



CO-PACKAGED OPTICS (CPO)

25.6T CPO Switch Deployment

Optical Systems Division

August 2022



Data Centers: Systems At Scale



\$100B

Annual Capex Spend
by Cloud with 15% CAGR¹

19.5

Zettabytes of
Cloud Data Movement²

Per hyperscale datacenter

> 100k Servers

> 10k Switches

> **1M Optical Interconnects**

Source:

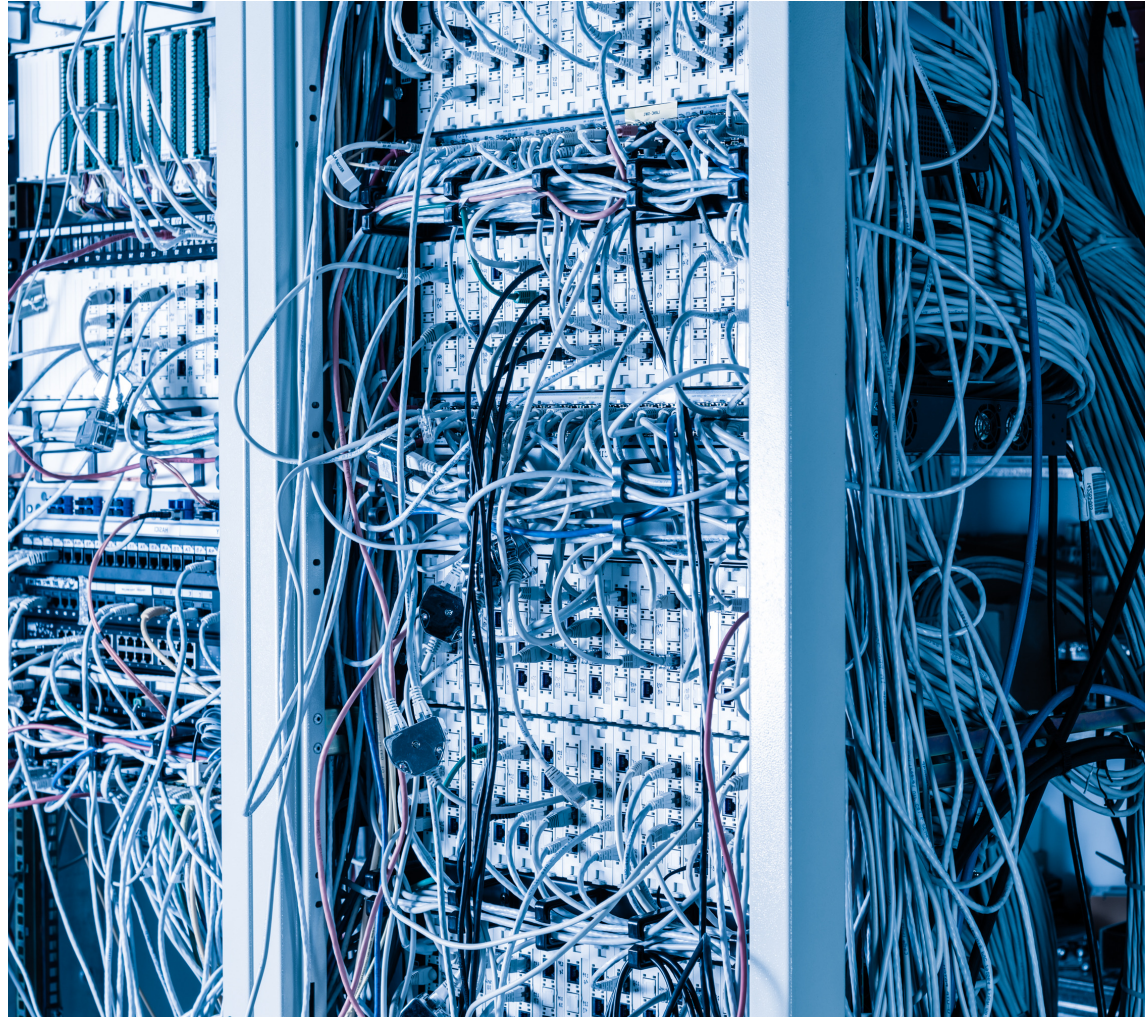
1. 650 Group, Cloud Total Market and Forecast Report

