Call For Interest Bidirectional 10Gb/s and 25Gb/s optical access PHYs

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Frank Effenberger, Huawei Technologies

Supporters

- Akio Tajima, NEC
- Albert Rafel, British Telecom
- Barry Colella, Source Photonics
- Cao Li, Accelink
- Curtis Knittle, Cablelabs
- David Li, Hisense Broadband
- Derek Cassidy, ICRG/IET
- Duane Remein, Futurewei
- Ed Harstead, Nokia
- Fabrice Bourgart, Orange
- Frank Effenberger, Futurewei
- Franz J. Schaefer, Intel
- Glen Kramer, Broadcom
- Hal Roberts, Calix
- Jiang Yi, Accelink
- John Johnson, Broadcom
- Jun Shan Wey, ZTE
- Kazuki Tanaka, KDDI Research, Inc.
- Kent McCammon, AT&T
- Leo Lin, Finisar
- Maurizio Valvo, Telecom Italia
- Peter Dawes, Vodafone Group
- Viput Bhatt, Finisar
- Yong Guo, ZTE

Outline

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

Background activities

- The origin of this work comes from network operators, who use bidirectional optics in their access networks, and want to standardize higher speeds
- There was an NEA session where the bidirectional higher speed idea was socialized
  - Generally well received, with no obvious major issues raised
- There was also a workshop between IEEE 802.3 and ITU-T SG15, where the optical access systems being standardized were discussed
  - One of the findings there was that the two groups should work to collaborate to specify bidirectional optics
- At the recent SG15 plenary, it was agreed to begin work on a new recommendation (G.9806) that would cover higher speed bidirectional fiber access links
  - This project is intended to work hand-in-hand with its counterpart in 802.3

Existing BiDi Ethernet Access

- Part of P802.3ah EFM (2004)
- 100BASE-X (Cl 58, 66), 100 Mb/s, 10 km
  - 100BASE-LX10 - 2 fiber (1310 nm)
  - 100BASE-BX10 - 1 fiber (1550 nm DS, 1310 nm US)
  - Similar to ITU-T G.985
- 1000BASE-X (Cl 59, 66), 1 Gb/s, 10 km
  - 1000BASE-LX10 - 2 fiber (1310 nm), SMF / MMF(550 m)
  - 1000BASE-BX10 - 1 fiber (1490 nm DS, 1310 nm US)
  - Similar to ITU-T G.986

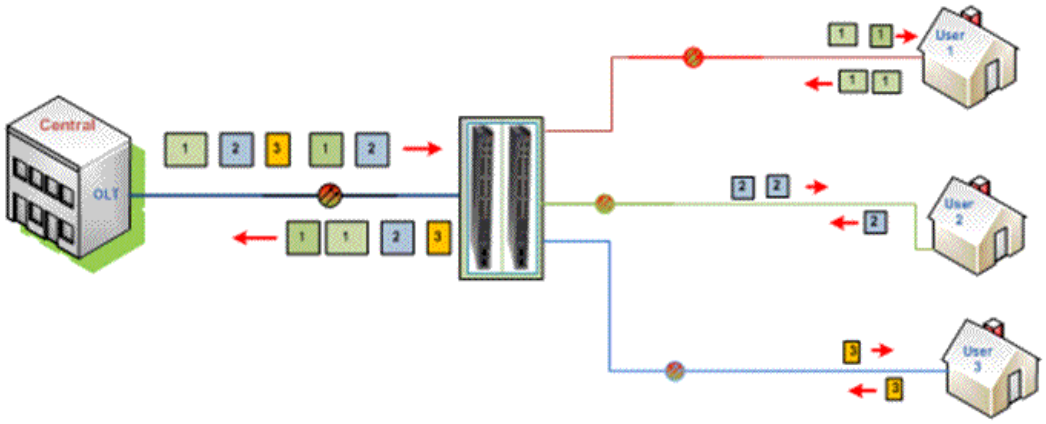
Requirements for Access Ethernet

- Operate over single strand of single mode fiber (G.652)
- Reach of 20km typical; 40km if possible, 10km if much cheaper
- Loss budgets Class S = 0~15dB, Class A: 5~20dB
  - Maybe similar to G.985 / G.986 classes
- 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
  - Currently dominated by GPON and EPON
    - "Peak G-PON" happened in 2016
  - Expected to slowly shift to XGS-PON and 10GEPON
    - Crossover time ~2020
- P2P (aka Active Ethernet) responsible for a steady portion of FTTH revenue
  - Basically, 5% of the worldwide market

