

# Supporting Material for D2.0 Comments

**IEEE P802.3cw Task Force**  
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# Comment Summary

This presentation addresses the following general topics:

General Description	Comment ID	Related Subclause
"400GBASE-Z" , 400GBASE-ZR, 400GBASE-R encoding, and description	10, 170, 171, 173, 338, 347, 412, 413, 414, 417, 418, 419, 423, 526, 558	1.4.144b / c, 155.1.5, 156.9.1
PCS / PMA / PMD Descriptions	5, 6, 7, 176, 177, 178, 200, 420, 421, 422	116.2.3, 116.2.4, 116.2.5
Clauses associated with 400GBASE-ZR PMD	4, 36, 164, 223, 174, 175, 192	116.1.4, 156.1

# What is the 400GBASE-ZR (Per P802.3cw D2.0)

- **1.4.144b 400GBASE-Z:** IEEE 802.3 **family** of Physical Layer devices using **400GBASE-R encoding**, a combination of phase and amplitude modulation, and coherent detection. (See IEEE Std 802.3, Clause 156.)
- **1.4.144c 400GBASE-ZR:** IEEE 802.3 Physical Layer specification for 400 Gb/s dense wavelength division multiplexing (DWDM) PHY using **400GBASE-R encoding**, dual polarization 16-state quadrature amplitude modulation (DP-16QAM) modulation, and coherent detection with reach up to at least 80 km. (See IEEE Std 802.3, Clause 156.)

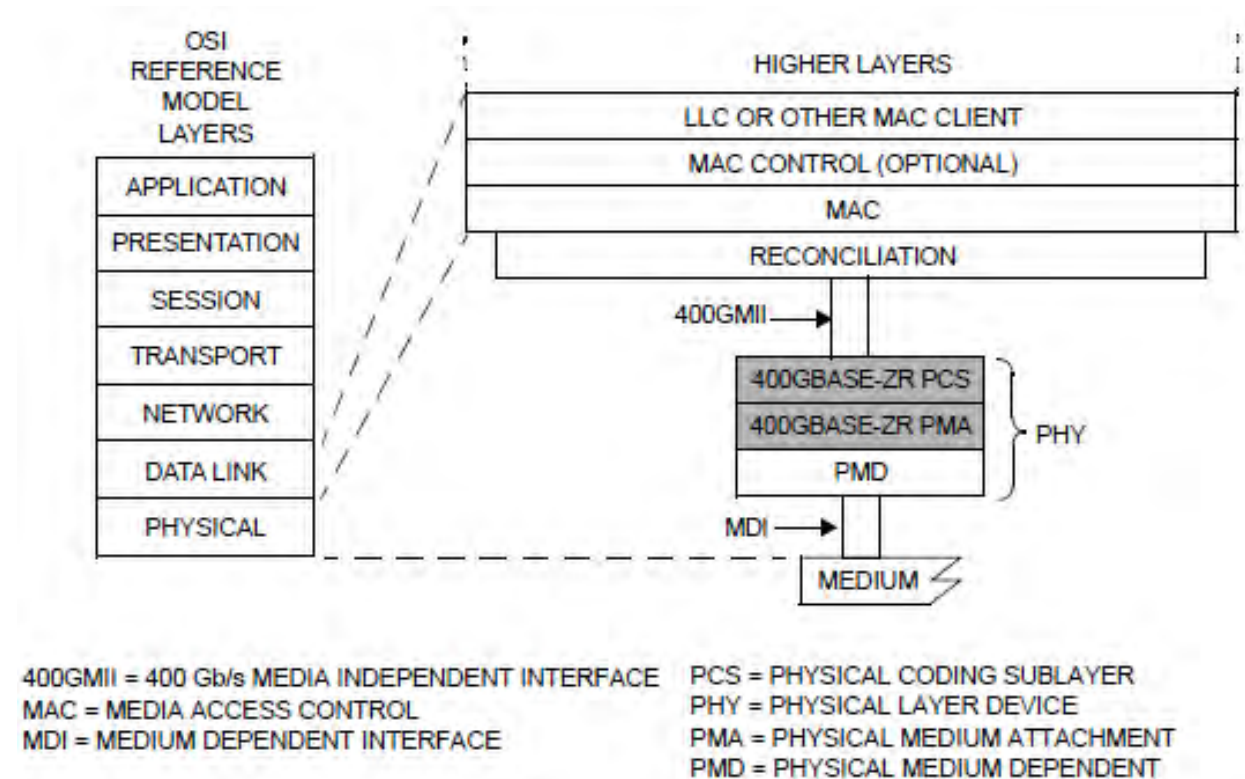


Figure 155-1—400GBASE-ZR PCS and PMA relationship to the ISO/IEC Open Systems Interconnection (OSI) reference model and the IEEE 802.3 Ethernet model

