

How NPO May Fit in IEEE 400GPL

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Disclaimer

- **About timeline:** The 802.3 rules allows objectives within the scope of the PAR and CSD to be added after Task Force formation. That gives the task force time to discuss and build consensus on this proposal.
- **About the name:** In this contribution, the term “AUI-C2O” is used for easy communication , the door is wide open to a new name.
- **Suggested focus point:** A new electrical interface to support implementations that are of significant market interest but hasn't been addressed in 802.3.

Motivation

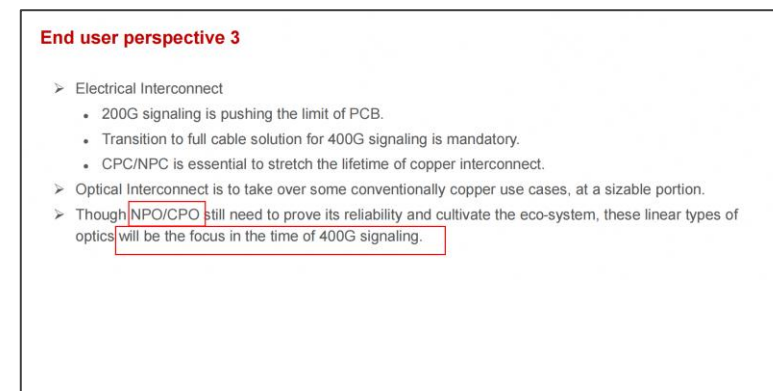
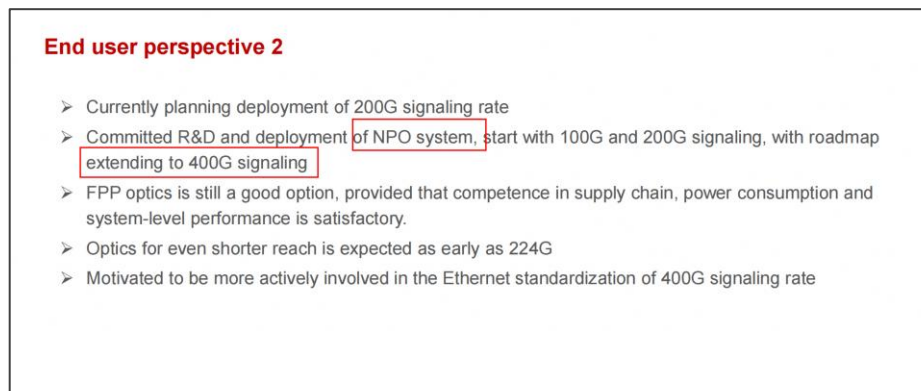
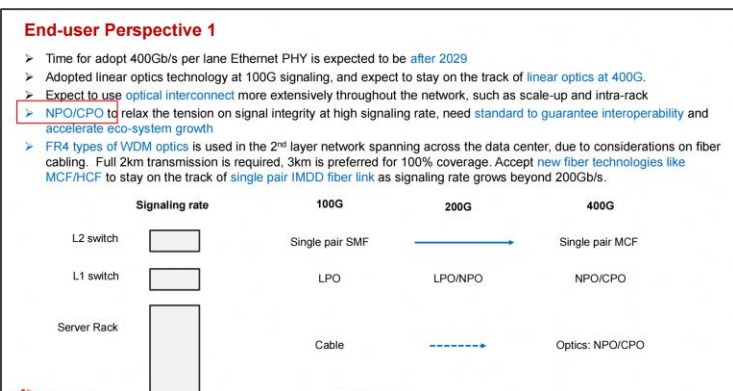
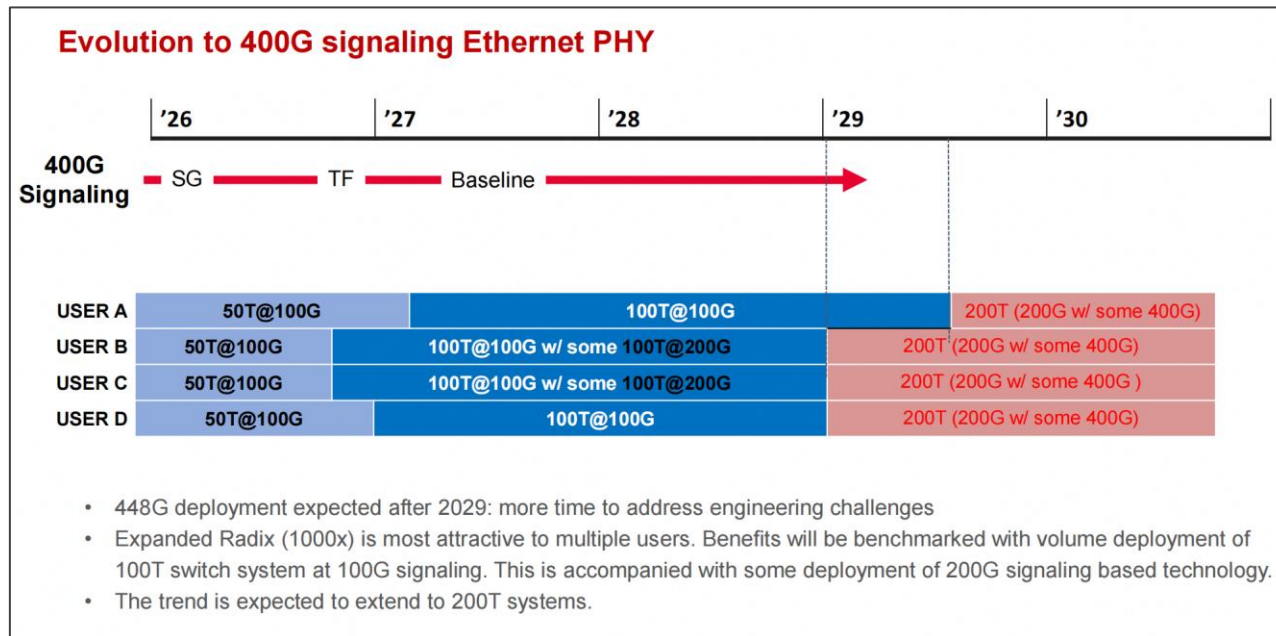
- **Scaling challenges in 400GPL Ethernet systems**
 - Increasing port density (800GE → 1.6TE → 3.2TE per port)
 - Power and bandwidth constraints of long-reach electrical interfaces
 - System-level complexity and cost
- **Emerging architectures supporting 400GPL:**
 - Fully-retimed pluggable optics → power & reach overdesigned
 - Linear pluggable optics → facing significant challenges on host loss
 - Co-packaged optics (CPO) → limited serviceability
 - Near-Packaged Optics (NPO) emerging as practical compromise!

