Universal Wavelength Plan
(Brownfield, Greenfield, and Seamless Evolution)

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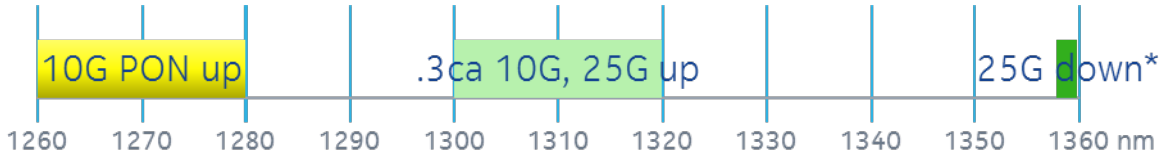
Background

- In the July 802.3ca meeting we passed a motion (#5) that says:

  802.3ca shall adopt an upstream wavelength plan for the first 25G and new 10G (EQ based) channel with two options, Option 1: at 1310nm width 20nm; WDM coexistent with 10G-EPON Option 2: at 1270nm width 20nm; WDM coexistent with G-PON reduced wavelength set. TDM coexistence with legacy PONs is not required (this includes 10G EPON).

- This addresses two brownfield applications:
  - **"Brownfield coexisting with 10G-PON" (BfX):**

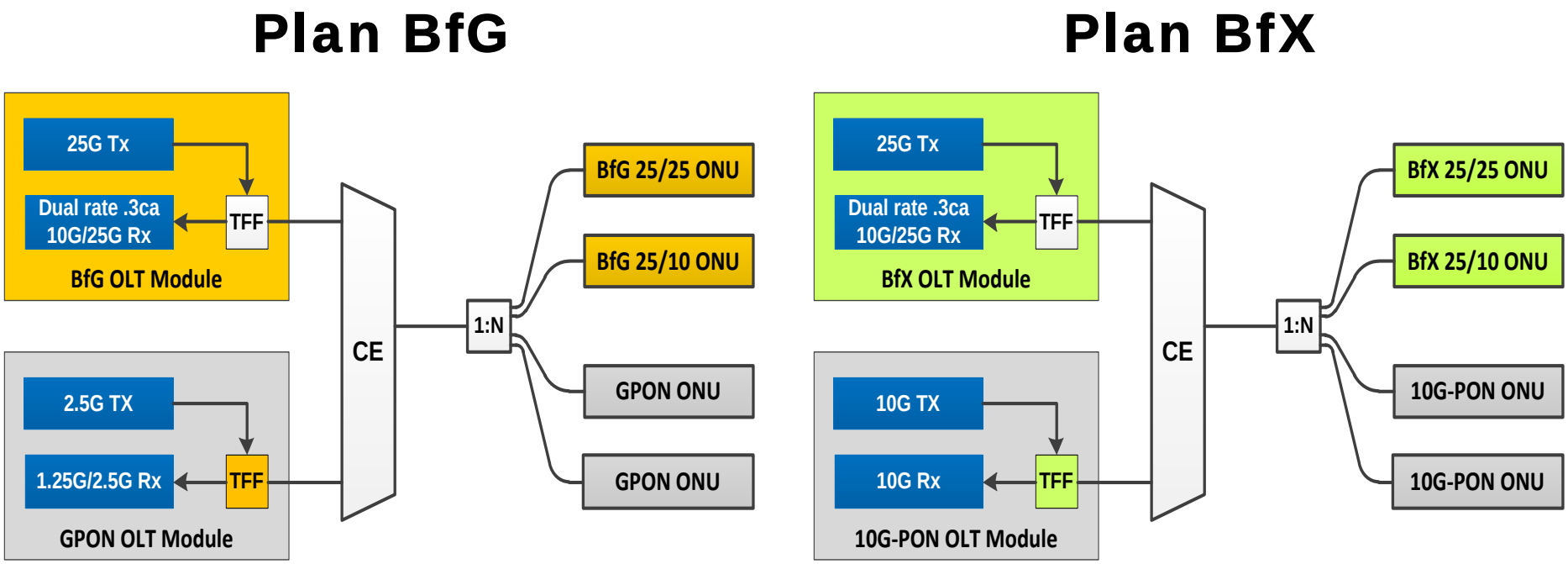


*25G down in O+ band, specific wavelength is t.b.d.

