

Motivation of 75-GHz spacing for 400G DWDM

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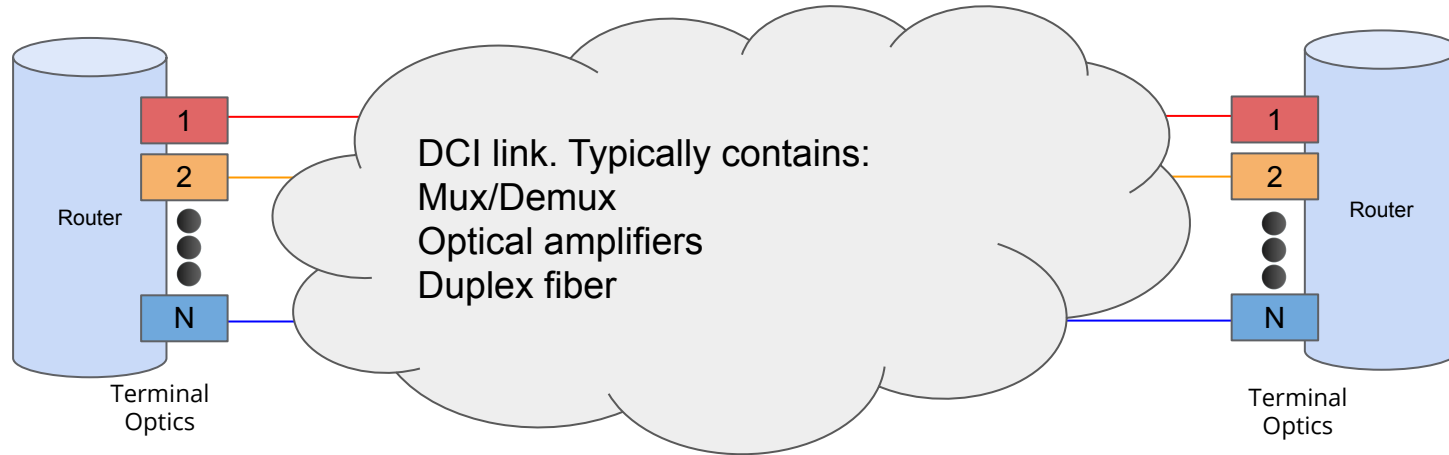
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Typical DCI link



- This is the most typical use case of 400 Gb/s DWDM
- Used for all links too long/expensive to use bulk dark fiber, where each fiber-pair carries a single 400 Gb/s stream

75-GHz vs 100-GHz spacing

- 100-GHz spaced - 48 channels: $400 \text{ Gb/s} * 48 = 19.2 \text{ Tb/s}$
- 75-GHz spaced - 64 channels: $400 \text{ Gb/s} * 64 = 25.6 \text{ Tb/s}$

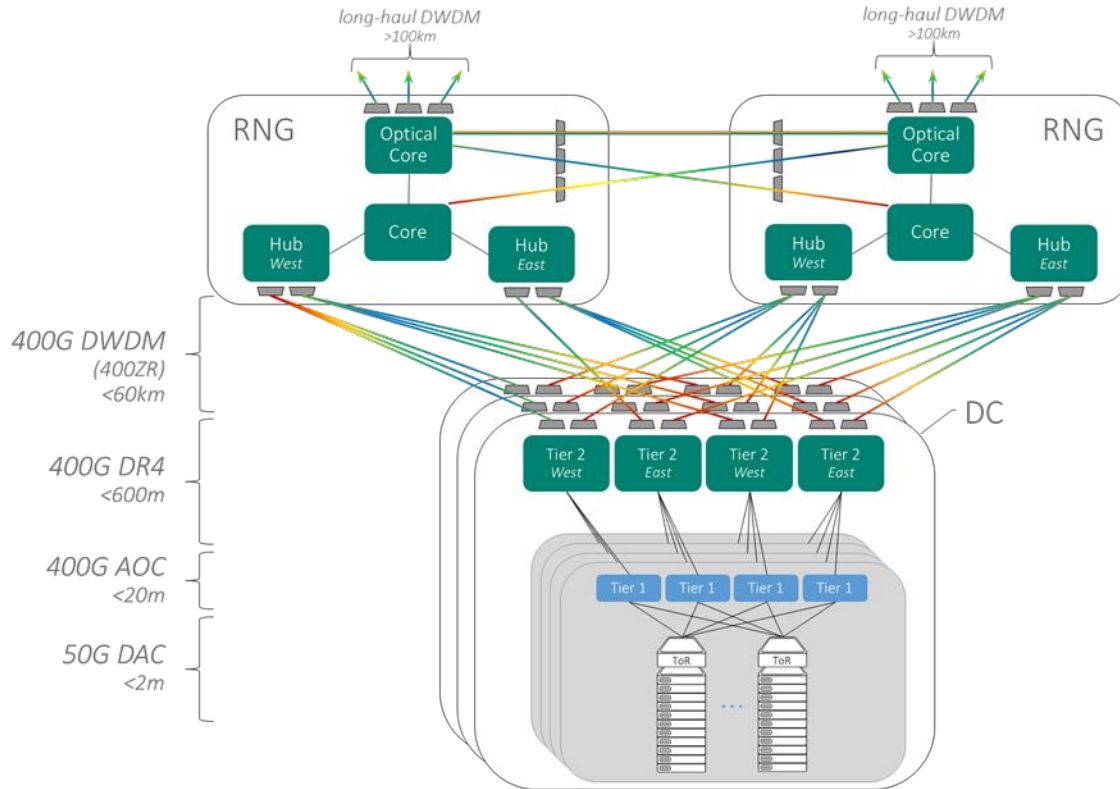
- Advantages of using 75-GHz channel spacing
 - 6.4 Tb/s increase in capacity for 64 channels
 - 33% increase in link capacity
 - @ 50% YoY traffic growth, the extra capacity delays the need for a second pair by 8 months

- Google's current traffic
 - Already using multiple DWDM pairs for Long-haul links
 - Anticipate needing multiple DWDM pairs for metro DCI links in 1-3 years

Cost of additional fiber-pairs

- More operational complexity
- Each additional leased pair comes with monthly recurring costs
 - Typically costs are by fiber mile so longer links cost more
 - Traffic growth is outpacing interface rate increases so leasing costs will become more and more significant over time
- Line systems are almost a fixed cost per fiber pair
 - More capacity per pair -> lower cost per bit in the line system

64-channels is a good number



- In a Clos “leaf-spine” fabric architecture, 2^n routers are typically used in each layer
- Microsoft builds metro areas using a single Clos fabric [[baca_3ct_01_190328](#)]
- This requires groups of 2^n links out of each DC
- Having a 2^n -channel capable system will aligns with a natural increment in the number of links needed

Work in progress

- Quantify the additional value that 400-Gb/s modules capable of operating on a 75-GHz grid enable for different DC architectures
- Currently working with AWG, optical component, transceiver module, and DSP experts
 - Discussions thus far: 75-GHz spacing capable modules and 100-GHz spacing capable modules will have identical BOM and DSP algorithms
- Aligning with affiliates from other datacenter operators on the number of channels required for their respective networks