Overview of
10G Ethernet Family

David Law
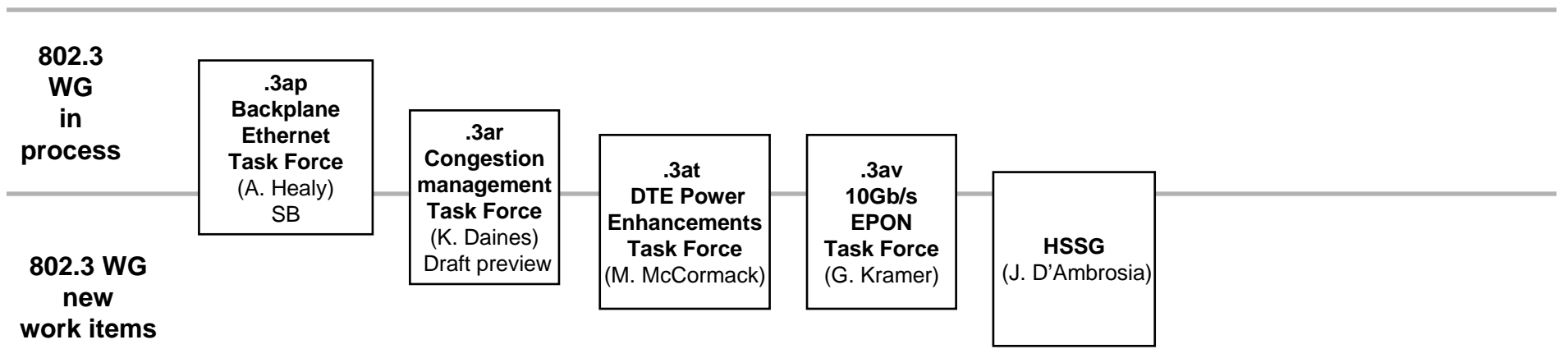
3Com

20th September 2006
Knoxville, TN
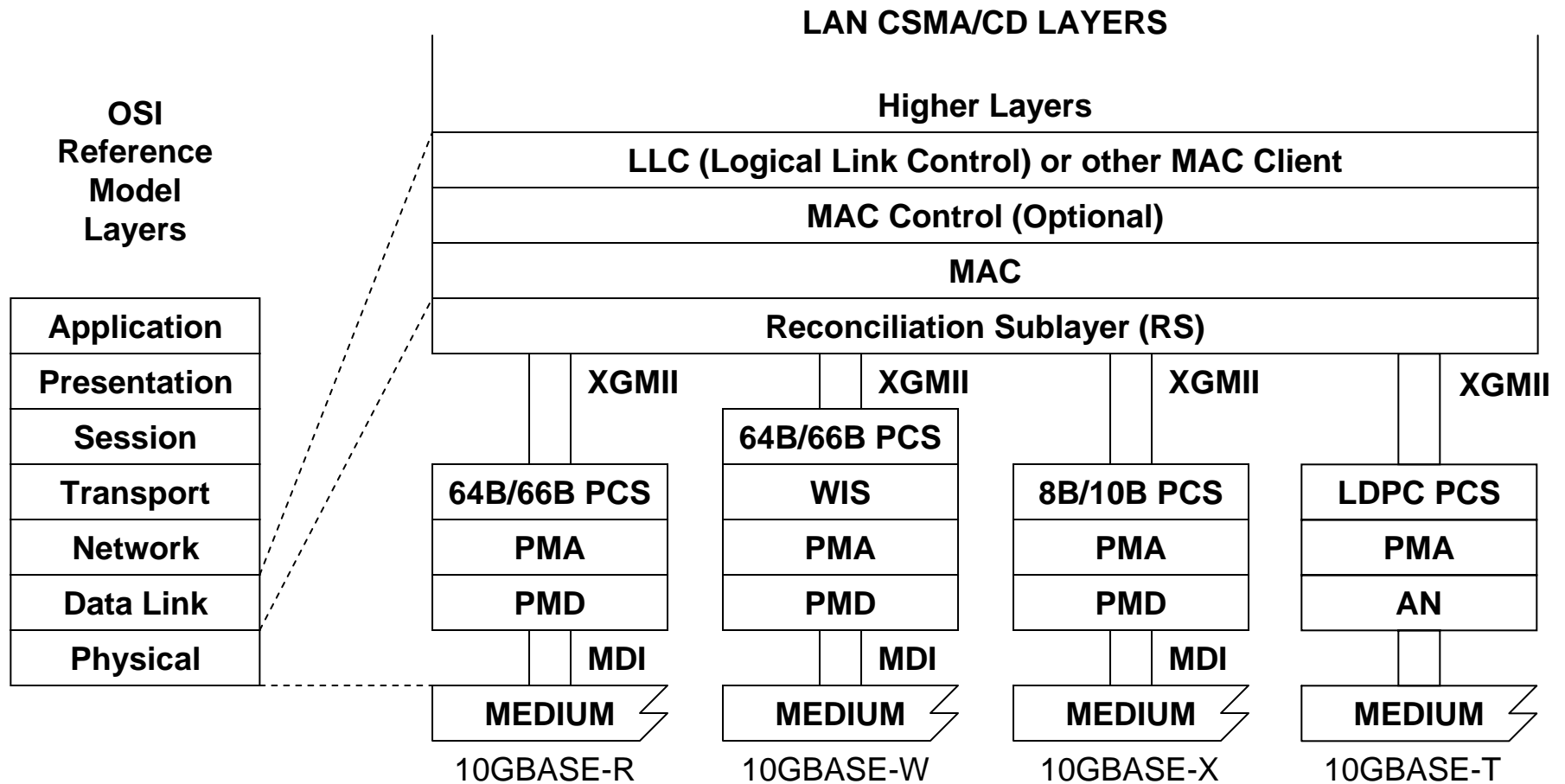
IEEE 802.3 Working Group Standards Status

