

O-band Wavelength Allocation for 100G EPON

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Motivations

- O-band is suitable for both 25G downstream and 10G upstream.
 - It has low chromatic dispersion induced power penalty even 25G NRZ signal and not need to use dispersion compensation technic.
 - OLT and ONU transceivers can be compact with a 25G EML, a 25G APD, a 10G DML and a 10G APD by applying NRZ modulation format.
 - 10G burstmode transmission technology was well matured and it will be used for 100G EPON in the early stage.
 - 25G burstmode transmission is feasible but it seems to be needed more time for applying to 100G EPON.
- 100G EPON may use 10G burstmode transmission before 25G burstmode transmission technology will be commercialized.

Straw polls for O-band and NRZ transmission in Macau Meeting

Straw Poll #5

I would support an upstream wavelength range in O-band with 20nm wide for the 25G single channel system.

Agree: 13 Disagree: 8 No opinion: 4

Straw Poll #6

I prefer to have all wavelengths allocated in O-band.

Agree: 14 Disagree: 6 No opinion: 3

There was an extended discussion regarding the difference between a 1+3 wavelength system contrasted with a 1+4 system. It was agreed that this topic deserves additional study and consideration.

Straw Poll #7

I prefer to have the 25G wavelength pair allocated in O-band.

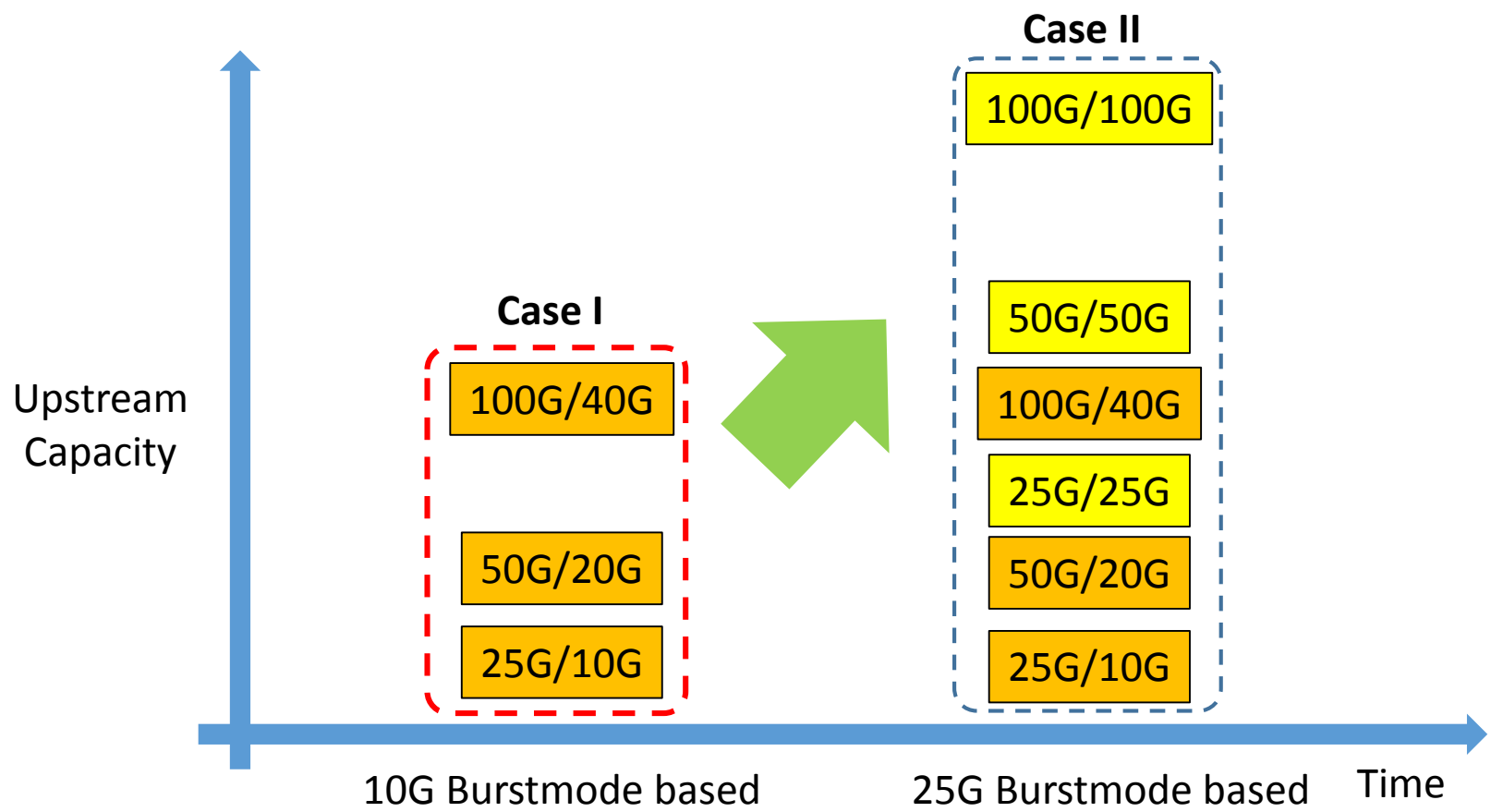
Agree: 13 Disagree: 4 No opinion: 6

Straw Poll #8

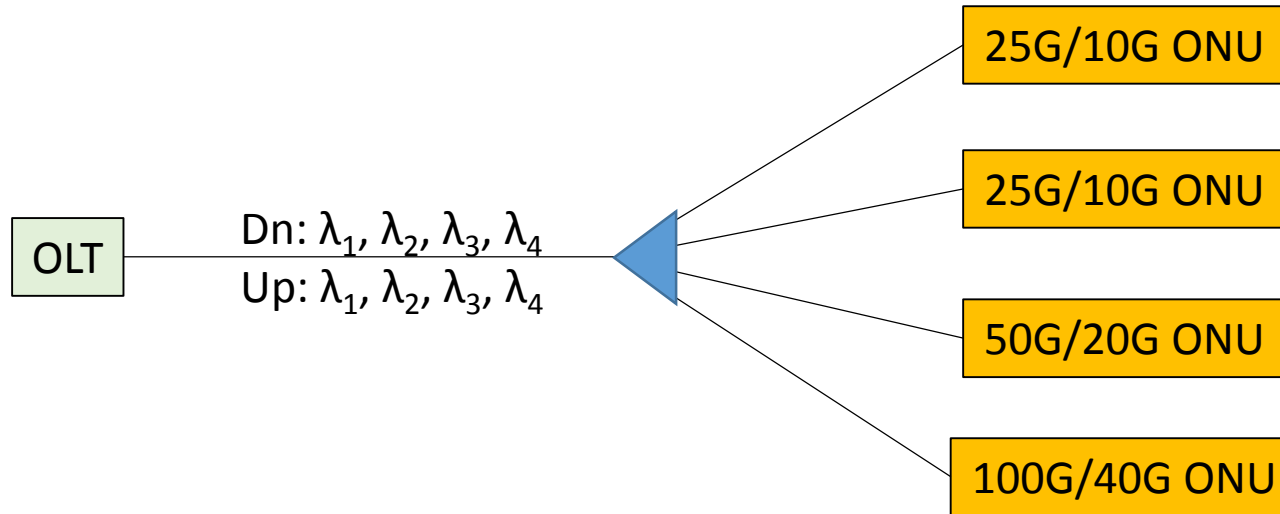
I prefer to use NRZ transmission for 25G per channel operation.

