

400Gb/s SMF PMD Technical Feasibility

400Gb/s Ethernet Study Group
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400Gb/s SMF PMD Link Reach Objectives

- 500m, 2km, 10km
- 500m link budget:
 - TDP = ~ TP (1310nm)
 - Loss budget = 4dB

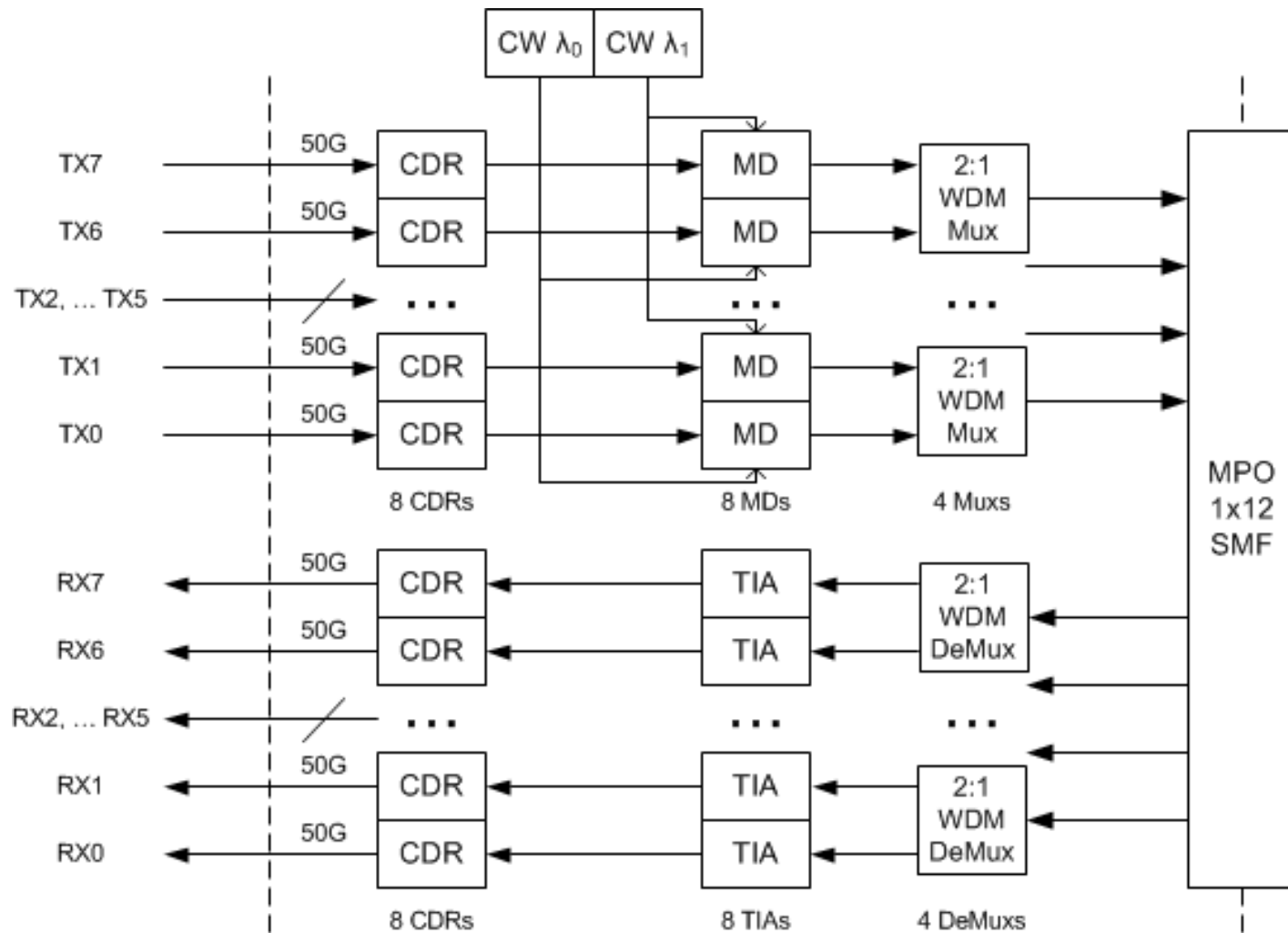
(http://www.ieee802.org/3/bm/public/mar13/kolesar_02_0313_optx.pdf)
- 2km link budget:
 - TDP = ~ TP (1310nm)
 - Loss budget = 4dB historical, 5dB preferred