ISO/IEC approved

ISO/IEC 8802-3:2000

ANSI/IEEE approved

IEEE Std 802.3-2005/Cor 1-2006 **Corrigenda 1** Published 26-Jun-06	**IEEE Std 802.3-2005** **5 Books (Sections) Published 12-Dec-05**

IEEE Std 802.3-2005
5 Books (Sections) Published 12-Dec-05

Section 1 Clause 1 to 20 Annex A to H	Section 2 Clause 21 to 33 Annex 22A to 32A	Section 3 Clause 34 to 43 Annex 36A to 43C	Section 4 Clause 44 to 54 Annex 44A to 50A	Section 5 Clause 56 to 67 Annex 58A to 67A
CSMA/CD Overview MAC PLS/AUI 10BASE5 MAU 10BASE2 MAU 10BROAD36 MAU 10BASE-T MAU 10BASE-F MAUs 10Mb/s Repeater 10Mb/s Topology 1BASE5 DTE & MAU Mgmt Repeater Mgmt	100Mb/s Overview MII 100BASE-T2 100BASE-T4 100BASE-TX 100BASE-FX 100Mb/s Repeater 100Mb/s Topology MAC Control Auto Negotiation Management	1000Mb/s Overview GMII 1000BASE-X AutoNeg 1000BASE-SX 1000BASE-LX 1000BASE-CX 1000BASE-T 1000Mb/s Repeater 1000Mb/s Topology Link Aggregation	10Gb/s Overview MDC/MDIO XGMII XAUI XSBI 10GBASE-SR 10GBASE-LR 10GBASE-ER 10GBASE-SW 10GBASE-LW 10GBASE-EW 10GBASE-LX4 10GBASE-CX4 Maintenance 7	Subscriber Access Overview OAM Multi-point MAC Control 100BASE-LX10 100BASE-BX10 1000BASE-LX10 1000BASE-BX10 1000BASE-PX10 1000BASE-PX20 10PASS-TS 2BASE-TL Subscriber Access Topology
Maintenance 6 Maintenance 7	DTE Power Maintenance 6 Maintenance 7	Maintenance 6 Maintenance 7		

