



# Marvell's Vision for Transforming Cloud Data Centers with CXL

**Dan Christman, EVP, Storage Products Group**

**Thad Omura, VP, Flash Marketing**

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# Forward-looking statements

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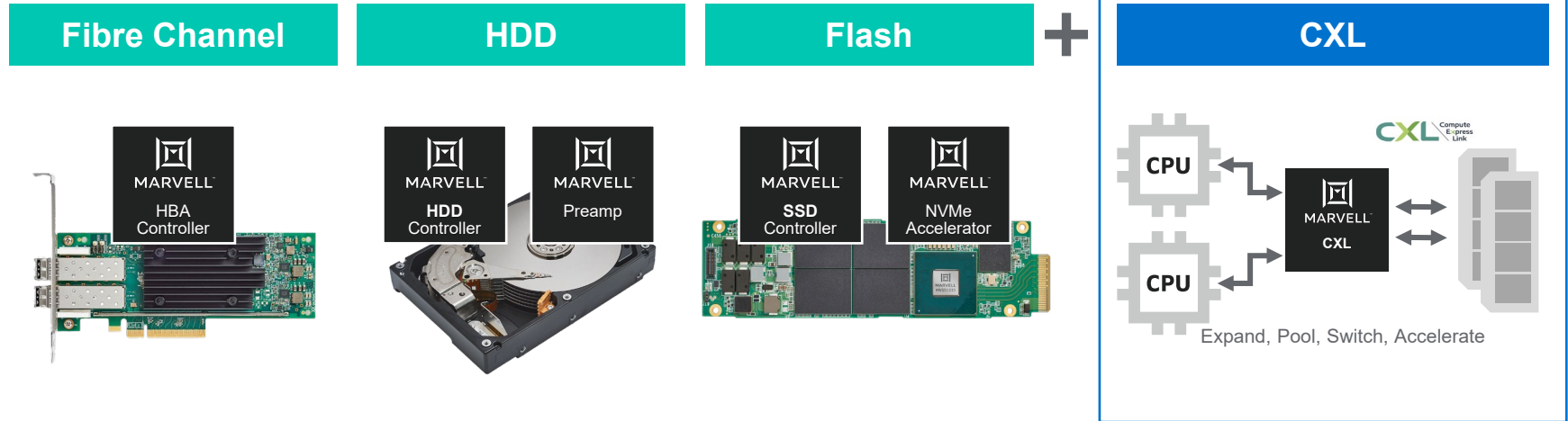
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# Dan Christman

