Consensus Building on Greater than 50 Gb/s Bidirectional optical access PHYs

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Outline

- Background
- Basic requirements for optical access Ethernet
- Market considerations
- Potential solutions for BiDi PMDs

Background activities

- This work is an extension of the 802.3cp project on bidirectional optics for access networks, and aims to standardize speeds higher than 50 Gb/s
- Several NEA sessions were held where the bidirectional higher speed idea was socialized
  - Generally well received, with no obvious major issues raised
- At the recent SG15 plenary, it was agreed to begin work on an amendment of recommendation G.9806 that would cover higher speed bidirectional fiber access links
  - Just as the current G.9806 heavily leverages the work done in 802.3cp, this new amendment is expected to follow the same model

Existing BiDi Ethernet Access

Part of P802.3ah EFM (2004)

- 100BASE-BX10 (Cl 58, 66)
  - Similar to ITU-T G.985
- 1000BASE-BX10, (Cl 59, 66)
  - Similar to ITU-T G.986

Part of P802.3cp (2021)

- 10GBASE-BR10, 20, 40 (Cl 158)
- 25GBASE-BR10, 20, 40 (Cl 159)
- 50GBASE-BR10, 20, 40 (Cl 160)
  - Similar to ITU-T G.9806

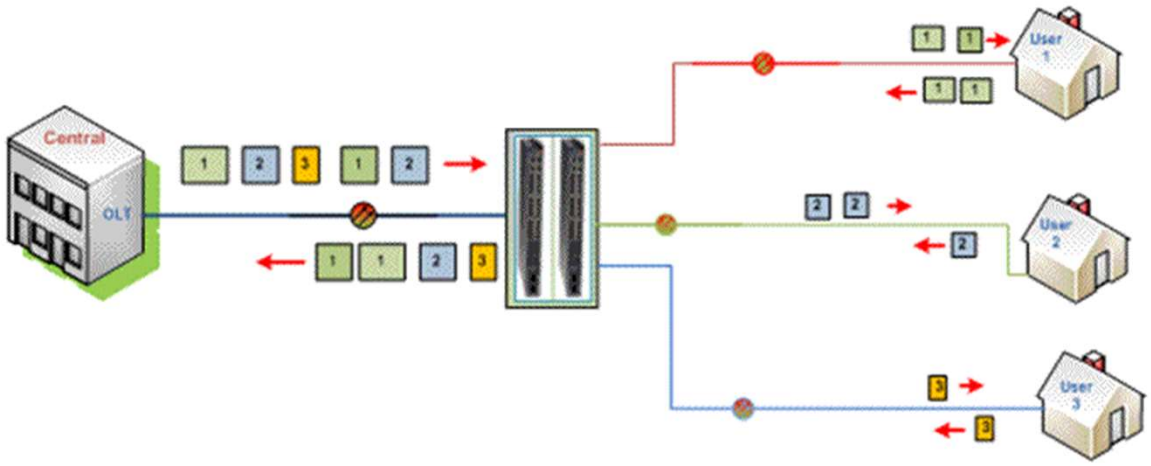
Requirements for Access Ethernet

- Operate over single strand of single mode fiber (G.652)
- Same reach and loss budget as lower rate PMDs
- Silent start behavior (ONU only speaks when spoken to)
- Power saving behavior (EEE and link rate adaptation)
- OAM features, such as Port-ID
- Support for synchronization / ToD

Market considerations

- There are three main applications for P2P access Ethernet
  - FTTBusiness
  - FTTHome
  - Wireless fronthaul (and backhaul)

Use of P2P for FTTH



FTTH market share by technology

- Worldwide FTTH market is quite large
  - That figure expected to remain steady over the next decade
  - Market currently in a crossover period
    - GPON and EPON are slowly declining in economic volume
    - XG(S)-PON and 10GEPON are increasing in volume
- P2P (aka Active Ethernet) responsible for a steady portion of FTTH
  - Basically, 5% of the worldwide market

P2P for G.fast backhaul

- G.fast is a high-speed copper technology
- Common usage is to place ONUs at the drop point or entry point of building
- Those ONUs need a backhaul solution, and P2P is one potential solution

