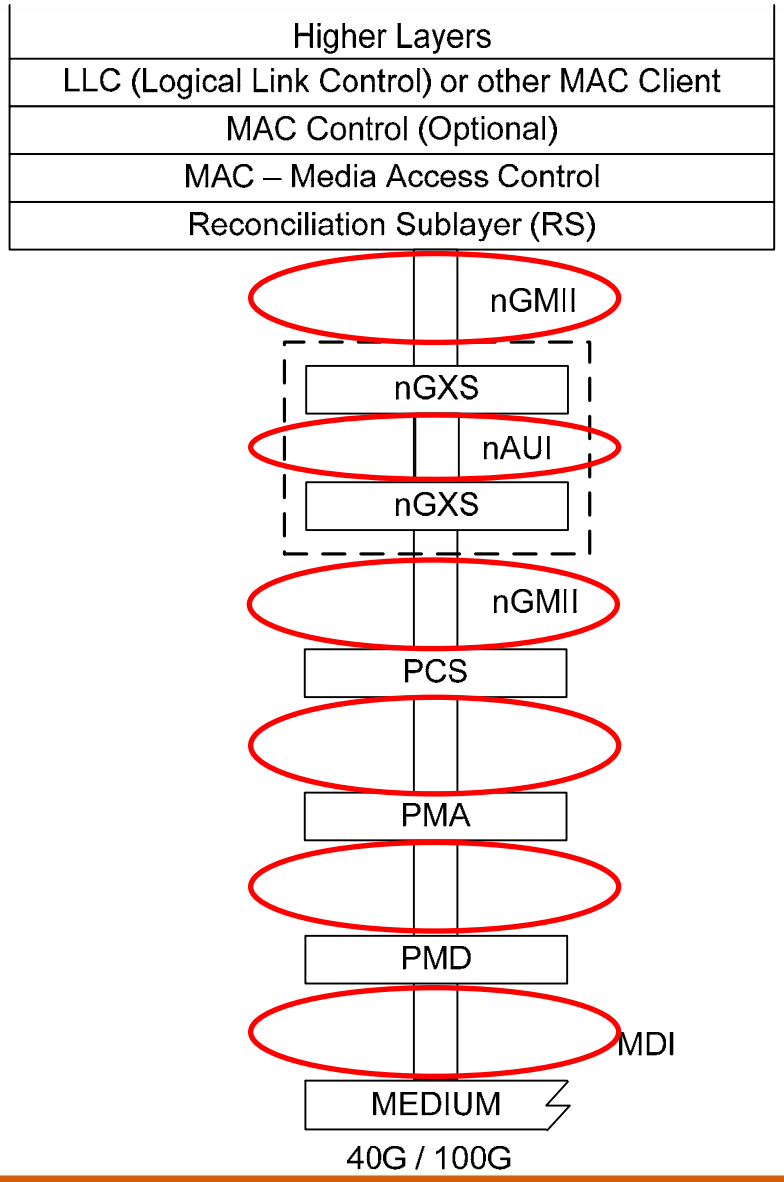
Consideration for Electrical Interfaces

Joel Goergen

VP of Technology / Chief Scientist

Introduction

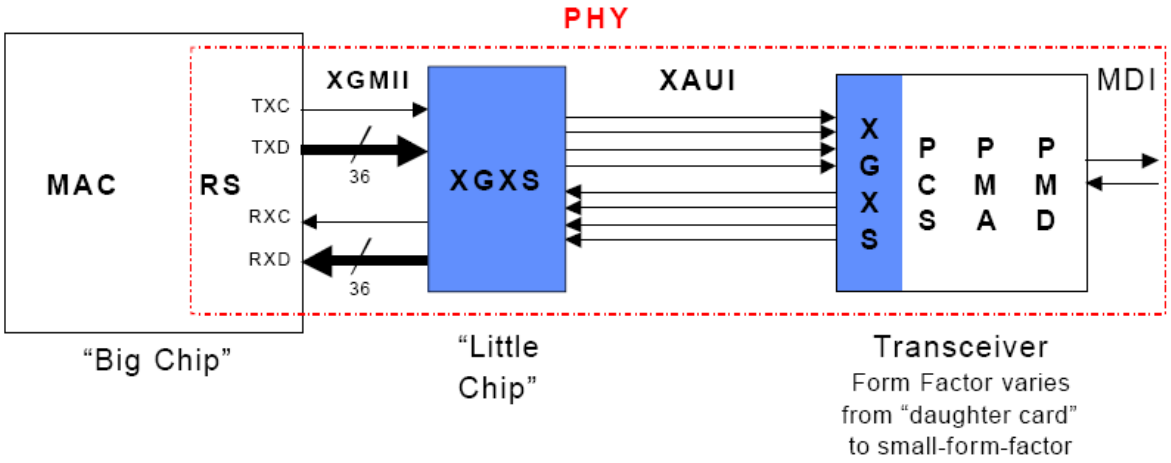
- All interfaces need to be discussed in terms of
  - Type of definition
    - Physical, Abstract, or Optional
  - Supporting 40Gbps and/or 100Gbps
  - If physical, what are signaling and channel definitions
- Necessary for a technically complete document
  - Lots of work in defining interfaces



