



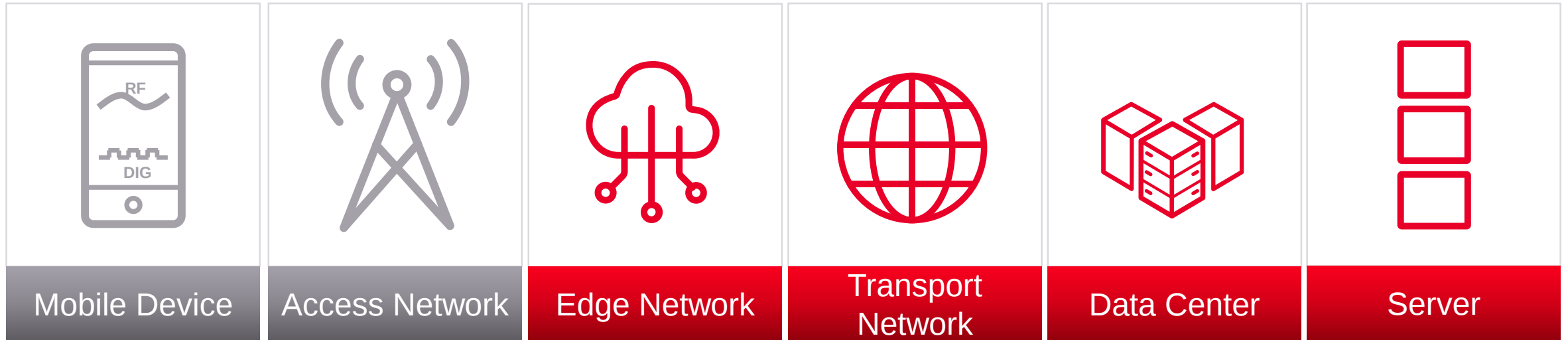
**KEYSIGHT
WORLD 2020**

Data Center and Optical Network Innovation: Enabling the 5G Ecosystem

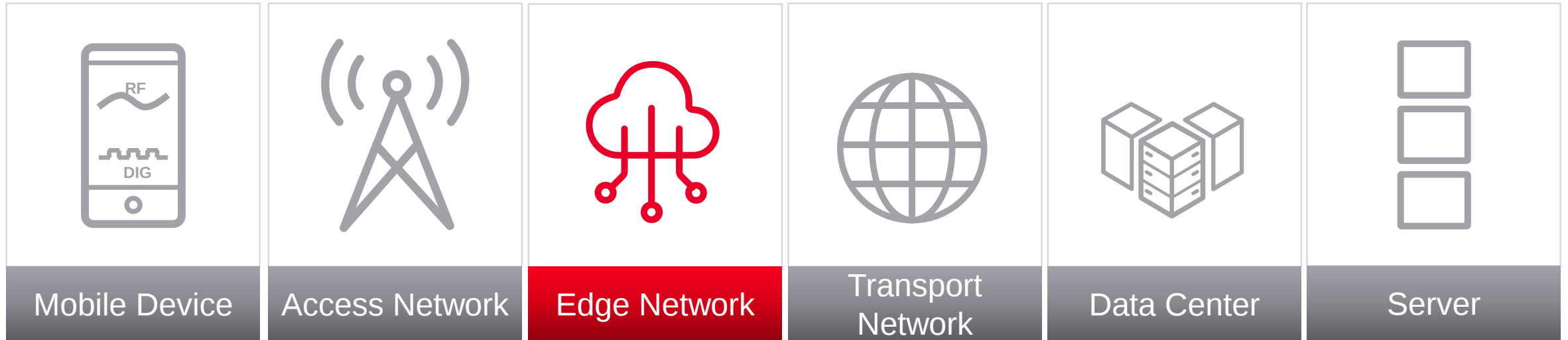
Hung-Jen Chang

Manager, Application Engineering Organization / Keysight Technologies

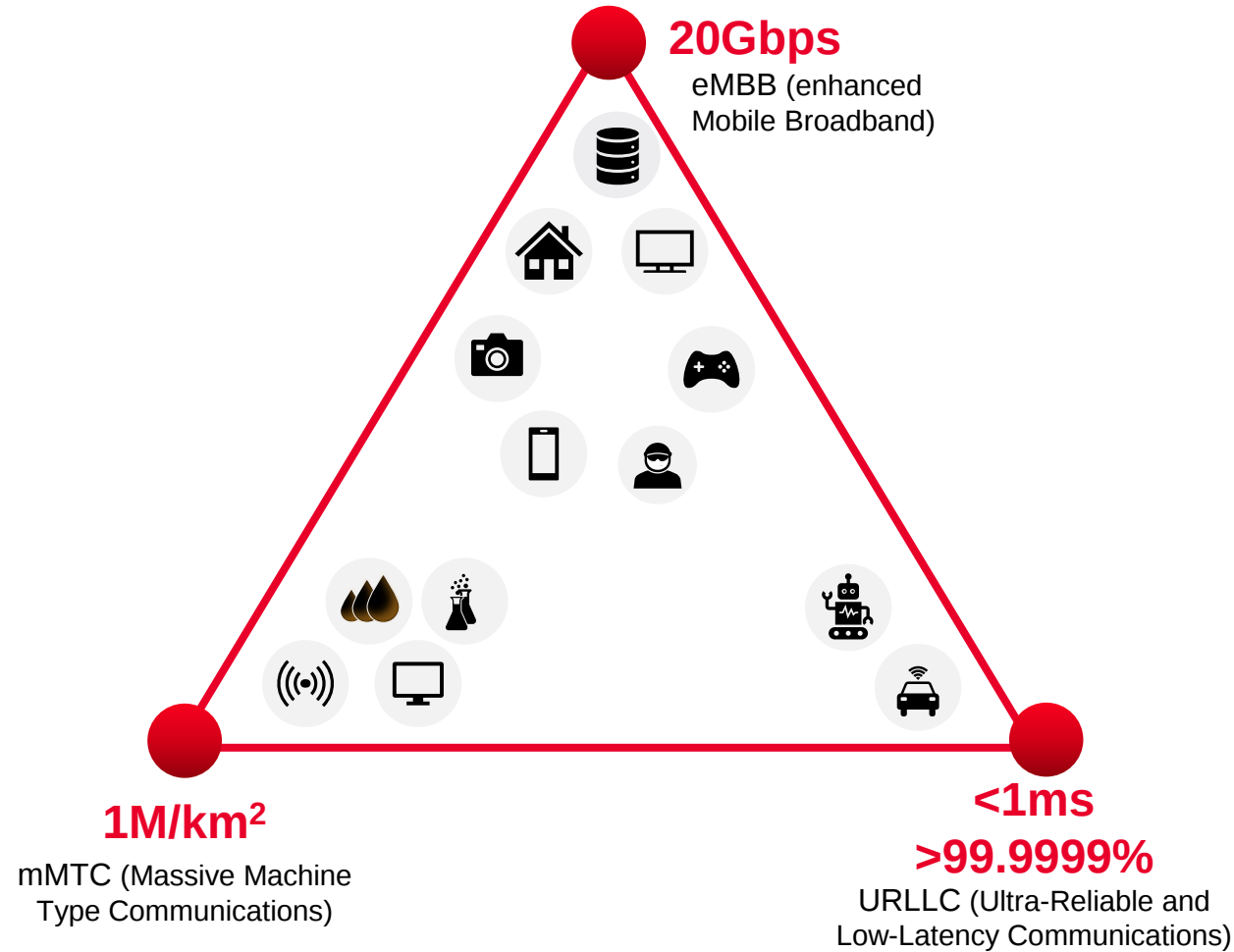
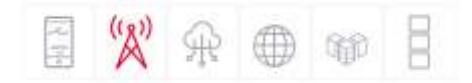
Enabling the 5G Communications Eco-System