EVP, Storage Products Group

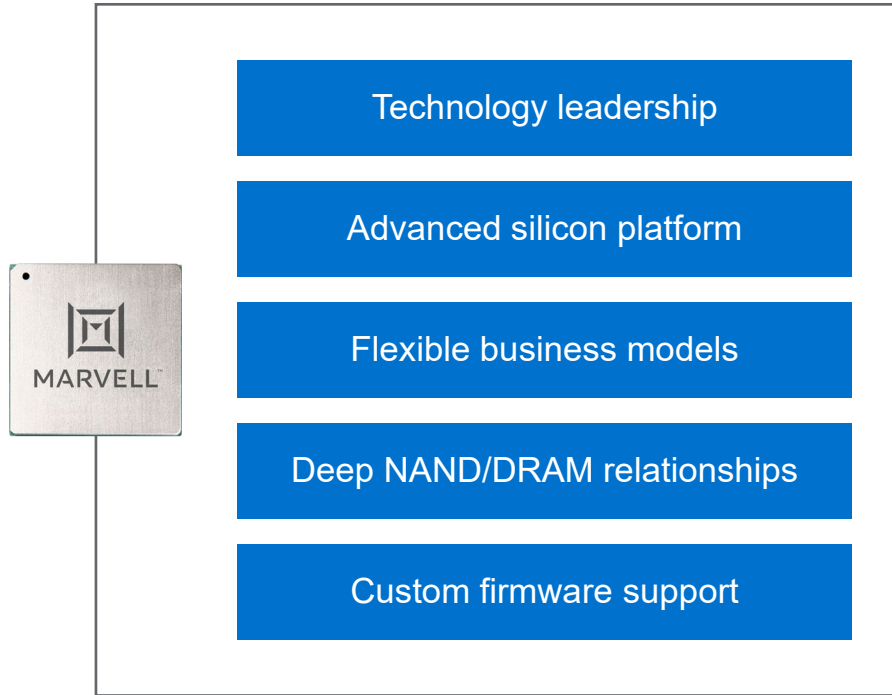


# Storage products group business



**Expanding our market opportunity**

# Uniquely positioned to win in storage and memory



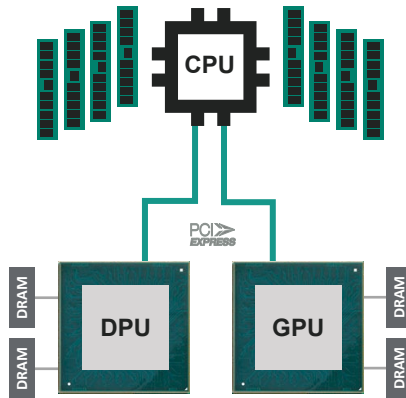
# Thad Omura

VP, Flash Marketing



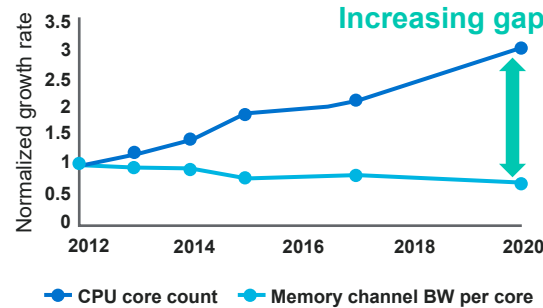
# Cloud data center memory challenges

## Memory tied-down to xPUs



Cannot share

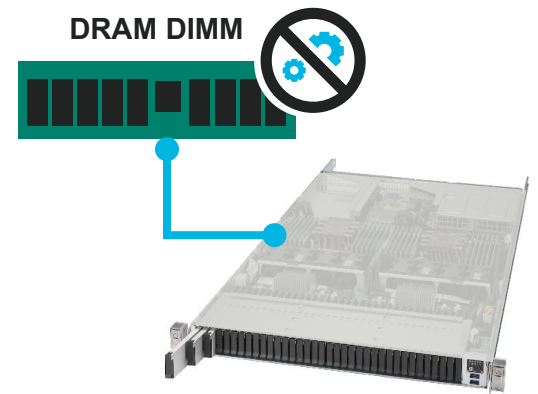
## Bandwidth per core declining



Source: Meta, OCP Summit Presentation Nov 2021

Degrades efficiency

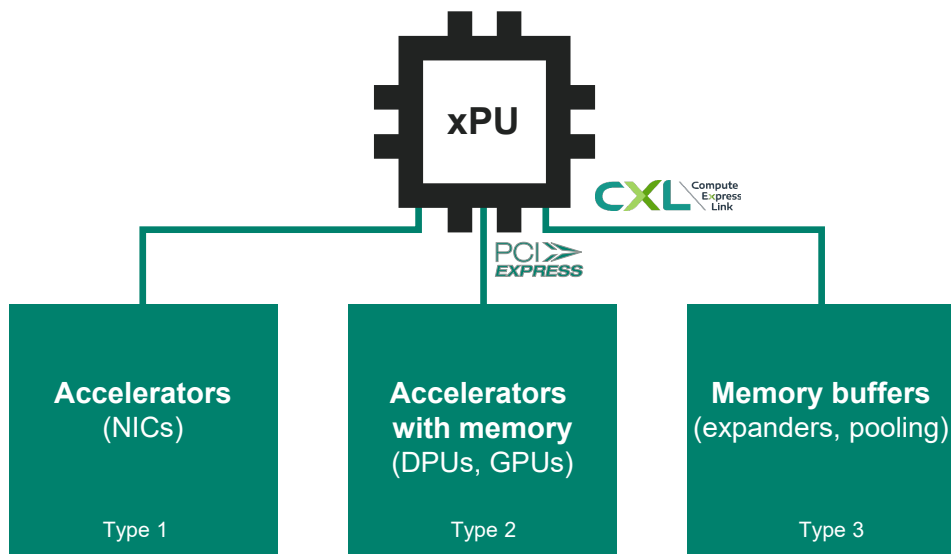
