CXL 2.0 Use Case
Using Both DDR4 & DDR5 on the Same Server to Allow Memory & Bandwidth Scaling

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MEMORY FABRIC FORUM

OCP GLOBAL SUMMIT

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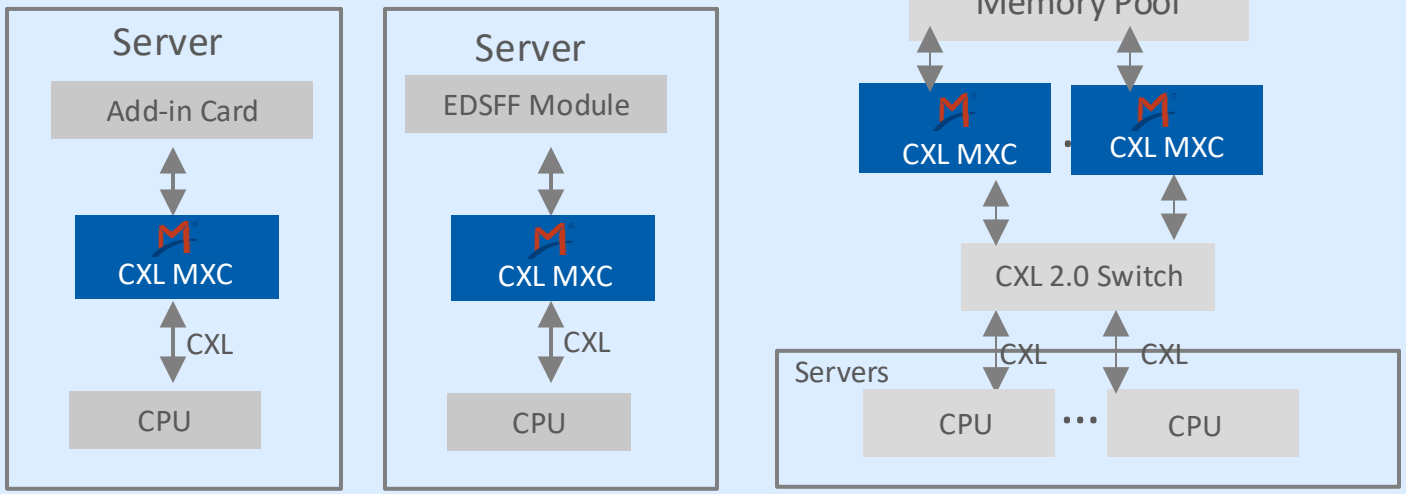
SAN JOSE, CA

About Montage Technology

- More than 20 years in memory products - leading the industry on DDR4 and DDR5 memory interface products
- PCIe Gen 4 and 5 Retimer portfolio with design wins around the world
- Leading in shipments and mass production of CXL controllers
- World Wide ecosystem enabling in cloud computing & data center markets

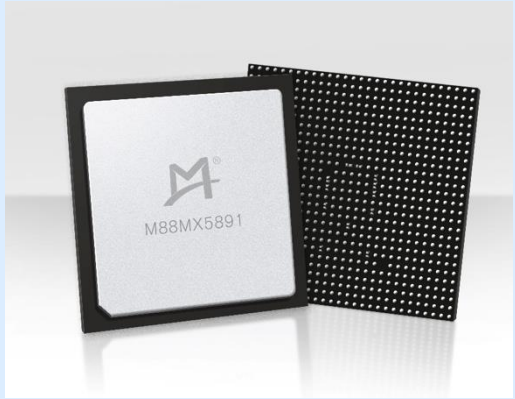
CXL technology-based solutions available today and future products in the pipeline!

