



Scaling Cloud Data Infrastructure with Industry's Broadest Portfolio

June 2021

Overview

Company founded

1995

FY21 revenue

\$3.0B*

Employees

6,000+

Patents worldwide

10,000+

Fabless and located in **Santa Clara, CA**

R&D centers in **US, Israel, India, Germany, China**

*Excludes Inphi CY2020 revenues (\$0.68B)

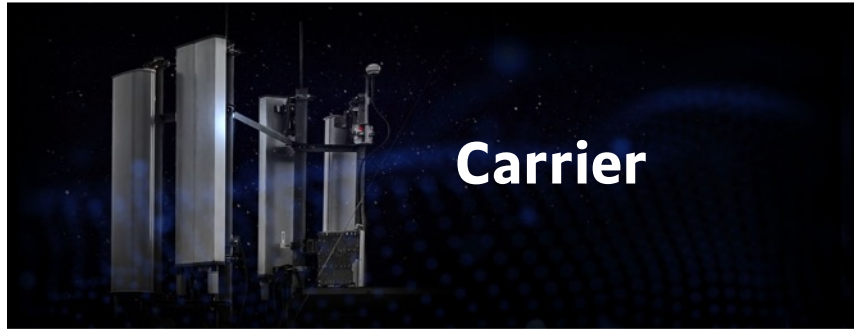


Marvell's Mission

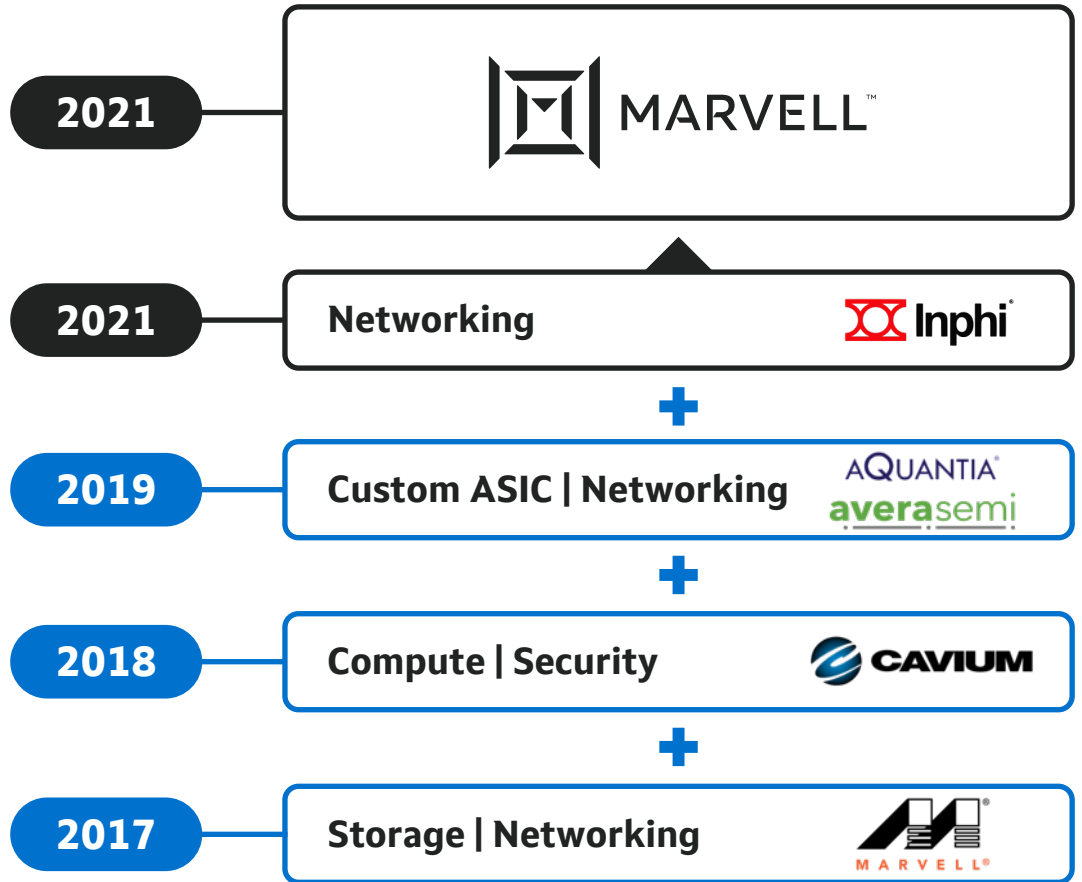
We develop and deliver semiconductor solutions that move, store, process and secure the world's data faster and more reliably than anyone else.

