



# Asymmetric 25GEPON and Wavelength Plan

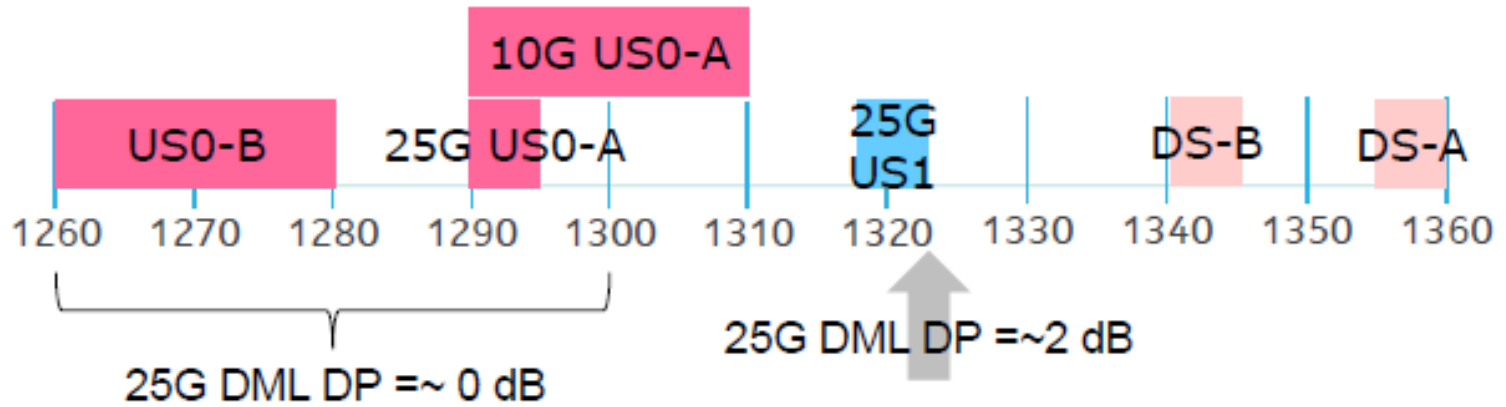


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# Outline

- Why is asymmetric 25GEPON needed?
- Creates a new legacy 10G standard?
- The grey 25G wavelength plan

# Recent discussions on 25G/10G



- ❑ DML DP  $\sim 0$  dB for 25G US0-A, to be equivalent to 25G US0-B.
- ❑ Keep 20 nm for 10G US0-A: allows uncooled DMLs in 25/10 ONUs using US0-A.
- ❑ The burden of DP=2 dB is deferred until 2x25G EPON Ed Harstead, Nokia

- The drawing above shows a new 10G US wavelength for asymmetric 25G/10G

# A new legacy 10G US standard?

- 10GEPON upstream wavelength is centered at 1270nm +/- 10nm
- The proposed new 10G upstream is at 1310nm +/- 10nm
- The motivation is likely for WDM coexistence
- WDM coexistence is more efficient in using TDM bandwidth
- TDM coexistence is more efficient in using optical spectrum resource

If optical resources are abundant, WDM coexistence is preferred. Even though, it is not worth it to create a new legacy 10G solely for WDM coexistence.

# The needs for asymmetric 25GEPON (technical & economical)

- The 25G asymmetric rate is needed in TWO scenarios
  - a). **The 25G burst mode receiver is difficult to implement**
  - b). **The cost for symmetric 25G is too high**
- It is a big advantage to combine 10G optical markets for 10GEPON and asymmetric 25G/10G

**Asymmetric 25G/10G is needed to provide the first low cost 25GEPON to the market**

# The needs for asymmetric 25GEPON (services & applications)

- The asymmetric 25G PON has the lowest asymmetric ratio of 2:1 so far
  - Asymmetric ratio for asymmetric 10GEPON is 10:1
  - Asymmetric ratio for asymmetric 2.5GPON is 2.5:1
- The residential traffic is asymmetric with relatively large asymmetric ratios
- The small/medium business data traffic (Internet, email...) is still asymmetric

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

# The key for successful 25G/10G

- Address the projected main markets of 25GEPON – residential and small/medium customers
- The low deployment cost is critical for residential and small/medium business markets
- These markets do not need a symmetric system
- **Coexistence need be considered, but whether it is WDM coexistence or TDM coexistence is not the most important issue**
- **Keep the migration path open for future PON is also important**

