

Arm-Enabled Controllers for Storage and CXL Devices

Presenter: Matt Bromage, Senior Storage Segment Manager @ Arm

Agenda

- Key considerations for future storage controllers
- Challenge: increasing performance without increasing power
 - Benchmark results with Cortex-R82
- Technology intercepts for next-gen storage controllers
 - CXL
 - Near-data compute
 - Chiplets

Key trends to consider for future storage controllers

Increased Capacities

- TLC SSDs with large capacities of 16TB and 32TB available now
- QLC SSDs with ultra large capacities of 64TB and 128TB coming soon

Power-Efficient Performance

- Design Goal: Saturate the host interface bus for maximum bandwidth
- PCIe Gen5 and Gen6, UFS and eMMC

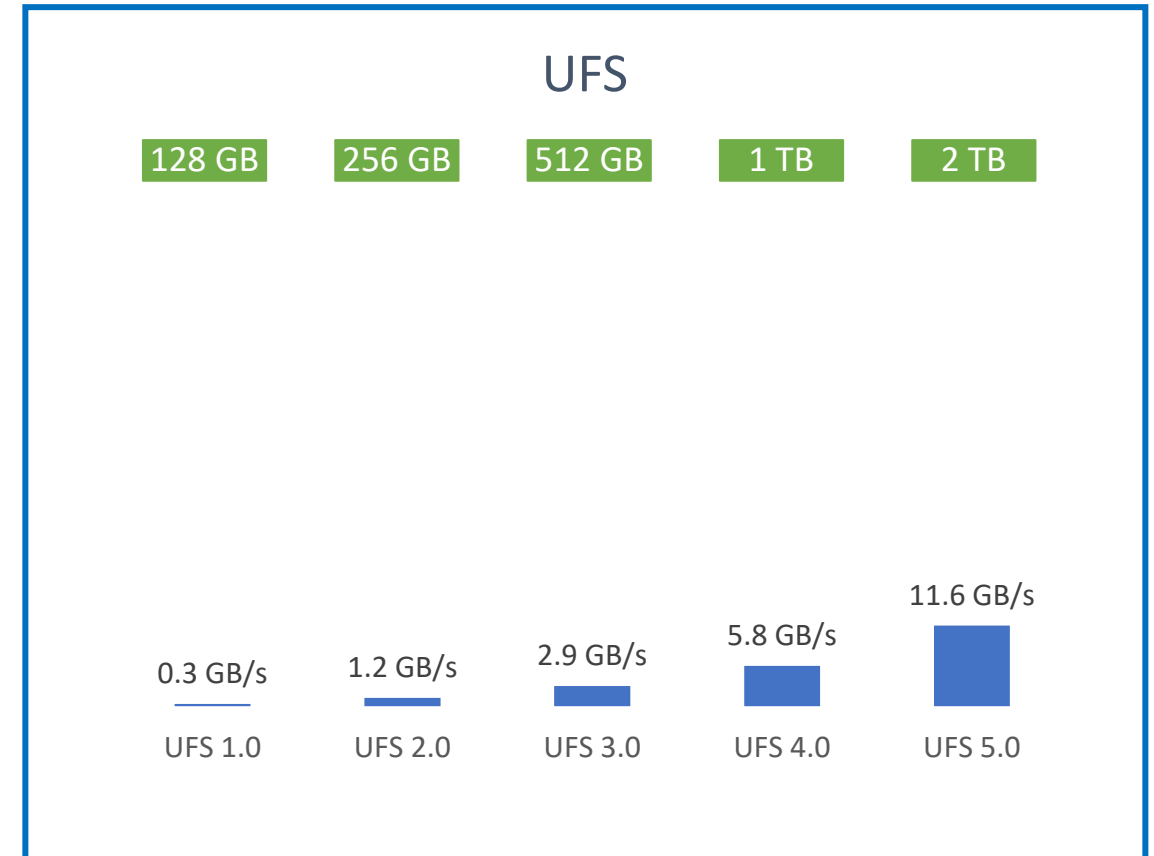
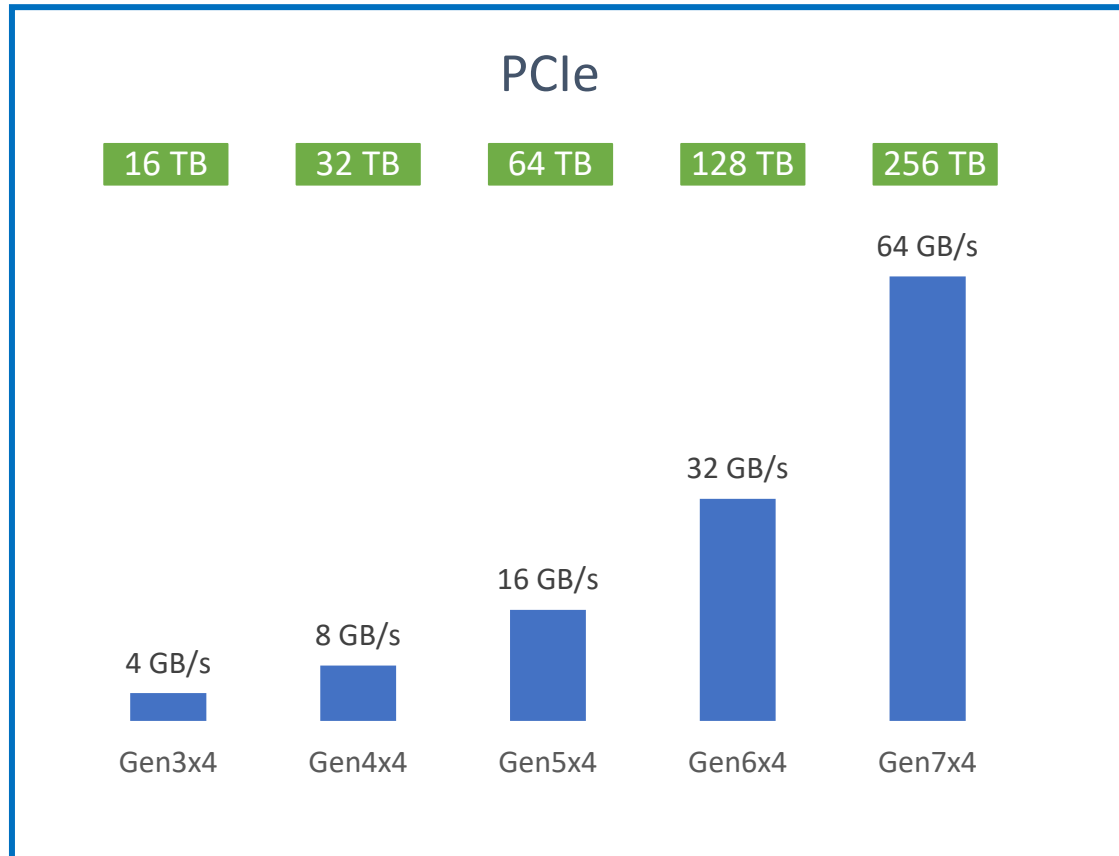
CXL Connectivity

- CXL provides a low latency & coherent interface for hosts to connect remotely to pools of SSD storage, Storage-Class Memories, and DRAM

Disaggregated Compute

- Instead of moving all the data to the host for processing, using the processing inside the drive where the data is located

