56.1 Overview

Ethernet for subscriber access networks, also referred to as "Ethernet in the First Mile", or EFM, combines a minimal set of extensions to the IEEE 802.3 Media Access Control (MAC) and MAC Control sublayers with a family of Physical Layers. These Physical Layers include optical fiber and voice grade copper cable Physical Medium Dependent sublayers (PMDs) for point-to-point (P2P) connections in subscriber access networks. EFM also introduces the concept of Ethernet Passive Optical Networks (EPONs), in which a point-to-multipoint (P2MP) network topology is implemented with passive optical splitters, along with extensions to the MAC Control sublayer and Reconciliation sublayer as well as optical fiber PMDs to support this topology. In addition, a mechanism for network Operations, Administration, and Maintenance (OAM) is included to facilitate network operation and troubleshooting. 100BASE-LX10 extends the reach of 100BASE-X to achieve 10 km over conventional single-mode two-fiber cabling. The relationships between these EFM elements and the ISO/IEC Open System Interconnection (OSI) reference model are shown in Figure 56–1 for ~~point-to-point~~ P2P topologies, Figure 56–2 for symmetric, 1 Gb/s EPON, Figure 56–3 for symmetric 10G–EPON and ~~Figure 56–2~~Figure 56–4 for ~~point-to-multipoint~~ asymmetric 10G–EPON topologies.

