The Beyond 10km Optical PHYs Project: An Overview

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Foreword

- Presentation is being given with my “Chair” hat on.
  - None of this discussion should be interpreted as an endorsement of any objective or potential proposal by me.
  - This presentation is my interpretation, as chair, of conversations in the Study Group and associated ad hoc calls.

- This presentation discusses the technical feasibility of the different PHYS
  - Provides an initial mapping of the baselines needed to work towards a technically complete draft

Adopted Objectives

- **Support full-duplex operation only**
- **Preserve the Ethernet frame format utilizing the Ethernet MAC**
- **Preserve minimum and maximum FrameSize of current Ethernet standard**
- **Provide appropriate support for OTN**

50 Gb/s Ethernet

- **Support a MAC data rate of 50 Gb/s**
- **Support a BER of better than or equal to 10^-12 at the MAC/PLS service interface (or the frame loss ratio equivalent) for 50 Gb/s**
- **Provide a physical layer specification which supports 50 Gb/s operation over at least 40 km of SMF**

100 Gb/s Ethernet

- **Support a MAC data rate of 100 Gb/s**
- **Support a BER of better than or equal to 10^-12 at the MAC/PLS service interface (or the frame loss ratio equivalent) for 100 Gb/s**
- **Provide a physical layer specification supporting 100 Gb/s operation on a single wavelength capable of at least 80 km over a DWDM system.**

200 Gb/s Ethernet

- **Support a MAC data rate of 200 Gb/s**
- **Support a BER of better than or equal to 10^-13 at the MAC/PLS service interface (or the frame loss ratio equivalent) for 200 Gb/s**
- **Provide a physical layer specification supporting 200 Gb/s operation over four wavelengths capable of at least 40 km of SMF**

400 Gb/s Ethernet

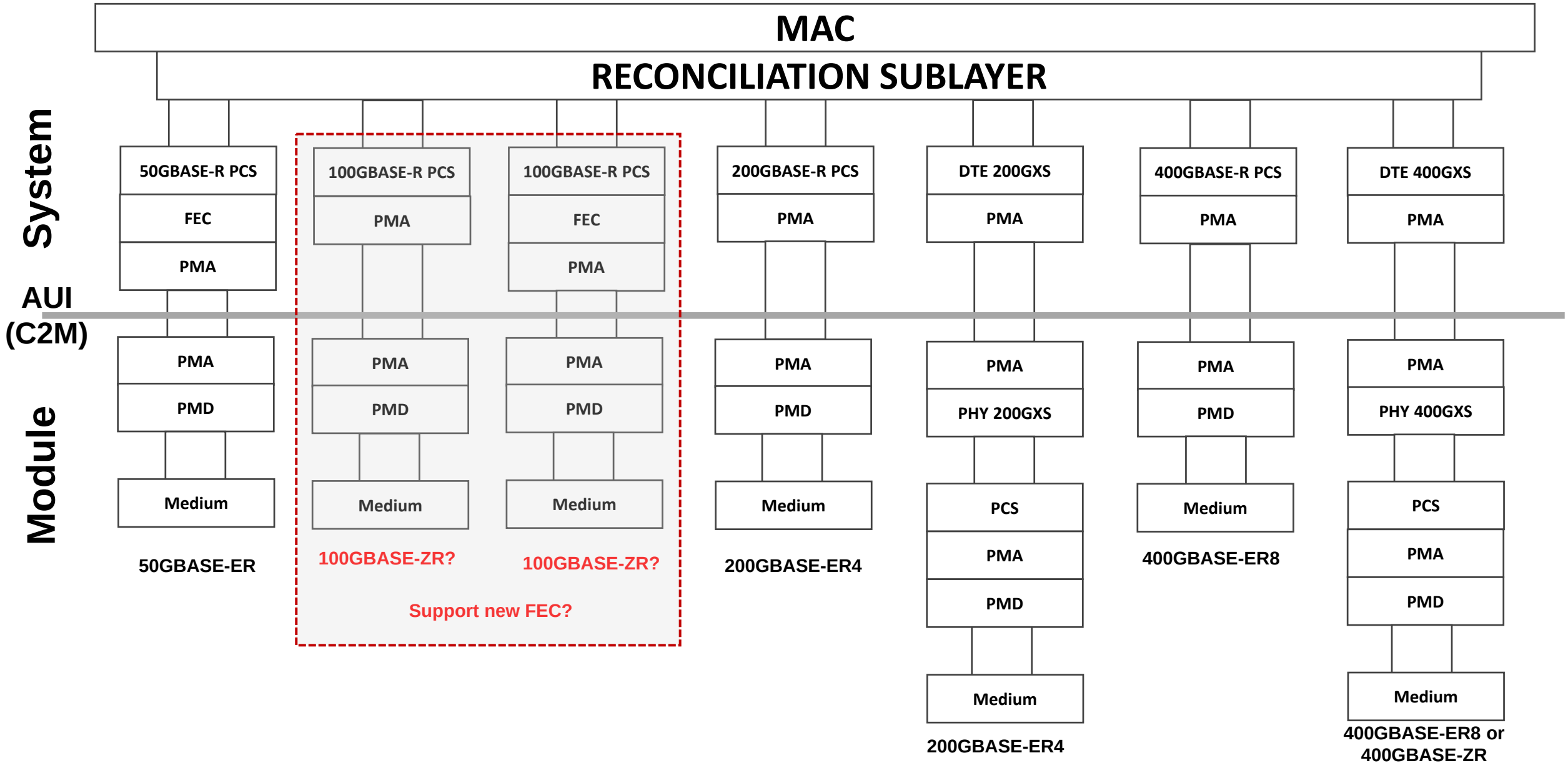
- **Support a MAC data rate of 400 Gb/s**
- **Support a BER of better than or equal to 10^-13 at the MAC/PLS service interface (or the frame loss ratio equivalent) for 400 Gb/s**
- **Provide a physical layer specification supporting 400 Gb/s operation over eight wavelengths capable of at least 40 km of SMF**
- **Provide a physical layer specification supporting 400 Gb/s operation on a single wavelength capable of at least 80 km over a DWDM system.**