CXL Adoption in the Datacenter



Memory Expansion

Memory Pooling

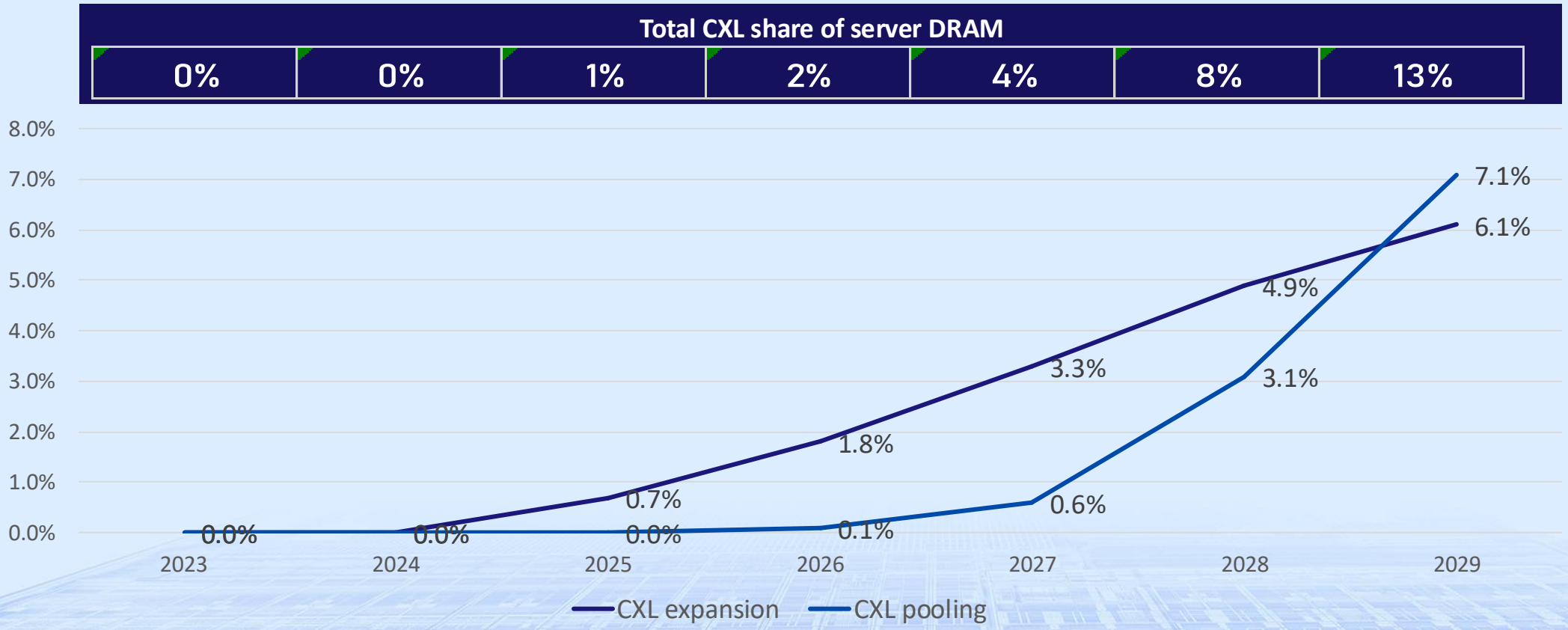


- Industry's leading Type 3 CXL Memory eXpander Controller (MXC)
- Providing high-bandwidth and low-latency interconnect between CPU and CXL-based devices to enable memory expansion and pooling for data centers
- Compliant with DDR4/DDR5 JEDEC and CXL 2.0 specifications, supporting PCIe 5.0 speeds
- Designed for use in Add-In Card (AIC), EDSFF Memory Module and CXL pooled memory

CXL Share of Server Bit Demand

DRAM behind CXL will grow to ~10% of server DRAM by 2029.