IEEE Std 802.3an-2006 **10GBASE-T** Published 1-Sep-06	
IEEE Std 802.3aq-2006 **10GBASE-LRM** Approved 20-Sep-06	
IEEE Std 802.3as-2006 **Frame Extension** Approved 20-Sep-06	

802.3 WG in process

802.3 WG new work items

.3ap **Backplane** **Ethernet** **Task Force** (A. Healy) SB	**.3ar** **Congestion** **management** **Task Force** (K. Daines) Draft preview	**.3at** **DTE Power** **Enhancements** **Task Force** (M. McCormack)	**.3av** **10Gb/s** **EPON** **Task Force** (G. Kramer)	**HSSG** (J. D'Ambrosia)

10Gb/s Layer Model

LAN CSMA/CD LAYERS

**OSI
Reference
Model
Layers**

Higher Layers
LLC (Logical Link Control) or other MAC Client
MAC Control (Optional)
MAC
Reconciliation Sublayer (RS)

Application
Presentation
Session
Transport
Network
Data Link
Physical

XGMII XGMII XGMII XGMII

64B/66B PCS	64B/66B PCS		
64B/66B PCS	**WIS**	**8B/10B PCS**	**LDPC PCS**
PMA	**PMA**	**PMA**	**PMA**
PMD	**PMD**	**PMD**	**AN**

MDI MDI MDI

MEDIUM	MEDIUM	MEDIUM	MEDIUM
10GBASE-R	10GBASE-W	10GBASE-X	10GBASE-T

MDI = Medium Dependent Interface
XGMII = 10 Gigabit Media Independent Interface
PCS = Physical Coding Sublayer
AN = Auto-Negotiation Sublayer

PMA = Physical Medium Attachment
PMD = Physical Medium Dependent
WIS = WAN Interface Sublayer

10Gb/s Layers and Interface(s)

XGMII

10 Gigabit Media Independent Interface
32 data (4 'lanes' of 8 bits),
4 control and 1 DDR clock

XAUI

10 Gb/s Attachment Unit Interface
4 serial lanes @ 2.5Gb/s
8B/10B encoded - 3.125GBaud/s

XFI (Not specified in IEEE Std 802.3)

10 Gb/s Serial Electrical Interface
Bit serial @ 10Gb/s
64B/66B encoded - 10.312GBaud/s

PCS = Physical Coding Sublayer
PMA = Physical Medium Attachment
PMD = Physical Medium Dependent (not for all PHYs)

Higher Layers

MAC Control (Optional)

