

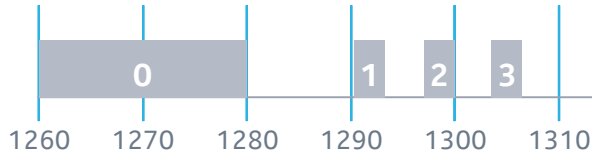
Compromise TDM / WDM co-existence wavelength plan

- Ed Harstead, Nokia
- Mike Emmendorfer, Arris
- March 2017

New compromise plan: support both TDM or WDM co-existence with 10G

Suggested by Mike Emmendorfer in Huntington Beach

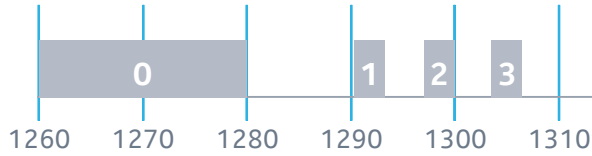
- Use Plan B, upstream



- Modification: 25G PON may be implemented in two different ways:
 - Use US0: TDM co-existence
 - Use US1, 2 or 3: WDM co-existence

New compromise plan: support both TDM or WDM co-existence with 10G

- Use Plan B, upstream

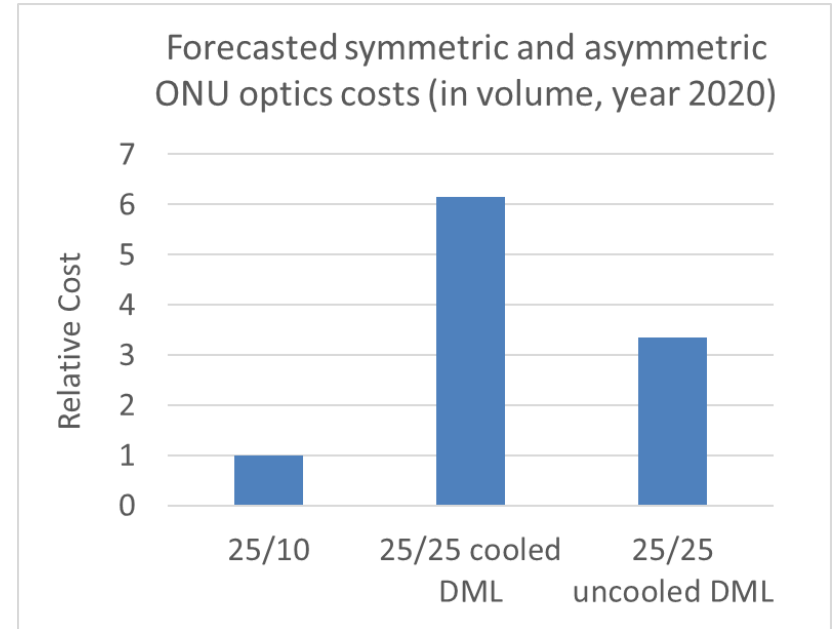


- Modification: 25G PON may be implemented in two different ways:
 - Use US0: TDM co-existence
 - **Use US1 (only): WDM co-existence:** No effect on 50G or 100G OLT, same as conventional Plan B
- Now there are two (and only two) flavors of 25G ONUs,
 - 1270 nm upstream
 - 1290 nm upstream.

The market could sort out the winner.

“Splitting” the 25G ONU market: how significant?

- 25/10 ONUs are not affected, there would be only one flavor of 25/10 ONU.
 - The significantly higher cost of 25/25 ONUs may relegate them to niche volumes where symmetrical bandwidth is absolutely required.
 - In which case, the compromise plan would have no effect on the vast majority of ONUs
- Choosing Plan A will likely not avoid a split anyway
 - If IEEE chooses Plan A, ITU-T will likely choose another plan to support GPON co-existence. Presumably Plan B.
 - In which case the 25/25 ONU market would again be split.

