

Considerations on duplex SMF PMDs for 400Gb/s Ethernet

Peter Stassar, Xiaolu Song, Yu Xu

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Outline

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- Choices
- Criteria for decisions
- Our view on potential decisions
- Our investigations
- Summary

Introduction

- 3 Objectives for SMF PMDs in 400GE task force (500m, 2km, 10km)
- Our application space: SMF duplex and 2km & 10km
- In May / Norfolk many presentations given, some practical, some “theoretical”
- Timeline was agreed, no time for long studies, need to make decisions
- Strawpolls were taken, so we know “preferences”, however ... not sufficient to take “right” decision(s)

Strawpoll 4A and 4B

4A. I believe that 2km 400GbE SMF PMD will use a duplex fiber solution

- Yes: 70 No: 6

4B. I believe that 10km 400GbE SMF PMD will use a duplex fiber solution

- Yes: 85 No: 0

SMF Duplex is clearly preferred for 2km and 10km

Strawpolls 5 and 6 (Chicago rules)

5. For 2km duplex SMF 400GbE PMD, I believe the TF should select a proposal based on an effective bit rate per wavelength per direction of

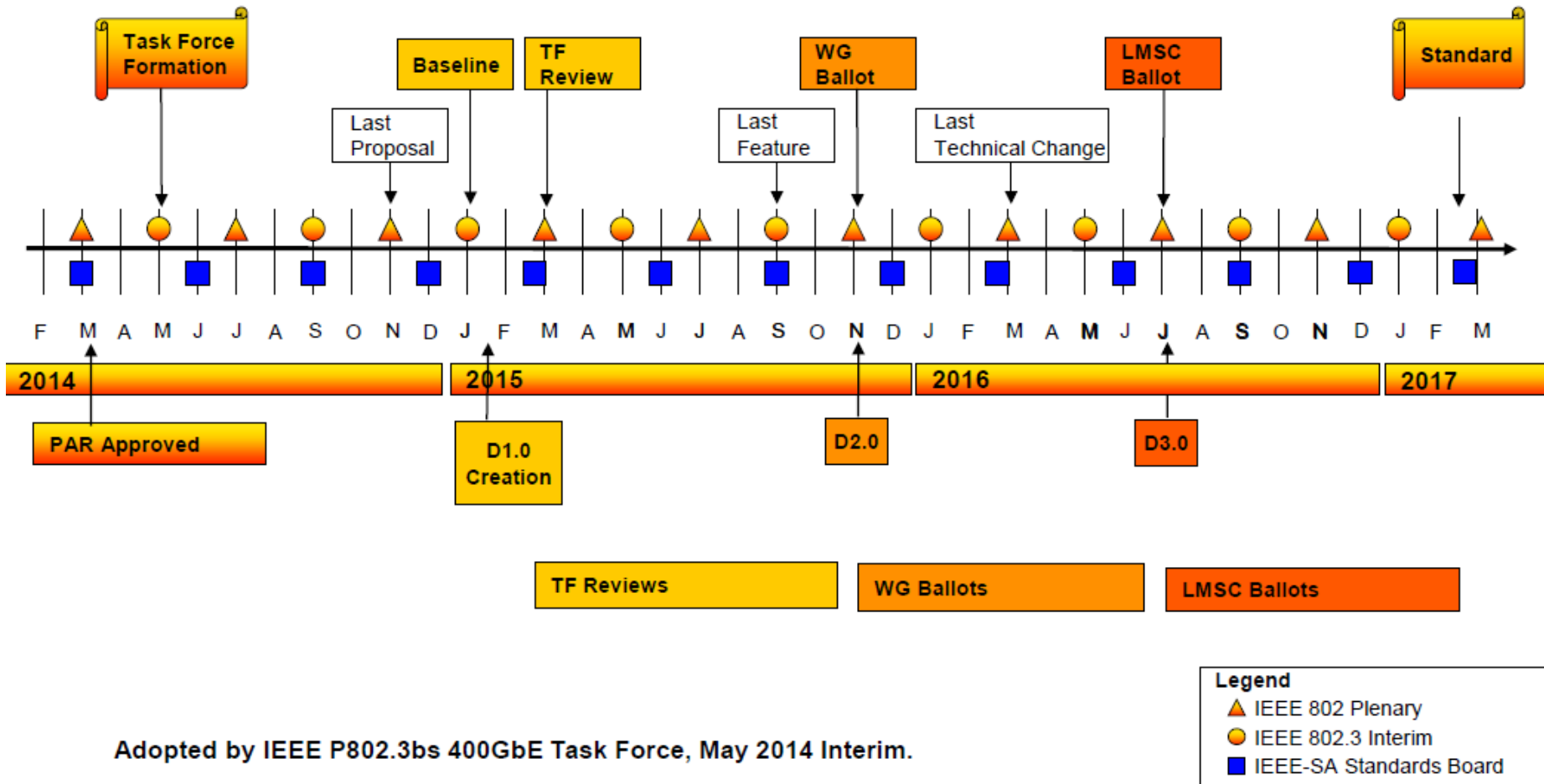
a)25G: 5; b)50G: 51; c)100G: 77; d)400G: 10

