Wavelength Plan Options

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July 2017

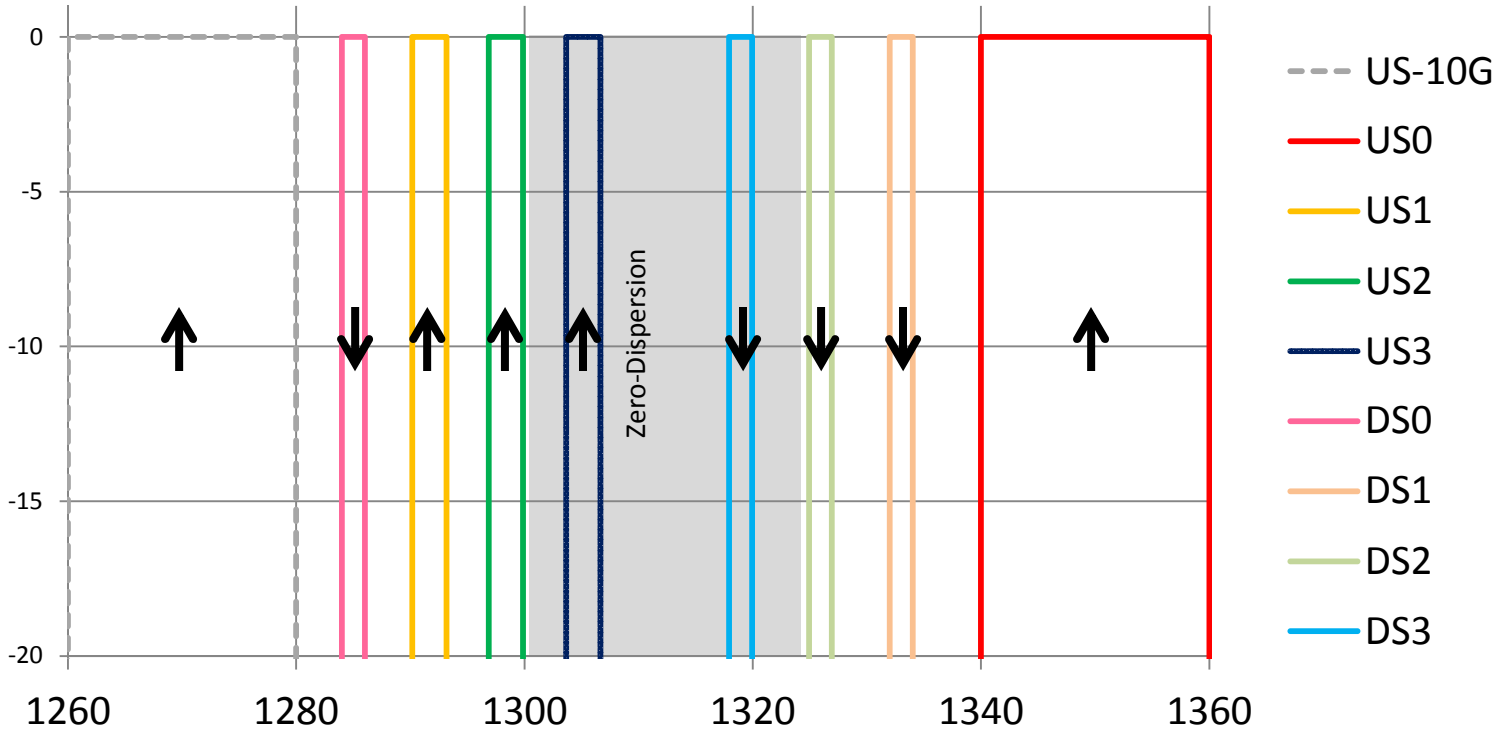
Attractive ideas

- Having the first upstream channel allowing the use of uncooled DML transmitter is good
- Having a wavelength plan that allows WDM coexistence with previous systems is good
- Previous systems include
  - 10G-EPON, XG-PON, XGS-PON (1260-1280nm)
  - Reduced G-PON (1290-1330nm)
- A big question is: Must we coexist with both simultaneously?