Agree: 15 Disagree: 2 No opinion: 6

100G EPON Evolution Path

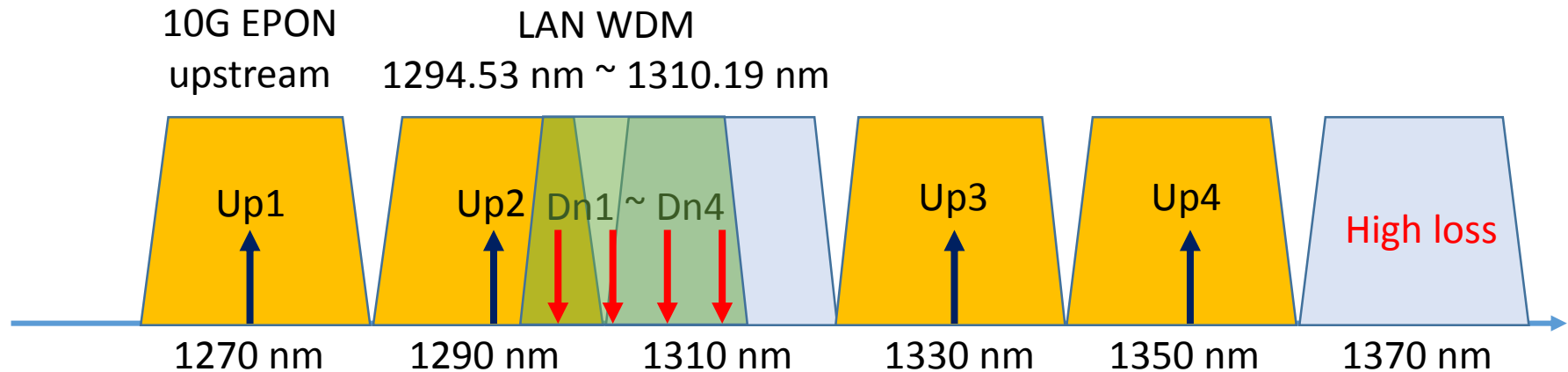


100G EPON based on 10G Burstmode Upstream



- Upstream wavelength
 - A first wavelength should be fixed with 10G EPON upstream wavelength (1260 nm ~ 1280nm) (Motion#3, Atlanta meeting).
 - It need to define other three wavelengths.
- Downstream wavelength
 - All four wavelengths should be defined.

Wavelength Allocation with LAN-WDM and CWDM

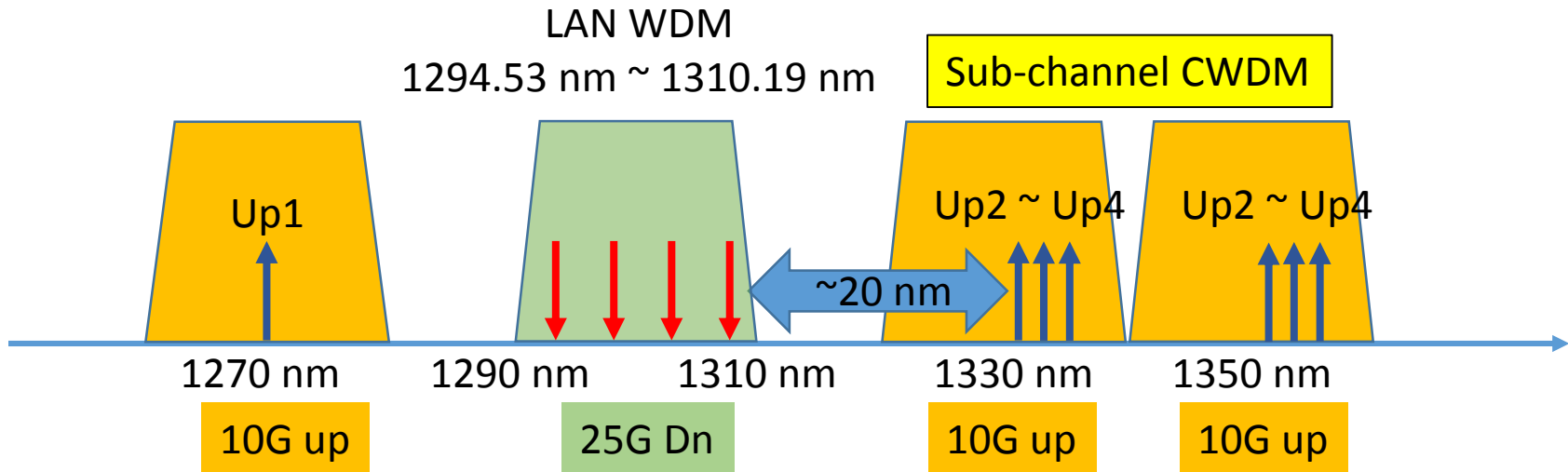


- Downstream wavelength
 - LAN WDM based wavelength allocation will be a good choice considering optical components such as 25G laser diode and optical filters.
- Upstream wavelength
 - CWDM based wavelength allocation is simple since 10G CWDM LD is commercially available.
- But, 1290 nm, 1310 nm CWDM bands and LAN WDM band overlapped each other.