## No near-memory compute



Limits performance

# CXL is poised to address these issues

# What is Compute Express Link (CXL)?



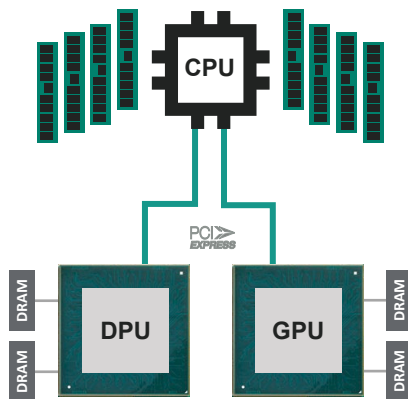
- Industry standard protocol
- Runs over PCI Express
- Low-latency interconnect
- Memory-optimized
- Cache-coherent

**Tremendous ecosystem momentum driven by data center leaders**



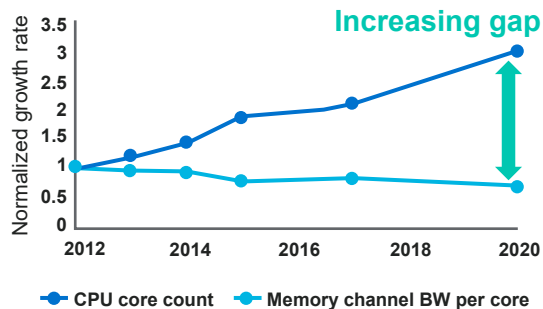
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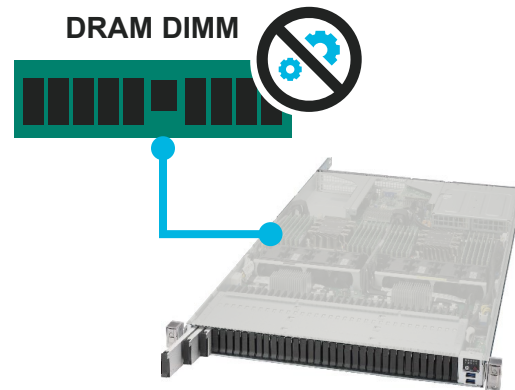
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CXL Expander

