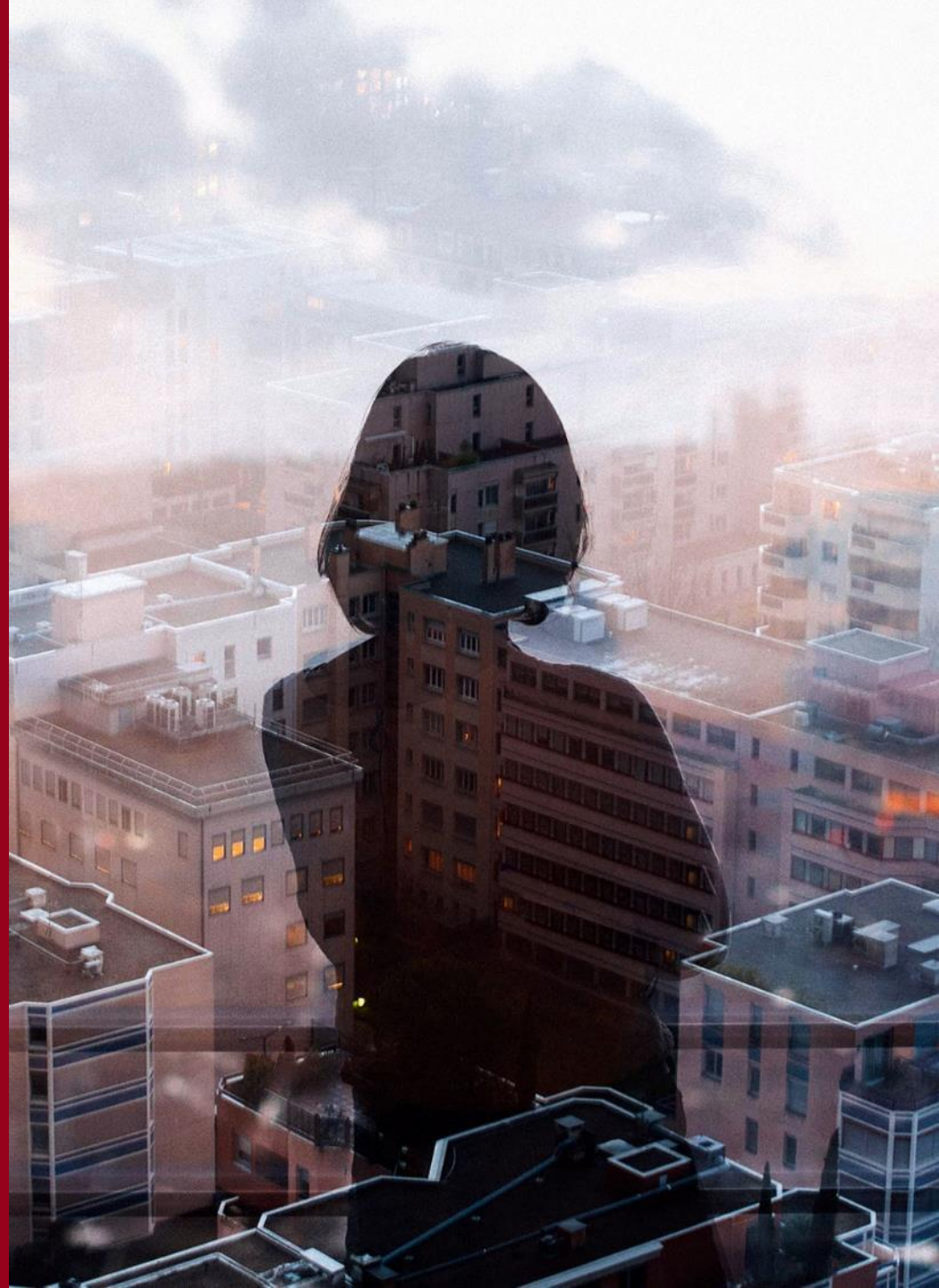
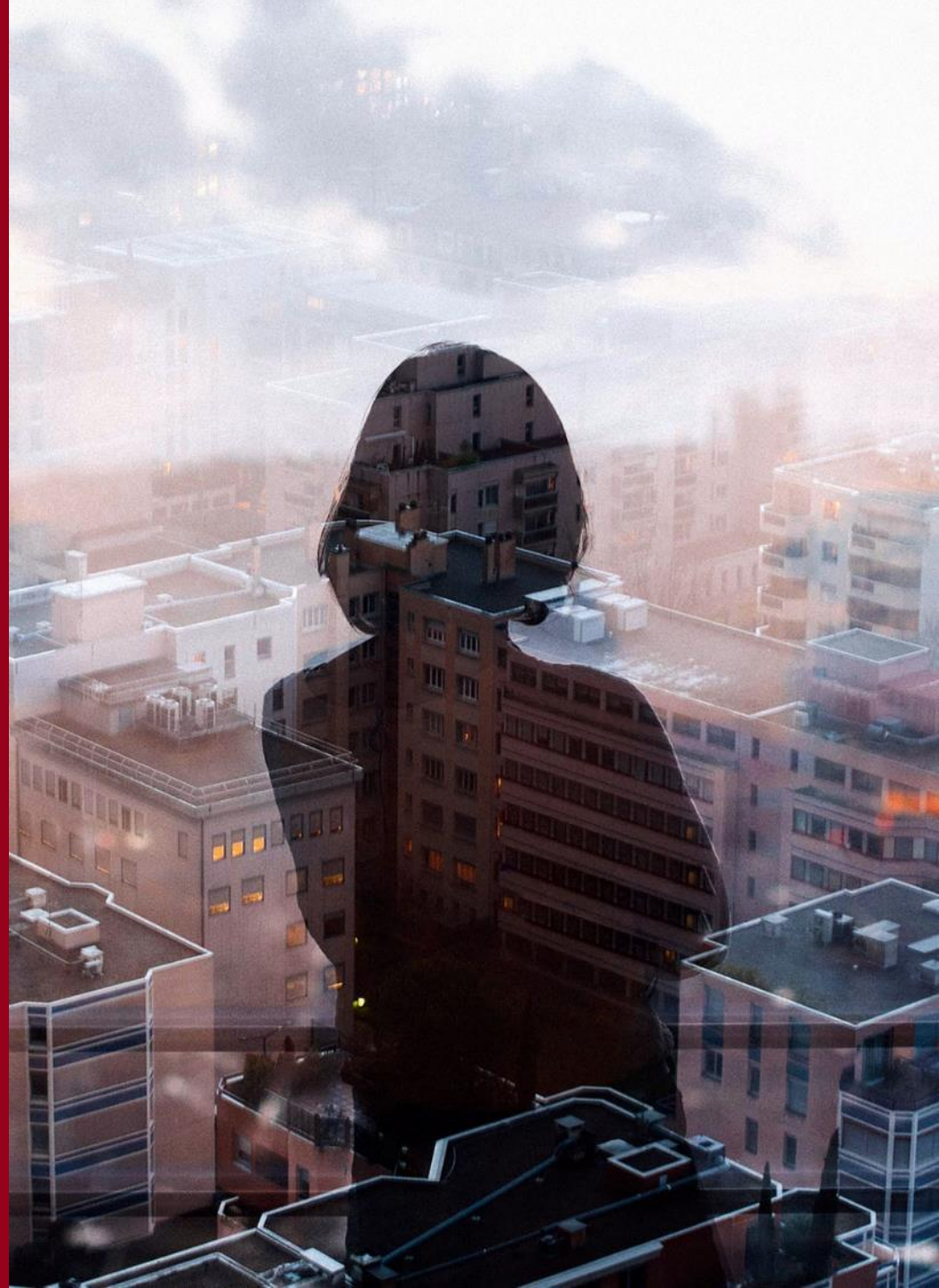
Expanding our Optical Leadership: Ciena's Strategy for Growth in AI and Data Center Markets



