Coexistence and Upgrade

Dezhi Zhang, Ming Jiang

China Telecom

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Background

- Regarding candidate wavelength plans, from operators' point of view, coexistence and upgrade need to be considered when making decision

- This contribution is target to provide possible coexistence and upgrade scenarios, with associated impact analysis to serve the wavelength discussion and decision

- The scenarios and impact analysis in the contribution may not be exhaustive. So it serves as a baseline for further refine by group

Possible coexistence and upgrade scenarios (green field)

Scenario	Legacy	OLT		ONU				
		Capacity	Rates combinations	10/10	25/10	25/25	50/50	100/100
G1	N	25G	DS:25; US:10	N	Y	N	N	N
G2	N	25G	DS:25; US:25	N	N	Y	N	N
G3	N	25G	DS:25; US:10+25	N	Y	Y	N	N
G4	N	100G (1+3)	DS:4*25; US:4*25	N	N	Y	Y	Y
G5	N	100G (1+3)	DS:4*25; US:10+4*25	N	Y	Y	Y	Y
G6	N	100G (1+4)	DS:4*25; US:4*25	N	N	N	Y	Y
G7	N	25G+100G (1+4)	DS:5*25; US:5*25	N	N	Y	Y	Y
G8	N	25G+100G (1+4)	DS:5*25; US:10+5*25	N	Y	Y	Y	Y

Possible coexistence and upgrade scenarios (brown field)

Scenario	Legacy	OLT		ONU				
		Capacity	Rates combinations	10/10	25/10	25/25	50/50	100/100
B1	10G	10G+25G	DS:10+25; US:10	Y	Y	N	N	N
B2	10G	10G+25G	DS:10+25; US:10+25	Y	Y	Y	N	N
B3	10G	10G+100G (1+3)	DS:10+4*25; US:10+4*25	Y	Y	Y	Y	Y
B4	10G	10G+100G (1+4)	DS:10+4*25; US:10+4*25	Y	N	N	Y	Y
B5	10G	10G+25G+100G (1+4)	DS:10+5*25; US:10+5*25	Y	Y	Y	Y	Y
B6	25G	100G(1+3)	DS:4*25; US:4*25	N	N	Y	Y	Y
B7	25G	25G+100G(1+4)	DS:5*25; US:5*25	N	Y	Y	Y	Y
B8	25G	25G+100G*(1+4)	DS:5*25; US:10+5*25	N	Y	N	N	N

Opex overview for coexistence and upgrade

- **Besides Capex (OLT, ODN, ONU etc), Opex is a big source of the Cost, which includes:**
  - **Space:** to place the OLT, WDM and ODF etc. For coexistence and upgrade scenarios
    - Typically we consider office space/area requirement to put new OLT chassis, WDM etc.
    - Given the density of 100G-EPON line card will be much lower than 10G-EPON, the space requirement should be higher, and ratio may be > 1:1
  - **Electricity:** to run communication equipment and air-conditioner. Generally the power consumption of equipment is a focus for evaluation
  - **Switch cost:** including lab test, field trial, management system development/adaption and cutover.
    - Lab test and field trial is a small and limited scale operation
    - Management system development/adaption may be complex given the original design
    - (OLT) Cut-over operations involves all deployed sites and may proceed several years, which has very heavy impact on Opex
  - **Human Cost:** including many manual operations' cost during coexistence and upgrade scenarios (note: manual operation during cut-over is counted in switch cost. And other human cost, which depends on operators' field procedure and varies widely, is not taken into the comparison)

Opex estimation in CO for Gx Scenarios

Scenario	Legacy	OLT		Opex		
		Capacity	Rates combinations	Space	Electricity	Switch Cost
G1	N	25G	DS:25; US:10	a	b	c
G2	N	25G	DS:25; US:25	a	b	c
G3	N	25G	DS:25; US:10+25	a	b	c
G4	N	100G (1+3)	DS:4*25; US:4*25	4a	4b	c
G5	N	100G (1+3)	DS:4*25; US:10+4*25	4.5a	4.5b	c
G6	N	100G (1+4)	DS:4*25; US:4*25	4a	4b	c
G7	N	25G+100G (1+4)	DS:5*25; US:5*25	5a+Δ+β	5b	1c-2c *
G8	N	25G+100G (1+4)	DS:5*25; US:10+5*25	5.5a+Δ+β	5.5b	1c-2c *

Δ: extra space for WDM component

β: extra space requirement when 10G/25G/100G placement in different cards cards

*: Depends on the number of times triggered by the OLT switch/placement

Opex estimation in CO for Bx Scenarios

Scenario	Legacy	OLT		Opex		
		Capacity	Rates combinations	Space	Electricity	Switch Cost
B1	10G	10G+25G	DS:10+25; US:10	1.5a	1.5b	c
B2	10G	10G+25G	DS:10+25; US:10+25	2a	2b	c
B3	10G	10G+100G (1+3)	DS:10+4*25; US:10+4*25	5a+Δ+β	5b	c
B4	10G	10G+100G (1+4)	DS:10+4*25; US:10+4*25	5a+Δ+β	5b	c
B5	10G	10G+25G+100G (1+4)	DS:10+5*25; US:10+5*25	6a+Δ+2β	6b	(1c - 2c) *
B6	25G	100G(1+3)	DS:4*25; US:4*25	4a	4b	c
B7	25G	25G+100G(1+4)	DS:5*25; US:5*25	5a+Δ+β	5b	c
B8	25G	25G+100G*(1+4)	DS:5*25; US:10+5*25	5.5a+Δ+β	5.5b	c

Δ: extra space for WDM component

β: extra space requirement when 10G/25G/100G placement in different cards cards

*: Depends on the number of times triggered by the OLT switch/placement

Thank you!

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