Proposed Changes to Support 100G and 200G BiDi PHYs in Clause 157

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Proposed changes to Clause 157

157. Introduction to ~~10 Gb/s, 25 Gb/s, and 50 Gb/s~~ BiDi PHYs

10 Gb/s, 25Gb/s, 50 Gb/s, 100 Gb/s and 200 Gb/s

157.1 Overview

157.1.1 Scope

10 Gb/s, 25Gb/s, 50 Gb/s, 100 Gb/s and 200 Gb/s

This clause describes the general requirements for ~~10 Gb/s, 25 Gb/s, and 50 Gb/s~~ Ethernet bidirectional Physical Layer entities (PHYs). Within this clause this family of PHYs is collectively referred to as Multi-Gigabit Ethernet BiDi PHYs. These PHYs are divided into two variants based on the direction of transmission; optical line terminal (OLT) PHYs transmit in the downstream direction and optical network unit (ONU) PHYs transmit in the upstream direction.

All Multi-Gigabit Ethernet BiDi PHYs specified herein use the IEEE 802.3 MAC sublayer operating at a data rate of ~~10 Gb/s, 25 Gb/s, or 50 Gb/s~~ as appropriate and are defined for full duplex operation only.

10 Gb/s, 25Gb/s, 50 Gb/s, 100Gb/s and 200 Gb/s

The Multi-Gigabit Ethernet BiDi PHYs provide a frame loss ratio of less than 6.2×10^{-10} for 64-octet frames with minimum interpacket gap.

157.1.2 Relationship of Multi-Gigabit Ethernet BiDi PHYs to the ISO OSI reference model

The Multi-Gigabit Ethernet BiDi PHYs couple to the IEEE 802.3 MAC. The relationships among the IEEE 802.3 Multi-Gigabit Ethernet BiDi Physical Coding Sublayer (PCS), forward error correction (FEC), physical medium attachment (PMA), and physical medium dependent (PMD) sublayers and the IEEE 802.3 MAC, with respect to the ISO Open System Interconnection (OSI) reference model are shown in Figure 157–1. While this specification defines interfaces in terms of bits, octets, and frames, implementations may choose other data path widths for implementation convenience. Exceptions to this are specified ~~in 44.1.3 (for 10 Gb/s), 105.1.2 (for 25 Gb/s), and 131.1.2 (for 50 Gb/s). In~~ addition to these exceptions the MDI specifications for Multi-Gigabit Ethernet BiDi PHYs are as follows:

44.1.3 (for 10 Gb/s), 105.1.2 (for 25 Gb/s), 131.1.2 (for 50 Gb/s), 80.1.3 (for 100 Gb/s) and 116.1.2 (for 200 Gb/s)

- For 10 Gb/s PHYs, see Clause 158
- For 25 Gb/s PHYs, see Clause 159
- For 50 Gb/s PHYs, see Clause 160
- For 100 Gb/s PHYs, see Clause X
- For 200 Gb/s PHYs, see Clause Y

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157.1.3 Nomenclature

For Multi-Gigabit Ethernet BiDi PHYs, the following nomenclature is used, with individual elements shown in Table 157–1:

rGBASE-BRx-d

Table 157–1—PMD parameter elements

Parameter	Description	Allowed values
r	PMD rate	10, 25, 50
x	PMD reach in km	10, 20, 40
d	PMD transmit direction	D = OLT PMDs, U = ONU PMDs

Updated as:

Parameter	Description	Allowed values
r	PMD rate	10, 25, 50, 100, 200
x	PMD reach in km	10, 20, 40
d	PMD transmit direction	D = OLT PMDs, U = ONU PMDs