Focused on enabling data infrastructure

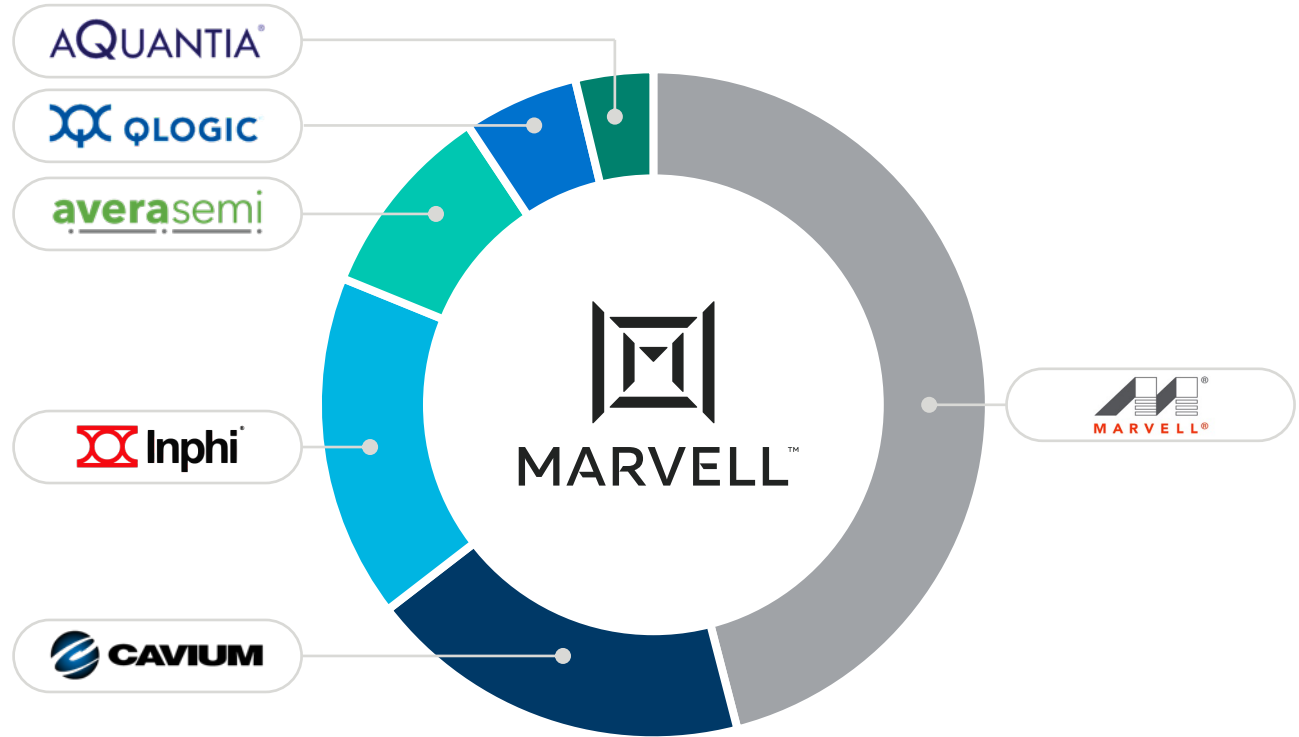
We specialize in semiconductor solutions across four end markets.



Transformation to premier data infrastructure partner



The New Marvell



Estimated employee population by company

Providing all the critical building blocks for data infrastructure

Marvell offers the most complete data infrastructure portfolio



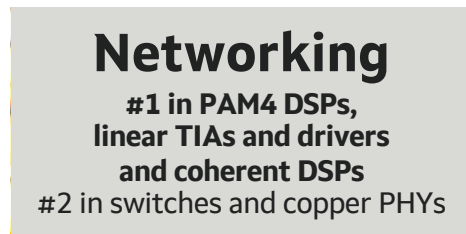
Processors

#1 in baseband and
data processor units (DPUs)



Storage

#1 in HDD, SSD and
Fibre Channel controllers



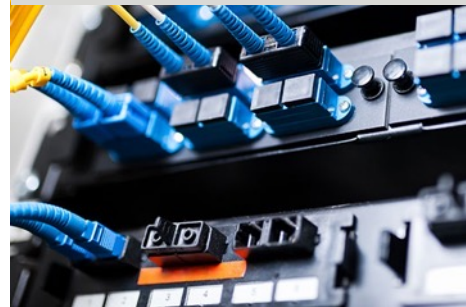
Networking

#1 in PAM4 DSPs,
linear TIAs and drivers
and coherent DSPs
#2 in switches and copper PHYs



Security

#1 in security processors
and cloud hardware
security modules (HSM)



Industry-leading data infrastructure product lines

Compute

Data Processor Units (DPUs)



SmartNICs

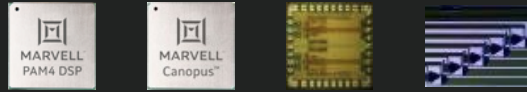


Security Solutions



Networking

High-speed Electro-Optics (PAM4 DSPs, Coherent DSPs, TIAs, Drivers and Silicon Photonics)