Challenge: interface speeds and device capacities are doubling every 2-3 years

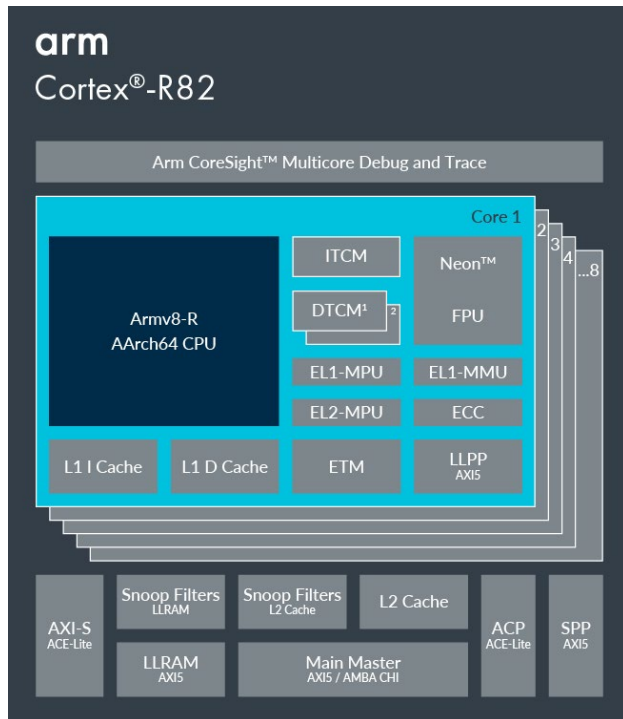


Power-efficient performance scaling and **flat memory addressing** will be two key design criteria for next-gen storage devices

Key Arm technologies to efficiently scale performance

PCIe Gen6 SSDs

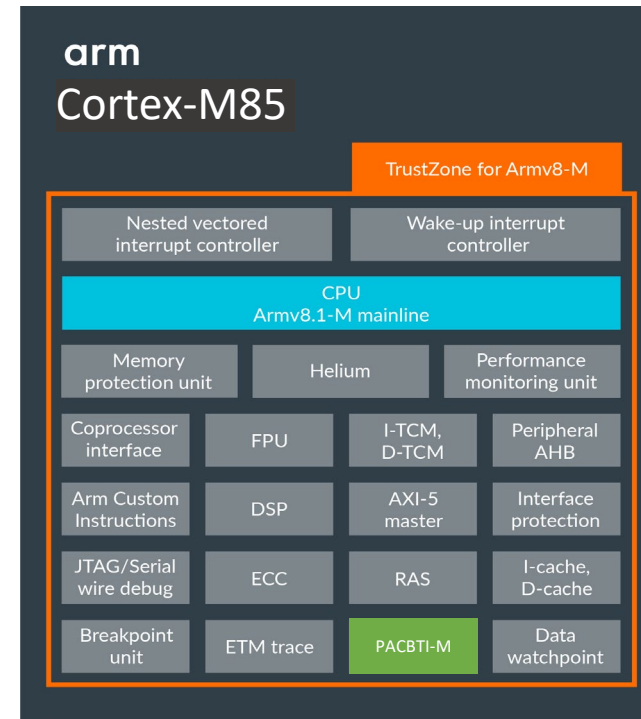
Highest performance, fully-featured Cortex-R for next-gen SSD and HDD controllers



- ✓ **Armv8-R ISA** for deterministic low latency
- ✓ **64-bit** to support higher capacities and up to 1TB flat memory space
- ✓ **TrustZone** compatibility operates in isolated, secure environments
- ✓ **Neon** for ML perf
- ✓ **MMU** for emb. Linux and disaggregated compute
- ✓ **CHI** cluster coherency
- ✓ +35% perf. efficiency
- ✓ +20% power efficiency
- ✓ +15% area efficiency

