Network Futures: Faster, Closer, Smarter, Greener

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Ciena’s R&D External Research Team

Investigate promising new technology
Look out, beyond product trajectories
Learn via experiment and be curious
Path find, explore, qualify, & engage experts

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Rodney G. Wilson; Chief Technologist, External Research.
Marc Lyonnais: Director





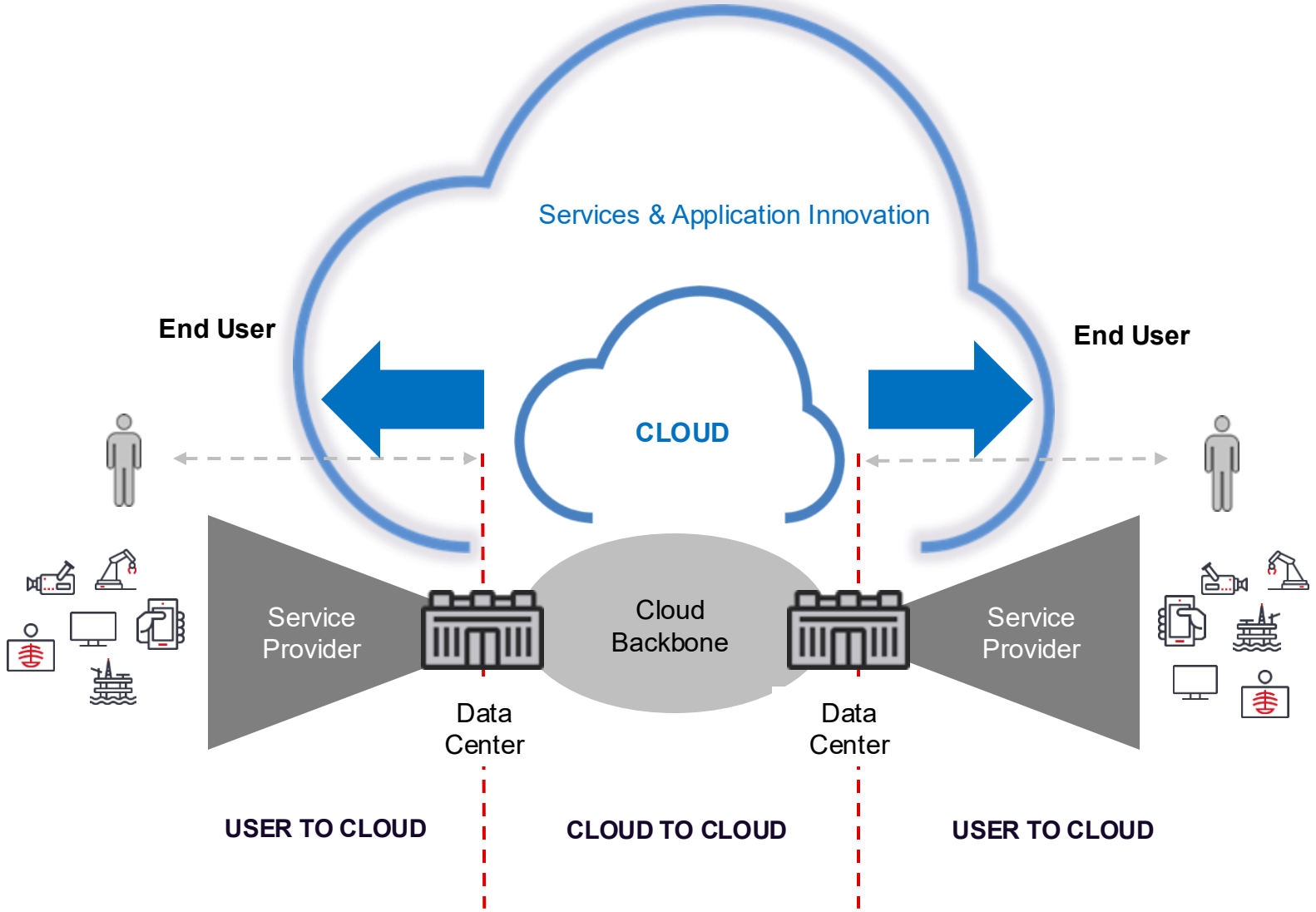






Industry insights

Networks are Bringing the Cloud Edge Closer to the User

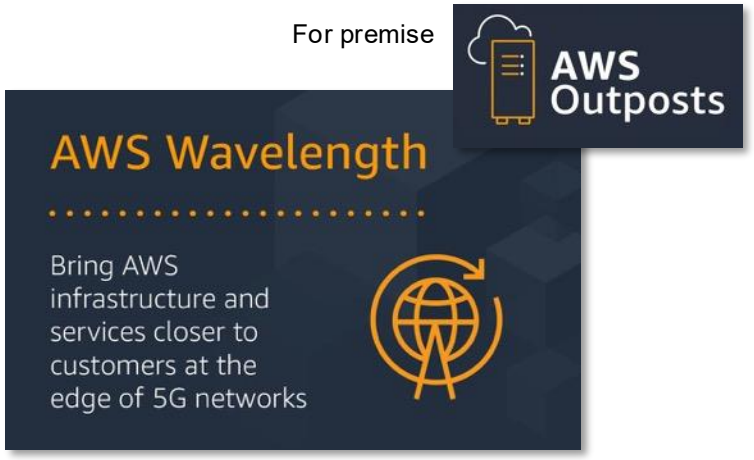


Global Content Providers are Building out their Edge for Ai

aws | Google Cloud | Azure

Edge Computing

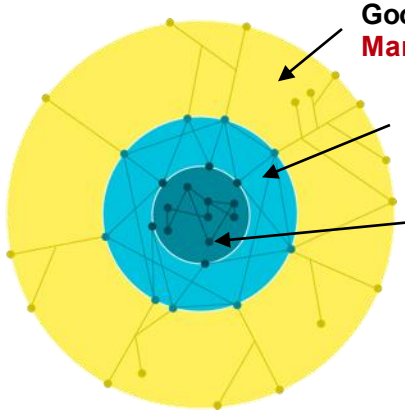
For premise



Growth in adoption of AWS Outposts and AWS Wavelength with edge compute

Announced 100G Direct Connect Service

Interconnection Edge Sites



Google Global Cache (GGC)
Many 1,000's of sites

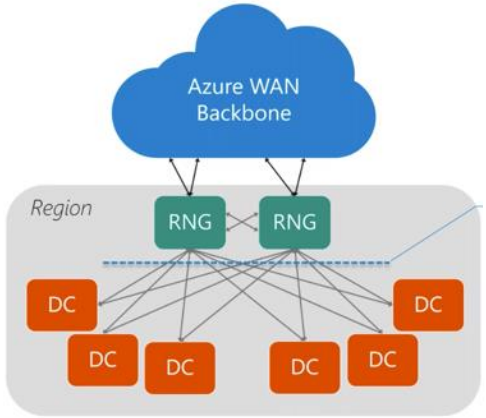
B2 Public Core (peering)
100's sites

B4 Private Core (DCs)
10's sites

Expanding GGC locations

Opportunity for private interconnection

Expanding Metro/Regions



Microsoft expanding cloud connectivity fabric across multiple metros & regions

Cross-section capacity rapidly increasing

Purchased Lumenisity – Hollow-core fiber

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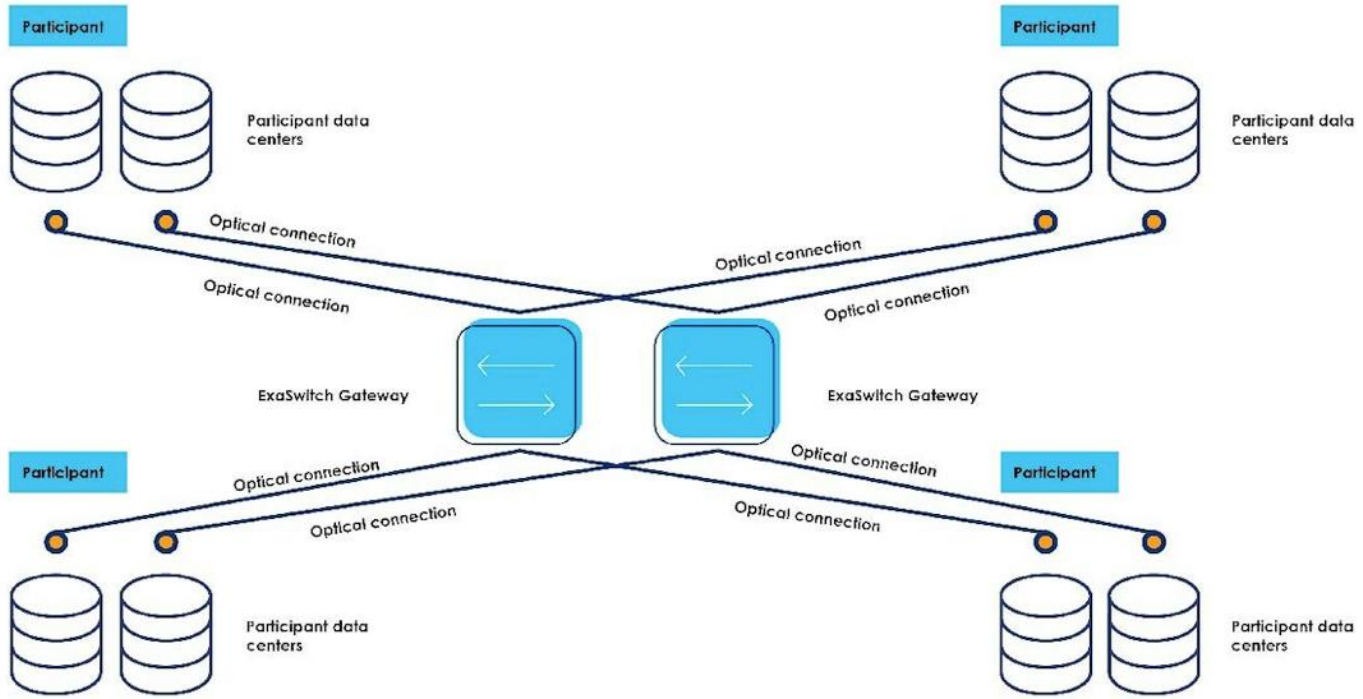
Lumen, Google and Microsoft develop Exaswitch optical interconnection ecosystem

June 2023 Claim: “1st Optical ecosystem to automate, scale and manage high-value interconnects”

With ExaSwitch:



ExaSwitch removes latency and provides real-time capacity deployment due to its distributed ecosystem design and automated interconnect provisioning.

https://exaswitch.net

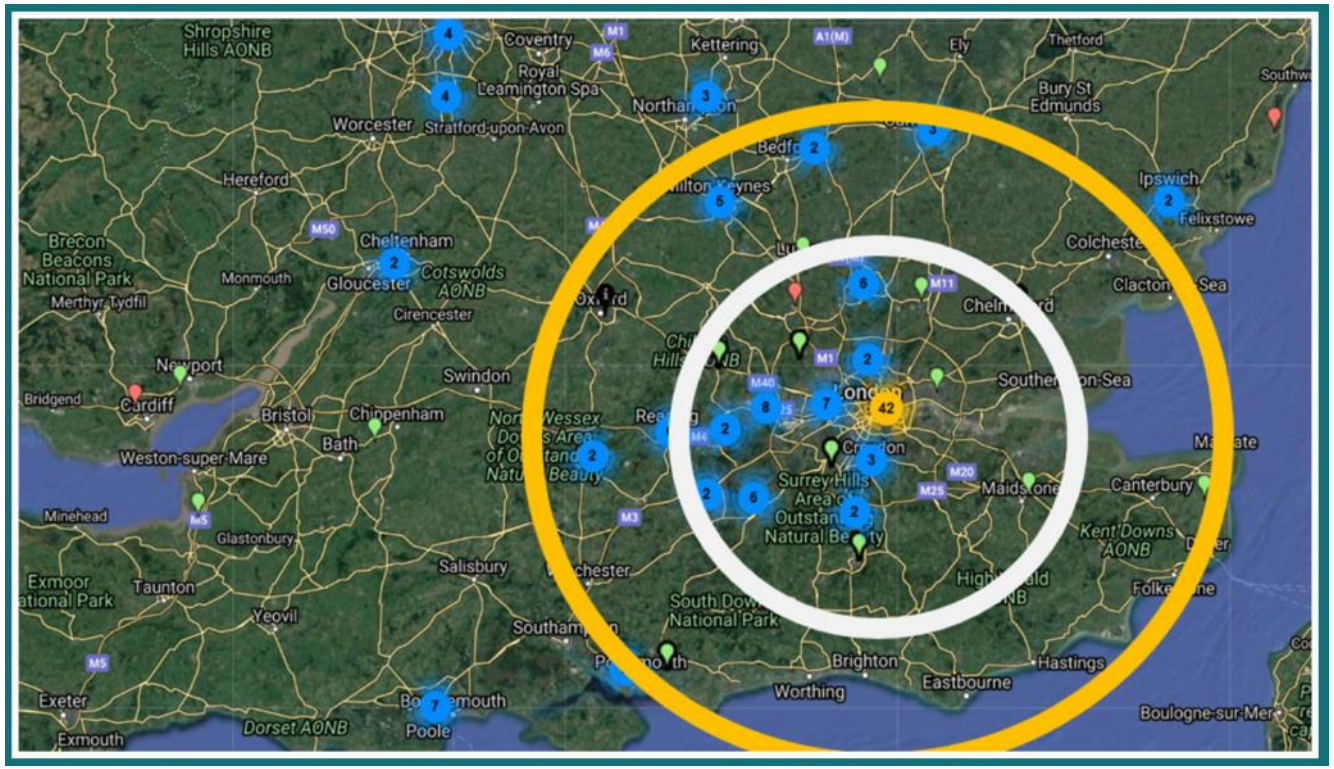
Microsoft acquires Lumenisity®, an innovator in hollow core fiber (HCF) cable

