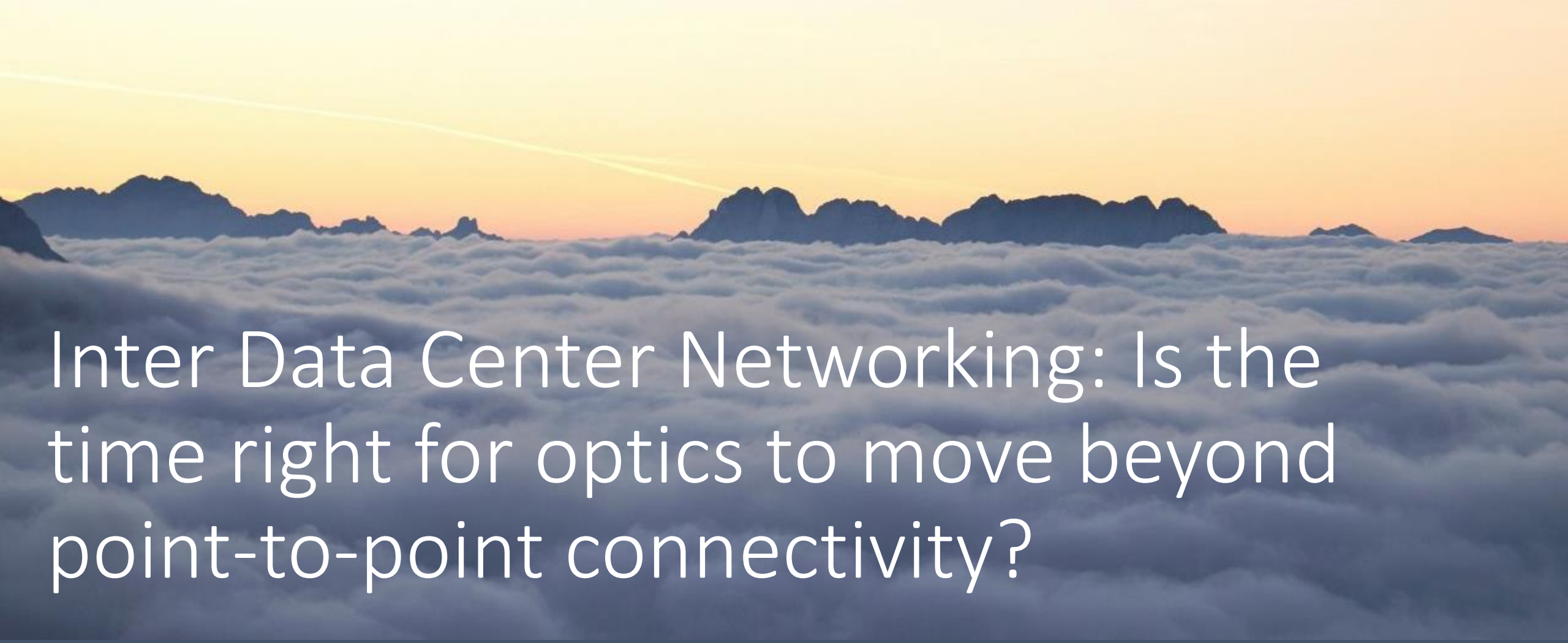


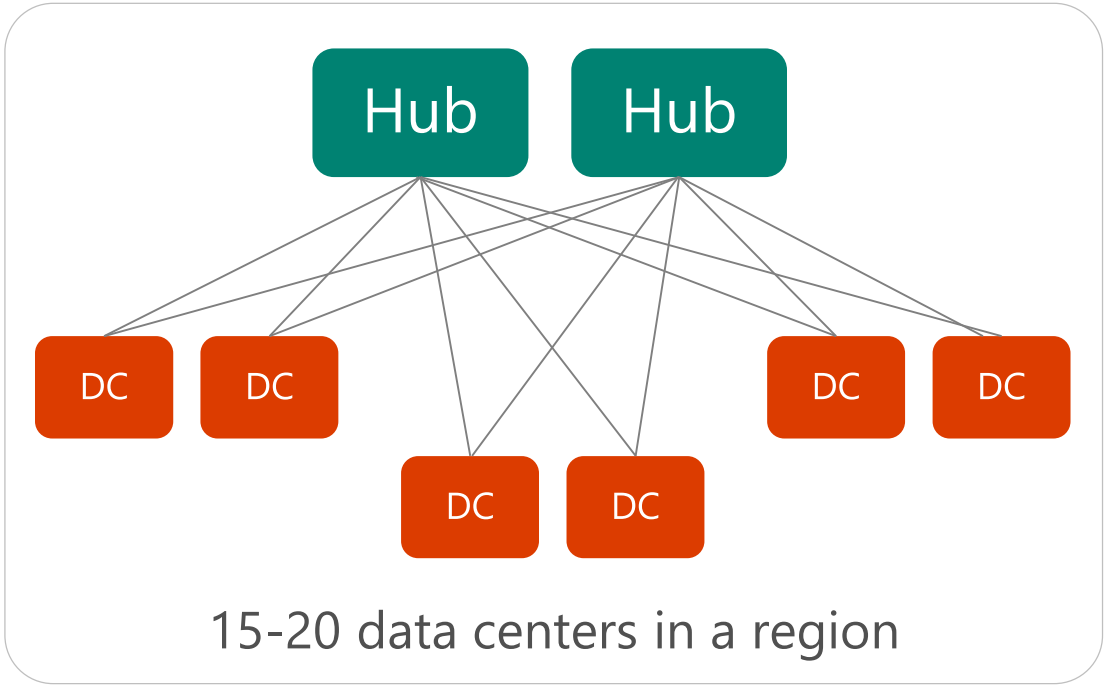
Inter Data Center Networking: Is the time right for optics to move beyond point-to-point connectivity?

Benn Thomsen

Microsoft Research

Microsoft

From Mega to Distributed “Regional” DC’s