2. Cisco Global Cloud Index, <https://blogs.cisco.com/news/acceleration-of-multicloud-era>

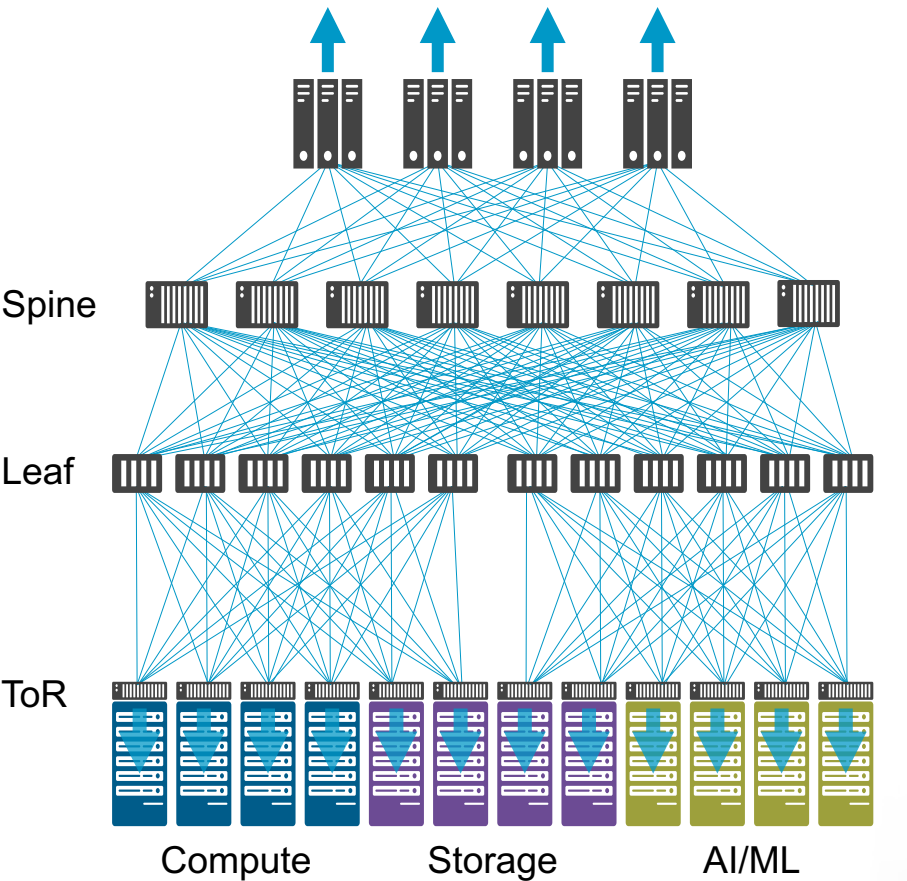
3. Left: Digital Realty's Loudoun Three campus in Ashburn, Virginia. Photo courtesy of Digital Realty

4. Right: Google's Council Bluffs, Iowa Data Center. Photo courtesy of Google

But Will This Scale...