Share of server bit demand*

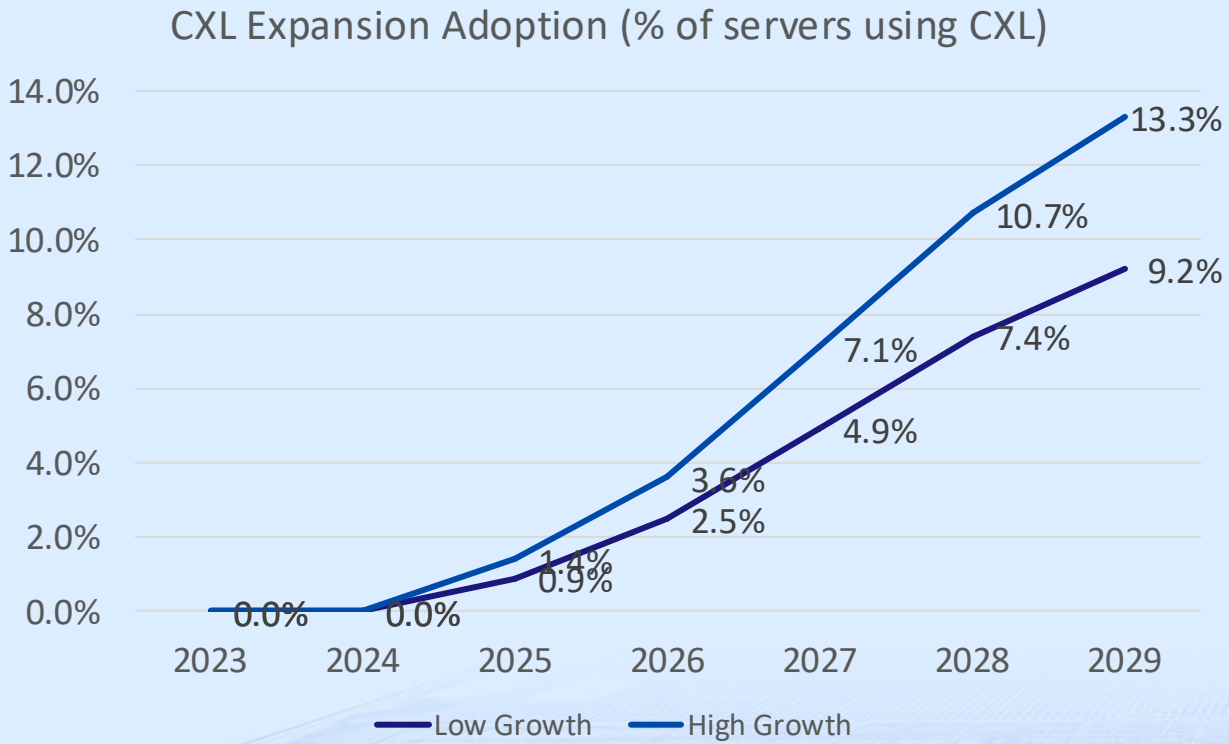


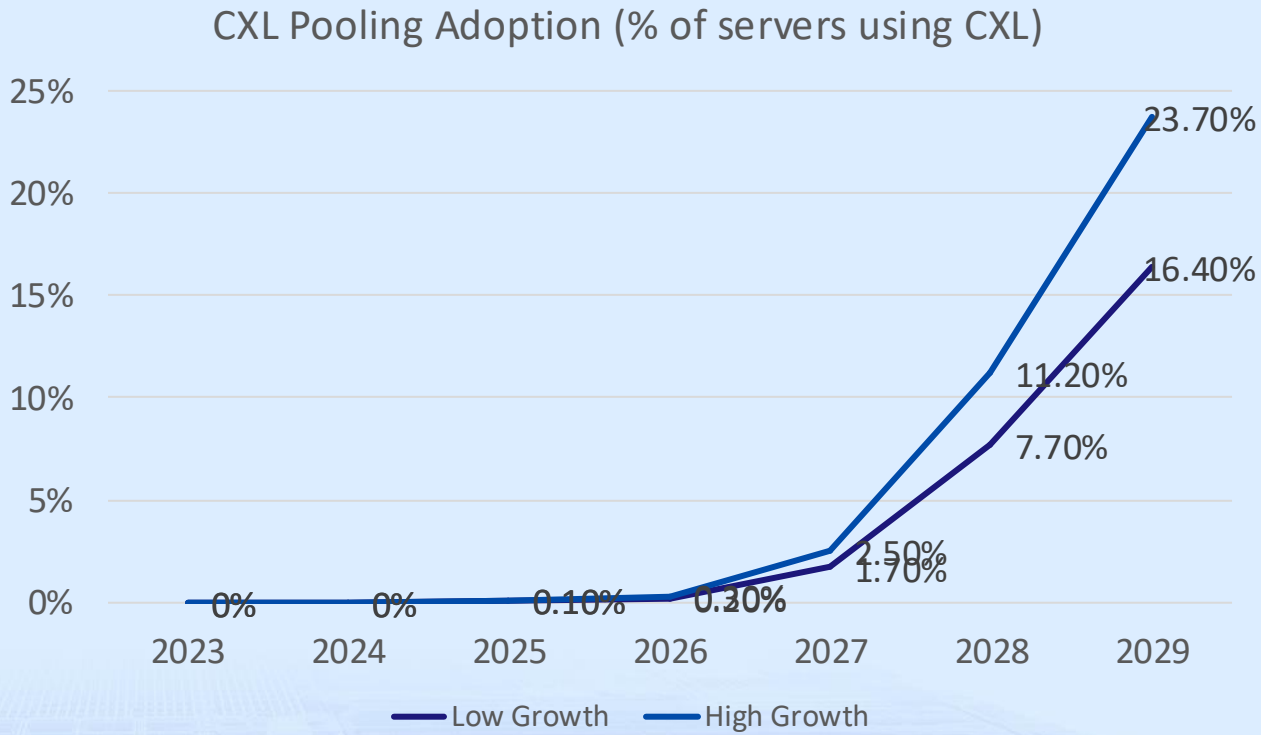
* Excludes GDDR and HBM

Source: Tech Insights Aug '24

CXL Adoption in the Datacenter – Two Areas of Opportunity