MAC

Reconciliation

XGMII →

XGXS

XAUI →

XGXS

XGMII →

Optional XGMII Extender

PCS

PMA

XFI →

PMD

PHY

Medium
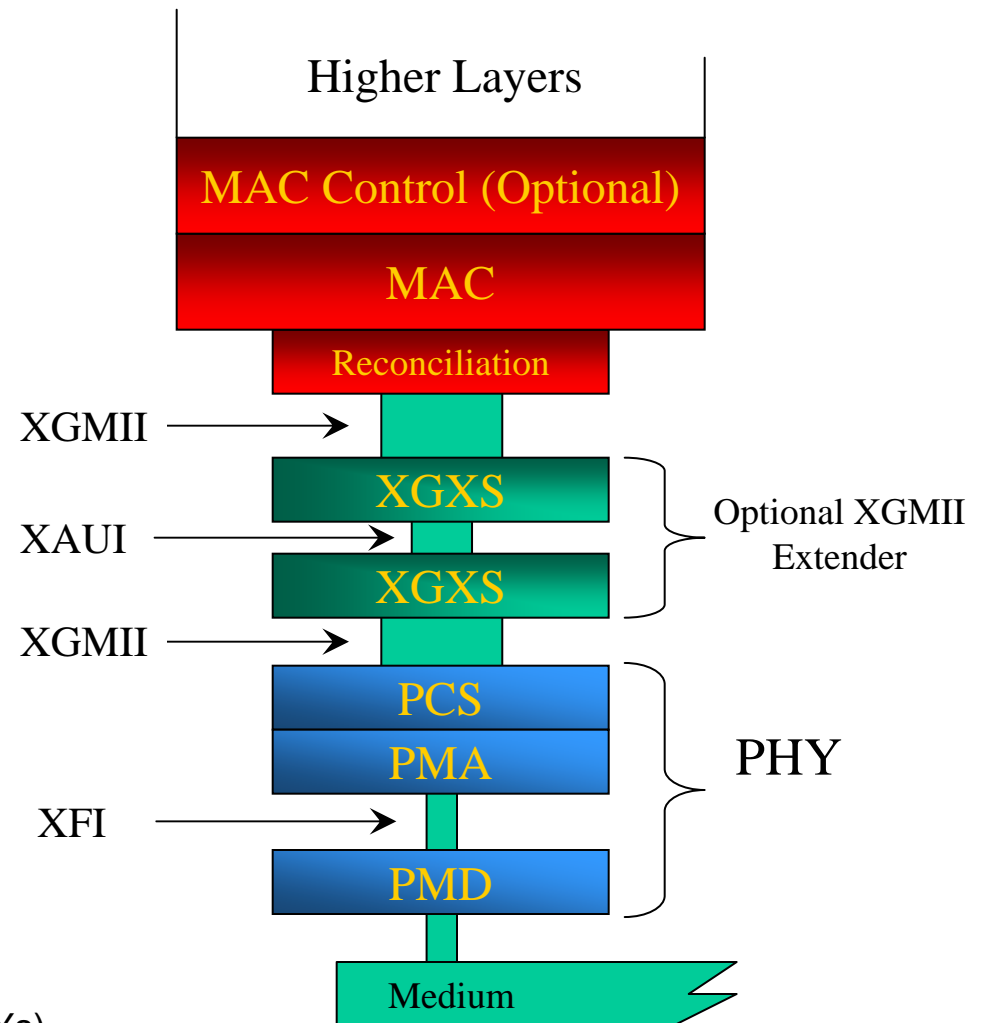
10GBASE-R

10GBASE-W Serial

MAC	Ethernet Packet + Min. IPG | Extra IPG	**10 Gbps**

- **XGMII or XAUI**

64B/66B PCS	64b 64b 64b 64b 64b 64b	**9.29 Gbps**