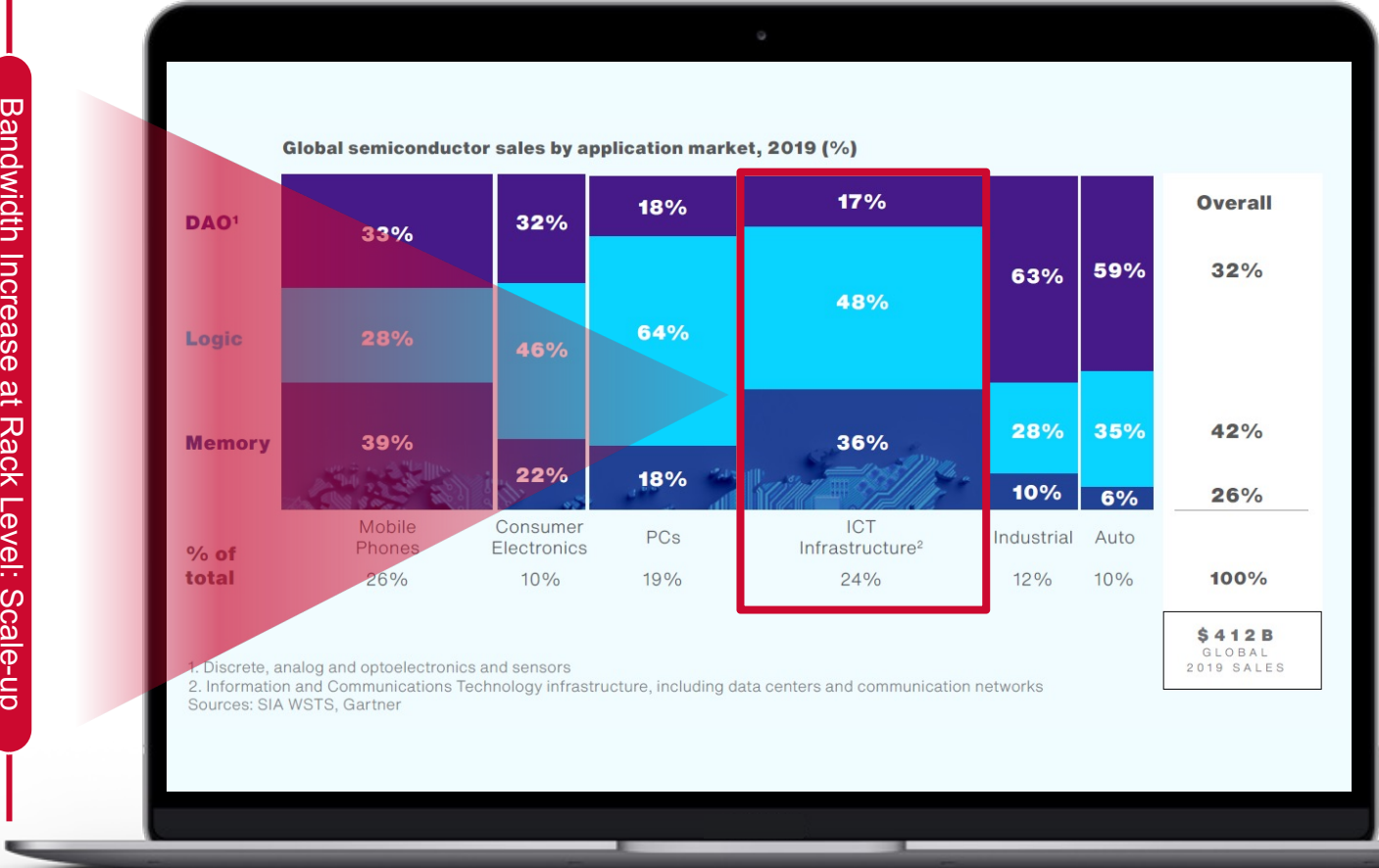


...As Compute System Trends Require More Data Movement...



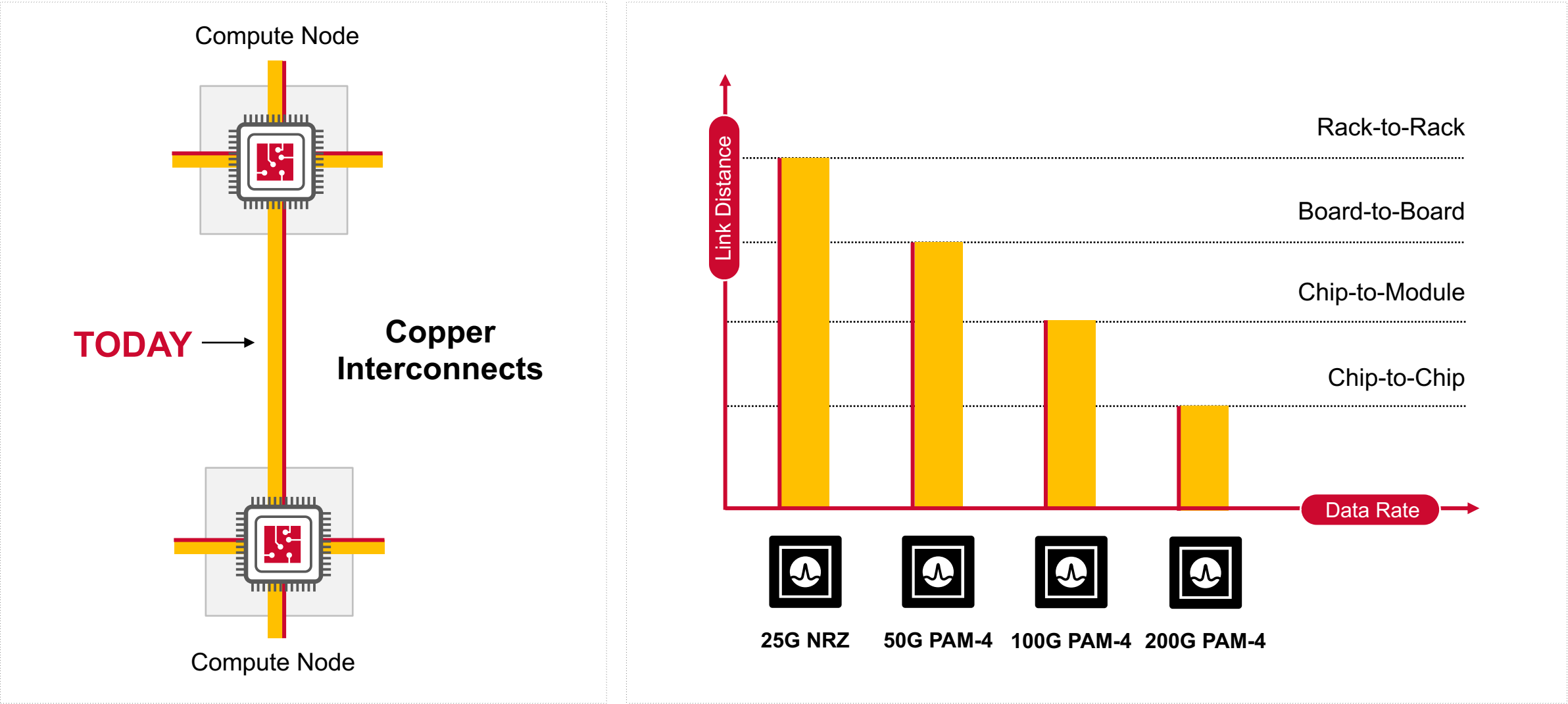
Bandwidth Increase at Rack Level: Scale-up