# Comments

- 400GBASE-Z
  - The term is only used 2x in Draft 2.0 (1. Page 18 1.4.144b and 2. Page 35 155.1.5)
  - There is no family of “Z” devices at 400 GbE – just 400GBASE-ZR
- 400GBASE-R encoding
  - No definition for “400GBASE-R encoding”
  - 1.4.141 400GBASE-R: An IEEE 802.3 family of Physical Layer devices using the physical coding sublayer defined in Clause 119 for 400 Gb/s operation. (See IEEE Std 802.3, Clause 119.)
  - Per 116.1.3 - 400GBASE-R represents a family of Physical Layer devices using the Physical Coding Sublayer for 400 Gb/s operation over multiple PCS lanes (see Clause 119). Physical Layer devices listed in Table 116–2 are defined for operation at 400 Gb/s.
  - Per 119.1.1 - The terms 200GBASE-R and 400GBASE-R are used when referring generally to Physical Layers using the PCS defined in this clause.
  - 400GBASE-ZR uses PCS defined by Clause 155
- 400GBASE-ZR
  - Not a family
  - Not 400GBASE-R encoded
  - 400GBASE-ZR PCS and PMA encoded (See Clause 155)

# Proposed Remedies

1. Delete 1.4.144b (a “family” can be created in future when necessary). Replace 400GBASE-Z with 400GBASE-ZR throughout draft.
  2. Modify 1.4.144c –
    - 400GBASE-ZR: IEEE 802.3 Physical Layer specification for 400 Gb/s dense wavelength division multiplexing (DWDM) PHY using 400GBASE-ZR PCS and PMA encoding, dual polarization 16-state quadrature amplitude (DP-16QAM) modulation, and coherent detection with reach up to at least 80 km. (See IEEE Std 802.3, Clause 155 and Clause 156.)
  3. Modify description Table 116-2
    - 400 Gb/s PHY using 400GBASE-ZR PCS and PMA encoding capable of transmission over a specified channel on a defined DWDM grid in each direction of transmission with reach up to at least 80 km (see Clauses 155 and 156)
  4. Modify 155.1.1
    - Delete current text and replace with
      - This clause specifies the physical coding sublayer (PCS) and physical medium attachment (PMA) sublayer for the physical layer implementation known as 400GBASE-ZR. The 400GBASE-ZR PCS and 400GBASEZR PMA are sublayers of the 400GBASE-ZR PHY listed in Table 116–2. The term 400GBASE-ZR is used when referring to the 400GBASE-ZR PHY, which uses the PCS and PMA defined in this clause.
- ▣ Relevant Comments
1. 10, 170, 338, 412, 413, 526
  2. 171, 414
  3. 173, 417, 418
  4. 423

# Current Descriptions Per D2.0

## ■ 116.2.3 Physical Coding Sublayer (PCS)

*Change the first paragraph of 116.2.3 as follows:*

The terms 200GBASE-R and ~~400GBASE-R~~ refers to a specific family of Physical Layer implementations based upon the 64B/66B data coding method specified in Clause 119 and the PMA specifications defined in [Clause 120](#). The term 400GBASE-R refers to a specific family of Physical Layer implementations based upon the 64B/66B coding method specified in Clause 119 or Clause 155 and the PMA specifications defined in Clause 120 or Clause 155. ~~Clause 119 PCSs 200GBASE-R and 400GBASE-R PCSs~~ perform encoding (decoding) of data from (to) the 200GMII or 400GMII to 256B/257B code blocks, apply FEC, distribute the data to multiple lanes, and transfer the encoded data to the PMA.

## 116.2.4 Physical Medium Attachment (PMA)

*Change the second paragraph of 116.2.4 as follows:*

The 200GBASE-R PMA and all 400GBASE-R PMAs other than 400GBASE-ZR are specified in [Clause 120](#). The 400GBASE-ZR PMA is specified in Clause 155.

## 116.2.5 Physical Medium Dependent (PMD)

*Change the second paragraph of 116.2.5 (as modified by IEEE Std 802.3ck-202x) as follows:* The 200GBASE-R PMDs and their corresponding media are specified in [Clause 121](#), [Clause 122](#), [Clause 136](#) through [Clause 138](#), [Clause 162](#), [Clause 163](#) and [Clause 167](#). The 400GBASE-R PMDs and their corresponding media are specified in [Clause 122](#) through [Clause 124](#), [Clause 138](#), [Clause 150](#), [Clause 156](#), [Clause 162](#), [Clause 163](#), and [Clause 167](#).