Summary of Objectives / Architecture

	Data Rate	Reach	PCS / FEC	Extender Sublayer
Assumed PAM4	50 Gb/s	40 km	Reuse Existing?	None exist
	200 Gb/s			Exists
	400 Gb/s			Exists
Assumed Coherent	100 Gb/s	80 km	New	None exist
	400 Gb/s			Exists

My Assumptions

- Co-existence with existing ports
  - Goal for 40km – reuse of existing FEC
  - New defined 80 km PHYs for use in modules
- No electrical interface development
  - Leverage prior interfaces
- Nomenclature
  - “-ERn” for 40km PHYs
  - “-ZR” for 80km PHYs


MAC
RECONCILIATION SUBLAYER
System
AUI
(C2M)
Module
50GBASE-R PCS
FEC
PMA
PMA
PMD
Medium
50GBASE-ER
100GBASE-R PCS
PMA
PMA
PMD
Medium
100GBASE-ZR?
100GBASE-R PCS
FEC
PMA
PMA
PMD
Medium
100GBASE-ZR?
Support new FEC?
200GBASE-R PCS
PMA
PMA
PMD
Medium
200GBASE-ER4
DTE 200GXS
PMA
PMA
PHY 200GXS
PCS
PMA
PMD
Medium
200GBASE-ER4
400GBASE-R PCS
PMA
PMA
PMD
Medium
400GBASE-ER8
DTE 400GXS
PMA
PMA
PHY 400GXS
PCS
PMA
PMD
Medium
400GBASE-ER8 or
400GBASE-ZR

Architecture Comments

	Data Rate	Reach	PCS / FEC *	Observations
PAM4*	50 Gb/s	40 km	Existing	Leverage existing PHY structure with new PMD to coexist with current 50G ports
	200 Gb/s			Leverage existing PHY structure with new PMD or extender sublayer with new PHY (based on new PMD) to coexist with current 200G ports
	400 Gb/s			Leverage existing PHY structure with new PMD or extender sublayer with new PHY (based on new PMD) to coexist with current 400G ports
COHERENT*	100 Gb/s	80 km	New	New PHY (PCS / FEC and PMD) anticipated. Architectural proposal needed for how to co-exist with current 100G ports.
	400 Gb/s			New PHY (PCS / FEC and PMD) anticipated. New PHY could be put in module, leveraging existing extender sublayer to coexist with current 400G ports.

Project Work

Logic Functions	Electrical Interfaces	Optical PMDs
▪ Extender Sublayer (100GXS)? ▪ PCS functions ▪ PMA functions ▪ OTN Compatibility	▪ None ?	▪ 50GBASE-ER ▪ 100GBASE-ZR ▪ 200GBASE-ER4 ▪ 400GBASE-ER8 ▪ 400GBASE-ZR ▪ MDI(s?) ▪ Media ▪ **Test Methods**
FEC ARCHITECTURE		▪ FEC related to PMD functions?
▪ Management related to Logic functions (Clauses 30, 45, etc.)		▪ Management related to PMD functions (Clauses 30, 45, etc.)