Refinements to PMA for 10Gbe WAN PHY

Enrique Hernandez-Valencia - Lucent Bell Labs
Nevin Jones - Lucent Microelectronics

Motivation

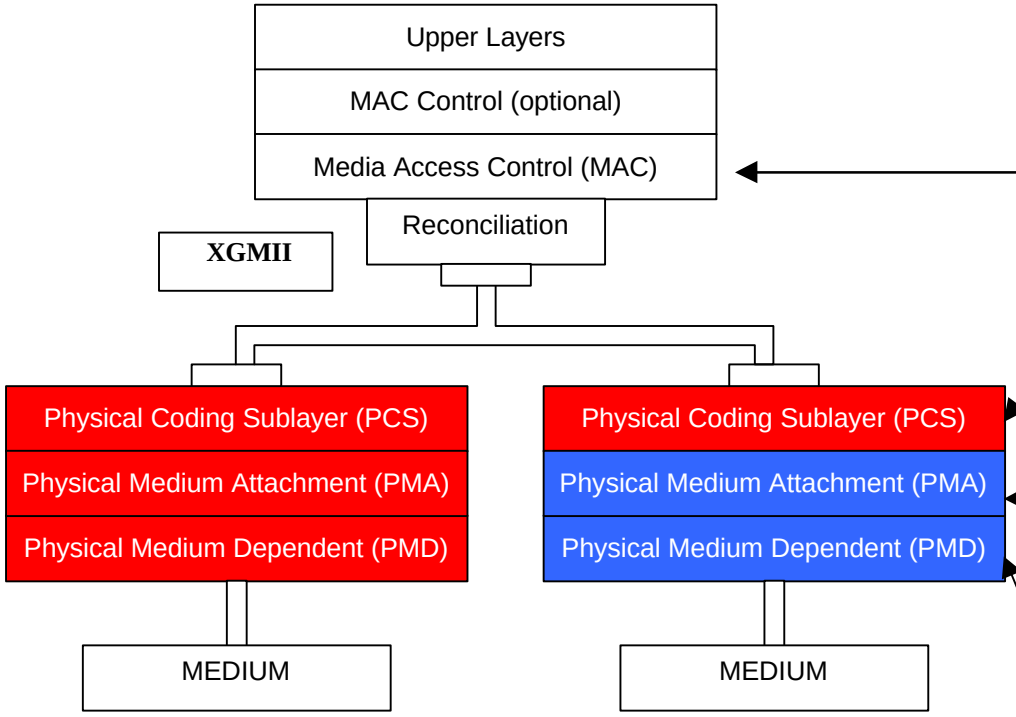
1) SONET/SDH Ready
   - SONET/SDH style interface
   - low cost access interface to WAN

2) Minimize transport overhead for WAN scenarios
   - bandwidth is the expensive commodity in the WAN market

3) Facilitate interworking between IEEE 10Gbe WAN PHY and T1X1.5 DoS/EoS capabilities

4) Minimize impact on Ethernet MAC

LAN-WAN Interconnect Model



LAN PHY

WAN PHY

- 802.3 MAC
- Packet Length Indication (Optional)
- PCS (8B/10B or SLP)
- Frame Encapsulation (<length><hec>)
- $X^{43} + 1$ Scrambler (PHY Payload)
- SONET-style Framing
- $X^{7} + X^{6} + 1$ Scrambler
- SerDes
- Optics
- Clock recovery

