support the next generation of applications and services that are eagerly sought by today's subscribers. The flexibility with which these new features can be implemented and easy scalability of the termination equipment adds to the appeal of DOCSIS 3.0. The seamless operation of DOCSIS 3.0 modems with legacy network management systems greatly minimizes the impact on network operational expenses incurred by a gradual or even sudden migration to the new standard.

The major new features that come with DOCSIS 3.0 are channel bonding, IPV6 support, improved security and enhanced multicasting capabilities.

3.1 CHANNEL BONDING

DOCSIS 3.0 enables four or more 6 MHz DOCSIS 2.0 channels (or four or more 8 MHz channels in Europe) to be bonded together to achieve higher data rates. Bonding four downstream 6 MHz DOCSIS 2.0 channels rated at 40 mbps will achieve an aggregate downstream data rate of 160 mbps; bonding four upstream DOCSIS 2.0 channels rated at 30 mbps will achieve an aggregate upstream data rate of 120 mbps. This represents a minimum offering of 160 mbps downstream and 120 mbps upstream for low-cost residential applications. For businesses and other subscribers that may require faster data rates, more channels may be quickly and cost effectively bound together as required. The precision and flexibility of the network's scalability is greatly enhanced by the ease in which channels can be bound together; bandwidth can be deployed quickly and targeted specifically to the location where it is needed most in response to competitive situations or to exploit emerging opportunities in the marketplace.

3.2 IPV6 SUPPORT

DOCSIS 3.0 includes native support for IP Version 6 (IPV6), expanding the number of assignable IP addresses from the millions supported in IPV4 to billions. IPV6 can streamline the network's addressing scheme, lowering the cable provider's operating expenses, and can enable a more efficient deployment of expanded services that may require assigning multiple IP addresses to multiple set top boxes in a residence. DOCSIS 3.0 also eliminates interoperability issues since it supports a hybrid environment where termination equipment can support either IPV4 or IPV6.

3.3 ENHANCED SECURITY

DOCSIS 3.0 strengthens security to prevent hackers and malicious viruses from doing harm. DOCSIS 2.0 supported Data Encryption Standard (DES) but DOCSIS 3.0 supports the much stronger Advanced Encryption Standard (AES).

3.4 ENHANCED MULTICASTING CAPABILITIES

DOCSIS 3.0 offers new enhancements to the multicasting capabilities available in previous DOCSIS versions. These enhancements allow DOCSIS 3.0 to more efficiently allocate network bandwidth to multiple users, freeing up network capacity for other revenue generating services.