Our Strategy in the Context of Evolving Industry Dynamics

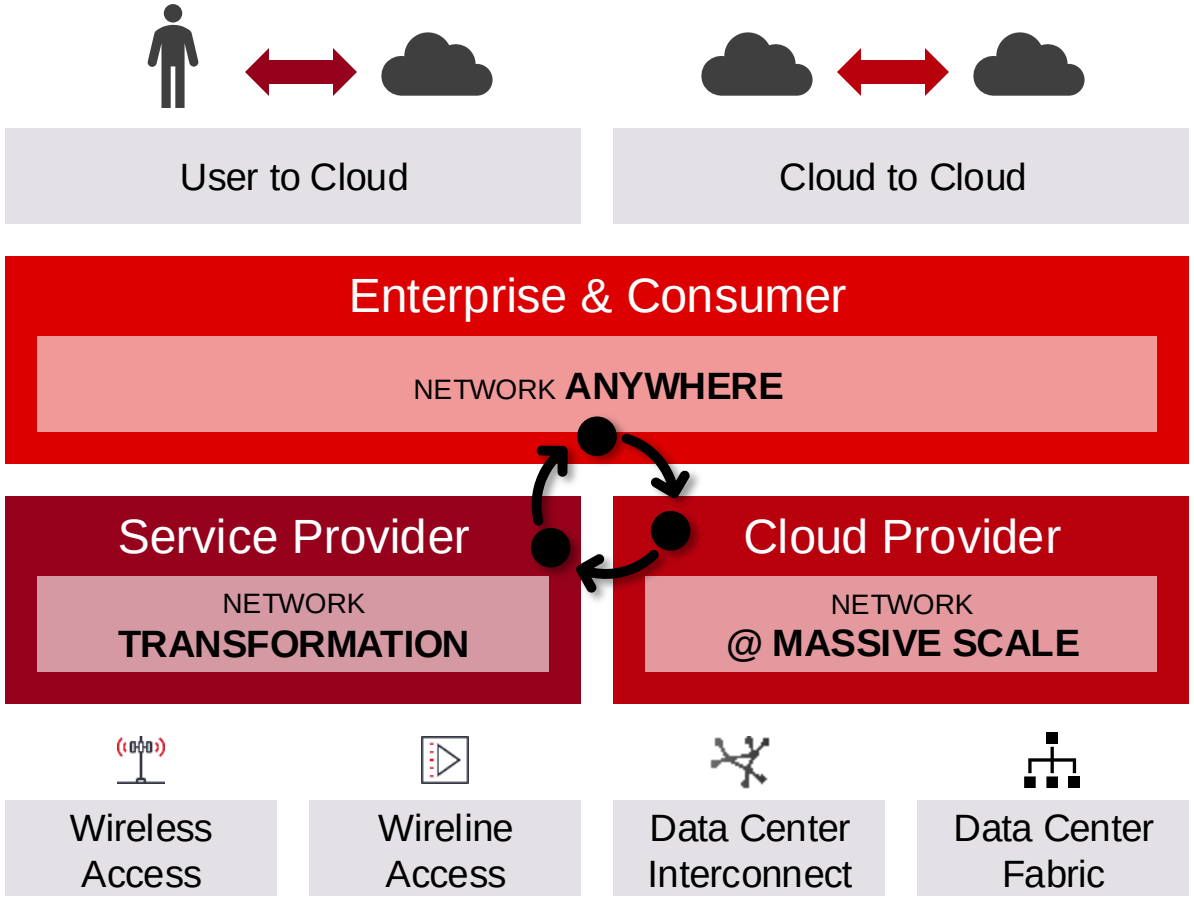
David Rothenstein

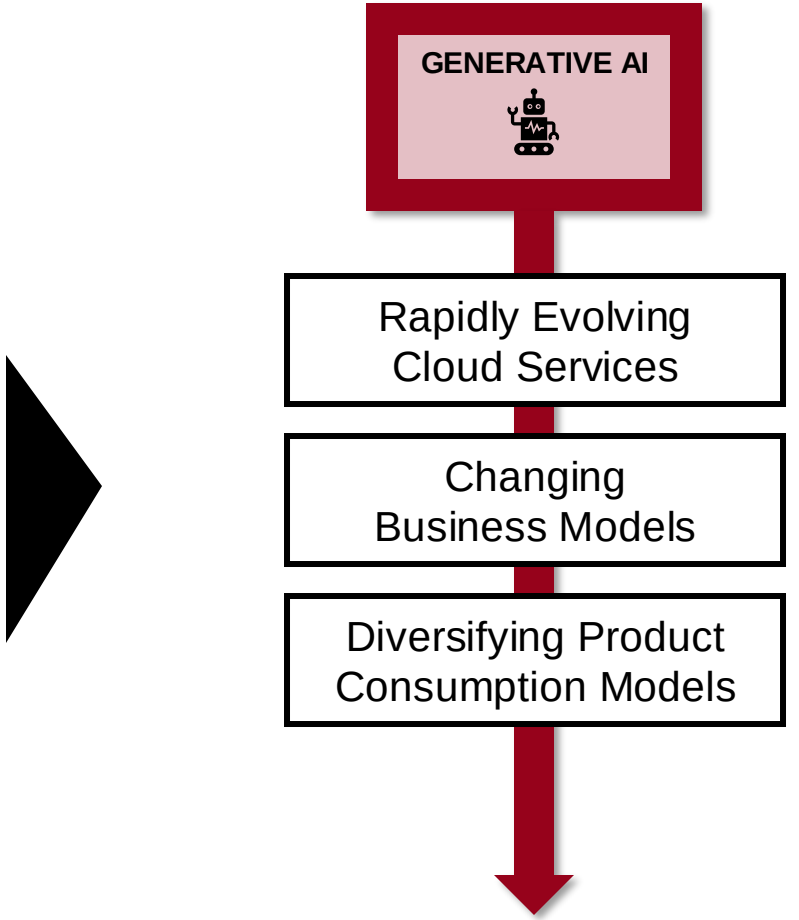
SVP and Chief Strategy Officer



Evolving landscape

Different segments are revisiting their agendas and reshaping networking markets

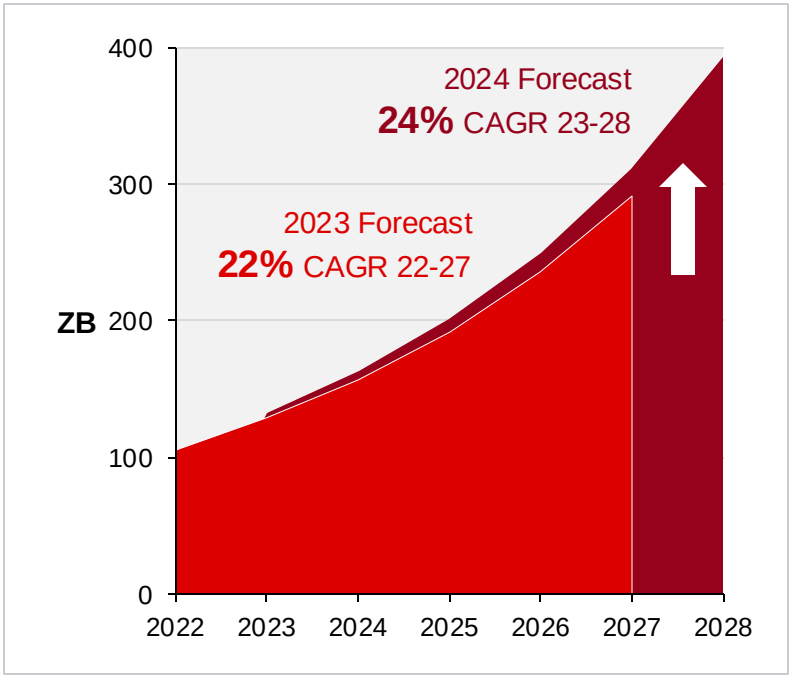




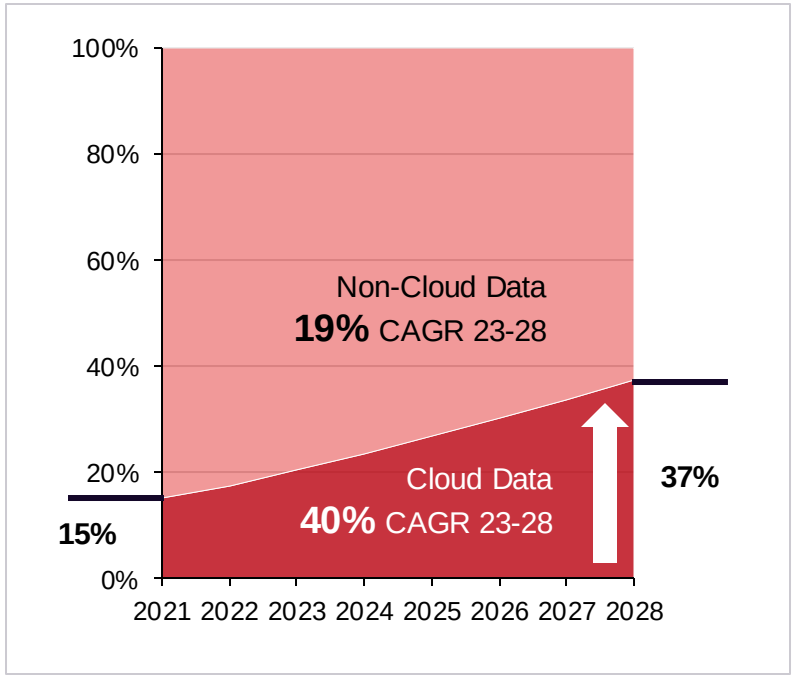
Bandwidth

Cloud and AI will accelerate WAN bandwidth growth, putting more data on optical fiber

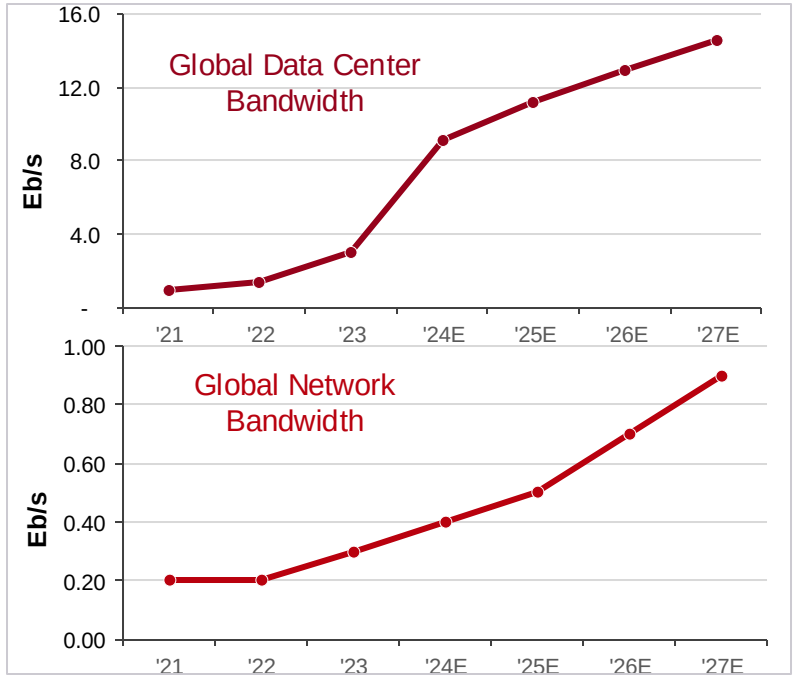
Growth of global data generation is accelerating



Cloud data is growing twice as fast as non-cloud



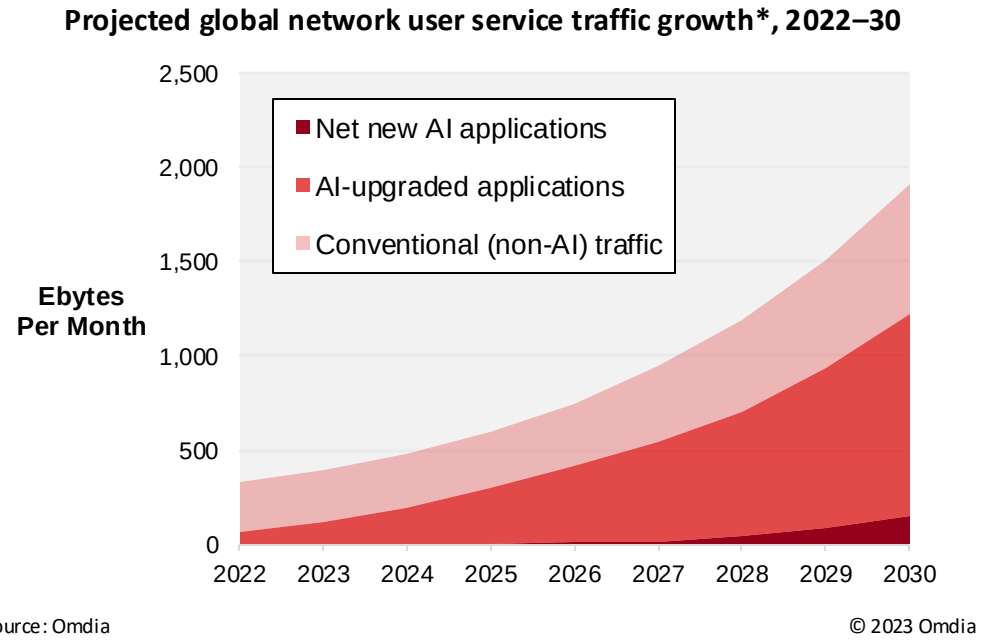
Bandwidth on optical fiber continues to grow at a high rate from a large base



Source: IDC, Global DataSphere, 2023 and 2024; Cignal AI, 4Q23 Optical Components for data rates >100Gbps

AI

Video is expected to continue to fuel user bandwidth growth



Source: Omdia

*Excludes internal CP traffic such as private DCI

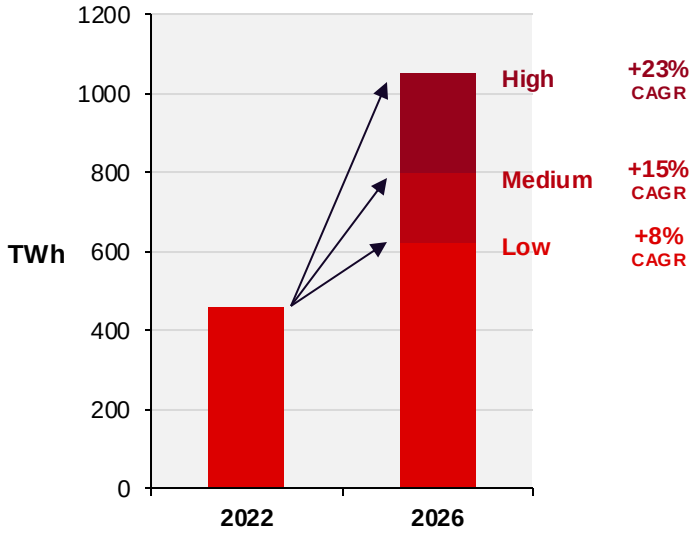
OpenAI …is a traffic amplifier

Input	Output	Tool Example	Response size
Text	Text	ChatGPT	KBytes
Text	Images	Dall-E	MBytes
Text	Videos	Sora	GBytes