UFS 5.0 Embedded Flash

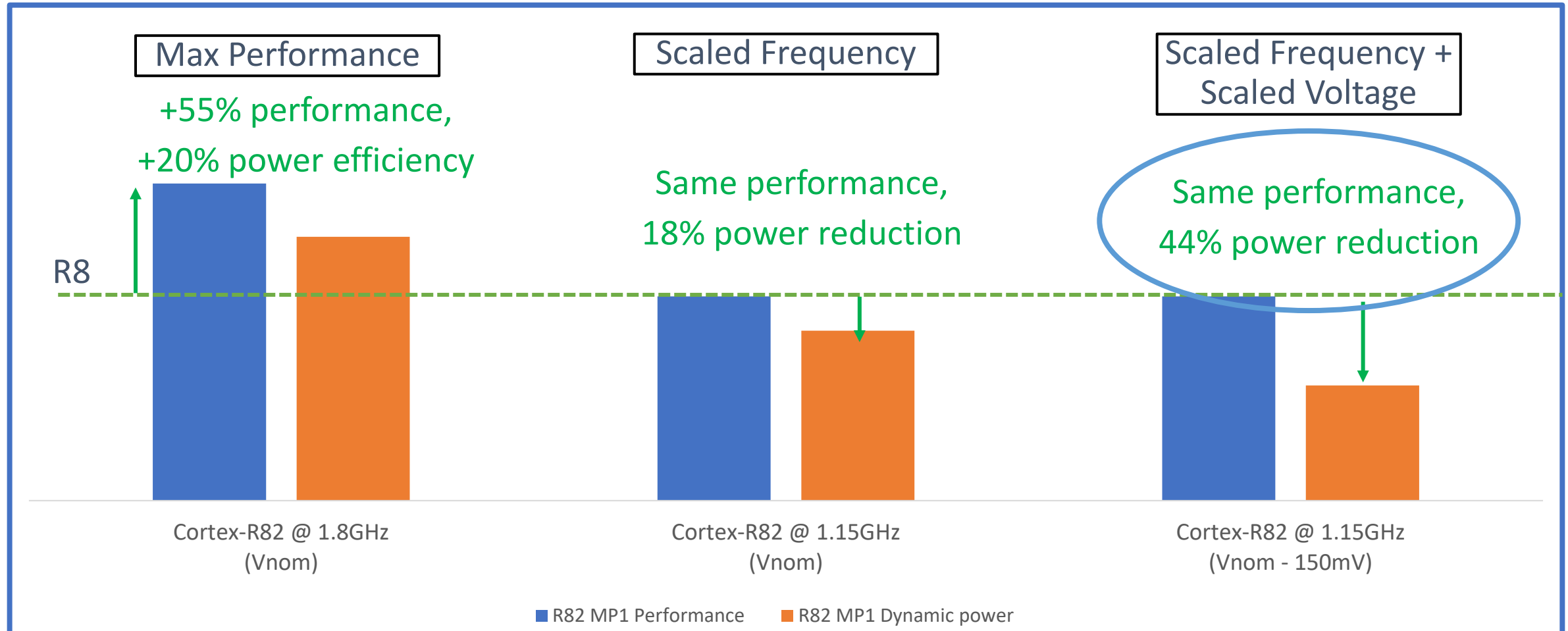
PPA-optimized, fully-featured Cortex-M for next-gen UFS and eMMC controllers



- ✓ **Armv8-M ISA** for ultra low latency
- ✓ **Arm Custom Instructions** for efficient execution of workloads
- ✓ **TrustZone** execution for secure, isolated compute
- ✓ **PAC/BTI** for reliable and secure operation
- ✓ **Helium** vector extensions for ML and DSP perf
- ✓ 4x ML performance
- ✓ 3x DSP performance

