

# 100G VCSELS with 30 m OM3 or 50 m OM4 Links

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# Note on use of “100G-SR” in this presentation

- In this presentation, I use the terms 100G-SR, 400G-SR4, etc. for the sake of clarity
- However, I believe the Task Force should save 100G-SR for future projects with 100 m reach targets
- This is a future topic for the Task Force at the appropriate time

# Motivation

- In Geneva the SG adopted these objectives:
  - Define a physical layer specification that supports 100 Gb/s operation over 1 pair of MMF with lengths up to at least 50 m
  - Define a physical layer specification that supports 200 Gb/s operation over 2 pairs of MMF with lengths up to at least 50 m
  - Define a physical layer specification that supports 400 Gb/s operation over 4 pairs of MMF with lengths up to at least 50 m
- For economic feasibility we need to offer the lowest possible cost for switch to server interconnects (< 30 m) to compete with DACs and AOCs
- For broad market potential, there is a benefit to support 50 m switch to switch links
- Will the 50 m objectives we adopted increase the cost of 30 m links? No

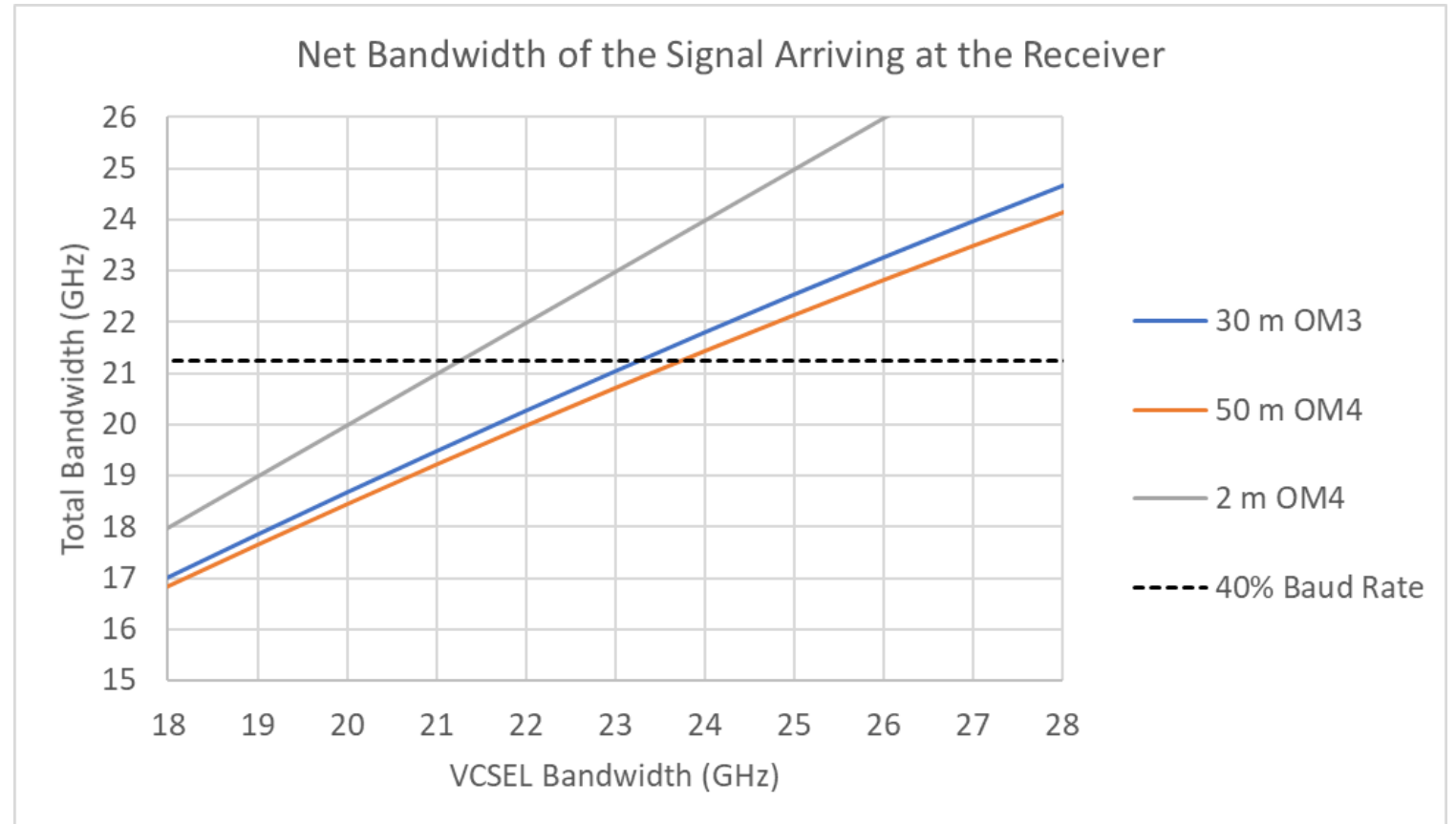
# Calculate total bandwidth as seen by the receiver

$$\frac{1}{BW_{Total}^2} = \frac{1}{BW_{VCSEL}^2} + \frac{1}{BW_{Chromatic\ Dispersion}^2} + \frac{1}{BW_{Modal\ Dispersion}^2}$$