AI

Data center infrastructure trends related to AI will require more connectivity

Global Data Center Power Consumption



Global energy requirements to double

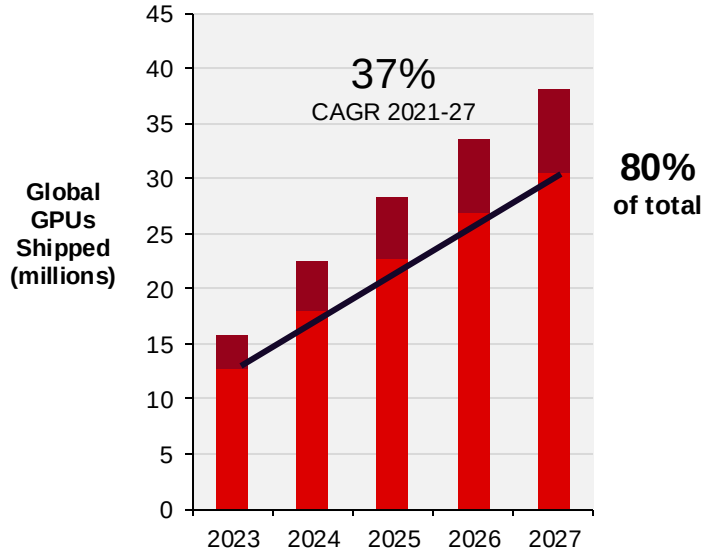
Encourages geographic distribution of data centers to access energy sources creating need for new DCI connectivity

Data Localization

Laws governing cross-border data flows

Government regulations force in-country data center builds creating new DCI connectivity and growth opportunities for local SP as hosting providers

AI Edge Monetization



Inference accounts for ~80% of GPUs

Potential for million units of global GPUs used for Inferencing by 2027 will drive WAN port growth associated with distributed AI Edge

Source: International Energy Agency, 2024

Sources: Omdia, Long Range Server Silicon Forecast, 1H24
Omdia, Connections in AI Networks Inside Data Centers, May 2024
Most chips used in inference AI "approximately 82% in 2024"
Nvidia earnings call, March 2024, 40% of GPU revenue in 2024 attributed to Inferencing

AI

Connectivity requirements are impacting Service Provider behaviors

Managed Optical Fiber Networks

Dark Fiber Conduits

Service Providers are seeing an uptick in MOFN and Dark Fiber opportunities driven by high-bandwidth connectivity requirements fueled by AI

Corning and Lumen reach supply agreement on next-generation fiber-optic cable to support data center AI demands

Microsoft and Lumen partner to power the future of AI and enable digital transformation to benefit hundreds of millions of customers

Our strategy

Strategic pillars are durable and evolving to address the market opportunities

EXPAND OPTICAL LEADERSHIP

GROW ADDRESSABLE MARKET IN NEXT-GEN METRO & EDGE

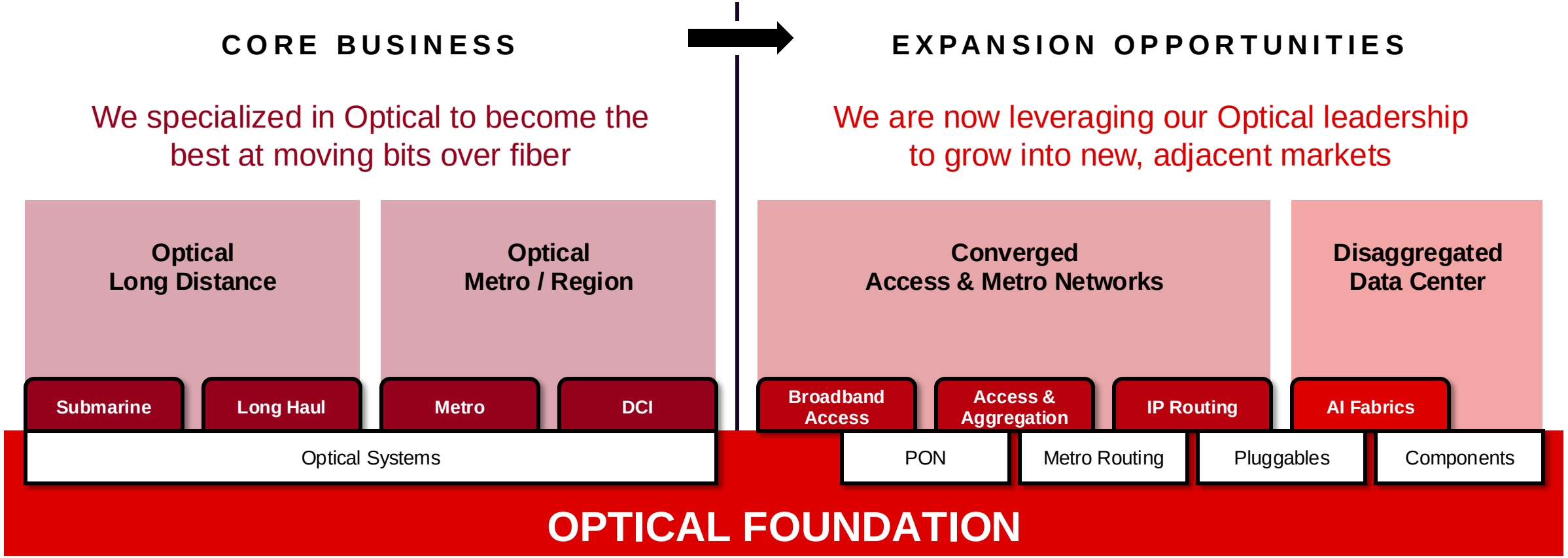
DRIVE SOFTWARE-LED TRANSFORMATION

REINFORCE OUR OPPORTUNITIES WITH GLOBAL SERVICES

ACCELERATE OPERATIONAL EXCELLENCE

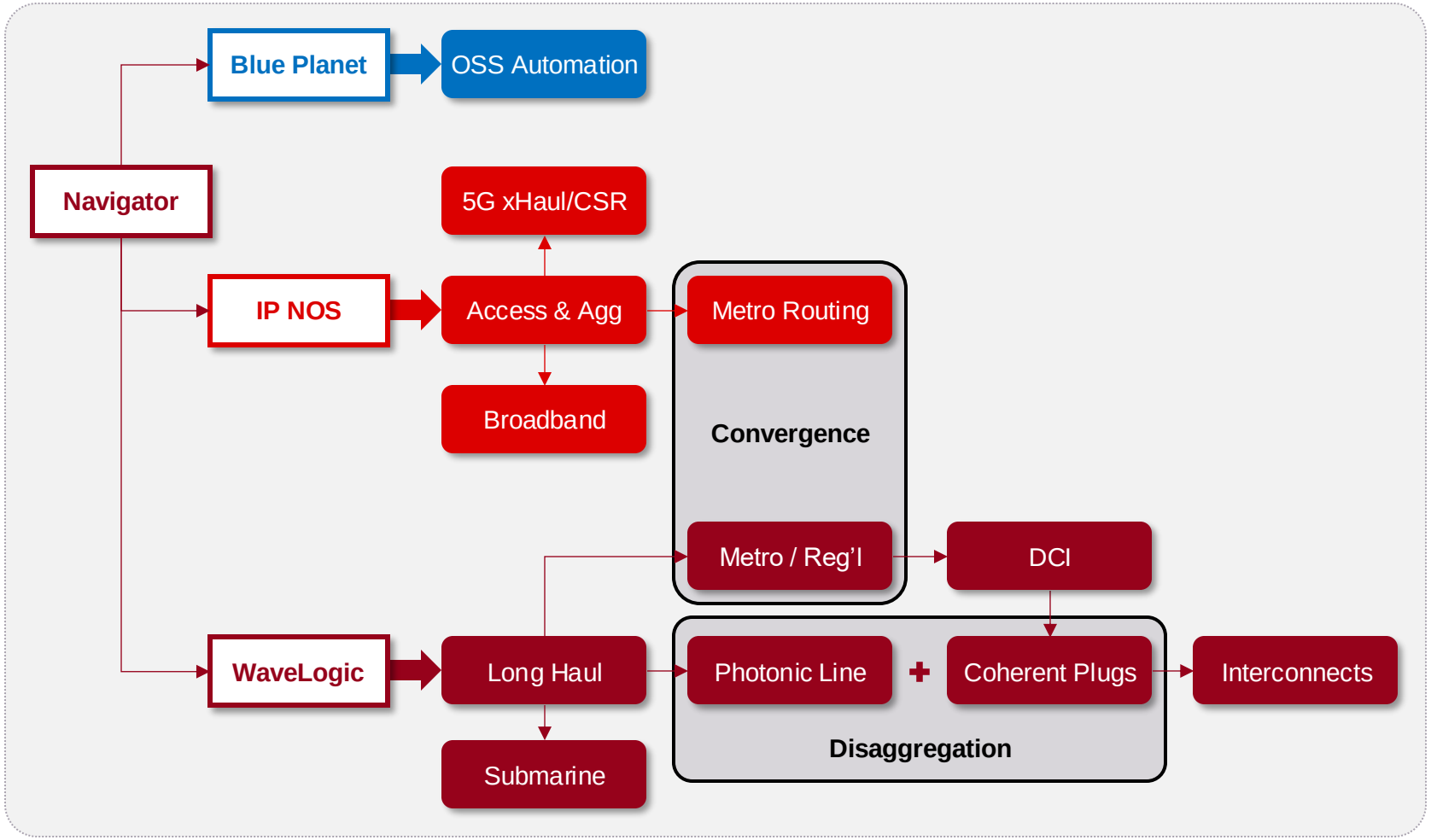
Our technology

Optical technology is the foundation of our business



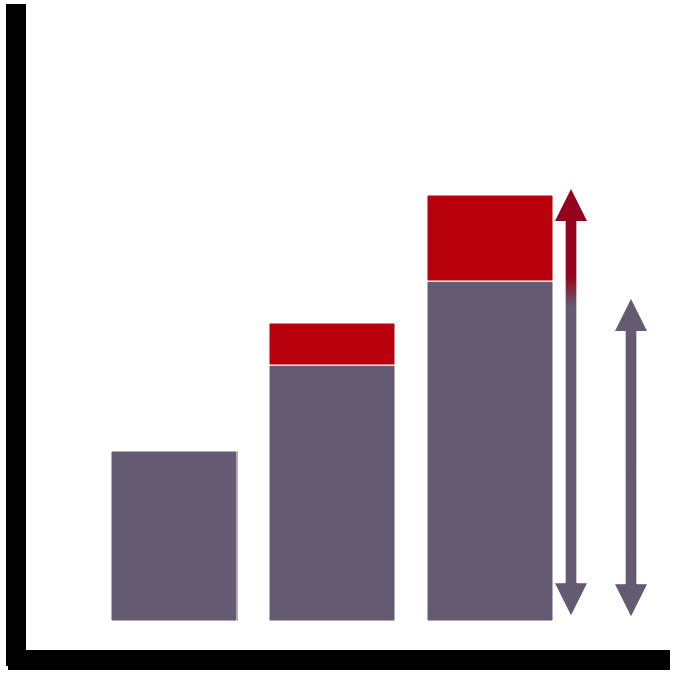
Our portfolio

We continue to evolve our portfolio and expand our addressable markets



Our future

Impact of Cloud and AI on bandwidth growth plus new addressable markets result in opportunity to outpace our traditional revenue CAGR over time