LAN WDM Wavelength

	Min	Center	Max	
CH1	1294.53	1295.56	1296.59	nm
CH2	1299.02	1300.05	1301.09	
CH3	1303.54	1304.58	1305.63	
CH4	1308.09	1309.14	1310.19	

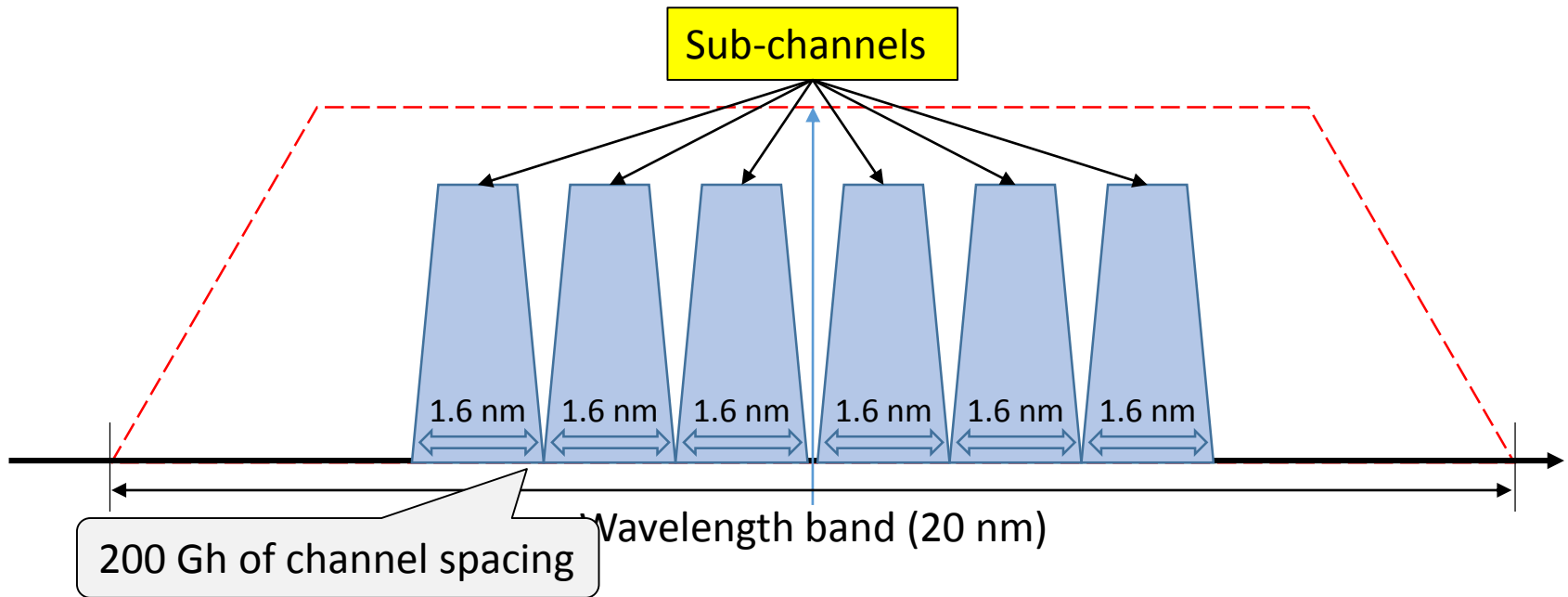
Wavelength Allocation with Sub-channel CWDM



- Candidates of 10G upstream wavelengths ($\lambda_2, \lambda_3, \lambda_4$)
 - 1330 nm Sub-channel CWDM
 - 1350 nm Sub-channel CWDM
- Guide band between downstream and upstreams can be around 20 nm in order to BOSA manufacturing.