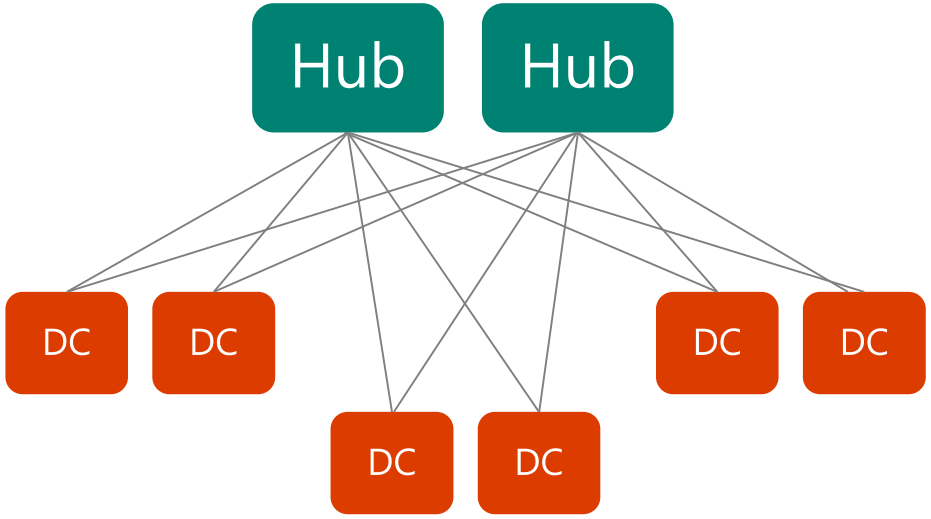


Distributed data centers across an 70km (**≤2.0ms RTT**) region to keep pace with cloud growth

- Site Availability
- Power, cooling, water
- Resiliency: Provides geographically separated failure domains