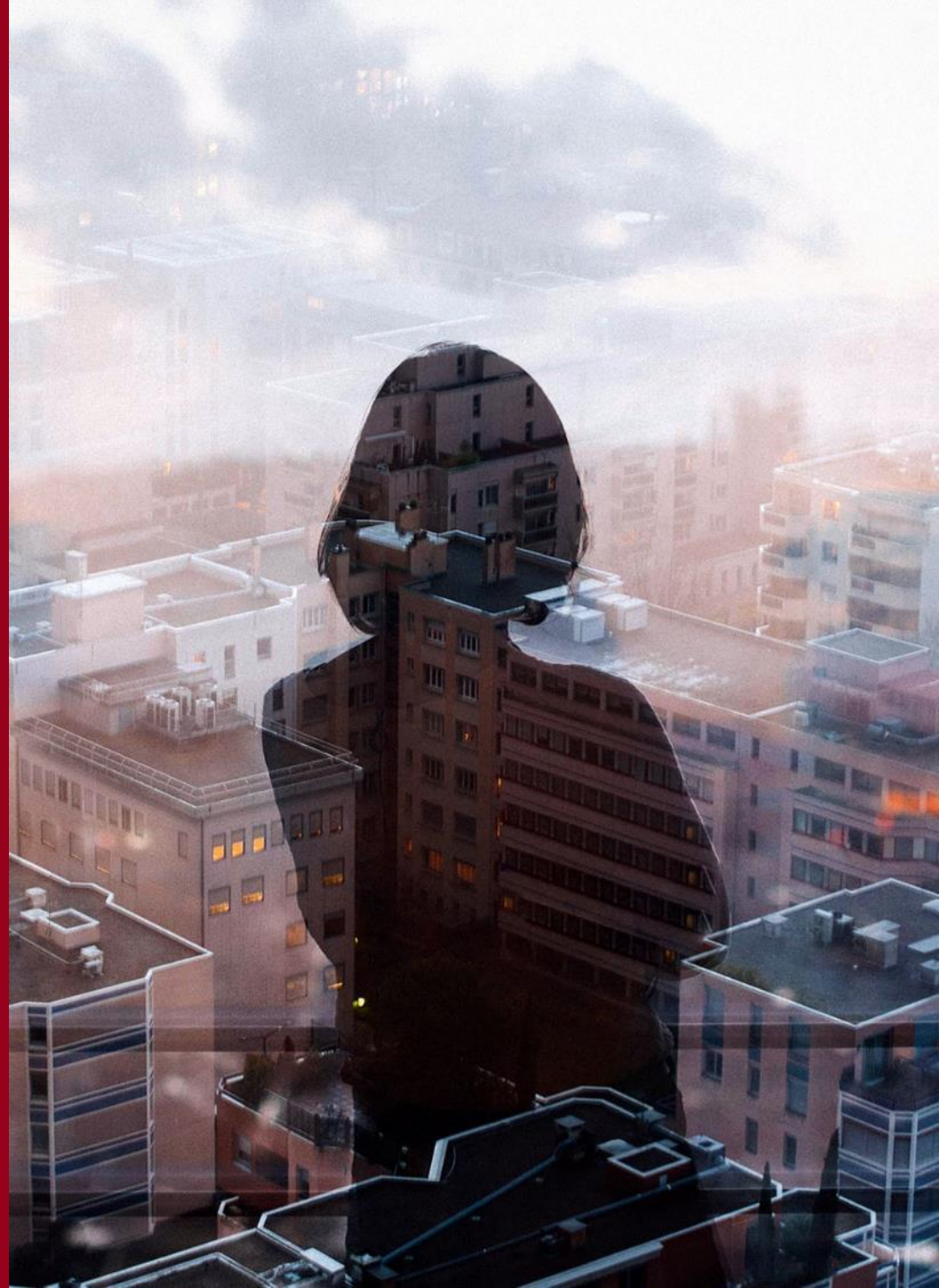


	Service Providers	Cloud Providers	ODM/OEM
New	• Interconnects • Metro Routing • BB Access	• Interconnects	Optical Components
Core	• Optical • R&S • Services & Software	• Optical • Services & Software	

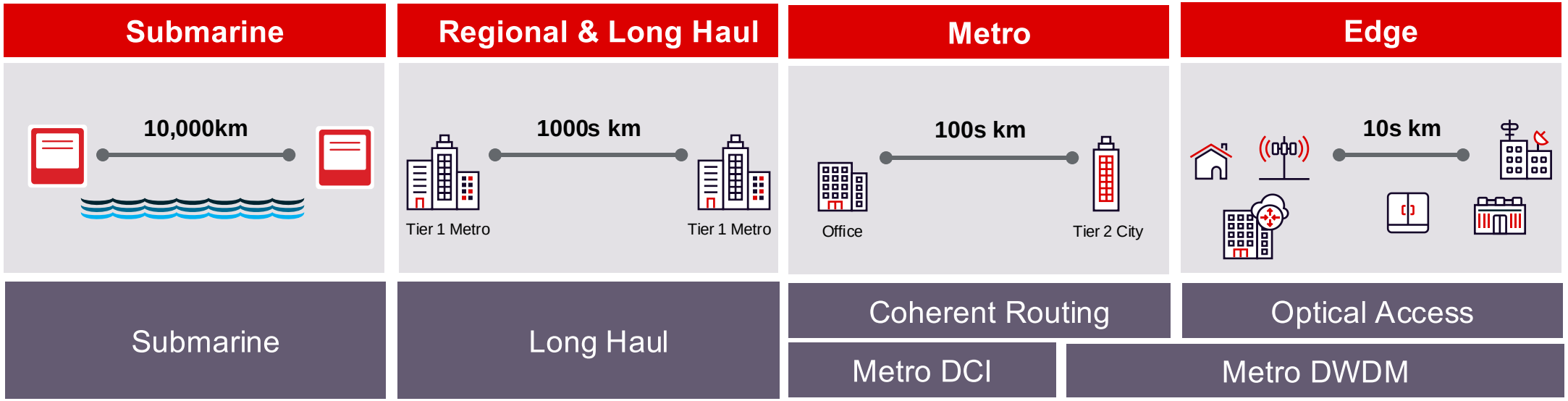
Overview of Ciena's Optical Systems

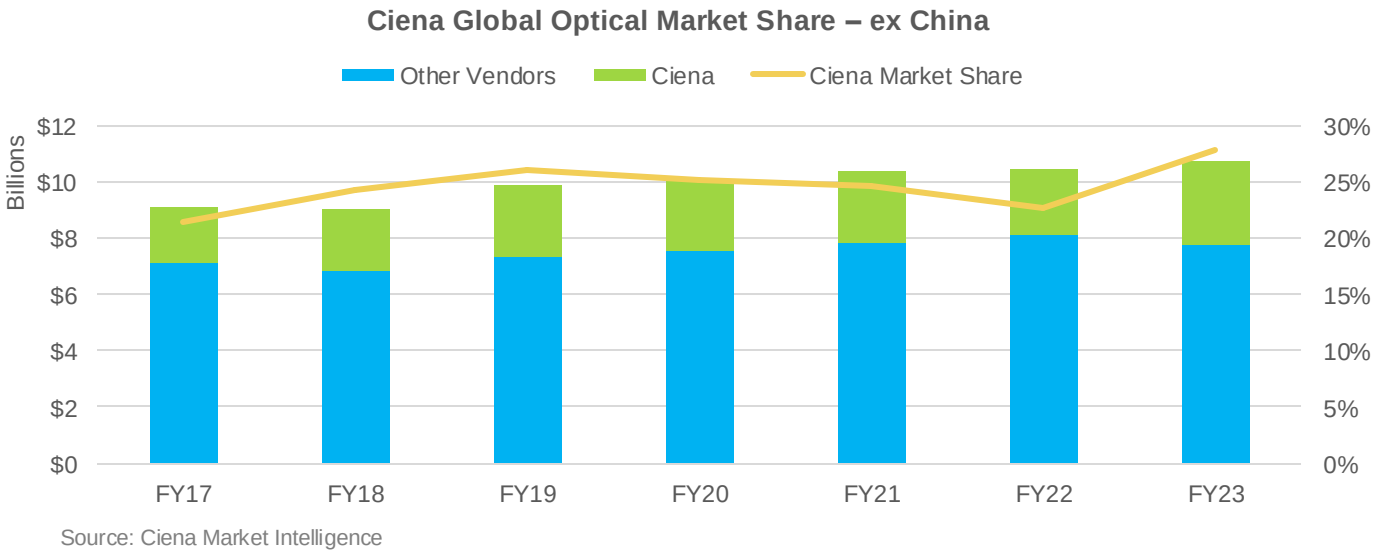
Brodie Gage

SVP, Global Products & Supply Chain



Market-leading optical systems addressing key network applications

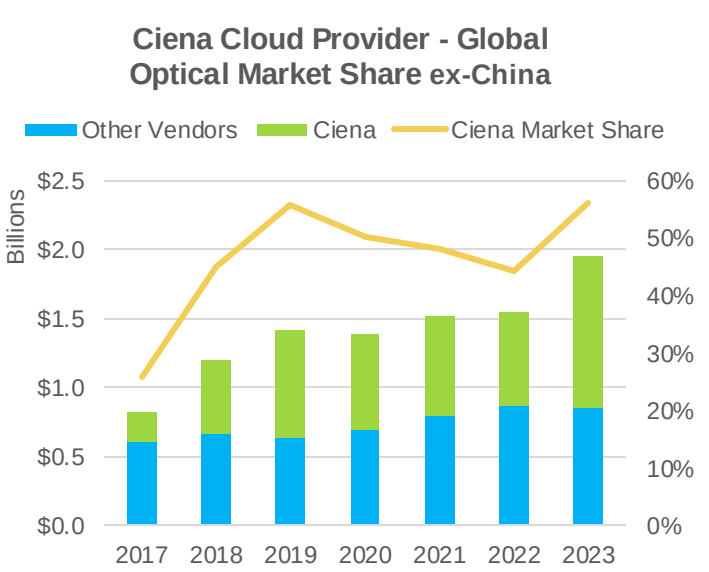


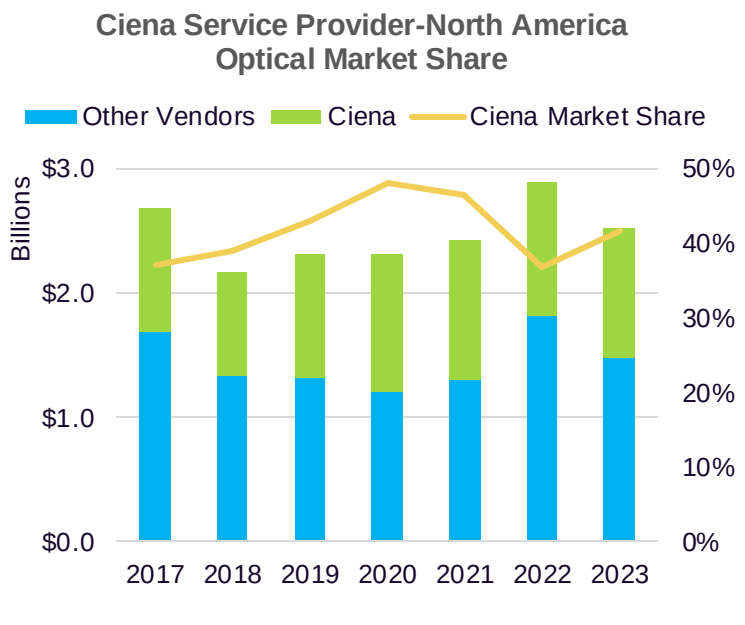


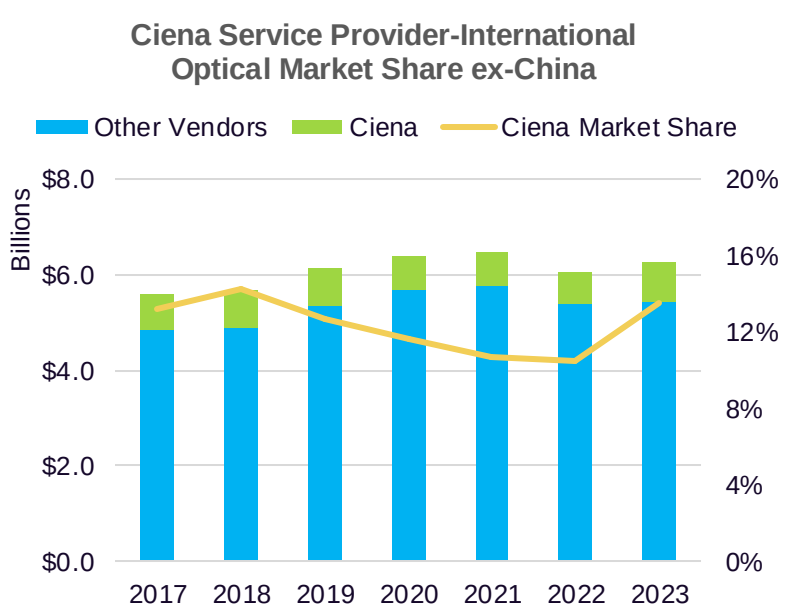
Source: Ciena Market Intelligence

- #1 Optical market share
- Optical systems partner of choice for all global Cloud Providers
- Leader across all key applications
- Deployed in ~70 countries and 26 of the top 27 Service Providers globally