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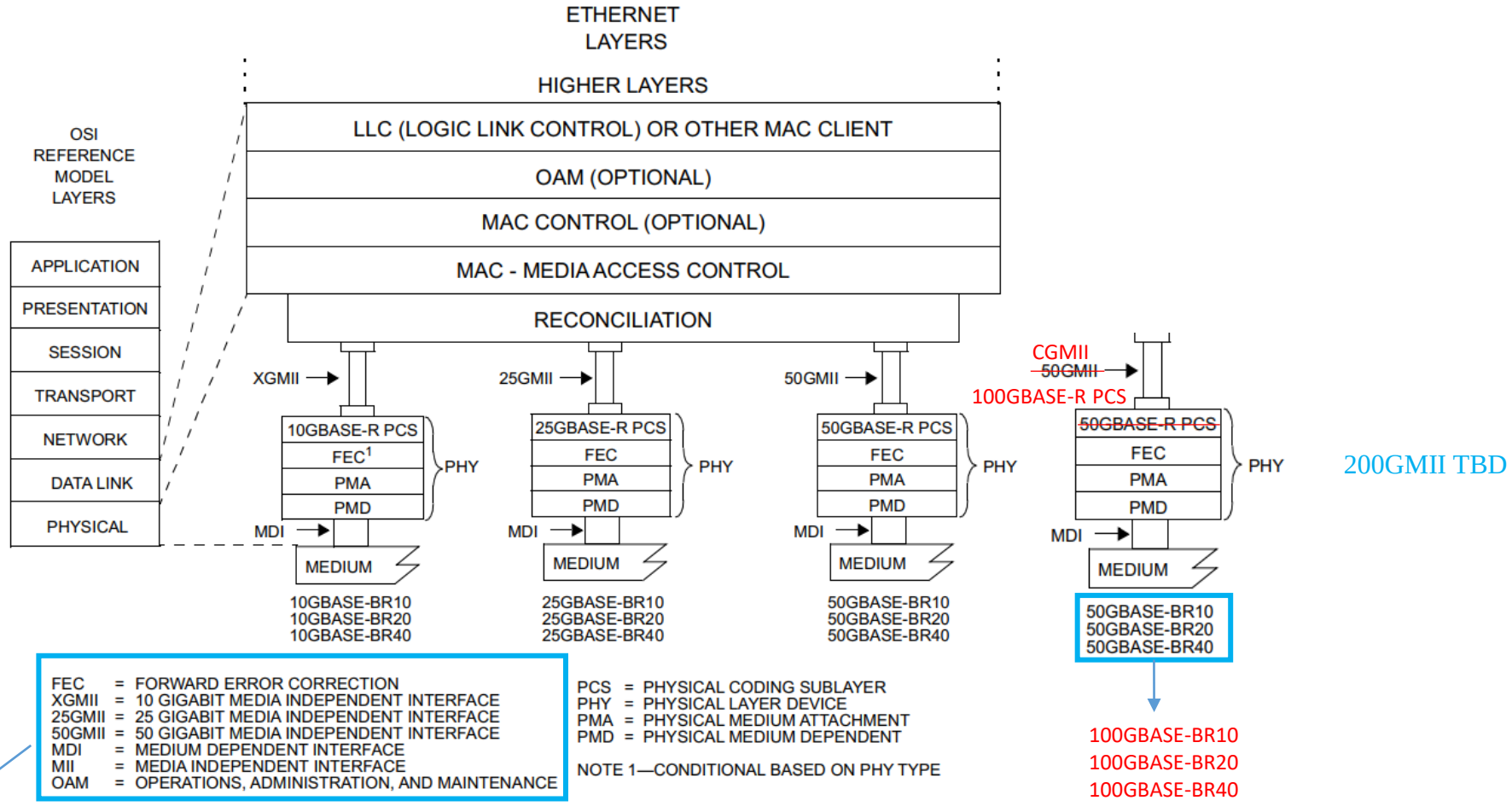

Figure 157–1—Architectural positioning of Multi-Gigabit Ethernet BiDi PHYs

FEC = FORWARD ERROR CORRECTION
XGMII = 10 GIGABIT MEDIA INDEPENDENT INTERFACE
25GMII = 25 GIGABIT MEDIA INDEPENDENT INTERFACE
50GMII = 50 GIGABIT MEDIA INDEPENDENT INTERFACE
CGMII = 100 GIGABIT MEDIA INDEPENDENT INTERFACE
MDI = MEDIUM DEPENDENT INTERFACE
MII = MEDIA INDEPENDENT INTERFACE
OAM = OPERATIONS, ADMINISTRATION, AND MAINTENANCE

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B refers to bidirectional, and R refers to the 64B/66B encoding. The term xMII is used to generically refer to the family of Media Independent Interfaces (MII) including the ~~XGMII, 25GMII, or 50GMII~~. All Multi-Gigabit Ethernet BiDi PHYs are listed in Table 157–2.