Clustering: Scale-out



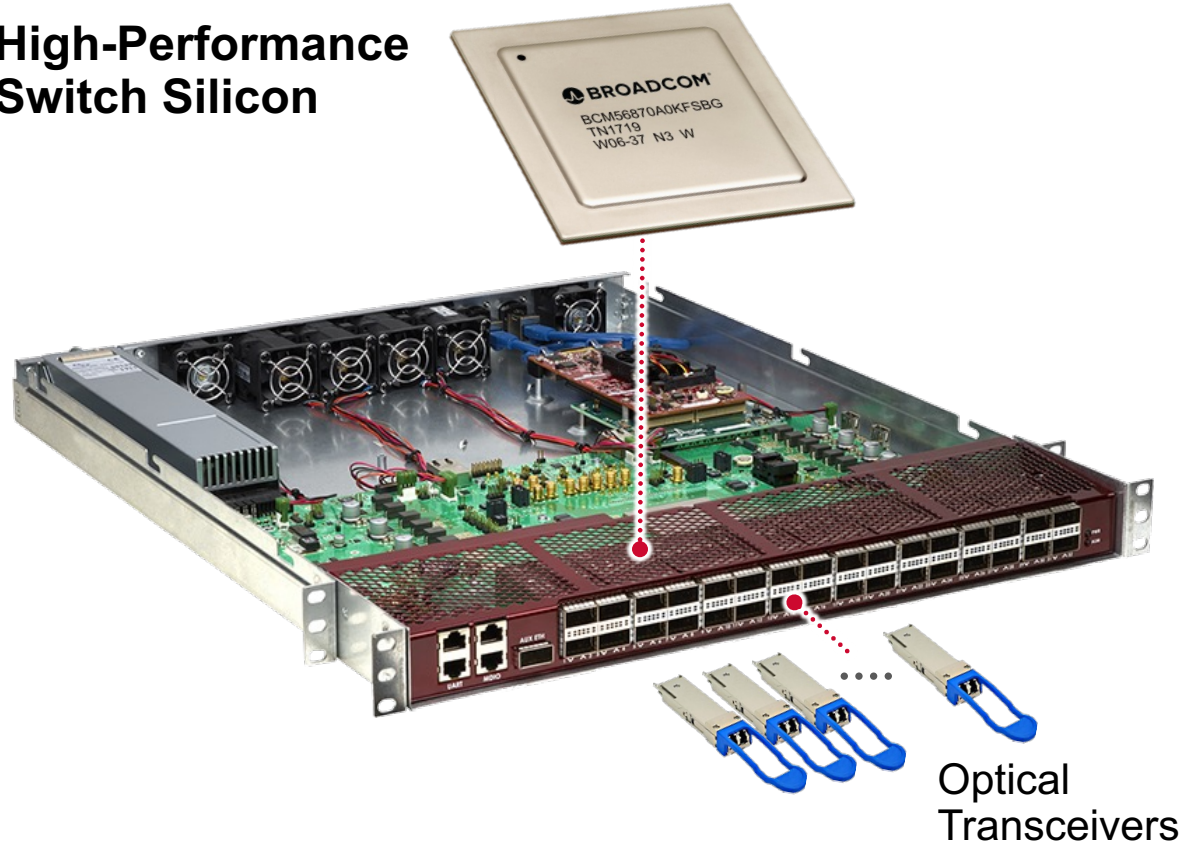
Source: SIA/BCG Report:
Strengthening the Global Semiconductor Supply Chain in an Uncertain Era, April 2021

...And Copper Interconnects Approach A Reach Limit...



...That Result In Very High Spend On The Optical Interconnect...