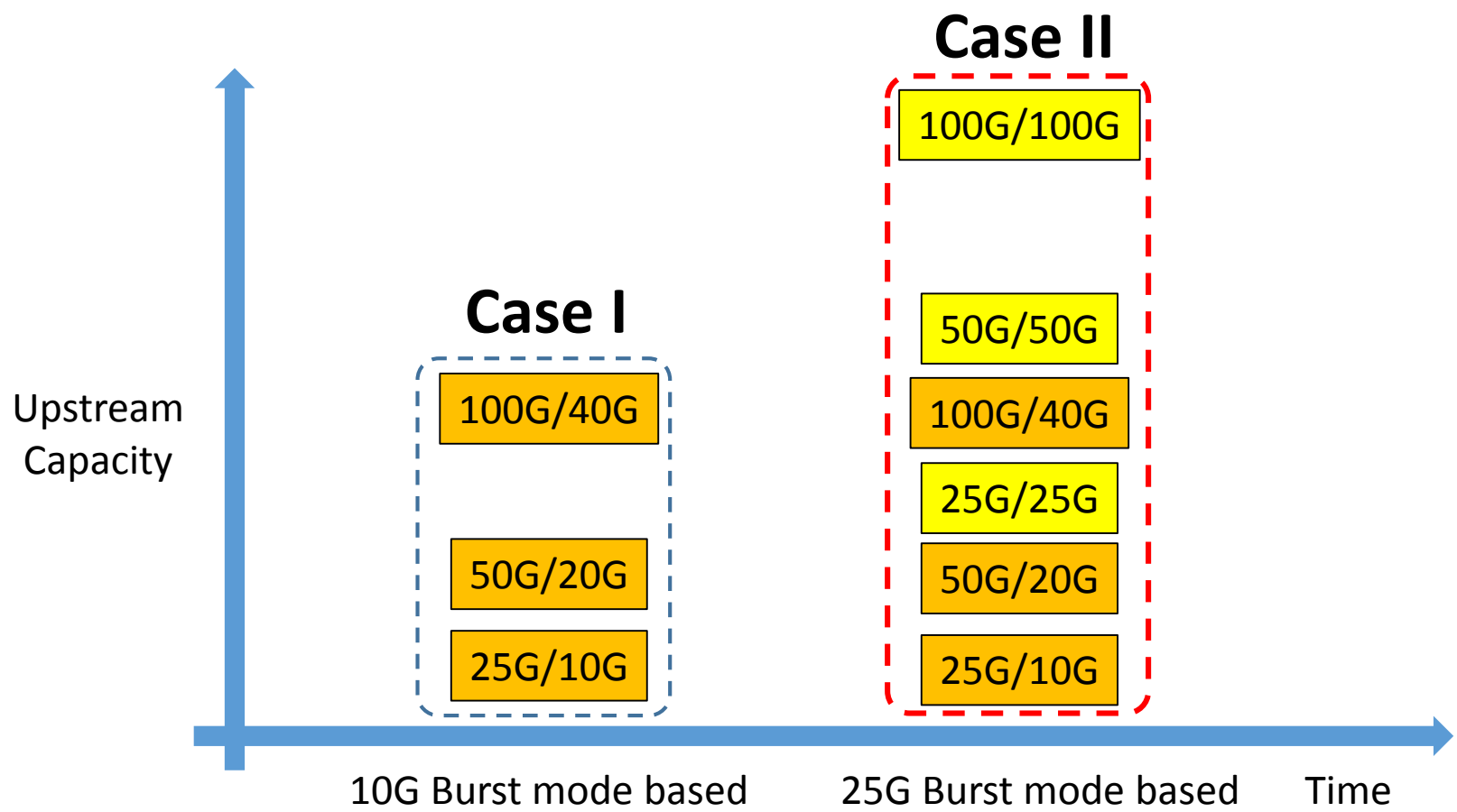
* Technical Feasibility of Bidirectional Sub-channel CWDM Technology, FSN meeting, Shanghai, April 18th – 21th 2016

