Document Number:

IEEE 802.16mp-99/16

Title:

Media Access Control Protocol Based on DOCSIS 1.1

Date Submitted:

1999-11-08

Source:

Karl Stambaugh	Voice:	480-441-7842
Motorola Inc.	Fax:	480-675-2116
8220 E. Roosevelt Street, M/D R1106	E-mail:	p13690@email.mot.com
Scottsdale, AZ 85257		
Glen Sater	Voice:	480-441-8893
Motorola Inc.	Fax:	480-675-2116
8220 E. Roosevelt Street, M/D R1106	E-mail:	p21661@email.mot.com
Scottsdale, AZ 85257		

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”

Notice:

Release:

IEEE Patent Policy:

Media Access Control Protocol Based on DOCSIS 1.1

IEEE 802.16mc-99/16

Glen Sater

Karl Stambaugh

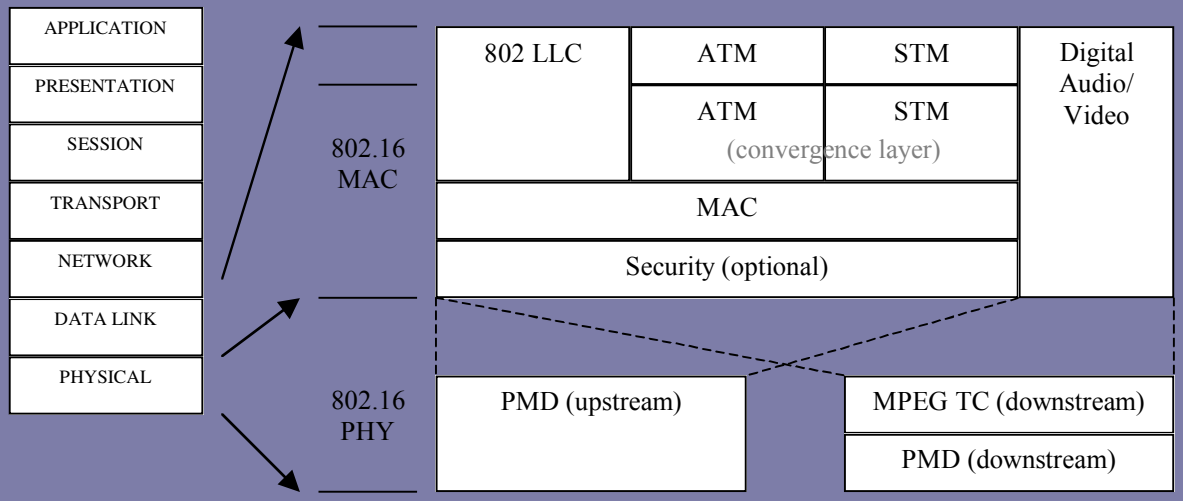
Motorola Inc.