High-Performance
Switch Silicon



Current Customer Spend*

10x \$

Optics

Switch

Opportunity for Step Function Improvement in Optical Connectivity

* Source: LightCounting, Dell'Oro, 650 Group and Broadcom internal estimates

CPO Helps Overcome The End Of Moore's Law

AI and Data Processing Requirements Increase

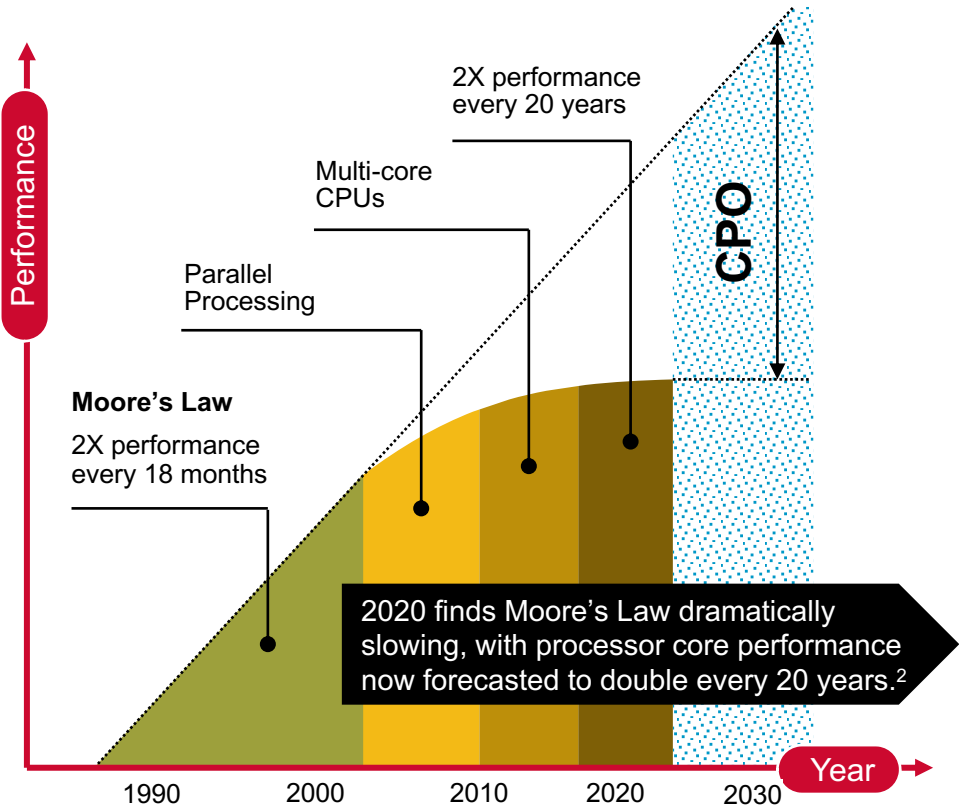


Silicon technology can't keep up with Moore's Law



Heterogenous Integration using optical links connects multiple processing nodes to meet Moore's Law scaling requirement

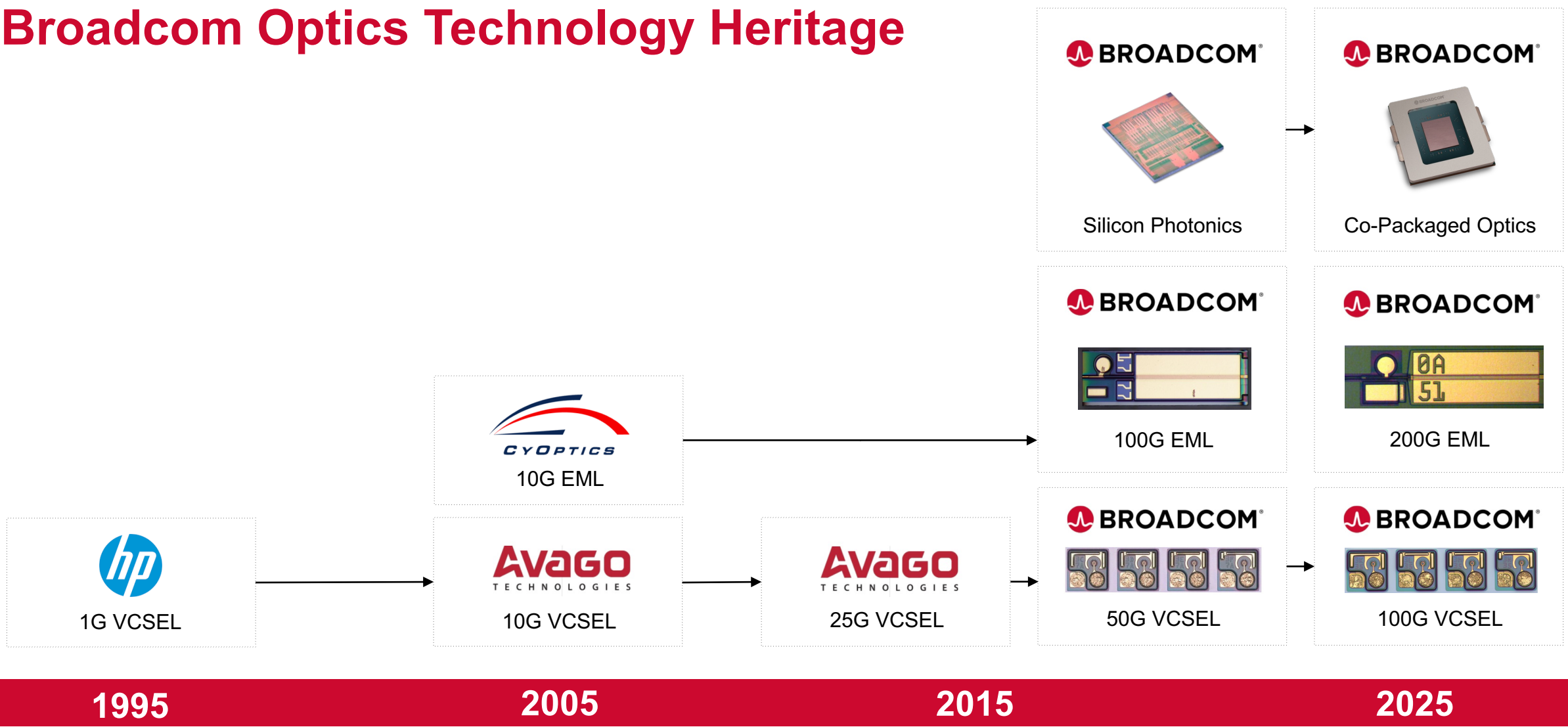
40 Years of Processor Performance³



The End of Moore's Law Drives Innovation in Heterogeneous Integration and Silicon Photonics