Repulsive ideas

- Inter-generational TDM coexistence
  - Requires the replacement of existing OLTs
  - Shares time (capacity) between the new and old systems
  - Encumbers the new system with the old PON
- TDM is still of interest, but only intra-generational
  - An asymmetric 25/10 ONU would use the same wavelength as the 25/25 ONU, using a slowed down version of the 25G protocol

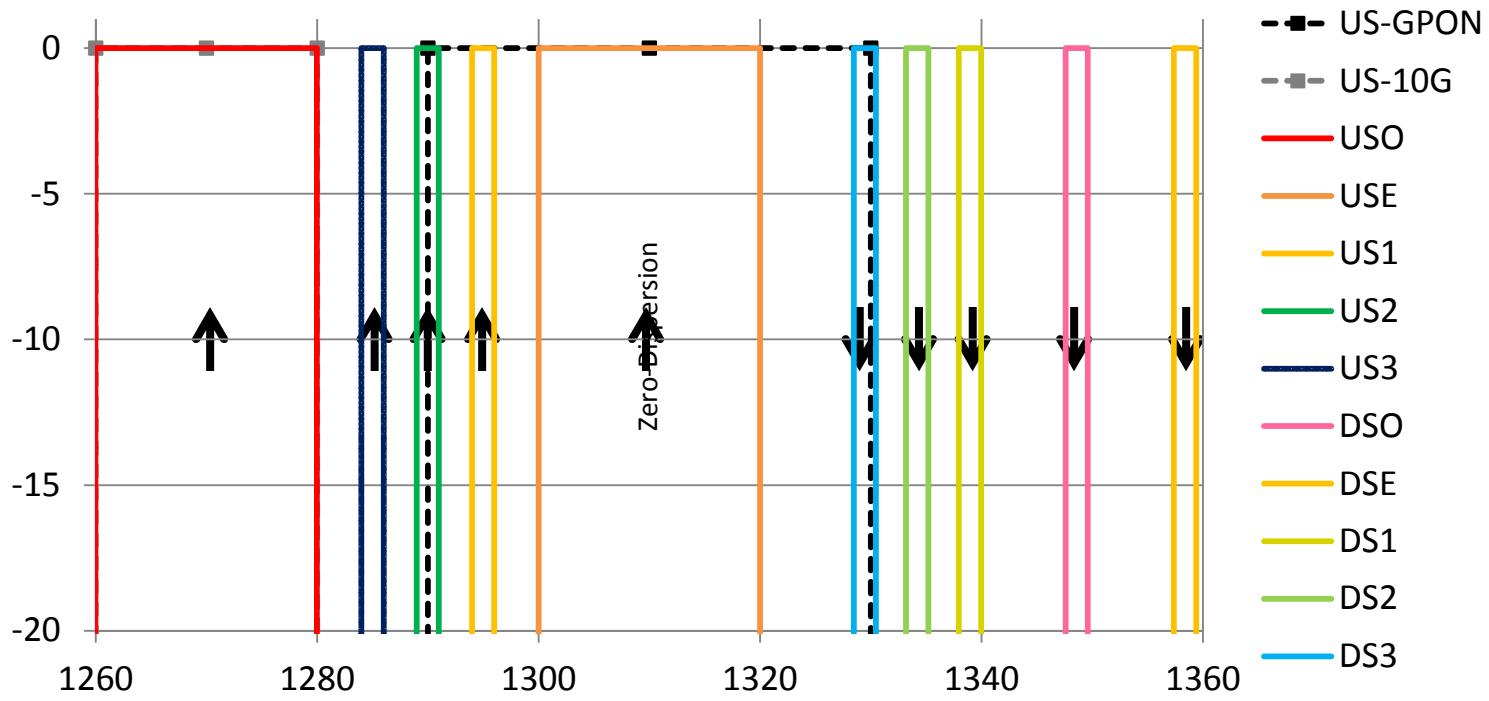
Simultaneous coexistence: Plan Z



	Center freq	Center WL	PB width
US0	222.07	1350.00	20
US1	232.10	1291.65	3
US2	230.90	1298.36	3
US3	229.70	1305.15	3

	Center freq	Center WL	PB width
DS0	233.30	1285.01	2
DS1	224.90	1333.00	2
DS2	226.10	1325.93	2
DS3	227.30	1318.93	2

Either-Or coexistence: Plan EO



	Center freq	Center WL	PB width
USO	236.06	1269.98	20
USE	228.85	1310.00	20
US1	231.50	1295.00	2
US2	232.40	1289.98	2
US3	233.30	1285.01	2

	Center freq	Center WL	PB width
DSO	222.30	1348.59	2
DSE	220.70	1358.37	2
DS1	223.90	1338.96	2
DS2	224.70	1334.19	2
DS3	225.50	1329.46	2