Supporters

- Eric Maniloff, Ciena
- Roberto Rodes, Coherent
- Bill Simms, NVIDIA
- Jeffery Maki, HPE.
- Adee Ran, Cisco
- Leon Bruckman, NVIDIA

Broad Market Potential

- E4AI contribution [mi_e4ai_01_260219](#)
gathered input from End-users on expectations for 400G per lane Ethernet interfaces:
Strong mutual interest in NPO



Background – Industry Activities

- **OIF EEI (Energy Efficient Interfaces):**
 - Focusing on short-reach, high-speed electrical interfaces, targeting chip-to-optics connectivity in advanced packaging scenarios
- **OIF HDC (High-Density Connector):**
 - Defines high-density electrical connector solutions, enabling short-reach, high-bandwidth module interconnects
- **Other Ecosystem Efforts:** Various MSAs and industry groups exploring:
 - Co-packaged optics (CPO)
 - Near-packaged optics (NPO): Open CPX MSA
 - Alternative pluggable form factors, e.g. XPO
- Strong activity exists in electrical interfaces and mechanical/form factor, but gap remains: No IEEE-defined interoperable electrical interface for NPO systems
- 400GPL is the perfect time to include support of NPO in IEEE 802.3.

Current IEEE 802.3 Coverage (and Gap)

- **Interoperable interface classes supported by current IEEE 802.3 standards**

Interface	Scope	Standardized?	Domain
AUI	Chip-to-module and chip-to-chip interfaces	YES	Electrical
PMD	Optical links	YES	Optical
CPO internal	Host to optical engine	NO, no need to define	Electrical
CPO external	Optical links	YES, rely on DR/FR specs.	Optical
NPO internal	Host to optical engine	NO, should be defined	Electrical
NPO external	Optical links	YES, rely on DR/FR specs.	Optical

How NPO is Different

- **IEEE philosophy:**
 - If two independently built things might connect → standardize the interface.
- **For CPO:**
 - There is no exposed interoperable electrical interface
 - Optics are tightly coupled to ASIC (no “plug boundary”)→ No need to standardize in IEEE.
- **For NPO, there is a replaceable module:**
 - There is a short-reach electrical interface
 - Vendors will mix – vendor A’s host can be connected with vendor B’s module.→ NPO naturally fits IEEE’s interoperability scope, unlike CPO.