- Shared PCS between LAN and WAN PHYs

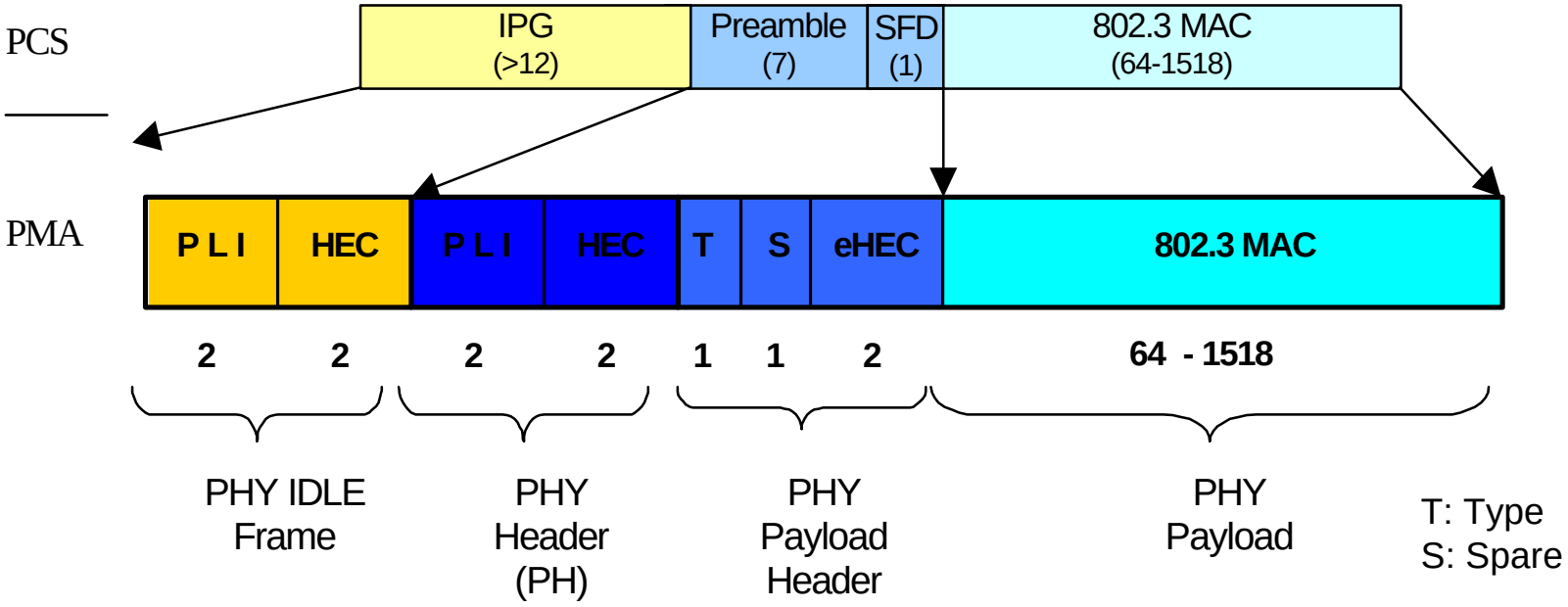
Scrambler-based PHY proposal

- Octet-synchronous data stream at PMA interface
- Refines PMA in WAN-C PHY proposal*
  - Length + HEC frame delineation mechanism preserved
  - Payload scrambling with $X^{43}+1$ SSS
  - SONET-style frame and $X^7+ X^6+1$ SRS scrambling
- Reduces WAN overhead by 5-8%, on the average, compared to *zero* overhead LAN PHY

* 10 GE WAN PHY: Physical Coding Sublayer - N. Figueira, et al- November, 1999
http://grouper.ieee.org/groups/802/3/10G_study/public/nov99/figueira_1_0100.pdf