XGMII, 25GMII, 50GMII, and CGMII

Table 157–2—Multi-Gigabit Ethernet BiDi PHYs

Name	Description
10GBASE-BR10-D	10 Gb/s OLT PHY using 10GBASE-R encoding over one single-mode fiber, with reach up to at least 10 km (see Clause 158).
10GBASE-BR20-D	10 Gb/s OLT PHY using 10GBASE-R encoding over one single-mode fiber, with reach up to at least 20 km (see Clause 158).
10GBASE-BR40-D	10 Gb/s OLT PHY using 10GBASE-R encoding over one single-mode fiber, with reach up to at least 40 km (see Clause 158).
10GBASE-BR10-U	10 Gb/s ONU PHY using 10GBASE-R encoding over one single-mode fiber, with reach up to at least 10 km (see Clause 158).

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Table 157–2—Multi-Gigabit Ethernet BiDi PHYs *(continued)*

Name	Description
10GBASE-BR20-U	10 Gb/s ONU PHY using 10GBASE-R encoding over one single-mode fiber, with reach up to at least 20 km (see Clause 158).
10GBASE-BR40-U	10 Gb/s ONU PHY using 10GBASE-R encoding over one single-mode fiber, with reach up to at least 40 km (see Clause 158).
25GBASE-BR10-D	25 Gb/s OLT PHY using 25GBASE-R encoding over one single-mode fiber, with reach up to at least 10 km (see Clause 159).
25GBASE-BR20-D	25 Gb/s OLT PHY using 25GBASE-R encoding over one single-mode fiber, with reach up to at least 20 km (see Clause 159).
25GBASE-BR40-D	25 Gb/s OLT PHY using 25GBASE-R encoding over one single-mode fiber, with reach up to at least 40 km (see Clause 159).
25GBASE-BR10-U	25 Gb/s ONU PHY using 25GBASE-R encoding over one single-mode fiber, with reach up to at least 10 km (see Clause 159).
25GBASE-BR20-U	25 Gb/s ONU PHY using 25GBASE-R encoding over one single-mode fiber, with reach up to at least 20 km (see Clause 159).
25GBASE-BR40-U	25 Gb/s ONU PHY using 25GBASE-R encoding over one single-mode fiber, with reach up to at least 40 km (see Clause 159).
50GBASE-BR10-D	50 Gb/s OLT PHY using 50GBASE-R encoding over one single-mode fiber, with reach up to at least 10 km (see Clause 160).
50GBASE-BR20-D	50 Gb/s OLT PHY using 50GBASE-R encoding over one single-mode fiber, with reach up to at least 20 km (see Clause 160).
50GBASE-BR40-D	50 Gb/s OLT PHY using 50GBASE-R encoding over one single-mode fiber, with reach up to at least 40 km (see Clause 160).
50GBASE-BR10-U	50 Gb/s ONU PHY using 50GBASE-R encoding over one single-mode fiber, with reach up to at least 10 km (see Clause 160).
50GBASE-BR20-U	50 Gb/s ONU PHY using 50GBASE-R encoding over one single-mode fiber, with reach up to at least 20 km (see Clause 160).
50GBASE-BR40-U	50 Gb/s ONU PHY using 50GBASE-R encoding over one single-mode fiber, with reach up to at least 40 km (see Clause 160).

Added new rows to Table 157-2: 200GBASE-BRx TBD

100GBASE-BR10-D	100 Gb/s OLT PHY using 100GBASE-R encoding over one single-mode fiber, with reach up to at least 10 km (see Clause X).
100GBASE-BR20-D	100 Gb/s OLT PHY using 100GBASE-R encoding over one single-mode fiber, with reach up to at least 20 km (see Clause X).
100GBASE-BR40-D	100 Gb/s OLT PHY using 100GBASE-R encoding over one single-mode fiber, with reach up to at least 40 km (see Clause X).
100GBASE-BR10-U	100 Gb/s ONU PHY using 100GBASE-R encoding over one single-mode fiber, with reach up to at least 10 km (see Clause X).
100GBASE-BR20-U	100 Gb/s ONU PHY using 100GBASE-R encoding over one single-mode fiber, with reach up to at least 20 km (see Clause X).
100GBASE-BR40-U	100 Gb/s ONU PHY using 100GBASE-R encoding over one single-mode fiber, with reach up to at least 40 km (see Clause X).

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157.1.4 Physical Layer signaling systems

Table 157-3, Table 157-4, Table 157-5, Table 157-6, and Table 157-7

This standard specifies a family of Physical Layer implementations. ~~Table 157–3, Table 157–4, and Table 157–5~~ specify the correlation between PHY types and specific clauses for the PCS, FEC, PMA and PMD. Implementations conforming to one or more PHY types meet the requirements of the corresponding clauses.