1. Moore's Law, Investopedia, CARLA TARDI Feb 24, 2021
2. Pliops storage processor, The-Dcline-of-Moore-s-Law-and-the-Rise-of-the-Hardware-Accelerator.htm, April 22, 2020
3. Moore's Law Performance Curve: John Hennessy and David Patterson, Computer Architecture: A Quantitative Approach, 6/e. 2018

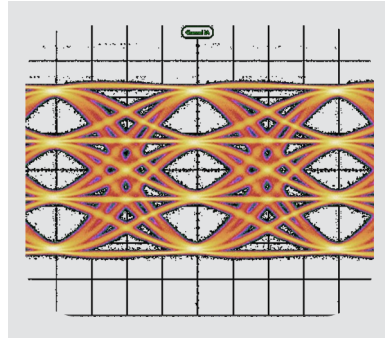
Broadcom Optics Technology Heritage



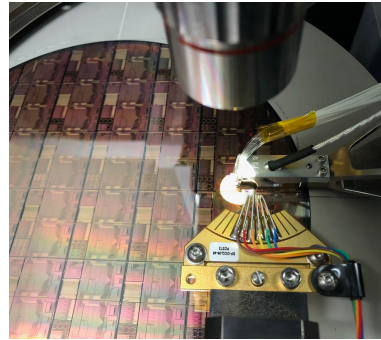
Broadcom's Disruptive Silicon + Photonics Platform ...



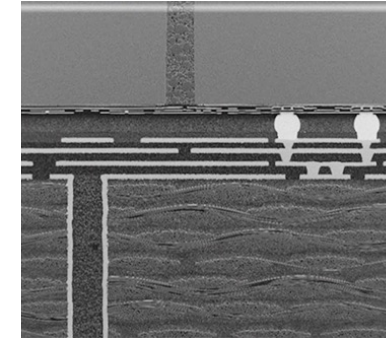
Switch
Silicon



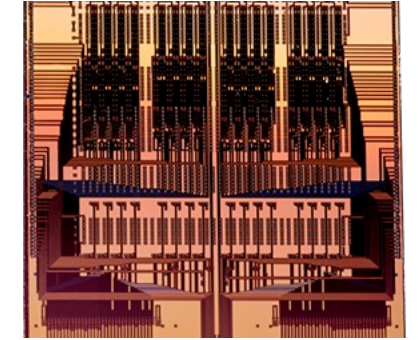
Mixed Signal
IC



Optical Devices
& Fabs



Advanced
Packaging & Test

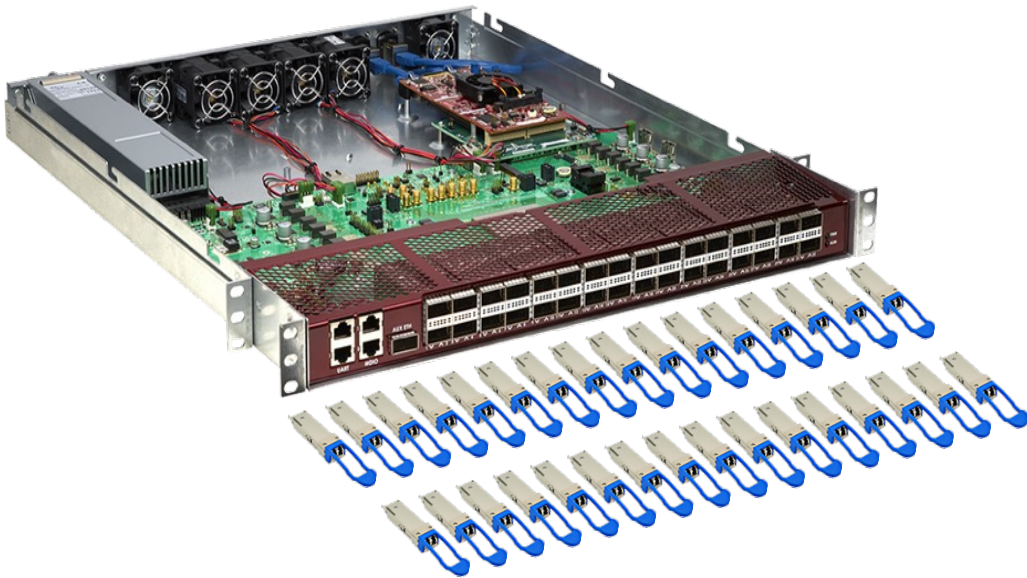


Silicon
Photonics

Industry-Leading Economics, Volume, Power Efficiency at Scale

...Enables Co-Packaged Optics And New System Architectures...