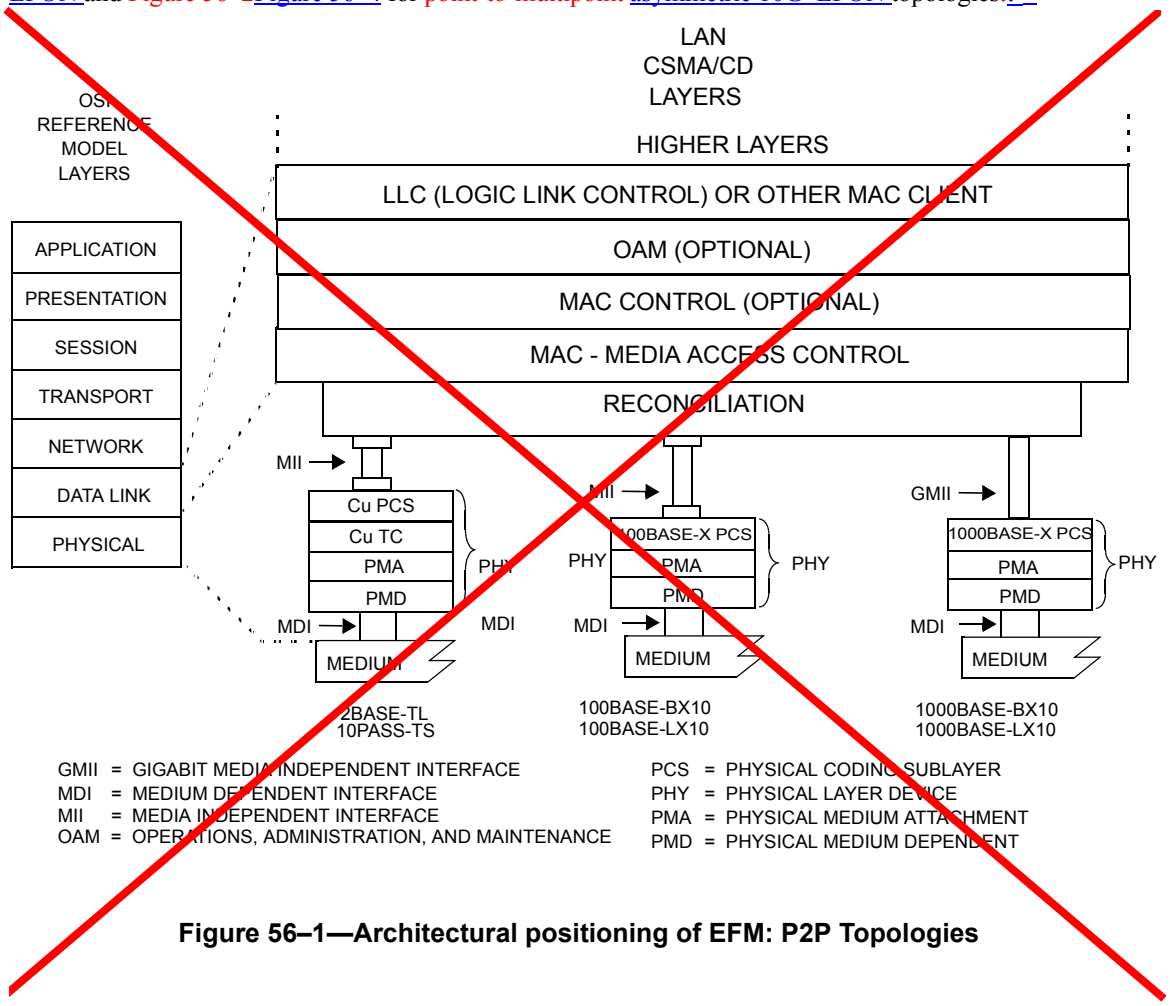

Figure 56–1—Architectural positioning of EFM: P2P Topologies

An important characteristic of EFM is that only full duplex links are supported. A simplified full duplex MAC is defined in ~~Annex 4A~~Annex 4A for use in EFM networks. P2MP applications must use this simplified full duplex MAC. EFM Copper applications may use either this simplified full duplex MAC or the Clause 4 MAC operating in half duplex mode as described in ~~61.1.4.1.2~~61.1.4.1.2. All other EFM P2P applications may use either this simplified full duplex MAC or the Clause 4 MAC operating in full duplex mode.