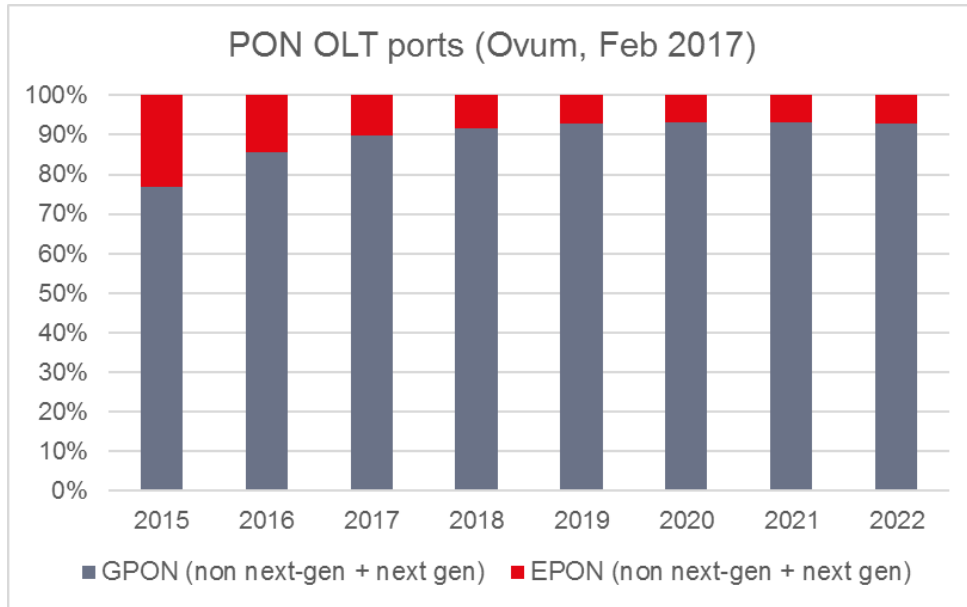


Notes:

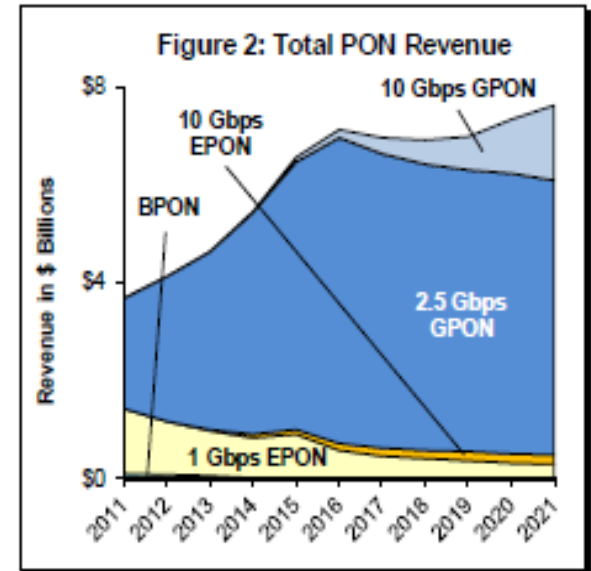
1. 25G source data: [harstead_3ca_1a_0716.pdf](#), p. 6
2. Assumes 10G receiver and EDB detection (absolute cost delta would remain the same for 25G APD or 10G APD + DSP implementations)

Who will benefit most from common ITU-T and IEEE volumes?

- Historical volumes indicate that at least since 2011 the ITU-T PON market is much larger than the IEEE PON market
- Forecasts (FWIW) indicate ITU-T PONs will be deployed on >90% of new PON ODNs



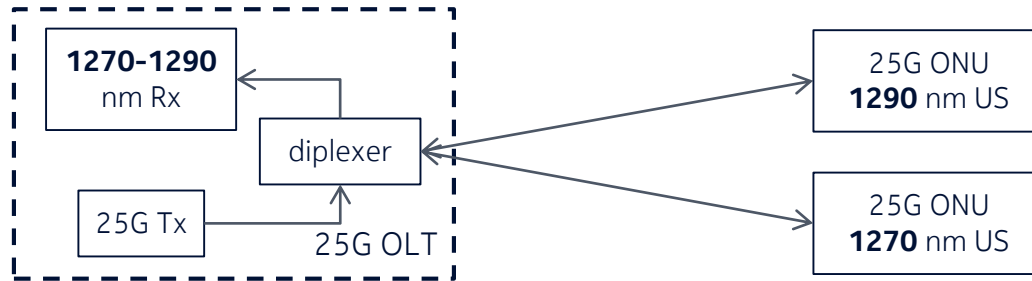
Dell'Oro, Jan. 2017



25 OLT variants

Single 25G OLT variant can support 1270 and 1290 nm ONUs

- A single 25G OLT can support both 1270 and 1290 ONUs, and on the same ODN
- Both 1270 and 1290 ONUs would be in the same MAC domain.



