CONNECTING AT THE SPEED OF LIGHT

Coherent Technology for Intra-Datacenter Applications

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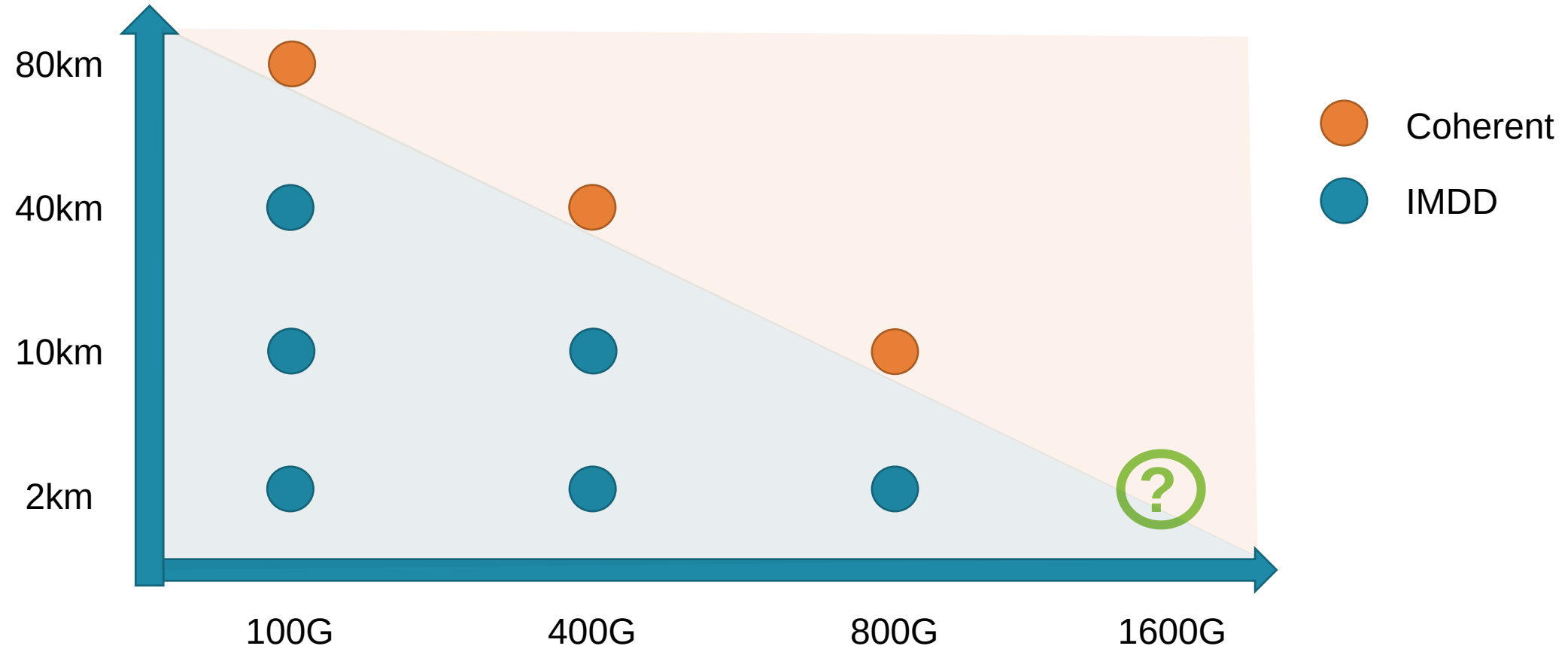
Agenda

- Coherent versus IM/DD transition points
- 1.6T Modulation Formats for 4x400G
- Key Comparisons
- Summary

Transition points from IM/DD to Coherent



Modulation Format options for 1.6T

- 1.6T can be supported many ways
  - For the Intra-Datacenter use case of 4 fiber pairs: Focus on ≤400G per channel
- Options for 400G per fiber
  - PAM4:
    - 53GBd FR4 (4x100G)
    - 112GBd FR2 (2x200G)
  - Coherent-Lite options:
    - 56GBd 16QAM (1x400G)
    - 84GBd 8QAM (1x400G)
    - 106GBd QPSK (1x400G)
    - 112GBd ASK (1x400G)

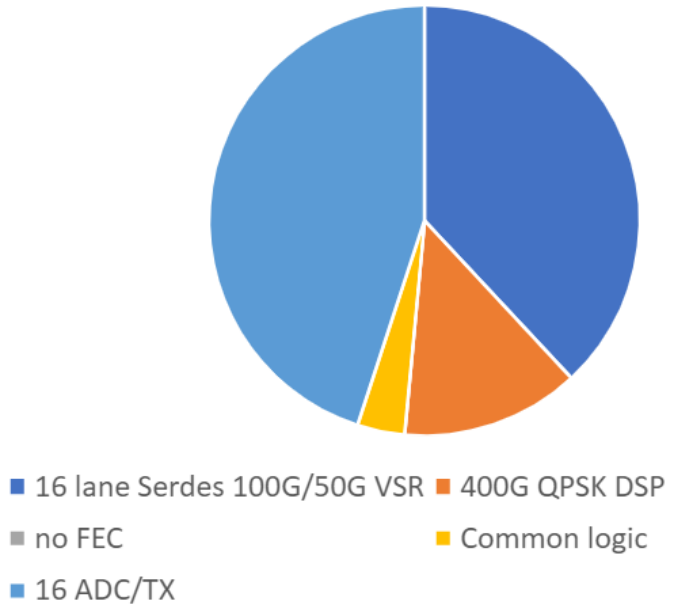
4x400G Coherent-Lite Assessment

- Coherent technologies **increase link budgets for 400G**
  - Avoids Mux/Demux losses incured by IM/DD
  - Avoids requiring strong FEC and the respective latencies
- QPSK is a 2-level system with low BER floor, **higher yields and simplified implementations**
  - Supports **lowest latency** implimentation: 100G SerDes with KP4 from Host to Host
- O-Band Coherent-Lite uses **standard CW lasers**
  - “Grey lasers” with simple TEC based wavelength control for LO-locking
- 4x 400G QPSK ”DR4” link budget allows one laser per module - **lowers cost and improves quality**
  - 4 to 8x fewer lasers than expected 1.6T IM/DD solutions
- Max Module **power consumption for OSFP-XD**: <30W in 5nm or <27W in 3nm (Except for ASK)
  - >20% lower than current 400G IM/DD solutions and competitive to future 5nm IM/DD
- Supports **1.6T 10km duplex fiber** Campus applications - using four lasers & Mux/DeMux
  - 2km Coherent-Lite investment can be shared with the 10km solution

Coherent-Lite DSP

- <30% of DSP Die used for DSP & MCU functionality
  - Similar size to IM/DD implementations

- DSP Supports relaxed implementations:
  - Laser linewidth 1MHz
  - RIN -140dB/Hz
  - LO_offset 10GHz
  - DGD 5ps
  - Dispersion 50ps/nm
    - For 10km O-Band WDM solutions



Summary

- 112GBd IM/DD PAM4 :
  - In development for 800G and 1.6T
  - Has momentum behind it from 100G and 400G solutions
  - Can’t support links beyond 2km
  - Will face challenges inside the Datacenter from O-Band Coherent-Lite technologies
- O-Band Coherent-Lite :
  - Does not require the cost, power or performance needed for line side
  - Competitive for 4x400G Intra-Datacenter applications with OSFP-XD
  - Can be a solution for both 2km and 10km Datacenter applications
  - Is achievable with current generation volume technologies
  - Can scale to millions per year

Thank You