CXL Expander

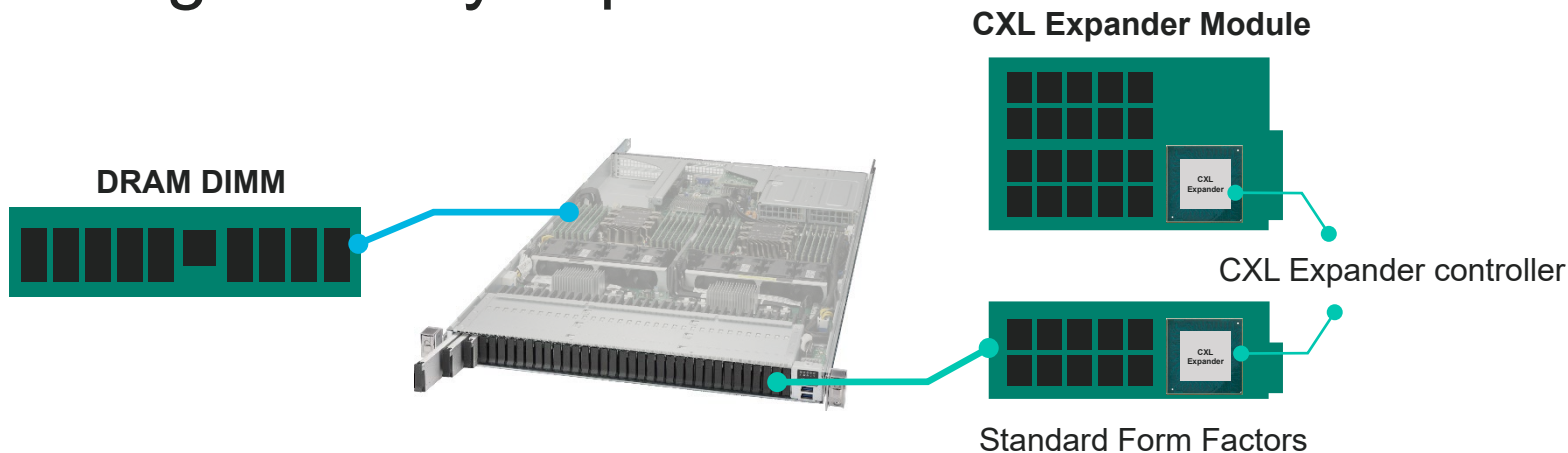
CXL Accelerator

CXL Pooling

CXL Switch

**CXL is poised to address these issues**

# Addressing memory expansion



## DIMM challenges

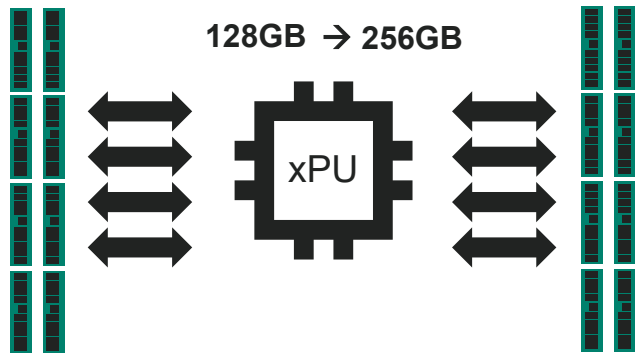
- Limited scalability
- Not serviceable
- No telemetry

## CXL solution

- Scalable
- Pluggable
- Telemetry
- Improved thermals
- Mix-and-match DRAM
- Config flexibility

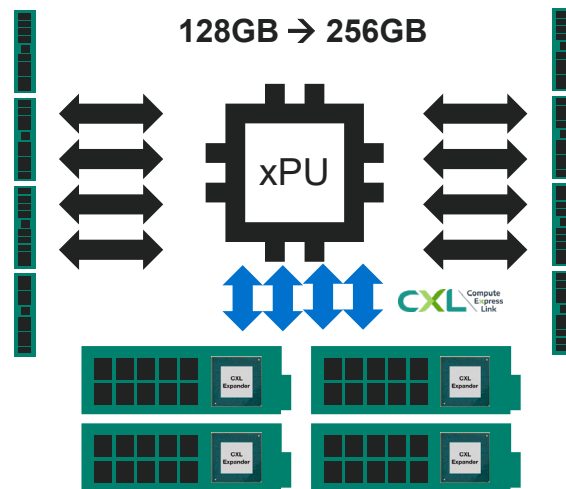
# CXL memory expanders improve performance

Today: 2 DIMMs per channel (2DPC)