(http://www.ieee802.org/3/100GNGOPTX/public/sept11/cole_01_0911_NG100GOPTX.pdf)
- 500m and 2km link budgets are similar enough that distinct duplex SMF (2f) PMDs are not justified
- A distinct 500m PMD is justified if it uses a different fiber plant, i.e. parallel SMF ($\geq 4f$) vs. duplex SMF (2f)

40GbE-SR4 Applications and Insights

- 40GbE-SR4 point-to-point, using parallel MMF (8f) cable
- 4x10GbE-SR break-out, using four duplex MMF (2f) cables
 - Ex.1: 40GbE-SR4 QSFP+ \Leftrightarrow 4x 10GbE-SR SFP+
 - Ex.2: 4x 40GbE-SR4 QSFP+ \Leftrightarrow 4x 40GbE-SR4 QSFP+
- 4x100GbE break-out will be an important 400GbE PMD application
- 400GbE 500m SMF PMD is a good choice to support duplex SMF break-out
- 40GbE-SR4 & 100GbE-SR10 result in low cost, high density 10GbE-SR
- 4x100GbE PMD optimization will result in low cost, high density 100GbE

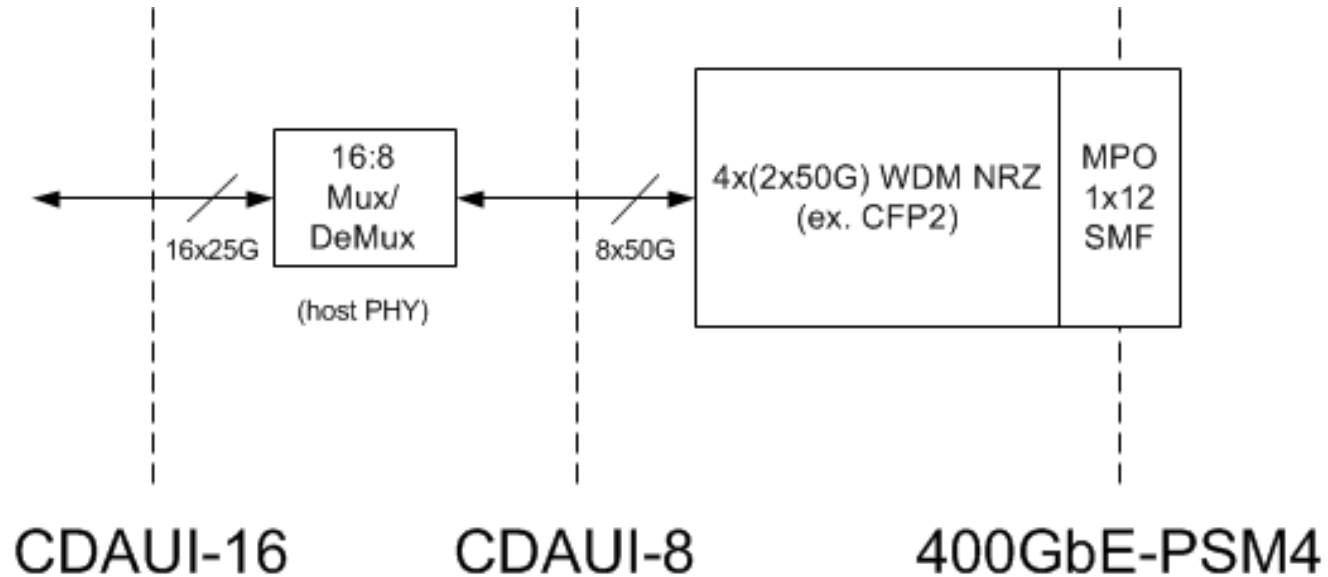
400GbE-PSM4 4x(2x50G) WDM NRZ 50G I/O



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400GbE-PSM4

400GbE-PSM4 4x(2x50G) WDM NRZ 25G I/O



400GbE-PSM4 Alternatives Comparison

Category	2x50GBaud NRZ WDM	50GBaud PAM-4	Comments
Lasers	2	4	based on lower NRZ SNR req.
TX Drivers & Modulators	8	8	equivalent
RX TIAs	8 (limiting)	4 (linear)	equivalent
Major Differences	4x WDM Mux 4x WDM DeMux	4x ADC 4x DSP	

- 50GBaud PAM-4 is a technically credible alternative
- 2x50G NRZ WDM is a simpler, lower cost, lower power alternative

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Thank you