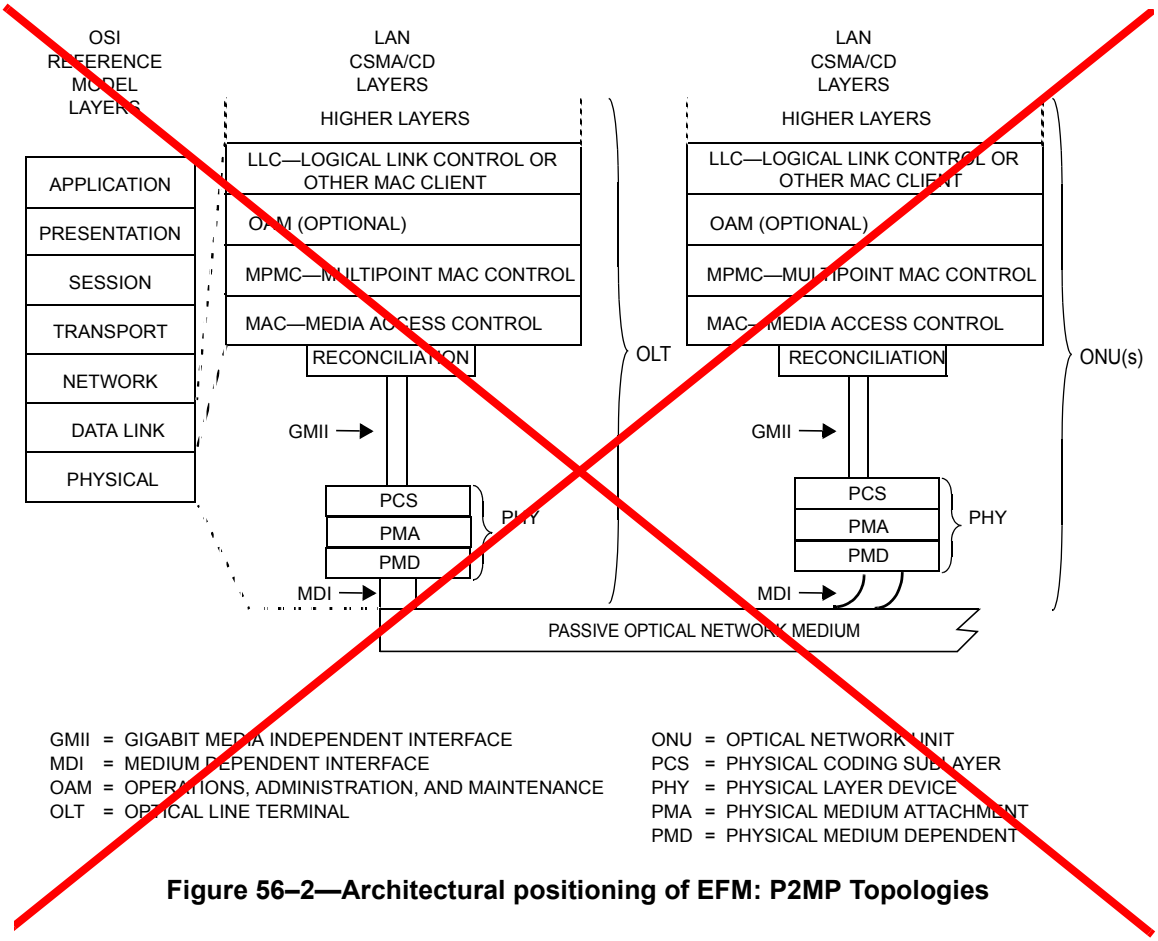

Figure 56–2—Architectural positioning of EFM: P2MP Topologies

EFM architecture is further extended in @@Clause 91@@ and @@Clause 92@@ by the addition of 10G–EPON. 10G–EPON extends the clauses of symmetric, 1 Gb/s EFM EPON to support symmetric (10 Gb/s downstream and 10 Gb/s upstream) as well as asymmetric (10 Gb/s downstream and 1 Gb/s upstream) PONs. In the following clauses, the symmetric, 1 Gb/s EFM EPON will be referred as EPON, while symmetric (10 Gb/s downstream and 10 Gb/s upstream) as well as asymmetric (10 Gb/s downstream and 1 Gb/s upstream) EPONs will be referred to as 10G–EPON.