Example of Sub-channel CWDM

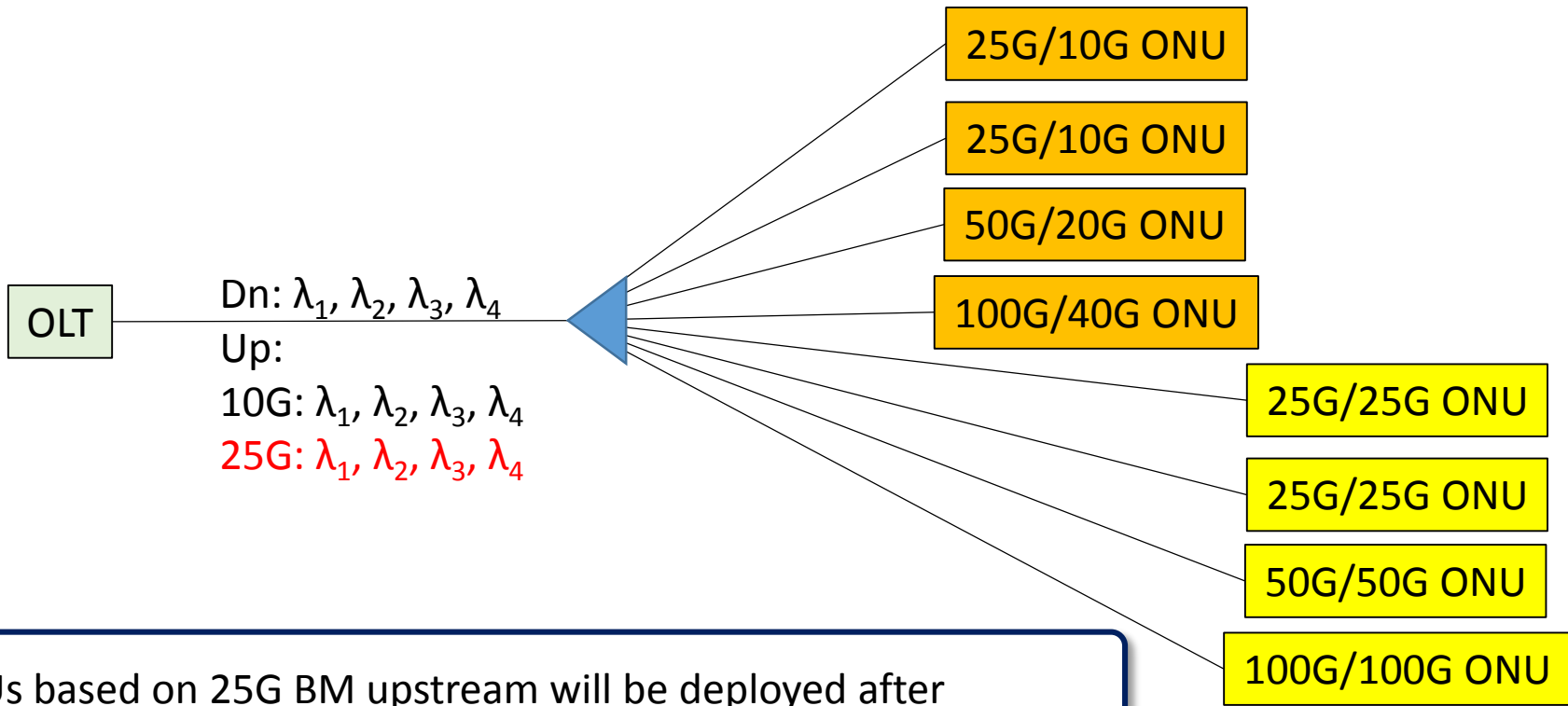


- Bidirectional CWDM optical transceiver was introduced in OFC2014.
- Feasibility of sub-channel CWDM technology was introduced in last FSAN meeting (March, 2016).
 - 6 sub-wavelengths within +/- 6.5 nm wavelength band are available.
 - 5G optical transceiver is available and 10G optical transceiver was introduced OFC 2016.

