

Multi-rate as a Path forward for 25/50/100GE-PON

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What we have

- Downstream is not seen to be a problem
 - O+ band, 1335 to 1360nm
 - EML Tx, APD Rx, Maybe a preamp if we need
- Upstream is the big issue
 - Wide windows in the O- band desired
 - Coexistence with previous systems
- Two wavelength bands have been agreed
 - 1270nm and 1310nm

A new view of requirements

- It has come to our attention that many major operators are not interested in a 25G only system alone
- 10GE-PON is in deployment now, and by the time the next system is needed, upgrade to 50G is desired
- Coexistence implication: 50G needs to coexist with either 10G or G-PON

A new way to coexist

- What if we use TDMA to make 25G and 50G coexist?
 - This is certainly possible in the upstream
 - It is also possible in the downstream, if we need
- This reduces the number of wavelengths we need to 2 (which we already have!)
- There is an interesting effect regarding the feasibility of 50G

What's the problem with 50G?

- In a word: Power. 50G will require 3~5dB more power on the receiver
 - Those are dB's that we just don't have
- All PONs to date have been designed with “worst case” (WC) loss budgeting
 - The sum of components WC loss is less than the budget number
- Real components have a statistical loss distribution, and therefore so do PONs
 - The average insertion loss is 3~5dB less than the WC
- Transmitters and receivers also have margins
- Combined together, there is at least 5dB (on average) that we are leaving on the table
 - We've had to do this, because optical systems are 'brittle'

Multi-rate Flexible PON

- If the optical system supports 25G and 50G, we can use those extra dB's
 - For the fraction of ONUs near the maximum loss, operate at 25G
 - For the majority of ONUs that have plenty of margin, use 50G
 - The actual bandwidth given to each customer is determined by the DBA algorithm
- In this way, 50G is economically feasible with the very same power level components as 25G

Total solution

- Approximate wavelength plan
 - Channel A: $1358 \pm 1.5\text{nm}$ down, $1300 \pm 10\text{nm}$ up
 - WDM coexistence with 10GE-PON
 - Channel B: $1335 \pm 1.5\text{nm}$ down, $1270 \pm 10\text{nm}$ up
 - WDM coexistence with G-PON
- 25 and 50G TDM coexist on both A and B
 - 25/10G ONUs would use same upstream as 25/25
- 100G system would be A+B

Straw poll

- Is dual-rate 25G/50G flexible PON system of interest?
 - Yes
 - No
 - Don't know