



# Coexistence Dilemmas of 25GEPON & 2x25GEPON with 10GEPON and Solutions



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# Background

- A motion passed (12) in the Nov. 2017 meeting that indicated a NEW US wavelength for 10GEPON

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<b>Motion #12</b>		
2x25G -EPON shall WDM coexist with 10G-EPON, i.e., the second upstream channel (US1) in any 2x25G EPON shall not re-use one of the two options for 25G US0 (US0-B and US0-A).		
Moved: Ed Harstead	Second: Ed Walter	
For: 16	Against: 4	Abstain: 7
Technical ( $\geq 75\%$ ) Motion Passed		

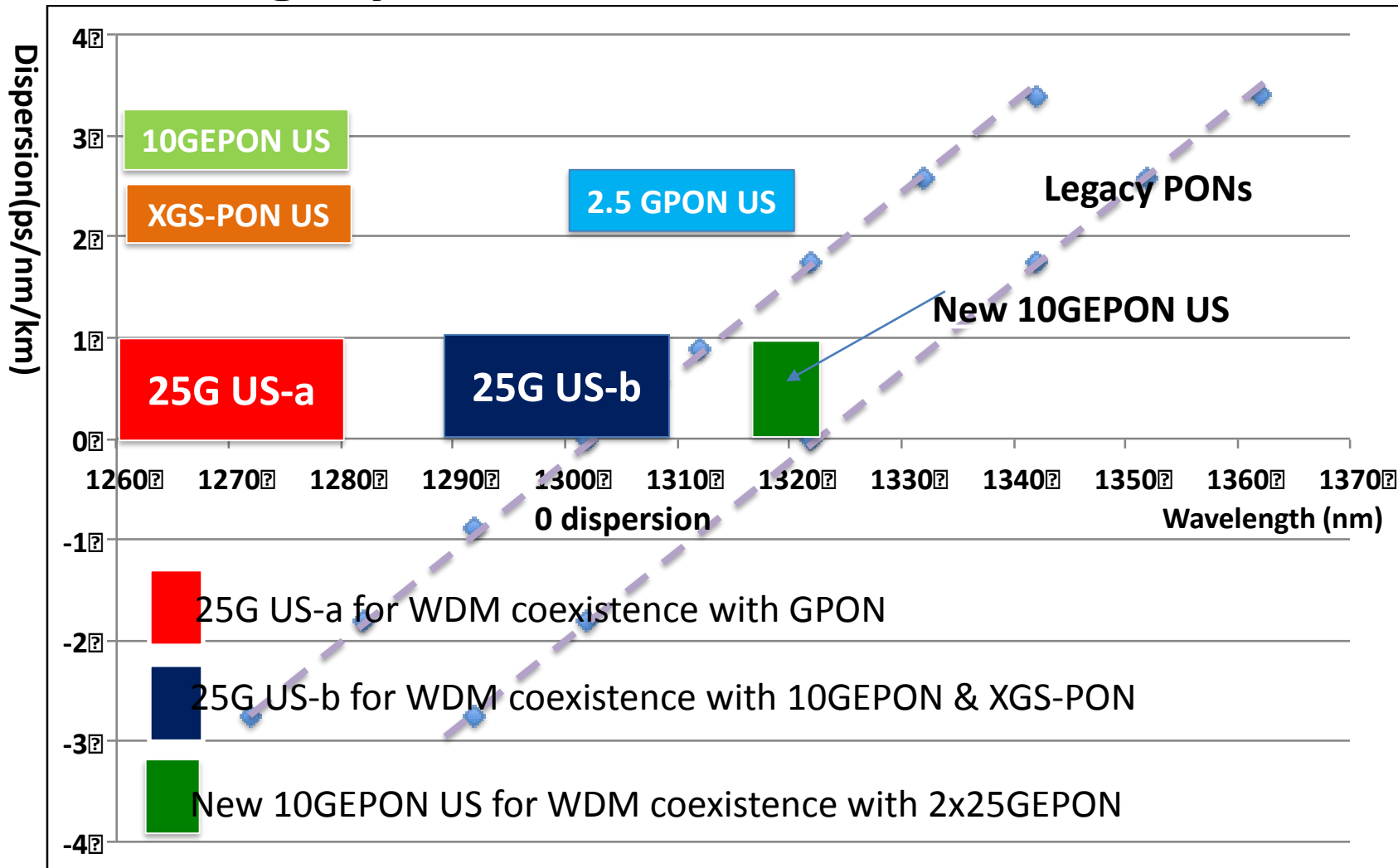
- A motion passed (15) in the Jan. 2018 meeting that defined this new 10GEPON US wavelength