  - **"Brownfield coexisting with GPON and EPON (reduced)" (BfG):**

- In both cases, the .3ca 10G US channel is on the same wavelength as the 25G US channel. To support both 25/10 and 25/25 ONUs on the same ODN, OLTs will need a dual rate OLT receiver and DBA, resulting in a variable total US capacity between 10 and 25 Gb/s.

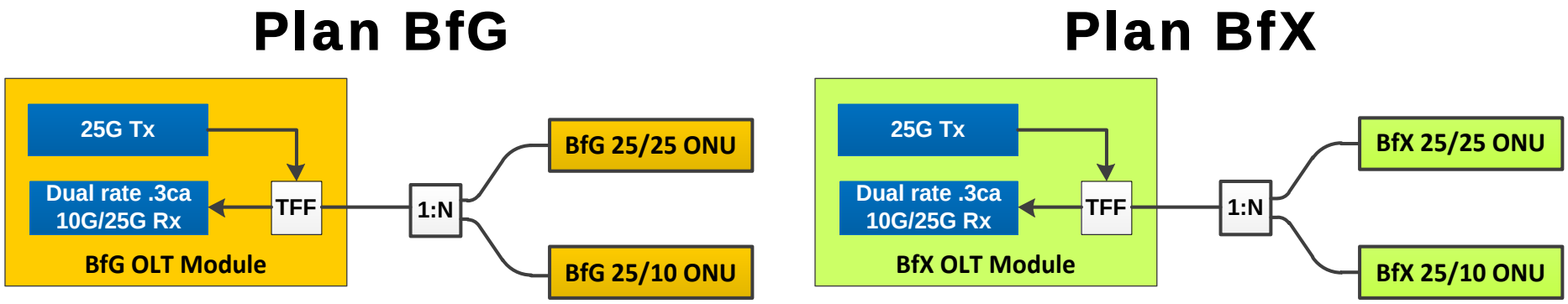
Coexistence Scenarios



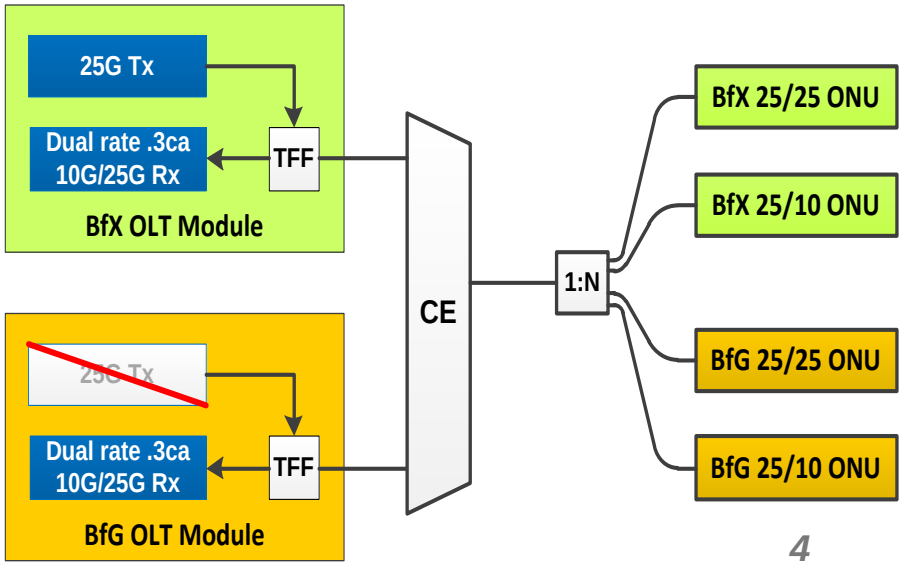
- The BfG and BfX OLT Modules have the same transmitters and receivers, just different filters.

Greenfield Scenarios

- The same BfG and BfX OLT Modules can be used in greenfield deployments.