Dec 9, 2022 | Girish Bablani, Corporate Vice President, Azure Core

30% Reduction in Latency

Doubles the Useful Geography for DCI

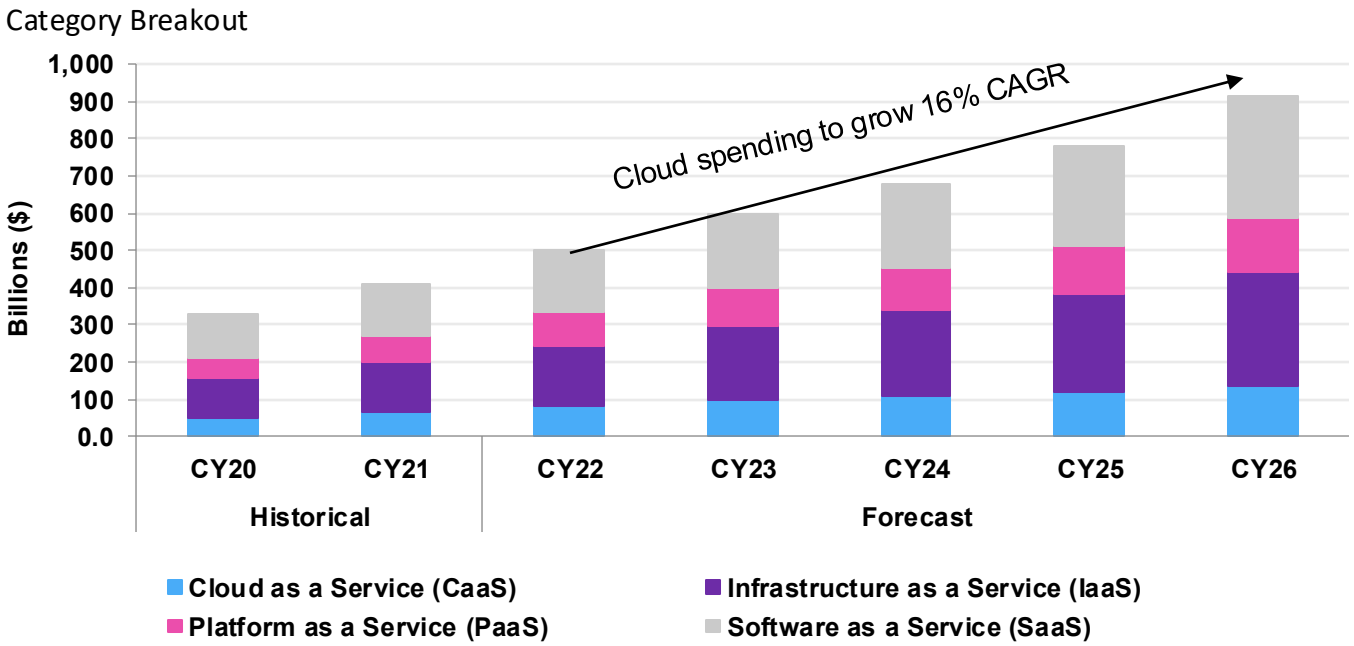
Supports Higher Optical Powers



London

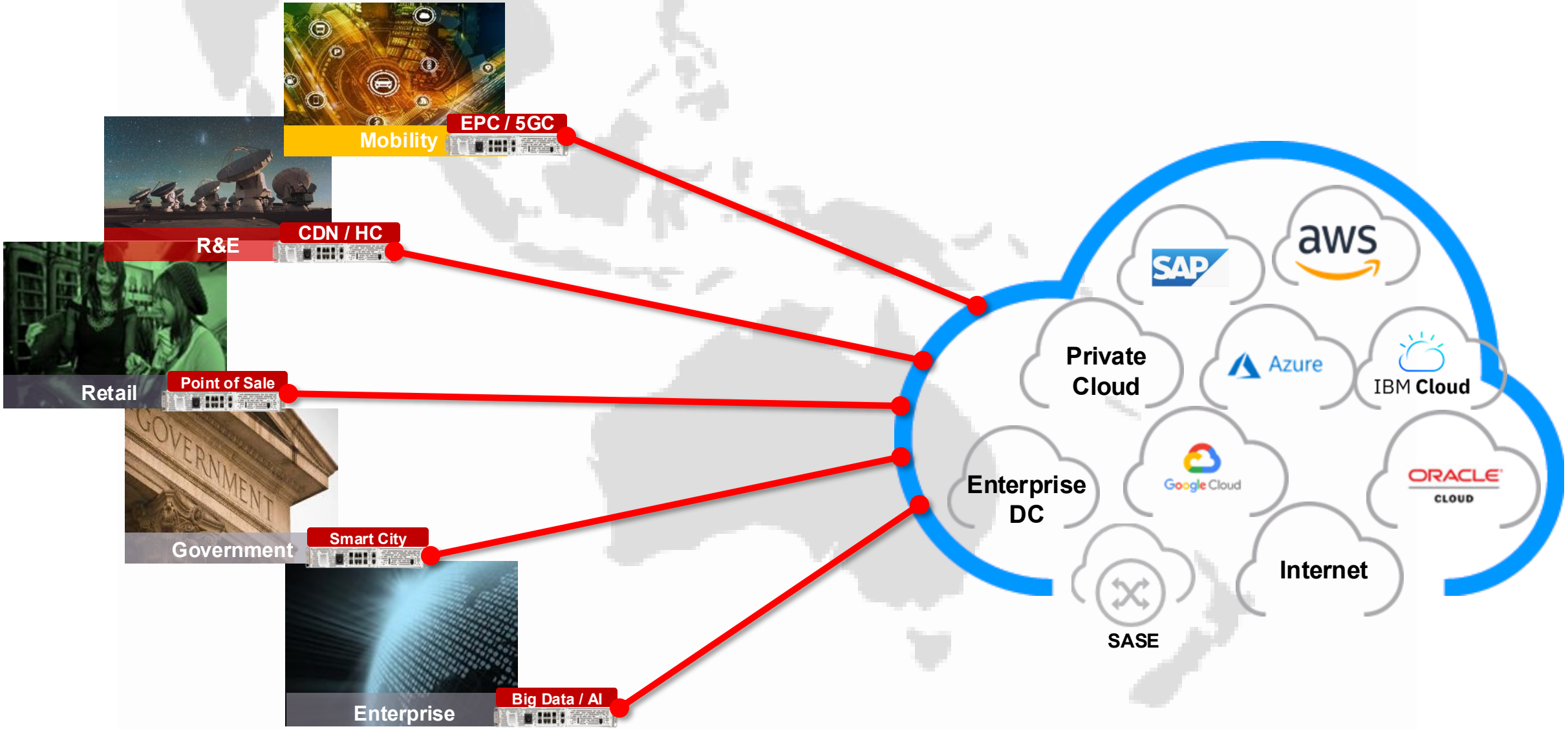
Key Drivers of Increased Cloud Adoption

- Machine Learning Artificial Intelligence
- Multi-Cloud
- Edge Computing
- Internet of Things
- Usage-based consumption per GB
- Cloud native applications
- 5G vRAN Telco Cloud
- New data center construction