Enabling the 5G Communications Eco-System



5G Use Cases Drive Network Changes

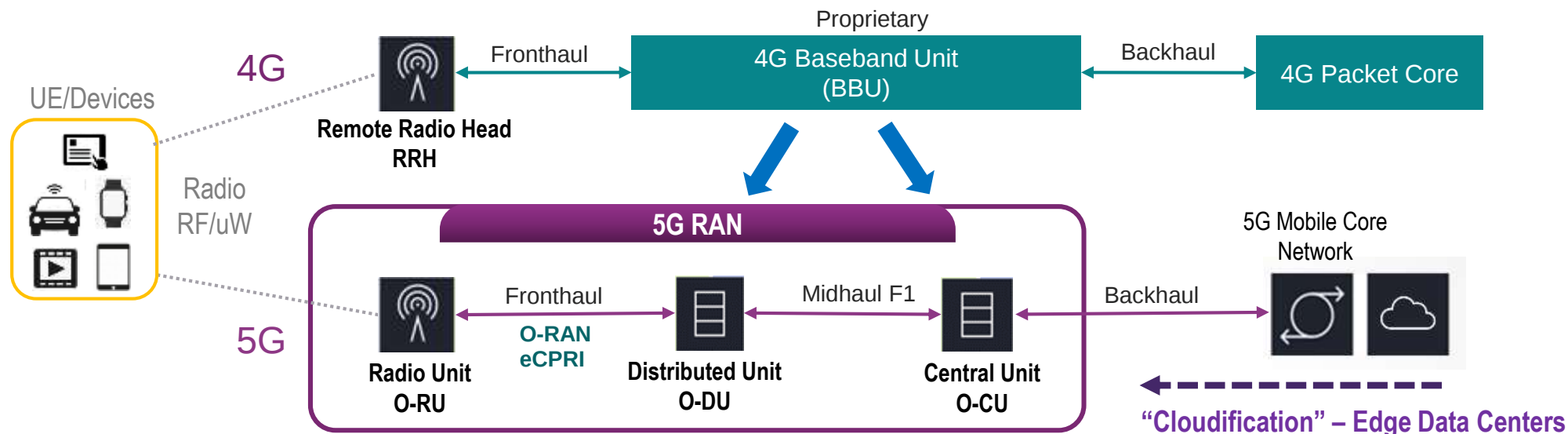


5G Mobile Access Networks

TOWARDS OPEN FRONTHAUL INTERFACES



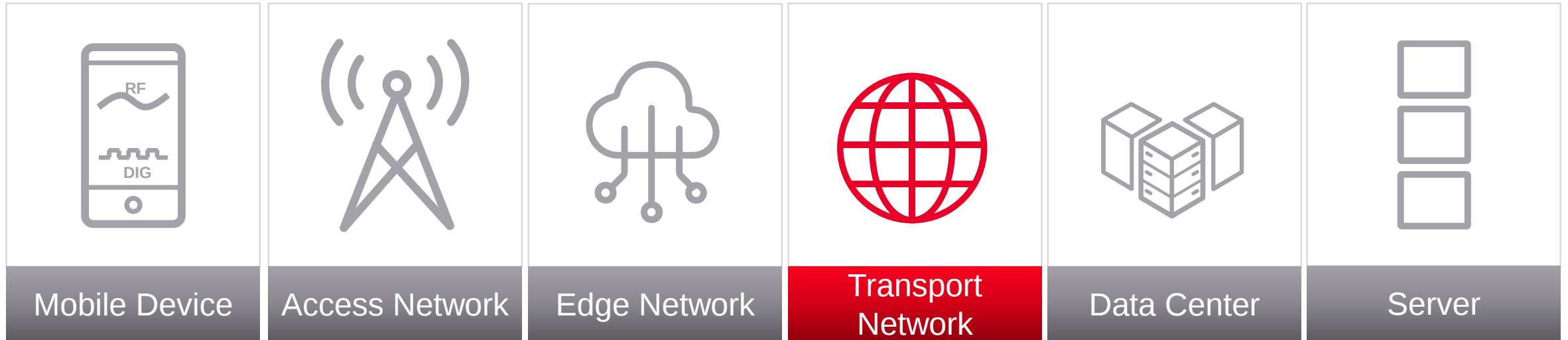
Evolution towards open, disaggregated, interoperable radio access networks (RAN)



- Open-RAN: AT&T, Deutsche Telekom, China Mobile, China Telecom, NTT Docomo
 - Driving for multi-vendor interoperability
- Fronthaul physical layer: standardized fiber links with 25G/50G Ethernet pluggable transceivers, 100GbE deployment coming
 - Tighter latency and timing requirements, wider temperature range
 - Interoperability conformance verification and compliance testing
 - Other options: WDM-PON, 5G-OTN



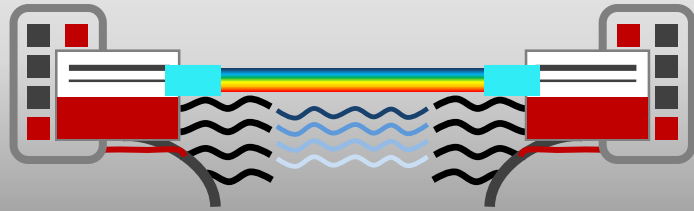
Enabling the 5G Communications Eco-System



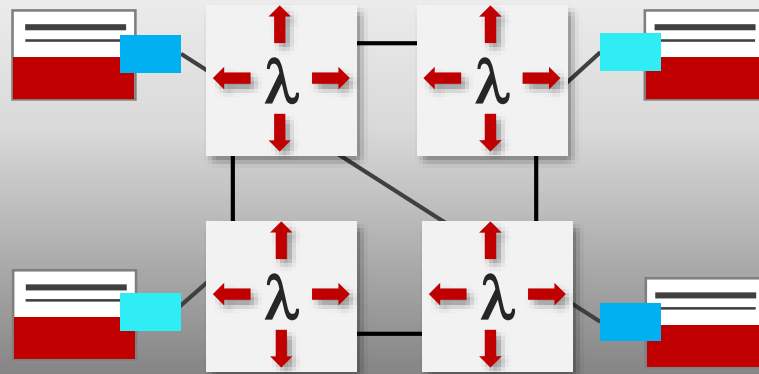
Different Challenges for Long-Haul and Metro/DCI



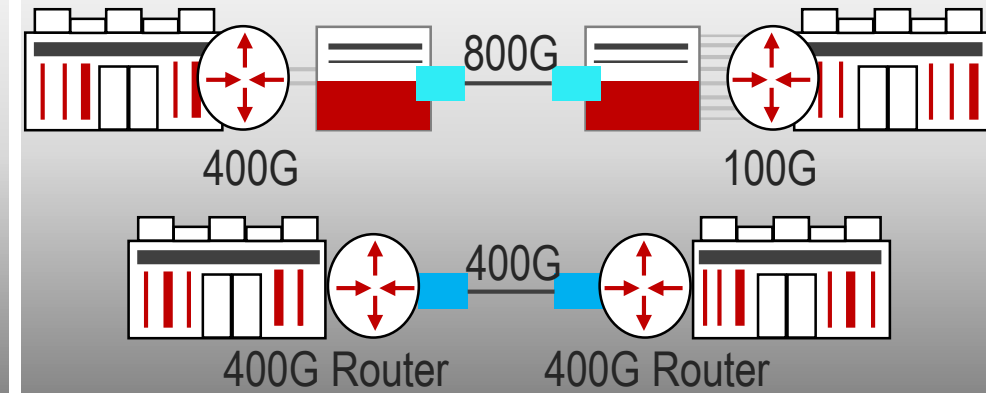
Sub-Sea



Terrestrial Long Distance



DCI



Coherent DSP Silicon for 400G, 600G and 800G



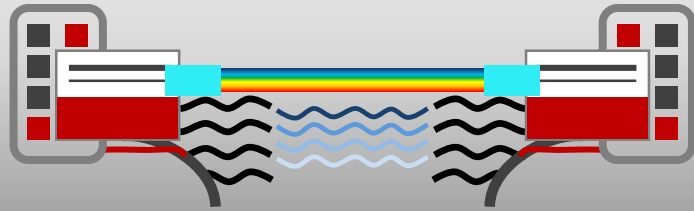
2018/2019 DSP INTRODUCTIONS

	Acacia Pico	NEL	Nokia PSE-3	Infinera ICE5 Stopped Coriant 600G offering	Infinera ICE6	Ciena Wavelogic Ai	Ciena Wavelogic 5	Inphi M200 LightSpeed-III
Speed-classes	100G-600G	100G-600G	100G-600G	100G-600G	800G	100G-400G	800G	100/200G
Availability	Second half 2018, commercial	Second half 2018, commercial	Second half 2018, internal	Second half 2018, internal	2019	2017, licensed to Lumentum, Oclaro, NeoPhotonics	2019	2018, commercial

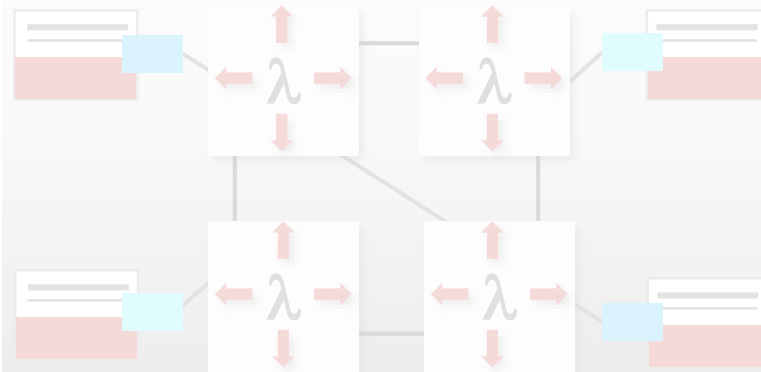
Different Challenges for Long-Haul and Metro/DCI