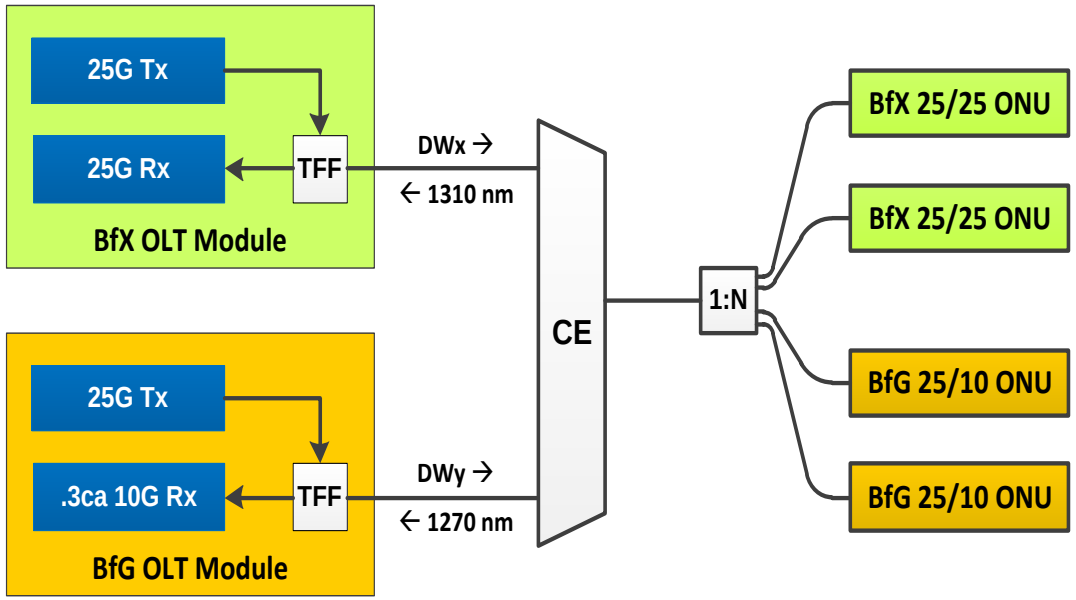


- But what about both plans together?
  - Double the upstream BW
  - An operator may decide to use BfG plan with all 25/10 ONUs and BfX plan with all 25/25 ONUs, eliminating dual-rate TDM coexistence.
  - This requires disabling one 25G Tx port and routing all traffic through the other Tx port



A Better Greenfield Solution

- Motion #5 from Berlin is silent on the downstream wavelengths for plans BfG and BfX.
- Whether the downstream wavelengths are the same or different makes no difference for any brownfield coexistence scenario.
- But in case of both plans being used together in a greenfield deployment, separate downstream wavelengths allow a complete separation of downstream and upstream channels among BfG and BfX ONUs.