Traditional Switch with Optical modules

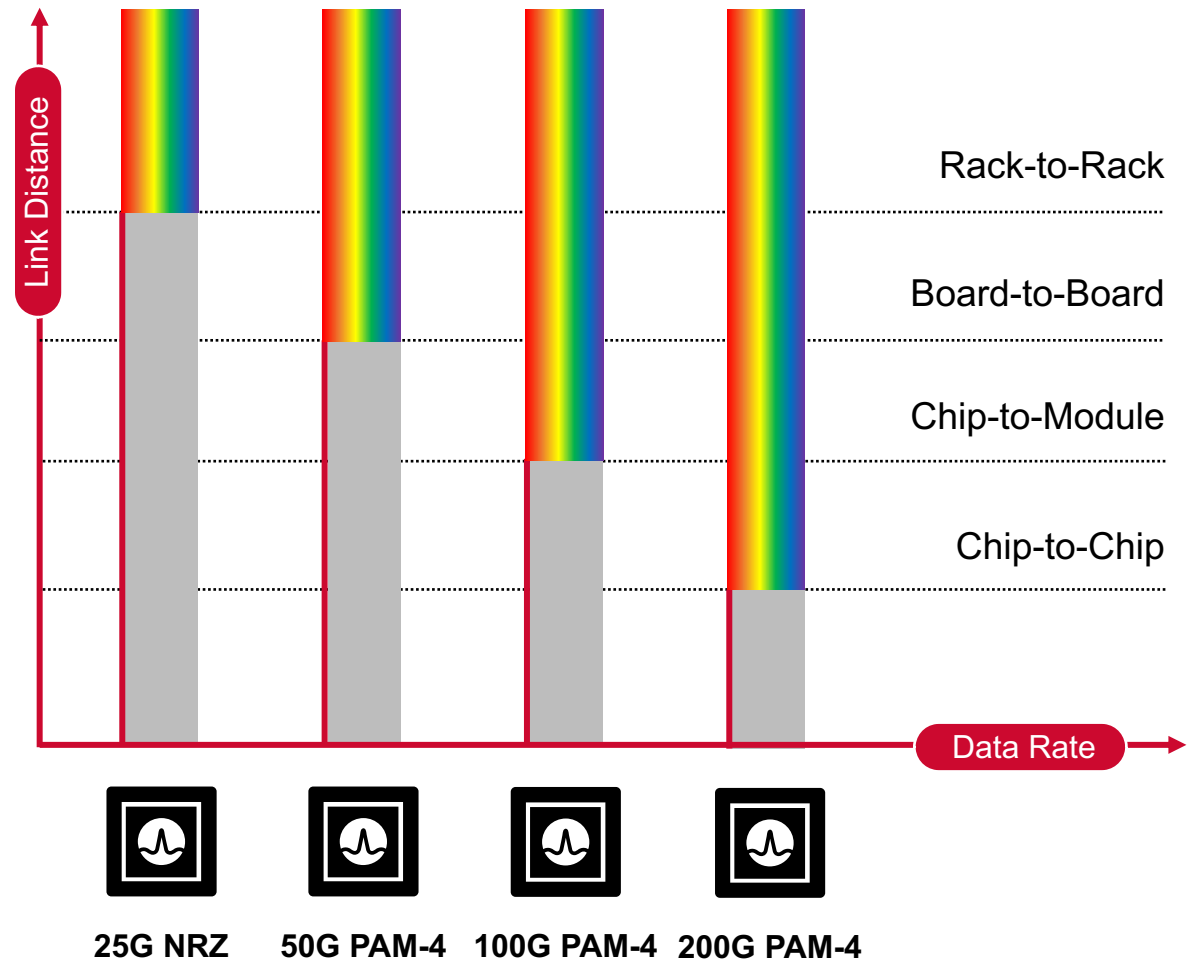
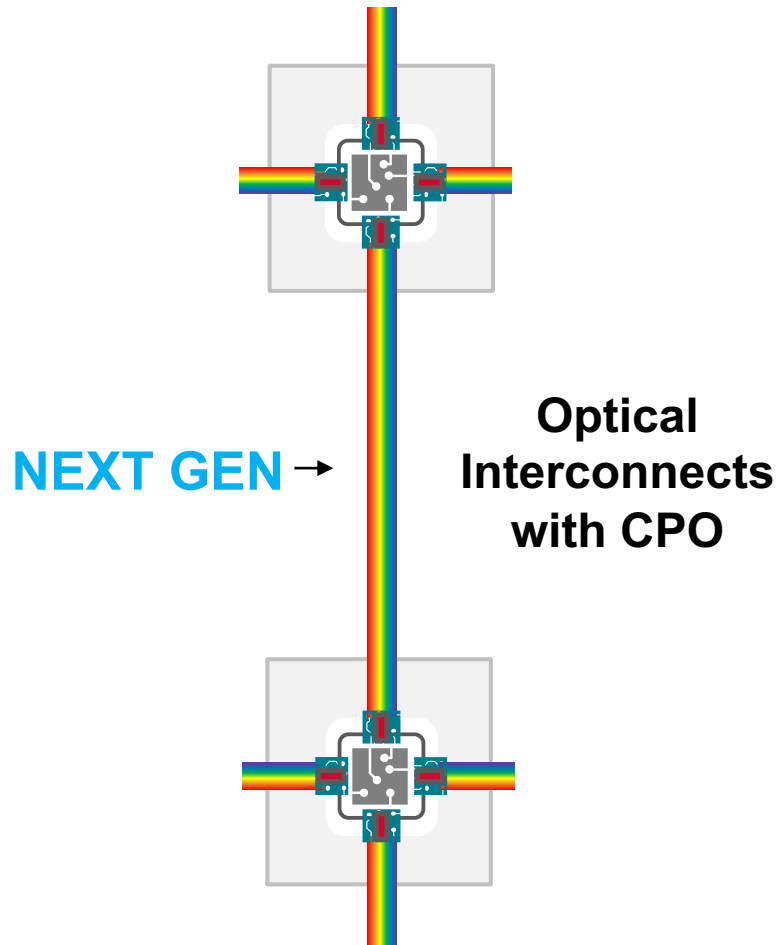


Broadcom CPO Solution



CPO Delivers Best-In-Class Power and Cost Savings

...That Break the Copper Limit AND Bend the Cost Curve...



