Ethernet Over Passive Optical Networks

Brian Petersen

Cisco Systems

Goals For This Presentation

- Propose a PHY that enables the use of Ethernet over passive optical networks
  - 1 Gbps data rate
  - Downstream broadcast transmission
  - Upstream blind shared media

Why EPON?

- Enables the sharing of OLT equipment by numerous subscribers
  - Reduces the cost of the installed network to economically viable levels
  - Significantly reduces the rack space required to support a certain number of subscribers
  - Provides reliable bandwidth for true multi-media over IP

Why Ethernet?

- Ethernet is nearly ubiquitous in home PCs & networks
- Ethernet is increasingly common in central offices
- Ethernet should be used to connect the two

Why In The PHY?

- Adaptation to EPON at the PHY assures preservation of the Ethernet packet format and MAC protocols
- Enables the rapid development and deployment of EPON networks

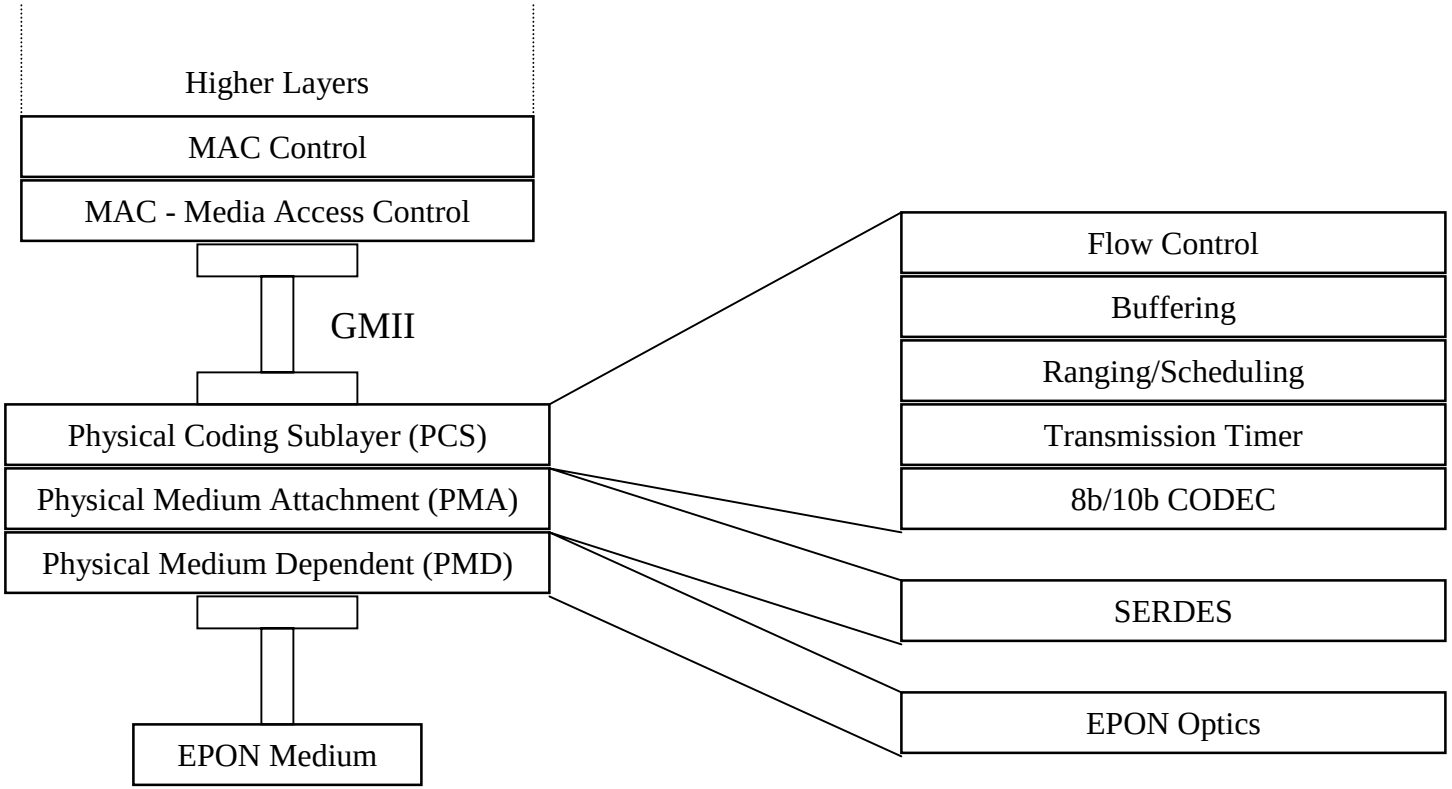
PON Characteristics

- Downstream broadcast.
  - OLT transmissions received by all ONTs.
- Upstream blind shared media.
  - ONT transmissions not visible to other ONTs

Collision Avoidance

- Upstream transmission scheduling.
  - Central authority (OLT) must schedule each ONT transmission.
  - Accurate ranging required to achieve acceptable efficiency.

EPON PHY


Higher Layers
MAC Control
MAC - Media Access Control
GMII
Physical Coding Sublayer (PCS)
Physical Medium Attachment (PMA)
Physical Medium Dependent (PMD)
EPON Medium
Flow Control
Buffering
Ranging/Scheduling
Transmission Timer
8b/10b CODEC
SERDES
EPON Optics

Flow Control

- Utilizes 802.3x to stanch the flow of packets
  - Prevents the packet buffer from overflowing while PHY is paused between transmission opportunities

Buffering

- Provides rate matching and finer level of control than afforded by 802.3x
  - At least one frame’s worth of packets are accommodated

Ranging/Scheduling

- Measures propagation delay of fiber interconnect
  - Time stamps are traded and compared
- Manages transmit times for shared media
  - Enables the avoidance of collisions

Transmission Timer

- Provides precise start times for transmission bursts
  - Maximizes utilization of the network
- Ensures that packets fit within centrally scheduled guard bands
  - Prevents interference between transmitters

Summary

- Resides in the PHY
- Preserves the Ethernet packet format
- Utilizes existing Ethernet MACs and GMII