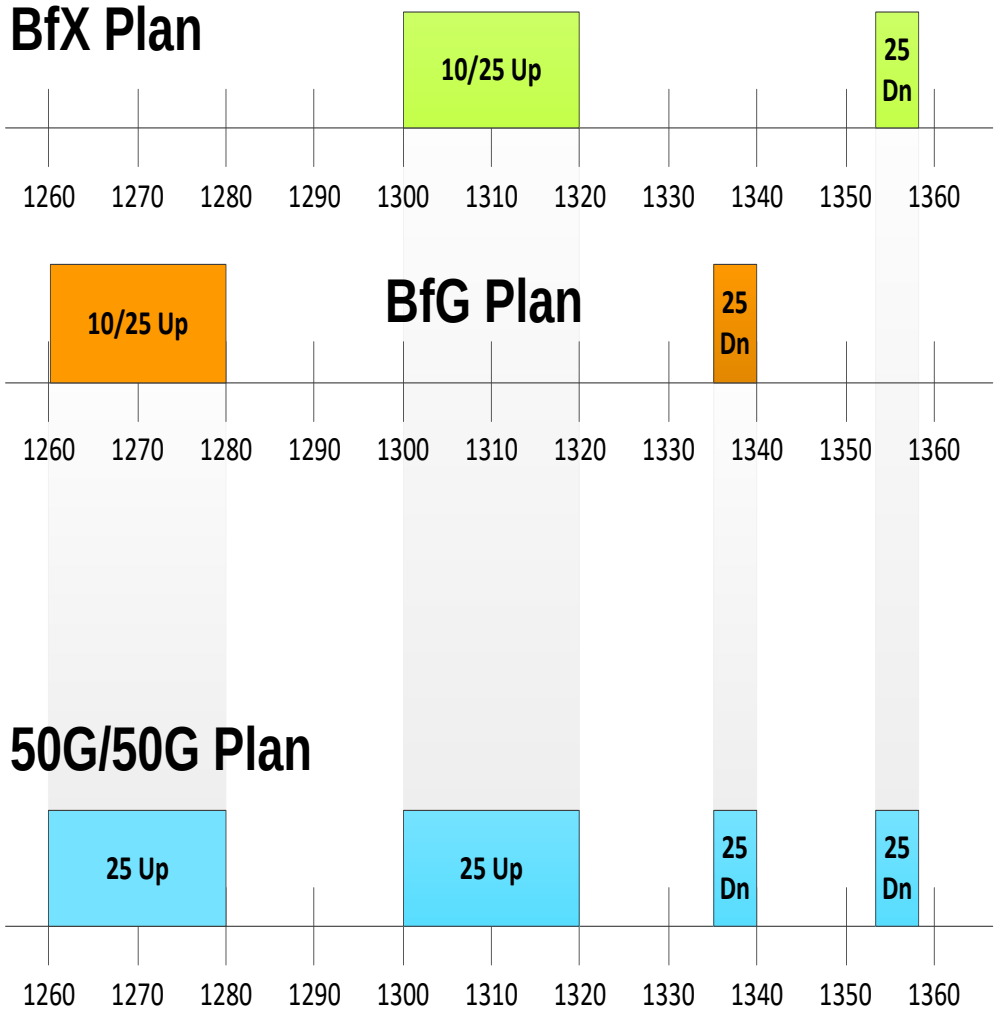
Proposals

Proposal #1:

- Use different downstream wavelengths for the BfG and BfX plans

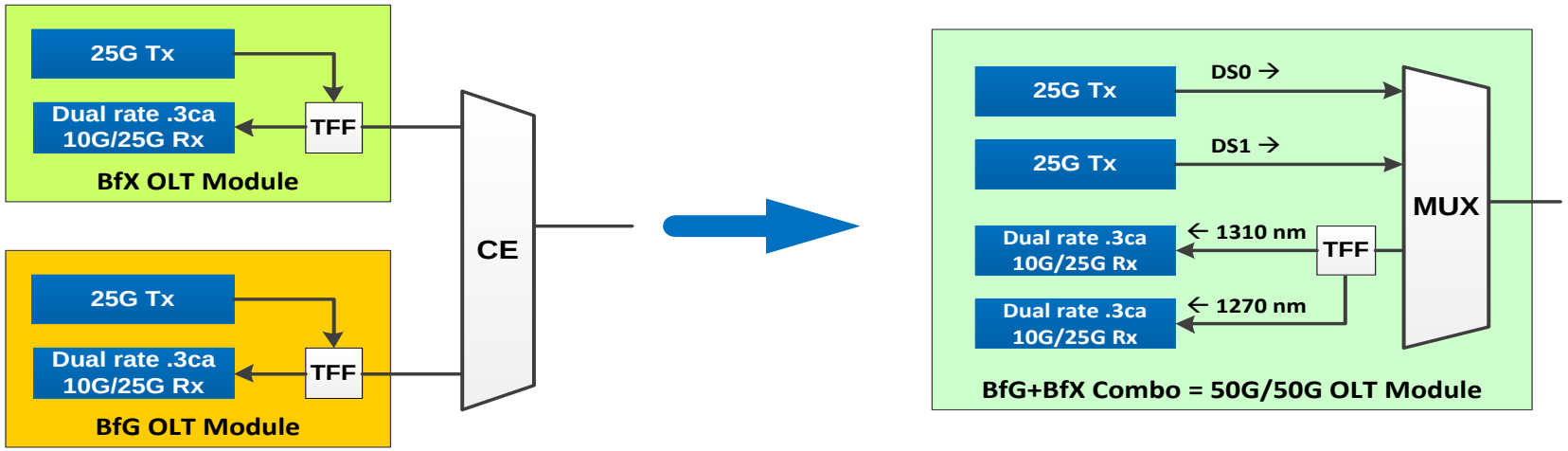
Proposal #2:

- Make the 50G/50G wavelength plan identical to the combination of BfG and BfX plans