<b>Motion #15</b>		
Adopt 1320±2nm as one of the upstream channels.		
Moved: John Johnson	Second: Daisuke Umeda	
For: 15	Against: 3	Abstain: 10
Technical ( $\geq 75\%$ ) Motion Passed		

The Chair requested a Roll Call vote, the details of the roll call vote are recorded below.

**The solution negatively impacts the field deployment and migration from 10GEPON to 25GEPON & 2x25GEPON**

# Coexistence of 25GEPON/2x25GEPON with legacy PONs – What it looks like



# A new legacy 10GEPON

- Legacy 10GEPON upstream is at 1270nm +/- 10nm
- The new 10GEPON upstream is at 1320nm +/- 2nm
- The motivation, as stated in the motion, is for WDM coexistence of 2x25GEPON with 10GEPON
- WDM coexistence is more efficient in using TDM bandwidth. TDM coexistence is more efficient in using optical spectrum resources
- WDM coexistence may be preferred. Creating a new 10GEPON is not the right solution, as it creates more problems than it solves

**What is the root of the problems?**

# **It time to review where are we and how we get here...**

- **The original timeline of 802.3ca has been postponed several times**
- **The 802.3ca TF is expected at D3.0 sponsor ballot stage in Jan. 2018 according the original timeline. Today we are not at D1.0 yet.**
- **During this period the objectives have been changed several times.**
- **Change of objectives may indicate difficulties**

**Review what objectives have been changed  
and why may help us see the road clearer**

# What objectives have been changed?

- The most recent change of the 802.3ca objectives happened at the Jan. 2018 meeting
- The objectives have been changed several times previously
- The changes are in two areas
  - Multi-channel architecture
  - Coexistence with legacy PONs
- 100G with 4x25G was removed from the objective at Nov. 2017 meeting
- WDM coexistence with legacy PONs (GPON, 10GEPON, XG-PON and XGS-PON) was added at Jan. 2018 meeting
- Coexistence with GPON was added at a 2017 meeting