- First order approximation, conservative
- VCSEL bandwidth ~15-33 GHz
- Use OM5 chromatic dispersion specs for OM3 and OM4
  - 1328 nm and 0.093477 ps/(nm<sup>2</sup>\*km)
- Modal dispersion from IEC 60793-2-10:2019
- Center wavelength 840 nm
- Spectral width 0.6 nm
- Use rule of thumb target total bandwidth = 40% of baud rate = 21.25 GHz

# Required VCSEL bandwidth for 40% target

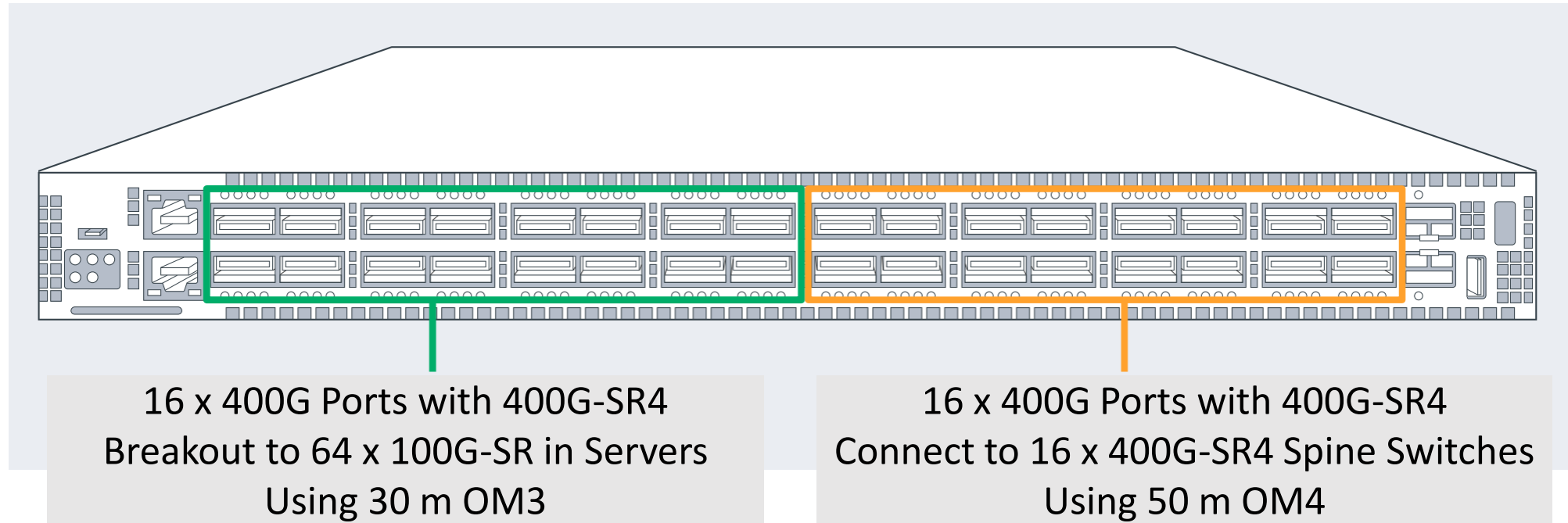
- 2 m OM4
  - 21.25 GHz
- 30 m OM3
  - 23.28 GHz
- 50 m OM4
  - 23.76 GHz
- < 0.5 GHz difference