		Extra IPG Dumped

64-bit Scrambler

Sync. Bits (2) → 64b — **9.58 Gbps**

- -

WIS	**Simplified SONET Framer**	**9.95 Gbps**

- **XSBI**

PMA	**SERDES**	**9.95 Gbps**
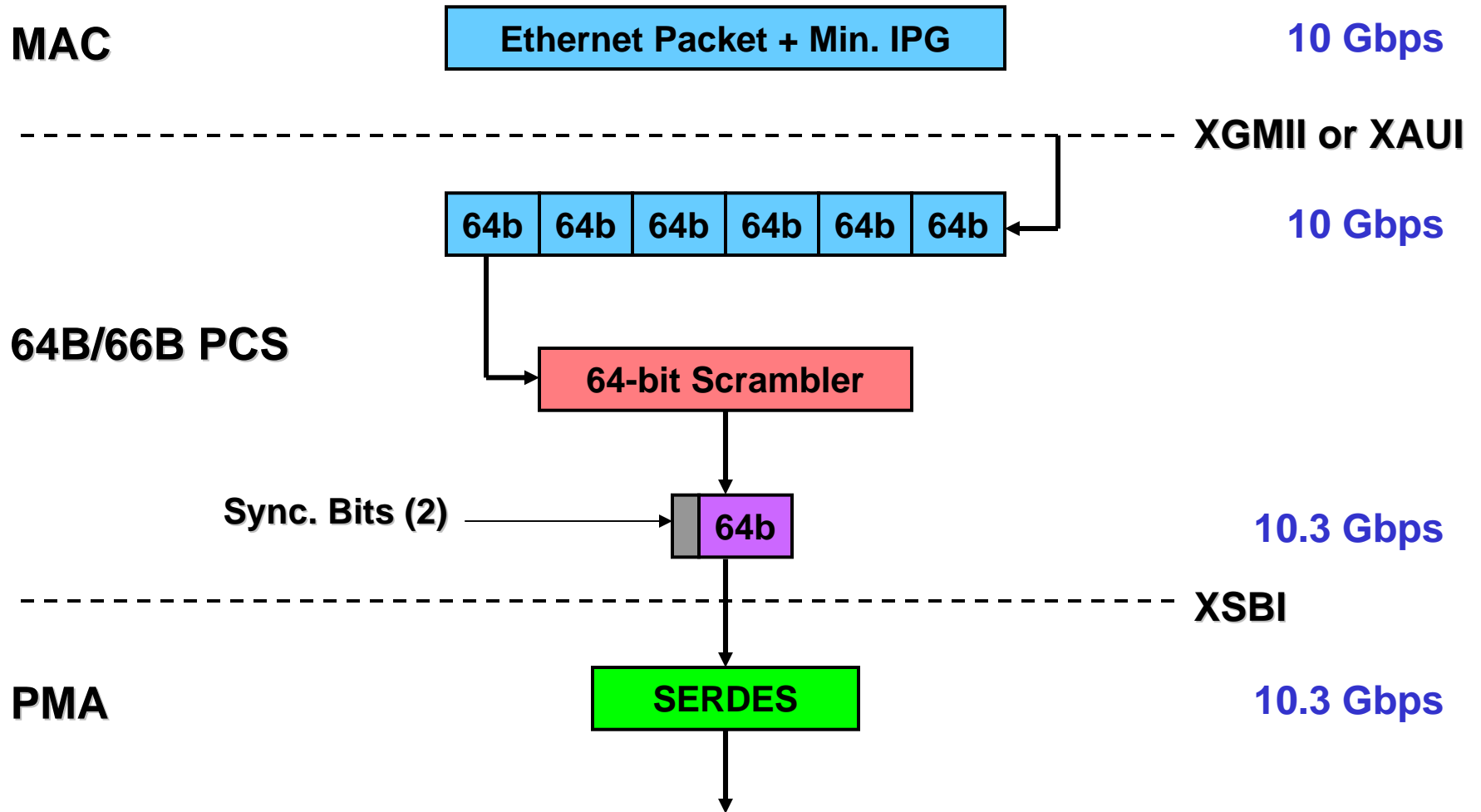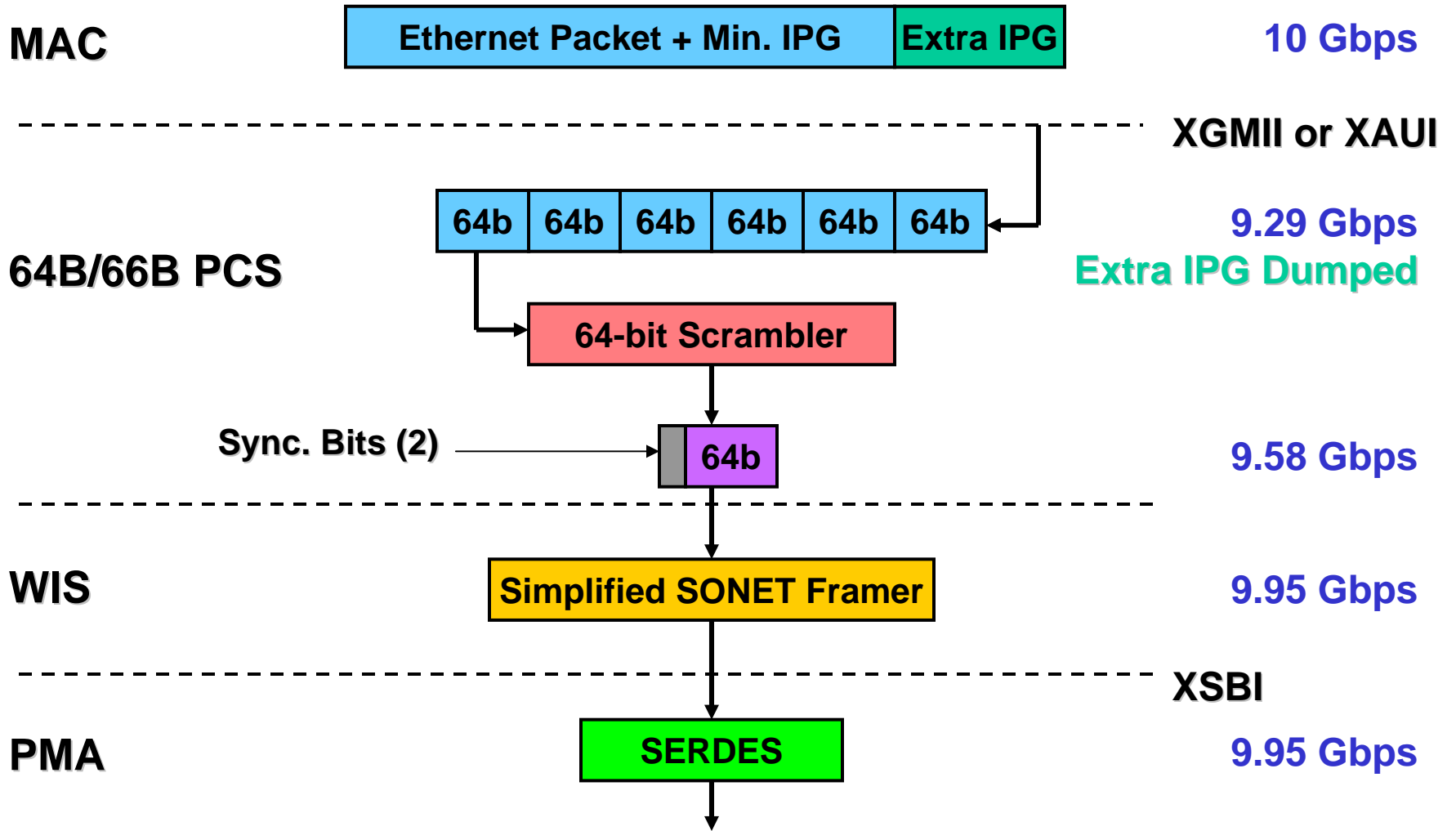
Overview of PMD Types

