Proposal for a Limiting, Non-retimed PMD for 100 Gb/s and 40 Gb/s Ethernet and Related Specifications

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Outline

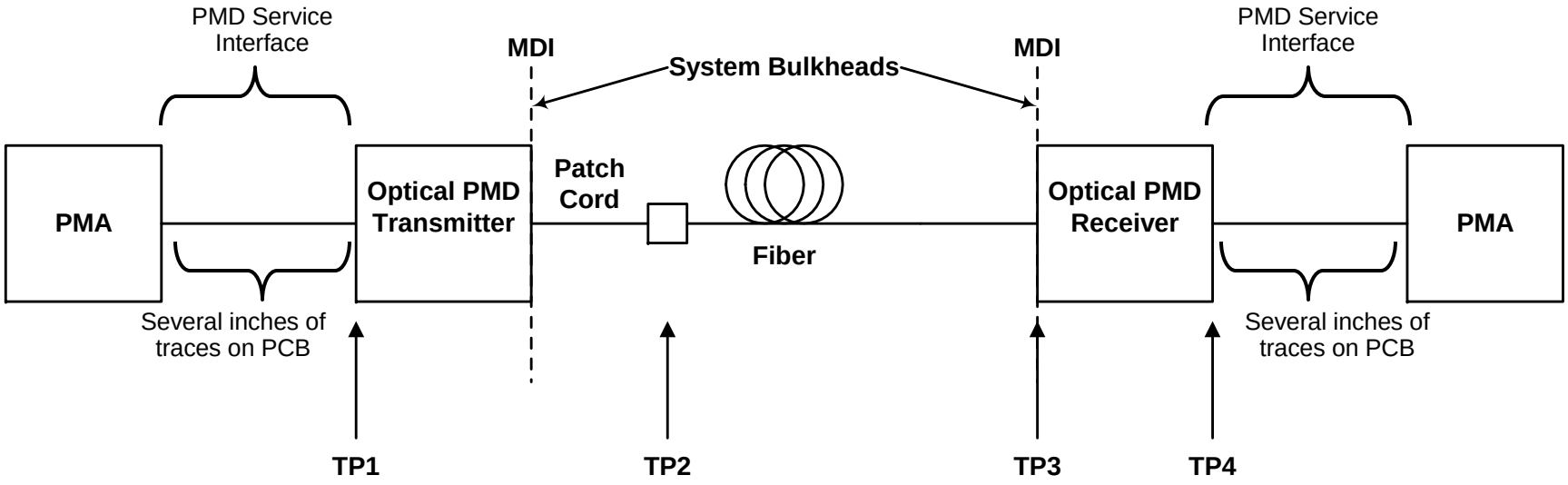
- Proposal of a limiting, non-retimed PMD to address 802.3ba objectives to reach 100m over OM3 at 100 Gb/s and 40 Gb/s
  - 10 lane parallel, short wavelength based PMD for 100 Gb/s
  - 4 lane parallel, short wavelength based PMD for 40 Gb/s
- Same per-lane specifications for both 100 Gb/s and 40 Gb/s PMD

Motivation for Non-retimed Limiting Parallel PMD Proposal

- 10 (4) parallel links operating at 10.3125 GBd utilize low cost, high performing 10 Gb/s optics and electronics used today in 10GBASE-S links
  - Limited, un-retimed interface is the highest density, lowest power, lowest cost 100m solution today
  - Uses existing, viable semiconductor technology
  - Uses known specification methods refined in SFP+ and 8GFC
- The 10 (4) optical lanes directly map the 10 (4) electrical lanes, without muxing or translation, retiming or deskewing
  - Works with all proposed striping methods
- This proposal is supported by multiple vendors and users and is economically feasible and competitive with other alternatives