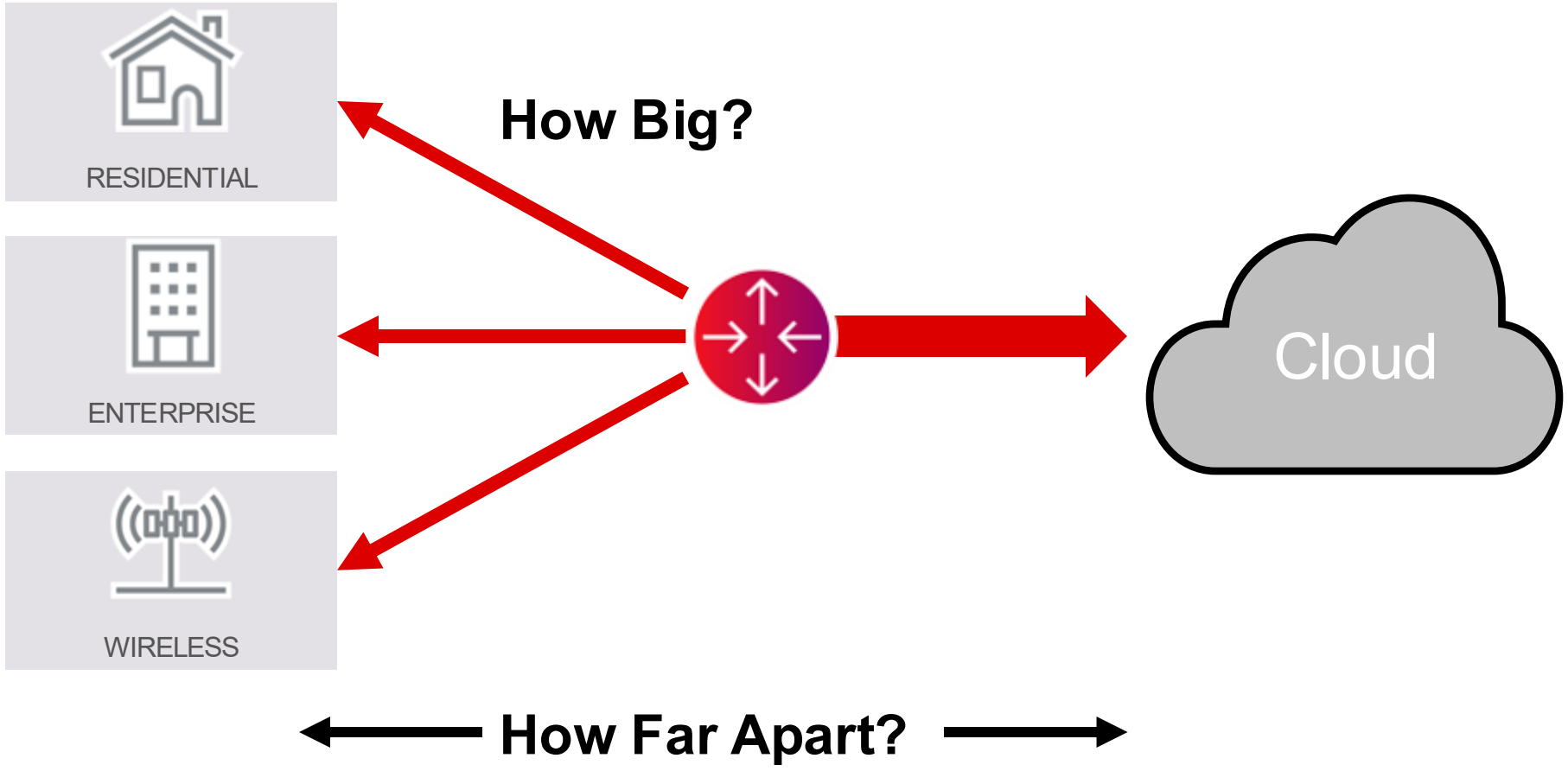


Source: Omdia, Cloud & Colocation Services Market Tracker, 1H22

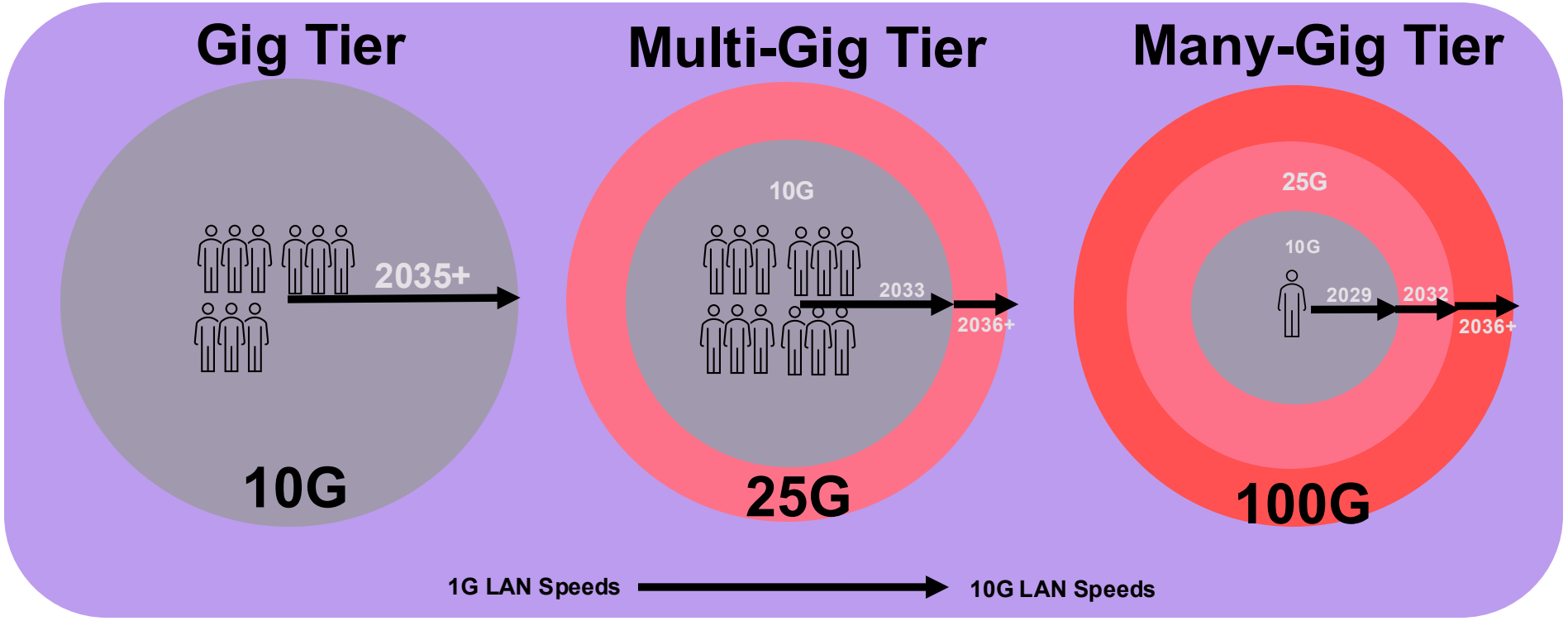
A Multi-Service Multi-Cloud World



A Simple Construct



How Big? - Broadband Access



Low Bandwidth Tier

30% CAGR

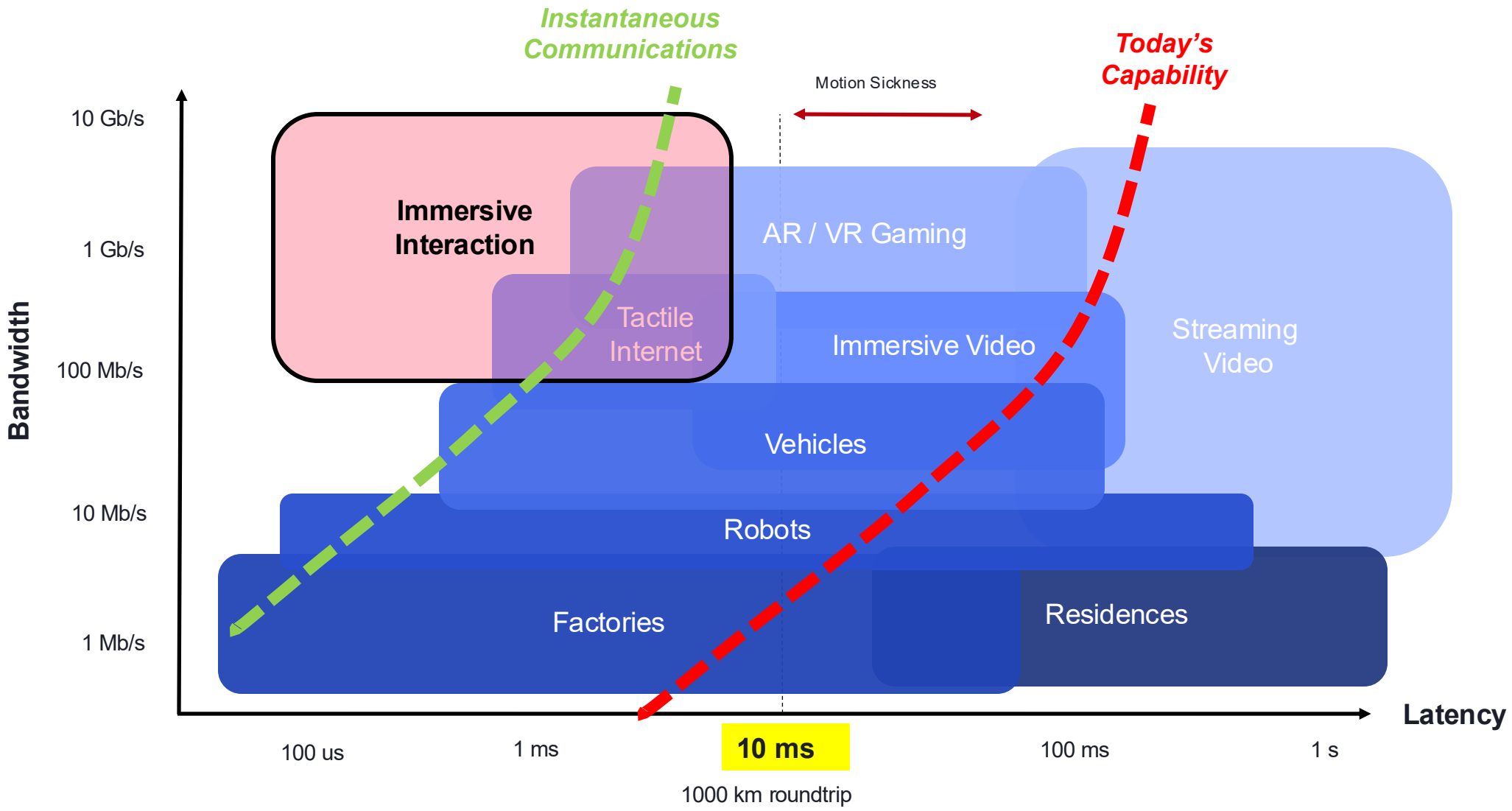
10G until 2040

25G until 2045