Ethernet PHYs



Ethernet switches



DCI optical modules



Ethernet NICs



Automotive ethernet



Storage

HDD controllers and pre-amps



Flash SSD controllers and NVMe accelerators

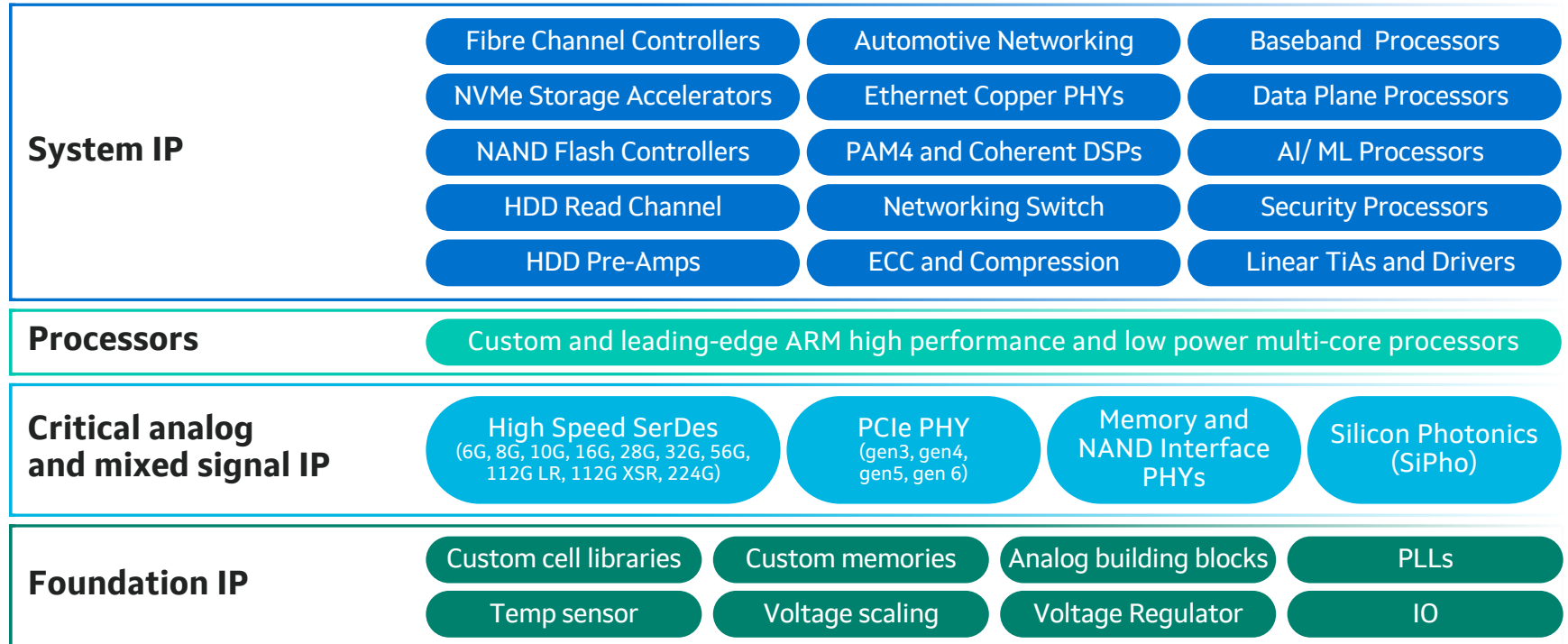


Fibre Channel HBAs

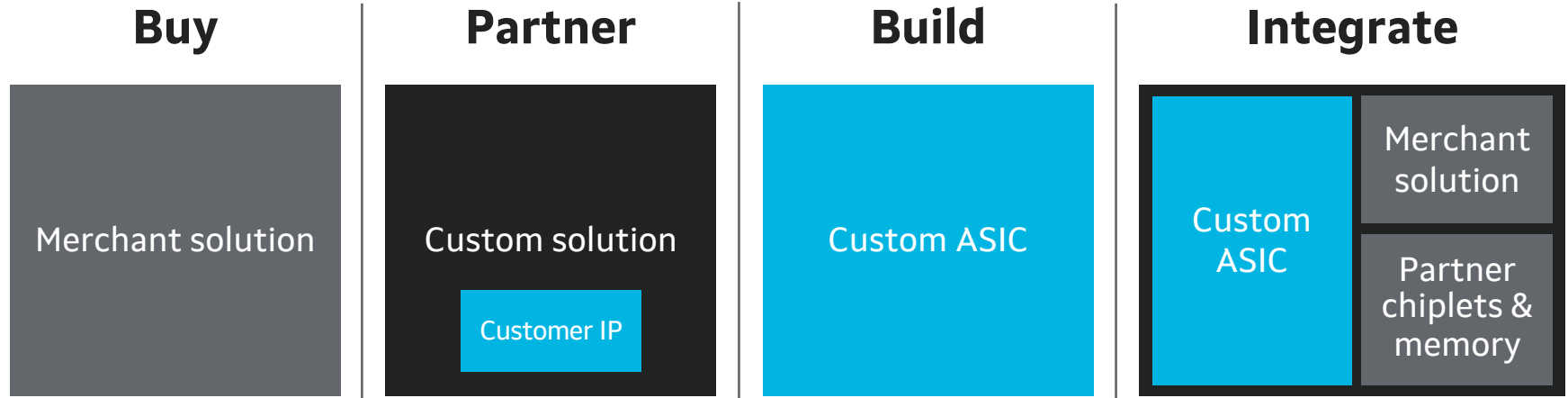


