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Comments on 802.3dg Draft 0.2

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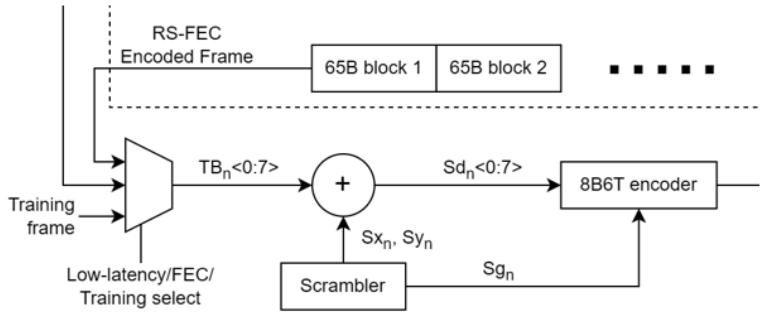
Introduction

- This presentation has some notes and comments on Draft 0.2
- Nomenclature
  - There are some conflicts with the signal names used in the PCS transmit bit ordering diagram and the pseudo code used to define the 8N/(8N+1) block coding with respect to the 8b6T code groups
  - We need to agree on consistent signal names
- Clause 146 Text
  - Some of the text in draft 0.2 brought in from Clause 146 is not correct for 100BASE-T1L as the corresponding functionality is not required or is implemented in a different way
- 8N/(8N+1) block coding
  - There is ambiguity and missing cases in the current tables and text used to define the operation of the 8N/(8N+1) block coding
- Should Table 199–4 (8B6T encoding) refer to the text file; Updated 8B6T codebook in text form
- Clauses 199.2, 199.3.5 and 199.4
  - The authors will provide text for clauses 199.2, 199.3.5 and 199.4 for the adopted Proposal for Training and PHY Control State Diagram for 100BASE-T1L
- Overview 199.1,199.1.2 and Figure 199-1 (Relationship to the ISO/IEC OSI reference model) need to be updated
  - Need some additional standard text in 199.1 for consistency with previous clauses
  - Auto-Negotiation is not optional

Nomenclature

- The PCS transmit bit ordering diagram refers to the bits that are input to the scrambler as $TB_n[0:7]$ {slide 5 of Riesco_3dg_02_10292024} / Figure 199-5 of draft 0.2
  - The NND symbols in a 4b6T or 8b6T 6-tuple have been referred to as $\{TA_n, TB_n, TC_n, TD_n, TE_n, TF_n\}$ {slide 6 of Curran_3dg_01a_01202025}
  - The pseudo code has used TD[n][0:7] {slide 10 of Murray_3dg_01a_11132024}
  - Need to use a consistent nomenclature that does not conflict between different sections
    - We propose using Txb_n<0:7> for the bits that are input to the scrambler
  - Need to spell out Non Negative Disparity (NND)



- Consistency in use of InfoField (preferred) versus Infofield
  - Clauses 55, 97, 113, 126, 149 and 165 switch back and forth between InfoField & Infofield
    - Clause 149 and 165 use Infofield except in equations 149-7/165-4 where InfoField is used
- Consistency in use of (8N)B/(8N+1)B (preferred) versus 8N/(8N+1)
  - The PowerPoint descriptions have referred to 8N/(8N+1) where the actual text of clause 97 uses 80B/81B and clause 199 would use 16B/17B and 64B/65B

Conventions

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- Should not need to explain the meaning of ^ for each use case in an equation

These two bits are derived from elements of the same maximum-length shift register sequence of length as $Scr_n[0]$, but shifted in time. The associated delays are all large and different so that there is no short-term correlation among the bits $Scr_n[0]$, X_n, and Y_n. The bits X_n and Y_n are generated as follows:

$$X_n = Scr_n[4] \wedge Scr_n[6]$$
$$Y_n = Scr_n[1] \wedge Scr_n[5]$$

where

^ denotes the XOR logic operator

  - Notation in equations are generally not defined

Clause 146 Text that is Not Correct

- Figure 199-3 (PCS reference diagram) has to be redrawn
  - Acknowledged in the Editor's note

> ***Editor's Note (to be removed prior to Working Group Ballot):***
>
> Figure 199-3 is a copy of Figure 146-4 and may need modification.