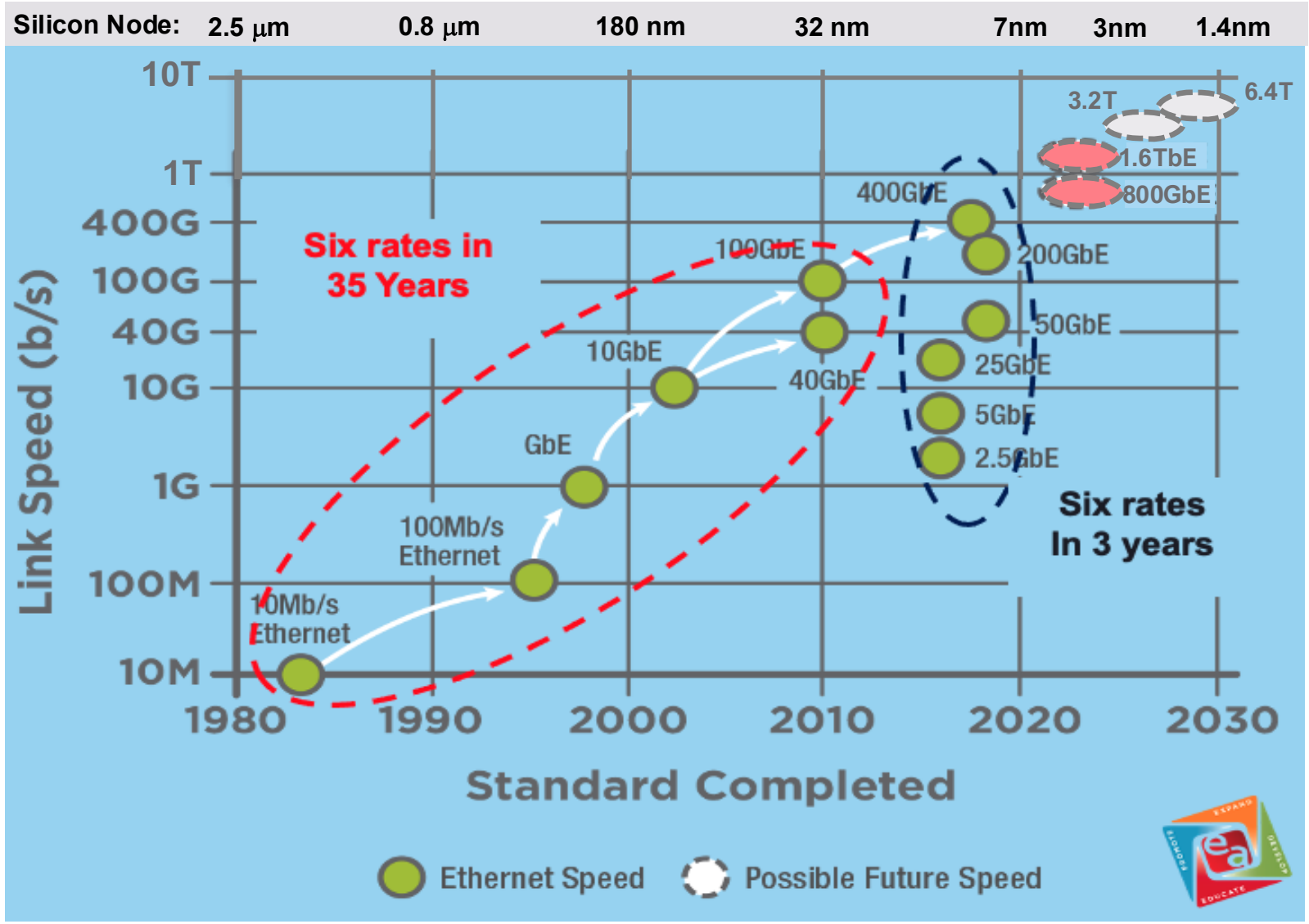
- Mid Bandwidth Tier
- 35% CAGR
- 25G until 2036+

- High Bandwidth Tier
- 40% CAGR

How Far? - “Mean-Time-to-Cloud”



Network Edge - Speed & Acceleration



Source: Ethernet Alliance & Ciena

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Driving Dramatic Reductions in Space & Power