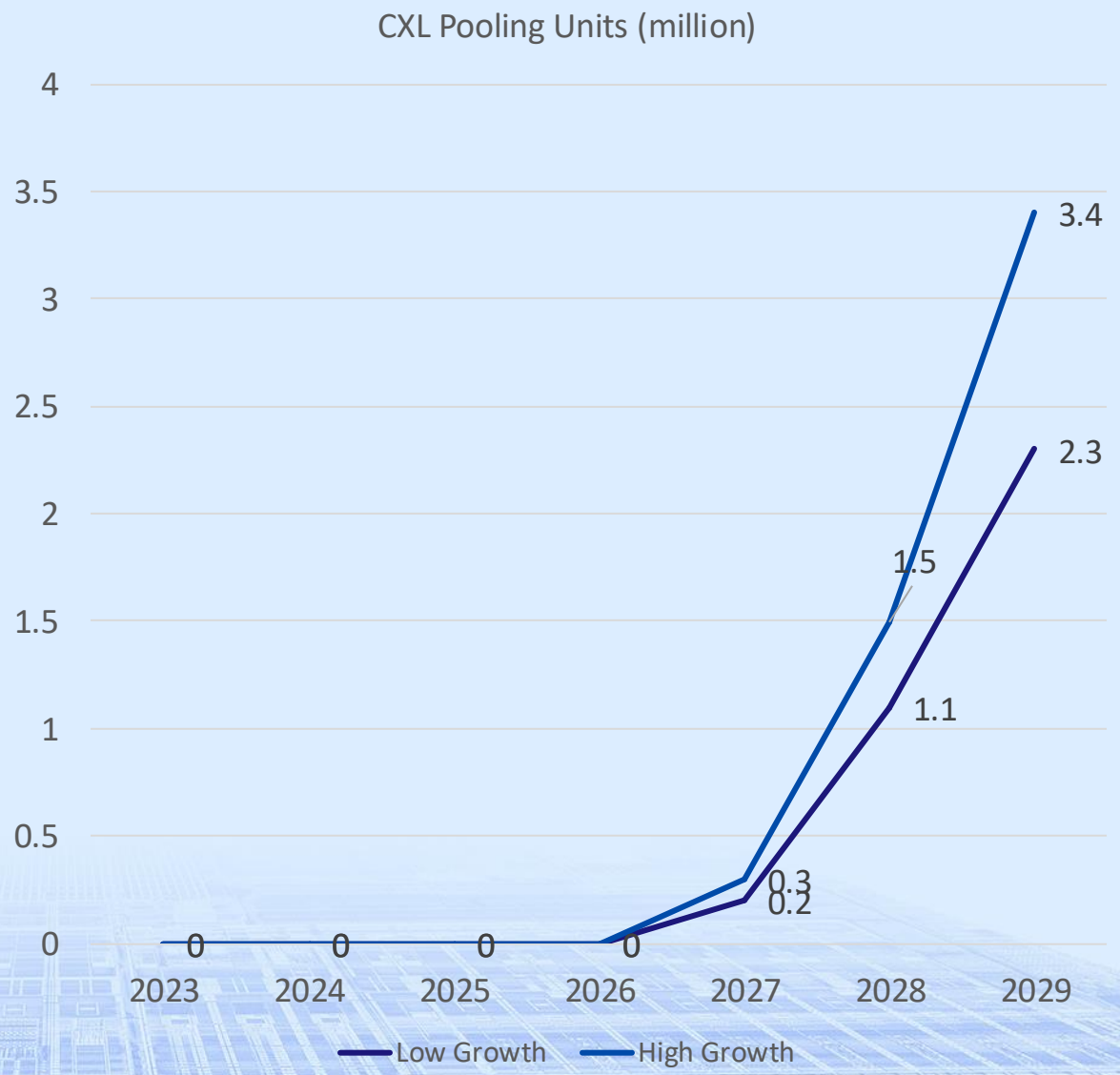
Expansion usage is being challenged by 32Gb monolithic die (and corresponding 128GB RDIMM) & the emergence of MRDIMM (with higher bandwidth).