Microsoft

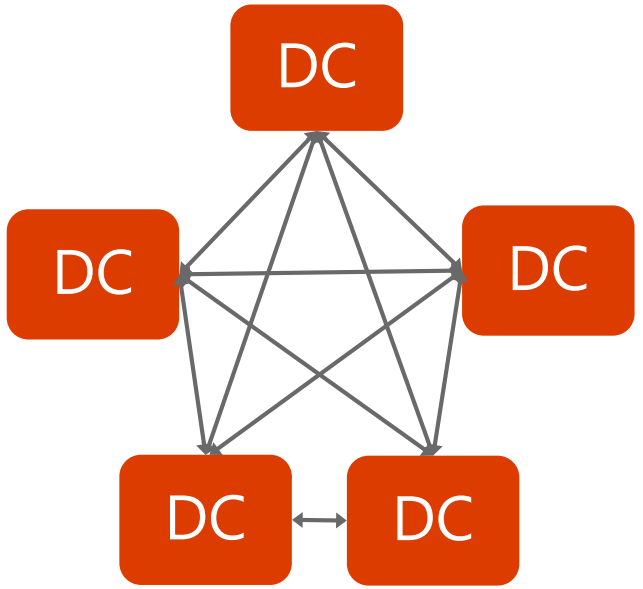
Can we improve performance



Packet Switched Hub & spoke

- 2*B*n ports
- simple design

but, latency inflation

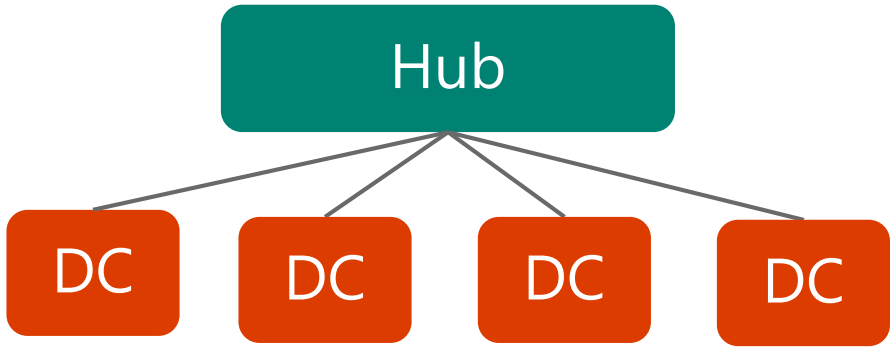


Full Mesh Optimal for latency but,

- B * n^2 ports
- port exhaustion for small DCs
- hard to scale

(B ports per DC, n number of DCs)

A perfect region



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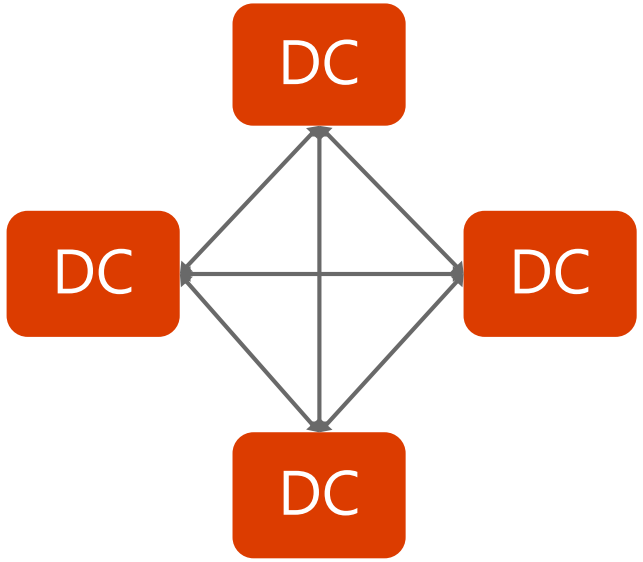

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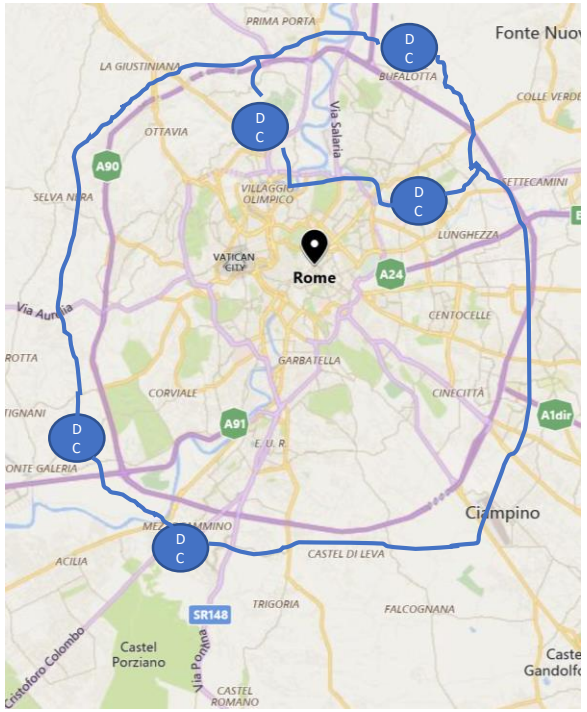