FASTER

GREENER

1995: 40G is 16 wavelengths of 2.5G
Occupied 1 Telco Bay, 400G requires 10 Bays

2022: OIF 400ZR
400G in your palm

2024: OIF 800ZR
800G in your palm

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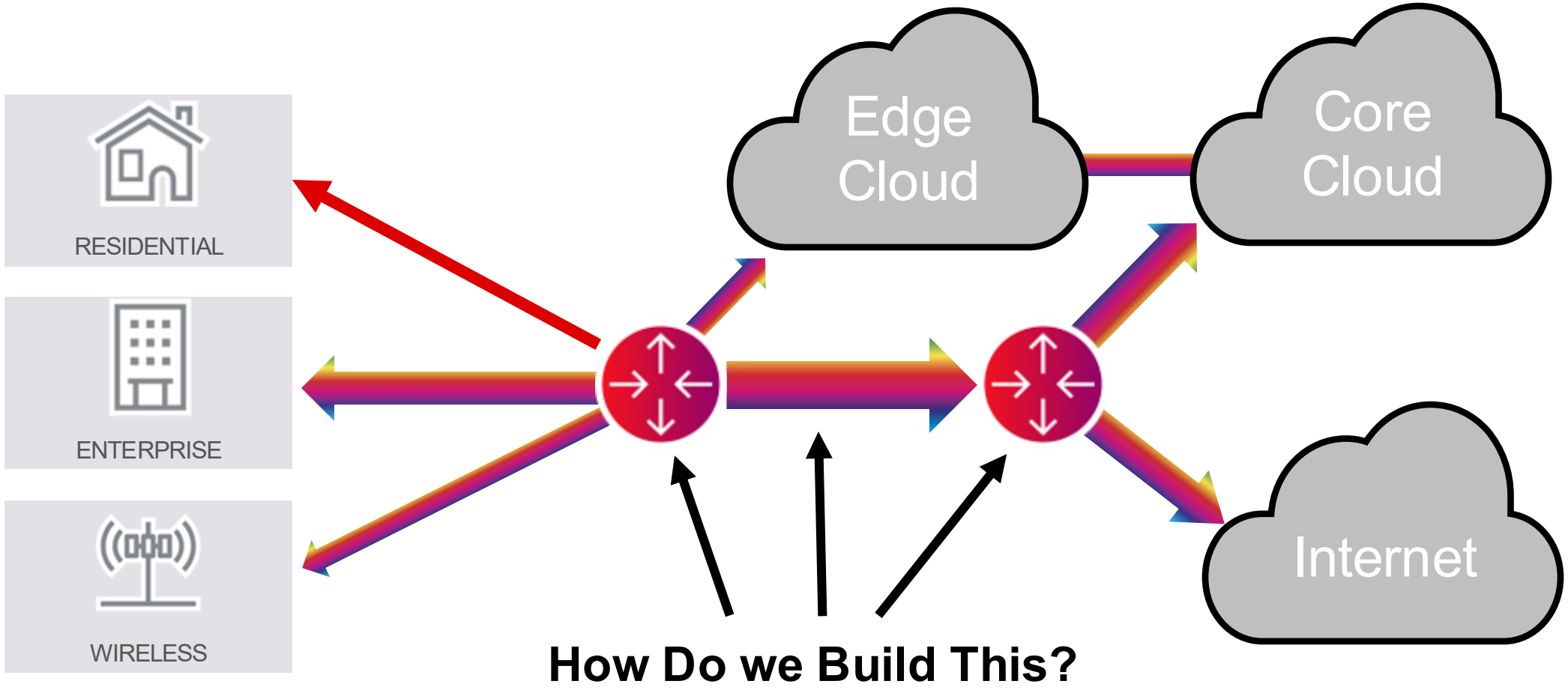