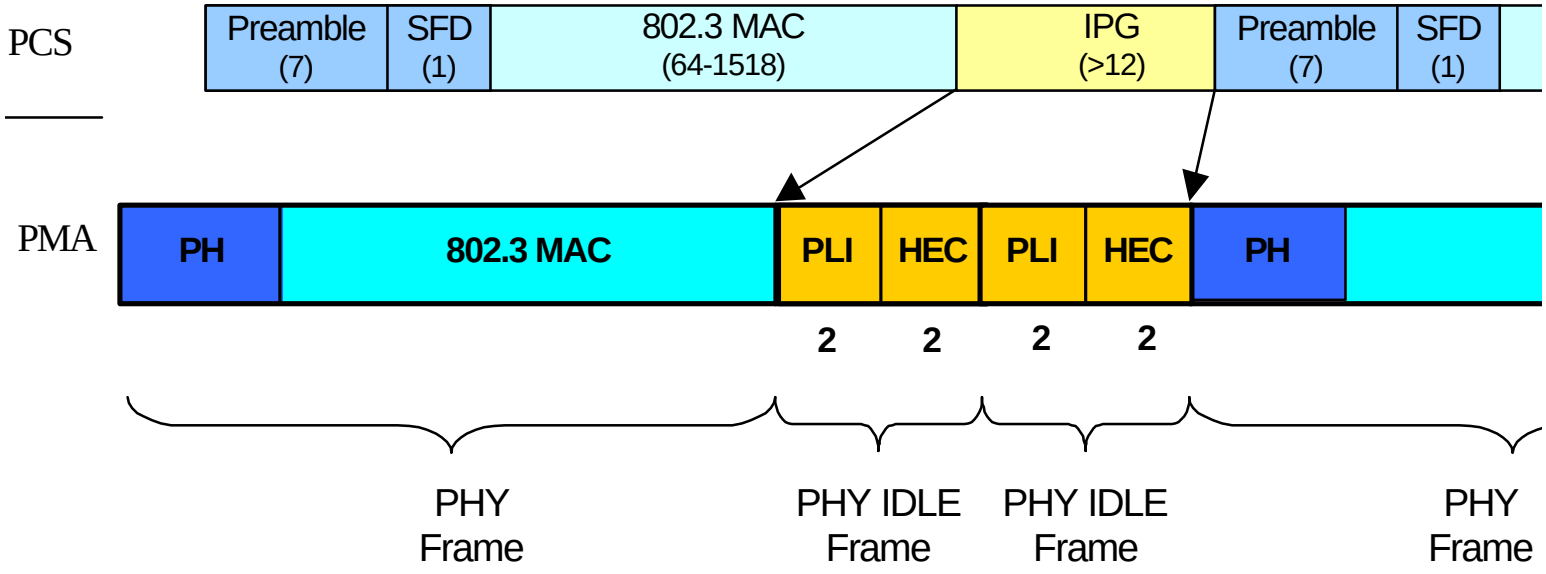
WAN PHY - PMA Encoding Rules

- IPG replaced by 3 or more 4-byte IDLE frames, when needed
- Preamble/SFD replaced by 4-byte IDLE frame and 4-byte PHY header
- Reduces IDLE frame to only 4 bytes



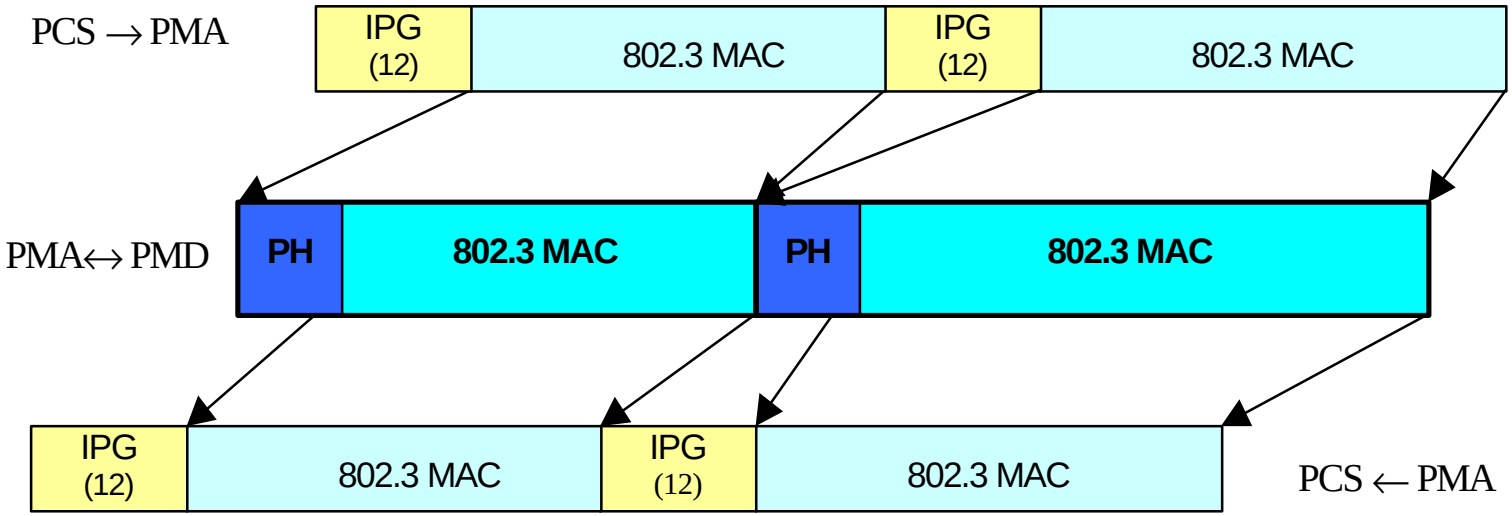
IPG Compression/Deletion

- IPG may be compressed/deleted by removing PHY IDLE frames
- Used whenever there is useful data to transmit to PMD



IPG Insertion

- IPG always reinserted at the PMA → PCS interface
- Consistent with IPG transmission rules at the XGMII



Rate Control

Reuse Frazier's* rate control proposal:

- PHY sends "Busy Idle" to MAC/PCS during IPG
  ⇒ MAC pauses transmission during IPG
- PHY sends "Normal Idle" to MAC/PCS during IPG
  ⇒ MAC resumes transmission

* http://grouper.ieee.org/groups/802/3/10G_study/public/Jan00/frazier_1_1199.pdf

Benefits

- Preserves 802.3/Ethernet MAC functions
- Shared PCS for LAN and WAN
  - ⇒ Agnostic to coding for XGMII
- Compact MAC encapsulation for WAN
  - ⇒ Reduced WAN overhead by 5-8% (in average)
- Simple and Integrated Rate Control via “Busy Idle”
- Consistent with SONET/SDH functionality

Benefits (Cont'd)

- Compatible PHY headers for WAN PHY and EoS:
- Compatible with frame format for PPP/SDL over SONET/SDH
  - ⇒ SDL mapping over SONET/SDH already recognized by ITU-T (G.707) and ANSI (T1.105)
  - ⇒ Experimental IETF RFC (Spring 2000)
    (see:http://info.internet.isi.edu:80/in-drafts/files/draft-ietf-pppext-sdl-06.txt)