Optical	10GBASE-SR / W	850 nm	Serial	300 / 33 m	50 um / 62.5 um MMF
	10GBASE-LRM	1310 nm	Serial	220 m	50 um / 62.5 um MMF
	10GBASE-LX4	1310 nm	WDM	300 m	50 um / 62.5 um MMF
				10 km	Single Mode Fiber
	10GBASE-LR / W	1310 nm	Serial	10 km	Single Mode Fiber
	10GBASE-ER / W	1550 nm	Serial	40 km	Single Mode Fiber
Copper	10GBASE-CX4		4 Lanes	15 m	Twinaxial
	10GBASE-T		4 Pairs	100 m	UTP
Backplane	10GBASE-KX4		4 Lanes	1 m	Improved FR-4
(Project)	10GBASE-KR		Serial	1 m	Improved FR-4

Link Aggregation

**OSI
Reference
Model
Layers**

LAN CSMA / CD Layers

Application
Presentation
Session
Transport
Network
Data Link
Physical

Higher Layers			
LLC (Logical Link Control) or other MAC Client			
Link Aggregation Sublayer (Optional)			
MAC Control (Optional)	MAC Control (Optional)	· · · · · · · ·	MAC Control (Optional)
MAC	MAC		MAC
Physical Layer	Physical Layer		Physical Layer