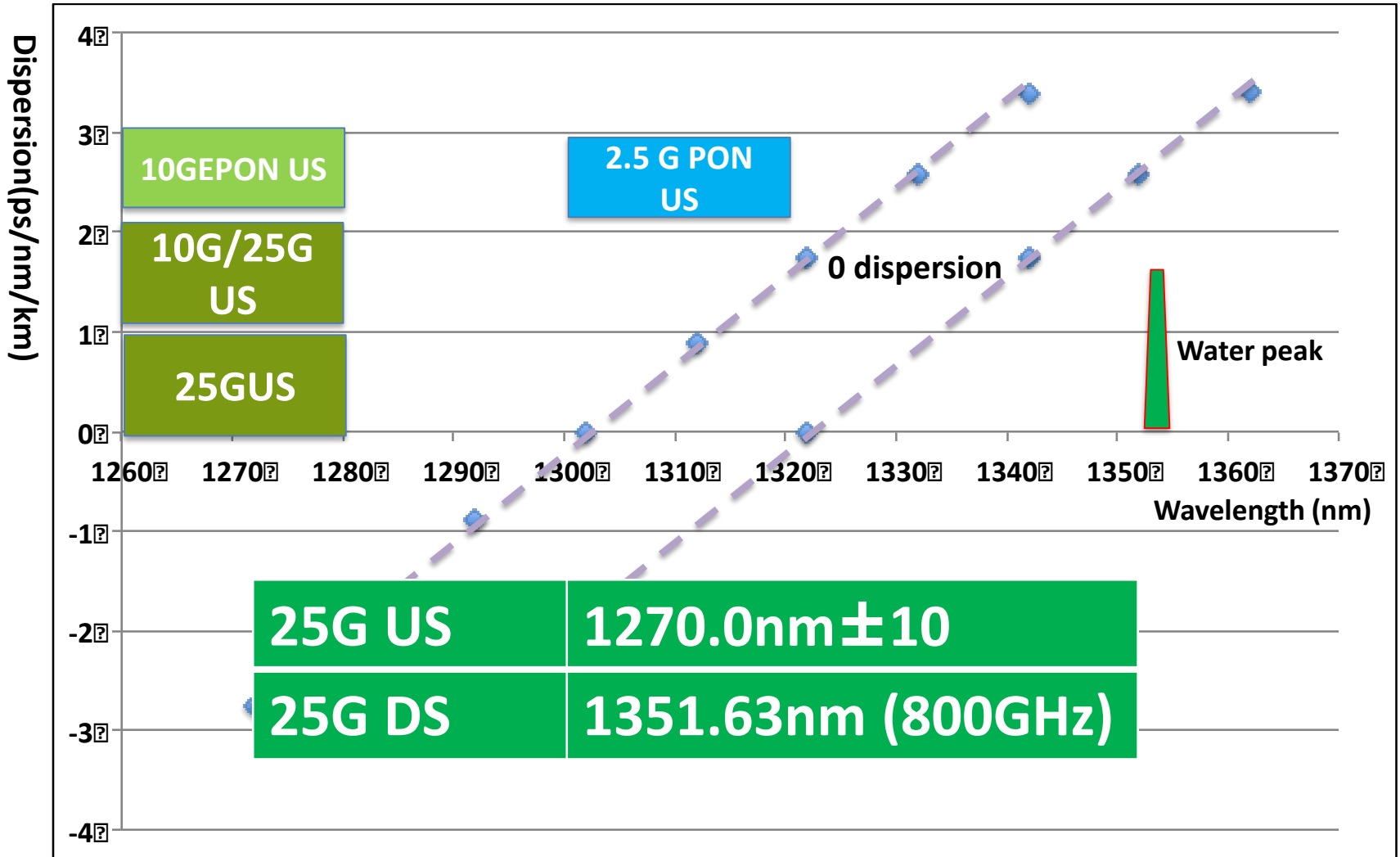
# No new legacy 10G standard

- Reusing the 10GEPON US wavelength and optics results in the lowest cost asymmetric 25GEPON
- This means that asymmetric 25G upstream TDMA coexists with 10G EPON
  - 25G/10G and 10G/10G have the same upstream rate
  - However, TDMA coexistence is still possible
    - Asymmetric 25G and 10GEPON upstream have different frame structures.
    - Or a field can be explicitly specified