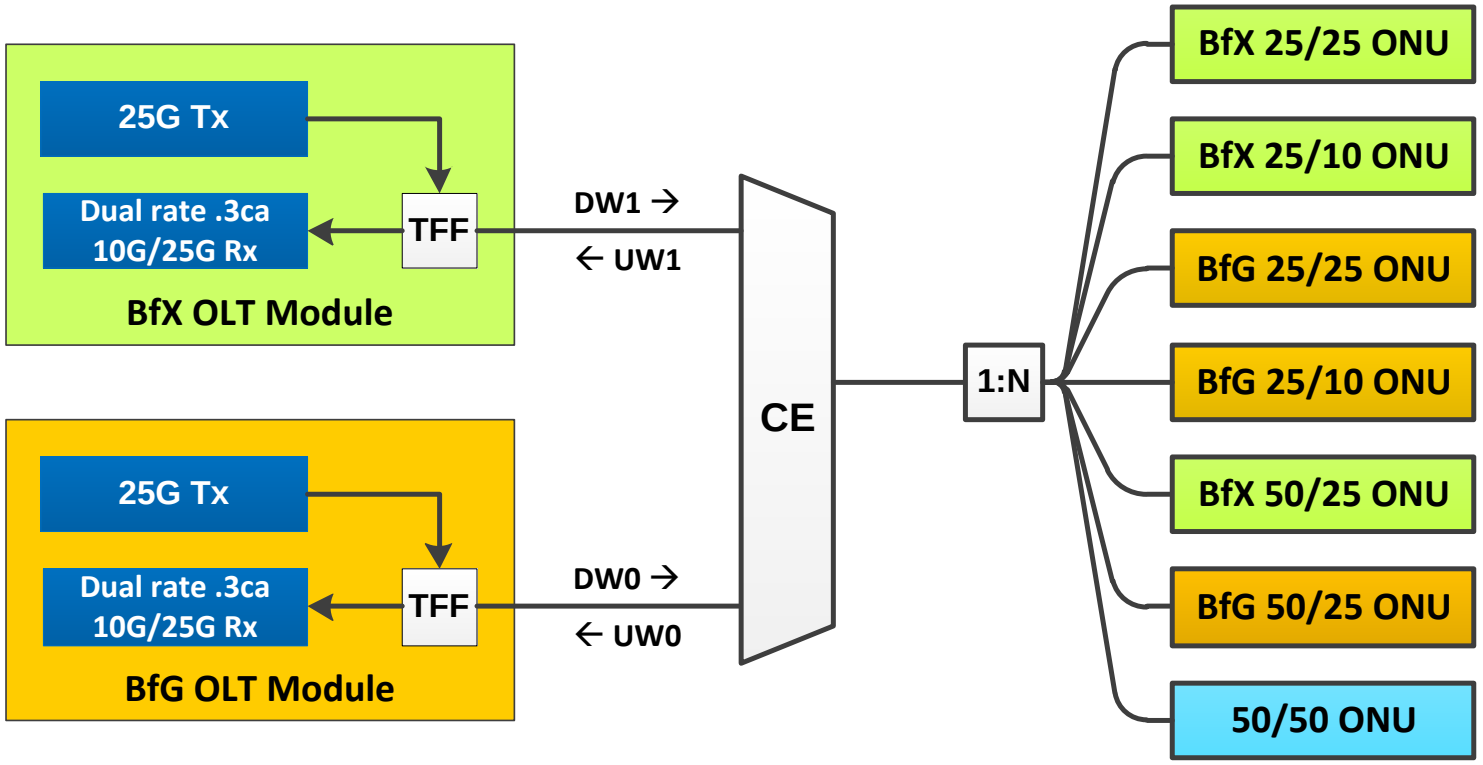
Advantages

- Doubles upstream and downstream capacities
- No changes to SoC beyond what is already required for Brownfield
- Allows operators to deploy 25/10 and 25/25 ONUs using full WDM coexistence (eliminates the need for dual-rate TDM)
- Each Rx path can be a single rate instead of double rate. This should improve sensitivity and lower the cost.
- Operators may start deployments with BfG-only modules, or BfX-only modules, or both modules with an external CE.
- When 50G/50G OLT module becomes available, it can replace the discrete BfG and BfX modules



Coexistence

- An OLT with two discrete BfG and BfX modules or with a single 50G/50G module can simultaneously support BfG ONUs, BfX ONUs, and 50G/50G ONUs.
  - The optical module(s) have to be connected to ports on the same OLT SoC



Channels vs. Wavelengths

- Within the MPRS and PCS, the data path consists of **four downstream channels (DC0-DC3)** and **four upstream channels (UC0-UC3)**. These data channels play distinct roles:

Data Channel Designation	Function
DC0	All ONUs can listen, broadcast, ONU discovery
DC1	Only 50/x and 100/x ONU can listen
DC2	Only 100/x ONU can listen
DC3	
UC0	All ONUs can transmit, ONU discovery
UC1	Only x/50 and x/100 ONUs can transmit
UC2	Only x/100 ONUs can transmit
UC3	1310

- Within the PMD, the information exchange is performed over **four downstream wavelengths (DW0-DW3)** and **four upstream wavelengths (UW0-UW3)**.