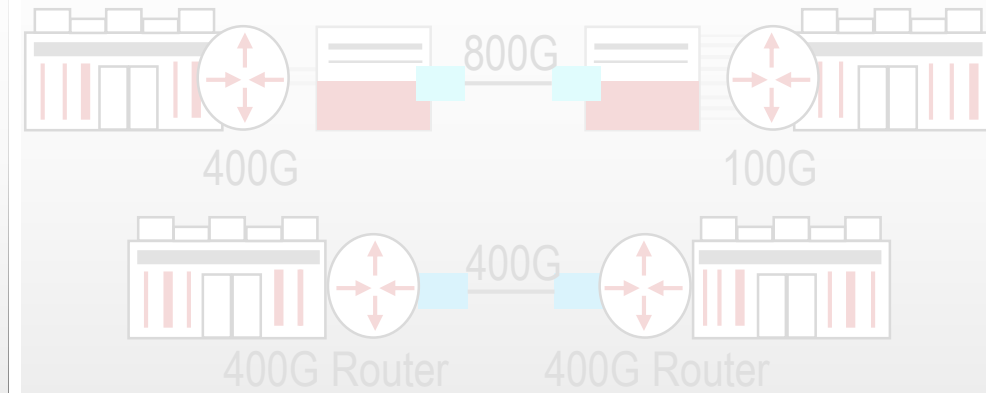
Sub-Sea



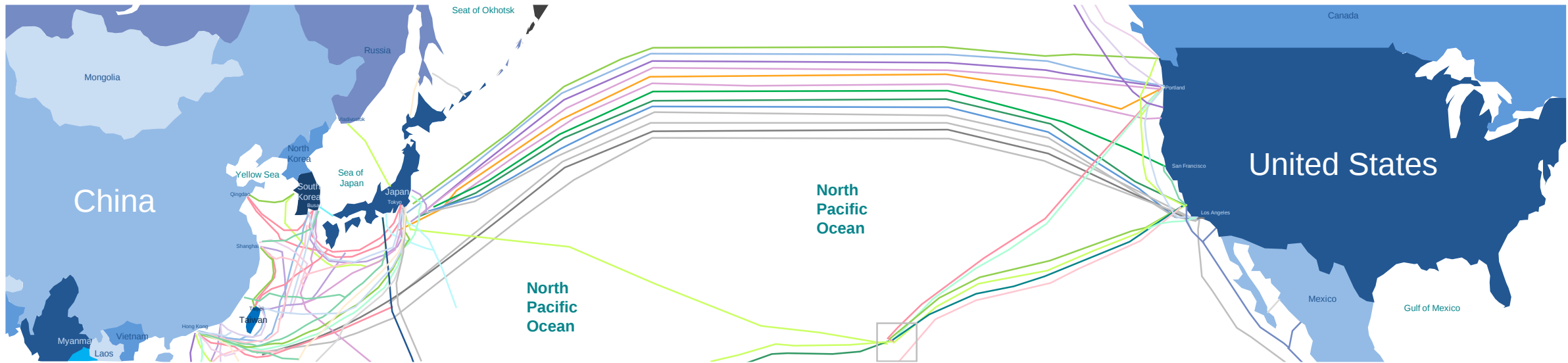
Terrestrial Long Distance



DCI



Subsea Cable Deployment



Submarine cable market

11%

CAGR between 2020 and 2025

Content providers used

54%

of subsea bandwidth in 2018

Content providers will used

80%

of subsea bandwidth by 2027

Content Provider Investments

Consortium Member

Major Capacity Customer

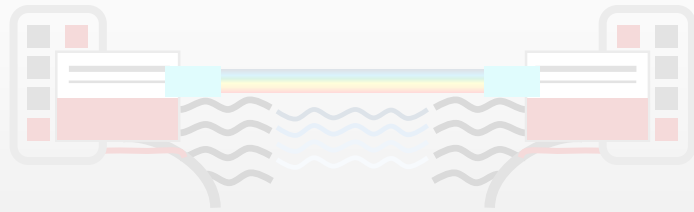
Sole Owner

Unity Google	SJC Google	GTT Express Microsoft	FASTER Google	Monet Google	Tannat Google	PLCN Facebook	SJC2 Facebook
RFS 2010	2013	2015	2016	2017	2018	2019	2020
			AEC-1 Facebook Microsoft		Junior Google		
			APG Facebook		Hawaiki Amazon		
					MAREA Facebook Microsoft		
					NDCP Microsoft		
			</				

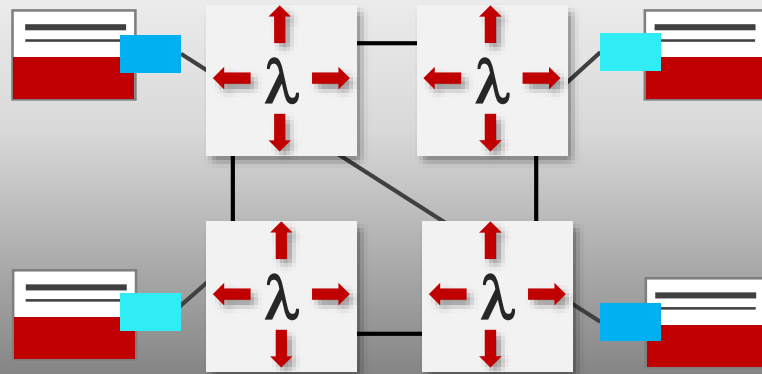
Different Challenges for Long-Haul and Metro/DCI