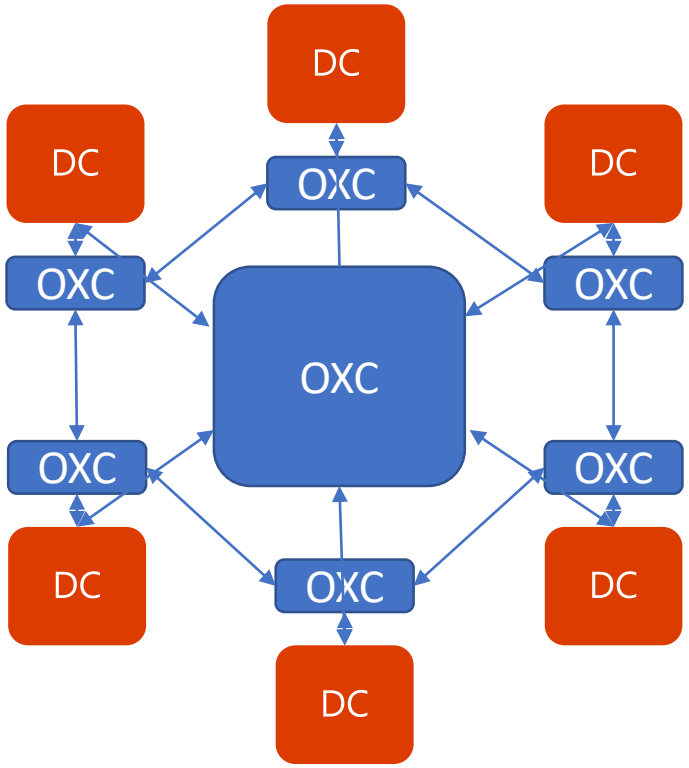
➔ *Intuitive* design
➔ Ports per DC *independent* of the number of DCs
➔ Easy scaling