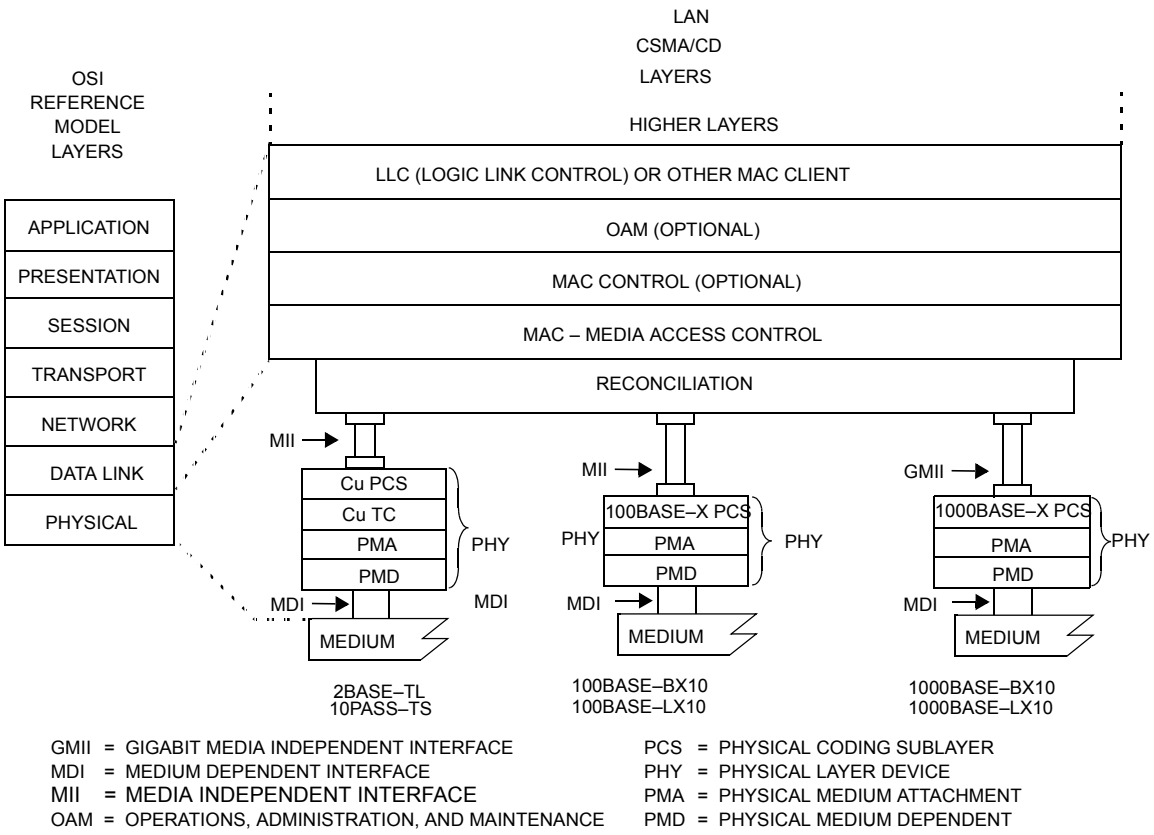

Figure 56–1—Architectural positioning of EFM: P2P Topologies

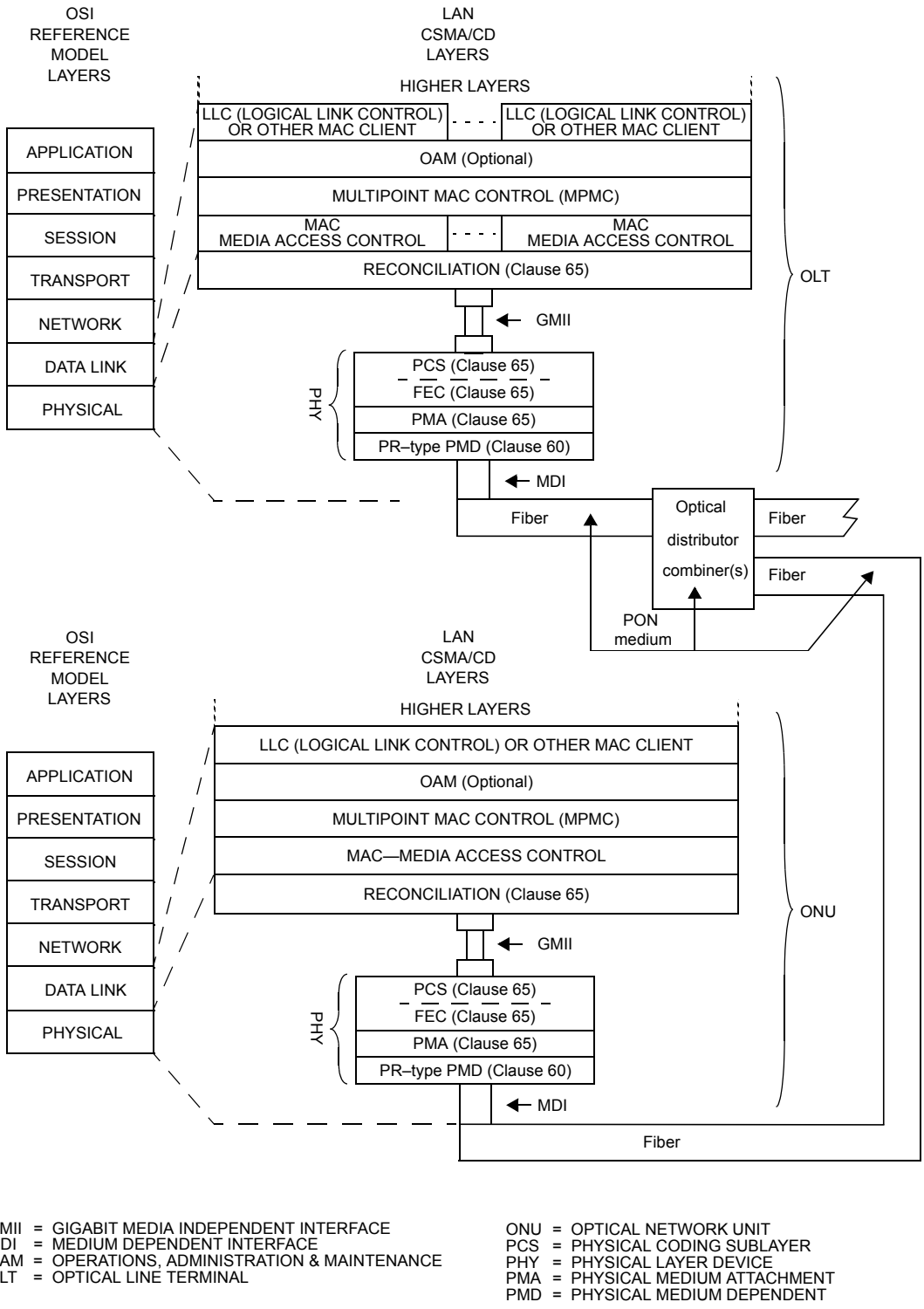

Figure 56–2—Architectural positioning of EFM:
P2MP symmetric 1 Gb/s EPON architecture (1 Gb/s downstream, 1 Gb/s upstream)