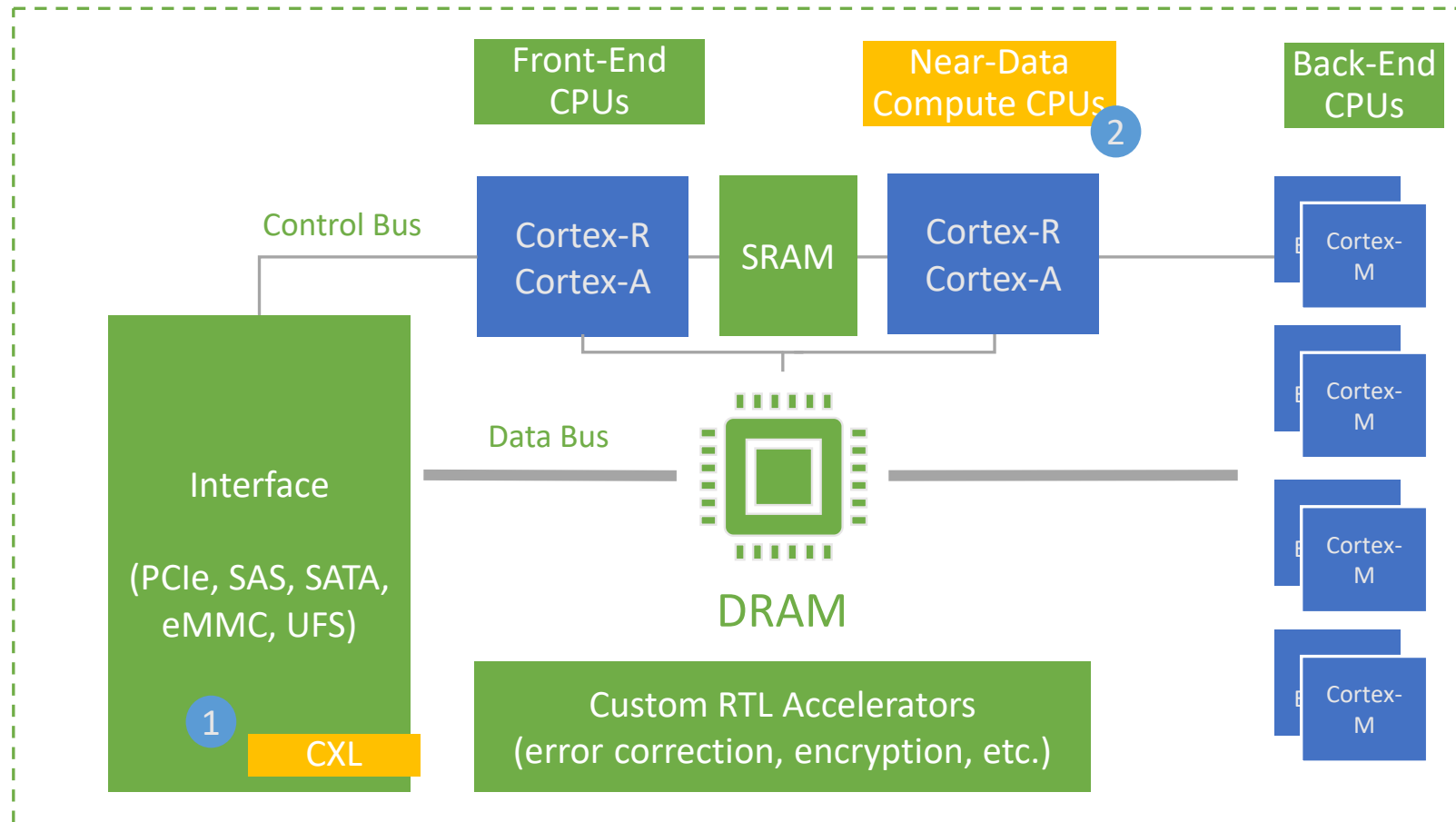
Benchmark results: scaling performance and power with Cortex-R82