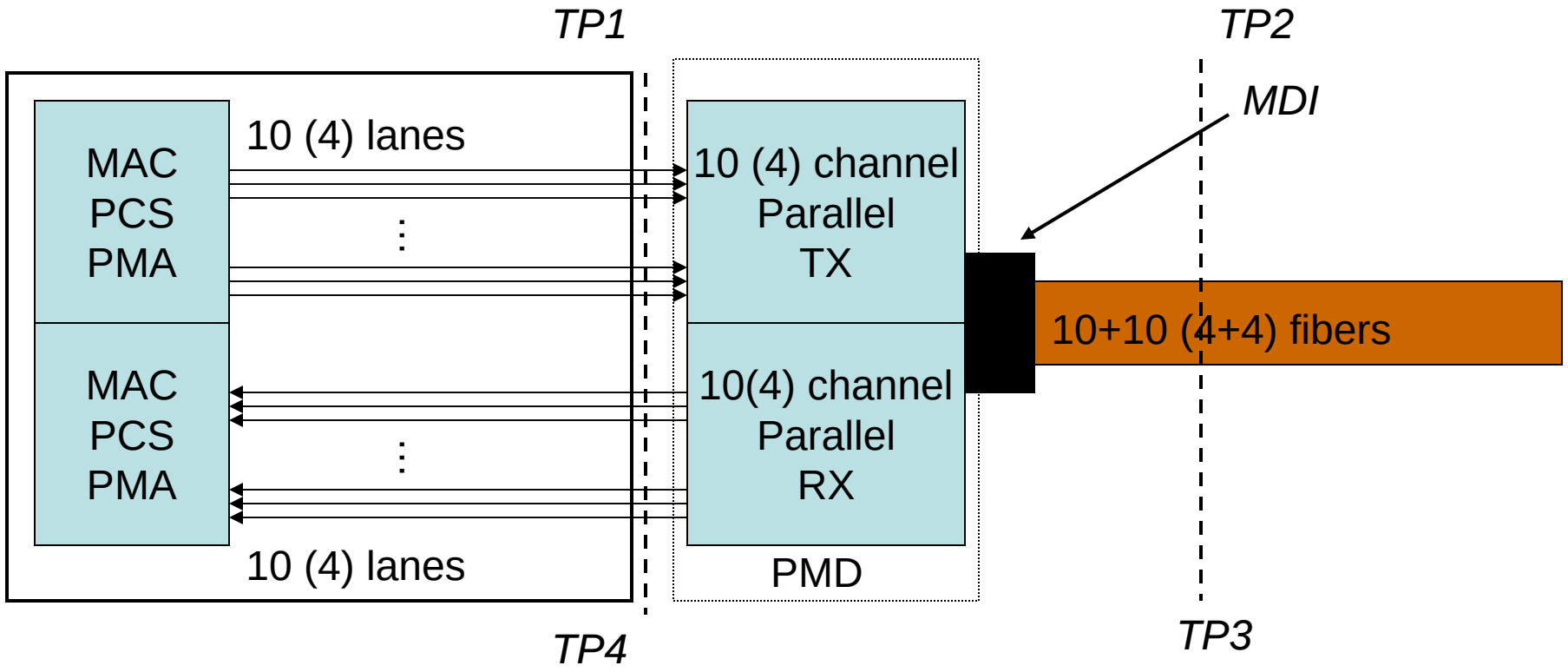
802.3ba PMD Block Diagram

- TP1, TP2, TP3 and TP4 are traditional labels in 802.3 for interfaces of a fiber optics link.
- Two physical interfaces are introduced between the PMA and PMD (TP1 and TP4)
  - PMA may be in the host ASIC, PMD is the optical module
- The block diagram below shows relevant elements and interfaces for a link between two PMAs. The patch cord is included for the definition of TP2.
  - Intermediate fiber connectors are not shown



Proposal

- 10 parallel lanes @ 10.3125 GBd for 100 Gb/s over OM3 fiber
- 4 parallel lanes @ 10.3125 GBd for 40 Gb/s over OM3 fiber
- No glue chip required
  - See also last slide



Operating range

- 0.5-100m over OM3 fiber with TBD dB allocated for connector loss
- This is more than sufficient to cover
  - all distances in HPC environment,
  - almost 100% of Enterprise Data Center Client-to-Access Channels,
  - >90% of Enterprise Data Center Access-to-Distribution Links, and
  - almost 85% of Enterprise Data Center Distribution-to-Core Channels.
- See flatman_01_0108, Data Centre Link Survey

Transmitter specifications (each lane)

Description	Value	Unit
Signaling speed (nominal)	10.3125	GBd
Signaling speed variation from nominal (max)	±100	ppm
Center wavelength (range)	840-860	nm
RMS spectral width (max)	0.65	nm
Average Launch Power (max)**	1*	dBm
Launch Power (min) in OMA	-3*	dBm
Average launch power of OFF transmitter (max)	-30	dBm
Extinction ratio (min)	3	dB
$RIN_{12}OMA$ (max)	-128*	dB/Hz
Optical return Loss Tolerance (max)	-12	dB
Encircled Flux	86% @ 19um, 30% at 4.5um *	
Transmitter eye mask definition	TBD	
TP1 jitter allocation	TBD***	U.I.

** - subject to further study*

*** - See presentation on eye safety by J. Petrilla*

**** - for further study, intermediate between 10G SFP+ and 8GFC*

Receiver characteristic (each lane)

Description		
Signaling speed (nominal)	10.3125	GBd
Signaling speed variation from nominal (max)	± 100	ppm
Center wavelength (range)	840-860	nm
Average receiver power (max)	1*	dBm
Average power at receiver input (min)	TBD*	dBm
Receiver reflectance (max)	-12	dB
Stressed receiver sensitivity in OMA (max)	TBD	dBm
- Vertical eye closure penalty (target)	TBD	dB
- Stressed eye jitter (target)	TBD	UI pk-pk
TP4 jitter allocation	TBD	UI