CPO Value Proposition



>15

External partners working on SCIP and CPO



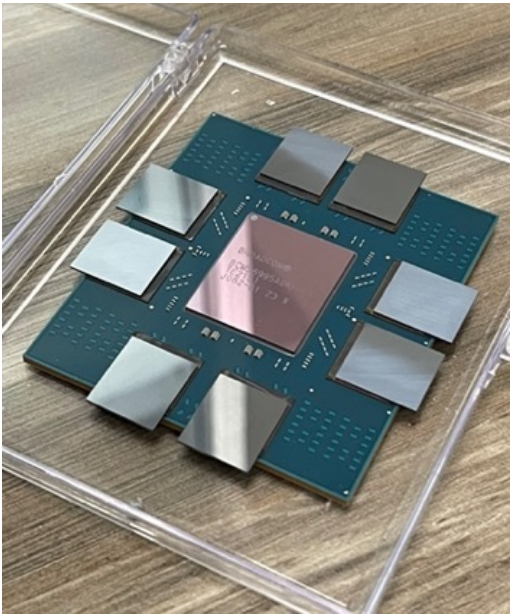
>10

Unique IP blocks in development

25.6T CPO



51.2T CPO



30%

Power Consumption Savings

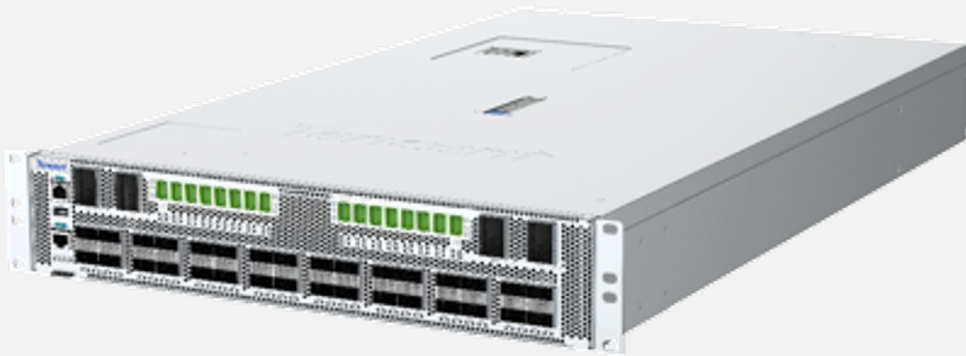


40%

Lower Optics Cost/Bit

Industry's First 25.6-Tbps CPO Switch Field Deployment

Tencent



- Tencent 25.6T CPO Network Switch
- Broadcom Tomahawk4 Switch
- Broadcom 3.2-Tbps Silicon Photonics

NEWS RELEASE



Broadcom and Tencent Partner to Accelerate Commercialization of Co-Packaged Optics Network Switch

Industry's first 25.6-Tbps CPO switch delivers unprecedented bandwidth density and power efficiency

SAN JOSE, Calif., August 22, 2022 – Broadcom Inc. (NASDAQ: AVGO) and Tencent Holdings Ltd. today announced a strategic partnership to accelerate the adoption of high bandwidth co-packaged optics (CPO) network switches for cloud infrastructure. Under this partnership, Broadcom will provide the 25.6-Tbps Humboldt CPO switch device that features Broadcom's best-in-class StrataXGS® Tomahawk® 4 switch chip directly coupled and co-packaged with four 3.2-Tbps Silicon Photonics Chiplets In Package (SCIP) optical engines. Tencent has defined the system architecture and worked closely with Broadcom to develop hardware and software for field deployment of the 25.6-Tbps CPO switch system. Ruijie Networks Co., Ltd. will verify the design, manufacture and test the full CPO switch system, and then provide the finished product to Tencent. The jointly developed 25.6-Tbps CPO switch system will be demonstrated at the China International Optoelectronic Exposition (CIOE) in Shenzhen from September 7th to 9th.

25.6-Tbps CPO Switch Product Highlights:

- 2RU system design with high efficiency air cooling to support 4x3.2-Tbps optical CPO interfaces routed to 16 MPO connectors and 32x400G electrical QSFP112 ports
- CPO engine to front-panel routing supports both traditional fiber and flexible printed fiber (FPF) solutions
- System design compatible to support multiple remote laser modules (RLM)
- More than 50% optical interconnect power consumption savings compared to standard pluggable optics solutions
- Production ready for data center deployment



BROADCOM[®]

connecting everything[®]