- MPRS and PCS are unaware of the PMD implementation. The data channel assignments should not depend on the wavelength plan used.

Channel-to-Wavelength Mapping

- In the standard, we only need to define a single wavelength plan
  - Each wavelength is defined at one and only one position
- 802.3ca shall provide mapping of upstream and downstream channels to specific wavelengths.
  - This mapping will be different for the BfG and BfX plans

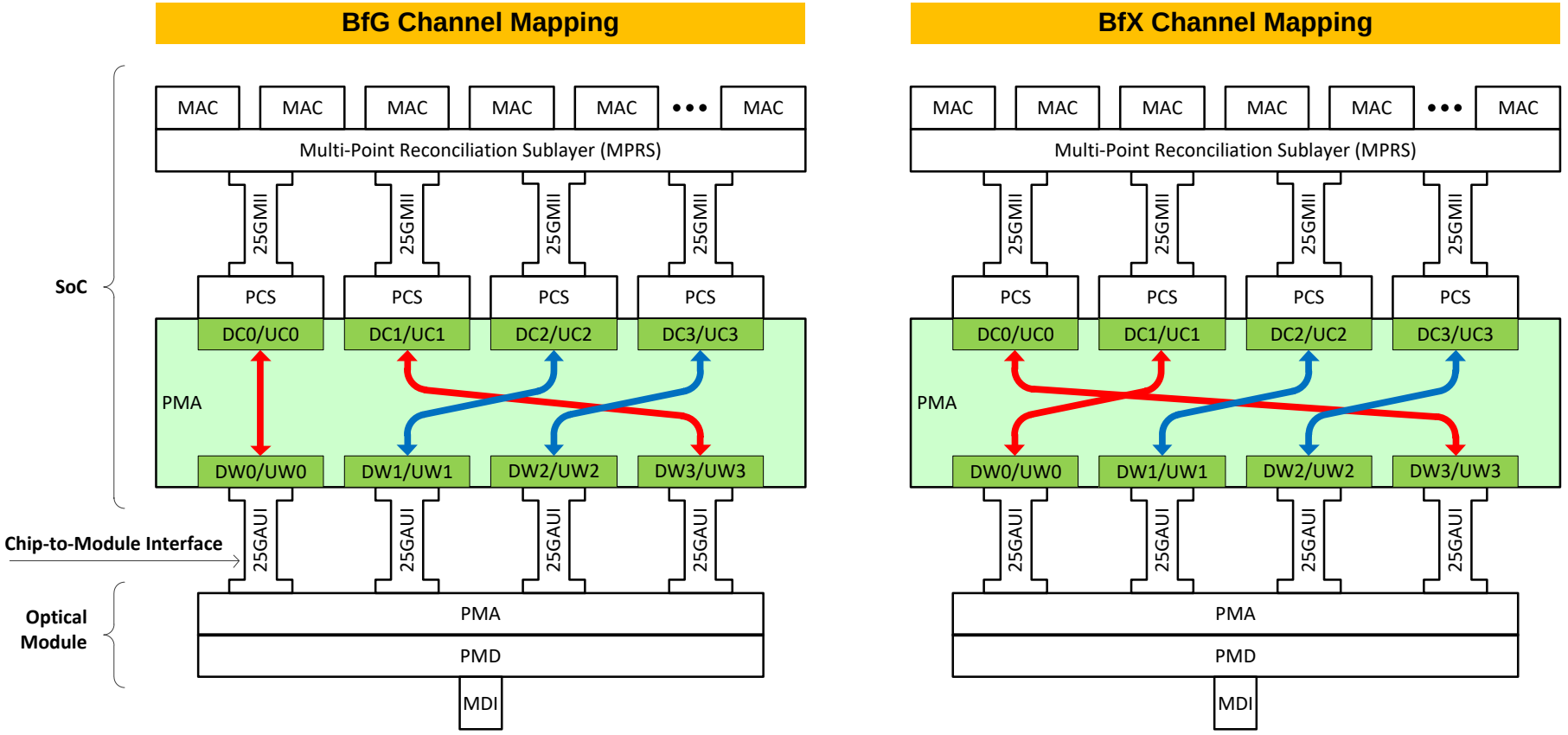
Wavelength Designation	Center (nm)	Width (nm)
DW0	1334*	3*
DW1	1342*	3*
DW2	1350*	3*
DW3	1358*	3*
UW0	1270	20
UW1	1286*	4*
UW2	1294*	4*
UW3	1310	20