# Why change these objectives?

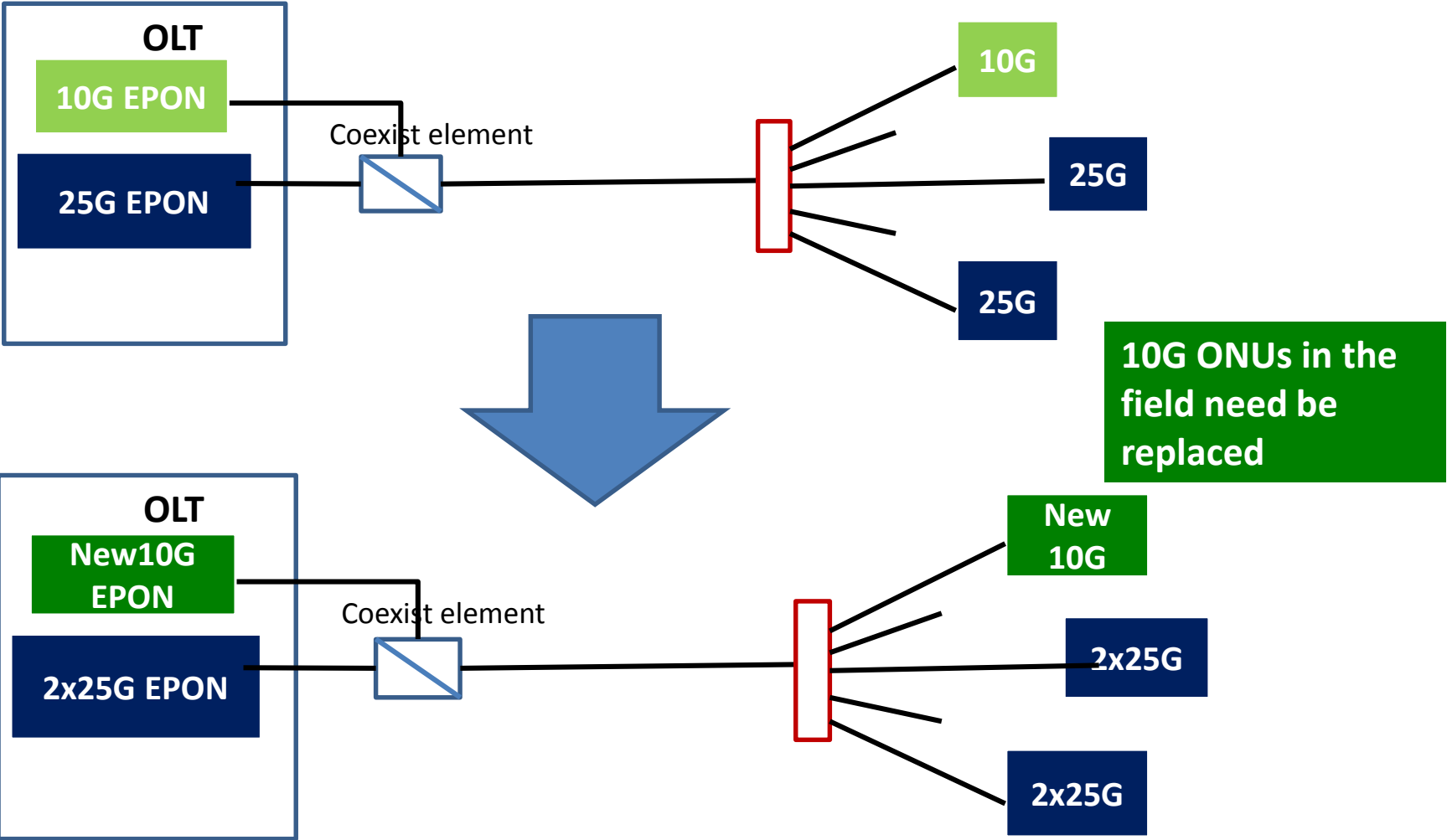
- **The removal of 100G with 4x25G objective was due to the difficulties in finding 4 pairs of wavelengths in O band and the power budget issues**
  - **The 802.3ca TF spent near 2 years in wavelength discussions**
  - **There are simply not enough spectra resources in O band that meet 20km PON reach requirements (FWM, dispersion, wide channel, etc.) with 4 pairs of channels**
- **The addition of coexistence with GPON helps with possible PON convergence in the future**
- **The addition of WDM coexistence with legacy PON was, according to a comment at last meeting, because some “operators prefer so”**

# Why set the objectives as they are?

- As stated previously, the addition of WDM coexistence with legacy PON, according to a comment at last meeting, was because some **“operators prefer WDM coexistence”**
- Then why set the multi-channel (2x25G, 4x25G) requirements? Also according to comments at the last meeting, because someone said that **“we don’t have to come back again”** when the rate beyond 25G are needed
- **The works of the 802.3ca TF from Jan. 2016 to today shows that the multi-channel architecture and the WDM coexistence with legacy PON requirements create many technical challenges.**
- **We should have better reasons to require them**



