Asymmetric Data Transmission Rates

10GEPON PHY Study Group
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Howard Frazier

Outline

- Question
- Annex 4A simplified full duplex MAC
- GMII & XGMII
- Conclusions

Question

- Are changes to the standard required above the physical layer in order to support asymmetric data transmission rates on an EPON?

Annex 4A MAC

- Simplified full duplex Media Access Control
- Defined by EFM
  - The ideal MAC for EPON
  - Applicable to EFM optical and copper P2P
  - Data rate independent specification
  - Independent Tx and Rx operation

Annex 4A MAC

- **4A.1.2 Full duplex operation**

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Transmit frame operations are independent from receive frame operations and respond to different signals from the Physical Layer.

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- **4A.2.2.3 Organization of the procedural model**

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This organization of the model is illustrated in Figure 4A–2 and reflects the fact that the communication of entire frames is initiated by the client of the MAC sublayer, while the timing of individual bit transfers is based on interactions between the MAC sublayer and the Physical-Layer-dependent bit time.

Annex 4A MAC

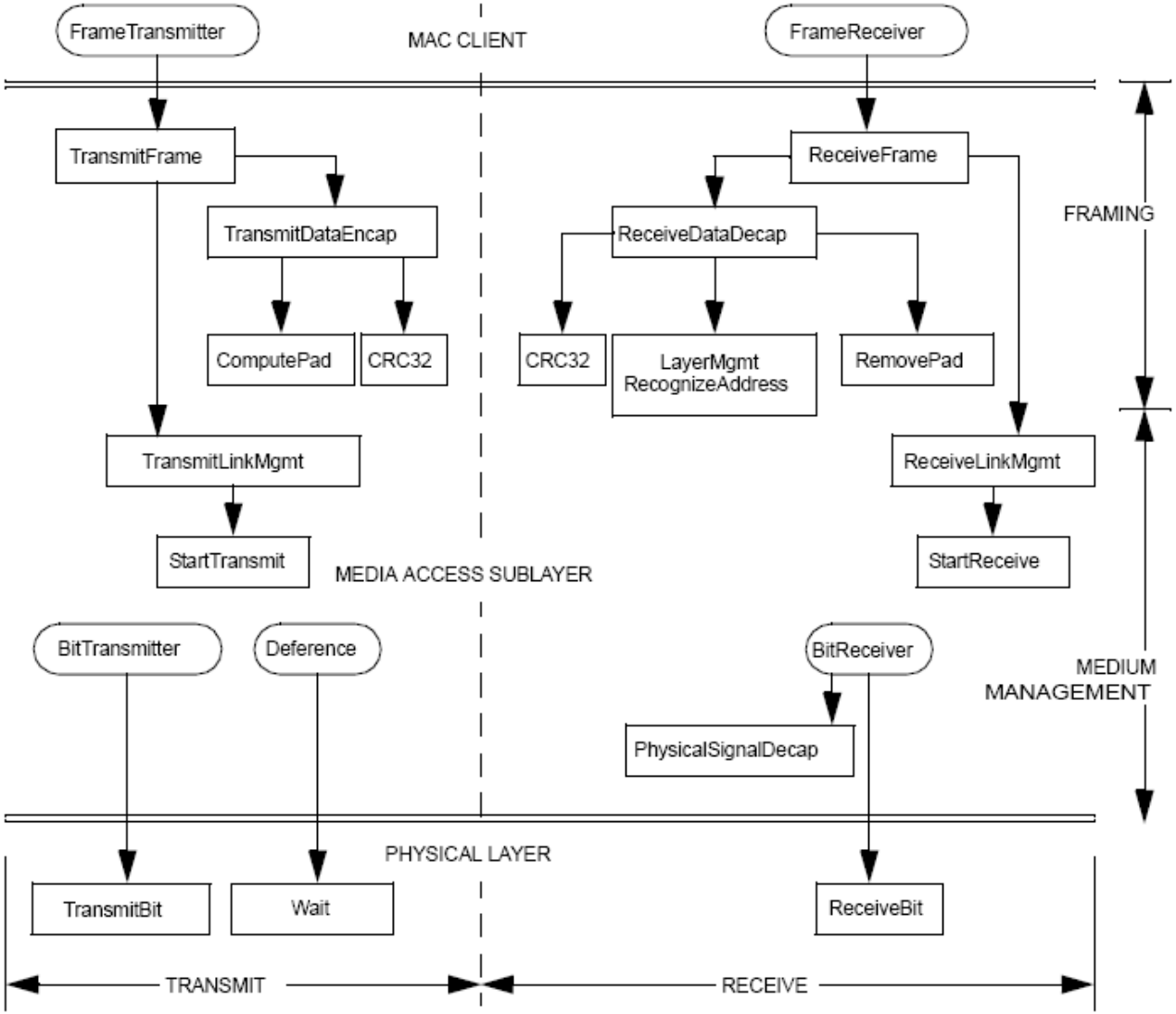

Figure 4A–2—Relationship among MAC procedures

Annex 4A MAC

- **4A.3.3 Services required from the physical layer**

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  During transmission, the contents of an outgoing frame are passed from the MAC sublayer to the Physical Layer by way of repeated use of the TransmitBit operation:

  procedure TransmitBit (bitParam: Bit);

  Each invocation of TransmitBit passes one new bit of the outgoing frame to the Physical Layer. TheTransmitBit operation is synchronous. The duration of the operation is the entire transmission of the bit. The operation completes when the Physical Layer is ready to accept the next bit and it transfers control to the MAC sublayer.

