Adtran

# O-E-O, No Need to Slow: The Optical Routing Revolution

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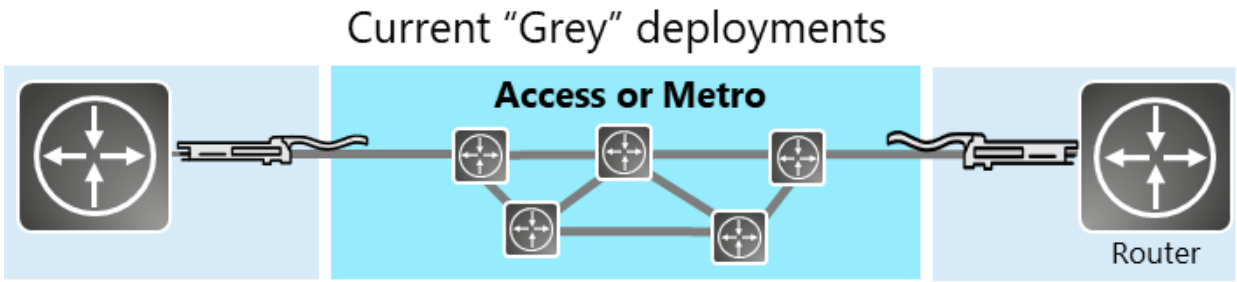
# Our Networks

Scenario

- Routers connected in **point-to-point**, DCI, any-to-any mesh, or in low-capacity chains and rings

Benefits

- No optical design and planning process, no λ inventory and routing

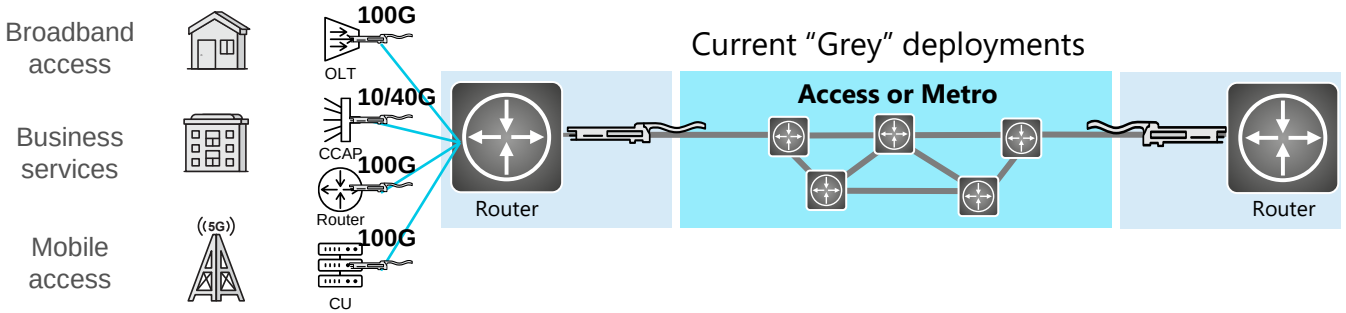


# Multiservice Networks

Service providers are being driven to expand service delivery with

- Broadband Access (FTTx)
- Business Services
- Mobile access

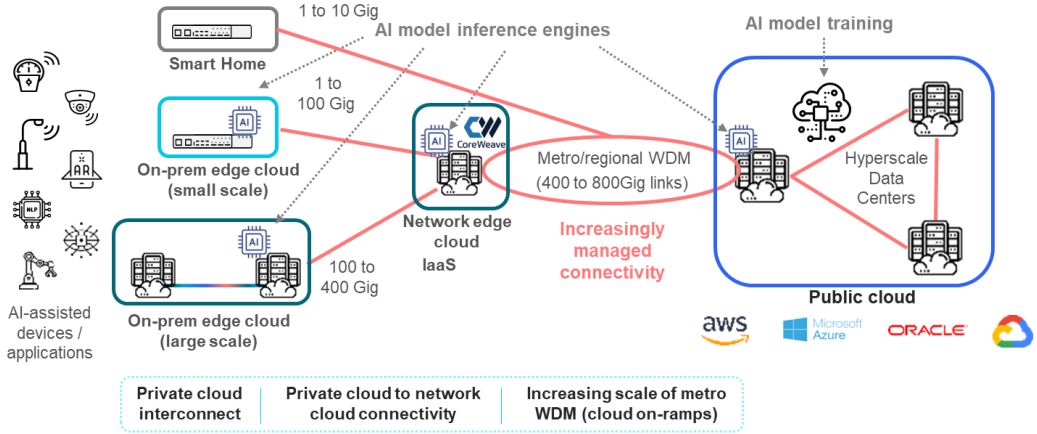
Most service providers started out with Business services