Source: Tech Insights Aug '24

CXL adoption in the datacenter - units



Source: Tech Insights Aug '24

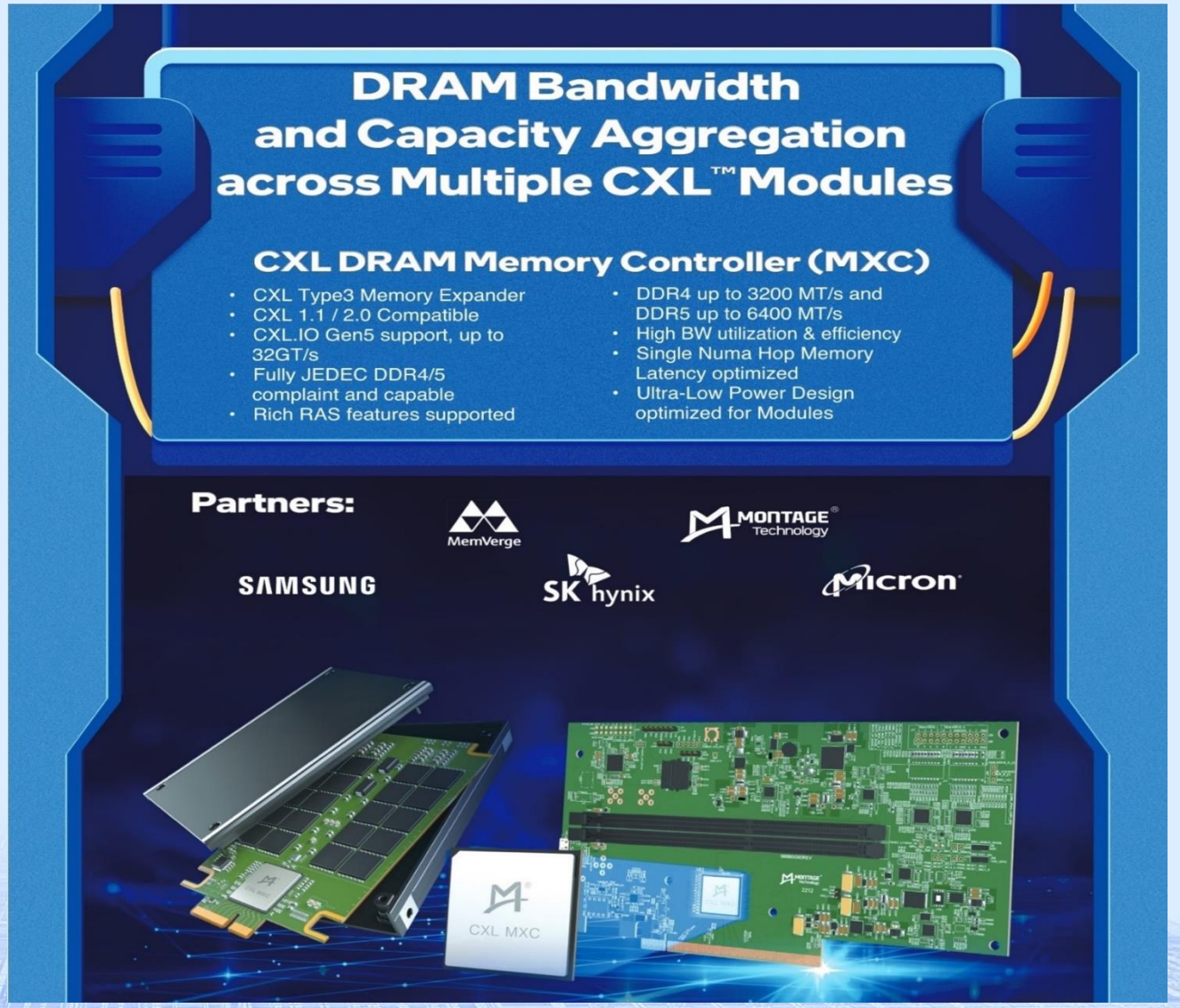
CXL Memory eXpander Controller: MXC

M88MX5891 MXC GEN1 Product:

- CXL Type 3 Memory Expander
- CXL 1.1/2.0 compliant
- DDR4-3200 up to 2DPC
- DDR5-5600 1DPC and DDR5-4800 2DPC
- Rich RAS features
- Security Features
- Support E3.s without using RCD
- Ultra Low Power

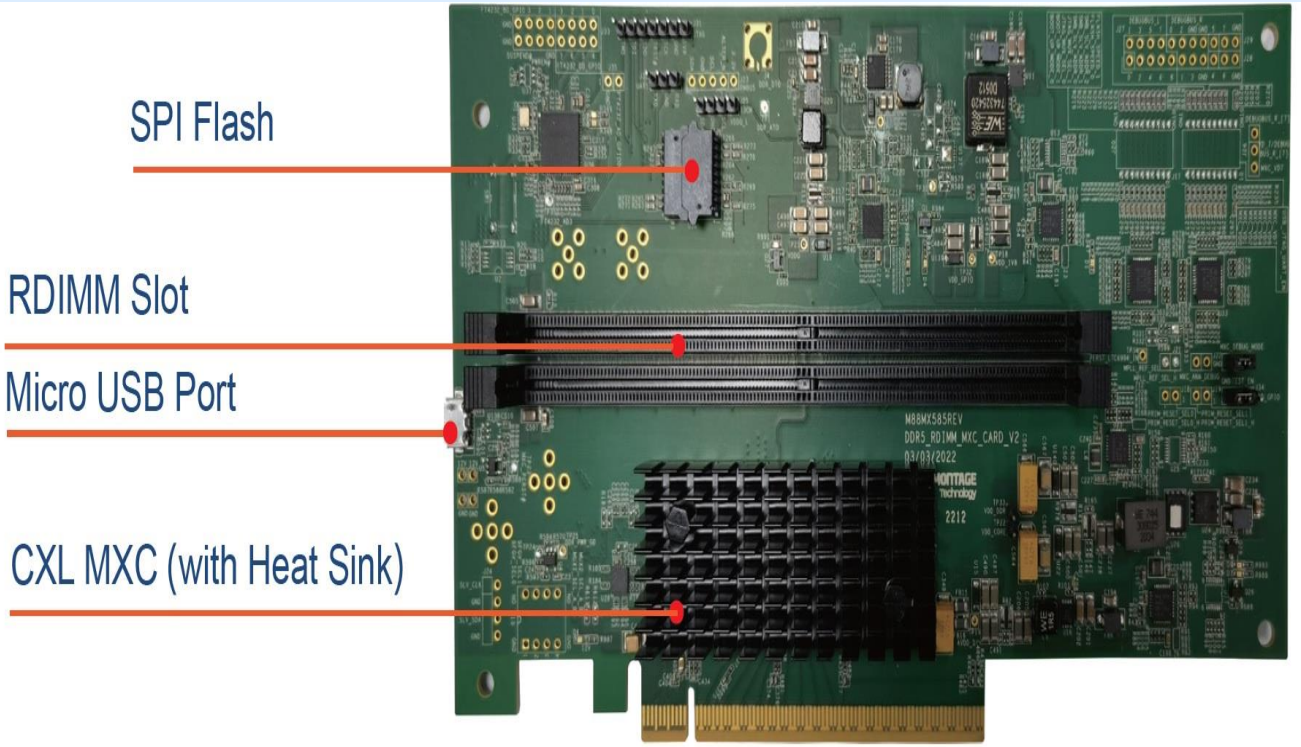
M88MX5851 MXC GEN2 Product addition:

- Support DDR5 only
- DDR5-6400 and DDR5-5600 2DPC
- 100ns Pin to Pin Latency
- Meta Data Storage
- CXL.IO & CXL.MEM IDE
- Montage DDR Characterization Features