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Annex 4A MAC

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During reception, the contents of an incoming frame are retrieved from the Physical Layer by the MAC sublayer via repeated use of the ReceiveBit operation:

function ReceiveBit: Bit;

Each invocation of ReceiveBit retrieves one new bit of the incoming frame from the Physical Layer. The ReceiveBit operation is synchronous. Its duration is the entire reception of a single bit. Upon receiving a bit, the MAC sublayer shall immediately request the next bit until all bits of the frame have been received (see 4A.2 for details).

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Annex 4A MAC

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The Physical Layer also provides the procedure Wait:

procedure Wait (bitTimes: integer)*;*

This procedure waits for the specified number of bit times. This allows the MAC sublayer to measure time intervals in units of the (physical-medium-dependent) bit time.

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- **Wait is used only in the MAC transmitter, specifically in process Deference. Therefore, Wait will use the transmitter's (physical-medium-dependent) bit time.**

Annex 4A MAC

- **4A.4.2 Allowable implementations**

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Table 4A–2—Full duplex MAC parameter values

Parameters	Values
interFrameGap	96 bits
maxUntaggedFrameSize	1518 octets
minFrameSize	512 bits (64 octets)

GMII & XGMII

- The GMII and XGMII are part of the physical layer

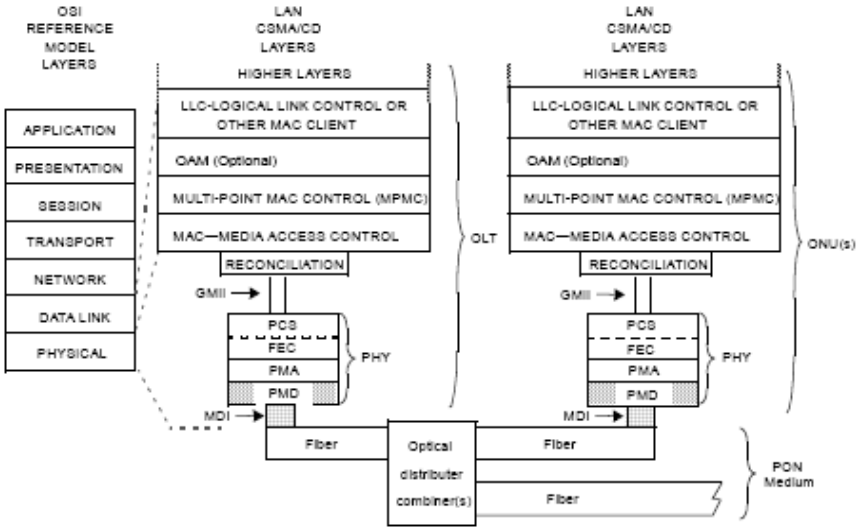

Figure 60–1—P2MP PMDs relationship to the ISO/IEC Open Systems Interconnection (OSI) reference model and the IEEE 802.3 CSMA/CD LAN model

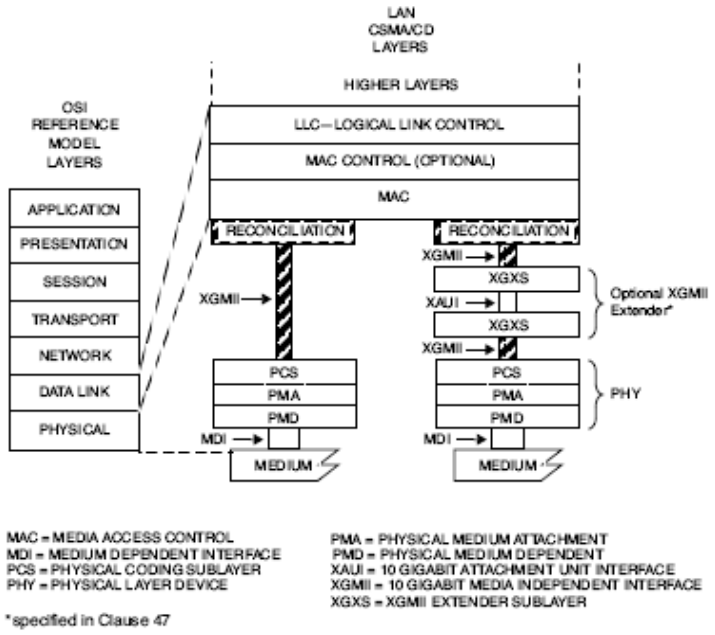

Figure 46–1—XGMII relationship to the ISO/IEC Open Systems Interconnection (OSI) reference model and the IEEE 802.3 CSMA/CD LAN model

GMII & XGMII

- The GMII and XGMII have independent transmit and receive paths

- **35.1 Overview**

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  This interface has the following characteristics:

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  c) It provides independent eight-bit-wide transmit and receive data paths.

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- **46.1 Overview**

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  The XGMII has the following characteristics:

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  c) It provides independent 32-bit-wide transmit and receive data paths.

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Conclusions

- The Annex 4A MAC is defined in a speed independent manner
- The Annex 4A MAC transmitter and receiver operate independently
- The GMII and XGMII are part of the physical layer
- The GMII and XGMII provide independent transmit and receive paths
- No changes to the standard are needed above the physical layer in order to support asymmetric data transmission rates on an EPON