Dhrystone benchmark: L1-D/I: 32Kb/32Kb, I/D-TCM: 32Kb/32Kb L2 \$: 1Mb



Aligning to Next-Gen Disaggregated and Composable Data Centers

Storage Controller

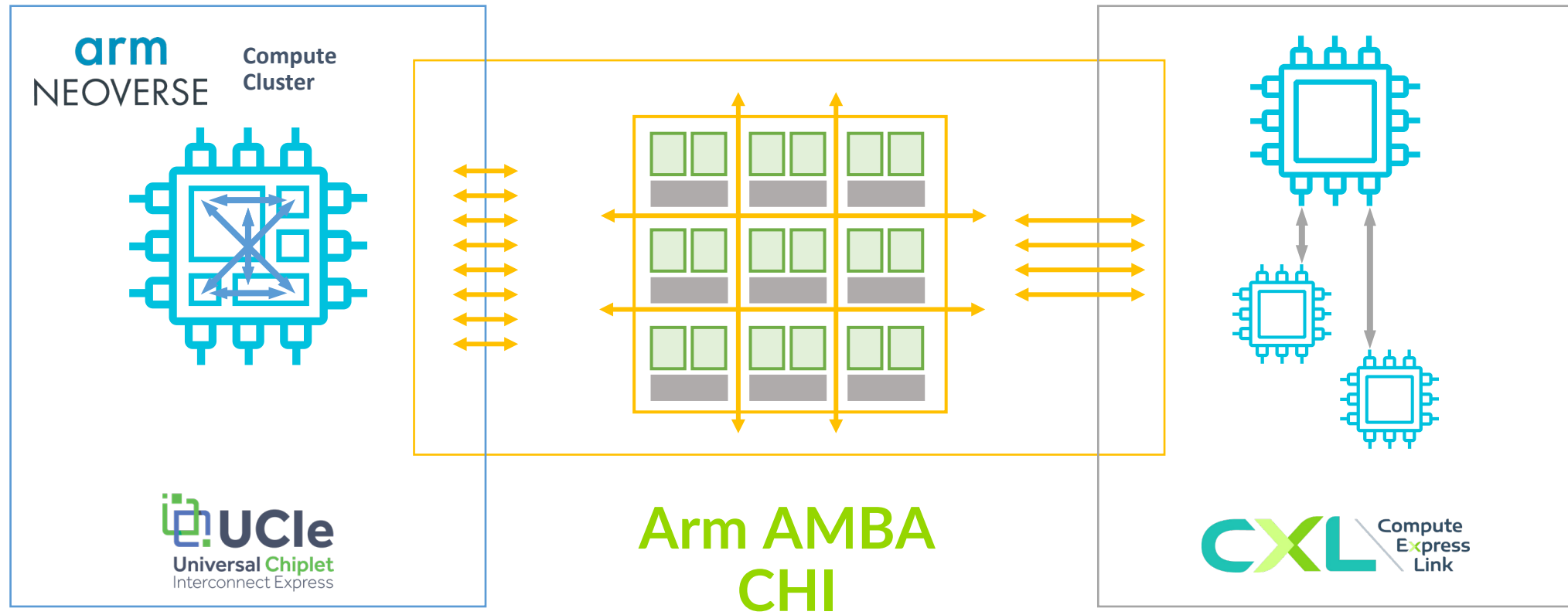


+ Next-gen controllers will need to consider adding new capabilities:

1. CXL interface (ex: Arm CMN)
2. Computational engines (ex: Cortex-R82 + MMU)

Arm is Driving Technology Leadership Across Standards

AMBA CHI, UCle and CXL deliver leadership die-to-die and chip-to-chip fabric solutions



CMN: Coherent Mesh Network
CXL: Compute Express Link

Arm's Storage Solutions Bring Value and Performance

Energy-Efficient Design

Arm's Cortex processors and system IP offer a high-performance and energy-efficient solution that are designed for complex computing tasks for storage devices.

Trusted Partner for Success

Proven Arm technology has been integrated into billions of storage devices to-date, helping optimize development and providing a foundation for success.

Faster Time-to-Market

The combination of ready-to-run, open-source code from Linux, cloud native software technologies and Arm's toolchain provides a foundation for fast development of storage solutions.

Thank you!

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