**A new 10G wavelength allocation will unnecessary erode the highly demanded O band spectrum resource for high-speed PON in the future**



# Grey 25G wavelengths allocation

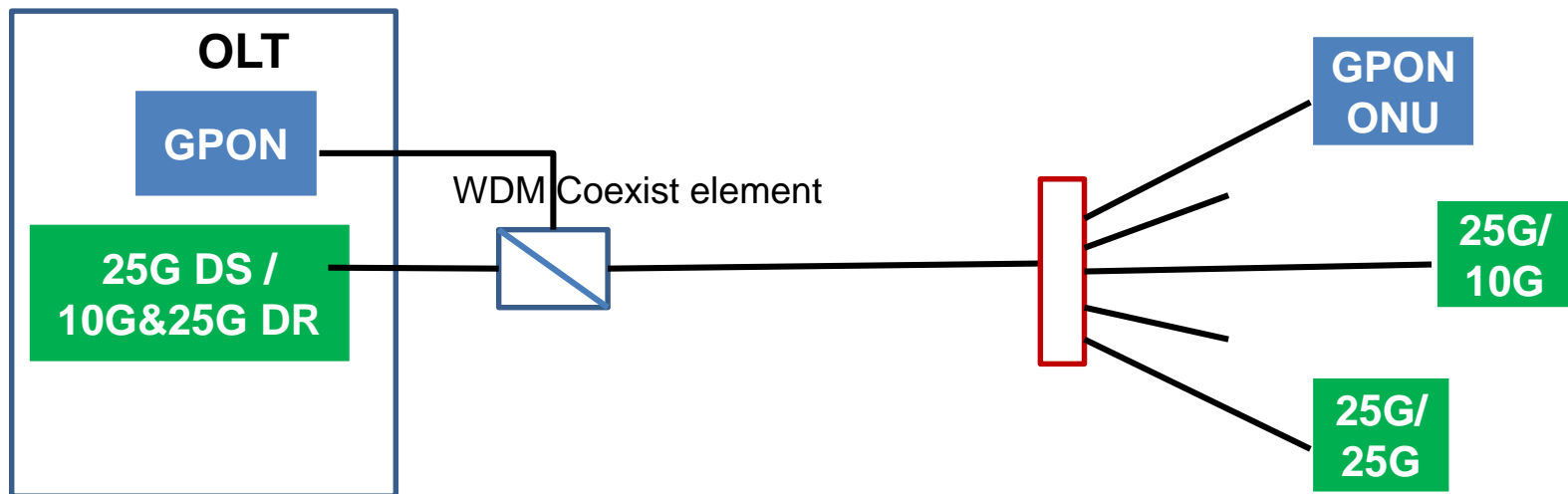


# Grey 25GEPON

- “Grey “ 25GEPON is named in contrast with “colored” 25GEPON
- “Colored” 25GEPON architectures have two sets of upstream wavelengths that result in two types of 25GEPON ONUs with different colors
- The issues of the colored 25G solution were discussed in dai\_3ca\_02a\_09\_17. The main concern is that it creates long term operational and evolutionary problems