# Growing Demand

Bandwidth needs **Increase**:

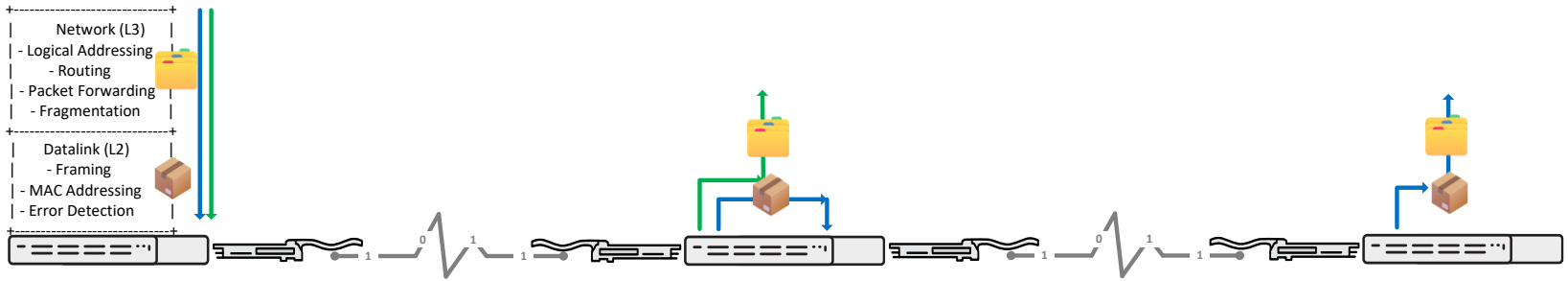
- Home users expecting higher data rates. Driven by Augmented Reality and IoT Smart Homes
- Business services expected to grow **AI** assisted Applications
- Increasing importance of **low** latency networks
- **Efficiency** in network operations and ability to expand



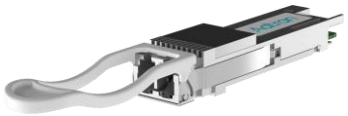
TRADITIONAL APPROACH

# E-O O-E-O… O-E-O O-E-O O-E

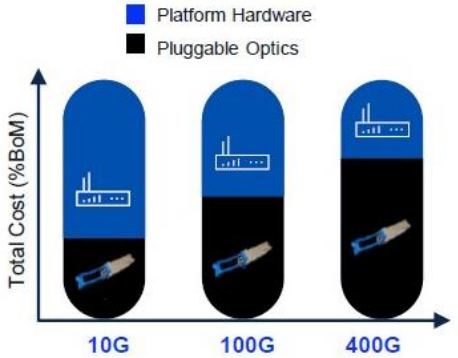
- Router to Router add latency
- Bottlenecks created by OEO conversion
- High power consumption
- Cost and complexity of scaling
- Impact on end-user experience and operational efficiency



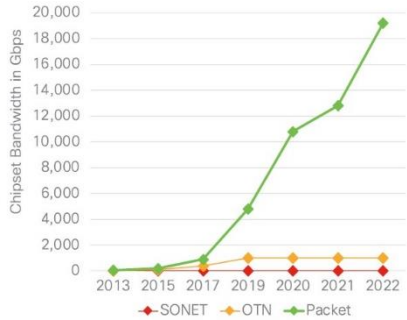
# Technology trends fueling IPoDWDM



Coherent transceivers no longer compromise router front plate density




Hardware costs of router plugs continue to grow




Packet switching chipsets are evolving while TDM switching is stalling

Routing as only electrical grooming. Optics integration is a viable option

# IPoDWDM benefits and challenges

## Benefits

### Cost, footprint and power consumption

- No transponder platform

### Architecture

- More distributed packet switching
- Seamless network bridging

### Management and interop

- Open management interfaces, as defined by industry forums and standard organizations, foster vendor interop and disaggregation and create automation potential

## Challenges

### Management

- Loss of e2e optical management and visibility
- Needs multi-layer management integration
- Existing single vendor solutions create lock-in

### Operations

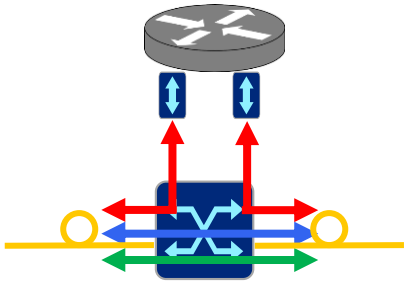
- Optical planning and performance guarantee
- Responsibility for troubleshooting and RMAs
- Coexistence with legacy services and brownfield network segments

