Potential optical baselines for new proposed objectives

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Overview

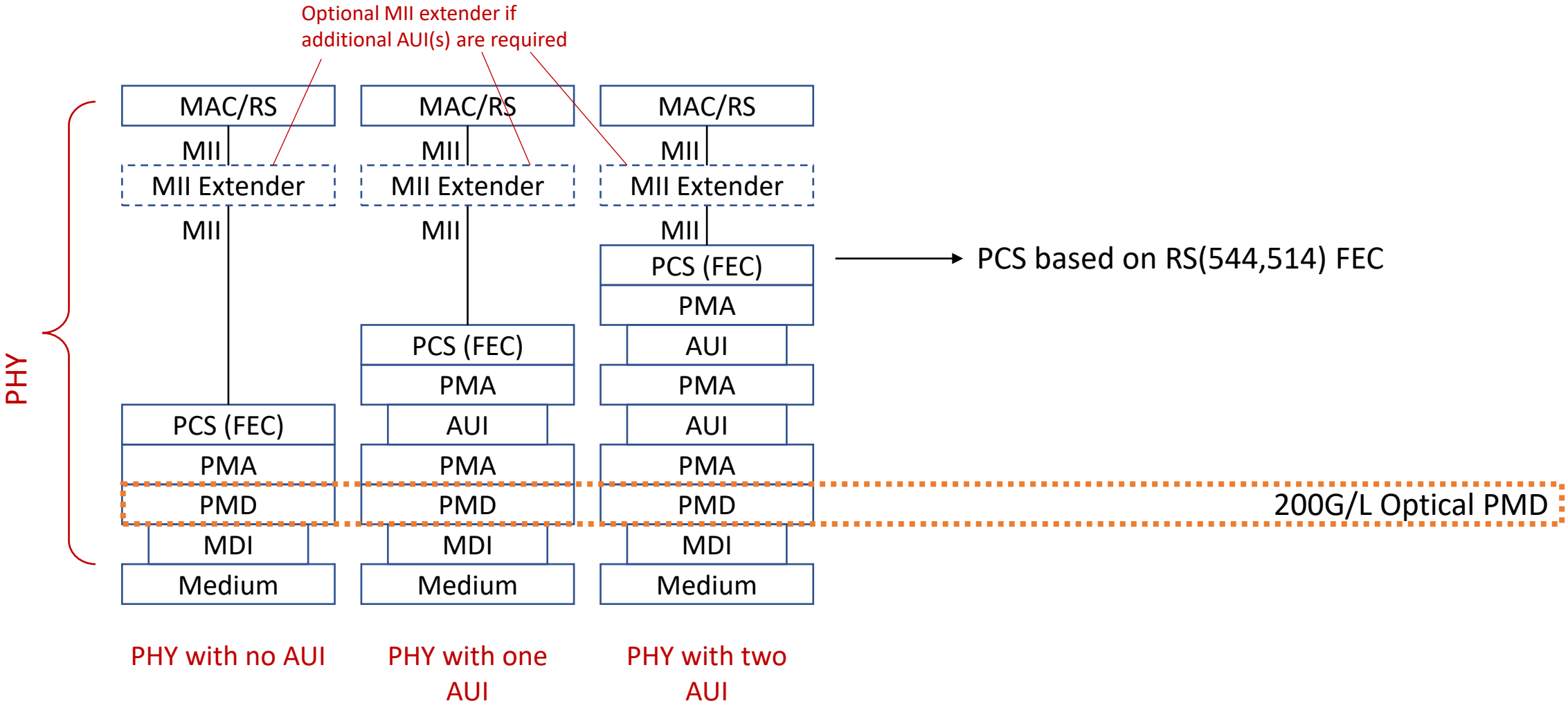
- Presentation is an extension of welch_3dj_02_2311, with baseline changes for new proposed objectives:
- Define a physical layer specification that supports 200 Gb/s operation:
  - over 1 pair of SMF with lengths up to at least 250 m
- Define a physical layer specification that supports 400 Gb/s operation:
  - over 2 pairs of SMF with lengths up to at least 250 m
- Define a physical layer specification that supports 800 Gb/s operation:
  - over 4 pairs of SMF with lengths up to at least 250 m
- Define a physical layer specification that supports 800 Gb/s operation:
  - over 4 wavelengths over a single SMF in each direction with lengths up to at least 250 m
- Define a physical layer specification that supports 1.6 Tb/s operation:
  - over 8 pairs of SMF with lengths up to at least 250 m

Changes vs. Welch_3dj_02_2311

- Changes to fiber plants to reflect reduced fiber reach.

- Dual link fiber plants still assumed.
  - Different connector loss budgets for duplex/breakout cases than parallel/non-breakout cases.

Location in Ethernet Stack: FECo



BER Requirements

- **FECo** : The BER of the PMD link shall be less than **2.4×10^{-4}** provided that the error statistics are sufficiently random that this results in a frame loss ratio of less than 1.7×10^{-12} for 64-octet frames with minimum interpacket gap when processed with an 800GBASE-R/1.6TBASE-R PCS.