# Coexistence with GPON

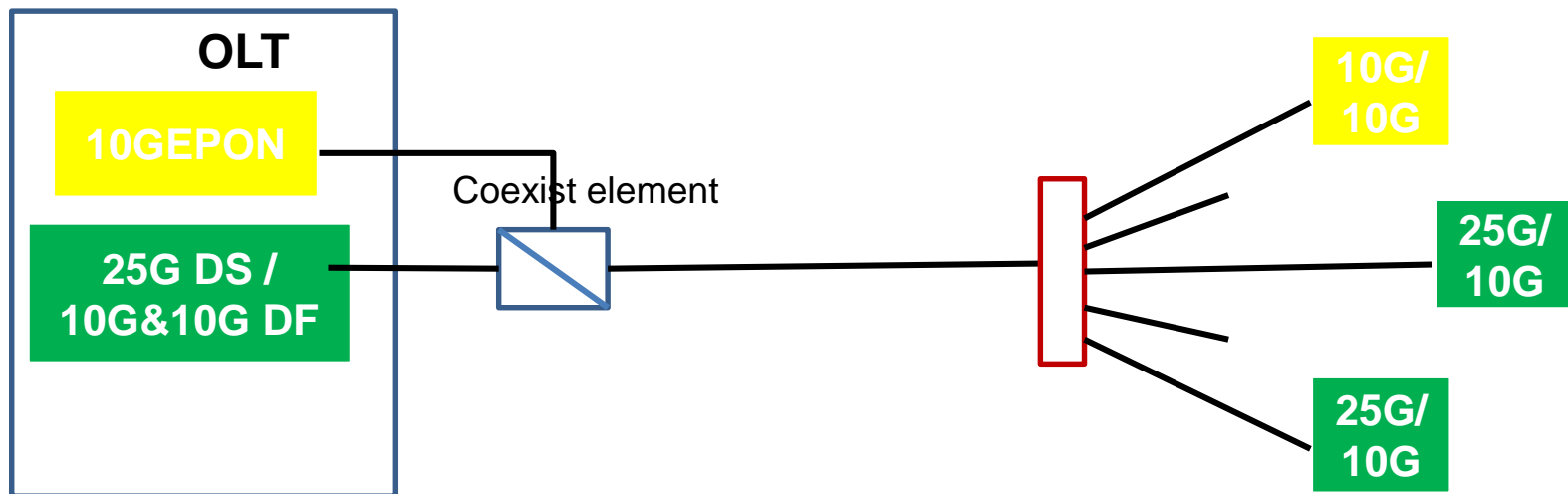
- Asymmetric 25G/10G WDM coexists with GPON
- Symmetric 25G/25G WDM coexists with GPON
- Asymmetric 25G/10G TDM coexists with symmetric 25G/25G



DR – Dual rate receiver

# Coexistence with 10GEPON - scenarios 1

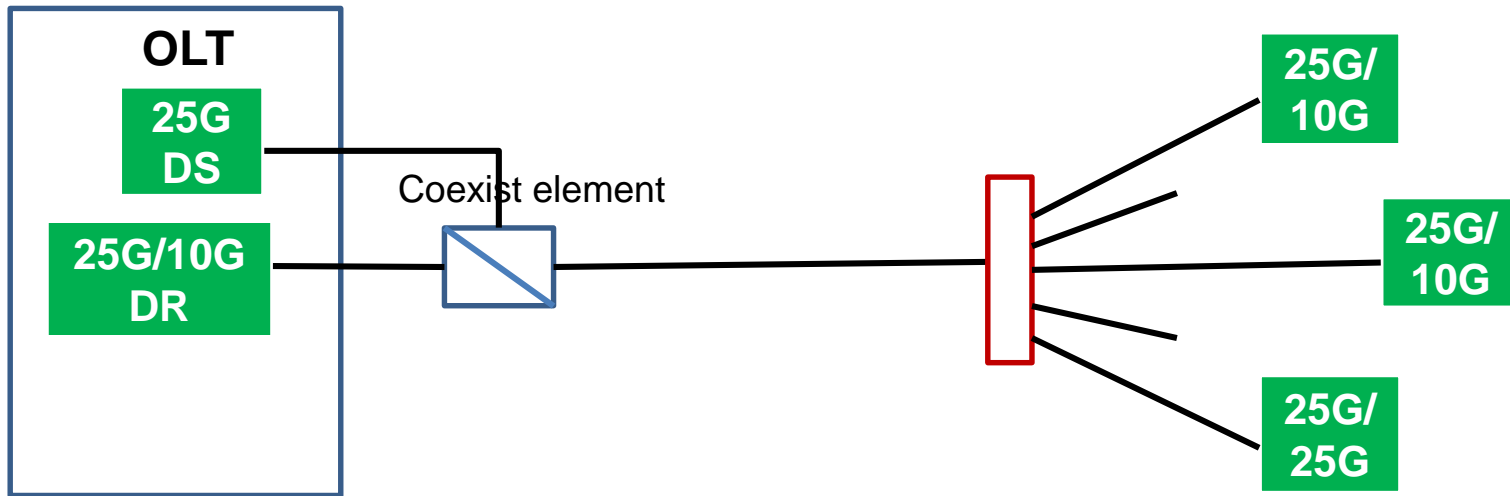
- The asymmetric 25GEPON has no major technical challenges, therefore, it is expected to be deployed first
- It is highly likely that the asymmetric 25G/10G EPON will coexist with 10G/10G EPON in brownfield deployment