➔ *Latency optimal*
➔ *No hub*

➔ *Exploit fiber availability*

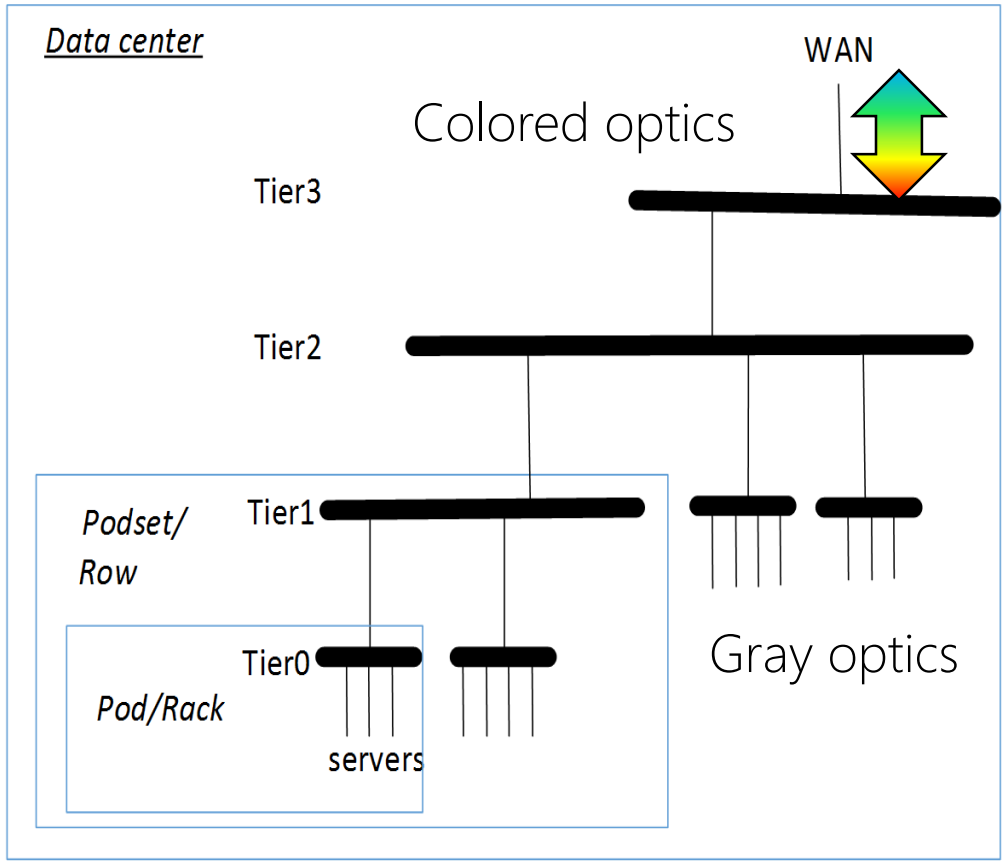
Microsoft

Slow Optical Switching to Provide Partial Mesh on Demand

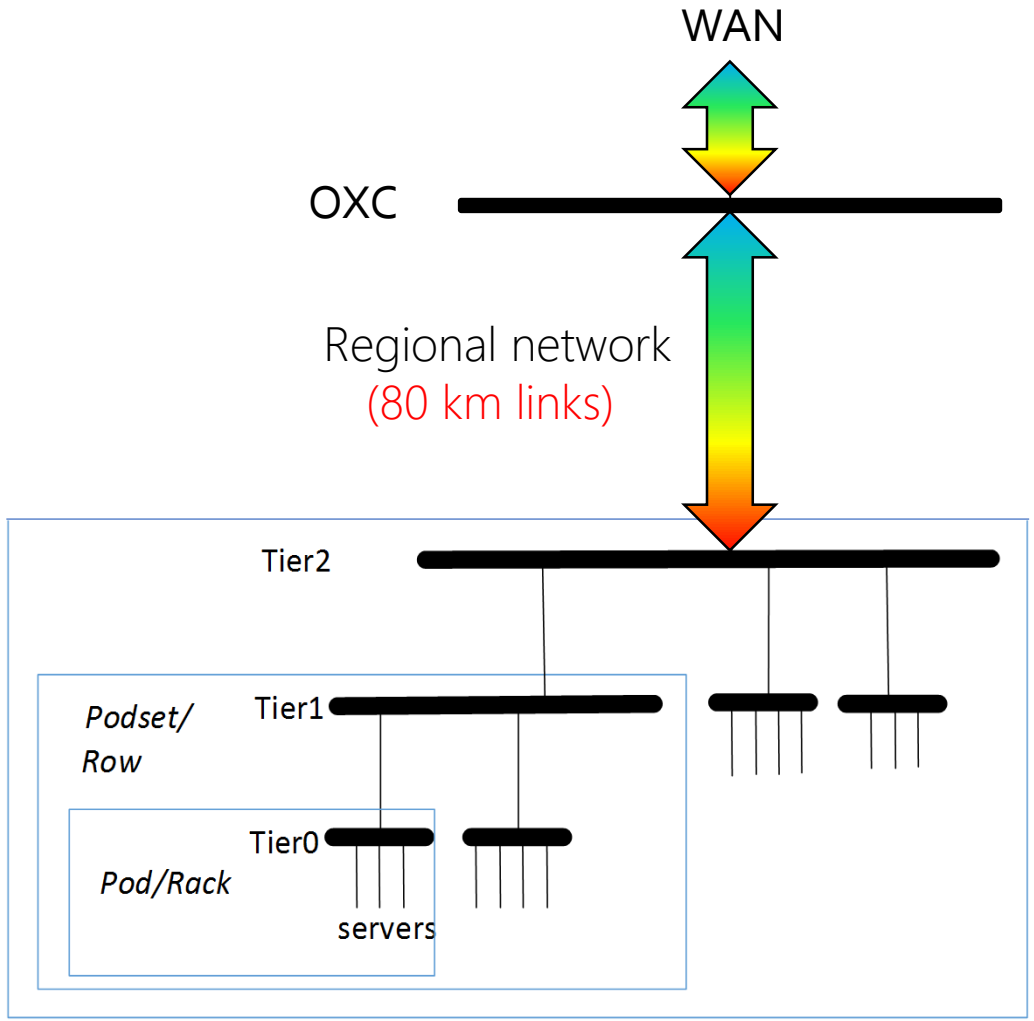


- Number of ports per DC as in hub & spoke model (i.e. B ports)
- Emulate a distributed hub through dynamic paths for DC-DC traffic
- Benefits
  - Improves latency over hub and spoke model. Does it matter??
  - Distributed network eases site selection
  - Graceful bandwidth scaling. OXC independent of line-rate

Network Reconfiguration time (secs-hours)



Mega data center



Regional architecture

Physical layer challenges

Control Plane

- Distributed control plane / Synchronisation
- Network management changes: Hybrid Packet/Circuit network
- Predictive dynamic traffic engineering to set DC to DC bandwidth

Physical layer

- Line system stability?
  - Fully load line (32-40 Wavelengths) At all times
  - 1-16 optically amplified spans (In distributed scenario)
- OXC requirements (<100ms, Wavelength granularity switching)
  - 80 rings 40 wavelengths
  - Ideally: 80x80 fibre ports, 40λ waveplane switch
  - Grouped Fibre: 16x (6x6 fibre ports, 40λ waveplane switches)
- Fast locking (<10ms) colorless coherent transceivers