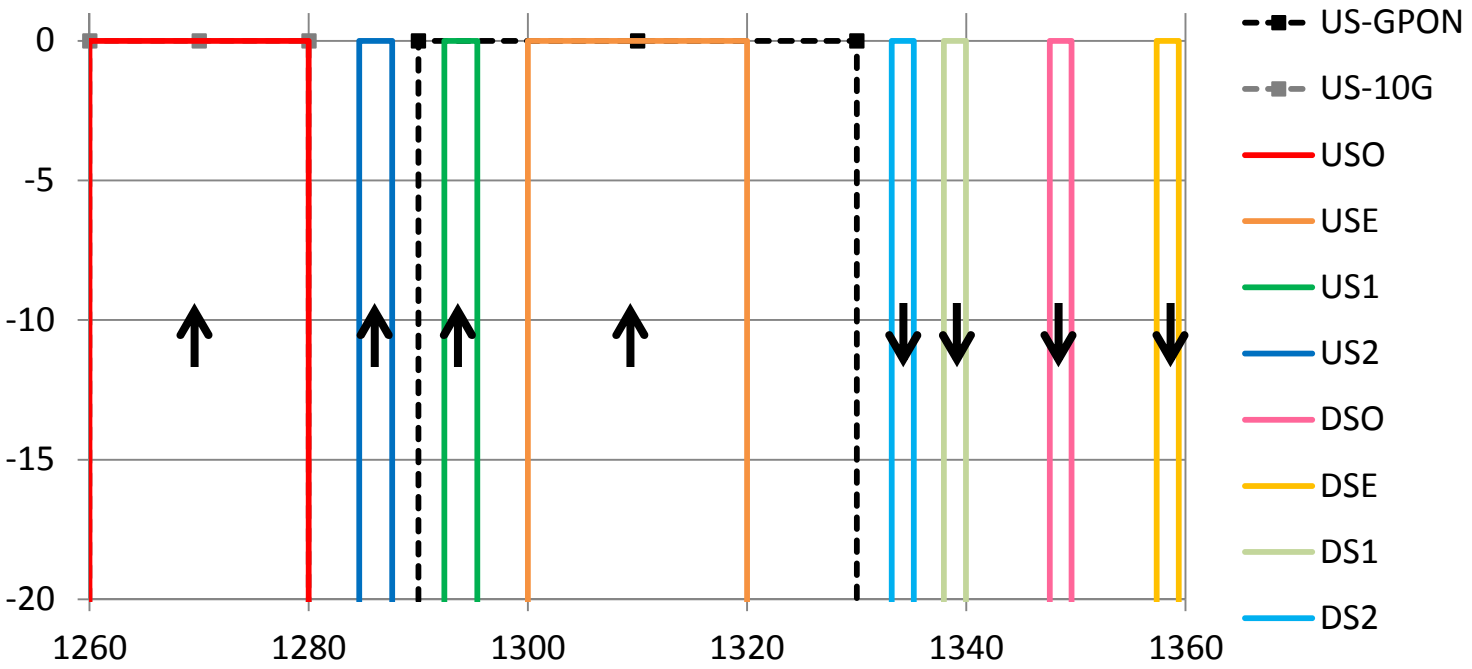
How to use Plan EO

- Either you coexist with 10GEPON
  - Use Channel pair E
- Or you coexist with G-PON
  - Use Channel pair O
- Channels 1, 2, and 3 get added later
  - The order of addition is a debatable point
- This plan ends up giving us 5 bidirectional channels
  - Standard would not specify such a system
  - However, it reflects a conservation of spectrum resources for some future system

Comment: Why have an E and O downstream channel?

- These plans have a 1 to 1 pairing of down and up stream channels
  - This makes each channel pair a complete system
  - They are on an equal footing
  - The E and O options can coexist with each other
- Other plans end up with 4 downstream and 5 upstream channel assignments, which is odd

Simplified plan EO



	Center freq	Center WL	PB width
USO	236.06	1269.98	20
USE	228.85	1310.00	20
US1	231.70	1293.88	3
US2	233.10	1286.11	3

	Center freq	Center WL	PB width
DSO	222.30	1348.59	2
DSE	220.70	1358.37	2
DS1	223.90	1338.96	2
DS2	224.70	1334.19	2