1DPC same bandwidth as 2DPC

1DPC + CXL Expanders

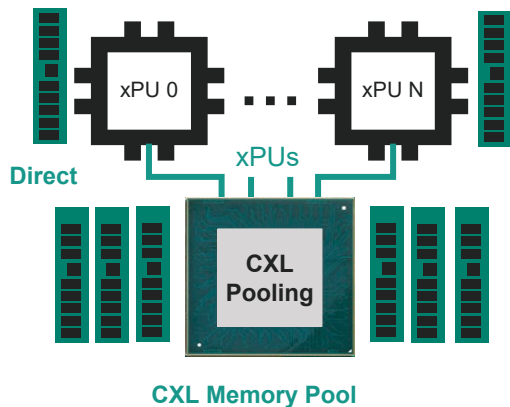


Use PCI Express to open bandwidth

**Same capacity with greater bandwidth and utilization**

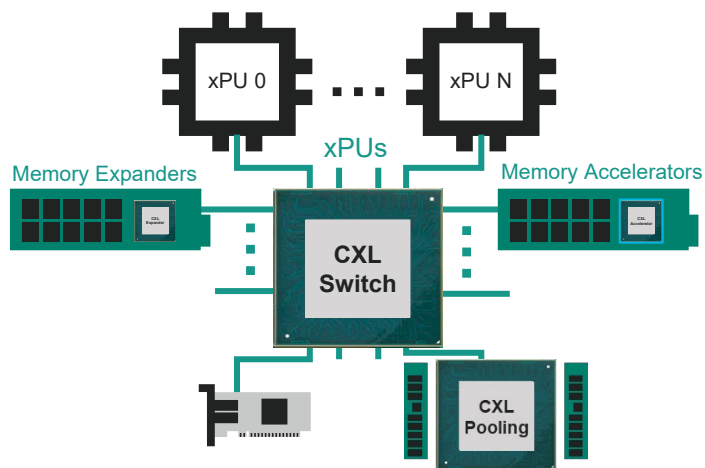
# Sharing memory with CXL

## CXL Pooling



- Pool memory across multiple xPUs
- Rescue under-utilized DRAM
- Scale memory independent of xPUs

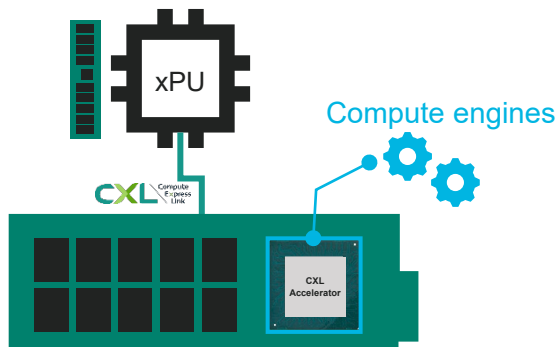
## CXL Switch



- Flexible to connect resources into fabric
- Scalable, serviceable
- Enables fully composable infrastructure

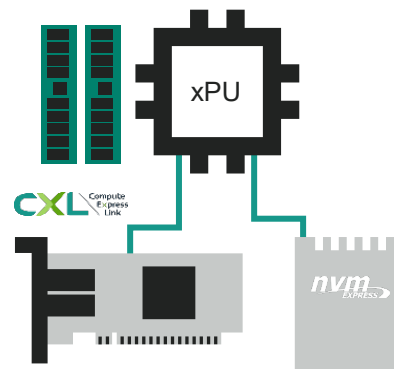
# Accelerating with CXL

## CXL Accelerator



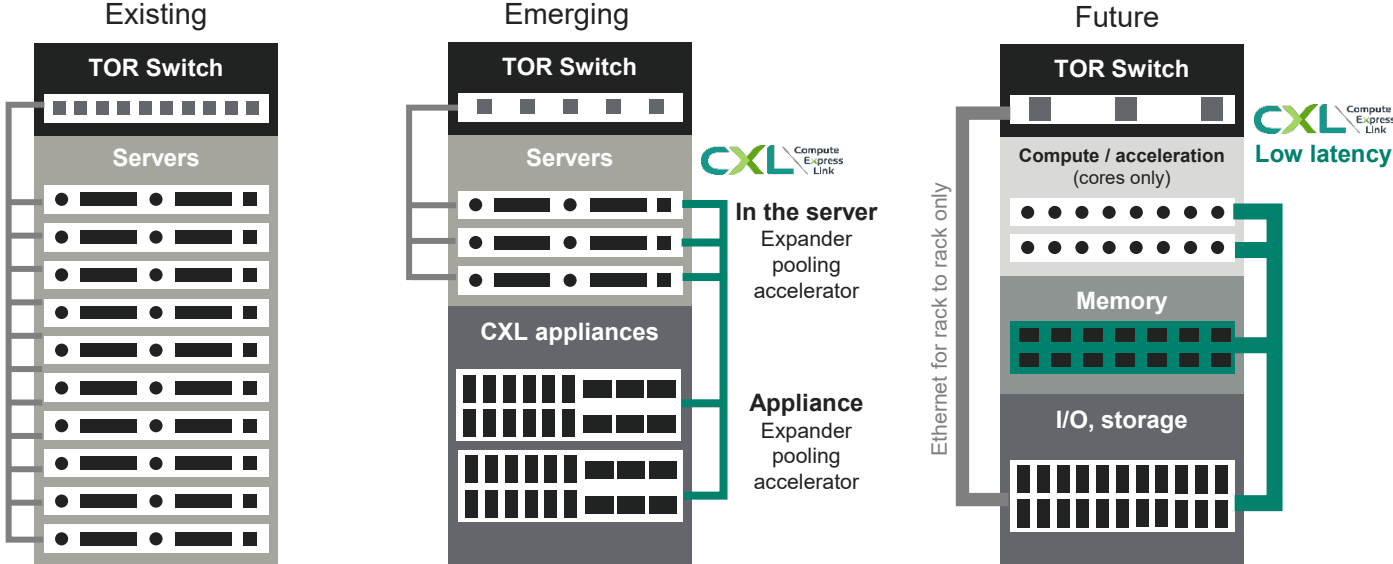
- Coherent, efficient
- Accelerate analytics, ML, search, etc.
- Improves efficiency and TCO