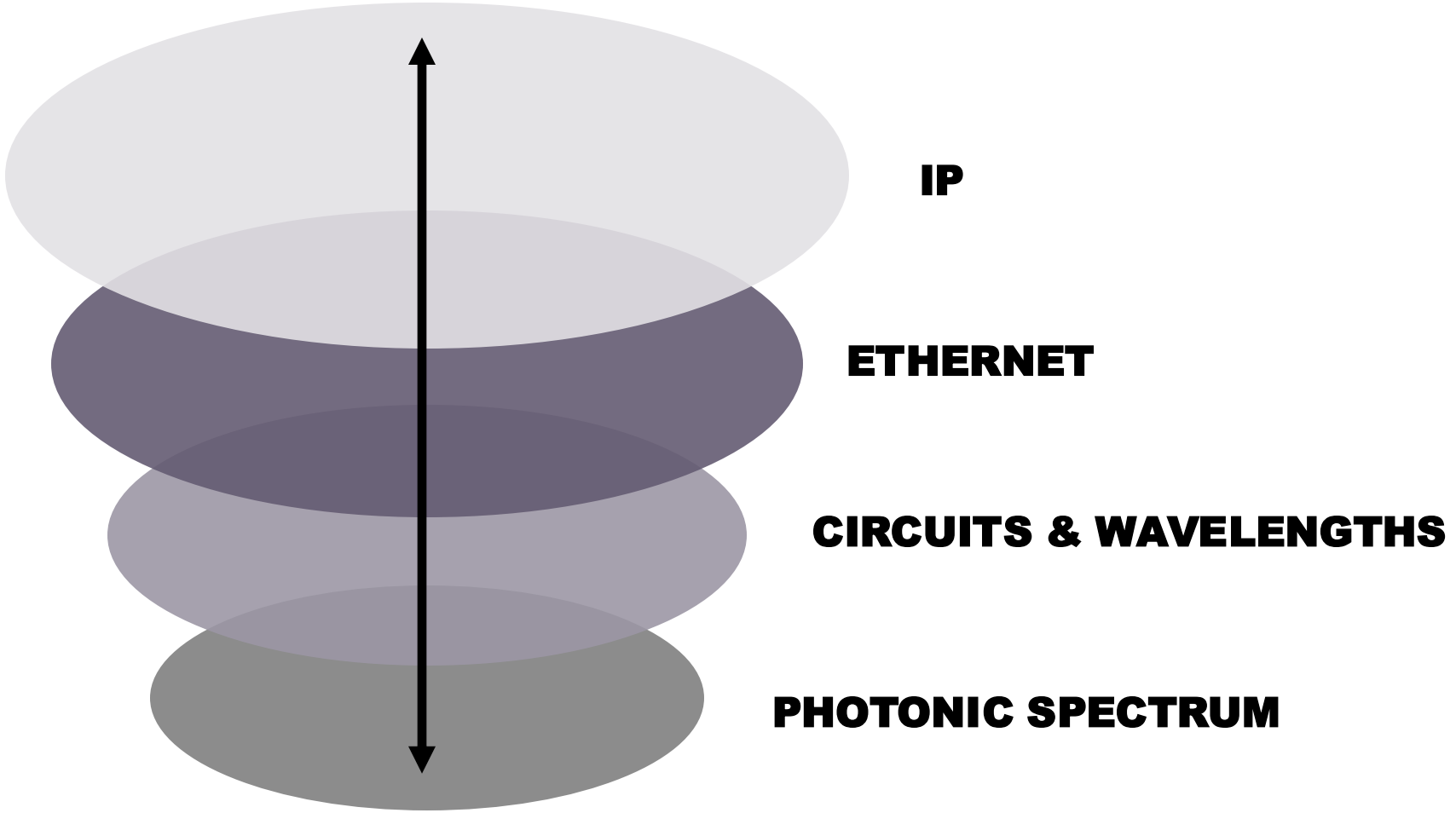
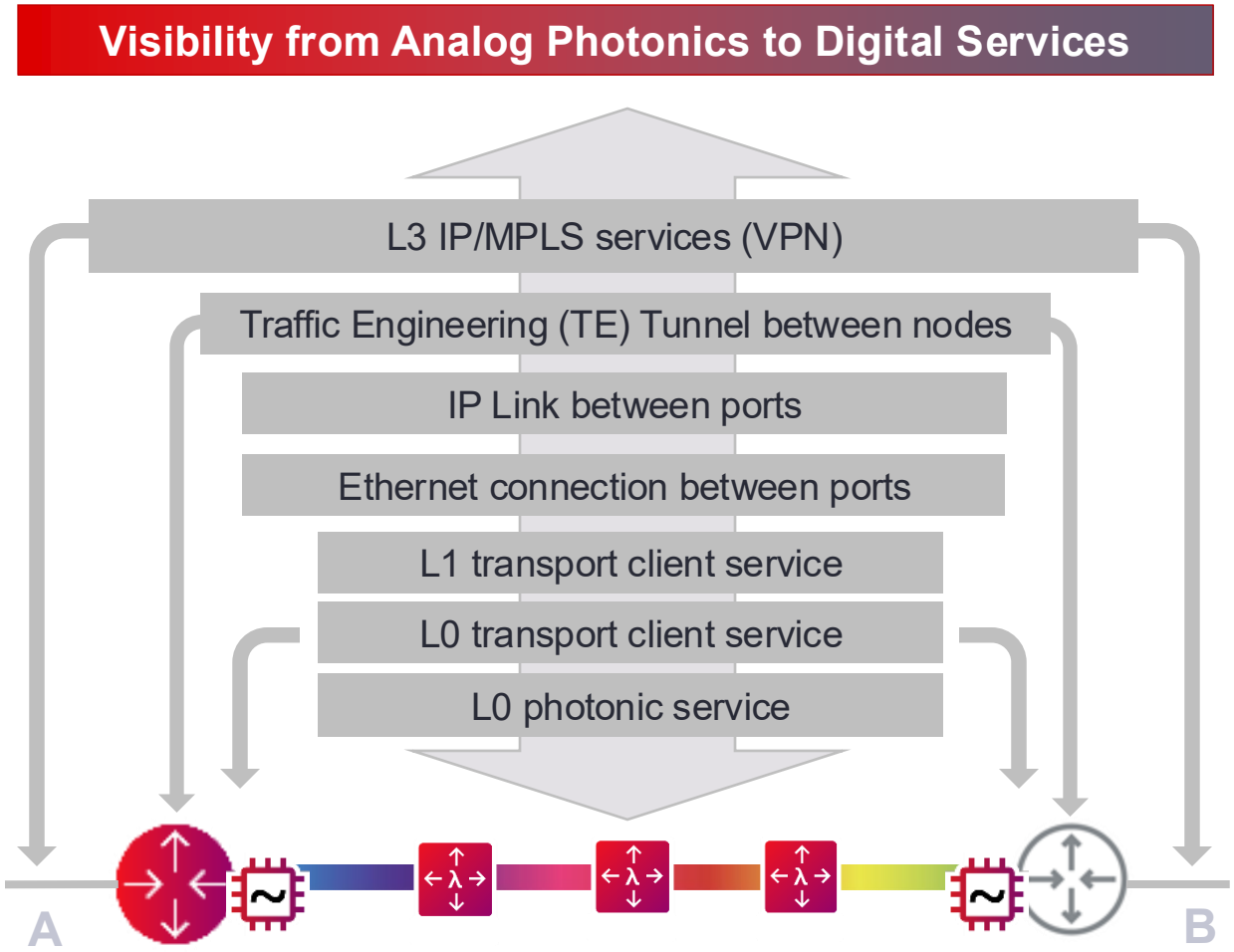
The Service Provider Metro



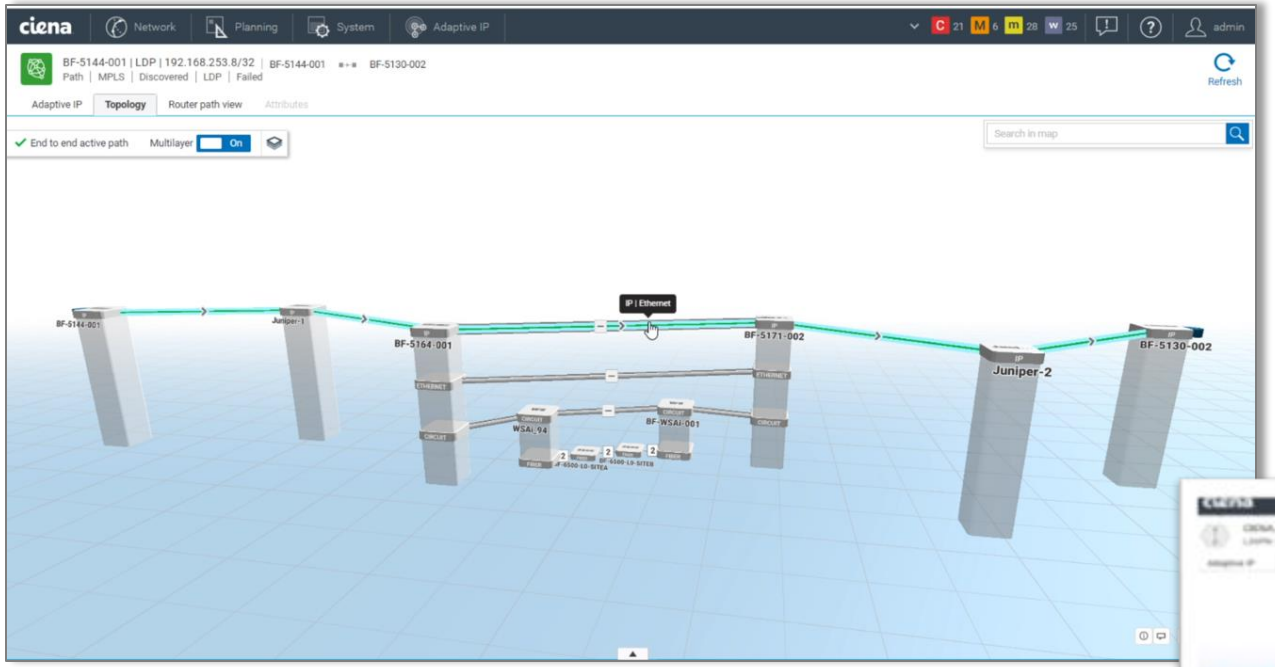
From Independent Layers to Cooperative Layers