# Migration issues with the new10GEPON



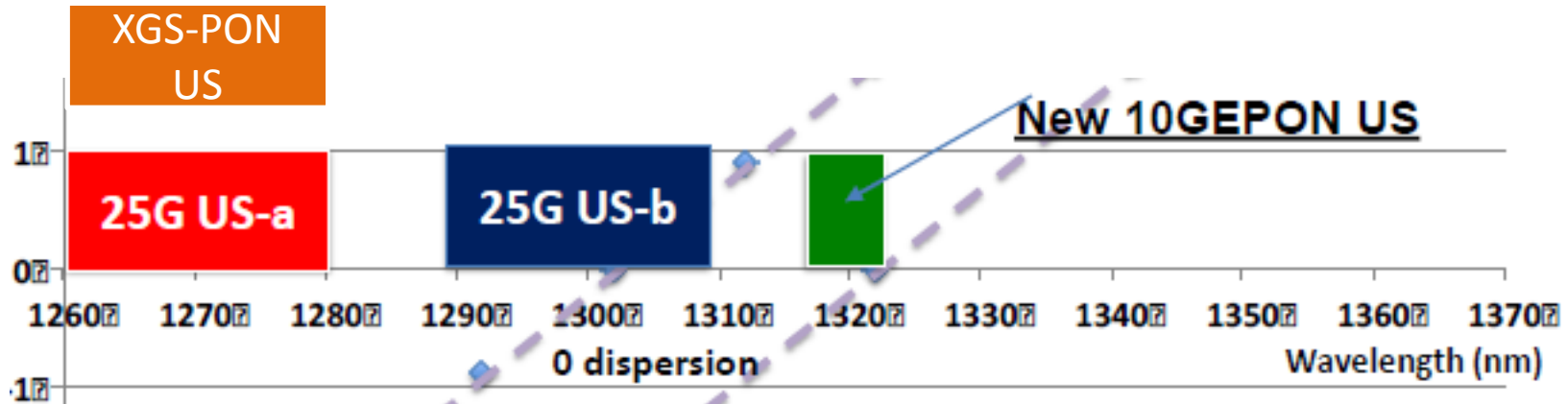
# Dilemmas of the new legacy 10GEPON

- When upgrading 25GEPON to 2x25GEPON, replacing the 10GEPON ONU with new 10GEPON ONU is costly
- The spirit of coexistence with legacy PON is too keep the legacy unchanged, especially in the field
- The new 10GEPON ONUs are more expensive because it has narrower spectra range
- Should operators deploy the 10GEPON today?
- Or wait for the new 10GEPON?

## Dilemmas – coexist or not coexist?

- **Coexist: Deploy 10GEPON today will facing expensive field replacement of ONU when deploying 2x25GEPON**
- **Not coexist: Or, keep 10GEPON, not upgrade to 2x25GEOPN on same ODN**

# Coexistence of XG-PON and XGS-PON is still a problem



- XG-PON and XGS-PON, as defined, CANNOT WDM coexist with 2x25GEPON
- As the result, the 802.3ca draft may not pass 802.3 WG ballot
- Or, should we not include coexistence of XGS-PON?

**But we just passed a motion at the Jan. 2018 meeting that adding WDM coexistence with XG-PON and XGS\_PON ...**

# New objective of coexistence with legacy PONs

- A motion (17) passed at Jan. 2018 meeting that requires WDM coexistence with XG-PON and XGS-PON
  - Support coexistence with select legacy PON technologies
    - Optical power budgets to accommodate channel insertion losses equivalent to PR20 and PR30, as defined in Clause 75.
    - Wavelength allocation allowing concurrent operation with 10G-EPON, XG-PON1, and XGS-PON PHYs (1575nm-1580nm downstream, 1260nm-1280nm upstream)
    - Wavelength allocation allowing concurrent operation of 25G-EPON and G-PON reduced wavelength set (1480nm-1500nm downstream, 1290nm-1330nm upstream) PHYs