FTTWireless

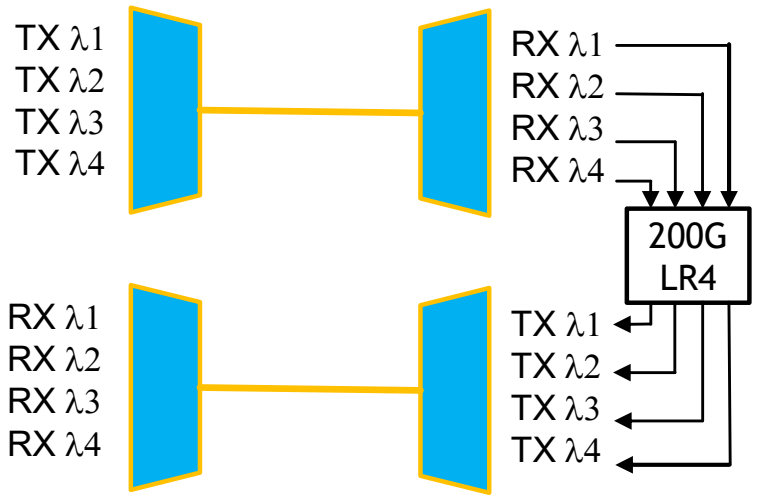
- eCPRI is a major application of P2P PMDs
  - eCPRI is more efficient than its predecessor, but 5G uses so much more bandwidth that we still need 25G up to 100G links in the fronthaul
- Volumes of 50G bidirectional modules already significant
  - Perhaps 200 thousand ports per year
- Interesting linkage of BiDi and wireless
  - Wireless systems need good Time-of-day data
  - Using conventional dual-fiber optics can have fiber delay skew
  - Bidirectional optics can't have skew, as there is only one fiber

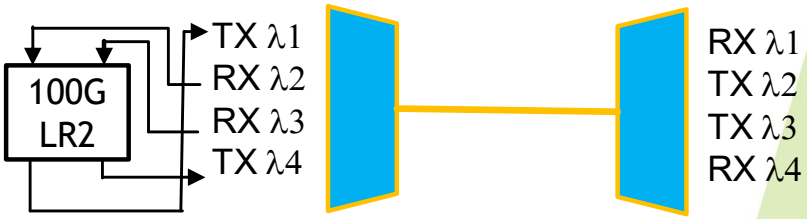
Potential solutions and challenges

- It is highly desirable to reuse existing PMDs and their sub-components
  - 50G per wave, 100G per wave, coherent
- As speeds increase, the design space becomes naturally smaller
  - No chance of uncooled wide spectrum bands
  - Fiber dispersion is far more severe
  - Four wave mixing can be a factor

Maximizing reuse

- Starting from a multi-wavelength PHY of bandwidth 2B, it should be possible to define a bidirectional PHY of bandwidth B that has no new optical components





Speeds of possible interest

- 100GBASE-BR – Definite interest in this speed
  - Two wavelengths at 100G each
  - Four wavelengths at 50G each
- 200GBASE-BR – Some question on the market demand
  - Four wavelengths at 100G each
  - Eight wavelengths at 50G each
- 400GBASE-BR – Some indications that this is attractive
  - Eight wavelengths at 100G each
  - Two coherent wavelengths at 400G each

Conclusions

- P2P optical access appears to be a viable use case for Ethernet technology
  - Certainly technically feasible, leveraging existing PHYs
  - Market opportunity is of reasonable size
- Why do this work in 802.3?
  - This is the rightful home of this technology
  - The special requirements (silent start) can reach a wider audience

Thank you

Questions? Comments?

(Straw polls to follow)

Straw Poll #1

- I would participate in the “Greater than 50 Gb/s Bidirectional optical access PHYs” Study Group in IEEE 802.3
  - Yes xx No xx Abs xx

Straw Poll #2

- I believe my affiliation would support my participation in the “Greater than 50 Gb/s Bidirectional optical access PHYs” Study Group in IEEE 802.3
  - Yes xx No xx Abs xx