- In reality, no matter which plan, there will likely be multiple OLT variants

25G OLT possible variants: Plan A

25G Tx

10G Rx

25G Tx

25G Rx

25G Tx

25G Rx

10G Rx

25G Tx

10G Tx

10G Rx

25G Tx

10G Tx

25G Rx

10G Rx

ONUs on ODN		
25/25	25/10	10/10
	✓	
✓		
✓	✓	
	✓	✓
✓	✓	✓

Superset variant

25G Tx

10G Tx

25G Rx

10G Rx

25G OLT possible variants: Plan B

25G Tx
10G Rx

25G Tx
25G Rx

25G Tx
10G Tx
10G Rx

25G Tx
10G Tx
25G Rx

ONUs on ODN		
25/25	25/10	10/10
	✓	
✓		
✓	✓	
	✓	✓
✓	✓	✓

Superset variant

25G Tx
10G Tx
25G Rx

25G OLT possible variants: Compromise Plan

ONUs on ODN				
25/25 1290 US	25/25 1270 US	25/10	10/10	10G/25G US co- existence
		✓		-
✓	✓			-
✓	✓	✓		TDM
		✓	✓	TDM
✓	✓	✓	✓	TDM
✓		✓		WDM
✓		✓	✓	WDM

Superset
variants

- 25G Tx
- 10G Tx
- 25G Rx

- 25G Tx
- 10G Tx
- 25G Rx
- 10G Rx



- 25G Tx
- 10G Tx
- 10G Rx

- 25G Tx
- 25G Rx
- 10G Rx

- 25G Tx
- 10G Rx

- 25G Tx
- 25G Rx

(Only adder to Plan A)

- 25G Tx
- 10G Tx
- 25G Rx

- 25G Tx
- 10G Tx
- 25G Rx
- 10G Rx

10G EPON OLT: went through a similar process

- 5 transceiver types commercialized. For example, Hisense-Ligent:

PN	10G 1577 nm Tx	10G 1270 nm Rx	1G 1490 nm Tx	1G 1310 nm Rx
LTH4301	✓		✓	✓
LTH5302	✓	✓	✓	✓
LTH5303	✓	✓		✓
LTH7214*	✓			✓
LTH7218*	✓	✓		