## CXL I/O Acceleration



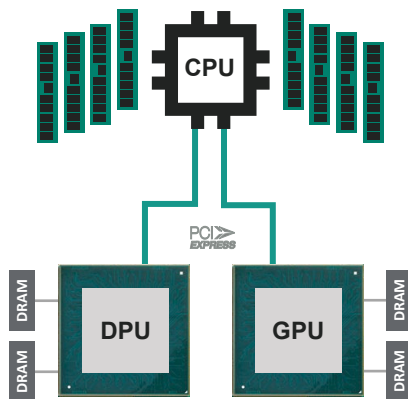
- DPU/NIC, SSD, ...
- Accelerate protocol processing
- Composable I/O devices

# CXL data center vision: full composability



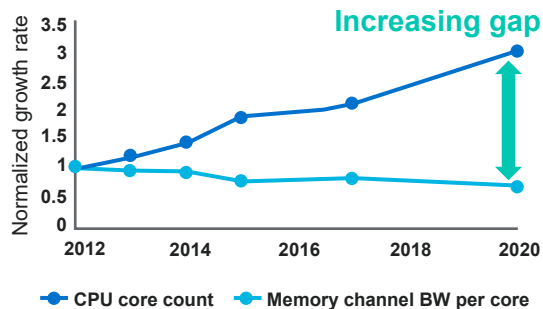
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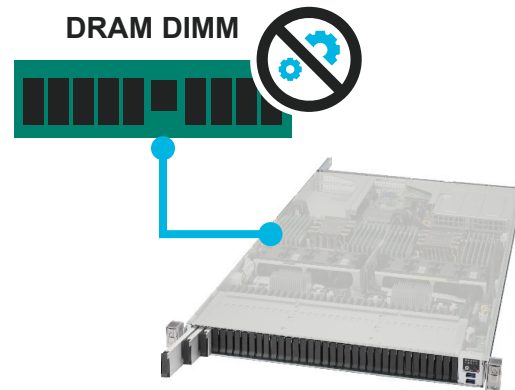
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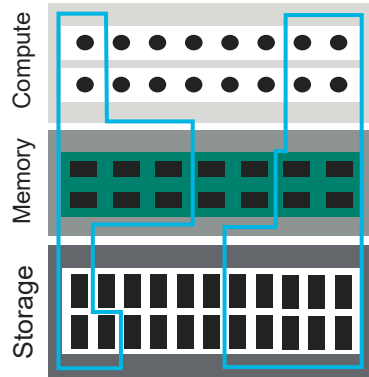
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**CXL is poised to address these issues**



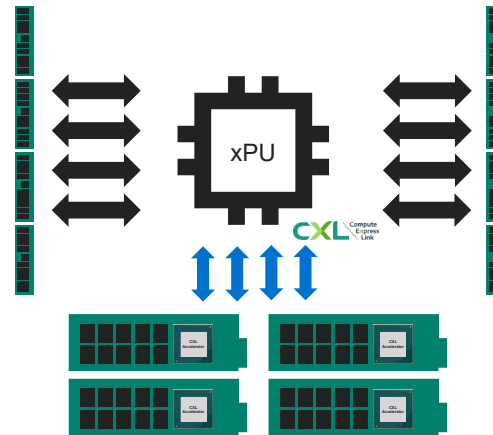
# CXL *solves* data center memory challenges

