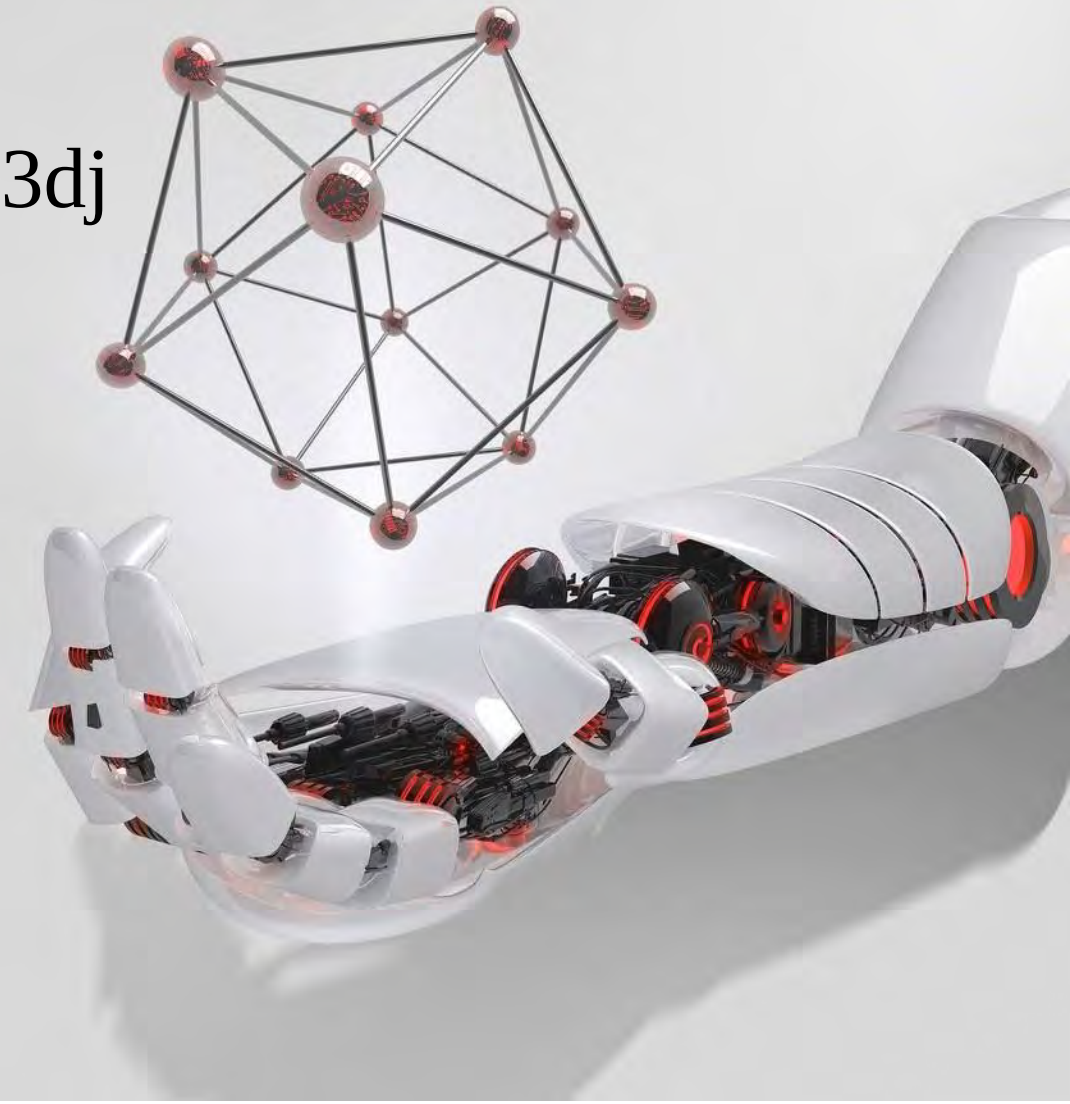
Proposals for coherent PMDs in P802.3dj



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Supporters

- Eric Maniloff, Ciena

Introduction

- During the May 2023 Interim meeting, a series of straw polls was conducted on the direction of the two coherent PMDs in 802.3dj.
- Results on Straw Poll 16 showed clear interest on sharing the logic layer specification for 800GBASE-LR1 and 800GBASE-ER1.

Straw Poll #16:
I support 800GBASE-LR1 and 800GBASE-ER1 sharing common logic (PCS/FEC)
Y: 49 , N: 19, NMI: 8, A: 26

- Results on Straw Poll 17 then showed a preference for using a type II FEC, KP4 + BCH FEC as the logical layer for 800GBASE-LR1.