Independent Operator technology usage

- Independent telcos tend to use Active Ethernet
- A recent study showed that
  - 480 providers used G-PON
  - 193 providers use active Ethernet
  - ~30% of the independent operator market

FTTWireless

- CPRI and eCPRI look to be major applications of P2P PMDs
  - CPRI is very inefficient, easily justifying 10G or higher
  - eCPRI is thankfully more efficient, but 5G uses so much more, we still need 25G up to 100G links in the fronthaul
- Volume estimation
  - 3B people / (100 people / RU) / 10 year rollout = 3M ports / year
- Per-port willingness to pay significantly higher than FTTH
  - Total revenue could surpass the existing market

Potential solutions

- The biggest issue regarding the PHY is the change to single fiber working (full duplex)
- Primarily, this is a wavelength question
  - Existing PHYs use the same wavelengths on both sides
  - This makes both sides identical, which is good for P2P (there isn't a low volume OLT and high volume ONU)
- We need to find two wavelengths, hopefully that already exist in the marketplace

Possible approach for 10Gb/s

- Start with 10GBase style optics
  - 10GBase-LR works at 1260-1355nm
  - 10GBase-ER works at 1530-1565nm
- P2P could use ER downstream, and LR upstream

Possible approach for 10Gb/s

- Start with 40GBase-_R4 style optics
  - 40GBase-LR4/ER4 use CWDM grid optics: 1271, 1291, 1311, 1331nm
- P2P could use 1331nm downstream, 1271nm upstream

Example from the marketplace

Optical Transceivers

10Gb/s Bidirectional 10km SFP+ Optical Transceiver

FTLX2071D3xx

(https://www.finisar.com/sites/default/files/styles/colorbox/public/product-images/FTLX2071D3xx%20SFP%2B%20Bi-Di.jpg?itok=eb850gQj)

Form Factor: SFP+

Finisar's FTLX2071D327/FTLX2071D333 10Gb/s Enhanced Small Form Factor Pluggable SFP+ transceivers are designed for use in 10-Gigabit Ethernet links up to 10km over a single-strand Single Mode fiber. This capability doubles the capacity of installed legacy single mode fiber links. They are compliant with SFF-8431 and IEEE 802.3ae 10GBASE-LR/LW, and 10G Fibre Channel 1200-SM-LL-L. Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472.

The FTLX2071D327/FTLX2071D333 is a "limiting module", i.e., it employs a limiting receiver. Host board designers using an EDC PHY IC should follow the IC manufacturer's recommended settings for interoperating the host-board EDC PHY with a limiting receiver SFP+ module. The optical transceiver is compliant per Directive 2011/65/EU. See Finisar Application Note AN-2038 for more details.

- Key Features
- Applications
- Downloads
- Specifications

Distance:	10 km
Data Rate (max):	10.5 Gb/s
Protocol:	10x Fibre Channel Compliant, 10 Gigabit Ethernet Compliant, Wireless CPRI Compliant
Low End Case Temperature (°C):	-40
High End Case Temperature (°C):	85
Diagnostics:	Digital
Transmitter:	DFB Laser
Receiver:	PIN
Voltage Supply:	3.3
Connector:	LC
Wavelength:	BiDi 1271/1331nm

Possible approach for 25G

- Start with 25GBase-ER style optics
  - 25GBase-ER works at 1295-1310nm
- Other wavelength could be borrowed from 802.3ca
  - One of the upstream choices is 1260-1280nm
- P2P could use 1295-1310nm downstream, 1260-1280nm upstream

Possible approach for 25 Gb/s

- Start with 100GBase-_R4 style optics
  - 100GBase-LR4/ER4 use 1295, 1300, 1305, 1310nm
- P2P could use 1310nm downstream, 1295nm upstream

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 Poll #1

- Should a study group be formed to consider bidirectional 10Gb/s and 25Gb/s PHYs?
  - All in the room: Yes 40 No 0 Abs 2
  - 802.3 Voters: Yes 31 No 0 Abs 3

Straw Poll #2

- I would participate in the bidirectional study group, if formed?
  - Tally 16 individuals from 13 entities