DF – dual frame receiver

# Coexistence with 10GEPON - scenarios 2

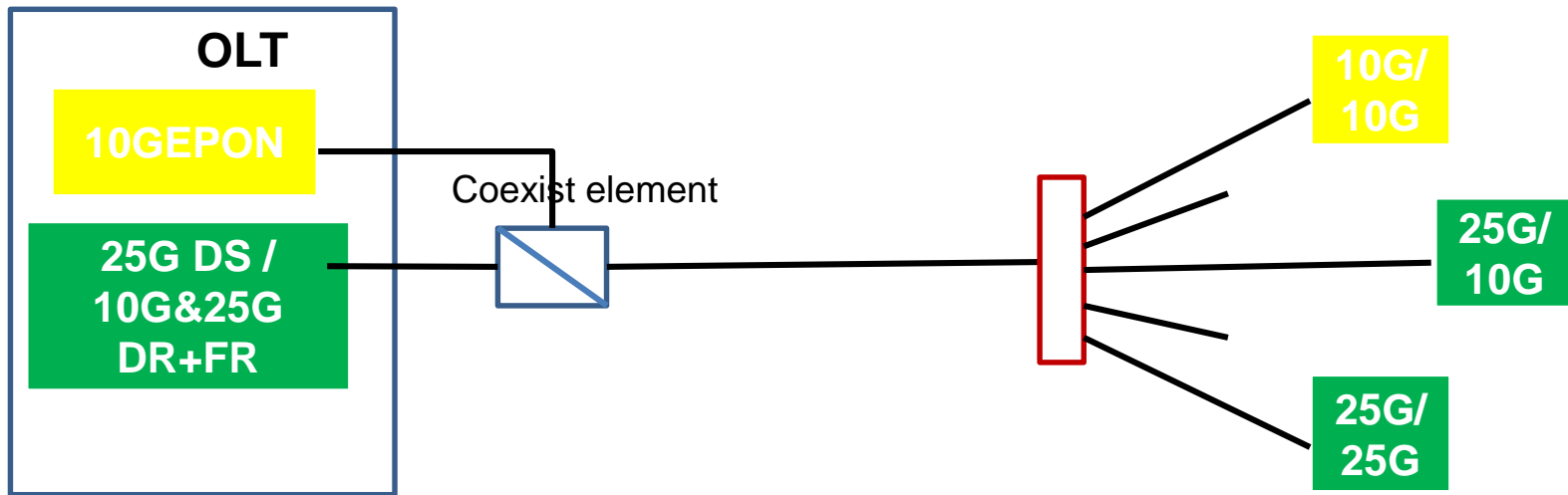
- When symmetric 25GEPON starts to be deployed, it is most likely that 10G EPON is fading out
- 25G/10G TDM coexists with 25G/25G



DR – dual rate receiver

# Coexistence with 10GEPON - scenario 3

- In theory, 10GEPON, asymmetric and symmetric 25GPON could coexist
- In practical PON networks we haven't seen triple coexistence yet



- **In principle triple coexistence could be supported with dual-rate dual-frame receivers**
- **In practice, it is harmless to rule out the triple coexistence scenario**

# Coexistence comparisons

	Grey 25G	Color 25G	Color 25G with new 10G wavelength
GPON	WDM	WDM	WDM
10GEPON	TDM	WDM/TDM	WDM
Asymmetric /Symmetric	TDM	TDM	TDM/WDM

Grey 25G – use one wavelength for 25G/25G upstream, reuse 10GEPON upstream wavelength for asymmetric 25G/10G

Color 25G – use 2 wavelengths for 25G upstream, reuse 10GEPON upstream wavelength for asymmetric 25G/10G

# Conclusions

- The proposed grey 25G asymmetric and symmetric wavelength plan coexists with both GPON and 10GEPON
- Reusing 10GEPON optics is required for lowest cost asymmetric 25GEPON
- Triple coexistence scenarios could be ruled out





Thanks

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