### Devices

- Asynchronous software upgrade cycles
- Only newer routers support coherent pluggable transceivers

# Simplifying Network Architecture

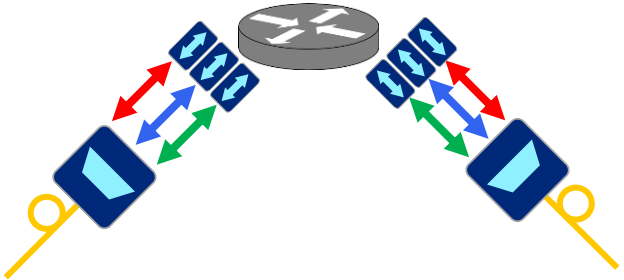
### OLS with optical bypass



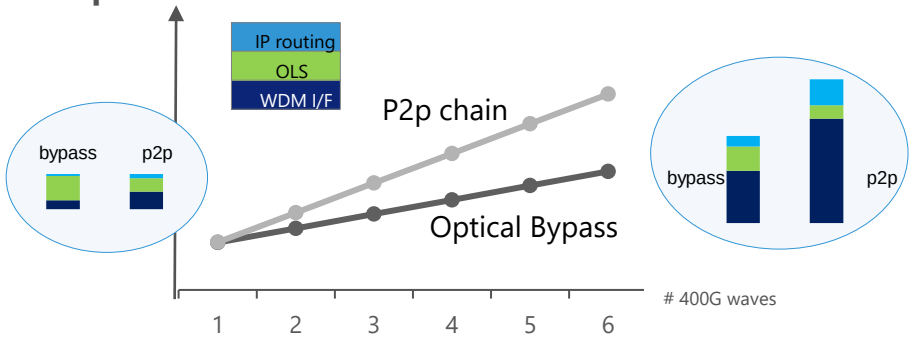
### Power dissipation

- IP fabric ~0.15W/Gb, 400G plug ~20W
- Forwarding a 400G wavelength consumes
  - ~100W through the IP fabric
  - ~4W through a ROADM

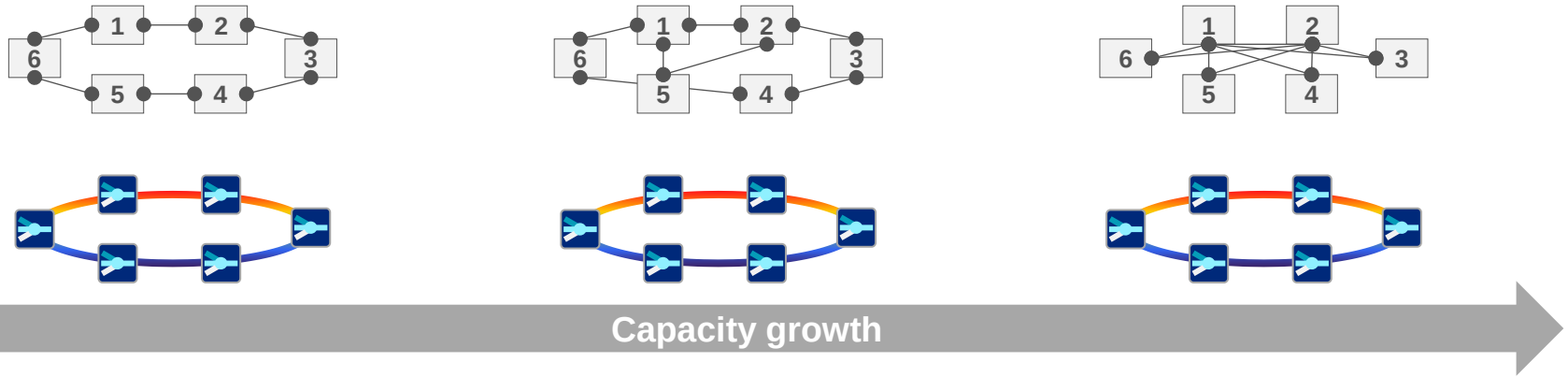
### Cascaded point-to-point OLS



### Capex



# Optical Routing for Regional Service Providers




**Low capacity**

- IP topology: daisy chain ring. One or few wavelengths in between neighboring routers
- DWDM topology: Chain of point-to-point OLS cheapest for one channel. Optical bypass OLS is ready for growth.