## Possible solutions

- Drop the coexistence requirement of 2x25GEPON with XG-PON and XGS-PON all together
- Or, ITU-T defines a new US wavelength for XGS-PON/XGPON
- Or, relax multi-channel and/or WDM coexistence requirements

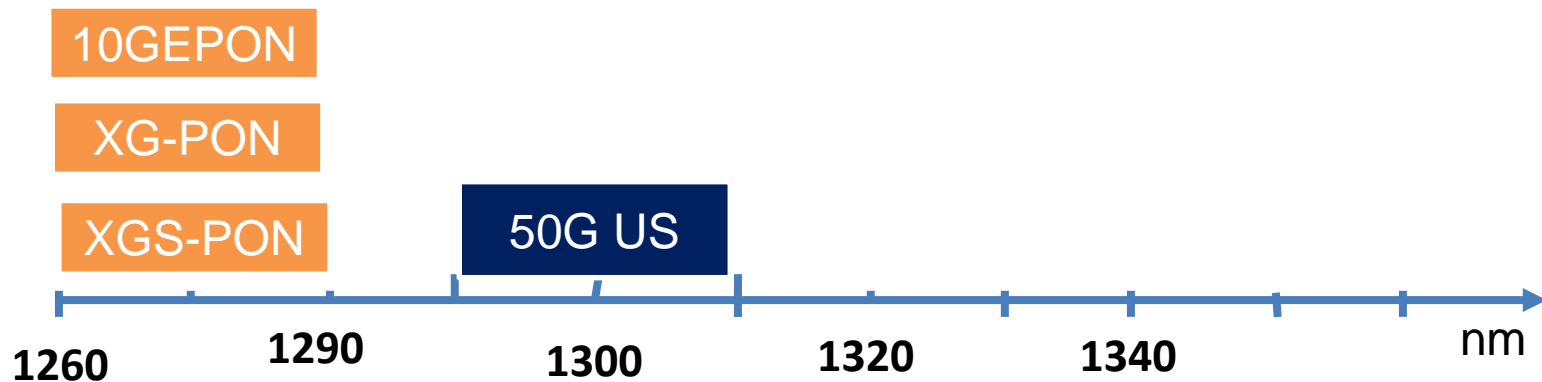
## **Dilemmas of coexistence**

- If drop the coexistence requirement of 2x25GEPON with XG-PON/XGS-PON all together
  - Dilemma: XG-PON and XGS-PON coexist with 25GEPON but not with 2x25GEPON
- If not drop the coexistence requirement of 2x25 with XG-PON/XGS-PON
  - Dilemma: Will not pass WG ballot
- Or, ITU-T defines a new US wavelength for XGS-PON/XGPON
  - Dilemma: It is not in IEEE control. It has all the limitations as the new 10GEPON has.

**The root cause of the dilemmas is the combination multi-channel architecture and the WDM coexistence requirement**

# Solution - relax multi-channel or WDM coexistence requirements

## Single channel 50G solves the dilemma



- 50GEPON WDM coexist with XGS-PON and/or XG-PON
- 50GEPON WDM coexist with 10GEPON
- Meet the coexistence objective passed at Jan. meeting
- 10G to 50G is the preferred upgrade path (5X rate increase)

# Conclusions

- The new legacy 10GEPON will cause a migration problem from 25GEPON to 2x25GEPON
- XGS-PON and XG-PON don't WDM coexist with 2x25G under current wavelength plans
- The WDM coexistence objective of XGS-PON and XG-PON with 2x25G could cause problem at WG ballot
- The root of the dilemma is the combination of multi-channel architecture and the WDM coexistence requirement with the legacy PONs.
- 50G signal channel architecture solves the problem (also see dai\_3ca\_02a\_0118 "Converged Wavelength Plan...")



Thanks

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