100G EPON Evolution



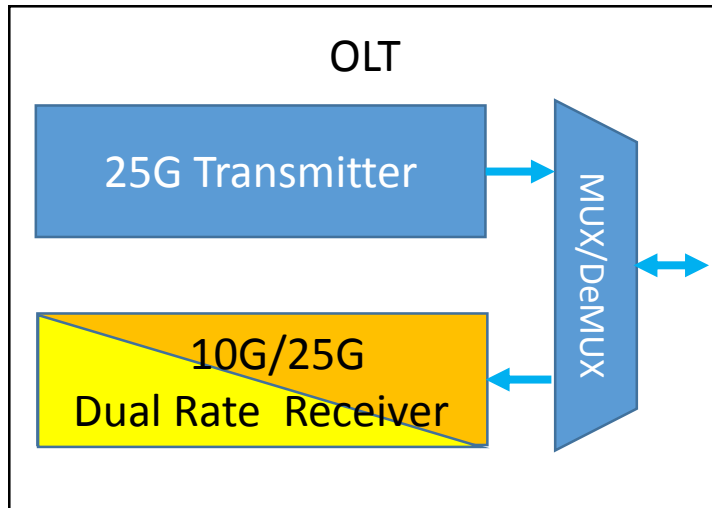
100G EPON based on 10G and 25G Burstmode Upstream



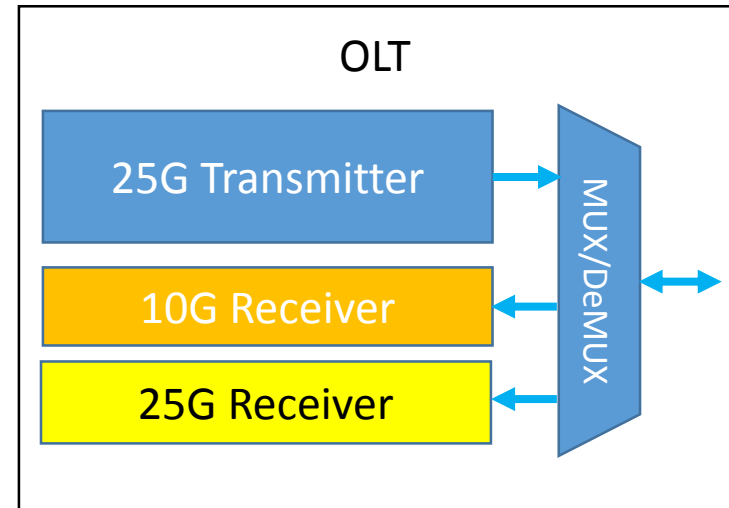
- ONUs based on 25G BM upstream will be deployed after deployment of ONUs based on 10G BM upstream.
- No change of downstream wavelengths to the case I.
- But, it is need to define 25G upstream wavelengths.