Reality – Cut to the Chase: MAC to PMD

- No disrespect intended to the layer stack and this is not an attempt to over-simplify. It's just reality.
- nGMII is not a practical interface for the dense PMD applications of systems designed today.
  - XAUI or XFI is a practical interface today.
- There is a desire to keep the optical modules as (relatively) simple as possible.
- Group this type of electrical interface in the SR application space.
- Likely signaling solution being NRZ.

Reality – Cut to the Chase: nAUI



From: XAUI / XGXS Proposal, taborek_2_0700

- nAUI
  - Possible interface:
    - To extend nGMII?
    - Reduce width (reduce routing issues)
  - If defined, need to decide to support 40G, 100G, or both
  - Supports Back Plane
- Possible examples
  - 10 x10Gbps
  - 4 x 25Gbps or 4 x 10Gbps
- Define with evolution path in mind
- Define with advanced channel methods deployed on new designs … try to avoid legacy baggage

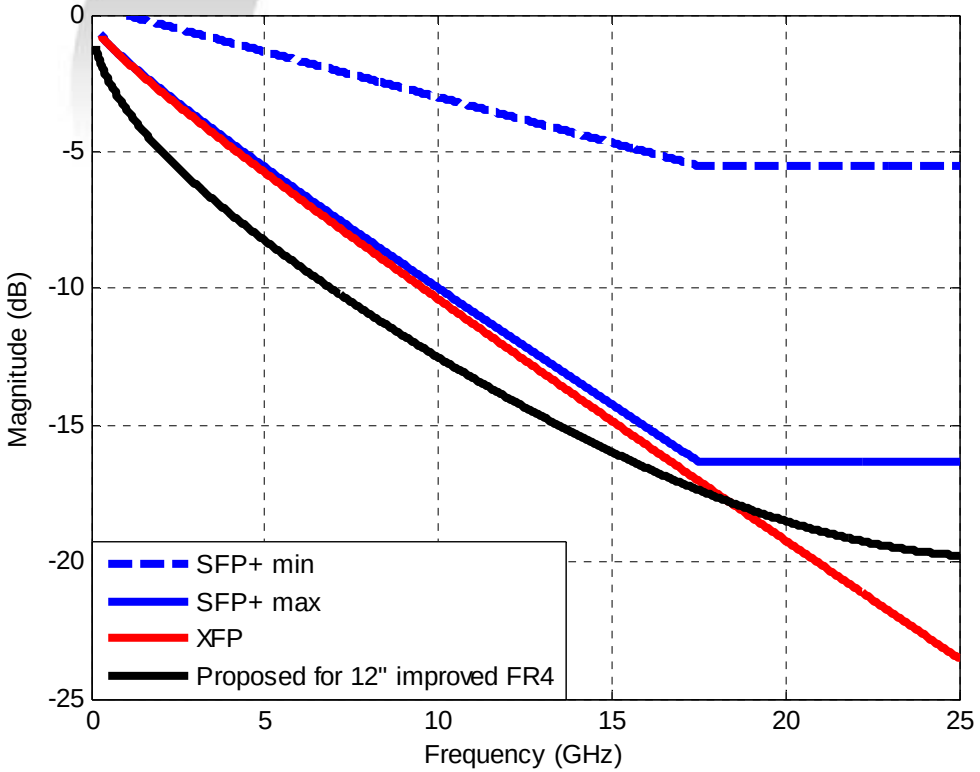
Thoughts on CAUI

- Applications
  - Chip to chip
  - Chip to module
- Input to module
  - Narrow interface is good
  - Can impact design complexity of module
- What type of channel?
  - SR – 8 to 12 inches
  - XAUI – 20 inches
  - LR – 25 to 30 inches
- Routing concerns
  - 10 x10Gbps
    - 20 differential pair
    - Signal integrity
  - 4 x 25Gbps / 4 x 10Gbps
    - 8 differential pair
    - Signal integrity