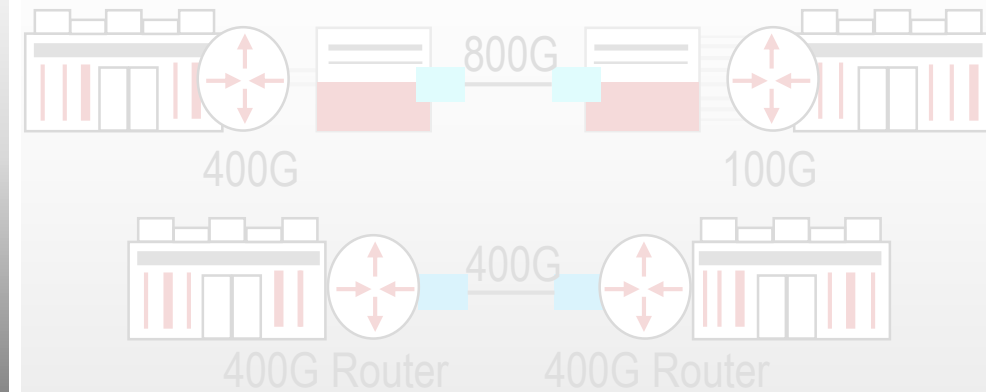
Sub-Sea



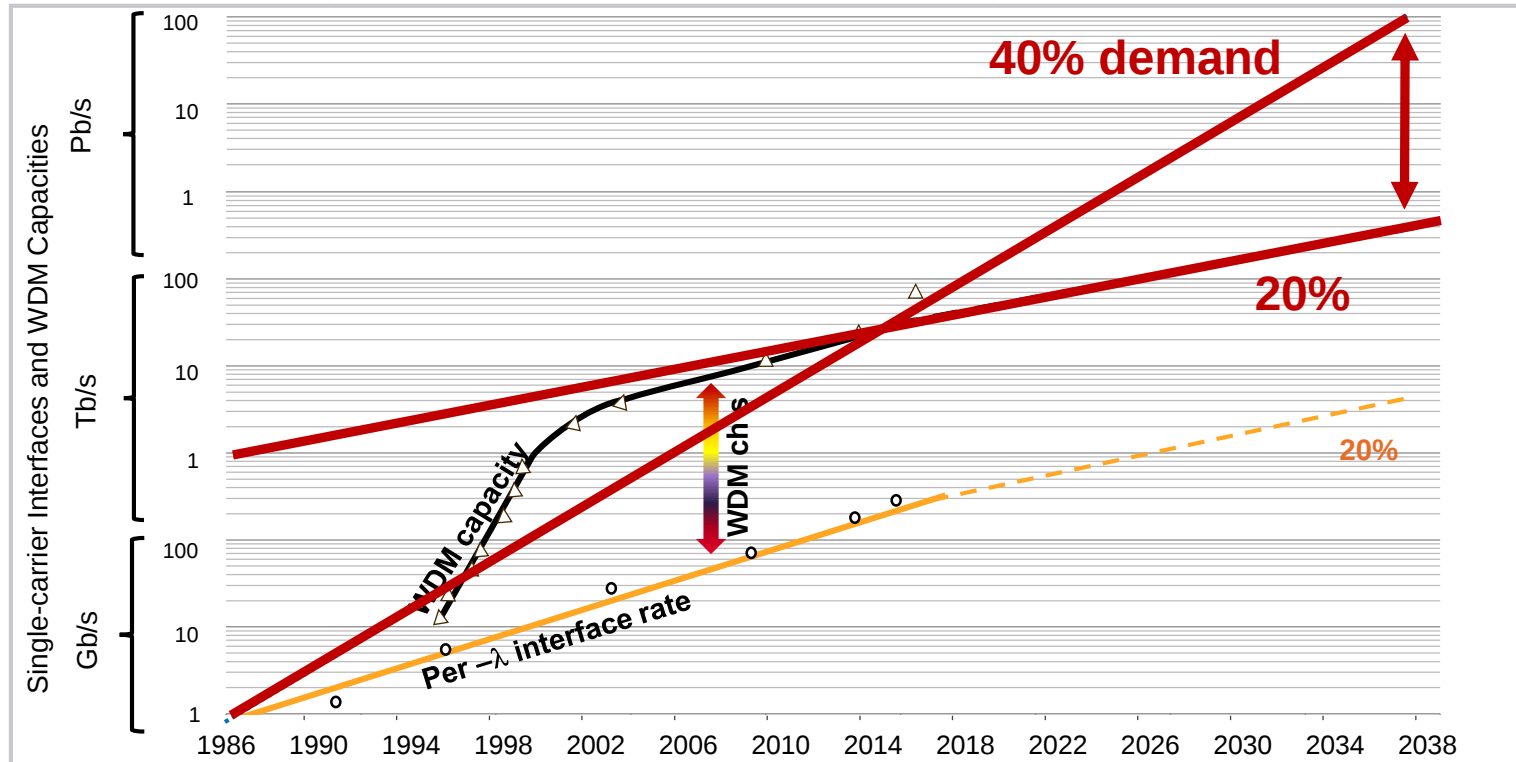
Terrestrial Long Distance



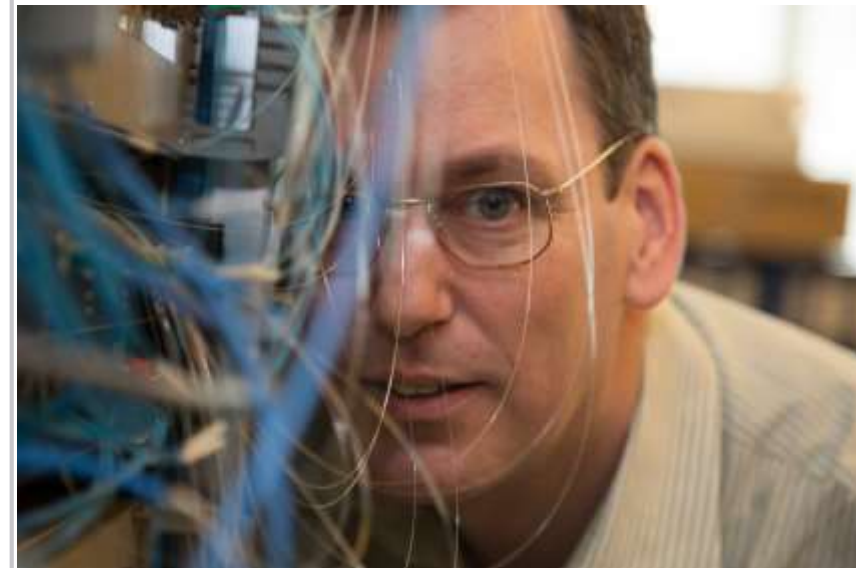
DCI



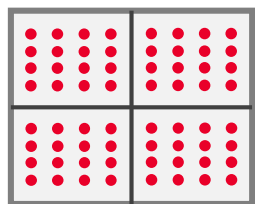
Capacity Crunch in Long-Distance/Metro



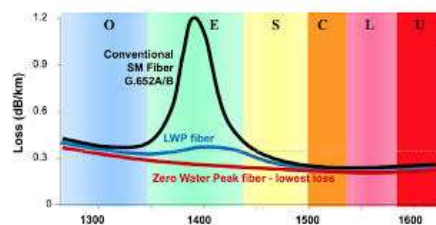
Source: Nokia



Improvement potential



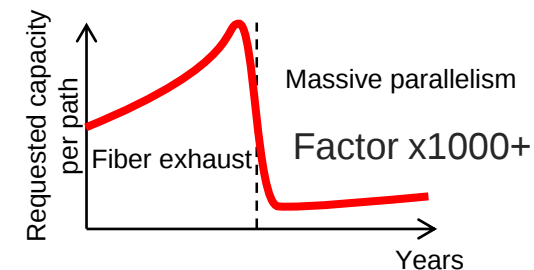
Factor x2



Factor x5



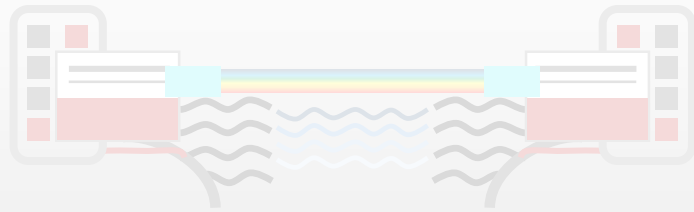
Factor x2



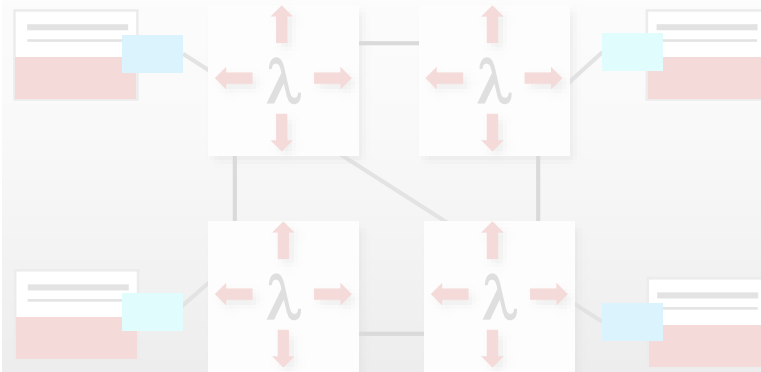
Different Challenges for Long-Haul and Metro/DCI



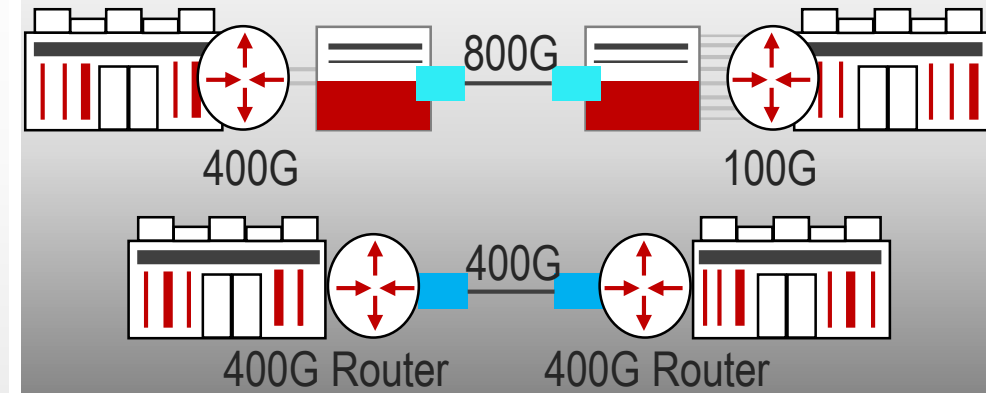
Sub-Sea



Terrestrial Long Distance

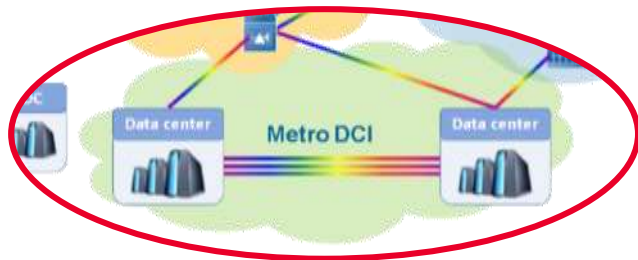
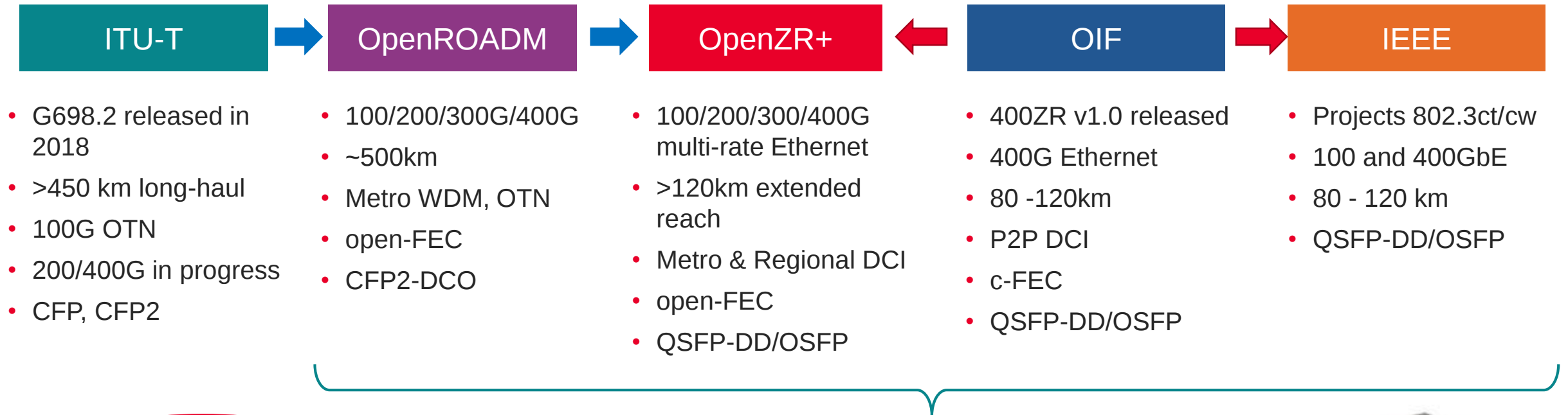