** For further study, depends on connector loss*

Link and Cable Characteristic

Parameter	Value	Unit
Effective Modal Bandwidth	2000*	MHz*km
Power Budget	>8.3**	dB
Operating Range	0.5-100	m
Channel insertion loss	TBD***	dB

** - depends on launch conditions*
*** - for further study*
**** - connector loss under study*

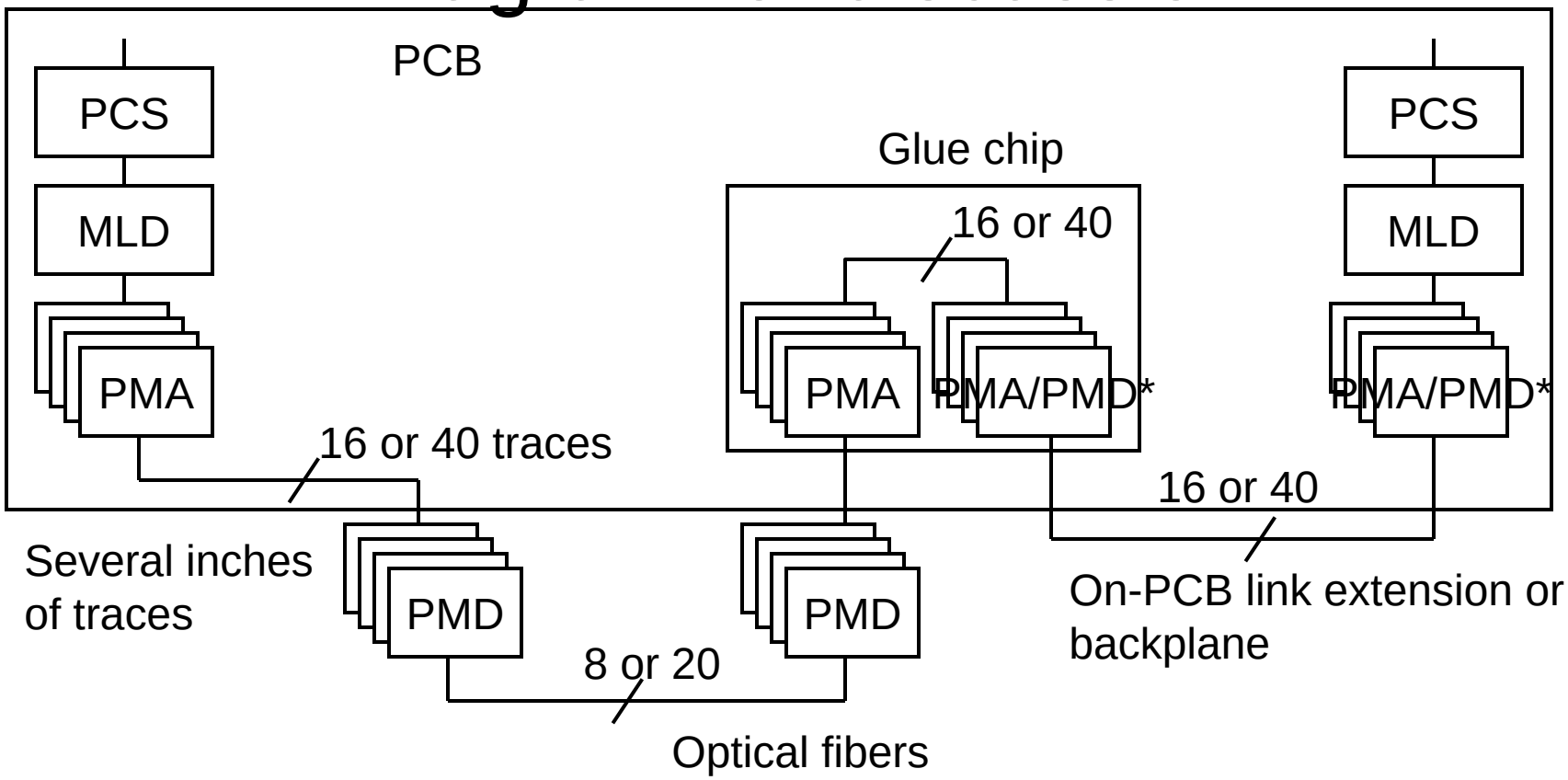
Further Work

- Jitter
- Crosstalk
- Connector loss
- Fine tune parameters/eliminate TBDs
- Compliance/testing simplification
- Study impact of Encircled Flux specs on link performance

Conclusion

- We propose 10 (4) lane parallel short wavelength based PMD with limited non-retimed interface operating at 10.3125 GBd for 100 (40) Gb/s Ethernet
- This proposal is the highest density, lowest power consumption and lowest cost 100m solution today
- This proposal uses viable, proven semiconductor technology
- It plans using known specification methodologies refined in other standards
- It has broad support from multiple vendors and users

Compatible with in-box link extenders Diagram for discussion



PMA is a CDR, possibly with simple EDC

* 10GBASE-KR PMA/PMD is different