The Needs of Asymmetric 25G Rate for 100G EPON

- And the impacts on wavelength plan

Eugene (Yuxin) Dai
Cox Communications
IEEE 802.3ca 100G EPON TF
July 9 - 14, 2017
Berlin, Germany

Outline

- The needs for 25G asymmetric rate
- The application of asymmetric 25G EPON
- Coexistence and impacts on wavelength plan

The status of the 25G asymmetric discussions

- The asymmetric 10G/25G has been discussed for some time along with the wavelength discussions (> 20 months?).
- There were several contributions, the most recent were from the last two meetings.
- No decision has been made.

This contribution discusses under what conditions the 25G asymmetric rate is needed and the impacts on coexistence and wavelength plan

Why the 25G asymmetric rate is needed or not needed?

- The 25G asymmetric rate is needed under TWO conditions
  a). The 25G burst mode receiver is difficult to implement
  b). The cost for symmetric 25G is too high
- There are no experiment demonstrations of 25G burst receiver for PON as of today (to the author's understanding)

Therefore, asymmetric 10G/25G is needed to provide the first low cost 25G PON to the market

Low cost 25G PON applications

- By reusing 10G PON burst mode transmitter and receiver, the cost of asymmetric 10G/25G will be lower
- The market for low cost 25G PON is mainly for small/medium businesses and residential customers
  - Asymmetric ratio for asymmetric 10G EPON is 1:10
  - Asymmetric ratio for asymmetric 25G PON is 1:2.5
- The residential traffic is asymmetric with relatively large asymmetric ratios
- The small/medium business customers data traffic (Internet, email…) is still asymmetric

The asymmetric ratio of 10G/25G PON is about right for residential and small/medium business customers

Symmetric 25G PON/100G PON

- The killer application of symmetric 25G and 100G EPON will likely be in the aggregation and transport segments of networks
- PON mobile backhaul and fronthaul applications are already moving towards this direction with GPON…
- Symmetric 25G and 100G EPON may be used for small data center interconnections
- RPHY (remote PHY) backhaul may be a killer application of the 25G/25G and 100G EPON for MSOs

As for network transportation, the cost of symmetric 25G & 100G PON are not as sensitive as for residential and small/medium applications

Wavelength allocation for asymmetric 25G PON

- Symmetric & asymmetric 25G PON will share downstream wavelength. The main problem is in upstream
- There are 2 choices for upstream
  - Reuse 10G EPON US wavelength – 1270nm ± 10nm
  - Find a new wavelength in the already tight O band space or in other bands
- Finding a new wavelength
  - May solve the lack of 25G burst mode receiver problem, but will not give the lowest cost for 25G PON
  - Besides, it will make allocation of wavelengths for 100G more difficult

Reuse 10G EPON US wavelength will solve both problems

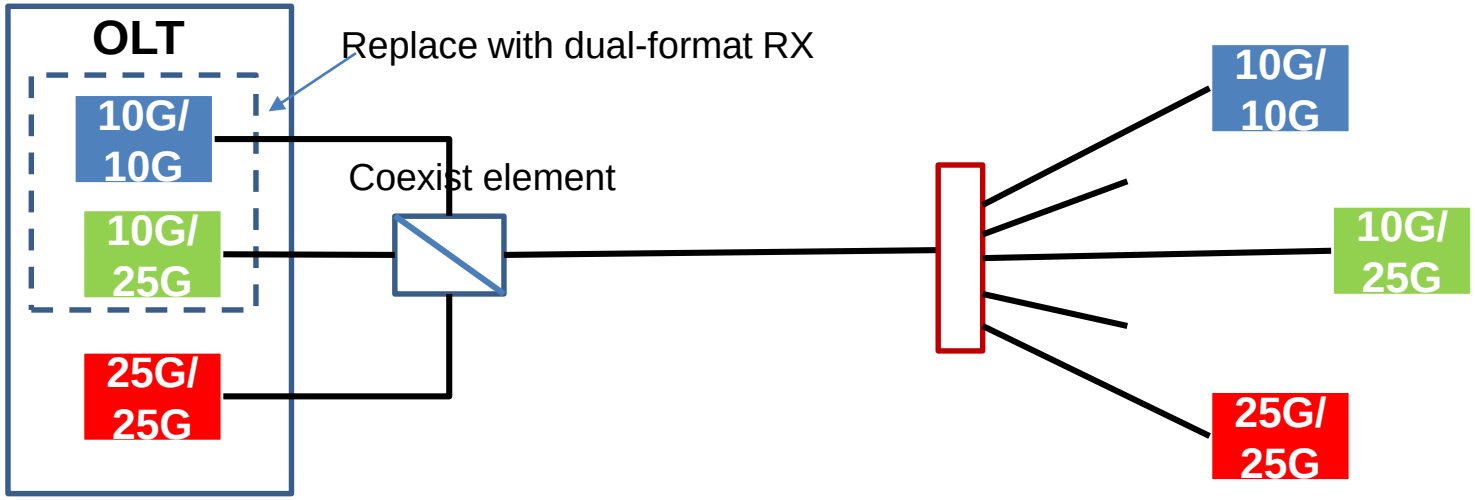
Reuse 10G EPON US wavelength

- Reuse 10G EPON US wavelength and optics results in the lowest cost asymmetric 10G/25G EPON or channel
- This means asymmetric 25G upstream has to have TDMA coexistence with 10G EPON
  - 10G/25G and 10G/10G have the same upstream rate
  - However, TDMA coexistence is still possible
    - Asymmetric 25G and 10G EPON upstream has different frame structure
- At the same time it has to coexist with symmetric 25G
  - TDMA or WDMA is still a question

Dual-format receiver is possible for asymmetric 10G/25G EPON/channel coexisting with 10G/10G EPON

Coexistence of 10G EPON, asymmetric and symmetric 25G EPON

- The 10G/25G EPON/channel has no major technical challenges, therefore, it is expected to be deployed first
- It is highly likely that 10G/25G will coexist with 10G/10G EPON
- When symmetric is 25G available, some 10G/25G customers, such as business customers, may upgrade to 25G/25G



Coexistence of symmetric 25G

- The 25G/25G could coexist with 10G/25G using TDMA; that means 10G/10G, 10G/25G and 25G/25G will TDMA coexist
  - Advantage: Save wavelength resources
  - Disadvantage: Scheduling efficiency is low and more complexity with dual-rate dual-format burst mode receiver
- The 25G/25G could coexist with 10G/25G and 10G/10G using WDMA
  - Advantage: Higher scheduling efficiency and easier integration to 100G/100G. That means the 100G EPON WDMA coexists with asymmetric 25G and 10G/10G.

Symmetric 25G WDMA coexists with asymmetric 25G; asymmetric 25G TDMA coexists with 10G/10G.

Conclusions

- Asymmetric 10G/25G is needed
  - to provide the lowest cost 25G EPON for residential and small/medium business customers
  - when the burst mode 25G receiver is difficult, and/or too costly
- Reusing 10G/10G EPON optics is necessary for lowest cost asymmetric 25G EPON
  - Therefore 10G/25G has to TDMA coexist with 10G/10G EPON
- Symmetric 25G is likely for network backhaul applications which could absorb higher cost

Thanks

Eugene.dai@cox.com