Data Channel	Maps to Wavelength	
	In BfG plan	In BfX Plan
DC0	DW0	DW3
DC1	DW3	DW0
DC2	DW1	DW1
DC3	DW2	DW2
UC0	UW0	UW3
UC1	UW3	UW0
UC2	UW1	UW1
UC3	UW2	UW2

* Value is TBD

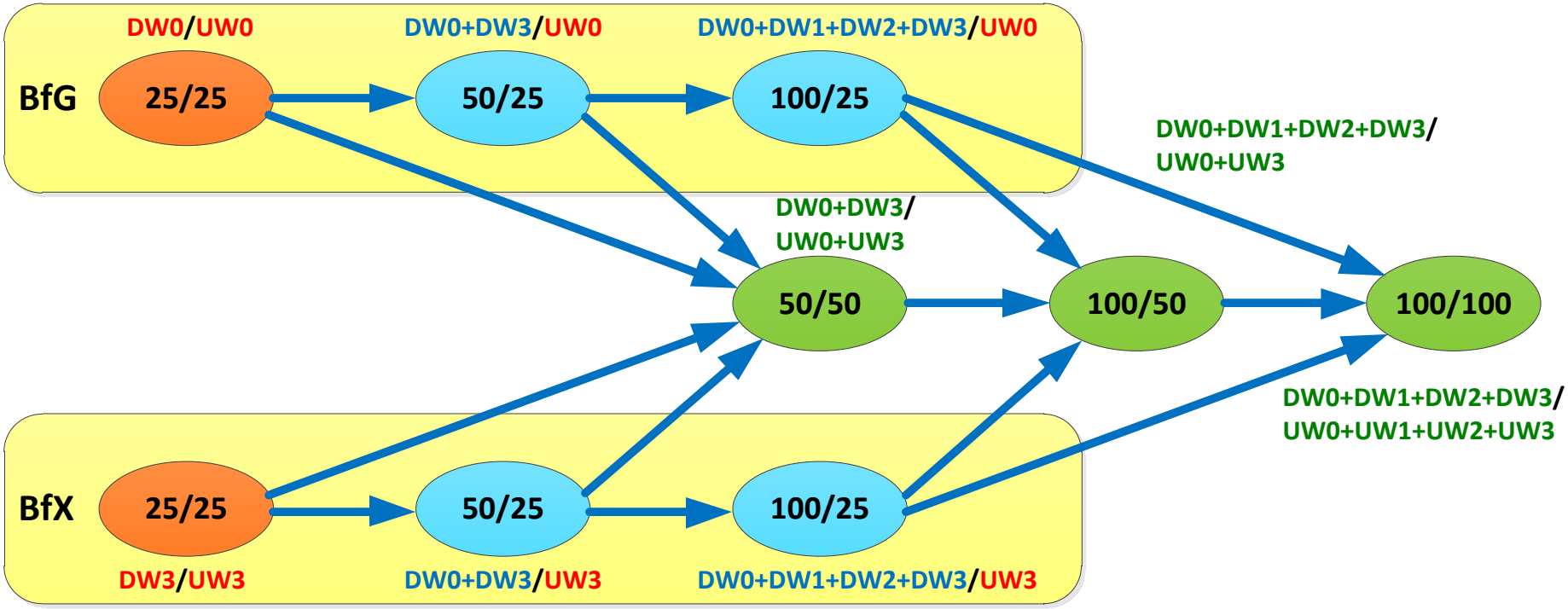
Multi-channel PMA

- Channel-to-Wavelength mapping is function of the PMA sublayer
- Via static provisioning, PMA should be configurable to support BfG or BfX configuration.