MXC Features

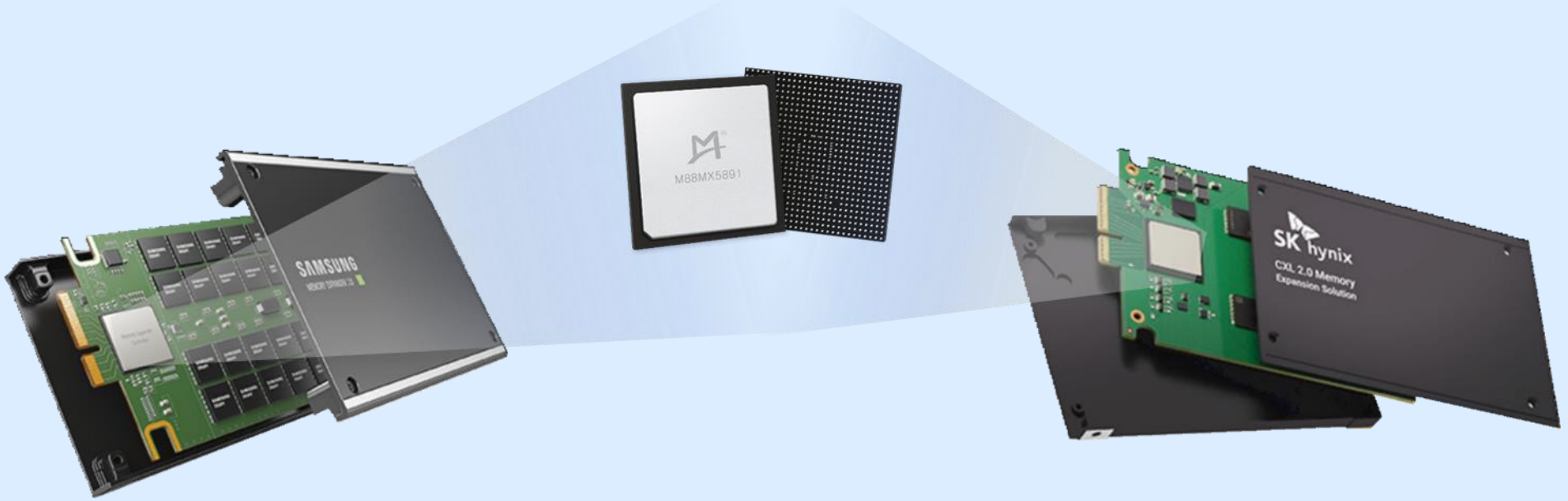
The MXC provides *high-bandwidth and low-latency interconnect* between the CPU and the CXL-based devices, allowing them to share memory for higher performance, reduced software stack complexity, and lower data center TCO.



CXL MXC Evaluation Board (DDR5 RDIMM)

- CXL Type 3 Memory eXpander Controller
  - Integrated x8 CXL Controller
  - 1 Channel DDR 4-3200/DDR5-5600 Controller (GEN1)
  - 1 Channel DDR5-6400 Controller (GEN2)
  - RISC-V micro-processor
  - On-Chip PVT Sensor
  - SMBus, I3C, I2C, SPI, JTAG, UART
  - Integrated RCD for E1/E3 application
  - Rich RAS Feature:
    - Advanced ECC to correct x4 DRAM device
    - Support Meta Data & poison bit
    - hPPR & sPPR
    - Others
  - 19mmX19mm FCCSP package with 0.7mm pitch
- Security
  - Secure Boot
  - Device Authentication & Attestation
  - DICE
  - Secure FW
- Management
  - Support PLDM, SPDM, CCI over MCTP
  - Supports MCTP binding to SMBus, VDM, I3C(GEN2)
  - Supports Mailbox