Growth opportunities in Global Cloud and Service Providers







#1 market share in Cloud Providers
>55% share in highest-growth segment

#1 market share in North America

Growing international share

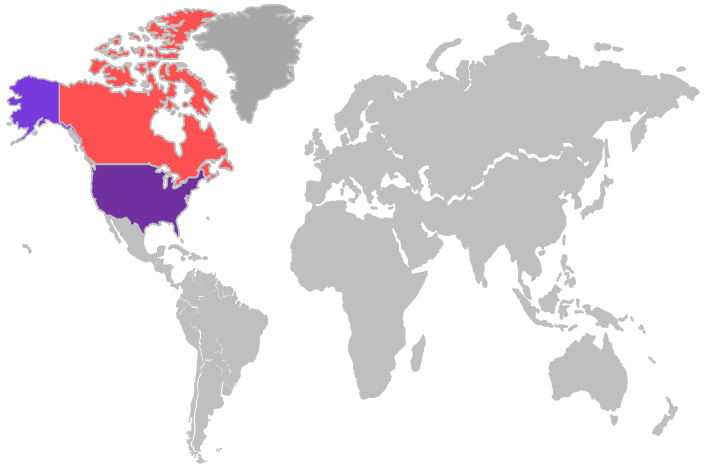
Source: Ciena Market Intelligence

Key trends in optical networking driving new opportunities

Cloud Providers

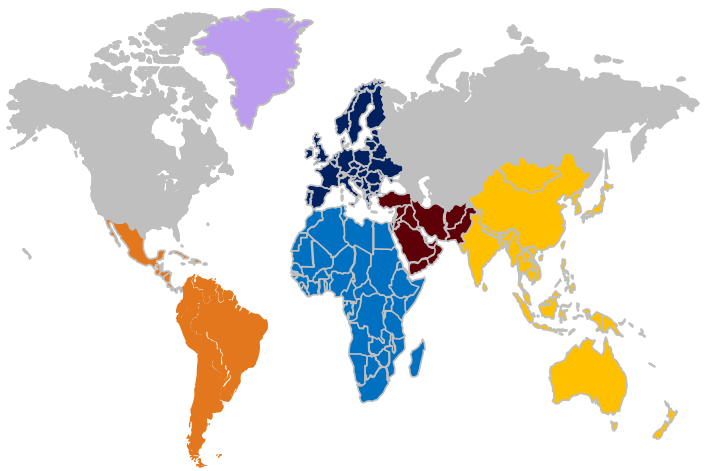
- AI innovation – GAI, LLM's, applications, data ingestion and distributed training
- Aggressive metro, inter-city and subsea network expansion – fiber and capacity
- New Cloud Providers requiring large-scale networks
- Optical connectivity at the heart of AI and Cloud innovation

Americas Service Providers



- Service models based on fiber and wireless access
- Digitalization and automating operations (AIOps)
- Inventory absorption challenges are abating

International Service Providers



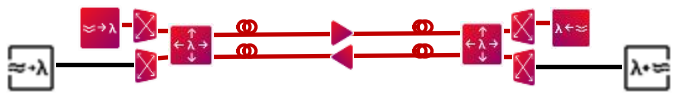
- AI uplift on metro capacity (inference & Edge AI)
- Convergence of IP and Optical for Metro
- Regulatory headwinds for Huawei
- Subsea expansion

- Managed Optical Fiber Networks (MOFN's) – providing service to Cloud Providers

Continuing to grow our leadership in Optical Systems

Cloud Providers

High-Capacity Metro DCI	Long Haul	Subsea
1.6Tb/s 100 km	800Gb/s-1.2Tb/s 100s to 1000s km	800Gb/s-1.2Tb/s 14,000km



Americas Service Providers

AT&T, LUMEN, verizon, COMCAST, windstream., Bell, zayo, CROWN CASTLE

New Growth in International

Telstra, Jio, airtel, colt, BT, Arelion, Seren Juno, SouthernCross Cable Network, one.nz, Spark nz

AI build-outs in existing and emerging network operators

New subsea cables and upgrades

Cloud and AI-driven capacity upgrades

Continue submarine leadership

Huawei replacement

MOFN build-outs – existing and new customers

Digital transformation with AIOps

Leverage Optical strength → IP/Optical convergence

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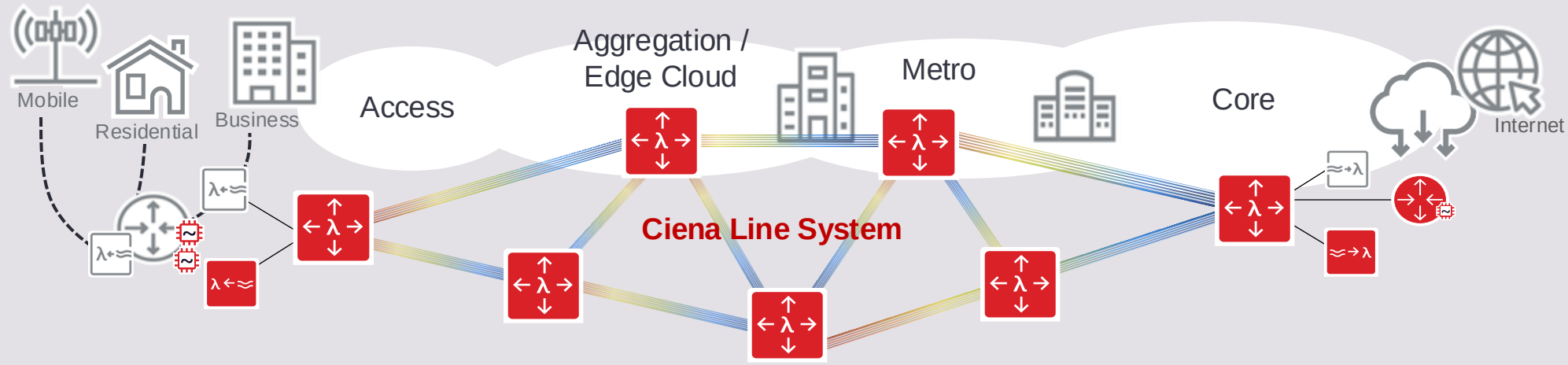
Ciena's Optical Systems differentiation – why we win

Programmable Infrastructure	• WaveLogic Coherent Optics • Photonic Line Systems
Software Control & Automation	• Navigator Network Control Suite
Professional Services	• Ciena Services

Photonic layer

Critical for achieving continued scale at the lowest cost

Supports all the applications and services running on top of it



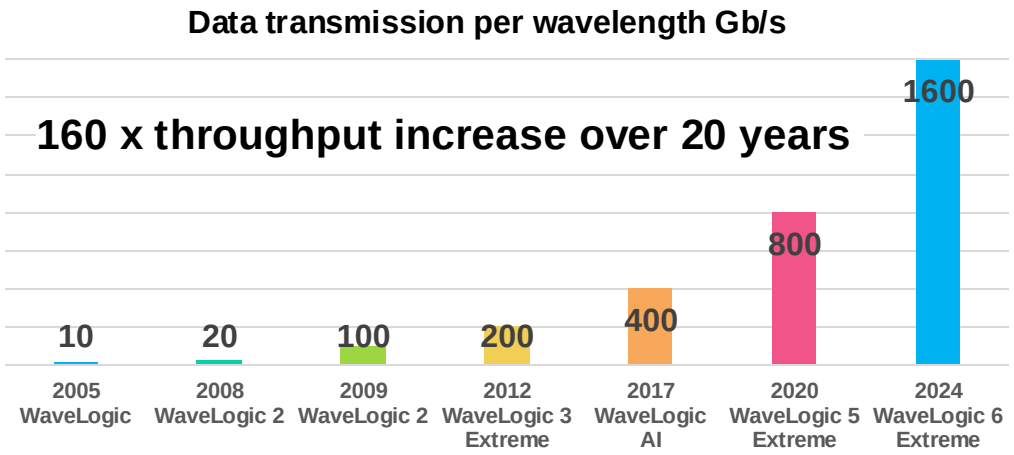
Photonic Layer

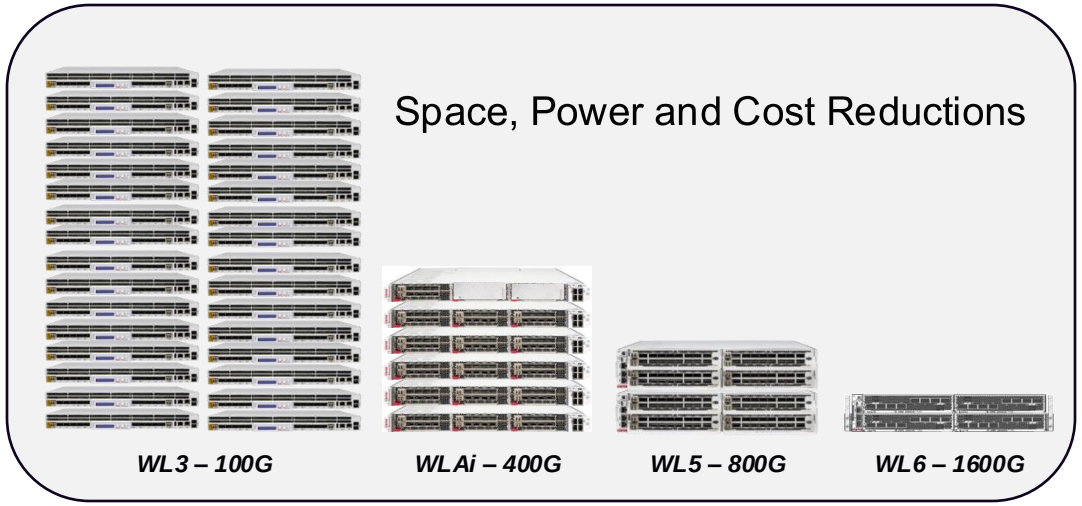
Provides lowest cost / power / latency solution for moving bits

Higher-speed services with fast adoption of new coherent technologies (flexible grids)

