Microsoft

Global Networking Services

Objectives to Support Cloud Scale Data Center Design

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IEEE 802.3 400Gb/s Ethernet Study Group
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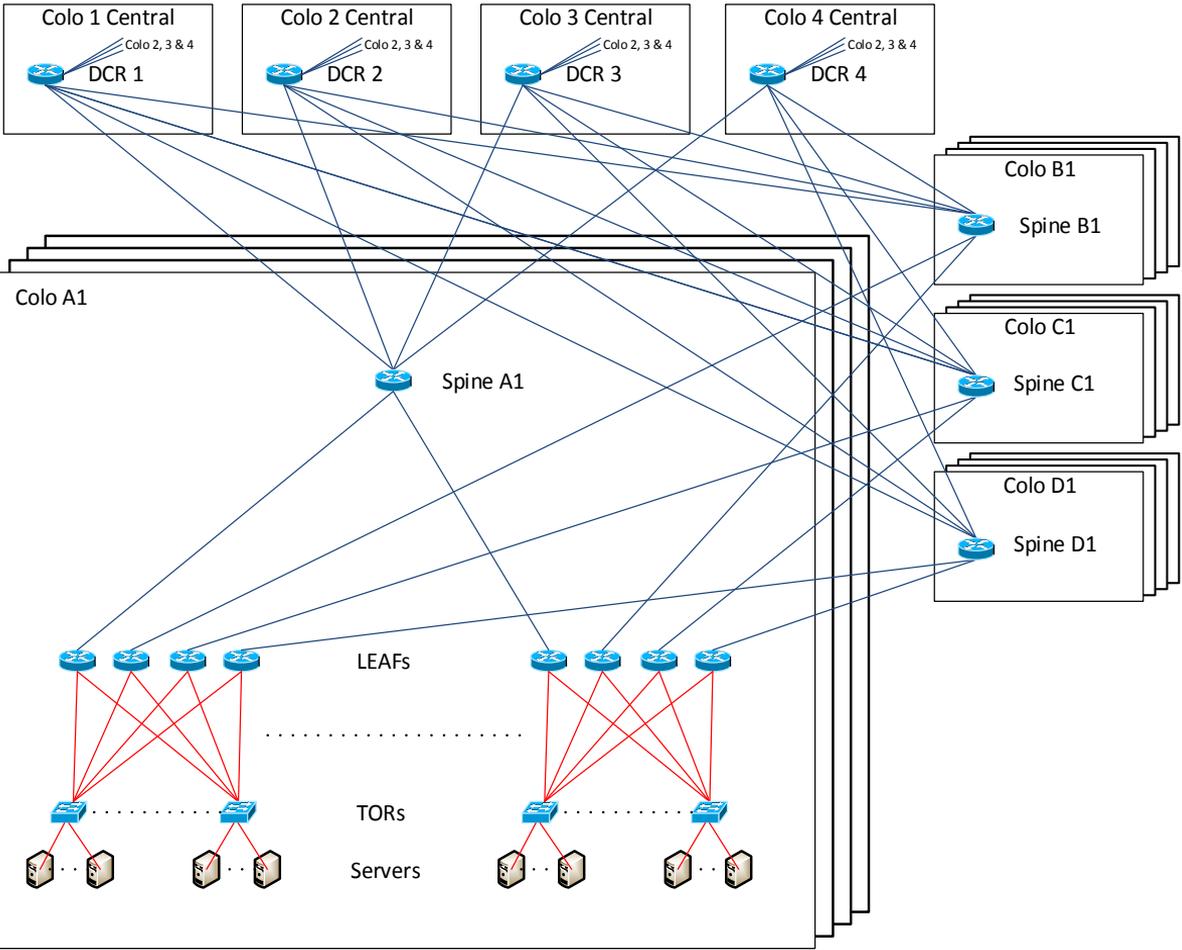Dallas, TX

Supporters

Cloud Scale Data Centers

- There is no single design or size for a cloud data center

  - Topologies continue to evolve with technology advancements and cost structures

- While we attempt to standardize designs, differences are driven by generation of design, location and scale

- While the overall traffic flow within different data centers is similar the design differences drive different link requirements

- Here is an overview of a typical cloud data center and the interconnections that would be required

Cloud Data Center Campus Interconnections

≤ 10 - 80 km
> 100 km

≤ 2,000 m

≤ 500 m

≤ 20 m

≤ 3 m

Colo 1 Central
Colo 2, 3 & 4
DCR 1

Colo 2 Central
Colo 2, 3 & 4
DCR 2

Colo 3 Central
Colo 2, 3 & 4
DCR 3

Colo 4 Central
Colo 2, 3 & 4
DCR 4

Colo A1

Spine A1

Colo B1
Spine B1

Colo C1
Spine C1

Colo D1
Spine D1

LEAFs

TORs

Servers

Metro/Core
(DWDM)

Infrastructure
designed to
use a single
data rate (X)