Changes to TDECQ/TECQ/SECQ Reference Receiver – Tap Restrictions

	Symbol	Value	Units
Feedforward equalizer (FFE) length	N_b	11	UI
Maximum FFE pre-cursors		3	UI
Maximum FFE post-cursors		9	UI
Normalized FFE coefficient maximum limit *n* = -3 *n* = -2 *n* = -1 *n* = 0 *n* = 1 *n* = 2 *n* ≥ 3	$bb_{max}(n)$	 TBD† TBD TBD TBD TBD TBD TBD†	-
Normalized FFE coefficient minimum limit *n* = -3 *n* = -2 *n* = -1 *n* = 0 *n* = 1 *n* = 2 *n* ≥ 3	$bb_{min}(n)$	 TBD† TBD TBD TBD TBD TBD TBD†	-
Sum of all tap weights	bb_{sum}	1	

† Coefficients beyond +/- 3 expected to be small

Proposed Transmitter Specifications

Description	800GBASE-DR4-FECo 1.6TBASE-DR8-FECo	200GBASE-DR1-FECo 400GBASE-DR2-FECo	800GBASE-FR4-FECo	Unit
Signaling rate, each lane (range)	106.25 ± 50 ppm	106.25 ± 50 ppm	106.25 ± 50 ppm	GBd
Modulation Format	PAM4	PAM4	PAM4	
Lane wavelengths (range)	1304.5 to 1317.5	1304.5 to 1317.5	1264.5 to 1277.5 1284.5 to 1297.5 1304.5 to 1317.5 1324.5 to 1337.5	nm
Side-mode suppression ratio (SMSR), (min)	30	30	30	dB
Average launch power, each lane (max)	4	4	4.9	dBm
Average launch power, each lane (min)	-2.8	-2.1	-1.8	dBm
Outer Optical Modulation Amplitude (OMA_{outer}), each lane(max)	4.2	4.2	4.8	dBm
Outer Optical Modulation Amplitude (OMA_{outer}), each lane(min) for MAX(TECQ,TDECQ) < 0.9 dB for 0.9 dB ≤ MAX(TECQ,TDECQ) ≤ 3.4 dB	 -0.3 -1.2 + MAX(TECQ,TDECQ)	 0.4 -0.5 + MAX(TECQ,TDECQ)	 0.8 -0.1+MAX(TECQ,TDECQ)	 dBm dBm
Transmitter and dispersion eye closure (TDECQ), each lane (max)	3.4[a]	3.4[a]	3.6[a]	dB
TECQ (max)	3.4[a]	3.4[a]	3.6[a]	dB
|TDECQ - TECQ| (max)	2.5[a]	2.5[a]	2.5[a]	dB
Average launch power of OFF transmitter, each lane (max)	-15	-15	-15	dBm
Extinction ratio, each lane, (min)	3.5	3.5	3.5	dB
Transmitter transition time (max)	8	8	8	ps
Transmitter over/under-shoot (max)	22	22	22	%
RIN_xOMA (max)	-139	-139	-139	dB/Hz
Optical return loss tolerance (max)	21.4 (15.5 for DR1)	21.4 (17.1 for FR1)	17.1	dB
Transmitter reflectance (max)	-26	-26	-26	dB

[a] Measured with FFE11 reference equalizer with SER = 4.8e-4

Proposed Receiver Specifications

Description	800GBASE-DR4-FECo 1.6TBASE-DR8-FECo	200GBASE-DR1-FECo 400GBASE-DR2-FECo	800GBASE-FR4-FECo	Unit
Signaling rate, each lane (range)	106.25 ± 50 ppm	106.25 ± 50 ppm	106.25 ± 50 ppm	GBd
Modulation Format	PAM4	PAM4	PAM4	
Lane wavelengths (range)	1304.5 to 1317.5	1304.5 to 1317.5	1264.5 to 1277.5 1284.5 to 1297.5 1304.5 to 1317.5 1324.5 to 1337.5	nm
Damage threshold, each lane	5	5	5.9	dBm
Average receive power, each lane (max)	4	4	4.9	dBm
Average receive power, each lane (min)	-5.8	-6.1	-5.6	dBm
Receive power, each lane (OMA_{outer}) (max)	4.2	4.2	4.8	dBm
Receiver reflectance (max)	-26	-26	-26	dB
Receiver sensitivity (OMA_{outer}), each lane (max) for TECQ < 0.9 dB for 0.9 dB ≤ TECQ ≤ SECQ	 -3.4 -4.3 + TECQ	 -4.0 -4.9 + TECQ	 -3.7 -4.6 + TECQ	 dBm dBm
Stressed receiver sensitivity (OMA_{outer}), each lane (max)	-0.9	-1.5	-1.0	dBm
Conditions of stressed receiver sensitivity test:				
SECQ	3.4[a,b]	3.4[a,b]	3.6[a]	dB
OMA_{outer} of each aggressor lane[c]	2.9	1.5	1.9	dBm

[a] Measured with FFE11 reference equalizer with SER = 4.8e-4
[b] No aggressors needed for 200GBASE-DR1-FECo or 200GBASE-FR1-FECo

Proposed Link Budget

Description	800GBASE-DR4-FECo 1.6TBASE-DR8-FECo	200GBASE-DR1-FECo 400GBASE-DR2-FECo	800GBASE-FR4-FECo	Unit
Power budget (for max TDECQ)	6.5	7.8	8.1	dB
Operating distance	250	250	250	m
Channel insertion loss	2.9	3.8	3.8	dB
Maximum discrete reflectance	-35	-35	-35	dB
Allocation for penalties (for max TDECQ)	3.5	3.8	4.1	dB
Additional insertion loss allowed	0.1	0.2	0.2	dB

- Revised channel insertion loss budgets derived from kolesar_3bs_01_0514.pdf
- Breakout (200G, 400G) and Duplex (FR4) solutions have higher connector loss budgets to accommodate aggregating to higher density fiber bundles: Up to 8 total connectors
- Non-breakout parallel (800G, 1.6T) do not aggregate to higher density fiber bundles: Up to 4 total connectors

Summary

- Baseline proposals for the proposed new objectives have been proposed.

Thank You