DCI



Coherent Optical 400G Standardization Activities

Enabled by 7nm CMOS and Photonic Integrated Circuits



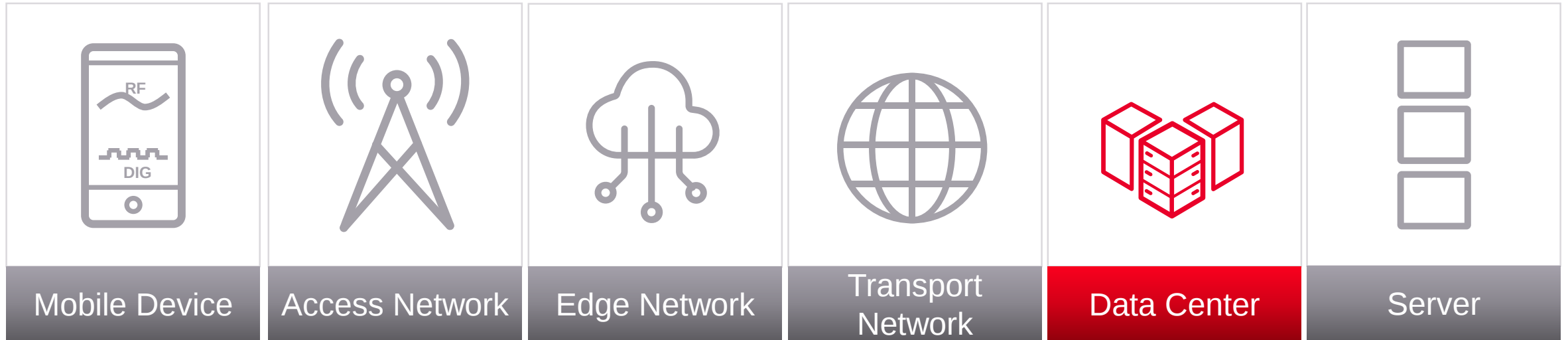
Now sampling: First coherent 400ZR/ZR+ pluggable transceivers in client-side form factor from Inphi, Acacia, NeoPhotonics



Source: Acacia

First 800Gb/s field trials: Infinera ICE6 over 950km, CIENA Wavelogic5 over Verizon network (96Gbaud). Deutsche Telekom deployed first Ciena 800Gb/s DCI link in Europe (Vienna/Austria).

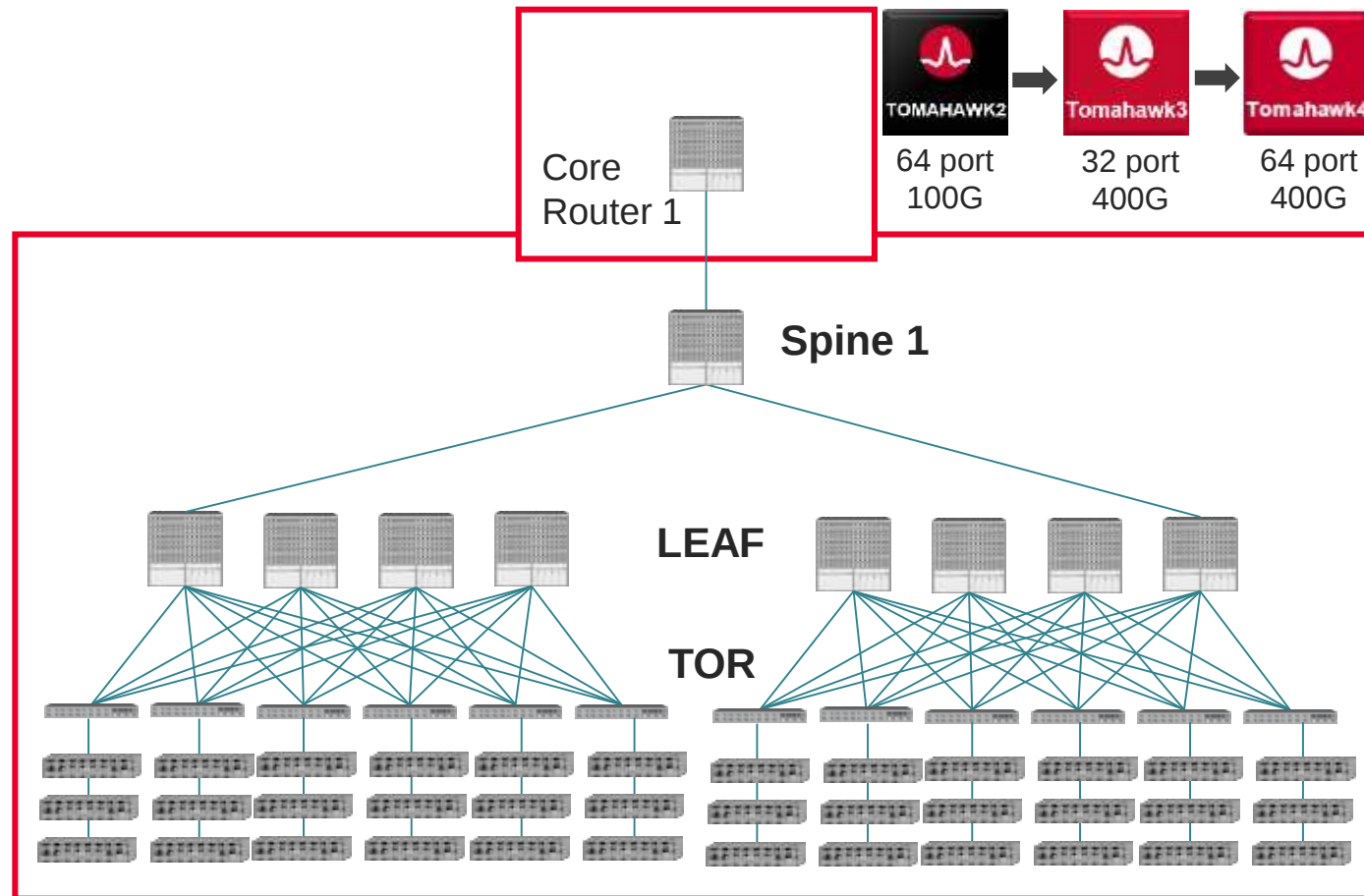
Enabling the 5G Communications Eco-System



400G in the Cloud Network



< 10-120km	400G-DCO
< 1000m (10km)	400G-LR4
< 500m (2km)	400G-FR4 400G-DR4
< 20m	400G-AOC 400G-SR8
< 3m	400G-CR8 50G-CR



PCIe5/DDR5

100G→ 400G rollover

< 10-120km

400ZR

< 1000m (10km)

400G-LR4

< 500m (2km)