Custom ASICs

Best-in-class data infrastructure IP portfolio



Delivering multiple R&D models to satisfy customer needs



Leading data infrastructure portfolio for cloud infrastructure customizations

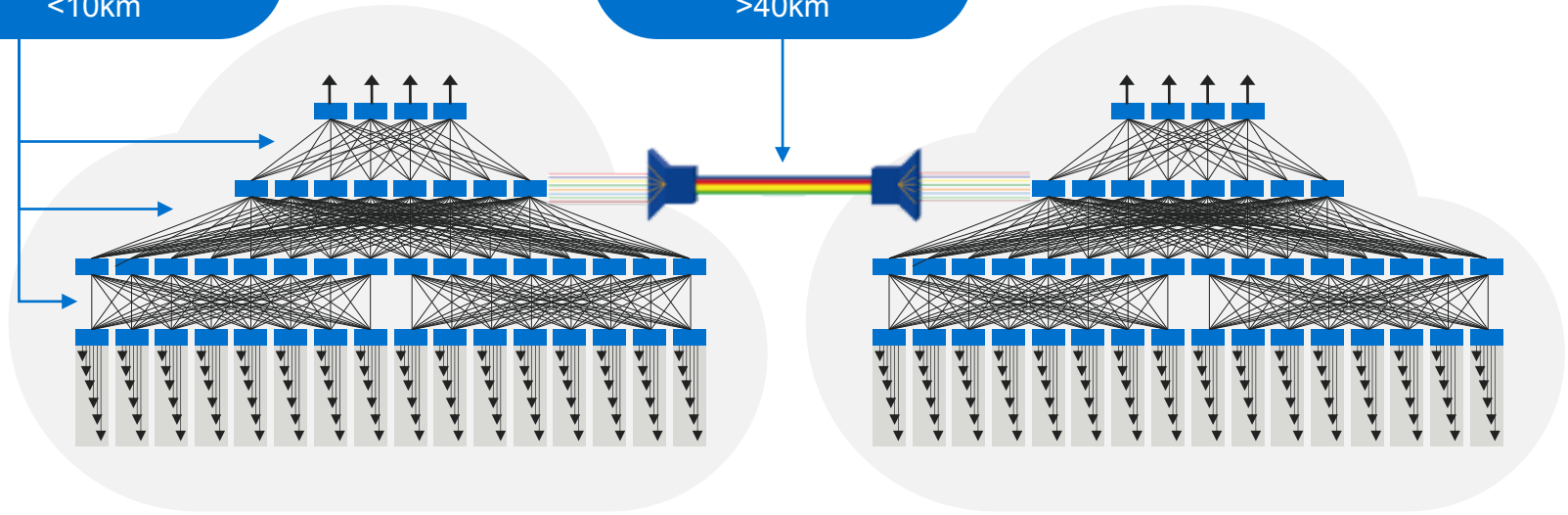
Leading the cloud data center connectivity revolution