Add new tables of 100GBASE-BRx and 200GBASE-BRx:

Table 157-6—Nomenclature and clause correlation, 100GBASE-BRx

Nomenclature	Clause												
	78	81		82	91	83	135D	135E	135F	135G	X		
	EEE	RS	CGMII	100GBASE-R PCS	100GBASE-R FEC	PMA	100GAUI-4 C2C	100GAUI-4 C2M	100GAUI-2 C2C	100GAUI-2 C2M	100GBASE-BR10 PMD	100GBASE-BR20 PMD	100GBASE-BR40 PMD
100GBASE-BR10-D	O[a]	M	O	M	M	M	O	O	O	O	M		
100GBASE-BR20-D	O	M	O	M	M	M	O	O	O	O		M	
100GBASE-BR40-D	O	M	O	M	M	M	O	O	O	O			M
100GBASE-BR10-U	O	M	O	M	M	M	O	O	O	O	M		
100GBASE-BR20-U	O	M	O	M	M	M	O	O	O	O		M	
100GBASE-BR40-U	O	M	O	M	M	M	O	O	O	O			M

[a]M = Mandatory, O = Optional

Table 157-7—Nomenclature and clause correlation, 200GBASE-BRx

200GBASE-BRx TBD

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157.2 Summary of Multi-Gigabit Ethernet BiDi sublayers

157.2.1 Reconciliation Sublayer (RS) and Media Independent Interface ~~(XGMII, 25GMII, and 50GMII)~~

XGMII, 25GMII, 50GMII, and CGMII

The RS provides a mapping between the signals provided at the xMII and the MAC/PLS service definition. The xMII provides a logical interconnection between the MAC sublayer and Physical Layer entities (PHY). The xMII may be physically instantiated or can logically connect layers within a device. While the xMII is an optional interface, it is used extensively in this standard as a basis for functional specification and provides a common service interface for the Physical Coding Sublayer (PCS). The specific RS and xMII for each Multi-Gigabit Ethernet BiDi PHY are given in ~~Table 157–3, Table 157–4, and Table 157–5.~~

Table 157-3, Table 157-4, Table 157-5, Table 157-6, and Table 157-7

157.2.2 Physical Coding Sublayer (PCS)

The PCS performs encoding of data from the xMII to 64B/66B code blocks and transfers the encoded data to the PMA or FEC sublayer and performs decoding of 64B/66B blocks from the PMA or FEC sublayer and transfers the decoded data to the xMII. The specific PCS for each Multi-Gigabit Ethernet BiDi PHY is given in Table ~~157–3, Table 157–4, and Table 157–5.~~ Table 157-3, Table 157-4, Table 157-5, Table 157-6, and Table 157-7

157.2.3 Forward error correction (FEC) sublayer

An FEC sublayer is required for all Multi-Gigabit BiDi PHYs except 10GBASE-BR10 and 10GBASE-BR40, where the FEC sublayer is not applicable. The FEC sublayer can be placed in between the PCS and PMA sublayers or between two PMA sublayers. The specific FEC for each Multi-Gigabit Ethernet BiDi PHY is given in ~~Table 157–3, Table 157–4, and Table 157–5.~~

Table 157-3, Table 157-4, Table 157-5, Table 157-6, and Table 157-7

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157.2.4 Physical Medium Attachment (PMA) sublayer

The PMA sublayer provides a medium independent means for the PCS or FEC sublayers to support the use of a range of physical media. The PMA performs the mapping of transmit and receive data streams between the PCS or FEC and PMA via the PMA service interface and mapping of transmit and receive data streams between the PMA and PMD via the PMD service interface.

The PMA performs retiming of the received data stream when appropriate, optionally provides data loopback at the PMA or PMD service interface, and optionally provides test pattern generation and checking. The PMA also may provide an observable electrical interface for the 25GAUI or 50GAUI chip-to-chip (C2C) or chip-to-module (C2M).

The specific PMA for each Multi-Gigabit Ethernet BiDi PHY is given in ~~Table 157–3, Table 157–4, and Table 157–5.~~ Table 157-3, Table 157-4, Table 157-5, Table 157-6, and Table 157-7

157.2.5 Physical Medium Dependent (PMD) sublayer

The PMD sublayer is responsible for interfacing to the transmission medium. The MDI connects the PMD to the medium and is defined in the associated PMD clause. The specific PMD for each Multi-Gigabit Ethernet BiDi PHY is given in ~~Table 157–3, Table 157–4, and Table 157–5.~~

Table 157-3, Table 157-4, Table 157-5, Table 157-6, and Table 157-7

157.2.6 Management interface (MDIO/MDC)

The optional MDIO/MDC management interface (Clause 45) provides an interconnection between MDIO Manageable Devices (MMDs) and Station Management (STA) entities.