Proposed Channel Thru Response

- The following work was contributed to CEI-25 in support of next generation interfaces.
  - This work supports a higher speed interface for dense optical ports.
- Improved maximum attenuation curves for consideration of 20Gbps to 25Gbps Signaling.
  - Research demonstrates that better channels can be created using enhanced geometry techniques.
  - Based on using high resin 4000-13 or Isola 620.

Comparison of CEI-25SR Proposed Model to Industry Standards

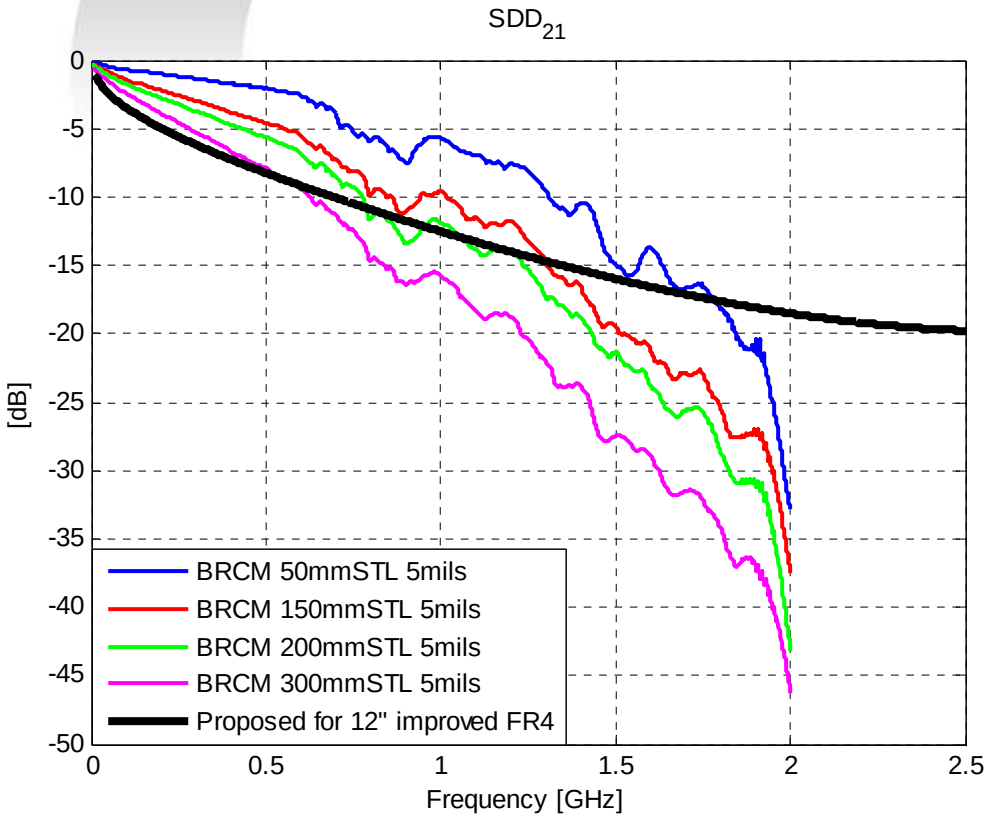


Channel Loss dB = 20*log[e]*[b1*sqr(f) + b2*(f) + b3*(f)^2 +b4*(f)^3]