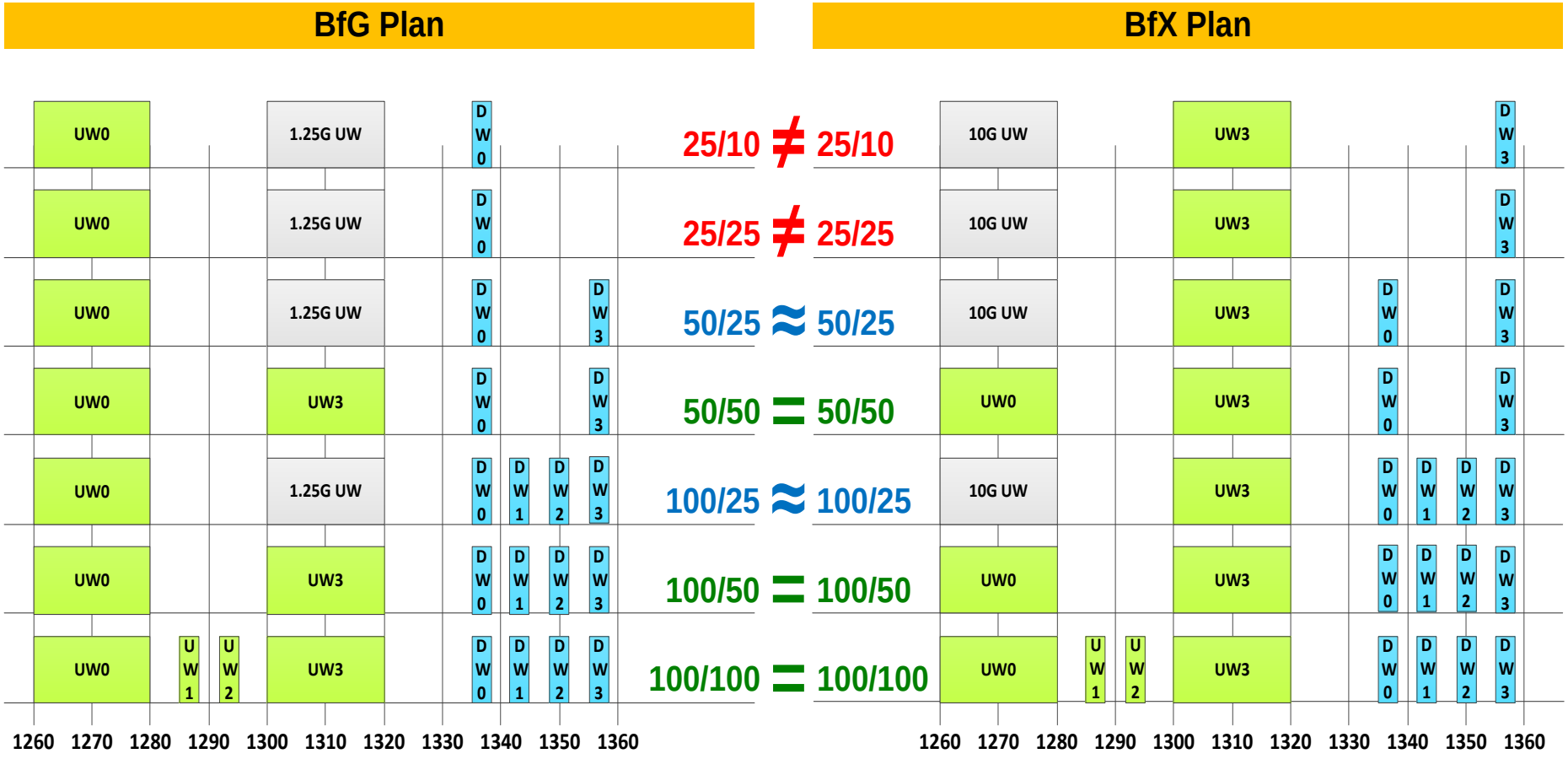
Optical Module Evolution

- We may start with two flavors for 25G optics (BfG and BfX)
- At 50/25 and 100/25, downstream components become identical
- At 50/50, 100/50, and 100/100, the two plans merge into one



Wavelengths

- BfG and BfX optical modules initially implement different wavelengths of the same wavelength plan.



Thank You