CXL® MXC Adopted by Well-known Customers

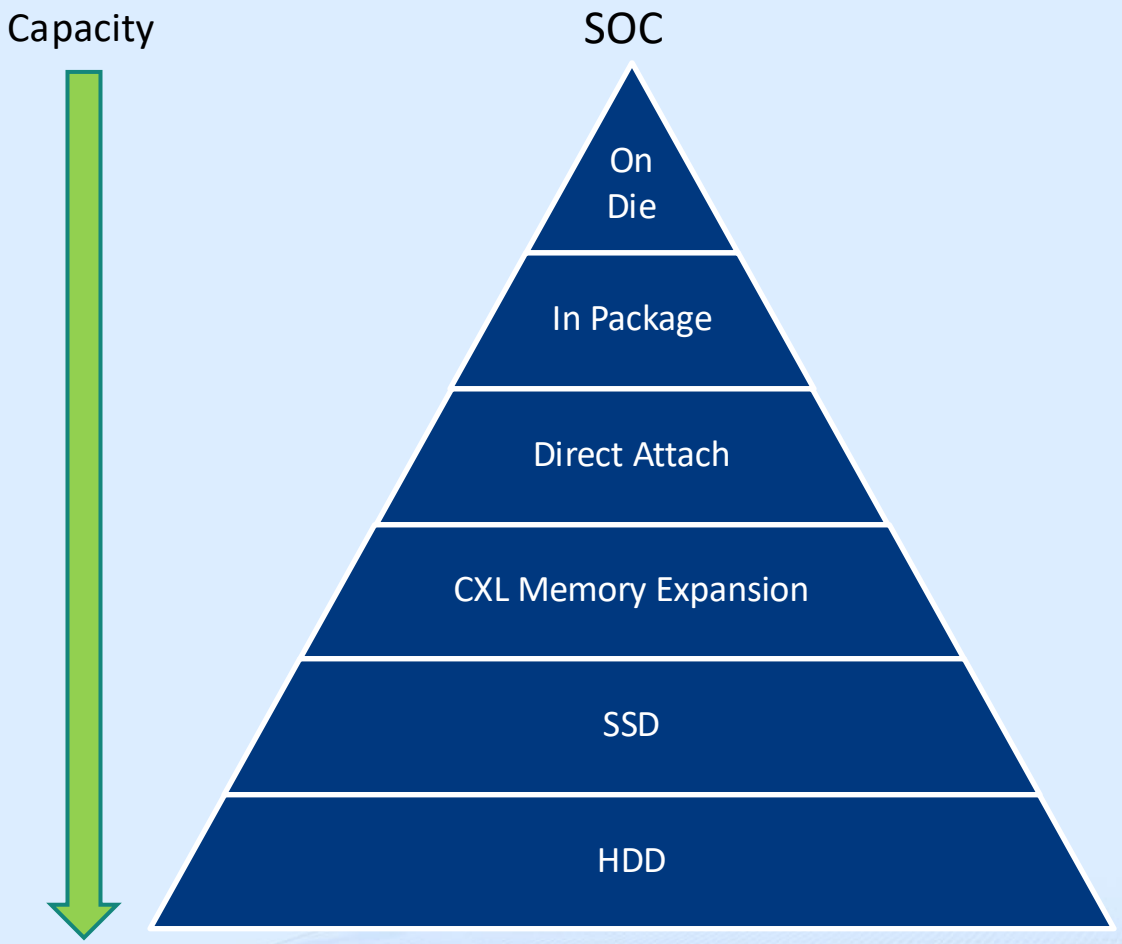


Montage's CXL MXC has been used on Samsung's first 512GB CXL® memory module

Montage's CXL® MXC has been used on SK hynix's first DDR5 DRAM-based CXL memory module

Note – we have an additional 6 smaller suppliers making AIC and E3 using our controller.

MXC Performance

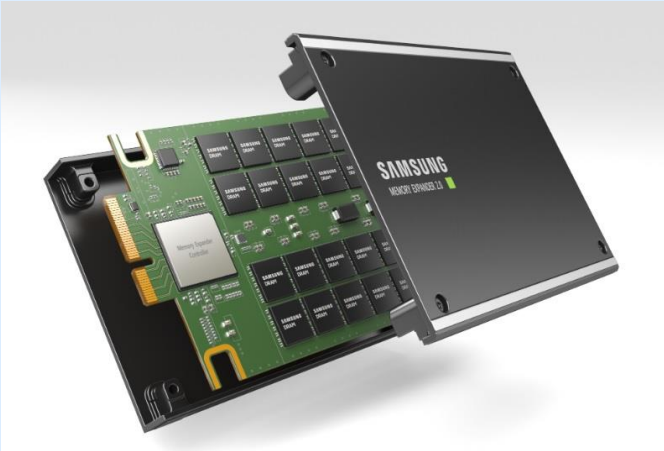


Direct Attach Memory is not able to keep up with the capacity/BW requirements per core.

CXL Memory Expansion addresses this issue!

- 4 ranks DDR5 per sub channel
- Two 40bit DDR5 Sub Channels
- One 72-bit DDR4 channel
- 2 DIMMs per channel
- Accommodate up to 80 DRAM placements
- Low Power
- 1.28TByte Capacity with 3DS DRAM
- Latency Optimized to 1 NUMA hop

MXC Readiness – Components Available Now



Samsung's CXL Memory Module with Montage's CXL Memory eXpander Controller
(Source: Samsung Electronics)

Status

- ✓ All major SOC suppliers
- ✓ All major memory suppliers

Contact your module provider for solution availability.