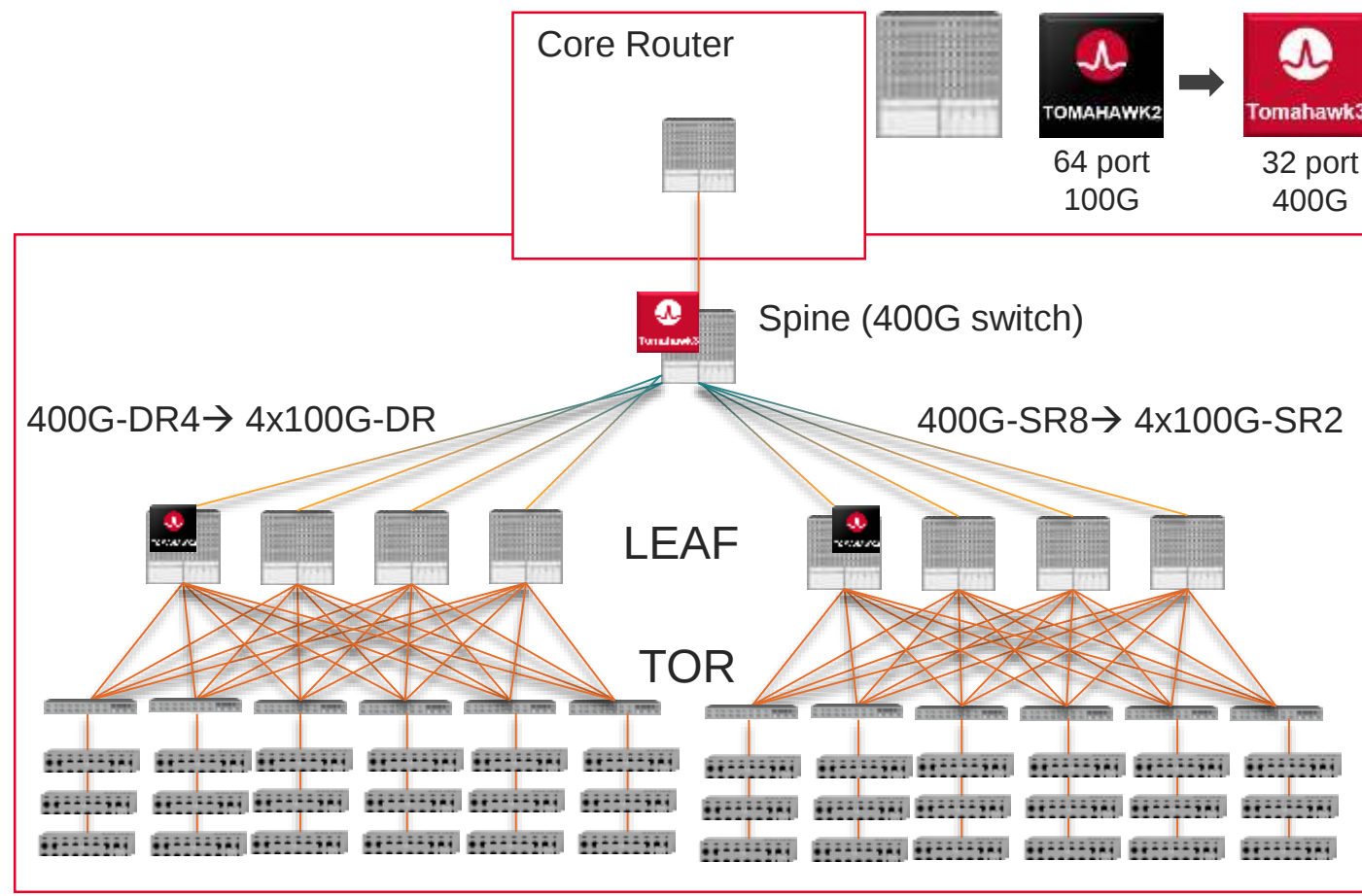
400G-100G
breakout

< 20m

100G-AOC

< 3m

100G-CR4
25G-CR1

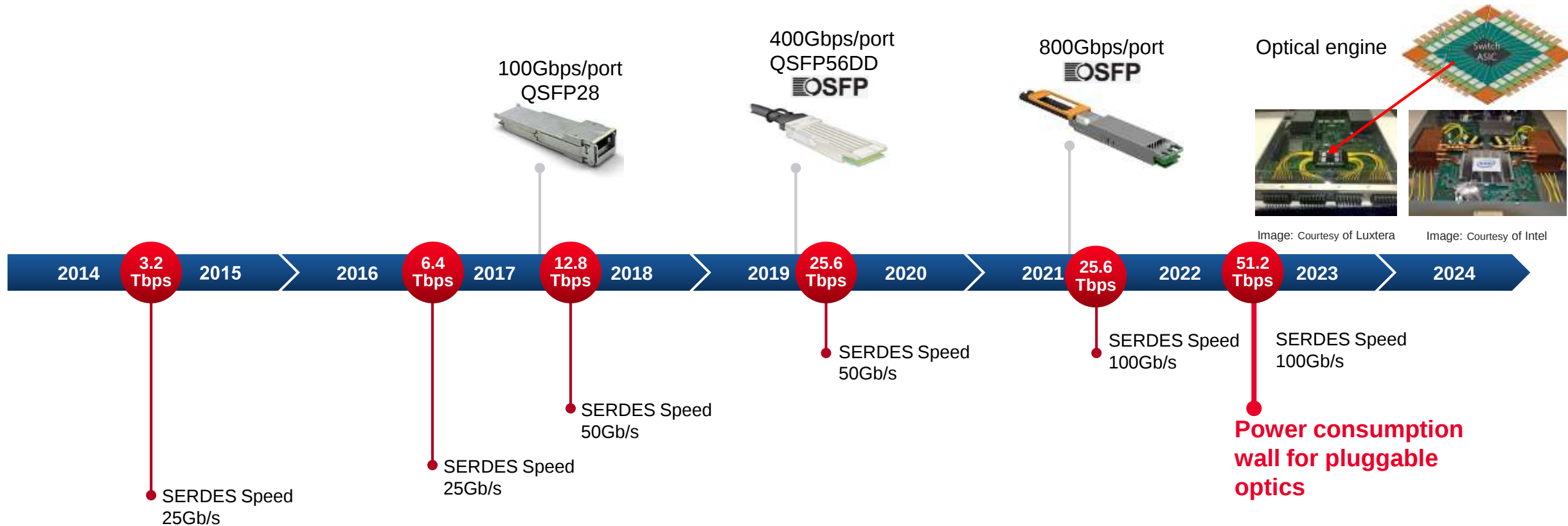


DDR3/4
PCIe3/4

Silicon Switch Evolution



THE POWER BRICK-WALL FOR PLUGGABLES



<https://www.laserfocusworld.com/articles/print/volume-54/issue-10/features/photronics-for-datacenters-integrated-optics-permeate-datacenter-networks.html>

Characterizing Error Mechanisms

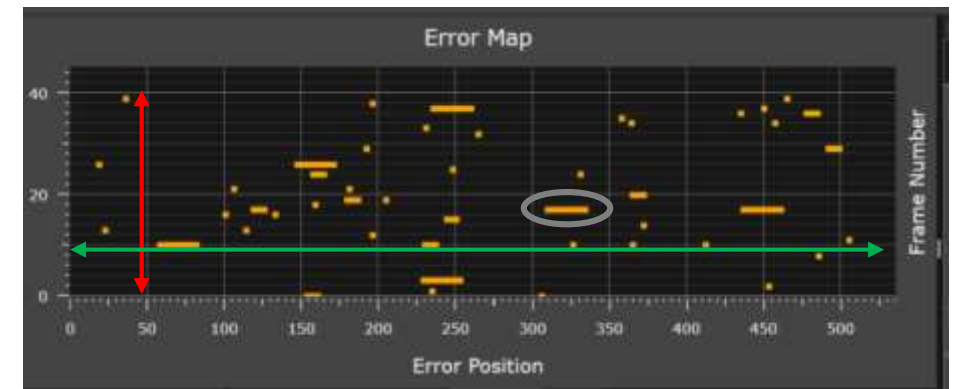
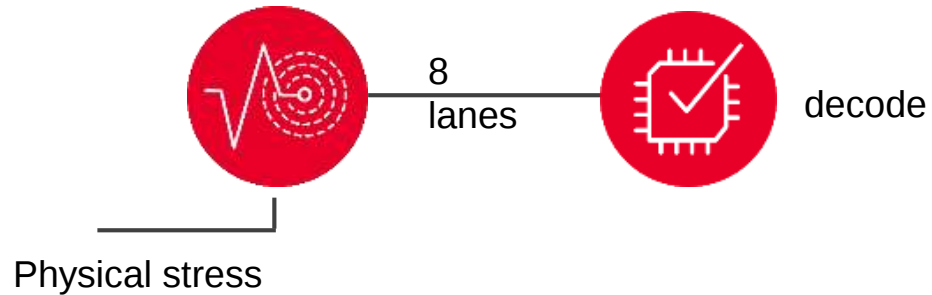