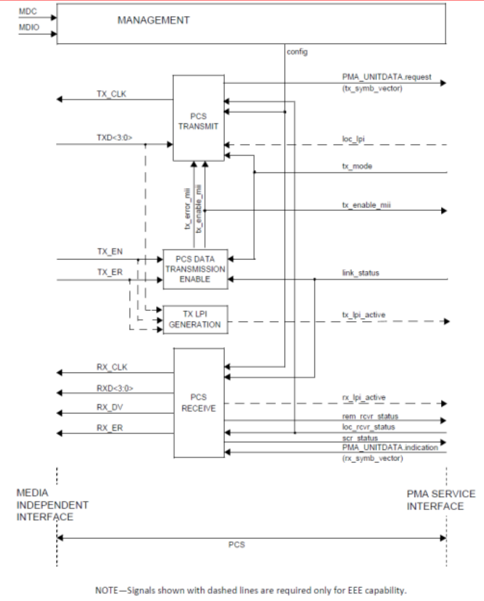

Figure 199–3—PCS reference diagram

- Figure 199–4 (PCS data transmission enabling state diagram) is not correct and may or may not be used
  - There has been no discussion on this topic in the task force
  - The use of this state machine will depend on how the text is updated to define the operation of the 8N/(8N+1) block coding

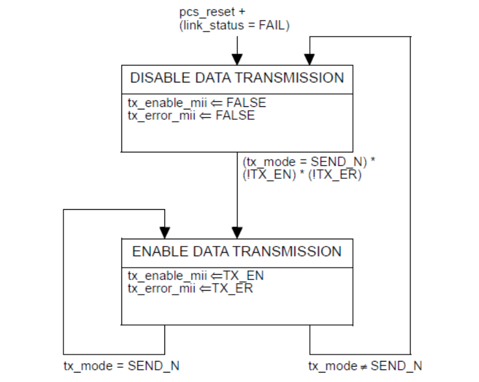

Figure 199–4—PCS data transmission enabling state diagram

Clause 146 Text that is Not Correct

- Table 199–5 (Disparity reset) and Table 199–6 (Delimiters) do not apply
  - Running disparity control will operate differently
  - The running disparity scheme for training and normal operation has been adopted
  - Acknowledged in the Editor's note

Editor's Note (to be removed prior to Working Group Ballot):

Delimiters and disparity are to be defined. Table 199–5 and Table 199–6 and text with cross-references are placeholders copied from Clause 146.

Table 199–5—Disparity reset - PLACEHOLDER TABLE

DISPRESET3	Disparity = 1	Disparity = 2	Disparity = 3	Disparity = 4
$Sy_n[4] = 0$	{−1, 0, +1}	{−1, 0, 0}	{−1, 0, −1}	{−1, −1, −1}
$Sy_n[4] = 1$	{+1, +1, +1}	{+1, 0, +1}	{+1, 0, 0}	{+1, 0, −1}

The XXX code-group is encoded as shown in Table 199–6:

Table 199–6—Delimiters - PLACEHOLDER TABLE

	Delimiter	$\{TA_n, TB_n, TC_n\}$
$Sy_{n-1}[4] = 0$	SSD4	{+1, +1, −1}
	ESD4	{+1, −1, +1}
	ESD_ERR4	{−1, +1, +1}
$Sy_{n-1}[4] = 1$	SSD4	{−1, −1, +1}
	ESD4	{−1, +1, −1}
	ESD_ERR4	{+1, −1, −1}

Text for 8N/(8N+1) Block Coding

- There is ambiguity and missing cases in the current tables and text used to define the definition of the 8N/(8N+1) block coding
  - Imprecise terminology, Idle, Error, Low power idle, Sequence ordered set are not defined at the MII (Table 22-1)
  - There are multiple overlapping rows, one example is First Data of Packet & Error

Table 199–1—MII nibble to octet symbol mapping

First Nibble	Second Nibble	Current Nalign	Next Nalign	Symbol
First Nibble	Second Nibble	Current Nalign	Next Nalign	Symbol
loc_phy_ready = NOT_OK (all other rows assume OK)		x	even	Ix
First Data of packet	x	x	even	Sp
Data 0xF	Idle	x	even	TuF
Error	x	x	even	E

  - Missing cases, for example; Transmit Error Propagation on the 1st and/or 2nd nibble of the packet
    - This error is not propagated which would be a conformance issue
  - Ambiguous or missing case, for example; Sequence immediately after end of frame