Overview

- 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

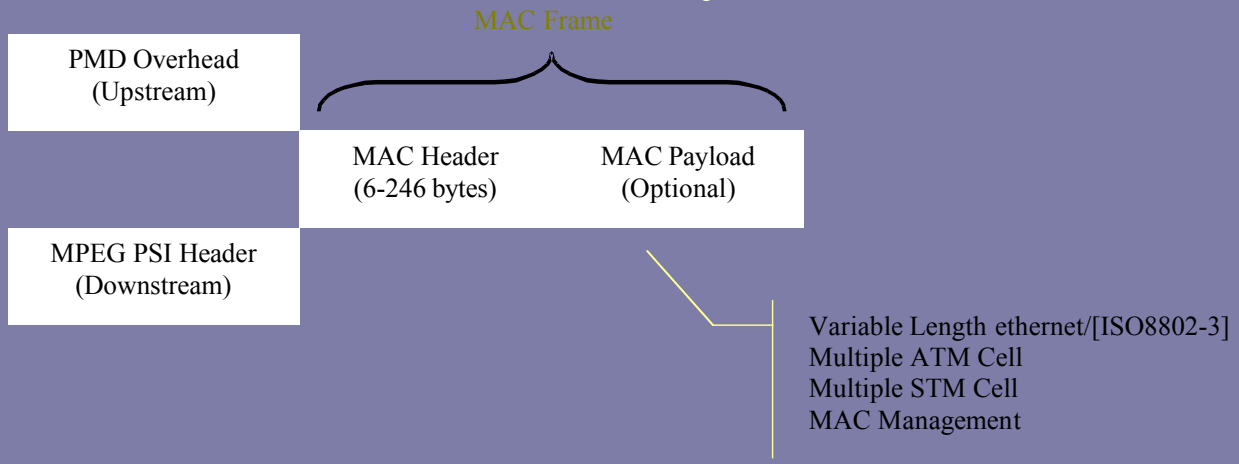
Protocol Reference Stack

- 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



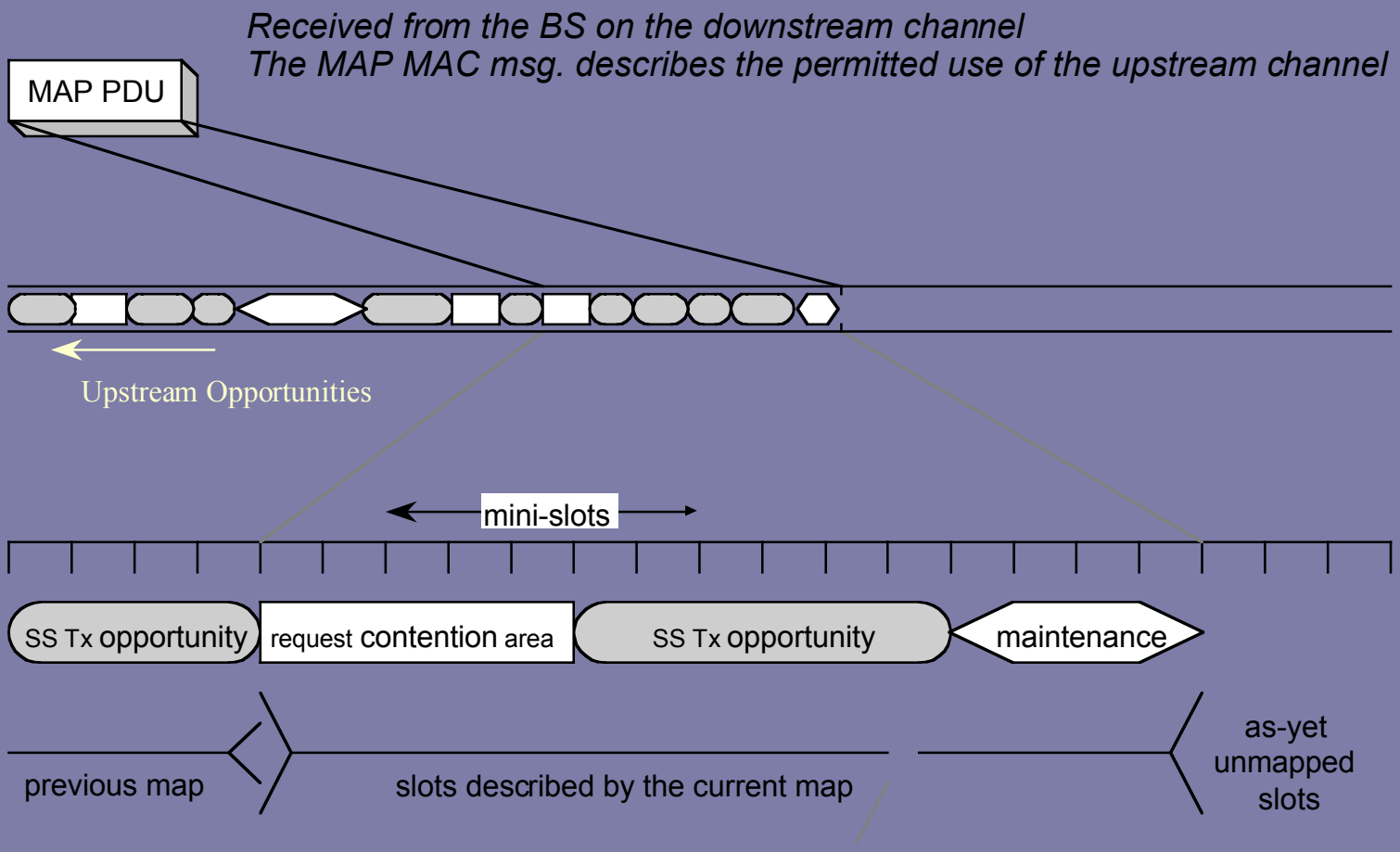
Upstream Access

- 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

- 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

Security

- 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