Straw Poll #17:
I am supportive of the direction of maniloff_3dj_01a_2305 (slides 4-12) as the baseline FEC proposal for the single wavelength 10 km 800Gb/s optical PMD.
Results: Y: 44, N: 13, NMI: 13, A: 34

- The results from these straw polls suggest it to be worthwhile to investigate the performance of KP4 + BCH FEC for 40 km distances over SMF, so shat **sharing** common logic between 800GBASE-LR1 and 800GBASE-ER1 can be enabled.
- This presentation provides further considerations and associated proposals on 800GBASE-LR1 and 800GBASE-ER1 specifications.

Channel loss requirements

- stassar_3dj_optx_01a_230427, presented during the optics ad hoc on 27 April, provided considerations on channel loss for 10 km and 40 km distances.
- For 10 km distances the TF could consider losses in the range of 4.6 dB (C-band) to 6.3 dB (O-band).
- For 40km distances the TF could consider the following losses (building on the considerations in stassar_3dj_optx_01a_230427:
  - In the case the TF would wish to make specifications for 40 km engineered links (as in existing in-force clauses):
    - 18 dB for O-band applications
    - 11 dB for C-band applications
  - However if there is a stronger preference to construct channel specifications for non-engineered links, add 2 dB for patch panel connectors:
    - 20 dB for O-band applications
    - 13 dB for C-band applications
- The authors suggest to use the channel loss assumptions to investigate the performance of KP4 + BCH FEC for 800GBASE-ER1
- The authors also suggest to assume C-band operation for 40 km distances, making FEC gain requirements significantly less than for O-band operation.

Investigation on FEC Performance in 40 km 800 GbE coherent link

Conditions assumed in the simulation

- Wavelength: C band 1550nm
- Fixed-wavelength laser, both ECL& DFB laser were considered, with linewidth up to 2MHz
- Optical Tx/Rx Devices: 3dB bandwidth ~60GHz
- Noise due to in-module amplifier was considered for 40km case, EDFA/SOA at the Tx

Link conditions assumed in the simulation

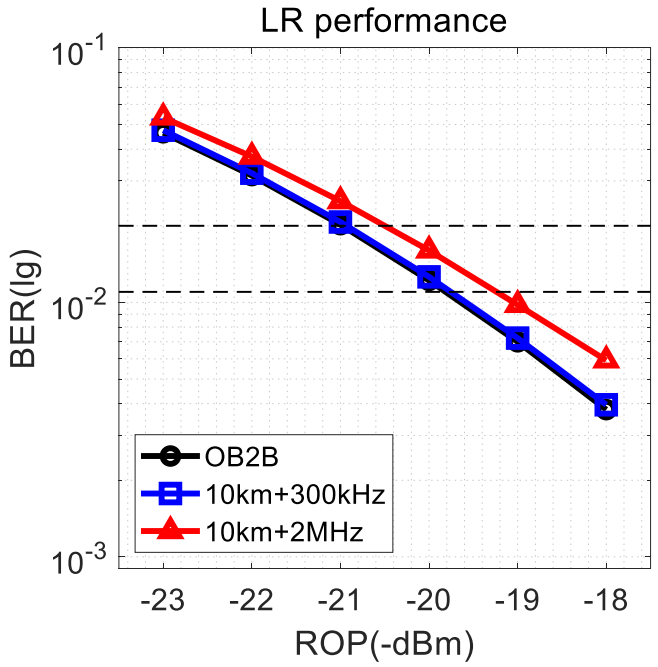
- Channel insertion loss for 40 km: as suggested in previous slide:
  - 11 dB, C-band for engineered link
  - 13 dB, C-band non-engineered link.
- CD/DGD/PDL/LOFO:

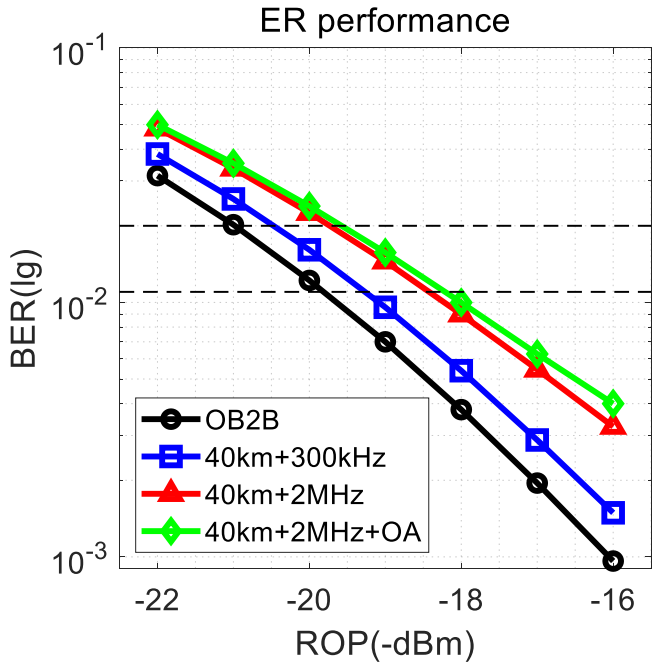
Spec	LR		ER	
	typical	worst	typical	worst
CD(ps/nm)	200*		800*	
DGD(ps)	1	6	3	21[+]
Rx PDL Tolerance(dB)	1.5	2	3.5	4
LOFO(kHz)	±1500	±3600	±1500	±3600

*: same as in maniloff_3dj_01a_230206

[+]: In force IEEE specifications have 10.3ps for 40km applications

Simulation result



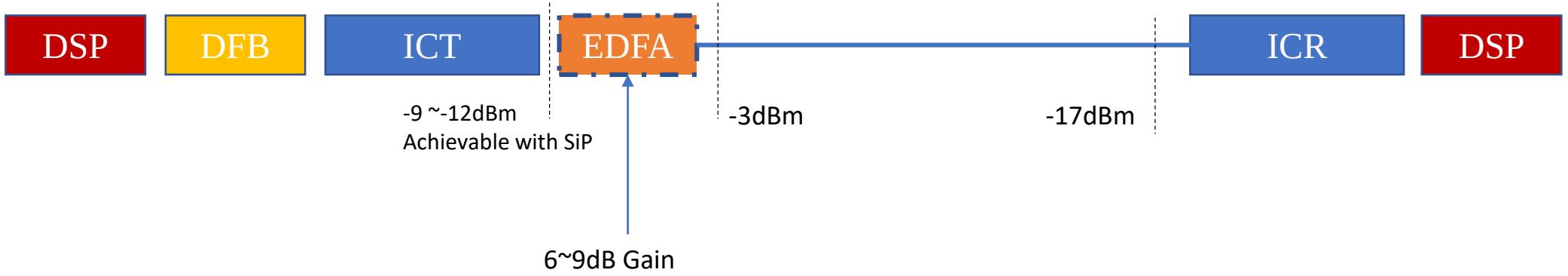


ROP (dBm)	OB2B	LR		ER		
		typical+300kHz	Worst+2MHz	typical+300kHz	worst+2MHz	worst+2MHz+OA
OFEC@BER=2E-2	-20.98	-20.92	-20.48	-20.46	-19.72	-19.56
KP4 + BCH @BER=1.1E-2	-19.8	-19.75	-19.24	-19.25	-18.41	-18.21
Difference in ROP (dB)	1.18	1.17	1.24	1.21	1.31	1.35

Rough power budget for 40 km C-band solution

	ER1	
Fiber link length	40	km
Channel Insertion loss (max), for C-band	13	dB
Optical path power penalty (max)	1	dB
Optical power budget (max)	**14**	**dB**
Chromatic dispersion (max)	800	ps/nm
Average Tx output power (min)	**-3**	**dBm**
Rx sensitivity (min)	**-17**	**dBm**

Possible to fulfill such a power budget with current coherent solutions



Assessment of suitability of KP4 + BCH FEC

- On the basis of the presented analysis we conclude that a KP4 + BCH FEC provides more than sufficient gain to support channel losses up to at least 14 dB
- Therefore we believe that there is no need for a very strong FEC, like OFEC, for an SMF distance of 40 km when a frequency in the C-band is used. Such a very strong FEC, designed for operation over demanding long distance DWDM links, would only introduce disadvantages, like higher latency and power consumption
- This is the first IEEE 802.3 project where coherent technology is being proposed for non DWDM, conventional/grey Ethernet applications and as such a KP4 + BCH FEC scheme, being a text book scheme without IP limitations, would be very suitable
- We are at the brink of introducing coherent technology in relatively short distances and it would be a fundamental mistake to use (because of convenience) an FEC scheme specifically designed for demanding long distance DWDM links, which generally require edge technology

Proposals

- For both LR1 and ER1 specify KP4 + BCH FEC
- For ER1 specify a single frequency in the C-band to support a worst case channel loss of 13 dB
- For optimum flexibility and commonality specify also single frequency in the C-band for LR1 to support a worst case channel loss of 5 dB

Thank you!