PAM4

Coherent

200G | 400G | 800G
Inside data centers
<10km

100G | 400G
Between data centers
>40km



Move data **inside** and **between** Cloud Data Centers faster and better

Enabled **inside data center** connectivity revolution

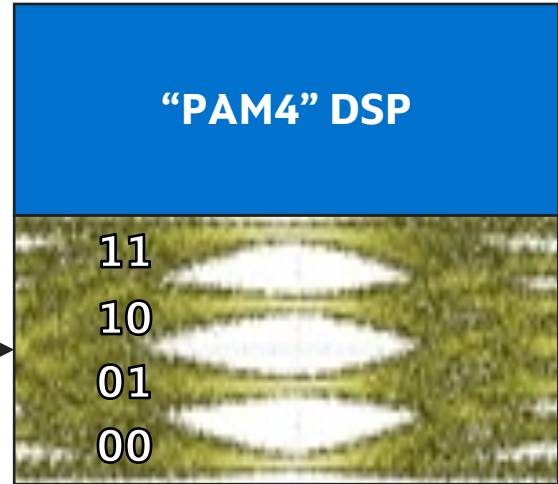
<10G/s



One-bit encoding



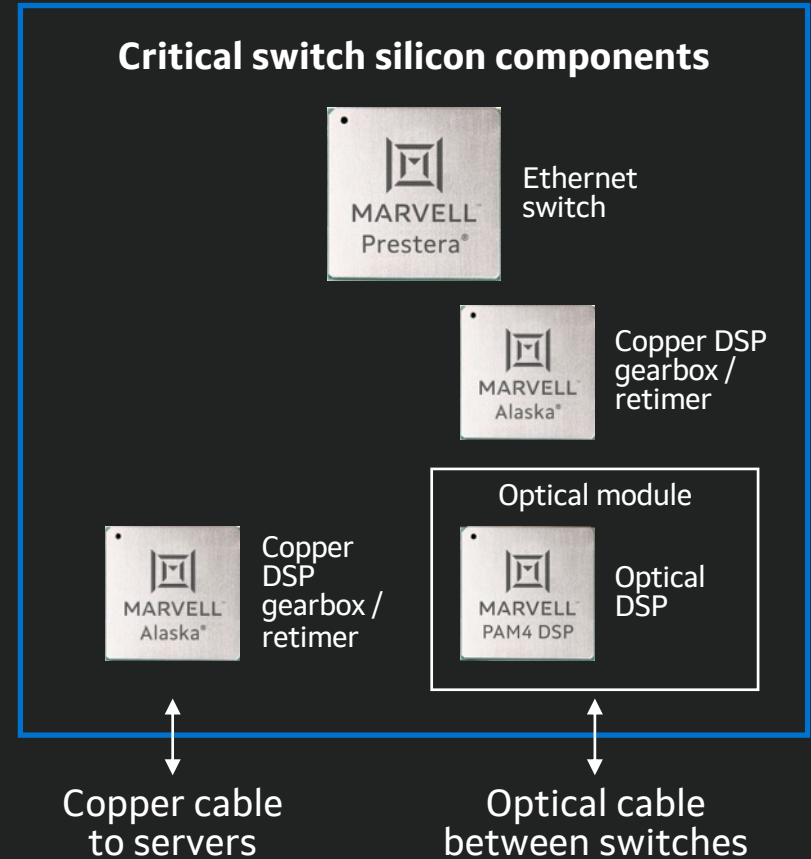
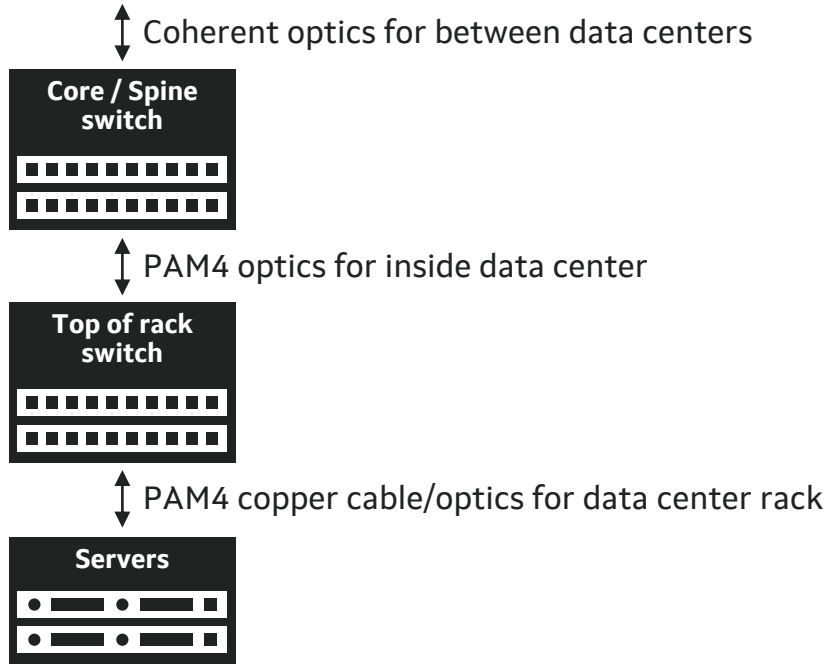
>25G/s