6. For 10km duplex SMF 400GbE PMD, I believe the TF should select a proposal based on an effective bit rate per wavelength per direction of

a)25G: 5; b)50G: 53; c)100G: 74; d)400G: 11

Preference 50G and 100G per optical lane for both 2km and 10km

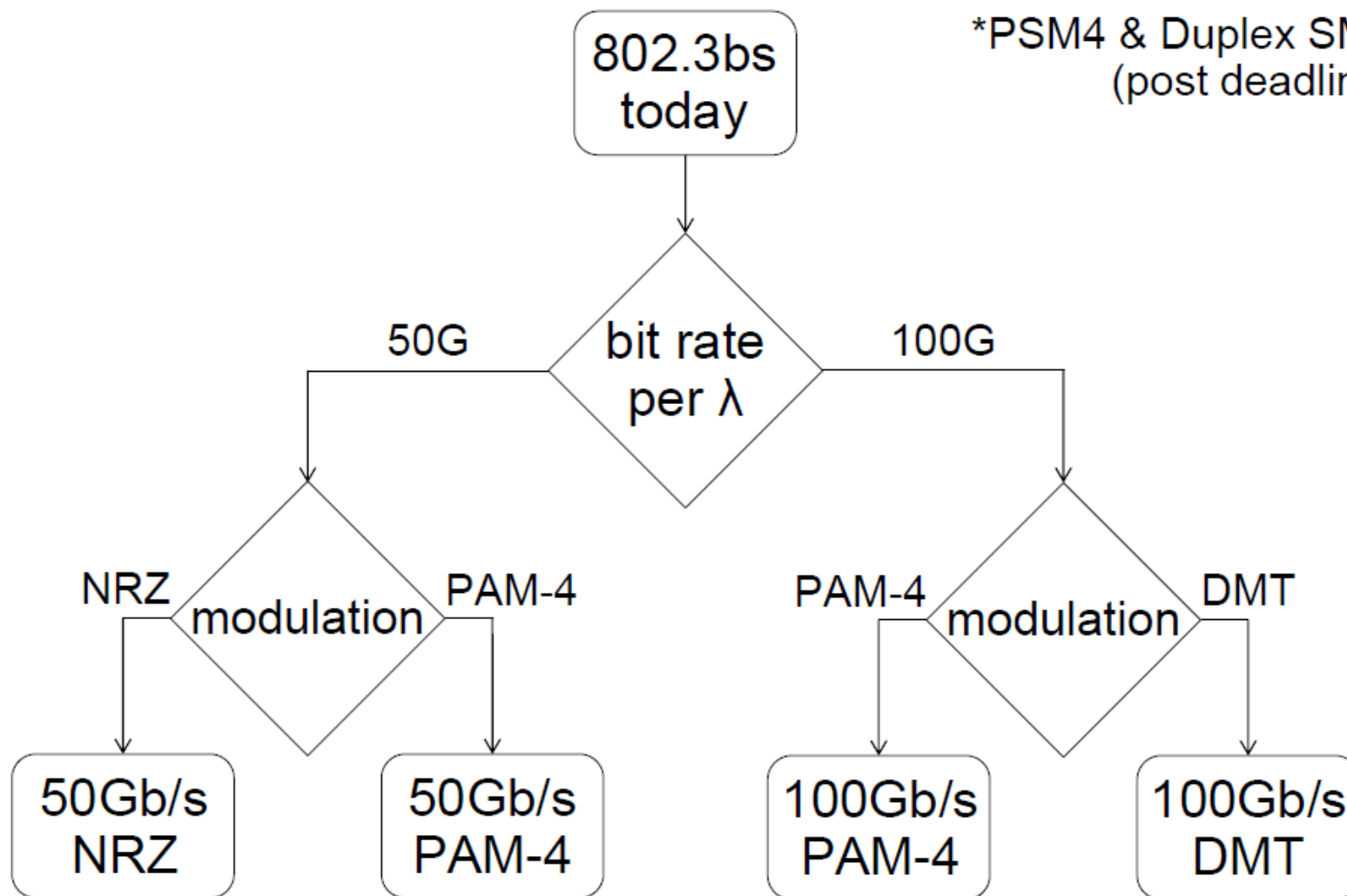
IEEE P802.3bs 400GbE Adopted Timeline



Source:
http://www.ieee802.org/3/bs/timeline_3bs_0514.pdf

Potential decision tree

*PSM4 & Duplex SMF
(post deadline)



Source:
cole_3bs_01a_0514

Criteria for decisions

- What do “we” (BS group) want/prefer?
 - Well that’s clear from the Norfolk straw polls
 - Work on both 2km and 10km SMF
 - Focus on 50G and 100G (preferred) per optical lane
- Is this enough to take a decision? **NO!!!**
- What is possible / feasible?
 - Information gathered up to now is necessary, but not sufficient evidence to be compelling for “right” decision.
- What to do more technically?
 - Complete (multi-sourced) testing of all critically important optical parameters, especially TDP, under worst case conditions.
- When do we need this?
 - ASAP, but latest November 2014.
- And then take a smart (business) decision

Our view on potential decisions

- Only a 2km PMD is not sufficient to satisfy customer needs.
- So we see 2 potential options:
 - A 10km PMD and a significantly lower cost 2km PMD
 - A 10km PMD that is also attractive to satisfy 2km needs
- We are still of the opinion that PAM4 is a very appealing approach for 2km & 10km but suitability is not yet confirmed
- We are committed to demonstrate the robustness and maturity of both configurations and cooperate with others to provide compelling evidence to support decisions.