Programmable capacity

WaveLogic coherent optics





Over the past decade, Ciena delivered:

- ✓ 35x fiber capacity – Modem & flex grid photonics
- ✓ 25-30% annualized cost & power/bit reduction
- ✓ Over 5.5M metric tons of CO2 AVOIDED over 10 yrs

Equivalent to CO_2 emissions from:*

2,013,070,657

Liters of gasoline consumed

2,371,824,751

Kilograms of coal burned

Equal to carbon sequestered by:*

78,146,139

Tree seedlings grown for 10 years

* U.S. Environmental Protection Agency

Two options to address range of networking requirements

Performance-optimized

ciena WaveLogic™ 6 EXTREME

First 1.6T

800G Everywhere

Performance-optimized optics
for regional / long haul / subsea, and
Metro applications
where spectral efficiency is important

Footprint / Power-optimized

ciena WaveLogic™ 6 NANO

800G ZR / ZR+

800Gb/s coherent pluggables,
for metro/regional and IPoDWDM
deployments, driving:
cost, space and power benefits

Ability to optimize for spectral efficiency, power, space and cost

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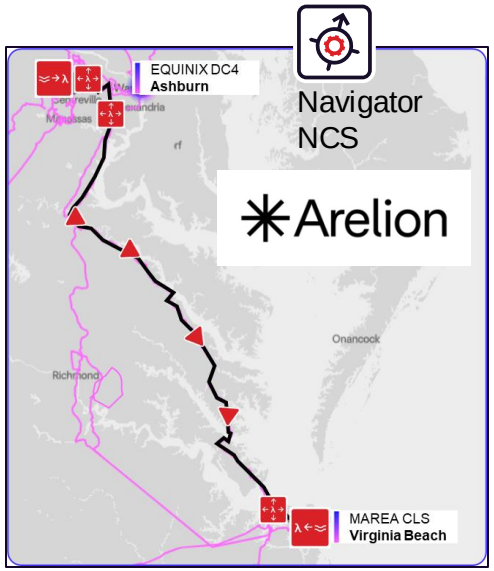
WaveLogic 6 Extreme – Lead applications



1.6Tb/s, 470km

- 470km route from Ashburn to Virginia Beach cable landing station
- 200GBd 1.6Tb/s
- 6 spans, 3 ROADMs
- WL6e in Waveserver chassis
- RLS C&L-band photonics
- Control thru Navigator NCS

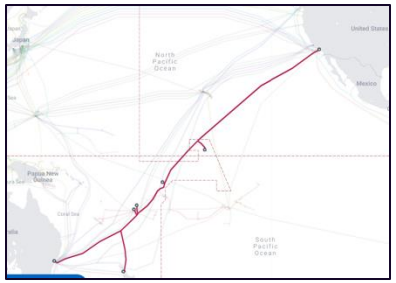
1Tb/s+ connecting key European routes

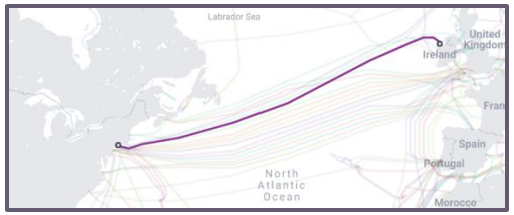
- 1.6Tb/s London – Paris
- 1Tb/s Dublin to London
- 1Tb/s Madrid to Lisbon

1.6Tb/s, 730km

- 1.6Tb/s connecting data center locations across 730km
- 200GBaud

800G - 1.2Tb/s across submarine links

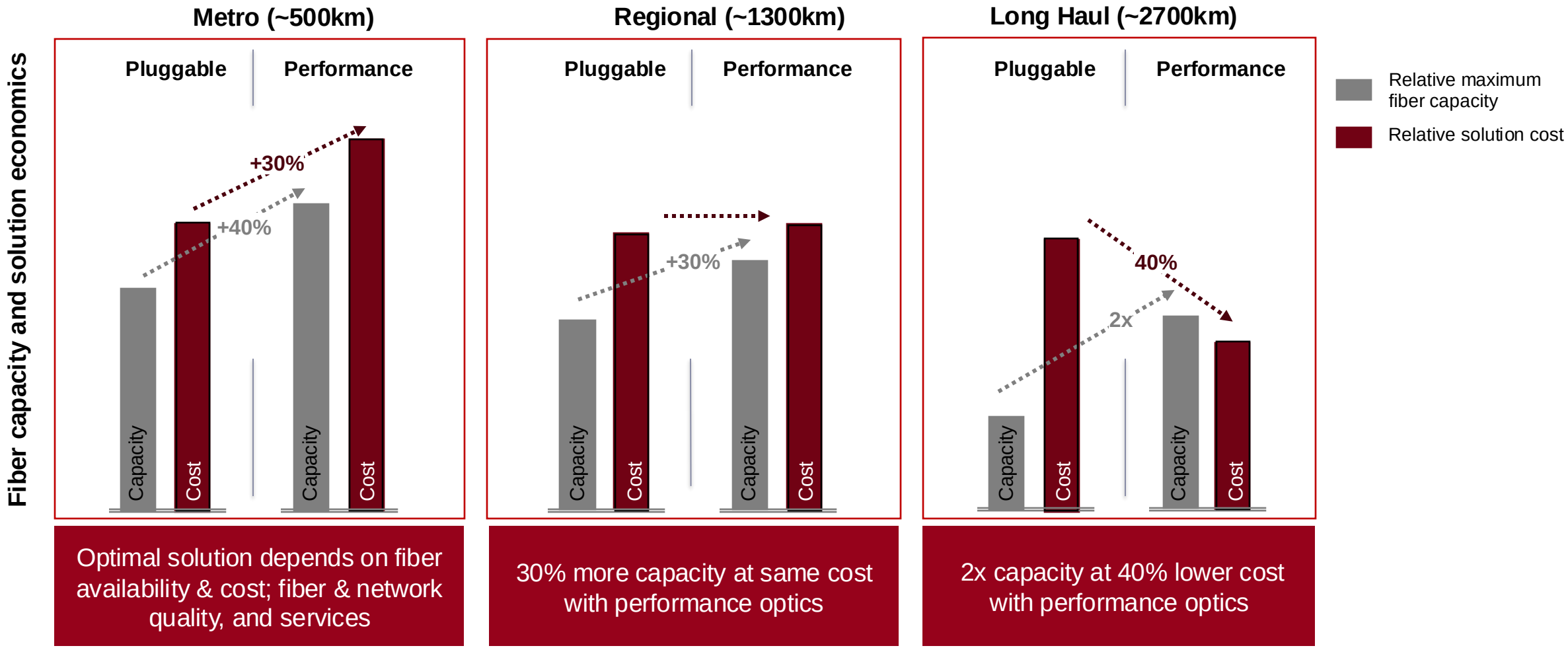




- 1Tb/s across 13,700km across the Pacific
- 1.2Tb/s across 5,854km across the Atlantic

All links are not equal

Cloud and Service Providers require both Optical Systems and pluggable solutions



Optimal solution depends on fiber availability & cost; fiber & network quality, and services

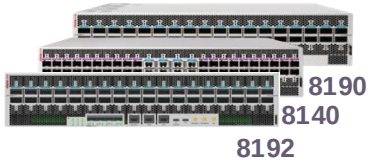
30% more capacity at same cost with performance optics

2x capacity at 40% lower cost with performance optics

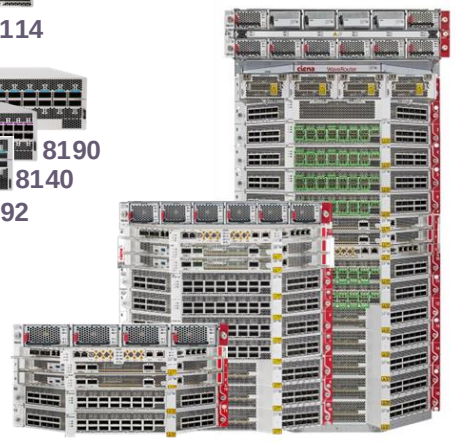
Two technology options enable optimization of fiber capacity, cost, power and space for given fiber and network quality

Application-optimized service terminals leveraging WaveLogic coherent optics

Purpose-built Coherent Routers



81xx family



WaveRouter family

Future-proof scalability from **2.4Tb/s to 192Tb/s** to address Service Providers' traffic demands

WaveLogic Coherent Optics

ciena WaveLogic™ 5 EXTREME — 800G

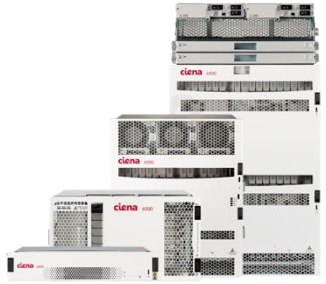
ciena WaveLogic™ 6 EXTREME — 1.6T

ciena WaveLogic™ 5 NANO — 400G

ciena WaveLogic™ 6 NANO — 800G

Converged Optical Transport Systems

6500 family



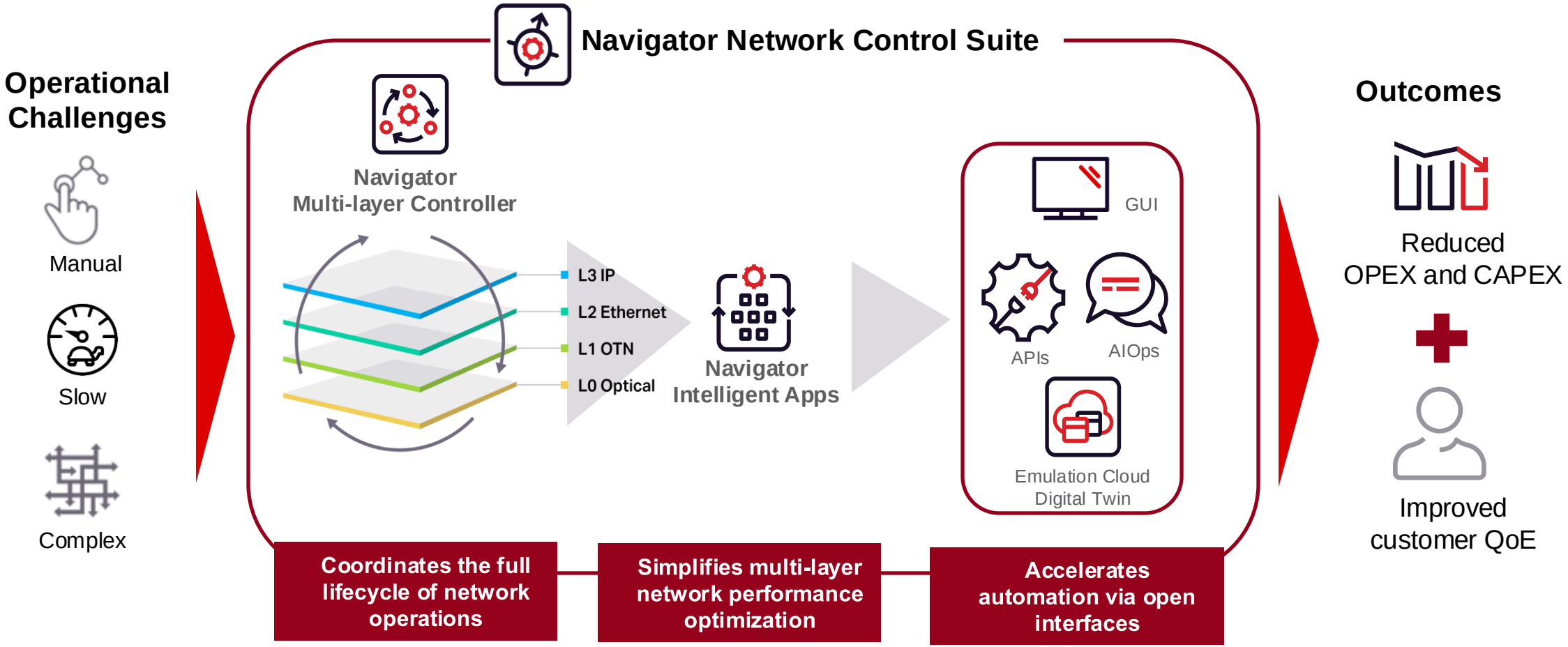
Disaggregated Transponders

Waveserver family

Edge Optical Service Demarcation

OTN NID family

Multi-layer network control and automation



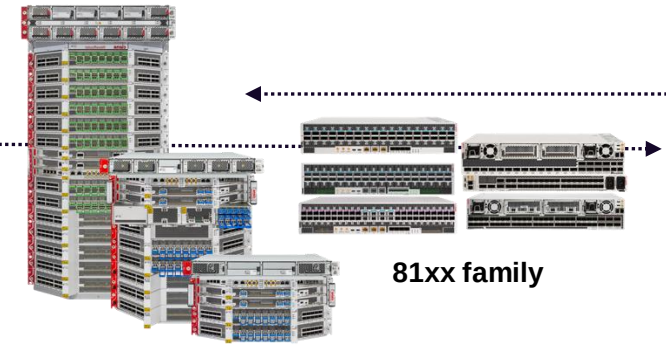
Intelligent network control for optimized multi-layer, multi-vendor operations