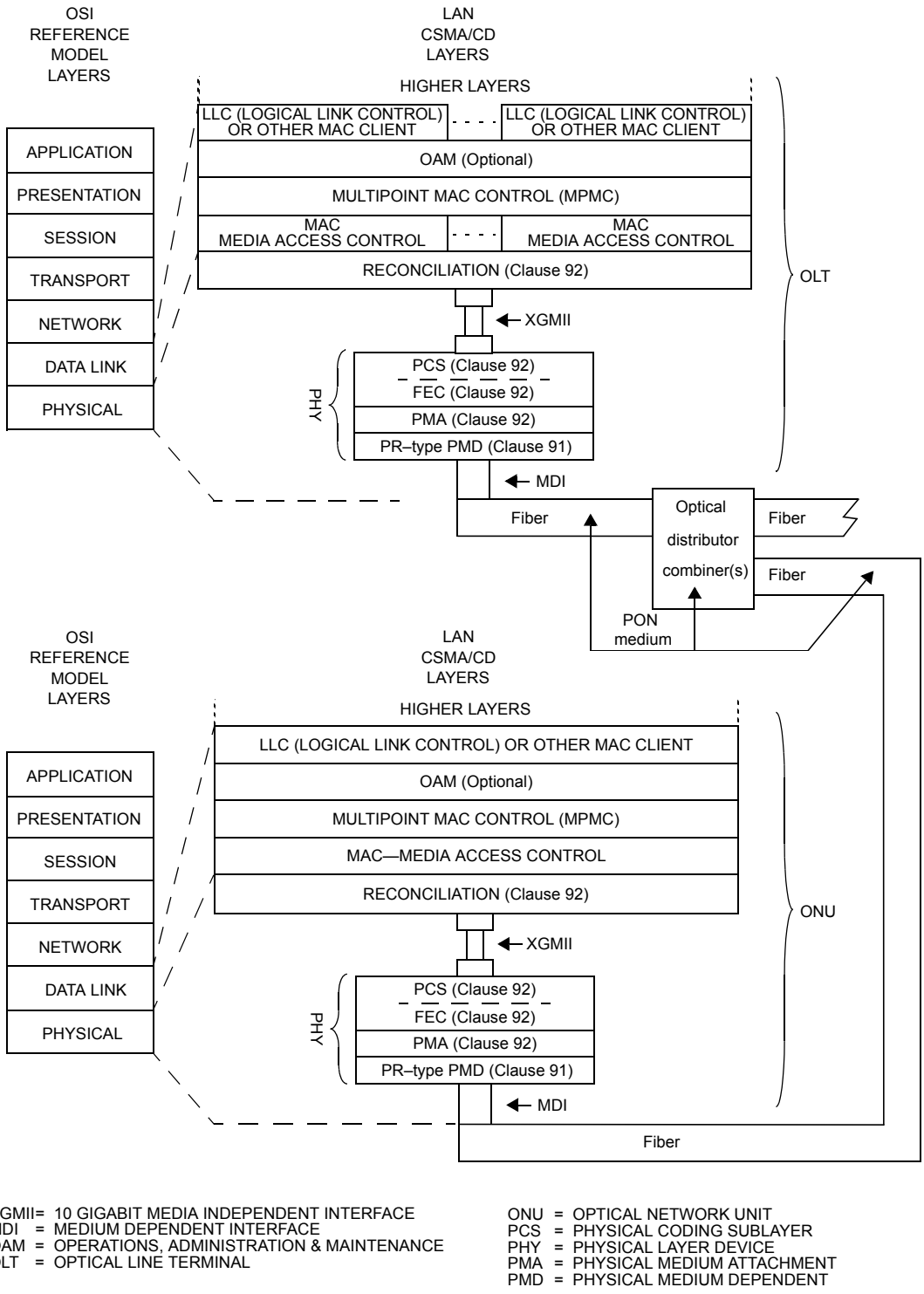

Figure 56–3—Architectural positioning of EFM:
P2MP symmetric 10G–EPON architecture (10 Gb/s downstream, 10 Gb/s upstream)

