

Towards an 800G 40km Coherent Baseline Proposal

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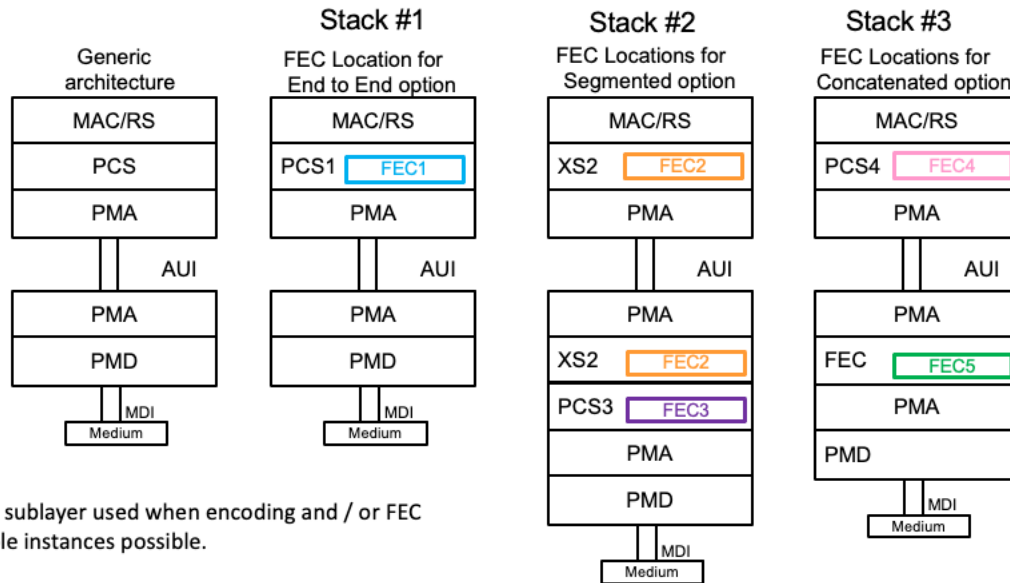
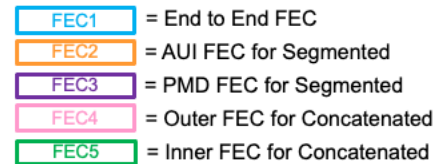
800G 40 km Reach Objective

- Coherent seems widely accepted for the 40km reach objective
- The goal of this contribution is to move that effort forward by proposing initial details for a baseline proposal
- Implementation can substantially leverage 800ZR development efforts
- C-band operation for reduced link budget
 - Chromatic dispersion, and other impairments, can be mitigated by the DSP
- Optical amplification, if needed, can be implemented within a pluggable module
 - Amplified coherent 400G in QSFP-DD form factor currently demonstrated
 - Both silicon photonics and indium phosphide technology

Coherent within a 802.3df/dj Architecture

Proposed 802.3df Overall Architecture

- For all Ethernet rates within this project (200G/400G/800G/1.6T)
- FECs might or might not be reused across schemes
- TBD which FEC scheme(s) are needed for this project



Note – Extender sublayer used when encoding and / or FEC changes. Multiple instances possible.

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A coherent interface is consistent with the adopted architecture for this project.

A higher gain FEC is needed to support the longer reaches.

Consistent with a segmented FEC scheme (Stack #2).

For implementations based on a 200G based AUI, a segmented FEC scheme will be needed

FEC

- Need to build consensus on FEC for this proposal, but no new innovation is required
- OIF's 800ZR specification uses oFEC, which can meet all the requirements of IEEE's 800G-ER1
 - Already widely deployed in 400ZR+ modules
 - Leverages industry investments
- Segmented approach can easily support 100G and 200G AUI architectures
- Latency well within 40 km requirements

Optical Amplification for Coherent 40 km

- Fiber impairments at 800G 40km are extremely challenging for IMDD approaches
- Coherent detection allows for digital compensation of fiber impairments
- Extending reach is primarily a function of additional gain in the link budget
- Optical gain has been implemented in QSFP-DD form factors for coherent 400ZR+ using both InP and SiPh
- Coherent can support a “true” 40km link budget (i.e. similar to 10G)
- TP2 spec compliance is independent of vendor implementation

Transmitter Specifications

Description	800G-ER1	Unit
Signaling rate	TBD	Gbd
Modulation format	DP-16QAM	
Channel frequency (Nominal)	193.7	THz
Channel frequency accuracy (+/-)	+/- 1.8	GHz
Average launch power (min)	-2	dBm
Average launch power (max)	2	dBm
Average launch power of OFF transmitter (max)	-20	dBm
Laser linewidth (max)	1.0	MHz
I/Q phase error (+/-)	5	Deg
I/Q quadrature skew (max)	0.75	Ps
I/Q amplitude imbalance (mean)	1	dB
Transmitter EVM	TBD	%

← TBD until FEC decision

← Same as .3cw?

Transmitter Specifications (cont.)

Description	800G-ER1	Unit
Transmitter OSNR	35	dB
Power difference between X and Y polarizations (max)	1.5	dB
Skew between X and Y polarizations (max)	5	ps
Transmitter reflectance (max)	-20	dB
RIN average	-145	dBc/Hz
RIN peak	-140	dBc/Hz

Receiver Specifications

Description	800G-ER1	Unit
Modulation Format	PM-16QAM	
Frequency offset between received carrier and local oscillator	TBD	THz
Receive sensitivity	-17	dBm
Average receive input power (max)	+3	dBm
CD tolerance (max)	800	ps/nm
Peak PDL tolerance	1.5	dB
DGD	10	ps
SOP tolerance	5	krad/s

Proposed Link Budget

Description	800G-ER1	Unit
Link Loss	14	dB
Operating distance	40	Km
Allocation for additional penalties	1	dB

Assumes 0.35dB/km fiber loss specification for G.652.B fiber

Summary

The details in this proposal can be used as the basis of a coherent baseline to satisfy the objective to “define a physical layer specification that supports 800 Gb/s operation over a single SMF in each direction with lengths up to at least 40 km.”

FEC selection will enable rapid progress toward a baseline.