## Disaggregated memory



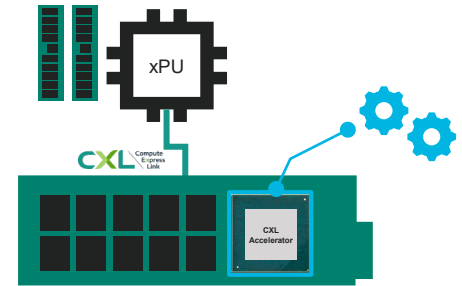
Fully composable

## More bandwidth per core



Optimize efficiency

## Near-memory computation



Ultimate performance

**CXL is disrupting cloud data center architectures**

# CXL technology roadmap

**CXL 1.1**

**Architect**

Memory Expanders

**PCIe 5**

**CXL 2.0**

**Deploy**

- + Pooling
- + Switch
- + Accelerators
- + I/O

**PCIe 5**

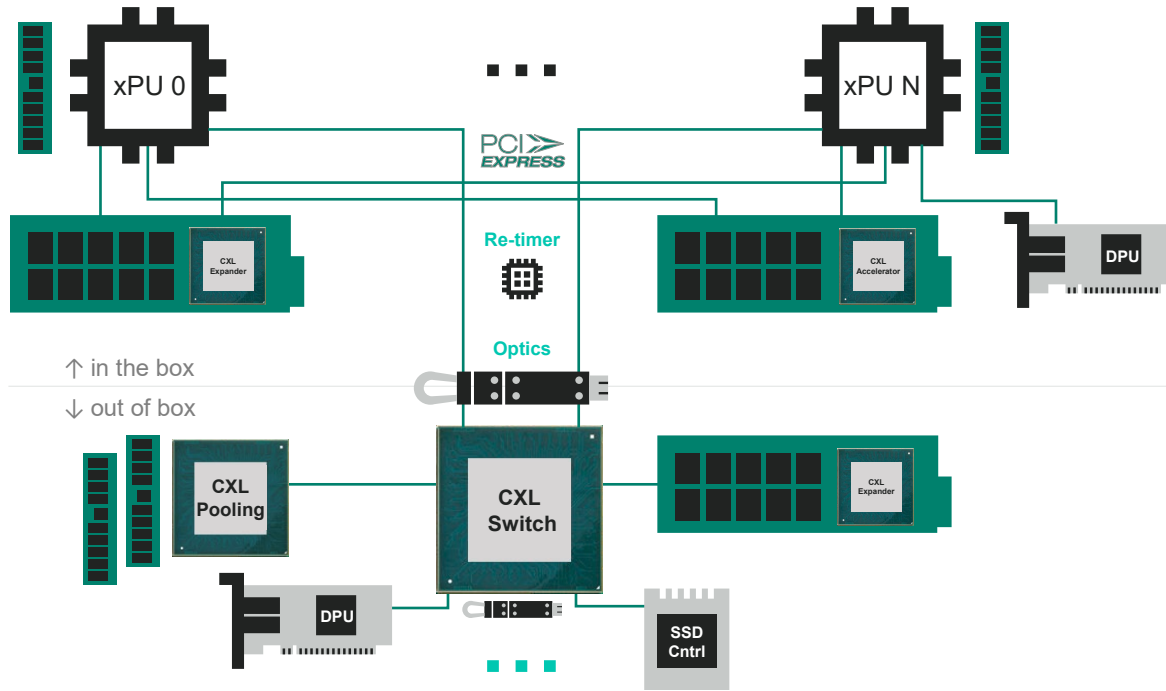
**CXL 3.0**

**Scale**

- + Full hot plug
- + Switch w/ composability

**PCIe 6**

# Comprehensive end-to-end CXL solutions



## CXL opportunities

- Expanders
- Pooling
- Switch
- Accelerators
- Custom Compute
- DPUs / SmartNICs
- Electro-optics
- Re-timers
- SSD Controllers

**Multi-billion \$ opportunity**

# Summary

1

CXL is disrupting cloud data center architectures

2

Uniquely positioned to enable end-to-end CXL in data center

3

CXL is driving the next multi-billion-dollar opportunity



Thank You



Essential technology, done right