Optical Systems portfolio addresses all key applications

Submarine	Regional & Long Haul	Metro	Edge
10,000km	1000s km	100s km	10s km
	Tier 1 Metro — Tier 1 Metro	Tier 2 City — Office	
Submarine	Long Haul	Coherent Routing	Optical Access
		Metro DCI	Metro DWDM

Navigator NCS

Ciena Services

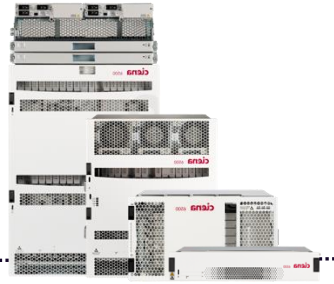


WaveRouter family

81xx family

Coherent ELS

O-NID



6500 family

Reconfigurable Line System (RLS)

Waveserver family

Key takeaways

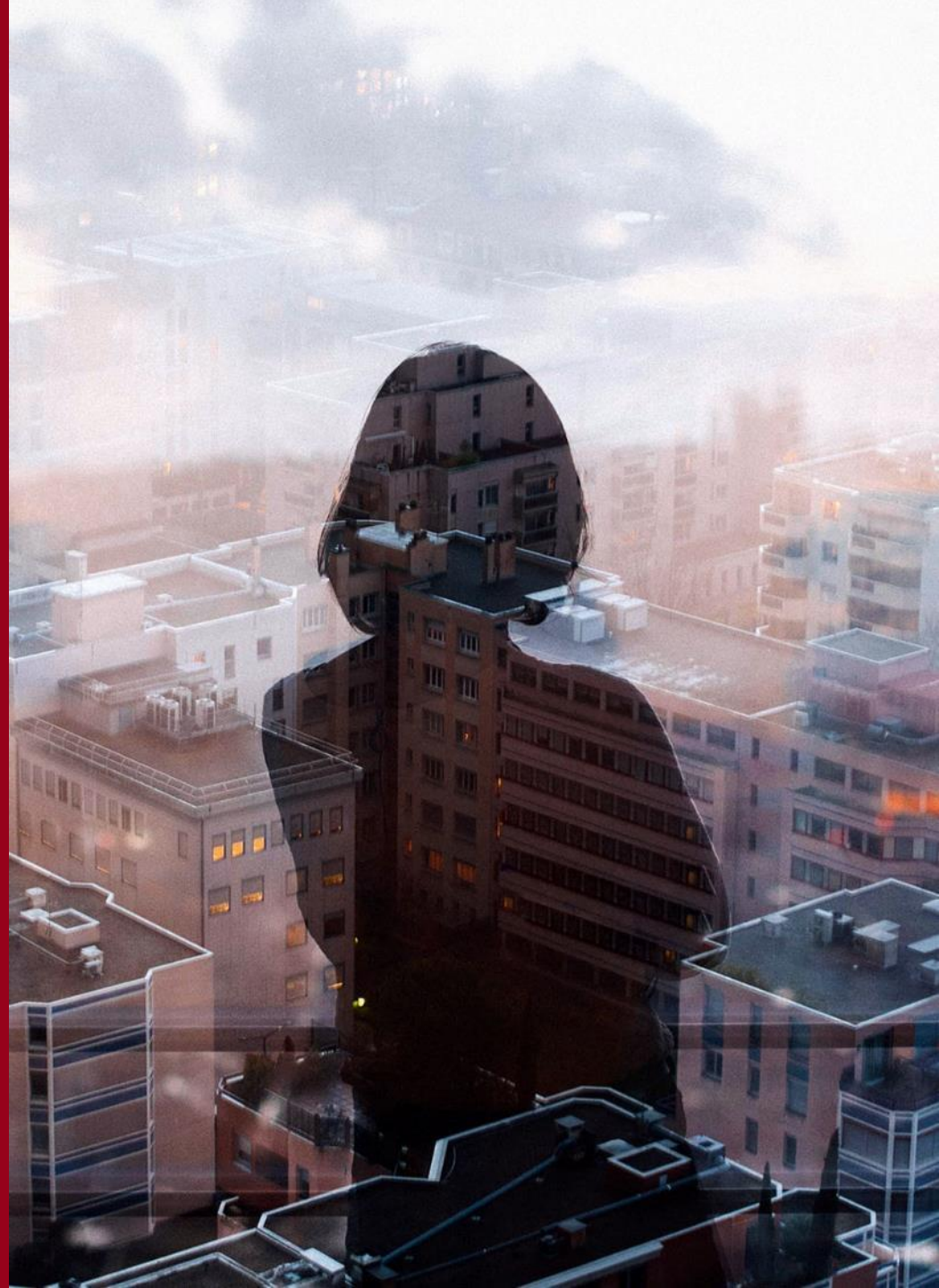
- Ciena is the global leader in Optical
- Continued demand for systems and pluggables – AI will accelerate this
- Positioned to WIN: Deep customer relationships, right portfolio: leading photonics + coherent optics + multi-layer control
- Leadership and expertise in Optical provides the foundation for TAM expansion: Access, Metro and into new areas – Inside & Around the Data Center

Expanding Inside & Around the Data Center

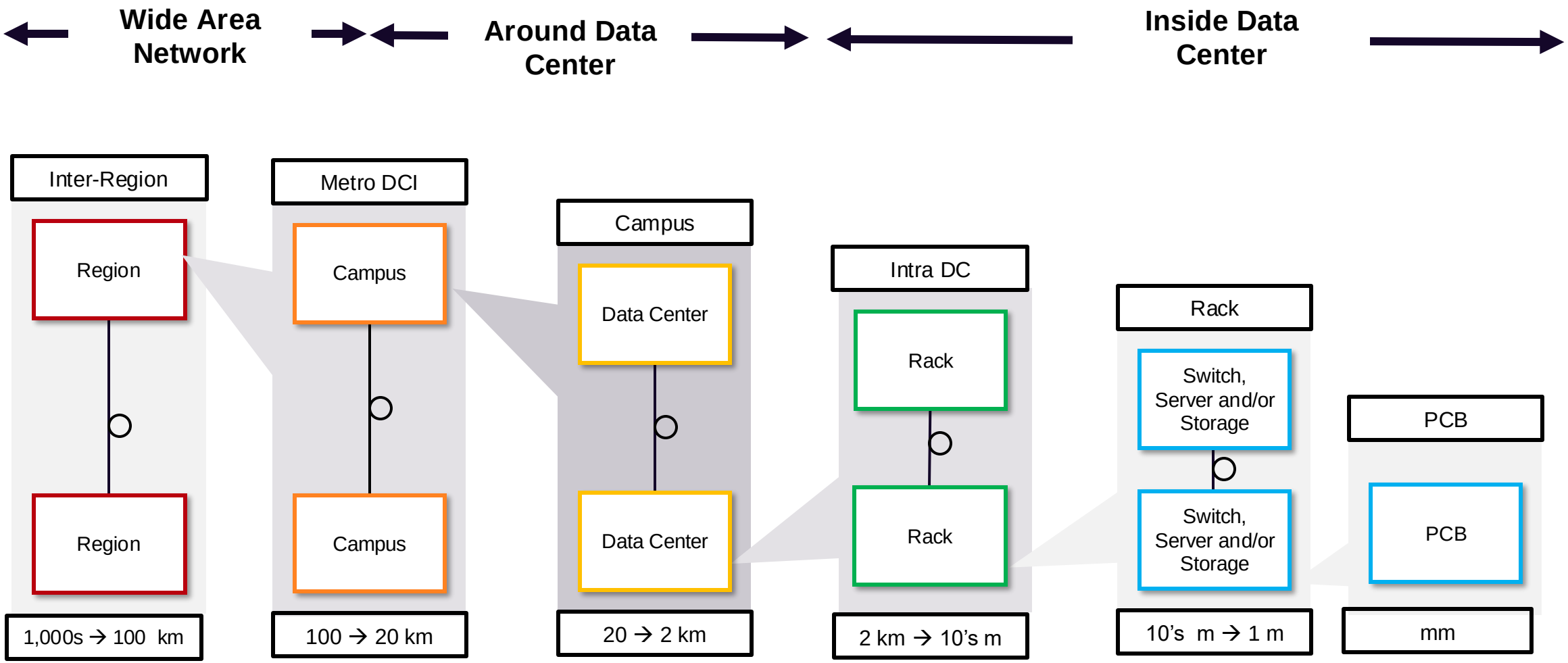
Leveraging Ciena's Core Optical Technologies

Dino DiPerna

SVP, Global Research & Development

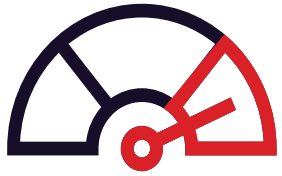


Data Center Interconnect applications based on reach



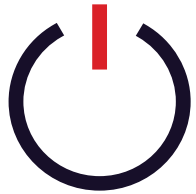
Current view

New AI requirements and evolving data center architectures

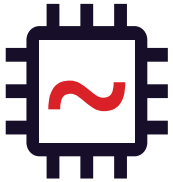


Higher Capacity

Lower Latency

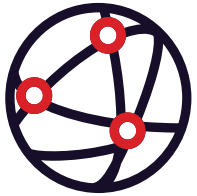


Lower Power



High-performance
GPU Interconnect

Optical Switching
Inside



Longer
Distances

Increasing Capacity -- Optical Impairments -- Reach
Data center interconnect performance is becoming critical

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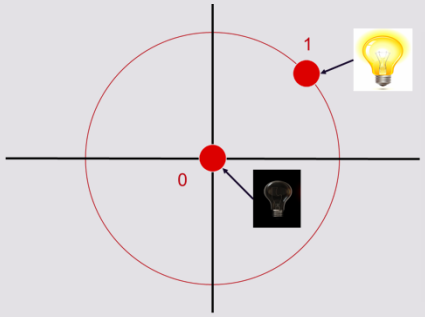
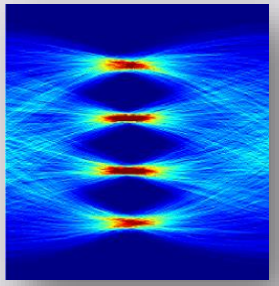
IMDD vs Coherent technology

