

Document Number:

IEEE 802.16mp-99/16

Title:

Media Access Control Protocol Based on DOCSIS 1.1

Date Submitted:

1999-11-08

Source:

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Venue:

802.16 Session #4, November 8-11, 1999, Kauai, Hawaii, USA.

Base Document:

IEEE 802.16mc-99/16 (http://grouper.ieee.org/groups/802/16/mac/contrib/80216mc-99_16.pdf)

Purpose:

This presentation is intended to provide an overview of the submission IEEE 802.16mc-99/16, "Media Access Control Protocol Based on DOCSIS 1.1"

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*Media Access Control Protocol
Based on DOCSIS 1.1*

IEEE 802.16mc-99/16

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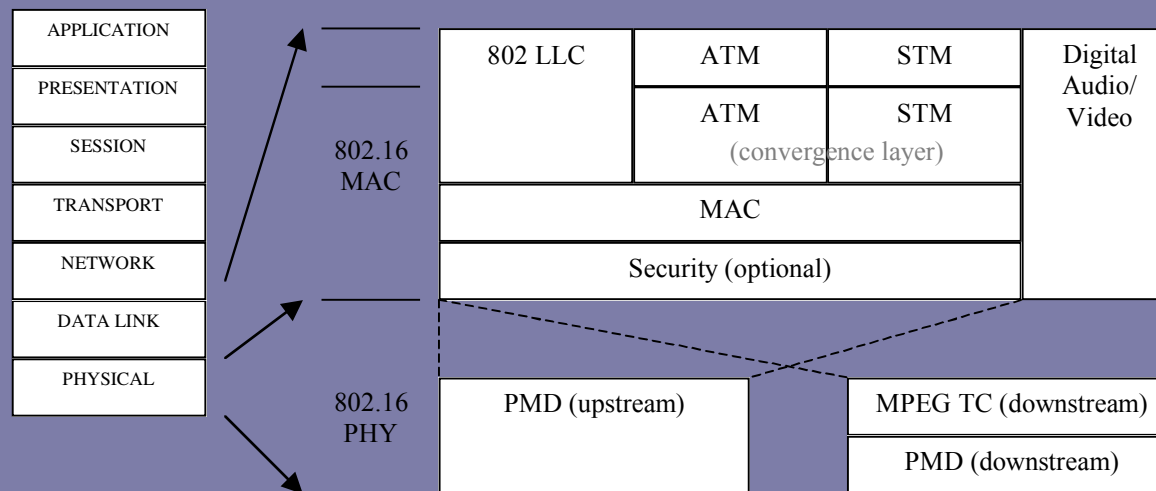
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- Point to multi-point MAC protocol
 - Broadcast downstream
 - TDMA upstream (multiple upstreams possible)
- Scheduler separate from MAC
- Variable-length native MAC PDU
 - Mapped into mini-slots for upstream bursts
- Service Flows
 - Integral to bandwidth allocation process
 - Multiple service flows per SS
 - Provides upstream and downstream QoS management

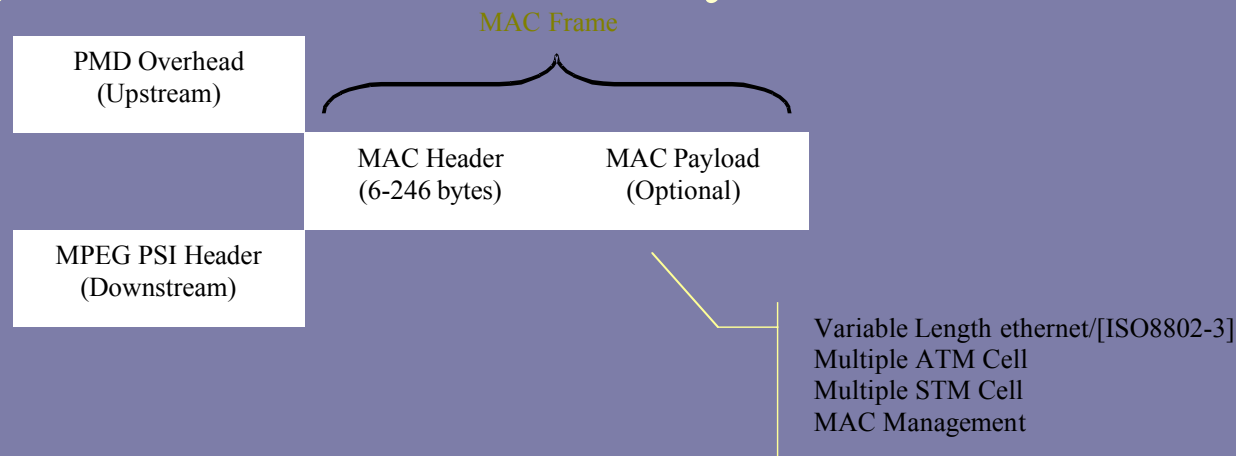
Protocol Reference Stack

- Support for ethernet/802.3
- Support for ATM/STM convergence
- Optional Security Layer



MAC Frame Format

- Variable-length native MAC PDU
- Same format in both upstream & downstream
- Downstream MAC frame starts anywhere
- Payload Mac header = 6 bytes