Table 199–1—MII nibble to octet symbol mapping

First Nibble	Second Nibble	Current Nalign	Next Nalign	Symbol
First idle after end of packet	x	x	even	Tp
Data 0x0	Idle	x	even	Tu0
Sequence	Sequence	even	even	Q

Text for 8N/(8N+1) Block Coding

- Idle is not defined
- 'Not first idle after end of packet' can be anything except 'first idle after end of packet' which overlaps multiple other rows

Table 199–1—MII nibble to octet symbol mapping

First Nibble	Second Nibble	Current Nalign	Next Nalign	Symbol
First Nibble	Second Nibble	Current Nalign	Next Nalign	Symbol
loc_phy_ready = NOT_OK (all other rows assume OK)		x	even	Ix
First Data of packet	x	x	even	Sp
Idle	First Data of packet	x	even	Su
First idle after end of packet	x	x	even	Tp
Error	x	x	even	E
Not Sequence	Error	x	even	E
Not first idle after end of packet	Not error and Not sequence	x	even	I
Low power idle	Not error and Not sequence	x	even	L
Sequence	Sequence	even	even	Q
Not first idle after end of packet	Sequence	even	odd	I
Low power idle	Sequence	even	odd	L
Sequence	x	odd	odd	Q
First idle after end of sequence ordered set	x	odd	even	Skip cycle

Definition of 8N/(8N+1) Block Coding

- Table 199–1 does not provide a good starting point for the definition of the 8N/(8N+1) block encoding
- A PCS Transmit state diagram may be a better approach
  - And might be the only way to specify the encoding unambiguously

Table 199–4 (8B6T Encoding)

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- Table 199–4 (8B6T encoding) has the entries of the table in the text of the standard, in the form -, 0, +

Table 199–4—8B6T encoding

$Sd_n[7:0]$	Code-Group[a]	$Sd_n[7:0]$	Code-Group	$Sd_n[7:0]$	Code-Group	$Sd_n[7:0]$	Code-Group
00000000	-+-++-	01000000	++--+-	10000000	0-+++-	11000000	+0-0++
00000001	-++--+	01000001	++-+--	10000001	0+-++-	11000001	+0+0-+
00000010	-++-+-	01000010	00--++	10000010	0++--+	11000010	-0++0+
00000011	+--+-+	01000011	00++--	10000011	0++-+-	11000011	+0-+0+
00000100	+--++-	01000100	0-0-++	10000100	-0-+++	11000100	+0+-0+
00000101	[illegible]	01000101	[illegible]	10000101	[illegible]	11000101	[illegible]

- The adopted Proposal for a 100BASE-T1L PHY using PAM-3 8b6T uploaded a separate text file with the list of non-negative disparity codewords
  - Updated 8B6T codebook in text form, -1, 0, 1
  - This is less error prone for a large data set and we would suggest follows best practice as used in later standards

00101100	1	-1	-1	0	0	1
00101101	1	-1	1	0	0	-1
00101110	0	0	0	0	-1	1
00101111	0	0	0	0	1	-1
00110000	0	0	0	-1	0	1
00110001	0	0	0	1	0	-1
00110010	0	0	-1	0	0	1
00110011	0	0	1	0	0	-1
00110100	0	-1	0	0	0	1
00110101	0	1	0	0	0	-1

Clauses 199.2, 199.3.5 and 199.4

- The January meeting adopted the Proposal for Training and PHY Control State Diagram for 100BASE-T1L
  - This proposal covers the sections
  - 199.2: 100BASE-T1L service primitives and interfaces
  - 199.3.5: Training
  - 199.4: Physical Medium Attachment (PMA) sublayer
  - And some clause 45 registers
- The authors will provide text for the above sections in the next few weeks

199.1 Overview

- Need some additional standard text in 199.1 for consistency with previous clauses

199. Physical Coding Sublayer (PCS), Physical Medium Attachment (PMA) sublayer and baseband medium, type 100BASE-T1L

199.1 Overview

This clause defines the type 100BASE-T1L Physical Coding Sublayer (PCS) and type 100BASE-T1L Physical Medium Attachment (PMA) sublayer. Together, the PCS and PMA sublayers comprise a 100BASE-T1L Physical Layer device (PHY). Provided in this clause are functional and electrical specifications for the type 100BASE-T1L PCS and PMA.