**TARGET
MARKET
FOR 400G**

Links are a
subset of X

Global Foundation Services

Interconnection Volume

- Multiple colo areas (≥ 4) per data center
- Volumes below are per colo area

A End	Z End	Volume	Reach (max)	Medium	Cost Sensitivity
Server[‡]	TOR	10,000s	3 m	Copper	Extreme
TOR	LEAF	1,000s	20 m	Fiber (AOC)	High
LEAF	Local SPINE	100s	300 m	SMF	Medium
LEAF	Colo SPINE	1,000s	400 m	SMF	High
SPINE	DCR	100s	1,000 m	SMF	Medium
DCR	Metro	100s	10 - 80 km	SMF	Low

‡ Server-TOR links may be served by breakout cables

Technology Timing Considerations

Technology Comparison
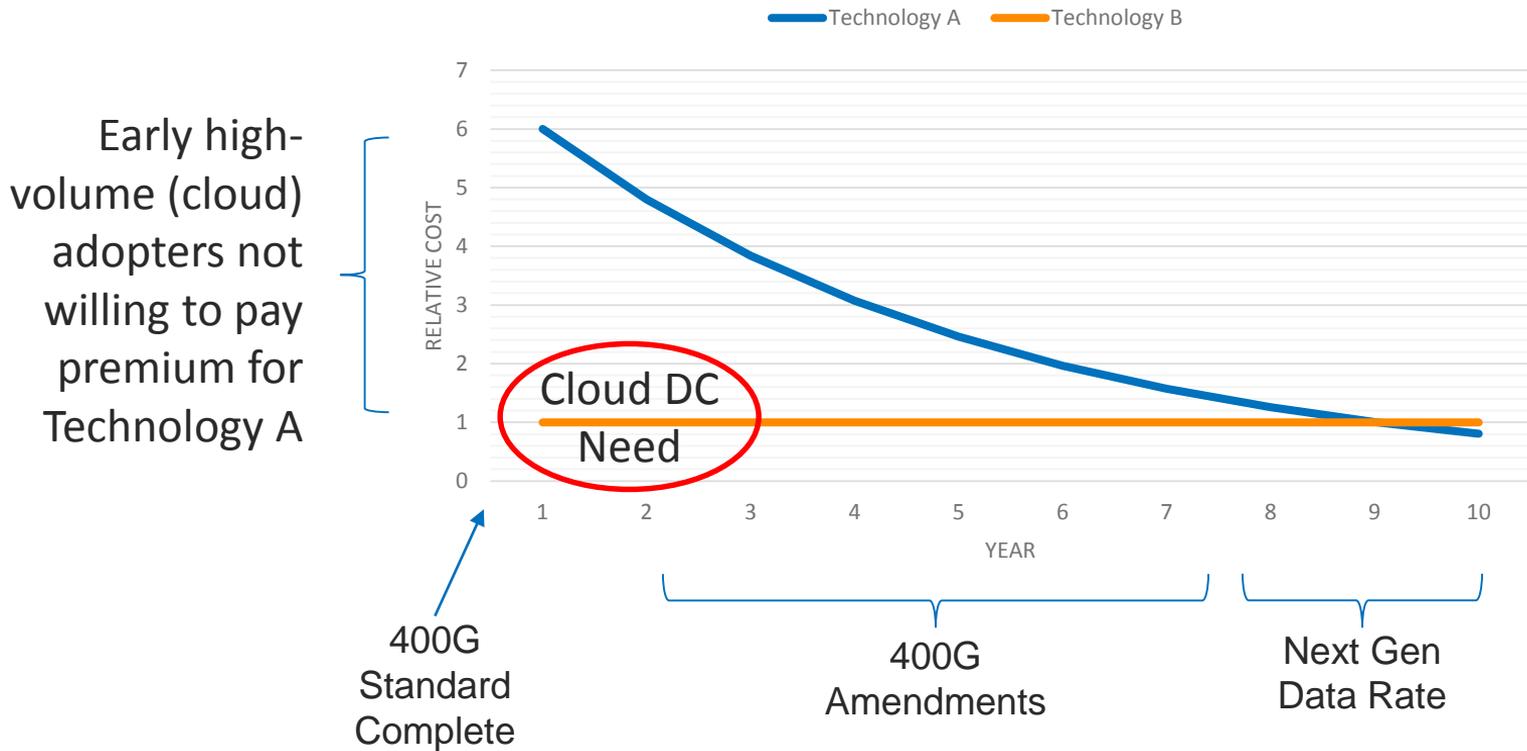
Reach Considerations

- Links < 500 m
  - Very cost sensitive due to high volume of links being used
  - Typically assume a 3-4 dB loss budget
- Links > 500 m
  - Decreased cost sensitivity due to lower volume and technical trade-offs
  - Loss budget typically in 4-6 dB range
- Links < 20 m
  - MMF is a possible consideration, but needs to be cost competitive with AOCs

Recommendations

- Adopt an objective to support the high-volume Cloud Data Center reach requirement
  - Provide physical layer specifications which support 400 Gb/s operation over:
    - At least 500 m of single-mode fiber
- Other reach objectives could be added
  - Above meets Cloud DC requirements