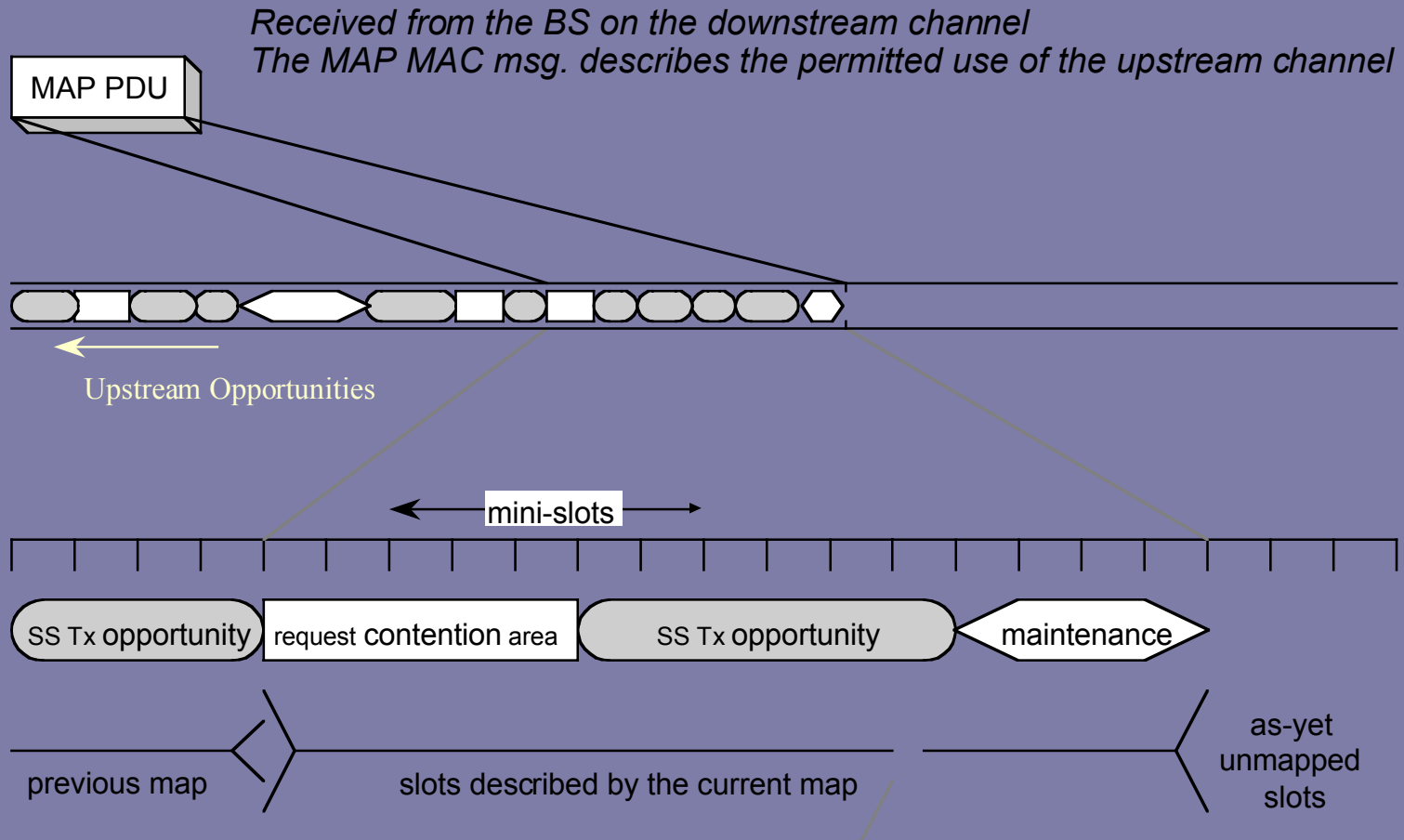
Upstream Access

- Timing based on mini-slots
 - Length independent of modulation symbol rate
 - Typical length: 8, 16, or 32 bytes
 - Timing relative to downstream SYNC MAC message
- MAP messages allocate mini-slots to SS
- Available access/transmission modes:
 - Contention (collision or polled)
 - Unsolicited (reservation-based or polled)
 - Transmission with contention
 - Maintenance (initial and ranging)
- Reservation request in upstream MAC burst

Scheduling Services

- Best Effort (BE)
 - traditional IP traffic
- Unsolicited Grant (UGS)
 - CBR traffic
- Unsolicited Grant with Activity Detection
 - switch between UGS and rtPS based on activity
 - VoIP with activity detection
- Real-Time Polling (rtPS)
 - periodic
- Non-Real-Time Polling (nrtPS)
 - non-periodic

Allocation MAP Example



Additional Efficiency and QoS Features

- Fragmentation
 - Defined in upstream; expanded to downstream
- Payload Header Suppression
 - Simple method for reducing bandwidth
 - Both directions
- Service Flows
 - Created, modified, and deleted dynamically
 - Assigned QoS characteristics

- Ranging Parameters for Upstream Transmission
 - RF Power
 - Timing
 - Frequency
 - Equalizer coefficients (optional)
- Ranging Types
 - Initial
 - When SS enters the network
 - Maintenance
 - Scheduled at regular intervals

- DOCSIS Baseline Privacy Plus Interface (BPI+)
 - Optional (implementation and use)
 - Optional by Service Flow
- Authentication
 - RSA Private/Public Key
 - Digital X.509 Certificates
- Privacy
 - DES Encryption using Cipher Block Chaining mode
 - User payload only

Proposed Extensions

- Mini-slot length (bytes) independent of symbol rate
- Support for ATM/STM transport
 - multiple cells within MAC frame
- Downstream Fragmentation
 - upstream fragmentation already defined
- Payload Header Suppression for ATM Cells
 - Ethernet header suppression now defined

Benefits

- Supports all BWA system requirements
- Minimal modification to existing standards
- Scales to support high transmission rates
- Available OPNET modeling and field data
- Good independence from PHY layer
- Optional security protocol
- Support for multiple bearer services to each SS
- Efficient usage of bandwidth
- Ability to bound delay and jitter
- Statistical multiplexing gain