# Proposed Descriptions Per D2.0

## 1. **116.2.3 Physical Coding Sublayer (PCS)**

Delete D2.0 text

Add as new last paragraph

The 400GBASE-ZR PHY uses the PCS specified in Clause 155. The 400GBASE-ZR PCS performs encoding of data from the 400GMII to the 400GBASE-ZR PMA service interface.

## 2. **116.2.4 Physical Medium Attachment (PMA)**

Replace D2.0 text with

The PMA provides a medium-independent means for the PCS to support the use of a range of physical media.

The 200GBASE-R and 400GBASE-R PMAs perform the mapping of transmit and receive data streams between the PCS and PMA via the PMA service interface, and the mapping and multiplexing of transmit and receive data streams between the PMA and PMD via the PMD service interface. In addition, 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 200GBASE-R and 400GBASE-R PMAs are specified in Clause 120.

The 400GBASE-ZR PHY uses the PMA specified in Clause 155.

## 3. **116.2.5 Physical Medium Dependent (PMD)**

Delete D2.0 text

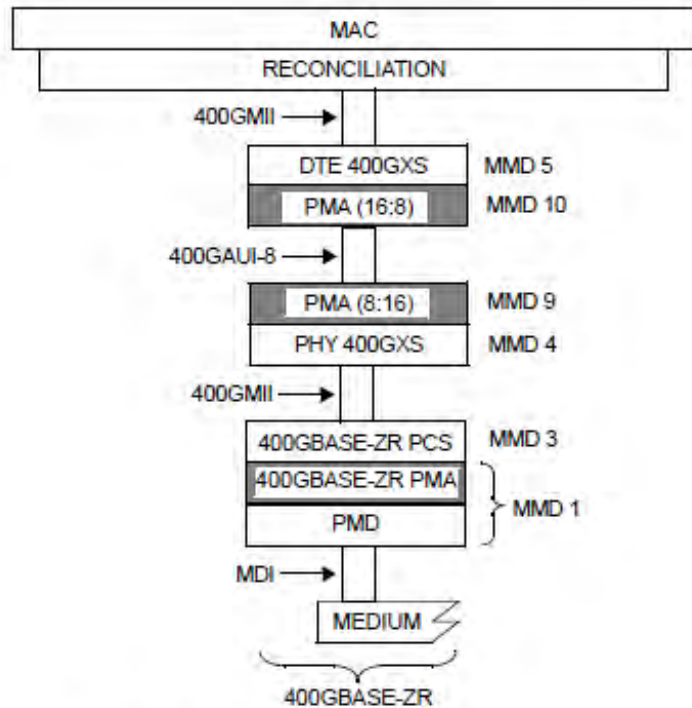
Add as new last paragraph:

The 400GBASE-ZR PMD and its corresponding media is specified in Clause 156.

### ▣ Relevant Comments

1. 5, 176, 420, 421
2. 6, 177, 200, 422
3. 7, 178

# IEEE P802.3cw D2.0



400GAUI = 400 Gb/s ATTACHMENT UNIT INTERFACE  
 400GMII = 400 Gb/s MEDIA INDEPENDENT INTERFACE  
 400GXS= 400 Gb/s EXTENDER SUBLAYER  
 DTE = DATA TERMINAL EQUIPMENT  
 MAC = MEDIA ACCESS CONTROL

MDI = MEDIUM DEPENDENT INTERFACE  
 MMD = MDIO MANAGEABLE DEVICE  
 PCS = PHYSICAL CODING SUBLAYER  
 PMA = PHYSICAL MEDIUM ATTACHMENT  
 PMD = PHYSICAL MEDIUM DEPENDENT

Figure 120A-9—Example 400GBASE-ZR PCS/PMA layering with two 400GMII and 400GAUI-8 interfaces

Table 116-5—PHY type and clause correlation (400GBASE optical)