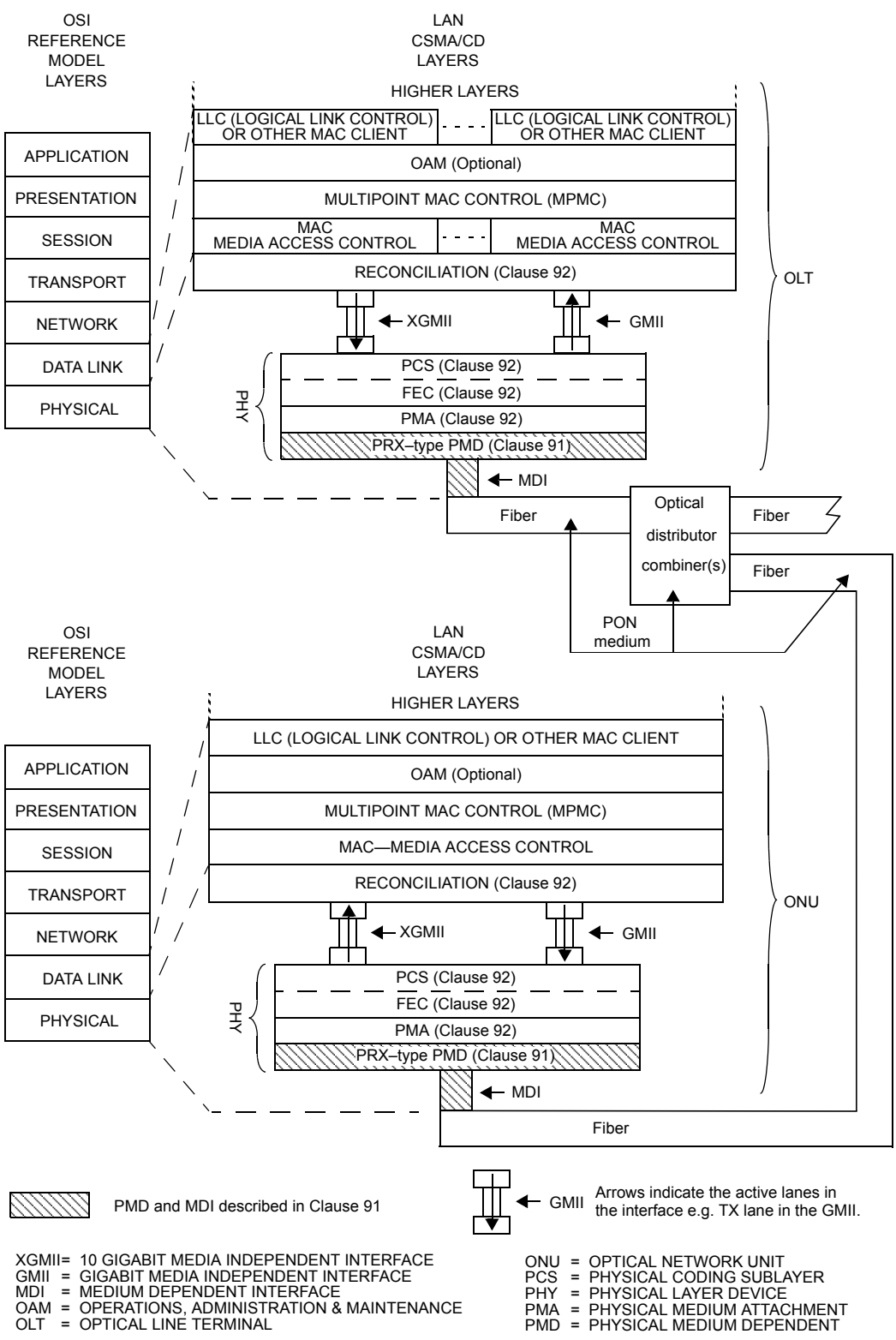

Figure 56–4—Architectural positioning of EFM:
P2MP asymmetric 10G–EPON architecture (10 Gb/s downstream, 1 Gb/s upstream)