Two-bit encoding doubles the data

PAM4 doubles networking bandwidth at lower cost and power per bit

Cloud data center connectivity



Complete cloud data center networking portfolio

Ethernet switch

Optical PAM4 DSP

Copper PAM4 DSP

12T / 25T switch
50G I/O



50G Host I/O
50G Line I/O
50GE – 400GE



4x50G



4x50G with PMD



50G serial

12T / 25T switch
50G I/O



50G Host I/O
100G Line I/O
50GE – 800GE



8x50G to 4x100G



5nm 100G serial

25T / 50T switch
100G I/O



100G Host I/O
100G PAM I/O
100GE – 800GE

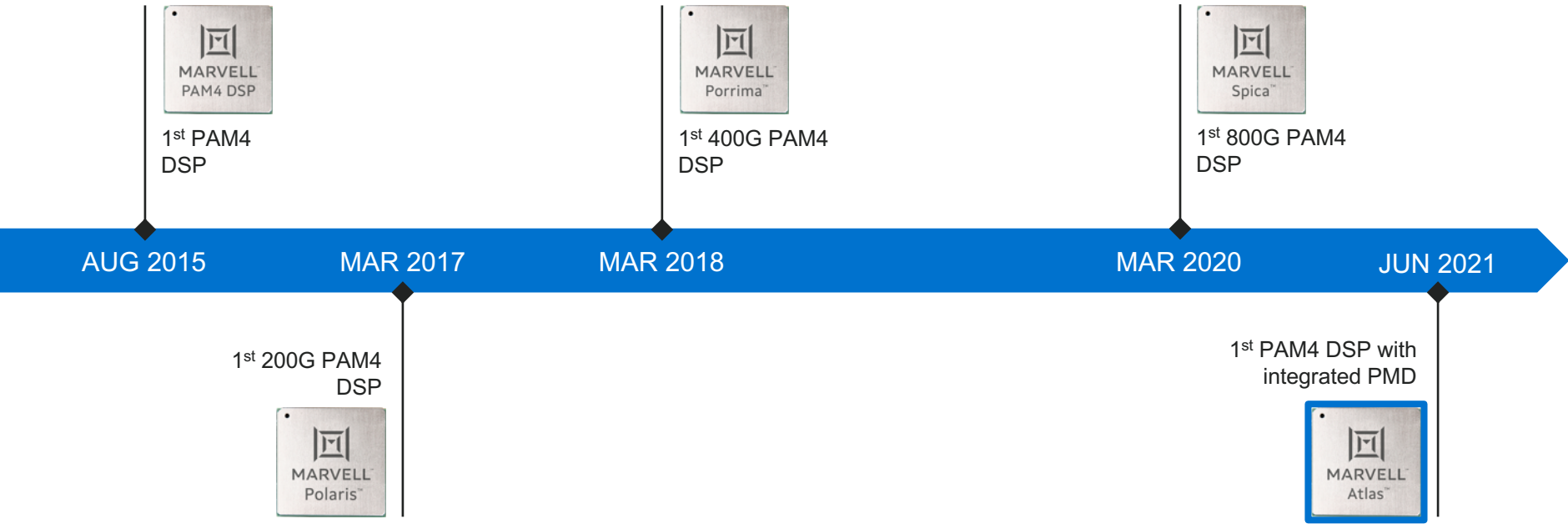


8x100G



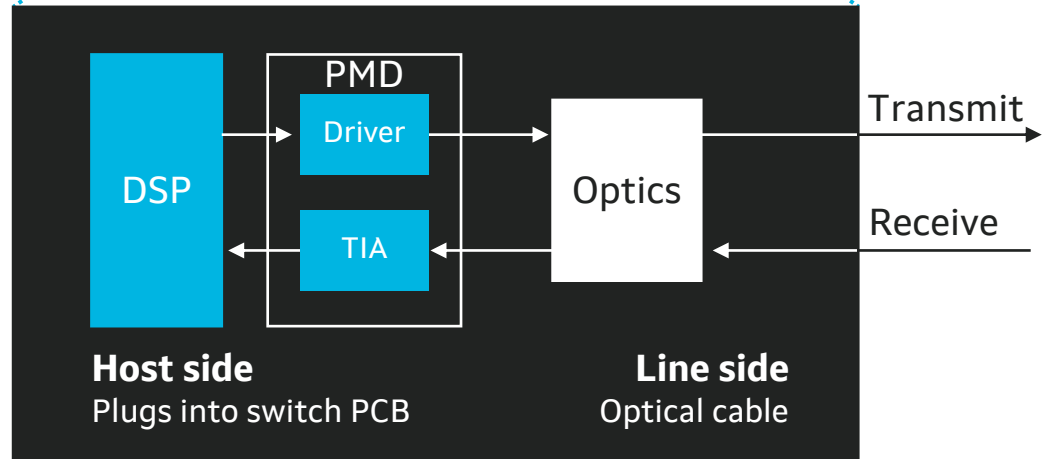
5nm 100G serial

Extending PAM4 industry leadership



Powering >10 optical module makers for leading cloud data centers

Data center optical module architecture



Electro-optics leader revolutionizing cloud data centers

Industry's 1st PAM4 DSP with integrated TIAs & LDs

Atlas: 4x50G PAM4

Proven market-leading Polaris IP

- DSP
- Host bus
- Software

25% power reduction

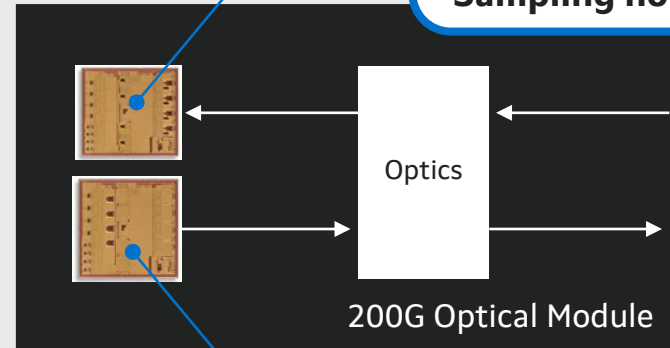
- < 3.5W module
- Integrated PMD
- Optimized DSP

Supply-chain optimized

- Single-chip PHY and PMD solution
- Bare die
- Single mode and multi mode versions

Atlas Receiver

4 x 50G Rx DSP
with TIAs



Atlas Transmitter

4 x 50G Tx DSP
with Laser Drivers

25% less power, 33% less components, single CMOS fab and no package

Industry's 1st 100G serial 5nm 1.6T retimer & gearbox

Alaska™ 88X93160

1.6T Ethernet PHY with dual-port 800GE

Industry-leading LR DSP Serdes

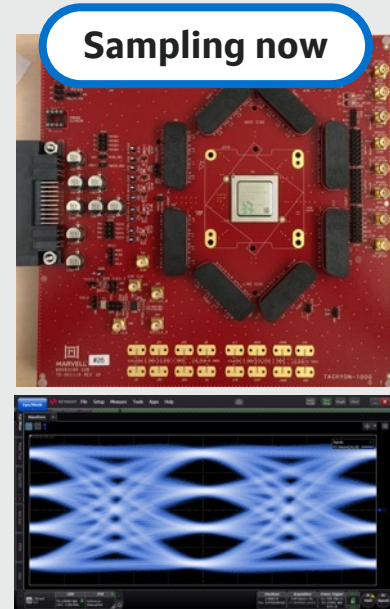
- >38dB Insertion Loss
- >2m passive DAC reach
- 40% power/bit savings vs existing 56G solutions

Standards compliance

- Consortium 800GE specifications
- IEEE 802.3ck
- Auto-negotiation and Link Training