PAM4 experimental results Norfolk, May 2014

Latest presented at Norfolk 802.3 interim in May 2014:

- 8x50G PAM4 in:
 - http://www.ieee802.org/3/bs/public/14_05/xu_3bs_01a_0514.pdf
 - http://www.ieee802.org/3/bs/public/14_05/bhoja_3bs_01_0514.pdf
 - http://www.ieee802.org/3/bs/public/14_05/way_3bs_01a_0514.pdf
- 4x100G PAM4 in:
 - http://www.ieee802.org/3/bs/public/14_05/song_3bs_01a_0514.pdf

Suggested topics for providing evidence

- Evaluate BER floor visible in shown experimental results and understand behaviour with shorter & longer PRBS length or OIF test pattern.
- Confirm robustness against MPI effects, under practical connector RL and Tx / Rx reflectance specs.
- Investigate the chromatic dispersion penalty for worst-case positive and negative dispersion.
- Establish a reasonable value for TDP.
- Develop a solid power budget as a draft baseline proposal

Business considerations

- Initially the number of 10km applications, relative to 2km applications will be much higher than several years later
- Initial volumes will be rather low
- Can our industry afford to develop both 2km and 10km solutions?
- Only smart:
 - When cost differences are significantly large
 - When additional investments are limited
 - When risks are low and yields sufficiently high
- We will need to know latest November 2014

Summary

- We are of the opinion that the first generation of 400GE modules need to do 10km
- For 10km SMF 8x50G PAM4 seems most promising
- For 2km SMF 4x100G PAM4 may be an attractive alternative
- It's too early to take a decision now
- Decisions should be made based on:
 - Solid facts (experimental demonstration)
 - Sound business considerations

Thank you