You Can’t Automate What you Can’t See

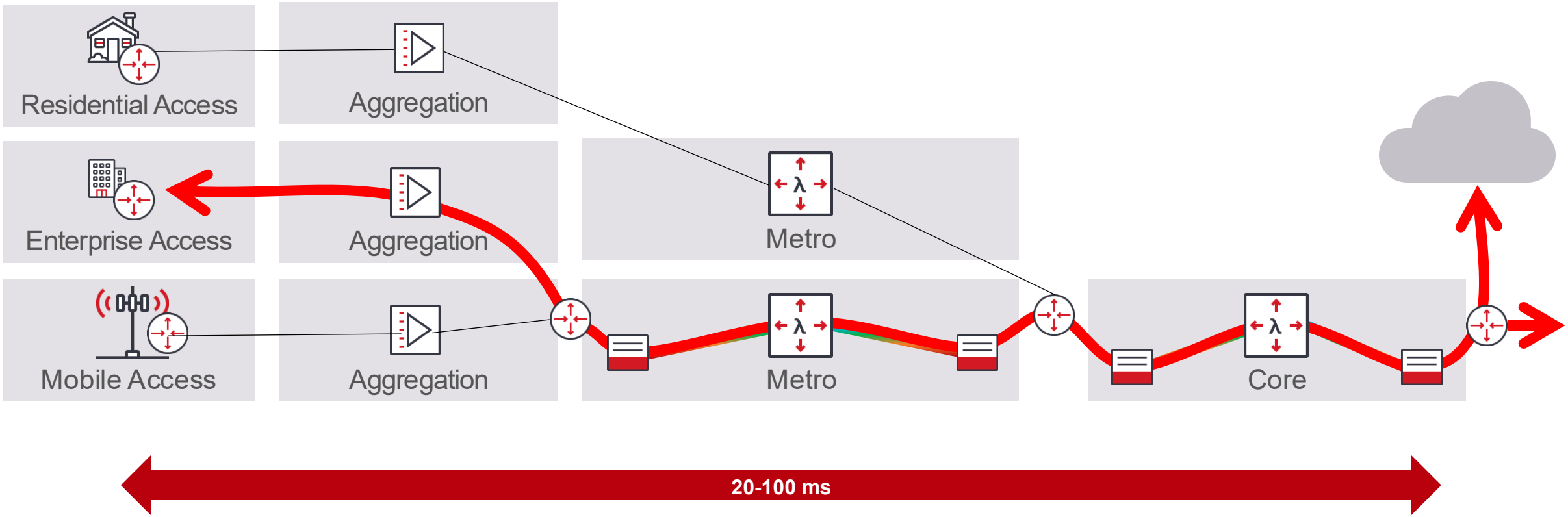


Multilayer Visibility & Correlation

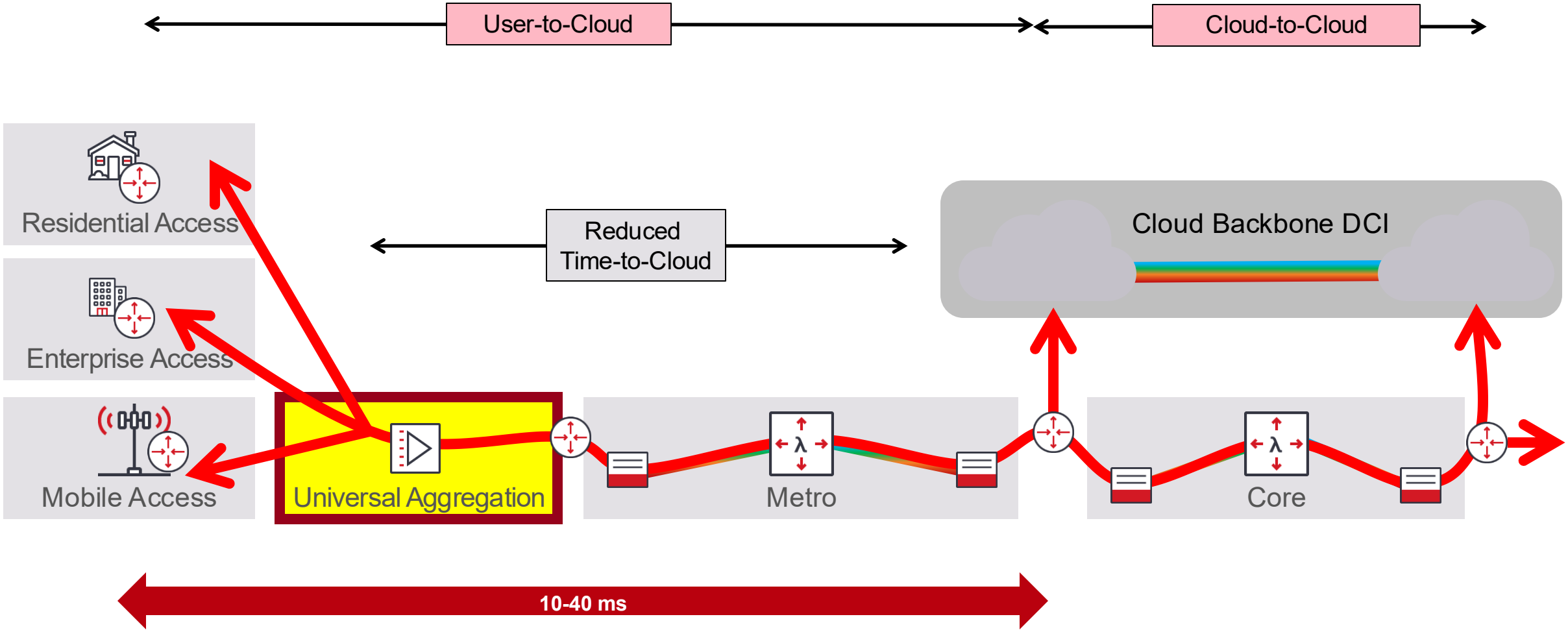


Traditional Network

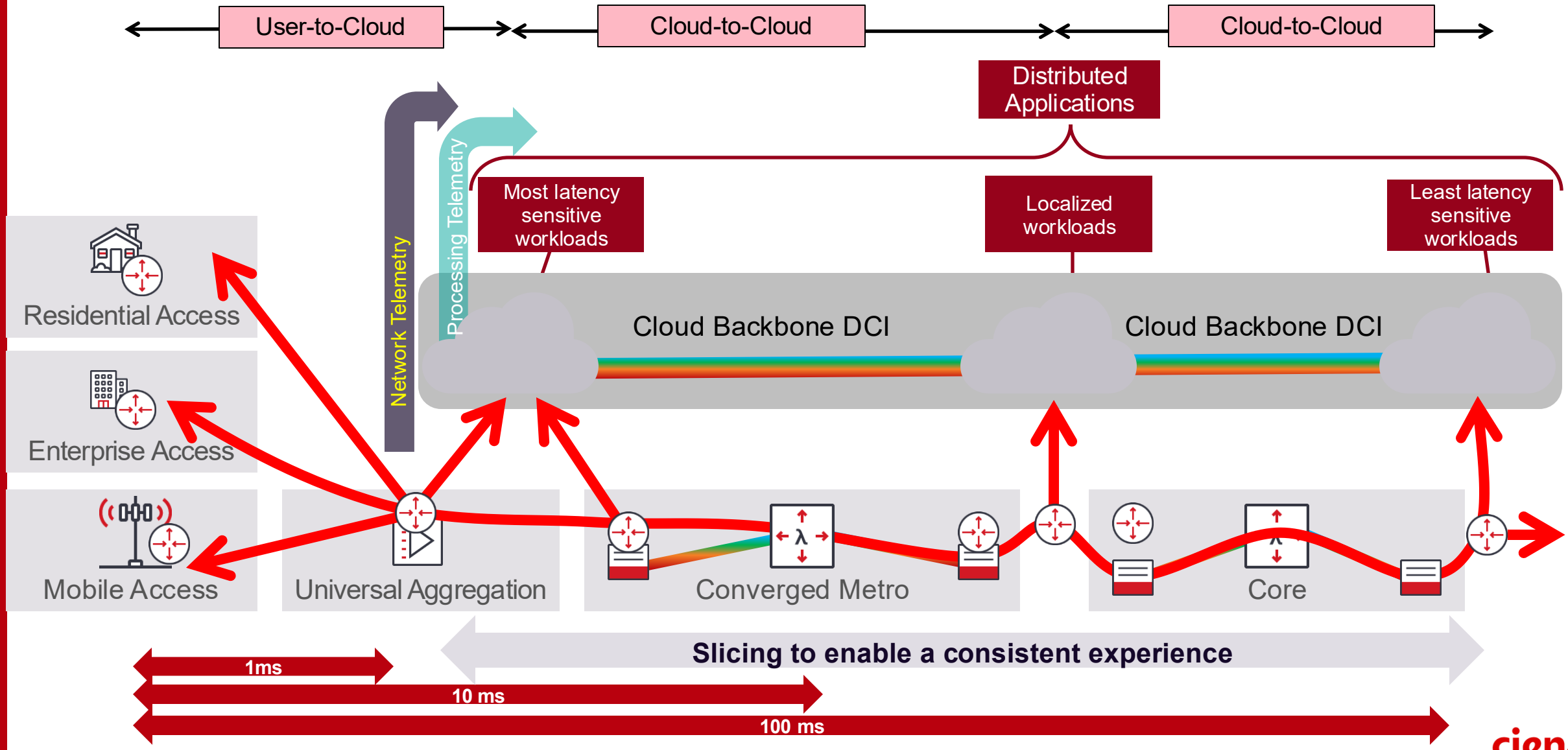
Lots of OEO, buffers, opportunities for delay