The 100BASE-T1L PHY is one of the 100 Mb/s Ethernet family of full-duplex PHY specifications, capable of operating at 100 Mb/s. A 100BASE-T1L PHY is intended to be operated over a single balanced pair of conductors, defined in 199.7. The cabling supporting the operation of the 100BASE-T1L PHY is defined in terms of performance requirements between the attachment points [Medium Dependent Interface (MDI)], allowing implementers to provide their own cabling to operate the 100BASE-T1L PHY as long as the normative requirements included in this clause are met.

This clause also specifies an optional Energy-Efficient Ethernet (EEE) capability. A 100BASE-T1L PHY that supports this capability may enter a Low Power Idle (LPI) mode of operation during periods of low link utilization as described in Clause 78.

165. Physical Coding Sublayer (PCS), Physical Medium Attachment (PMA) sublayer, and baseband medium, type 25GBASE-T1

165.1 Overview

This clause defines the type 25GBASE-T1 Physical Coding Sublayer (PCS) as well as the 25GBASE-T1 Physical Medium Attachment (PMA) sublayer. Together, the corresponding PCS, PMA, and optional Auto-Negotiation sublayers comprise a 25GBASE-T1 Physical Layer device (PHY). Provided in this clause are functional and electrical specifications for the type 25GBASE-T1 PCS and PMA.

A 25GBASE-T1 PHY is intended to be operated over a single balanced pair of conductors. The link segment specifications defined in 165.7 were derived from automotive requirements, but can also be used for non-automotive applications. The conductors supporting the operation of a 25GBASE-T1 PHY are defined in terms of performance requirements between the Medium Dependent Interfaces (MDIs) allowing implementers to provide their own conductors to operate a 25GBASE-T1 PHY as long as the normative requirements included in 165.7 are met.

This clause also specifies an optional Energy-Efficient Ethernet (EEE) capability. A 25GBASE-T1 PHY that supports this capability may enter a Low Power Idle (LPI) mode of operation during periods of low link utilization as described in Clause 78.

97.1 Overview

This clause defines the type 1000BASE-T1 Physical Coding Sublayer (PCS) and type 1000BASE-T1 Physical Medium Attachment (PMA) sublayer. Together, the PCS and PMA sublayers comprise a 1000BASE-T1 Physical Layer device (PHY). Provided in this clause are fully functional and electrical specifications for the type 1000BASE-T1 PCS and PMA.

The 1000BASE-T1 PHY is one of the Gigabit Ethernet family of high-speed full-duplex PHY specifications, capable of operating at 1000 Mb/s. The 1000BASE-T1 PHY is intended to be operated over a single twisted-pair copper cable, referred to as an *automotive link segment* (Type A) or *optional link segment* (Type B), defined in 97.6. The automotive link segment specifications defined in 97.6 may also be used for other applications that have similar link segment requirements. The cabling supporting the operation of the 1000BASE-T1 PHY is defined in terms of performance requirements between the attachment points [Medium Dependent Interface (MDI)], allowing implementers to provide their own cabling to operate the 1000BASE-T1 PHY as long as the normative requirements included in this clause are met.

199.1.2 Operation of 100BASE-T1L

- The text on page 27, lines 24-27 may be tying us to a particular cable type and reach requirement

199.1.2 Operation of 100BASE-T1L

The 100BASE-T1L PHY operates using full duplex communications over a single balanced pair of conductors with an effective data rate of 100 Mb/s in each direction simultaneously. The PHY supports operation on a link segment supporting up to five in-line connectors using a single balanced pair of conductors for up to at least 500 m. The supported link segments are defined in 199.7.

- Suggest the following:

The 100BASE-T1L PHY operates using full-duplex communications over a balanced pair of conductors with an effective rate of 100 Mb/s in each direction. The link segment specifications defined in 199.7 were derived to support operation with up to five in-line connectors using a single balanced pair of conductors for up to at least 500 m. The conductors supporting the operation of a 100BASE-T1L PHY are defined in terms of performance requirements between the MDIs allowing implementers to provide their own conductors as long as the normative requirements included in 199.7 are met.