157.2.7 Management

Managed objects, attributes, and actions are defined for all Multi-Gigabit Ethernet BiDi PHY components. These items are defined in Clause 30.

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157.3 Service interface specification method and notation

The service interface specification for Multi-Gigabit Ethernet BiDi Physical Layers is as per the definition in 1.2.2.

The 10GBASE-BRx PHYs use the inter-sublayer service interfaces specified in 49.2.2.

The 25GBASE-BRx PHYs use the inter-sublayer service interfaces specified in 105.4.

The 50GBASE-BRx PHYs use the inter-sublayer service interfaces specified in 131.3.

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The 10GBASE-BRx PHYs use the inter-sublayer service interfaces specified in 49.2.2.

The 20GBASE-BRx PHYs use the inter-sublayer service interfaces specified in 105.4.

The 50GBASE-BRx PHYs use the inter-sublayer service interfaces specified in 131.3.

The 100GBASE-BRx PHYs use the inter-sublayer service interfaces specified in 80.3.

The 200GBASE-BRx PHYs use the inter-sublayer service interfaces specified in 116.3.

157.4 Delay constraints

Predictable operation of the MAC Control PAUSE operation (Clause 31, Annex 31B) demands that there be an upper bound on the propagation delays through the network. This implies that MAC, MAC Control sublayer, and PHY implementers must conform to certain delay maxima, and that network planners and administrators conform to constraints regarding the cable topology and concatenation of devices.

The maximum delay constraints for 10GBASE-BRx PHY sublayers are specified in 44.3.

The maximum delay constraints for 25GBASE-BRx PHY sublayers are specified in 105.5.

The maximum delay constraints for 50GBASE-BRx PHY sublayers are specified in 131.4.

→

The maximum delay constraints for 10GBASE-BRx PHYs sublayers are specified in 44.3.

The maximum delay constraints for 20GBASE-BRx PHYs sublayers are specified in 105.5.

The maximum delay constraints for 50GBASE-BRx PHYs sublayers are specified in 131.4.

The maximum delay constraints for 100GBASE-BRx PHYs sublayers are specified in 80.4.

The maximum delay constraints for 200GBASE-BRx PHYs sublayers are specified in 116.4.

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157.5 ONU silent start

Silent start is provided by Multi-Gigabit Ethernet BiDi ONU PHYs to reduce the likelihood of disruption to established services if a Multi-Gigabit Ethernet BiDi ONU PHY is inadvertently attached to a point-to-multipoint network.

All members of the Multi-Gigabit Ethernet BiDi PHY family include PCS registers or variable equivalents that:

a) Indicate the receive status of the PCS (see 49.2.14.1 and 45.2.3.15.1).

b) Disable the PHYs transmitter (see 45.2.1.8).

By monitoring the PCS receive status indicator and appropriately setting the PHY transmitter control, upper layer management can prevent transmission by a Multi-Gigabit Ethernet BiDi ONU PHY when connected to an incompatible network (e.g., an EPON).

Transmission by a Multi-Gigabit Ethernet BiDi ONU PHY is disallowed whenever a receive fault is declared by the status indicator; once the status indicator declares the PCS is receiving a proper Multi-Gigabit Ethernet BiDi PHY signal for a pre-determined time period (e.g., 1 second) transmission may be enabled. Note that silent start does not apply to the OLT PHY types.

157.6 Protocol implementation conformance statement (PICS) proforma

The supplier of a protocol implementation that is claimed to conform to any part of IEEE Std 802.3, Clause 45, Clause 49, Clause 73, Clause 74, Clause 106 through Clause 112, Clause 114, Clause 158 ~~through Clause 160~~, and related annexes demonstrates compliance by completing a protocol implementation conformance statement (PICS) proforma.

through Clause Y

A completed PICS proforma is the PICS for the implementation in question. The PICS is a statement of which capabilities and options of the protocol have been implemented. A PICS is included at the end of each clause as appropriate. Each of the Multi-Gigabit Ethernet BiDi PICS conforms to the same notation and conventions used in 21.6.

Thank you

Any questions?