OLT Rx Configurations

Shared wavelength

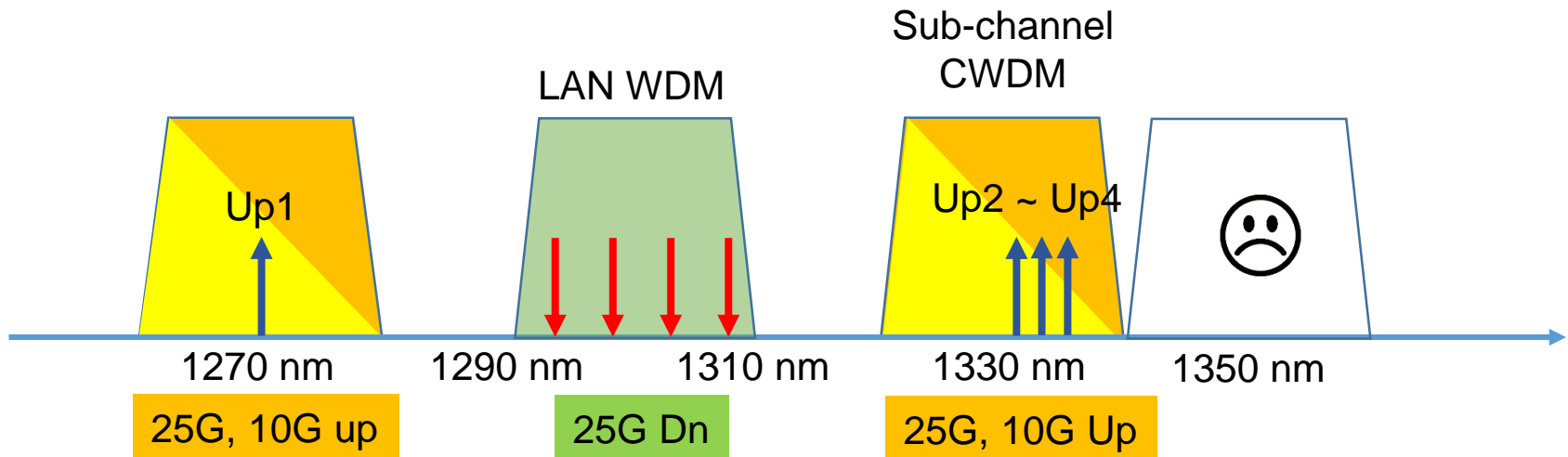


Separated wavelength



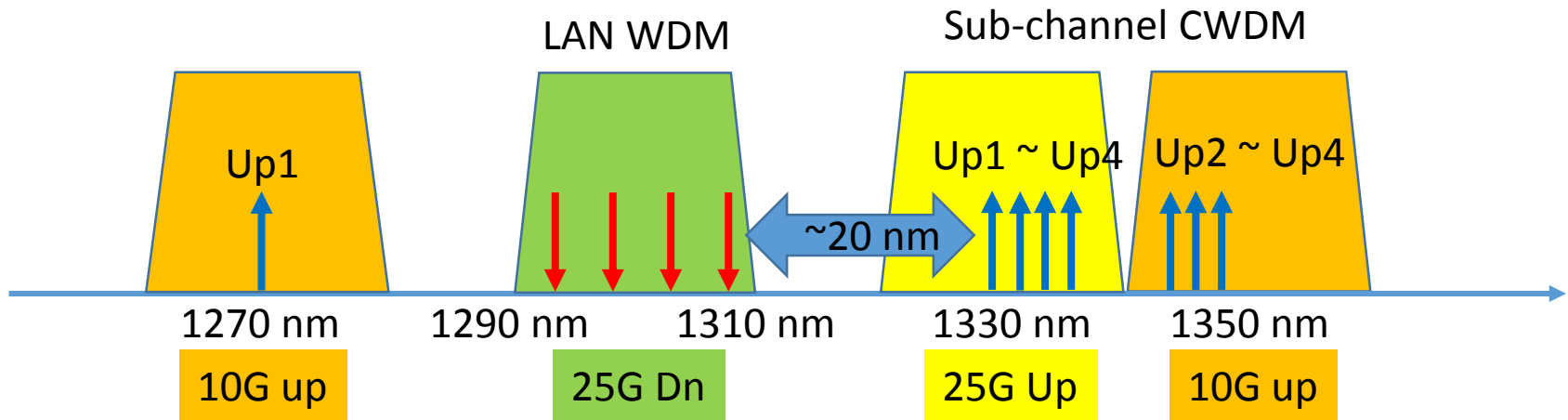
- Shared wavelength case
 - Same wavelength allocation will be used for both Case I and Case II.
 - OLT dual rate receiver will be required.
- Separated wavelength case
 - Additional wavelength allocation for 25G upstreams should be defined.

Wavelength allocation: Shared Wavelength Case



- Upstream wavelength band
 - 1330 nm Sub-channel CWDM will be good rather than 1350 nm band because the 1350 nm band would be avoided due to chromatic dispersion induced crosstalk to 25G transmission.

Wavelength Allocation: Separated Wavelength Case



- 10G upstream wavelength band
 - 1350 nm Sub-channel CWDM
- 25G upstream wavelength band
 - 1330 nm Sub-channel CWDM

Conclusions

- O-band wavelength allocations for 25G downstream and 10G, 25G upstreams are discussed.
- Number of wavelengths allocated for a 100G-EPON system
 - Depends on the cases with shared wavelength or separate wavelength for 10G and 25G burstmode upstreams.
 - 1+3 wavelength system would be simple to design PON MAC, PHY and optical transceiver.
- Their respective locations in the optical spectrum
 - Downstream wavelength allocation: Based on LAN-WDM
 - Upstream wavelength allocation: Based on Sub-channel CWDM