NG-EPON:
Comments on architecture

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Introduction

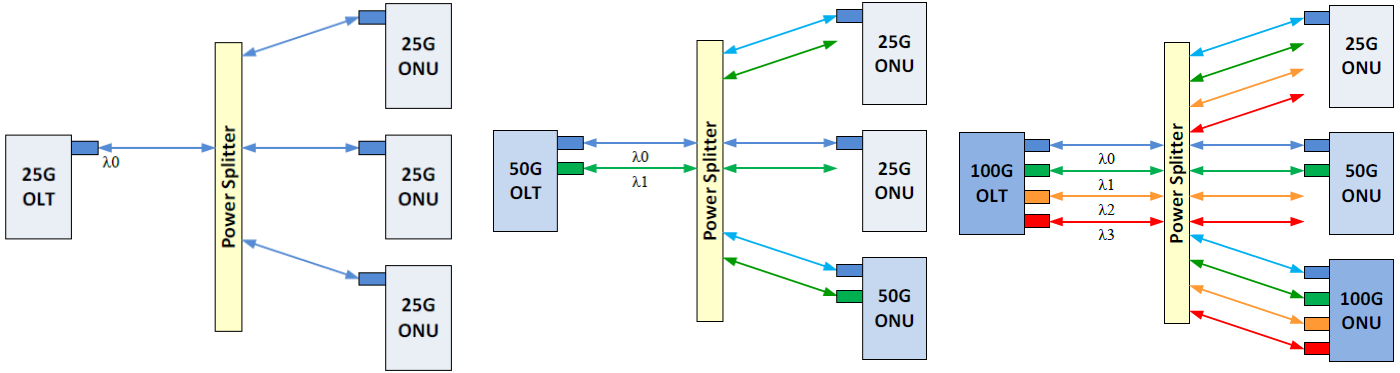
During weekly consensus call and open discussions, some architectural issues were discussed trying to reach agreements.

- NG-EPON should include generations deployed one by further.
- First generation should be simplest and lowest cost while deferring the extra cost and complexity to later generations.
- All generations might share same wavelength plan.
- New generations' OLT should enable coexistence of ONUs of old generations.
- Tunable optics has flexibility but introduces cost and complex concerns. Colored optics is cost-effective but causes operational difficulties. Multiple transceivers array is also considered alternatively.
- ONU peak rate seems to have impact on future high data rate service scenarios.

Recollection

In Atlanta meeting, we proposed to define single lane 25G-EPON as the first step, and then extend to multi-lane 100G-EPON with multi-rate ONU support.

So, we have common understanding to basic ideas in ‘kramer_3ca_1b_0216’, with further suggestions.



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Wavelength plan

In ‘kramer_3ca_1b_0216’, minimum 4 wavelengths were suggested for 3 generations. Components should be shared among generations for economical concerns.

Based our analysis, keep the wavelength in minimum while sharing components among generations, especially on enabling smooth migration generation by generation, can be technically feasible.

So, ‘1+3’ wavelength plan options with different migration methods are proposed. Details are elaborated in ZTE presentation of ‘NG-EPON wavelength plan’.

Tunable optics or fixed optics

Tunable optics

- Obviously, tunable optics can be applicable only for the 1st generation in one 25Gb wavelength, using two or more tunable optics in higher rate ONUs would not be cost efficiency.
- Moreover, the bigger challenge of using tunable optics is its reliability. Taking an example in NG-PON2, the upstream inter channel interferences using DFB lasers can hardly be completely eliminated with acceptable power penalties, that's the reason OOB&OOC parameters are defined.
- Since cost and maturity are more important concerns at this stage, tunable optics would not be the first choice unless the task force decide to distribute 25Gb ONUs to more wavelengths rather than more fiber trunks.

Fixed optics

- Fixed optics would be the right choice for 1st generation because of its lowest cost.
- For 2nd and 3rd generations that need multiple 25Gb wavelengths, 2 or 4 fixed transceivers' array can be considered.

Estimated ONU optics cost comparison

Number of wavelengths	Fixed optics	Tunable optics
1	Assumed as 1 (anticipated down to same price level as 10/10 in 2020)	~3.5x (based on open discussion in 2020)
2	~2x	/
4	~4x	/

Fixed optics eliminates the unreliable and immature concerns of tunable optics.

- 1st generation of 25Gb-EPON can use the low cost fixed wavelength optics.
- For 50Gb generation, there are 2 options for ONU optics
  - 2 fixed transceivers' array: either exhaust all combinations, or few combinations without flexibility.
  - 4 fixed transceivers' array: can be most flexible to achieve various ONU rate by turning on/off any set of wavelengths with moderate cost compared to tunable optics.
- For 100Gb ONUs, 4 fixed transceivers' array is the only choice.

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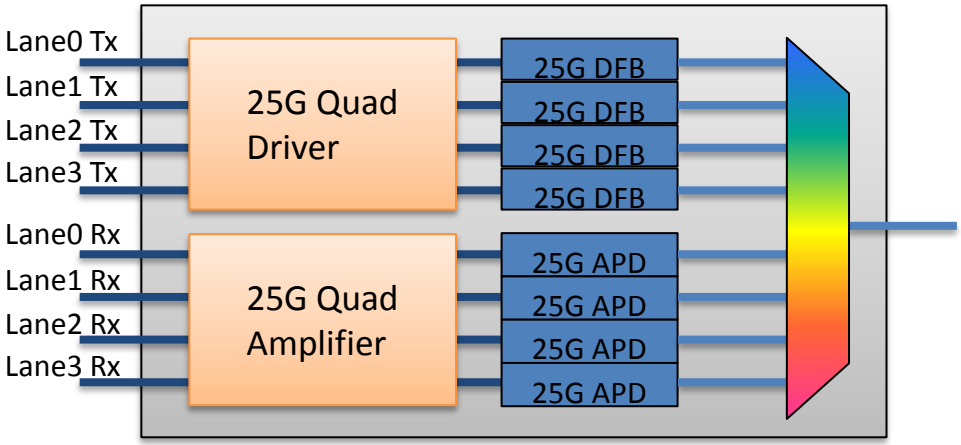
Example of 4x25G transceivers' array

- 1 type of ONU optics covers all rate targets and offers maximum flexibility
- QSFP package for 100G industry can be leveraged
- Great deal of 100Gb chipsets are using quad-channel design, piggyback these designs can significantly accelerate development process and reduce cost.
- 4x25Gb CAUI-4 C2C and C2M interfaces can be reused.
- Further cost reduction can be expected via silicon photonics.



Summary

Several key issues on NG-EPON architectures are addressed

- NG-EPON rate targets should be satisfied via several generations
- Wavelength plan should enable both smooth migration and economical components reusing.
- Tunable optics are not suggested in NG-EPON due to cost and maturity concerns.
- Fixed optics avoids the complexity and reliability issues of tunable optics.
- 4x25Gb transceivers' array is considered more suitable for high data rate NG-EPON ONUs, because it provides maximum flexibility using single type of ONU transceiver, also existing 100Gb industry supply chain can be maximally reused.

Thank you

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