Figure 199-1

- Figure 199-1 (Relationship to the ISO/IEC OSI reference model) need to be updated, as Auto-Negotiation is not optional
  - Remove "NOTE 2—Auto-Negotiation is optional"
  - Acknowledged in the Editor's note

Editor's Note (to be removed prior to Working Group Ballot):

Edits to Figure 199–1 may be needed.

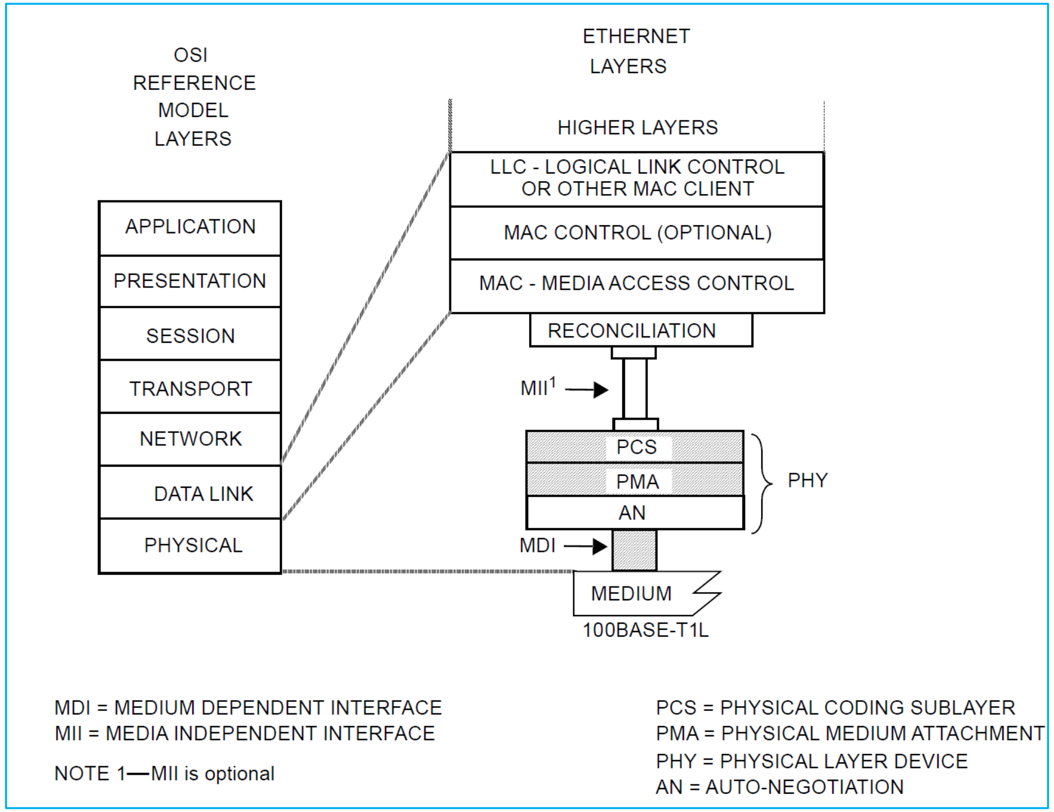

Figure 199–1—Relationship of 100BASE-T1L PHY to the ISO/IEC OSI reference model and the IEEE 802.3 Ethernet model

Medium Independent Interface

- Need to make it clear that we are specifying to the clause 22 MII

100BASE-T1L PCS and PMA sublayers map the interface characteristics of the MDI to the services expected by the Clause 22 Reconciliation Sublayer (RS) and the logical and electrical characteristics of the Media Independent Interface (MII). Though the MII is an optional interface, it is used as a basis for specification. The 100BASE-T1L PCS is specified to the MII, so if not implemented, a conforming implementation shall behave functionally as if the Clause 22 RS and MII were implemented.

  - Should this be done locally in 199.1 (like in clause 48) or should this be in clause 22?

- Drawing from language used for example in clause 46.1, 80.1, 106.1, …

The RS adapts the bit serial protocols of the MAC to the parallel encodings of 2.5 Gb/s, 5 Gb/s, and 10 Gb/s PHYs. Though the XGMII is an optional interface, it is used extensively in this standard as a basis for specification. The 2.5 Gb/s, 5 Gb/s, and 10 Gb/s Physical Coding Sublayers (PCS) are specified to the XGMII, so if not implemented, a conforming implementation shall behave functionally as if the RS and XGMII were implemented.

Questions ?