Layer 2, 64B – 14,000B frames

(FEC) Interoperability

FEC symbol errors

Protocol



Introducing A400GE-QDD and N4891A



A400GE-QDD

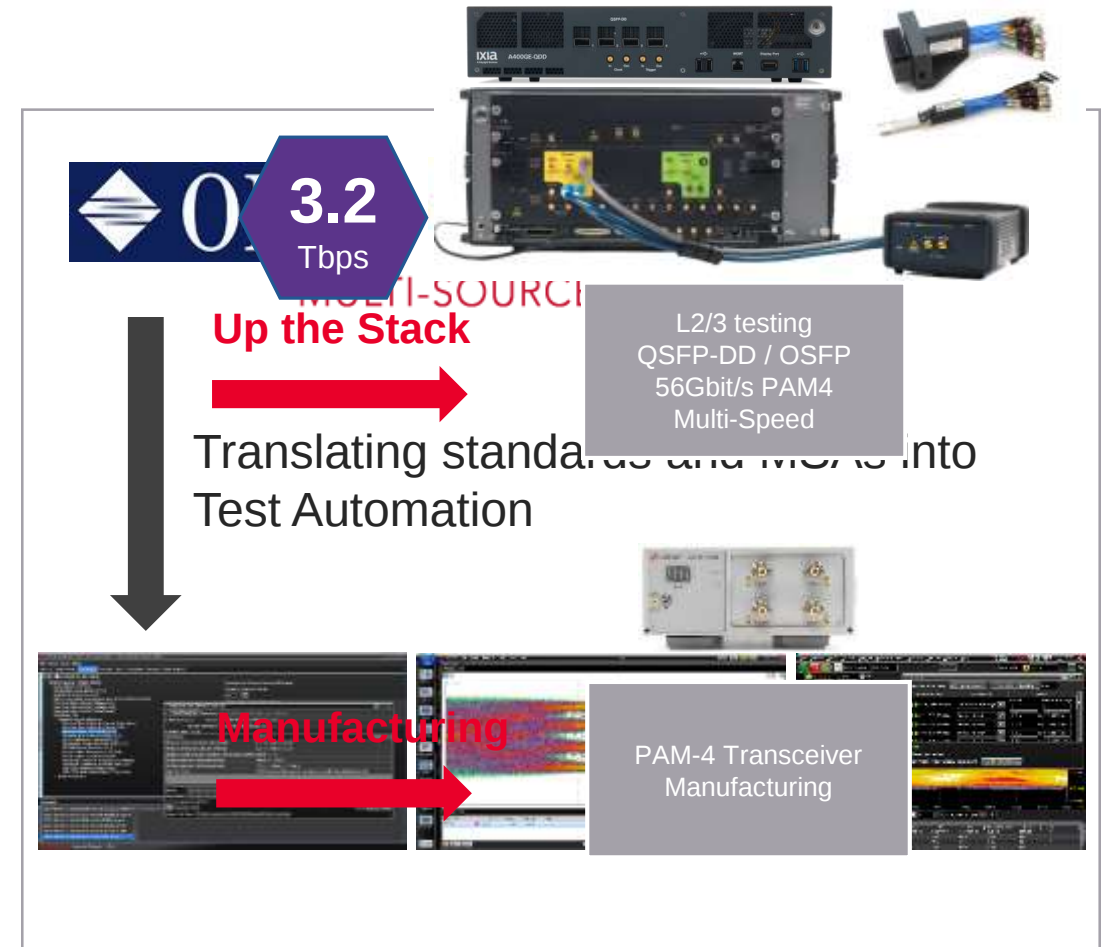
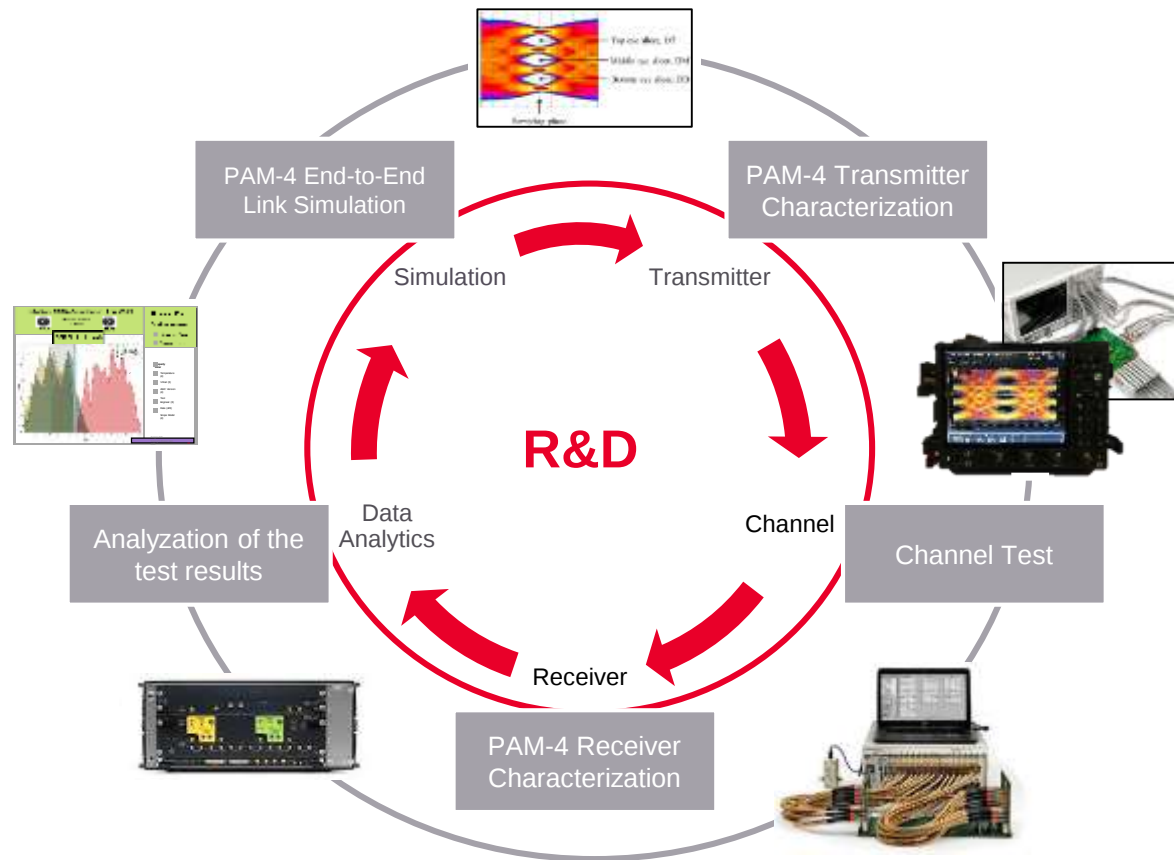
Affordable 400G interop. and manufacturing solution with uncompromised performance



N4891A

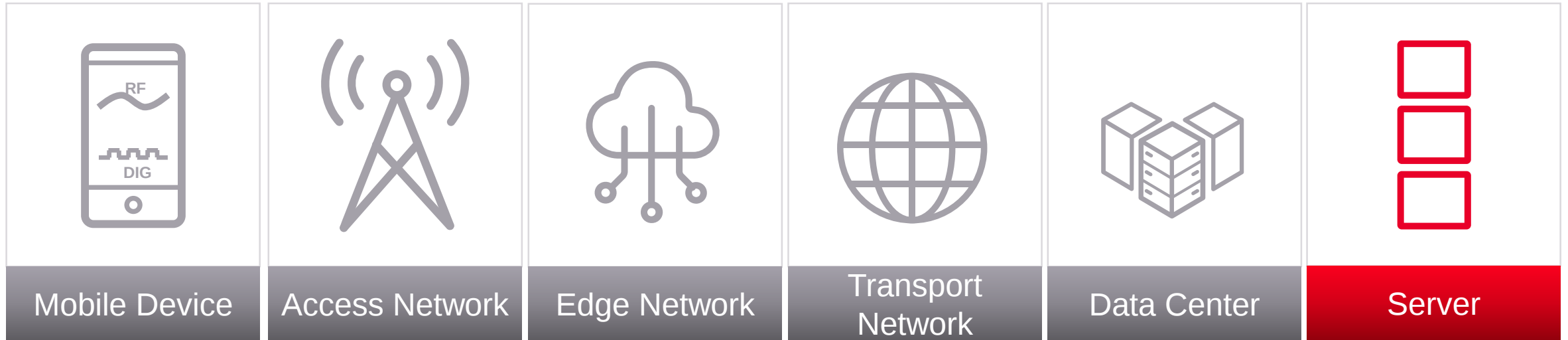
Industry's first 400G FEC-aware Rx test solution for bullet-proofed design and modules qualification

End-to-End Automated Test Solutions for Direct Detection



Keysight partners with key players in the optical component and transceiver industry and OIF, IEEE, OCP, ODCC