MemoryViewer
MONTAGE Technology
Version v1.2.2
MONTAGEDEMO01
System Topology
Overview
CXL: Micron (DDR5)
Capacity: 128.00 GB
Device Vendor: Montage
CXL: SK hynix (DDR5) E3.S
Capacity: 96.00 GB
Device Vendor: Montage
CXL: Samsung (DDR5) E3.S
Capacity: 128.00 GB
Device Vendor: Montage
CXL: Micron (DDR4)
Capacity: 128.00 GB
Device Vendor: Montage
x8CXL
intel CPU 0
intel CPU 1
- 17 GB/s Read Write Bandwidth
- 2 GB/s Read Write Bandwidth
CXL Memory Capacity 480.00 GB
DRAM Capacity 94.10 GB
System Total Capacity 574.10 GB
MemVerge
Usage
Throughput
CPU
DRAM
Real Time
read
write
2.3 GB/s
1.9 GB/s
1.4 GB/s
954 MB/s
477 MB/s
0.0 B/s
09:47
09:48
09:49
09:50
09:51
CXL Memory
Real Time
read
write
20 GB/s
17 GB/s
14 GB/s
11 GB/s
8.4 GB/s
5.6 GB/s
2.8 GB/s
0.0 B/s
09:47
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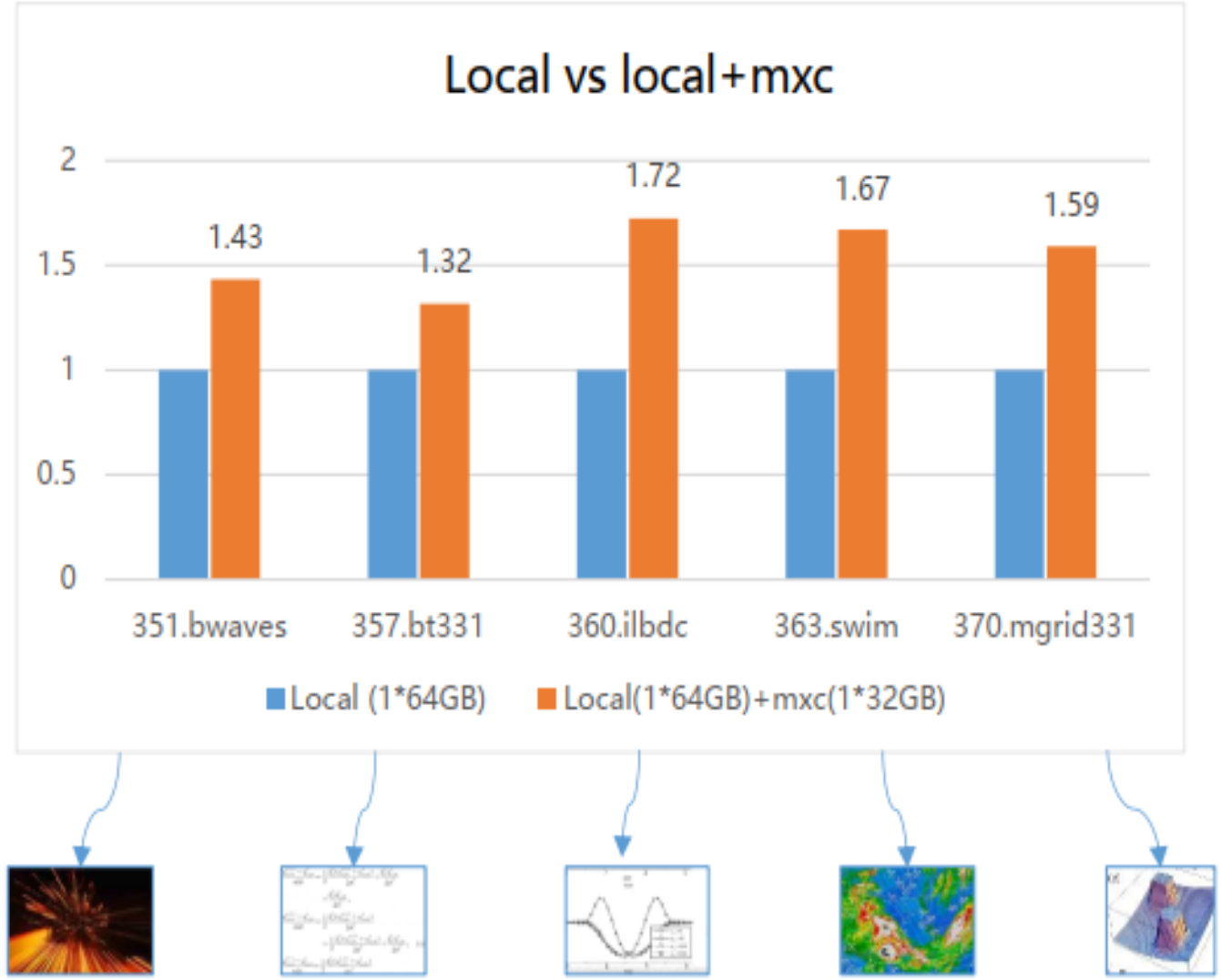
Summary: CXL improves the performance of specific applications in the SPECOMP2012



Platform: Archercity CPU: D0 CPU*1 BIOS: 83D22REL DIMM: 64GB Samsung*1 OS: ubuntu20.4 Kernel:5:18 Test cmd: ./app	Platform: Archercity CPU: D0 CPU*1 BIOS: 83D22REL DIMM: 64GB Samsung*1 OS: ubuntu20.4 Kernel:5:18 MXC FW:30R02 MXC DIMM: Samsung 1Rx4 32GB Test cmd: numactl –N 0 –interleave=all ./app
Local (1*64GB)	Local (1*64GB) + mxc(1*32GB)

Call to Action

Now is the time to invest in CXL!

The MXC CXL controller is available from Montage today, both as raw silicon and on a reference board.

Add-in card, such as those offered by Samsung & SK hynix, are available today.

Servers with CXL slots are being offered by all major OEMs.

Demonstrations are available showcasing CXL's increases in BW and Capacity performance for memory-bound applications.

View our demo featuring multiple suppliers with multiple technologies & speeds - all working on Intel and AMD's latest platform.

Thank You