

Potential optical baselines for new proposed objectives

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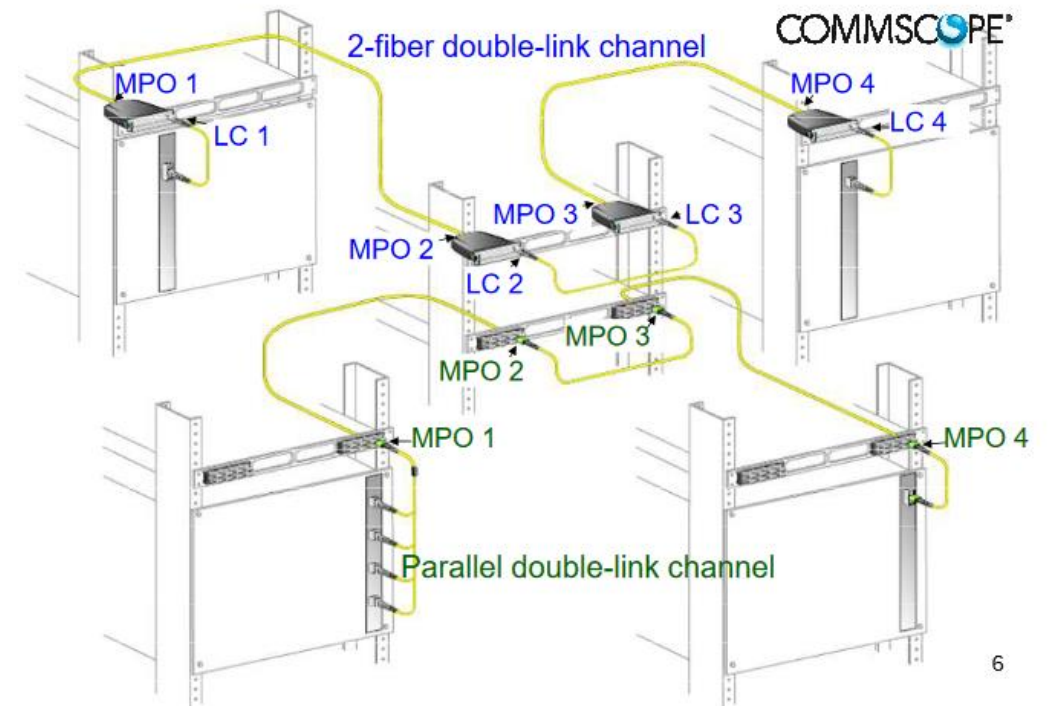
Overview

- 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

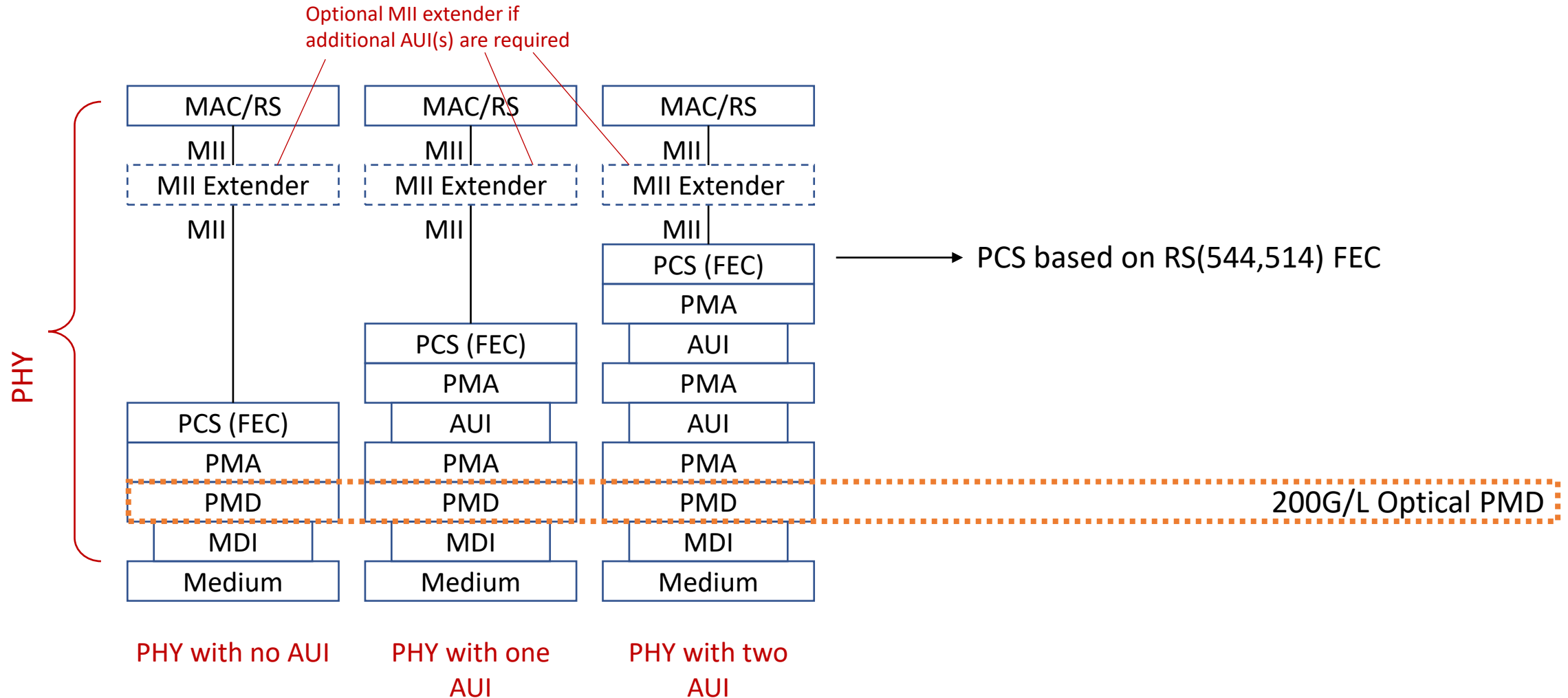
- Changes to fiber plants to reflect reduced fiber reach.
- Dual link fiber plants still assumed.
 - Different connector loss budgets for duplex/breakout cases than parallel/non-breakout cases.

Double-link cabling channel examples



from [kolesar 3bs 01 0514.pdf](#)

Location in Ethernet Stack: FECo



BER Requirements

- **FEC_o** : 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 $n = -3$ $n = -2$ $n = -1$ $n = 0$ $n = 1$ $n = 2$ $n \geq 3$ | $bb_{\max}(n)$ | TBD [†] TBD TBD TBD TBD TBD TBD [†] | - |
| Normalized FFE coefficient minimum limit $n = -3$ $n = -2$ $n = -1$ $n = 0$ $n = 1$ $n = 2$ $n \geq 3$ | $bb_{\min}(n)$ | 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 _x OMA (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