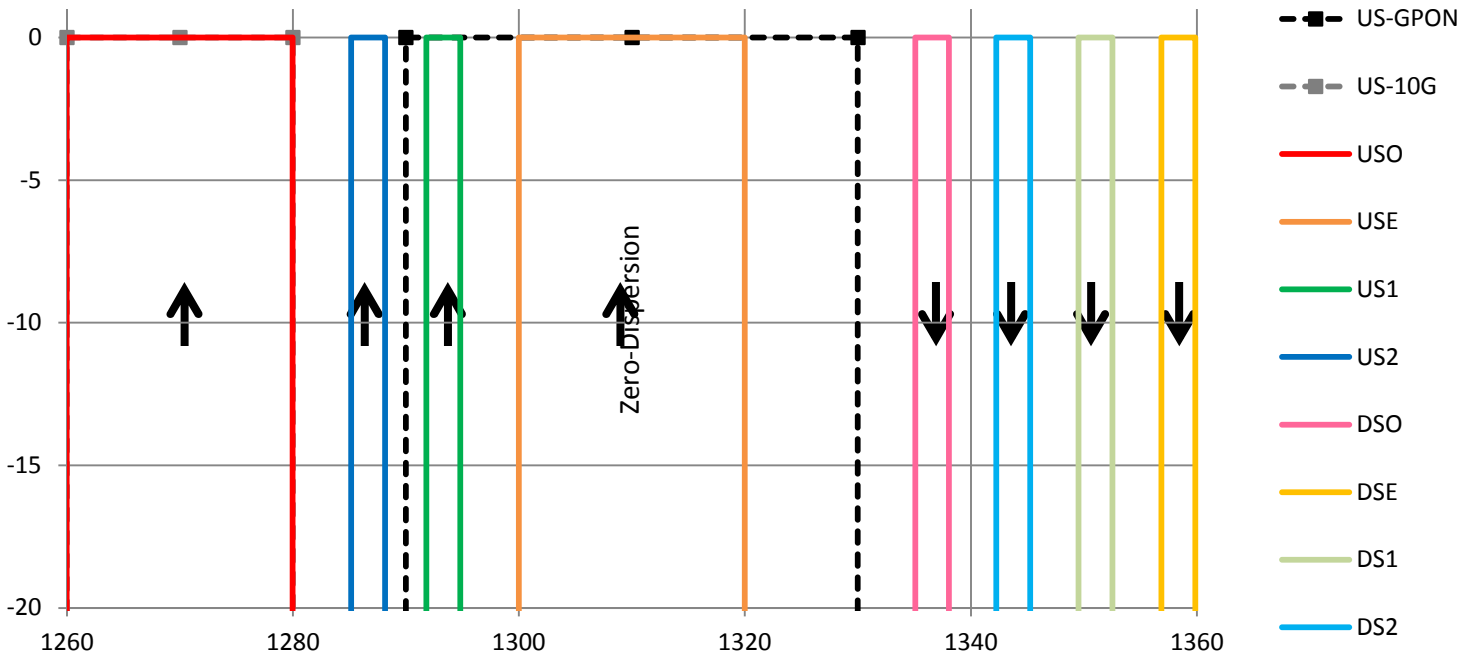
How to use Plan Simple-EO

- Either you coexist with 10GEPON
  - Use Channel pair E
- Or you coexist with G-PON
  - Use Channel pair O
- Then add channels 1 and 2 for 50G
- 100G would activate the “other” wavelength
- This plan only has 4 bidirectional channels
  - Not as future proof, but…
  - Upstream channels are 3nm wide and 7nm spaced

Comment: Can we make the downstream channels 3nm wide?

- There is nothing magic about the downstream channel arrangement
- The following “simpler” plan implements 3nm wide, and 1200GHz spacing
- The downstream channels are also in the same order as the upstream channels
  - Trying to make the diplexer requirements balanced over all the plans

Simpler plan EO



	Center freq	Center WL	PB width
USO	236.06	1269.98	20
USE	228.85	1310.00	20
US1	231.80	1293.32	3
US2	233.00	1286.66	3