b1 - 1.20E-05
b2 - 1.20E-11
b3 - 1.90E-21
b4 - -7.10E-32

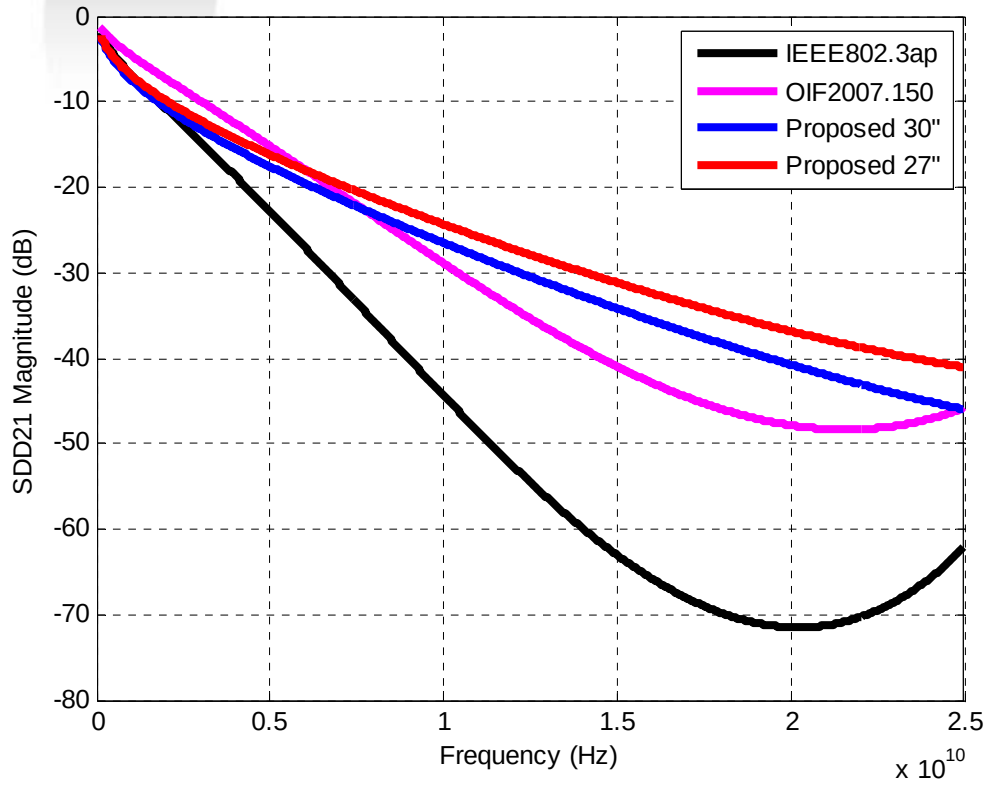
XFI / SFP+ channel models do not correlate to 12” improved FR-4. Review of Table 67, XFP specification, indicates the channel model is to approximately 6.3”.

Comparison of CEI-25SR Proposed Model to Measured SFP+ Channel Data



Comparison of proposed maximum attenuation curve to measured SFP+ channel data. (SFP+ data from Ali Ghiasi, Broadcom, T11 contribution 06-683v0)

CEI25-LR Proposed Maximum Attenuation at 27in and 30in



Channel Loss dB = 20*log[e]*[b1*sqr(f) + b2*(f) + b3*(f)^2 +b4*(f)^3]

27 Inch	30 inch
b1 - 2.40E-05	b1 - 2.60E-05
b2 - 2.10E-11	b2 - 2.30E-11
b3 - 2.70E-21	b3 - 3.00E-21
b4 - -8.20E-32	b4 - -8.10E-32

Proposed 27” Maximum Attenuation scales the loss at Nyquest frequency from IEEE802.3ap to 25 Gb/s

Conclusion

- 40G Optical Module Electrical Interface
  - Likely 1st generation based on 4 x 10.3125Gbps.
  - Expect possible 16 x 3.125Gbps or 8 x 6.25Gbps.
- 100G Optical Module Electrical Interface
  - Likely 1st generation based on 10 x 10.3125Gbps.
  - Likely 2st generation based on 4 x 25Gbps.
  - Likely someone will present a concept to negotiate between 4 x 10.3125Gbps and 4 x 25Gbps.
- Anticipate 25G proposals for >10m Cu Cabling
  - Anticipate 25G Backplane PHY in future.
- Consider looking at SR and LR channels separately for 25Gbps
  - LR channels may need more time to develop a solution.
  - LR channels may overburden SR applications so compatibility should not be a requirement.

Thoughts …

- 10G signaling today makes sense, but 25G signaling will be needed.
  - There is a future need for 4by25Gbps optics modules.
  - IEEE 802.3 needs to focus on 40Gbps and 100Gbps.
- Efforts such as OIF CEI-25 can be used to define SR and LR applications for some interfaces.
  - Allows IEEE 802.3 to refrain from some physical interface definitions.
  - Allows segments of the interface work to be done in parallel, saving time.
- IEEE P802.3ba should establish a closer rapport / liaison with OIF in support of the CEI-25 interface.