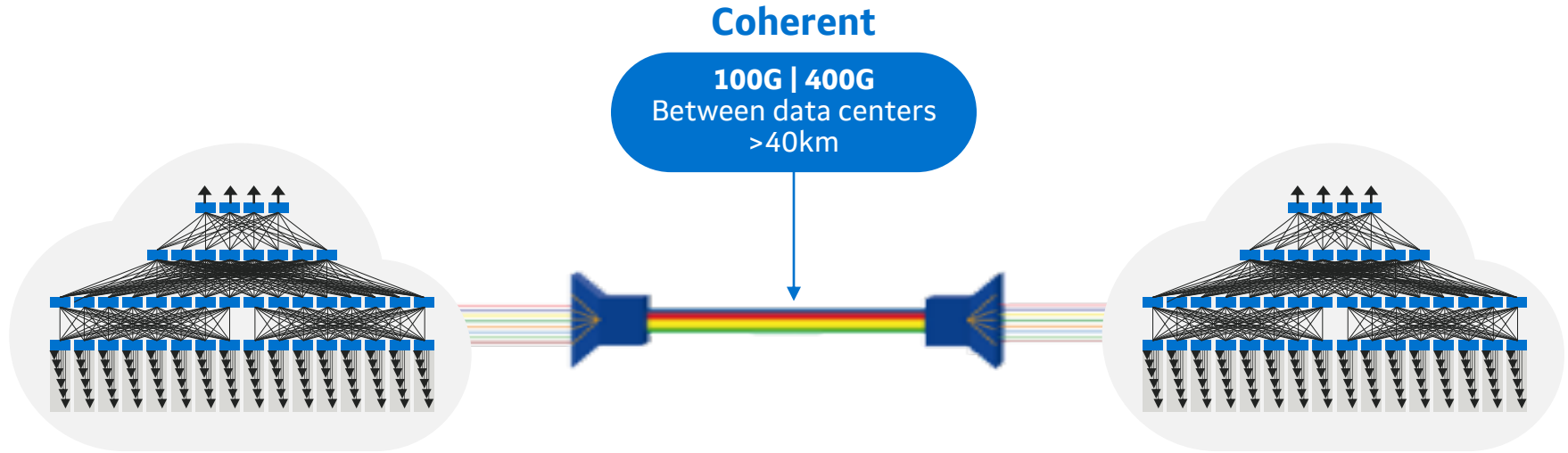
Flexible configurations

- 1GE to 800GE
- Retimer and Gearbox
- FEC termination and regeneration



Key data center building block for next decade

Revolutionizing **between data centers** connectivity



Enabling low-power, high-density and open coherent pluggable modules

Enabling coherent evolution to pluggable modules

Line
card

100G
MSA module

200G
CFP-DCO

400G multi-rate CFP2 and
400G ZR/ZR+ QSFP-DD/OSFP

Data center and carrier benefits

- Higher density
- Pay as you go
- Lower power
- Industry standard with multiple suppliers
- Lower per port cost
- Lower OPEX



Delivered industry's 1st 400G coherent DSP: Canopus

2019

Industry's 1st 400G
coherent DSP



Enabled industry's
1st 400G ZR modules



Enabled industry's 1st
multi-rate 400G ZR+
modules



Enabled industry's 1st
400G Ultra CFP2 DCO
modules



Data Center Interconnect

Metro and Long Haul

Enabling the industry disruption to 400G coherent pluggable modules

Delivered industry's 1st 400ZR module: COLORZ II

Telecom transport



200W/100G
100G / Slot

2010

"DCI box"