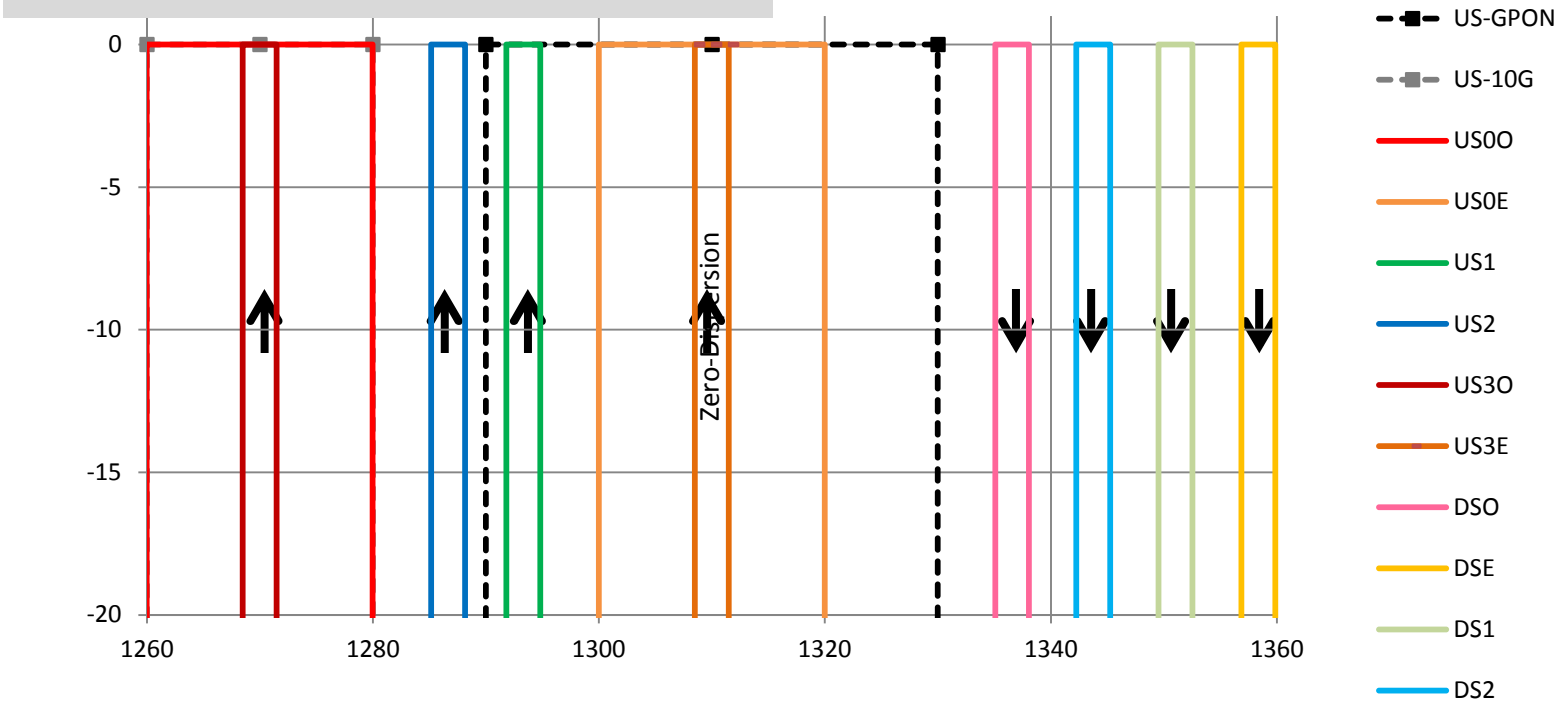
	Center freq	Center WL	PB width
DSO	224.30	1336.57	3
DSE	220.70	1358.37	3
DS1	221.90	1351.03	3
DS2	223.10	1343.76	3

Comment: Why is the 4th channel wide?

- The motivation is to reuse the same transmitters for the two uses of the channel, and to make each plan use all the same optics (at some point)
- However, it is likely that the 4 channel 100G ONU will need a high power, and be cooled
- In that sense, it would be suitable to define narrower ranges for the 100G application of those channels
  - The same lasers would be used for both, either with cooling (3nm wide) or uncooled (20nm wide)
- The following plan illustrates this idea
- Interestingly: The 4 narrow channels are almost on an 8nm wavelength grid, making a cyclic AWG design possible

Plan EO v4

AWG ch:4* 1 2 3 4 1’



	Center freq	Center WL	PB width
US0O	236.06	1269.98	20
US0E	228.85	1310.00	20
US1	231.80	1293.32	3
US2	233.00	1286.66	3
US3O	236.06	1269.98	3
US3E	228.85	1310.00	3

	Center freq	Center WL	PB width
DSO	224.30	1336.57	3
DSE	220.70	1358.37	3
DS1	221.90	1351.03	3
DS2	223.10	1343.76	3

Discussion

- It is our belief all three of these systems are technically feasible
  - Plan Z carries some technical risk, as DSP in the OLT is nearly essential here
  - However, plan Z is a unified plan, and DSP brings other advantages (soft decoding)
- The big question is: Do we need simultaneous coexistence?
  - If yes, then Plan Z is the only choice
  - If no, then Plan EO variants can also work
- If we can use plan EO, do we want 4 channels or 5?
  - We would tend towards 4 channels

Straw poll

- Of these plans, which do you think has some merit?
  - Plan Z
  - Plan EO
  - Plan simplified EO
  - Plan simpler EO
  - Plan EOv4
- Vote for as many as you like – just to get a sense of the room's opinion