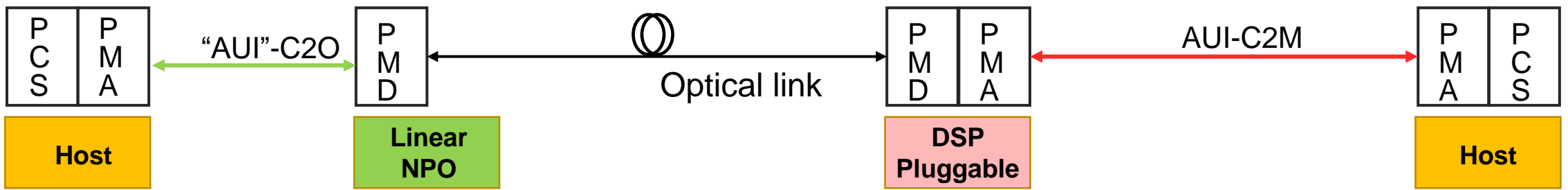
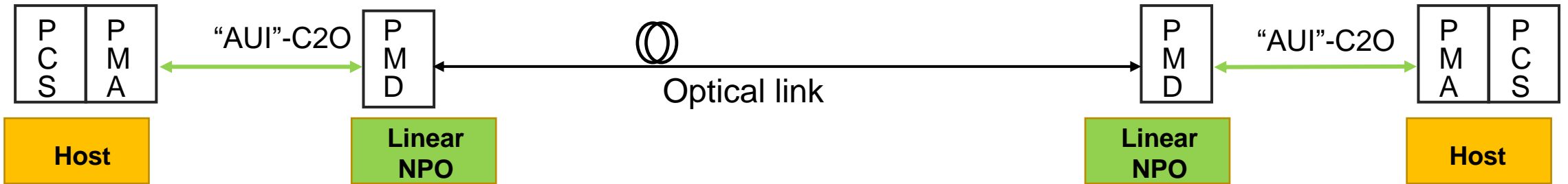
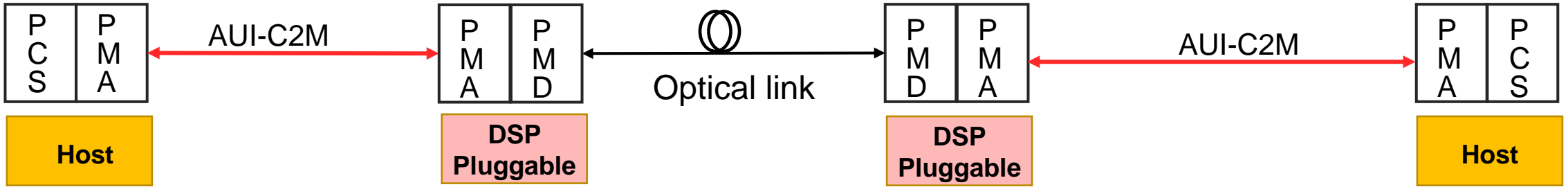
Near-Packaged Optics (NPO) Objectives – Nothing special needed!

- **The optical side should follow optical PMDs**
- **The electrical side requires a new class of “AUI” , a shorter reach electrical interface.**
 - Option A: a new name (C2O?) – preferred
 - Option B: Include in the C2M objectives – a sub-type of C2M (e.g. C2M-NPO).

Future work for the Task Force:

- Define a short-reach electrical interface between host devices and NPO modules supporting interoperable multi-vendor implementations.
- Specify electrical characteristics for it
- Define channel characteristics for it
- Define compliance and test points enabling interoperability between host devices and near-packaged optical modules.

The New “C2O” Interface Completes the Ethernet Interface Stack



* AUI-C2C instantiation was not illustrated, for simplicity

Summary

- For the first time, NPO introduces a **pluggable** yet ultra-short electrical interface that requires interoperability, something neither CPO nor traditional FPP pluggables address today.
- We propose to start investigation on adding a separate “AUI” type to include NPO for the 400 Gb/s per lane generation. (No rush, but think of it!)

Proposed objectives for consideration:

- Support optional single-lane 400 Gb/s attachment unit interfaces for near-package optics applications
 - Support optional two-lane 400 Gb/s attachment unit interfaces for near-package optics applications
 - Support optional four-lane 400 Gb/s attachment unit interfaces for near-package optics applications
- Call for action: find a new nomenclature for this ultra-short electrical interface addressing new market needs

Thank you!