Enabling the 5G Communications Eco-System



Requirements on Server Performance



Data Analytics



Artificial Intelligence



Video Transcoding



Cyber Security

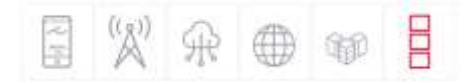


Financial Acceleration

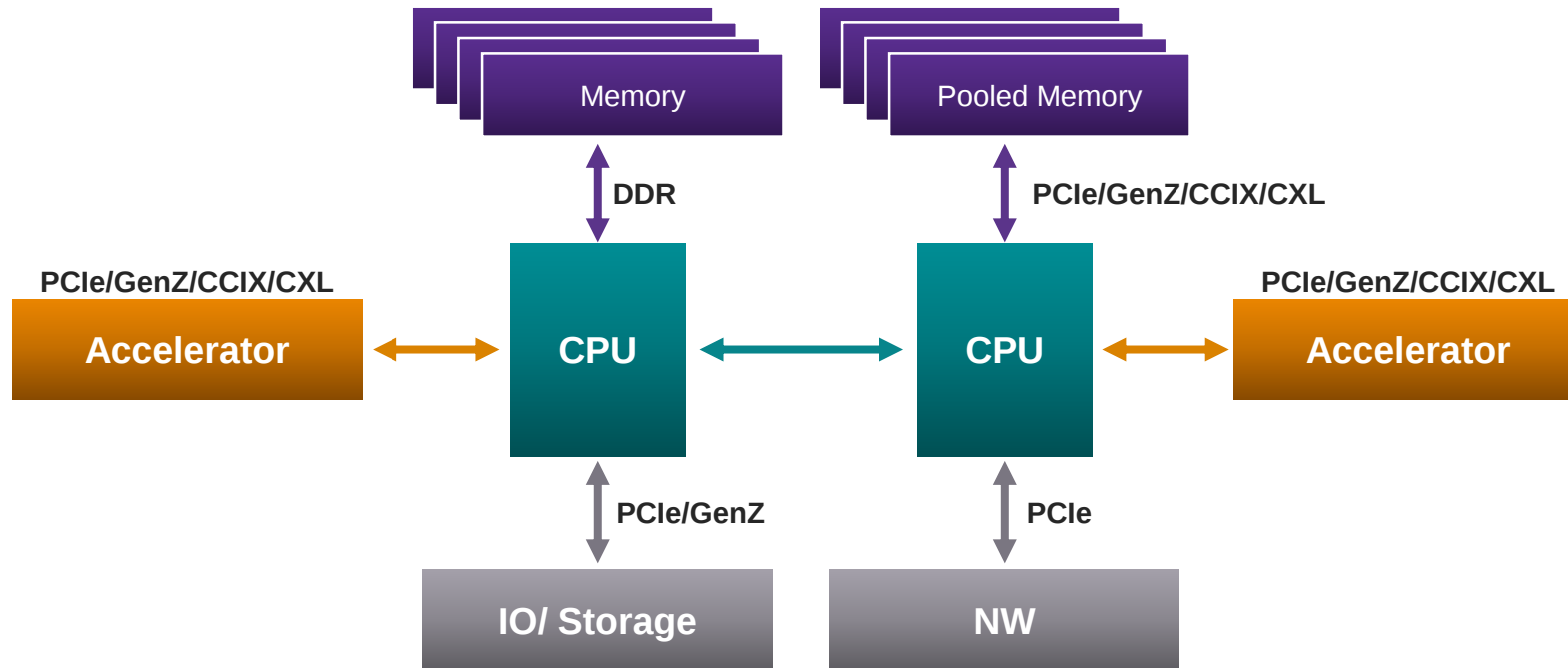


Genomics

Server Architecture Evolution



DISAGGREGATION AND ACCELERATION



90%
of compute happens off CPU

Improve memory utilization by
30%

https://www.microsoft.com/en-us/research/uploads/prod/2018/04/oi2018_final.pdf

Dis-aggregation Drives BW



GEN Z CXL CCIX™

		Raw Baud Rate/Lane	Total x16 Bandwidth	Modulation
2003	PCIe 1.x	2.5GT/s	32Gb/s	NRZ
2006	PCIe 2.x	5.0GT/s	64Gb/s	NRZ
2010	PCIe 3.x	8.0GT/s	126Gb/s	NRZ
2017	PCIe 4.x	16.0GT/s	~252Gb/s	NRZ
2019	PCIe 5.x	32.0GT/s	~504Gb/s	NRZ
2021	PCIe 6.x	64.0GT/s	~1000Gb/s	PAM4

Rick Eads, Keysight
BoD PCI-SIG

End-to-End Automated Test Solutions for High-Speed I/O



Physical Layer Interconnect Design



ADS Design Software



86100D DCA-X/TDR



N5227B PNA w/ PLTS

Verify PCIe 5.0 Compliant Channels; Verify Return Loss Compliance; Capture break-out channel S-Params

Physical Layer Transmitter Test



UXR-Series, Z-Series Real-Time Oscilloscopes



D9050PCIC PCI Express 5.0 TX Electrical compliance software



86100CU-400 PLL and Jitter Spectrum Measurement SW

DSA UXR-Series & Z-Series Real-Time Oscilloscopes

Physical Layer Receiver Test



M8046A J-BERT High Performance BERT w/ integrated CDR + M80454A Interference Source

M8049A-1 Substitute PCIe 5 BASE Channel board



N5991PB5A PCIe 5.0 32GT/s RX Test Software

Automated RX Test software
- Accurate, Efficient
- Comprehensive RX Testing



Standards document



Method Of Implementation

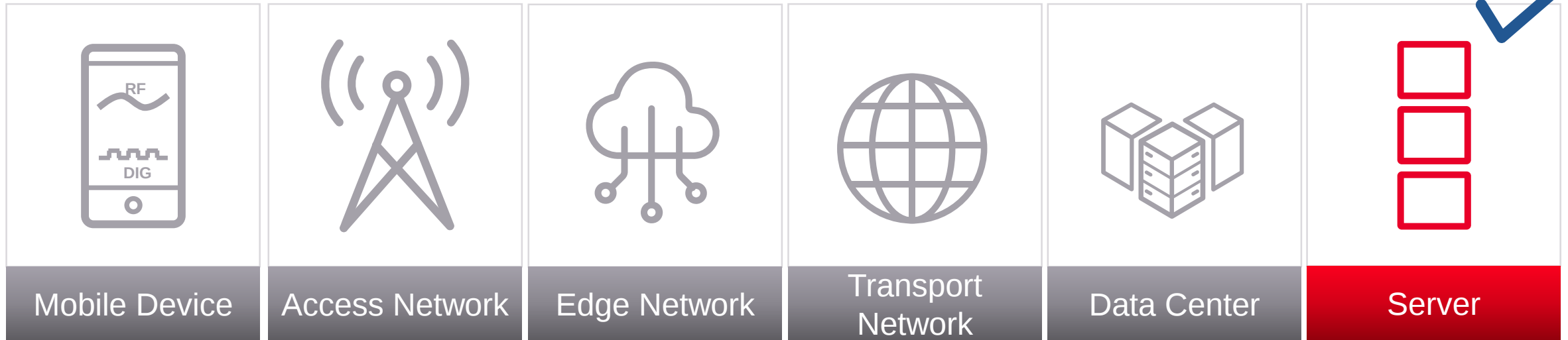


Test Automation



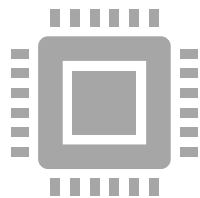
We enable next generations high-speed I/O by working with market makers, standard bodies, open communities

Enabling the 5G Communications Eco-System



A Comprehensive Solutions Portfolio

COVERAGE OF ENTIRE COMMUNICATIONS INDUSTRY



Components & Chipsets



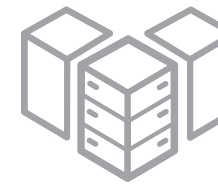
Devices



Access Network



Long-Distance



Data Centers



Server

Layers
2-7

Protocol Design & Acceptance		Field & Drive Test	Network Security	
Over-The-Air (OTA) Test	Key Performance Indicators	WiFi Coexistence	Network Monitoring	
Beamforming	MIPI ¹ Digital Test and LP/DDR5	Channel Emulation	Network Loading	
mmWave Parametric	Circuit Simulators	5G Waveforms	100G / 400G / 1T	Gen 5 PCIe & Memory

Layer 1

Solutions: ■ Keysight Classic ■ Ixia ■ Anite ■ AT4

Enabling Market Leaders

HOME / TEST

FormFactor partners with Keysight and GLOBALFOUNDRIES on Cascade CM300xi probing system for SiPh testing

Electrical test and measurement supplier FormFactor, Inc. (NASDAQ:FORM) said that it has deployed

2019年4月24日 武汉

星源科技 (NYSE: KEYS) 今日宣布与国家信息光子创新中心 (NOEIC) 在武汉光谷成立硅基测试共建实验室。这也是国内首家拥有最高级别光通信测试能力的实验室。目前该实验室具备：超100Gbaud复杂调制等硅基光通信领域测试能力。必将会为光通信产业前沿科技的加速发展影响力，并成为国内一流的信息光子产业创新平台。

从左侧起为沈为：

wallstreet online

DAK: 12.135,20 +0.55 % Dow Jones: 25.814,00 +0.50 % EUR/USD: 0.9153 -0.11 % Gold: 1.267,00 +1.31 % US Tech 100: 7.430,30 +0.72 % Bitcoin: 7.862,32 +1.76 %

Suchbegriffe, Wertpapier-Namen, WKN oder ISIN

Nachrichten Börsenlicher Meine Finanzen Mein K.K. n

Video Themen Nachrichten-Suche Newsletter

Interessensbereiche Branchen

Empfehlung bis zu 200% Gewinn - Neue Chance nicht verpassen! +++

Zeigen > Nachricht

Enthaltene Werte: Keysight Technologies

Ixia, a Keysight Business, and InnoLight Demonstrate 400 GE Interoperability Achieving 3.2 Tbps Live Ethernet Traffic with OSFP Optical Transceivers

Nachrichtensource: Business Wire (engl.) | 17.09.2018, 17:36 | 290 | 0 | 0

凭借与客户长期的优质合作，是德科技也在本次峰会中荣获 ODCC 2018 Plugfest Award 400G 奖项。

sdx central

SD-WAN Security 5G AI Edge Data Center IoT SDN Storage NFV APM/NPM Op

Keysight Provides NTT DoCoMo With 5G Network Emulation for 5G NR Devices

Alli Longwell August 21, 2018 11:45 am MT

Keysight Technologies, FormFactor, Industrial Technology Research Institute Collaborate to Deliver Silicon Photonics Test and Measurement Solution

Share Share Tweet

SANTA ROSA, Calif., October 16, 2018

Keysight Technologies, Inc. (NYSE: KEYS), a leading technology company that helps enterprises, service providers, and governments accelerate innovation to connect and secure the world, announced a collaboration with FormFactor and the Industrial Technology Research Institute (ITRI) to accelerate integrated photonics innovation.



KEYSIGHT
WORLD 2020