Non-Coherent Optics

Morse Code:

- Power (on/off) carries info
- Dumb receiver



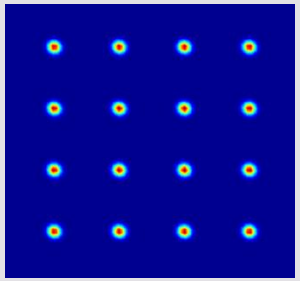


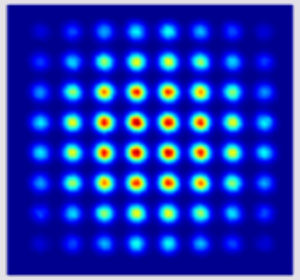
Amplitude-based
1 or 2 bits per symbol
1 channel per fiber pair

Coherent Optics

Digital Radio:

- Amplitude and phase carry info
- Tunable receiver
- Digital enhancements





Amplitude, Phase, Polarization
Many bits per symbol
Many channels (WDM) per fiber pair

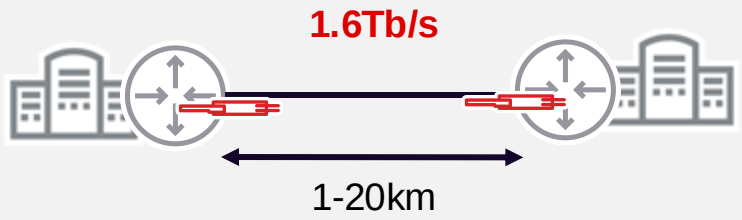
IMDD is running out of gas

IMDD starts to reach physical limits at higher speeds
Coherent technology becomes critical Inside & Around the Data Center

		400G	800G	1.6T	3.2T
Around DC	Metro DCI <100km	Coherent	Coherent	Coherent	Coherent
	Campus <20km	IMDD	IMDD / Coherent	IMDD / Coherent	Coherent
Inside DC	Fabric <2km	IMDD	IMDD	IMDD / Coherent	IMDD / Coherent
	AI Cluster Optics <500m	IMDD	IMDD	IMDD	IMDD / Coherent

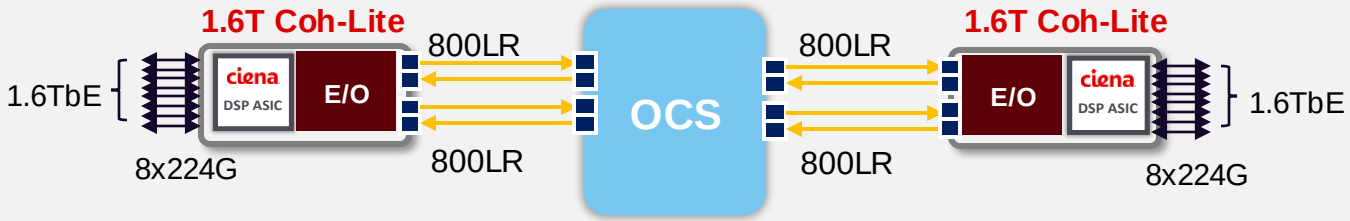
Coherent optical performance enables new data center applications

Campus - Reach



Campus - WDM

Inside the Data Center - Emerging architectures

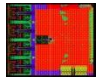


Ciena has unmatched expertise in high-speed interconnects across multiple technology generations

2005
- World's 1st DSP-assisted electro-optics, eliminating dispersion compensators from line

130nm BiCMOS

2008



90nm CMOS

- World's 1st coherent system at 40Gb/s
- ADC miniaturization
- Highest-performance mixed-signal ASIC

2009
- World's 1st coherent 100Gb/s
- 1st dual-carrier implementation

2012

32nm CMOS

- High-speed DAC
- 200Gb/s using 16QAM
- Soft-decision FEC
- Multi-dimensional constellations

2017
- World's 1st 400Gb/s
- 1st at delivering higher Baud (56GBd)
- Foundation of DCI networks globally

28nm FD SOI

- World's 1st 800Gb/s
- World's 1st 7nm CMOS
- World's 1st 50GHz E/O and DAC/ADC
- PCS

2020

7nm FinFET

- Lowest power, highest performance 400ZR

2021

7nm FinFET

- World's 1st 1.6Tb/s
- World's 1st 3nm DSP
- World's 1st 100GHz E/O and DAC/ADC

2024

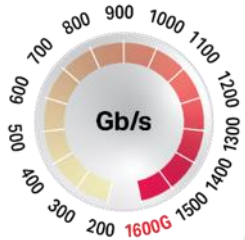
3nm FinFET

- 140GBaud in QSFP-DD800 form factor
- 1st low-power DAC/ADC, SerDes using 3nm CMOS

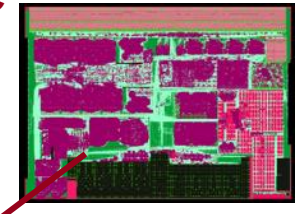
20+ years of experience – Leading-edge Silicon/CMOS and Electro-optic material systems

WaveLogic 6 – Core technologies

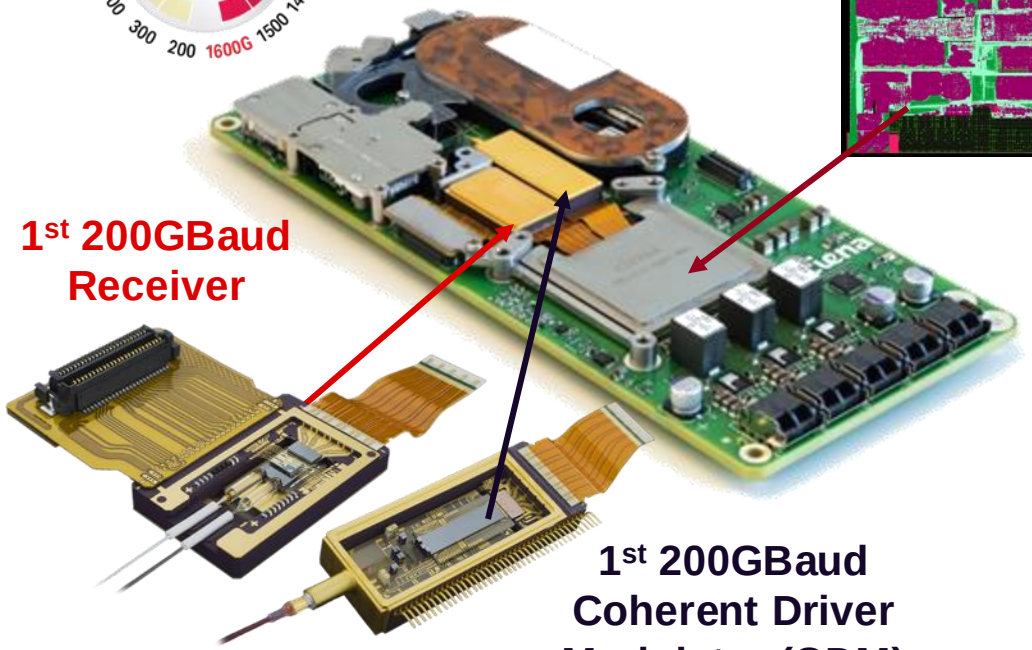
WaveLogic 6 Extreme



1st 3nm coherent DSP ASIC

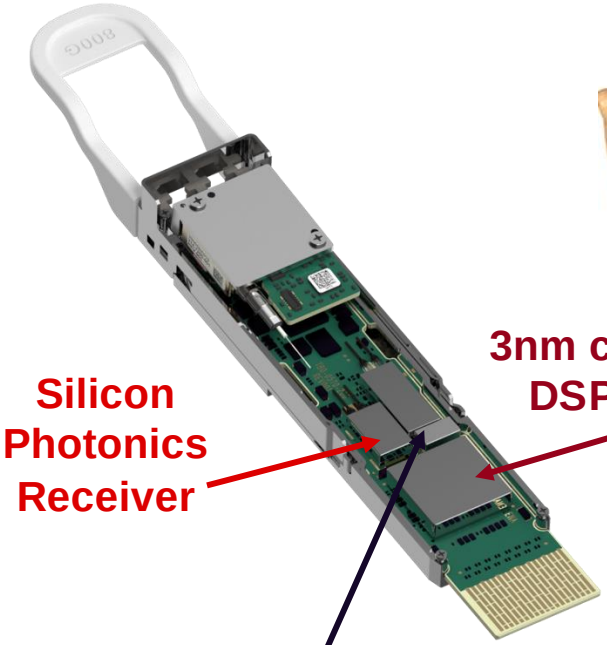


1st 200GBaud Receiver



1st 200GBaud Coherent Driver Modulator (CDM)

WaveLogic 6 Nano



Silicon Photonics Receiver

3nm coherent DSP ASIC

Silicon Photonics-based Modulator with integrated SOA

Ciena's leading interconnects solutions

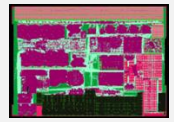
400ZR/ZR+

800ZR/ZR+

- Major wins for coherent pluggables across all 4 of the largest Cloud Providers
- Lowest power; highest performance
- Industry's only 800ZR+ win awarded to date

NEW: 1.6 Tb/s Coherent Lite pluggable for data center fabric and campus applications

1.6T



Coherent ASIC

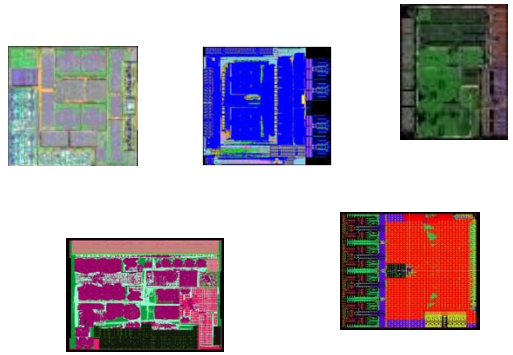
3nm 224G SerDes

Opportunities to serve a broader ecosystem

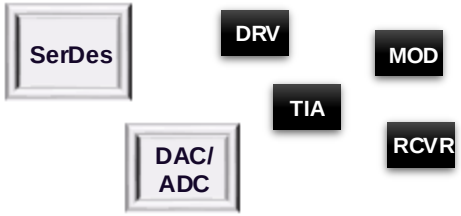
Systems

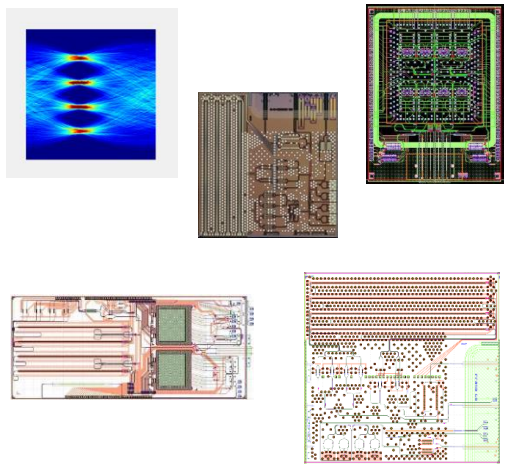
Coherent Modules

DSP ASIC



High-speed Analog and Electro-optics





TODAY

EXPANSION

SerDes – Serializer-deserializer
DSP – digital signal processor
DAC/ADC – digital/analog converter
ITLA – laser assembly

DRV – driver
RCVR – receiver
MOD – modulator
TIA – transimpedance amplifier

Thank You