The evolution of cloud data center connectivity

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Bandwidth growth drives infrastructure expansion

More bandwidth

Data Center Bandwidth

2022 2027

90K

Petabits

50% CAGR

PAM accelerating

135M

Interconnect Ports*

Data Center Ports*

2022 2027

28% CAGR

NRZ

-2% CAGR

PAM

*Ethernet switch ports
PAM is port speeds of 200Gbps and greater
NRZ is port speeds of 100Gbps and lower

Source: 650 Group
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What keeps cloud operators up at night?

24x7, 99.999% availability

Downtime = significant revenue loss

Massive scale

1000s data centers worldwide
100s added every year

Reliability = Revenue and Reputation

Source: Analyst estimates
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What do cloud operators want?

**Bandwidth**
- Higher speeds
- Time to market
- Lower cost and power per bit

**Pluggable, multi-vendor ecosystem**

**Scale**
- Plug and play
- Backward / forward compatibility
- Asynchronous upgrades

**Reliability**
- Serviceability
- Diagnostics and telemetry
- Resiliency
Analog hits scale wall
DSP enables cloud data centers at scale
Who needs the DSP…
DSP essential to scale bandwidth reliably

“Linear drive technology still needs to be validated. Retimed DSP pluggables is the only proven way forward for the industry.”

LightCounting

“The idea that somebody with such intimacy on network requirements would recklessly discard the DSP… seems nonsensical.”

fibeReality

“LDD vs. DSP; Pluggables Have the Ball: LDD to potentially play a limited role in some future architectures but see pluggable PAM4 DSP dominating for the foreseeable future.”

Oppenheimer

“Linear drive interface (LDI) generated a lot of buzz at OFC……most of the networking engineers we spoke to agreed that this technology has significant limitations…not plug and play…not likely to be a competitive threat to Marvell’s DSP-based architecture”

JP Morgan
Why is DSP essential?

- Digital SerDes → Compensates electro-optical impairments
- Error correction → Resolves component variations
- Telemetry → Enhances network monitoring and reliability
- Gearbox → Enables heterogenous network

10s of millions Marvell DSPs deployed
Demand for DSP increases in **future** data centers

**Inside data center**
- Increasing data rates
- Transition to AEC

**Between data centers**
- 400ZR with Coherent DSP
- Gateway

**Demand for DSP increases in future data centers**

*DAC: Direct Attach Copper; AEC: Active Electrical Cable*
Demand for DSP increases with **AI/ML**

- 2x speed every 18-24 months
- Fast deployment
- 24x7 availability, no downtime

Source: ChatGPT, Medium, Towards Data Science
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Expanding DSP opportunity ahead

More use cases → AI/ML, ZR, AEC

More DSPs

Early stages of adoption

More customers to come

Exponential data growth

Higher speeds, ASP uplift
Key takeaways

1. Growing bandwidth creates scale and reliability challenges
2. Pluggable DSP ecosystem essential
3. AI/ML massively accelerating DSP adoption
4. Expanding DSP opportunity ahead
Q&A