**Moderate capacity**

- IP topology: High-capacity site is taken out of the daisy-chain-ring forming an additional ring in the IP layer
- DWDM topology: chain of point-to-point OLS with regenerations similar CapEx as ROADM ring with next neighbor connections and optical bypass

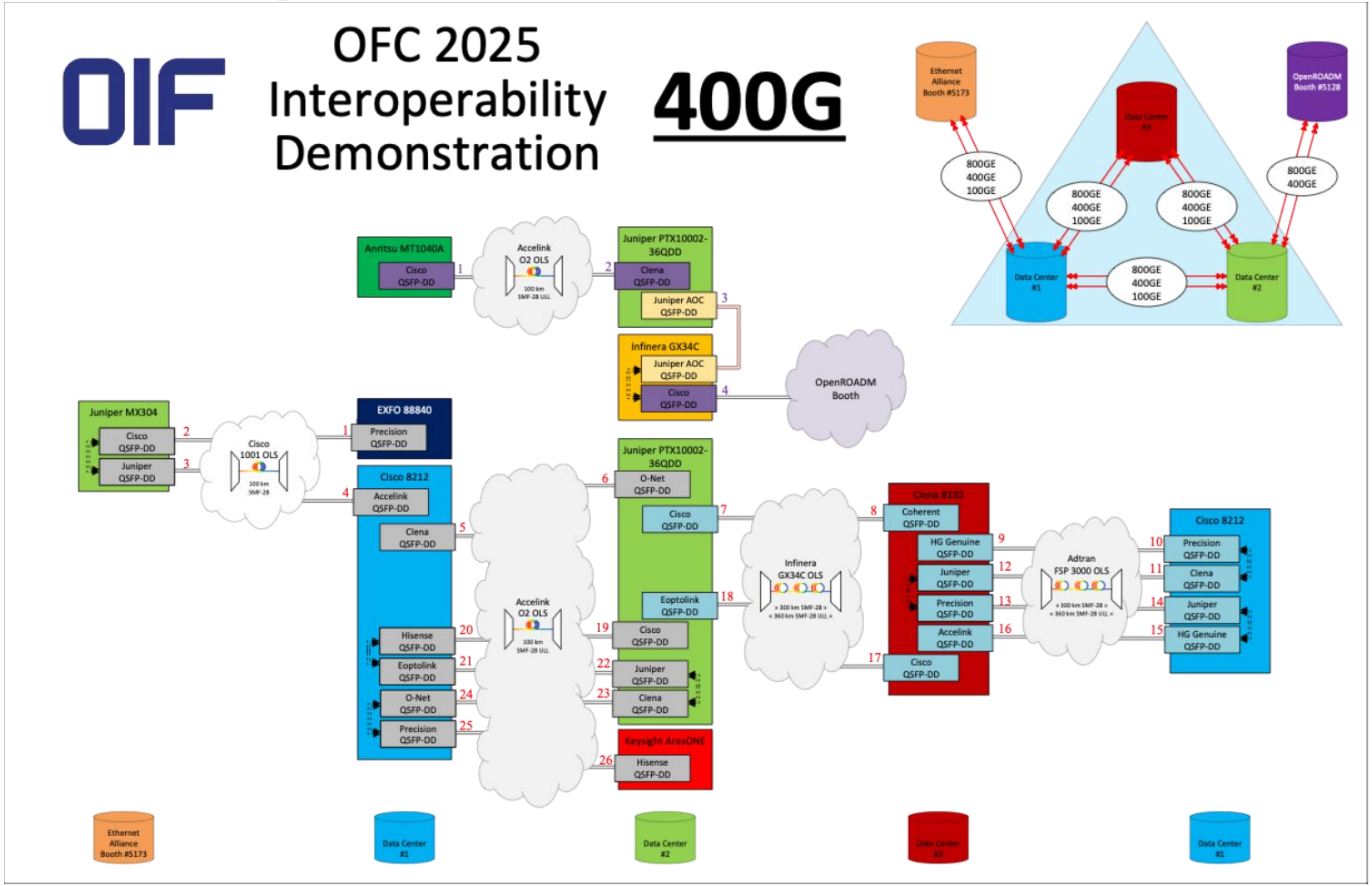
**Medium to high capacity**

- IP topology: multiple IP rings up to full hub&spoke
- DWDM topology: ROADM ring with optical bypass much lower cost than point-to-point OLS chain with multiple regenerations

# Improving Network Resilience

- WDM networks can route further distances
- Fibre loss easier to absorb
- Loss of router does not impact Optical signals
- Optical protection for 1+1 Optical paths switch at < 50ms

# Real-World Examples



# Conclusion

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# Thank you

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