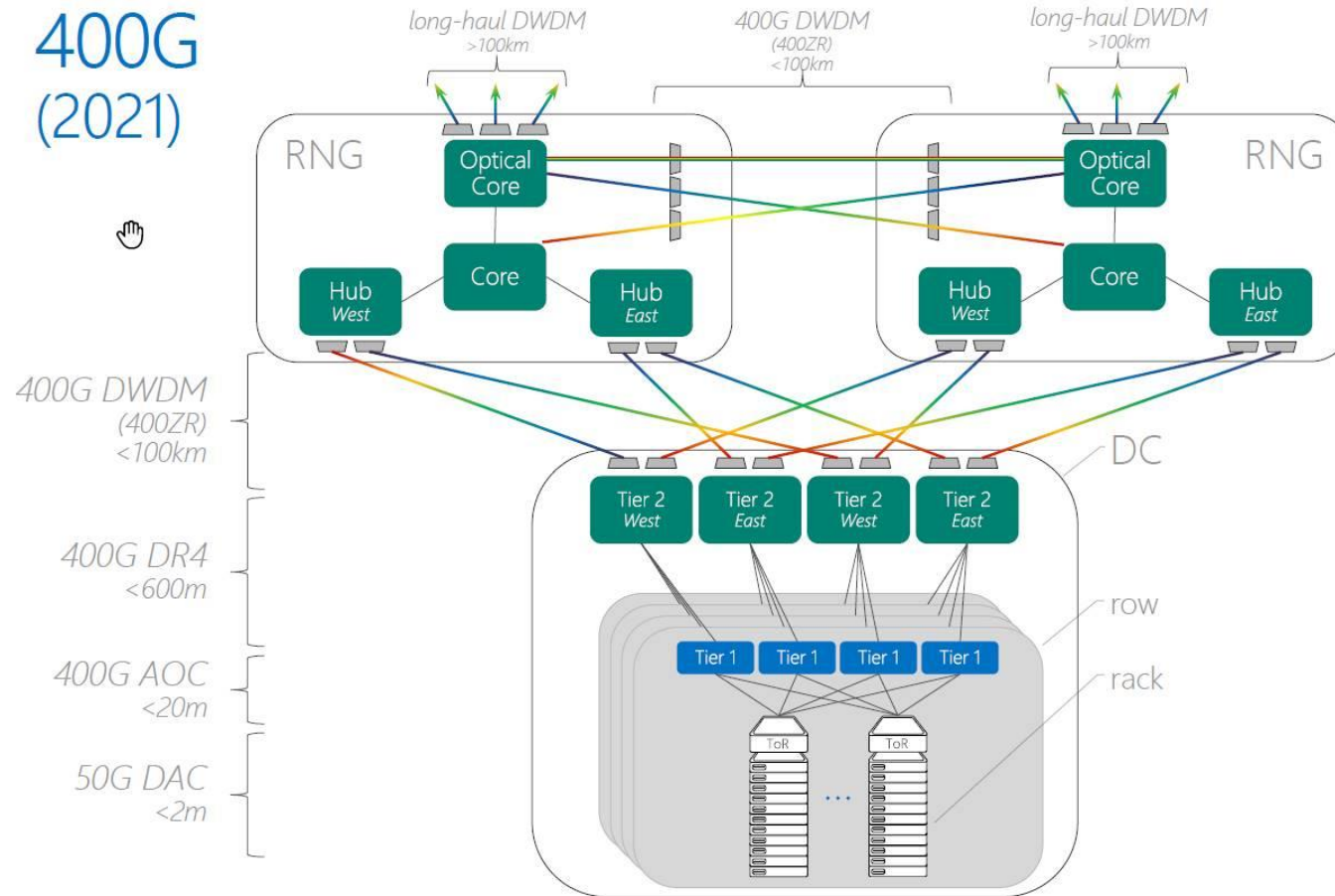
- Minimal increase in VCSEL cost to support 50 m reach over 30 m reach
- 50 m objective increases broad market potential and volumes

# 400G-SR4 transceivers can populate the entire Leaf Switch for moderate size data centers

12.8T Leaf Switch with 32 x 400G ports with 4 x 100G lanes  
Positioned in Middle of Row



# One view of data center architecture

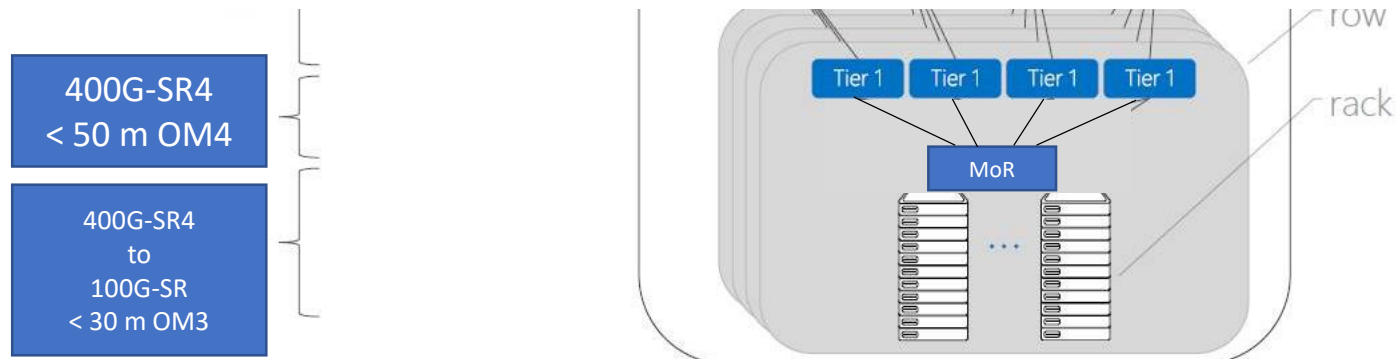


From Jeff Cox (Microsoft) OFC 2019

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# 802.3dB could replace DACs and AOCs

- 400G-SR4 between Middle of Row (Leaf) switches and Tier 1 (Spine) switches with up to 50 m OM4
- 400G-SR4 to 100G-SR breakout between MoR switch and servers with up to 30 m OM3
- When considering economic feasibility we need to keep ToR elimination in mind





# Conclusions

- The 50 m objectives adopted in Geneva will not increase the cost of 30 m switch-to-server links, supporting economic feasibility
- The 50 m objectives will accommodate switch-to-switch links and increase the broad market potential