*no demand

Source: David Li, Ligent

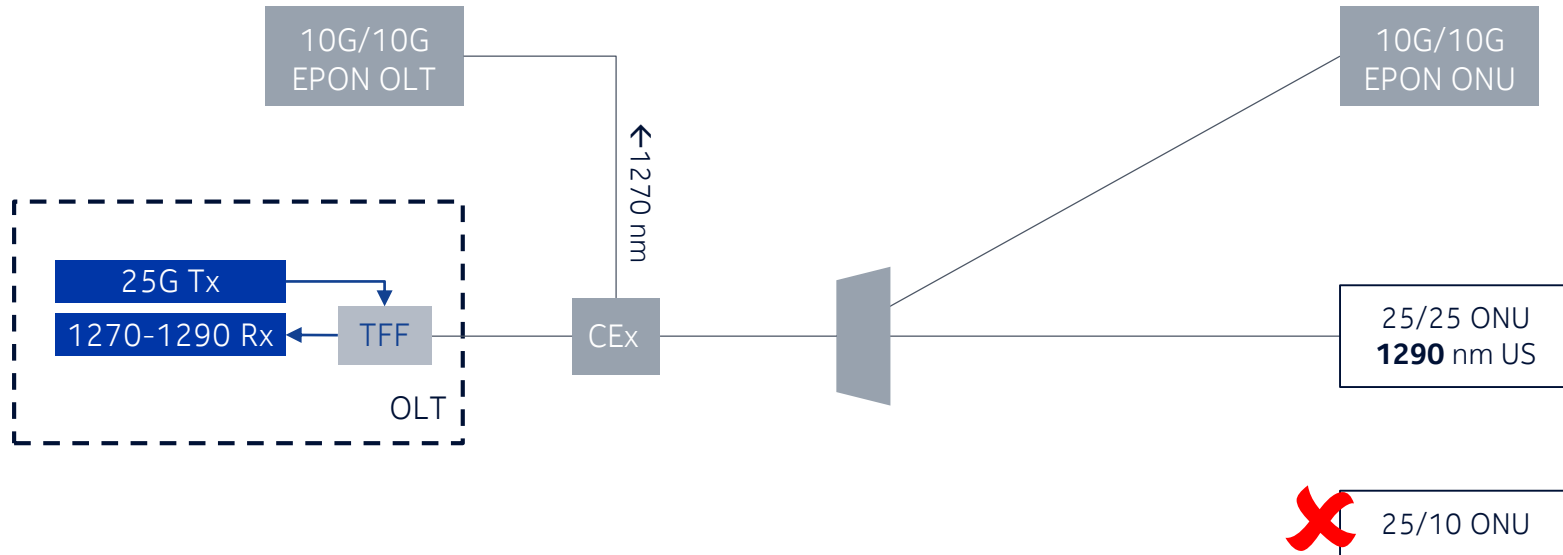
Discussion

- Advantage of the compromise TDM/WDM co-existence plan
 - Most of the advantages of Plan A and Plan B are available
 - Risk mitigation. Don't have to predict what the technology and the market will favor in years 2020+
- Disadvantage
 - Possible split of the market into two flavors of 25/25 ONU optics (but not 25/10 ONUs), if the market can't pick a single winner.
 - But this is likely anyway if Plan A is selected.

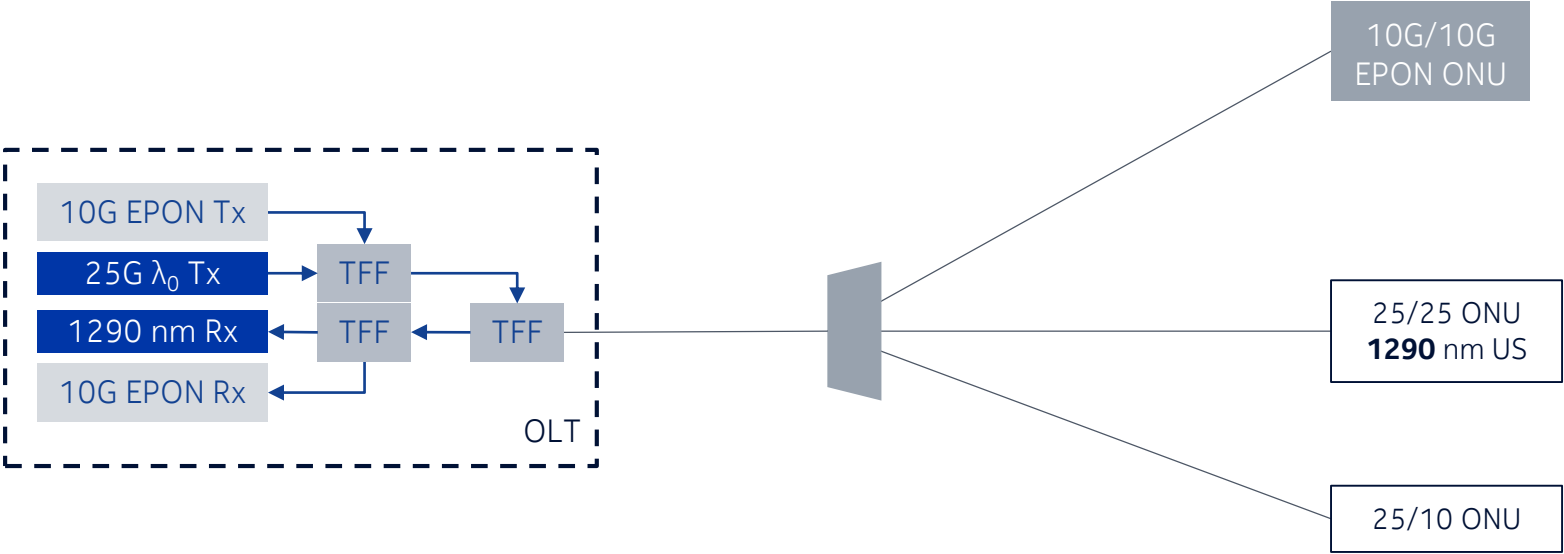
NOKIA

Back up: co-existence with 10G EPON

WDM co-existence with 10G EPON: Separate 10G EPON OLT, no 25/10 ONU support



WDM co-existence with 10G EPON: integrated OLT



TDM co-existence with 10G EPON