PHY type	Clause <sup>a</sup>																						
	78	117	118	119	120	120B	120C	120D	120E	120F	120G	167	123	138	167	150	124	122	151	122	155	156	
400GBASE-VR4	O	M	O	O	M	M	O	O	O	O	O	O	M										
400GBASE-SR16	O	M	O	O	M	M	O	O	O	O	O		M										
400GBASE-SR8	O	M	O	O	M	M	O	O	O	O	O			M									
400GBASE-SR4	O	M	O	O	M	M	O	O	O	O	O				M								
400GBASE-SR4.2	O	M	O	O	M	M	O	O	O	O	O					M							
400GBASE-DR4	O	M	O	O	M	M	O	O	O	O	O						M						
400GBASE-FR8	O	M	O	O	M	M	O	O	O	O	O							M					
400GBASE-FR4	O	M	O	O	M	M	O	O	O	O	O								M				
400GBASE-LR4-6	O	M	O	O	M	M	O	O	O	O	O									M			
400GBASE-LR8	O	M	O	O	M	M	O	O	O	O	O										M		
400GBASE-ER8	O	M	O	O	M	M	O	O	O	O	O											M	
400GBASE-ZR	O	M	O	O	O	O	O	O	O	O	O											M	M

<sup>a</sup> O = Optional, M = Mandatory.



# Comments

- **Does not use the 400GBASE-R PCS (Clause 119)**
- **400GMII Extender can only exist above any PHY (Refer Fig 118-1)**
  - Uses 400GBASE-R PMA (Clause 120) as defined by Clause 118
  - Can use 400GAUI-16 C2C (Annex 120B) as defined by Clause 118
  - Can use 400GAUI-16 C2M (Annex 120C) as defined by Clause 118
  - Can use 400GAUI-8 C2C (Annex 120D) as defined by Clause 118
  - Can use 400GAUI-8 C2M (Annex 120E) as defined by Clause 118
  - Can use 400GAUI-4 C2C (Annex 120F) as defined by Clause 118
  - Can use 400GAUI-4 C2M (Annex 120G) as defined by Clause 118
- **Proposed Remedies**
  1. For the 400GBASE-ZR row in Table 116-5 delete “o” (optional) in following clauses (119, 120, 120B – 120G)
  2. Create two tables in 118.1 Overview (see Page 10)
  3. Update Table 156-1 (See Page 11)
  4. **Create paragraph in 156.1 explaining use of 400GMII Extender for supporting optional physical instantiation of an AUI.**
- Relevant Comments – 174, 175, 192,

# Updates to Clause 118

Add following tables to Subclause 118.1

Table 118-1 Physical Layer clauses associated with the 200GMII Extender

Associated Clause	200GMII Extender
117- 200GMII	Required
118- DTE 200GXS	Required
120 - 200GBASE-R PMA	Required
118- PHY 200GXS	Required
120B - 200GAUI-8 C2C	Optional
120C - 200GAUI-8 C2M	Optional
120D - 200GAUI-4 C2C	Optional
120E - 200GAUI-4 C2M	Optional
120F - 200GAUI-2 C2C	Optional
120G - 200GAUI-2 C2M	Optional
78—Energy-Efficient Ethernet	Optional

Table 118-2 Physical Layer clauses associated with the 400GMII Extender

Associated Clause	400GMII Extender
117- 400GMII	Required
118- DTE 400GXS	Required
120 - 400GBASE-R PMA	Required
118- PHY 200GXS	Required
120B - 400GAUI-16 C2C	Optional
120C - 400GAUI-16 C2M	Optional
120D - 400GAUI-8 C2C	Optional
120E - 400GAUI-8 C2M	Optional
120F - 400GAUI-4 C2C	Optional
120G - 400GAUI-4 C2M	Optional
78—Energy-Efficient Ethernet	Optional

# Update Table 156-1

**Table 156–1—Physical Layer clauses associated with the 400GBASE-ZR PMD**

Associated Clause	400GBASE-ZR
117—RS	Required
117—400GMII <sup>a</sup>	Optional
118—400GMII Extender <sup>b</sup>	Optional
155—PCS for 400GBASE-ZR	Required
155—PMA for 400GBASE-ZR	Required
78—Energy-Efficient Ethernet	Optional

<sup>a</sup> The 400GMII is an optional interface. However, if the 400GMII is not implemented, a conforming implementation behaves functionally as though the RS and 400GMII were present.

<sup>b</sup> The 400GMII Extender, if implemented, can provide an optional physical instantiation of an interface.

# Summary of Proposed Remedies

General Description	Comment ID	Related Subclause	Proposed Remedy
"400GBASE-Z" , 400GBASE-ZR, 400GBAS-R encoding, and description	10, 170, 171, 173, 338, 412, 413, 414, 417, 418, 423, 526	1.4.144b / c, 155.1.5, 156.9.1	See Page 5
PCS / PMA / PMD Descriptions	5, 6, 7, 176, 177, 178, 200, 420, 421, 422	116.2.3, 116.2.4, 116.2.5	See Page 7
Clauses associated with 400GBASE-ZR PMD	174, 175, 192	116.1.4, 156.1	See Page 9