Better Cloud Experience

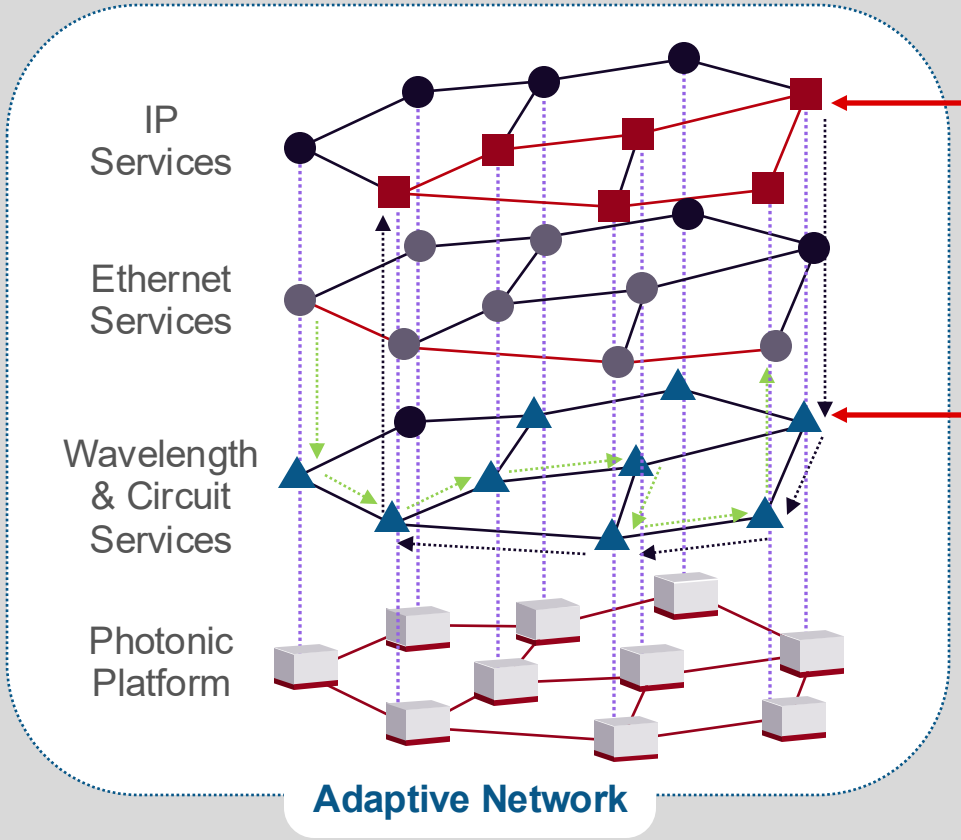


Evolved Network



Visibility + Intelligence + Automation = Simplicity

SMARTER



New elephant flow here…

…results in a new wavelength connection here…add capacity on the fly…reducing congestion, hop count & latency.

The Network can become a sensor of its own requirements.
It adapts without manual intervention.

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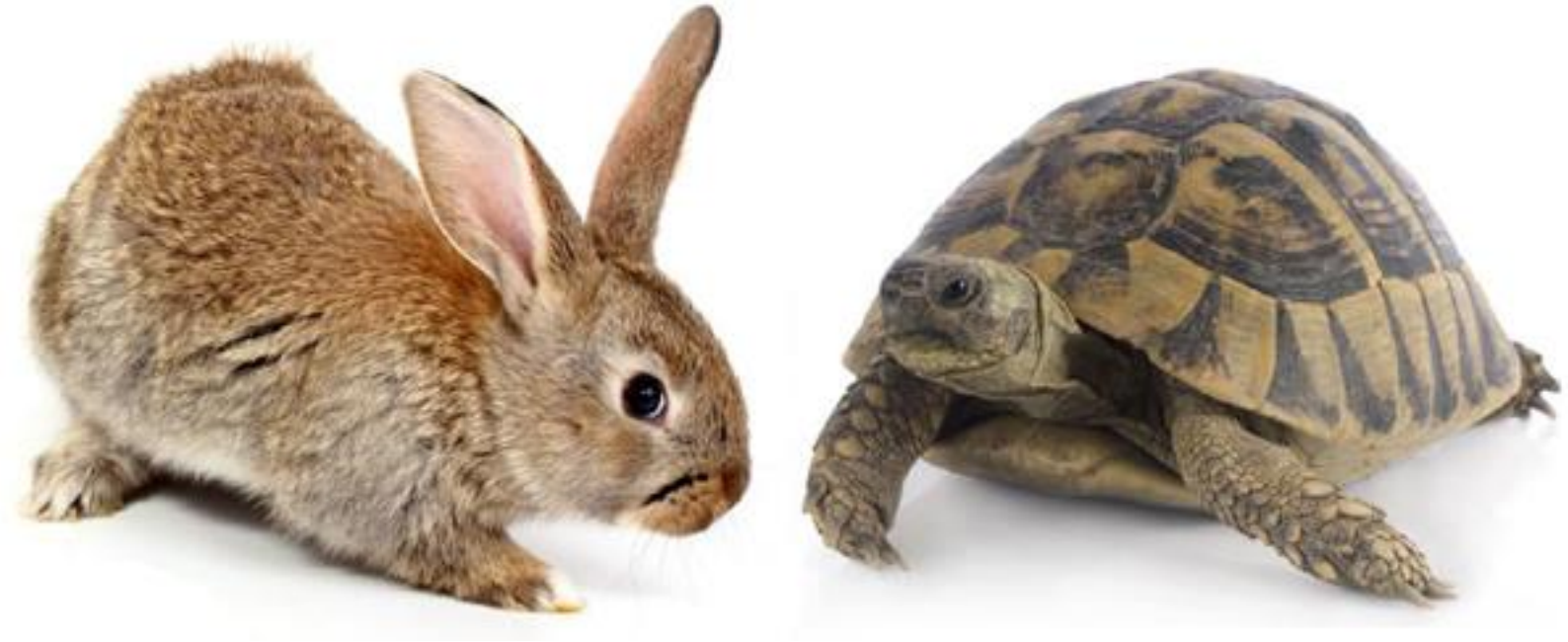
Remember Bit-Heads vs. Bell-Heads



Cloud Service Velocity vs Telecom Operator Service Velocity

Key Take-Aways

	PRESENT	FUTURE
Faster	400G Everywhere	800G Everywhere 1.6T per Wavelength
Closer	10's to 100's of ms	Workloads optimally placed 10 μs – 10 ms
Smarter	Automation of Manual Workflows	AI & ML Enable Networks to Adapt and Operate at Cloud-Speed

All underpinned by power reduction, energy conservation and optimized carbon foot-print architectures

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Thank You
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