Coherent DWDM
25W/100G
500G / 1RU

2014

COLORZ

100G QSFP28
ZR / 80 km

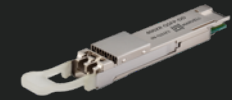


PAM DWDM
4.5W/100G
3.6T / 1RU

2017

COLORZ II

400ZR QSFP-DD
ZR / 120 km | ZR+ / 400 km

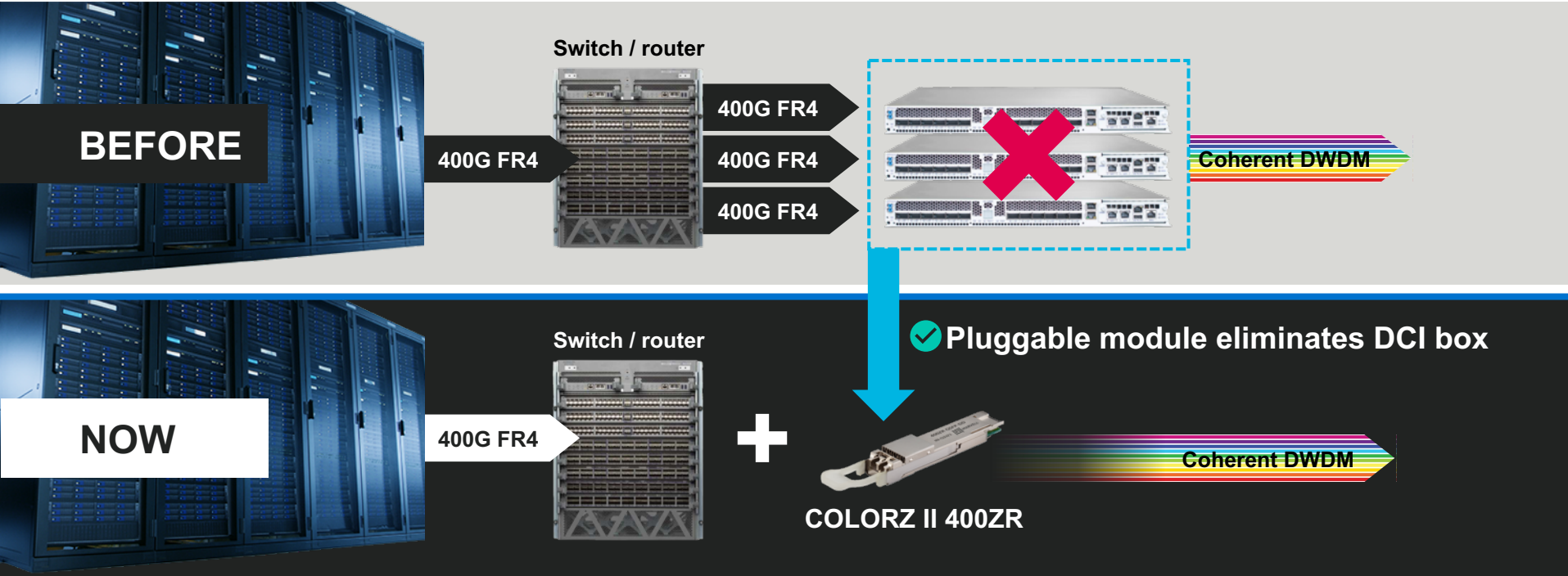


Coherent DWDM
4.5W/100G
14.4T / 1RU

2021

**ZR/ZR+ optics enable massive bandwidth deployment
between data centers at lower cost and power/bit**

COLORZ II 400ZR optimizes density, cost and power



Deneb extends Marvell coherent DSP leadership

2019

Industry's 1st
400G ZR/ZR+ DSP



400G ZR/ZR+



Ultra 400G
probabilistic shaping

In production

DCI, metro
and long-haul

2021



400G OpenZR+ / 100G ZR
400G Open ROADM /
100G CableLabs



400G OpenZR+ /
100G ZR



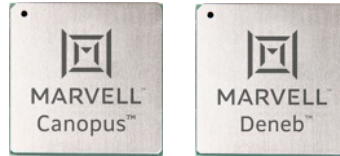
400G
Open ROADM

Open DCI, metro and long-haul +
emerging access applications

Sampling now

Optimized DSP for open optical standards enabling new applications

Enabling industry's only open coherent ecosystem



400G ZR/ZR+



Ultra 400G
Probabilistic Shaping



+ multiple other module and OEM partners

400G Open ZR+/100G Access



400G Open ROADM



Partnering with leading module makers and OEMs to drive innovation and adoption

Industry-leading portfolio for cloud data centers

Custom ASICs and Custom Arm Server CPUs



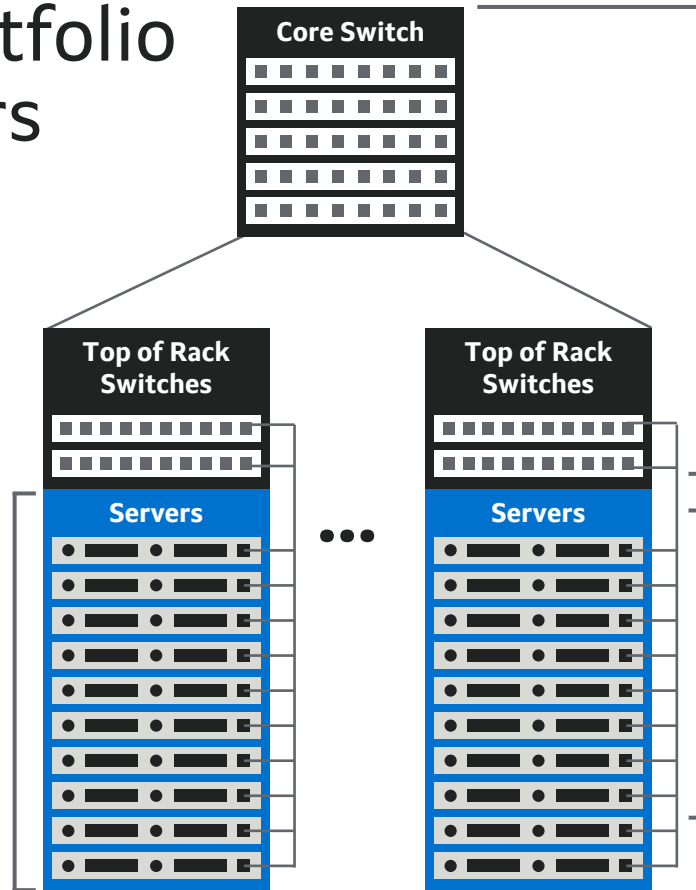
DPU and SmartNICs



Flash Storage & Accelerators



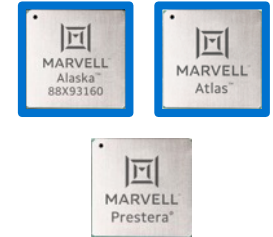
Security Solutions



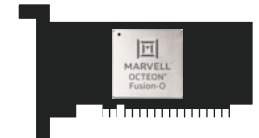
DCI coherent pluggable modules



Ethernet Switches and Connectivity



5G vRAN and ORAN DPU accelerators



Key takeaways

1

Marvell offers industry's most complete data infrastructure portfolio

2

Investing to accelerate high-speed electro-optics innovations

3

Advancing PAM4 leadership with Atlas and 5nm Alaska product launches

4

Deneb extends 400G coherent DSP leadership to enable new applications

5

Partnering with eco-system to enable open, multi-sourced optical solutions



Thank You



Essential technology, done right™