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Current Developments in Big Data Computation

Gen-Z & Compute Express Link

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Agenda

- Introduction in Memory-Based Computing
- Gen-Z
- Compute Express Link
- Combination of both standards

Memory-Based Computing

- Goal is to break through the memory wall
- Memory is in the center of the architecture instead of the processor
- Reduces overhead, when a SoC has to request more resources from another node
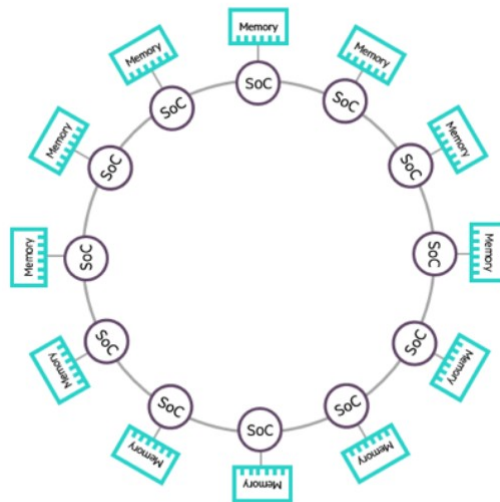
From processor-centric computing...
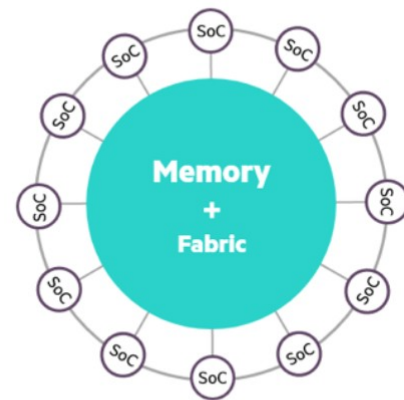
...to Memory-Driven Computing

Sandbox and the Librarian File System

- HPE Sandbox implements the concept of memory-based computing
- Fabric Attached Memory is the distributed pool of memory
- Librarian File System manages the memory
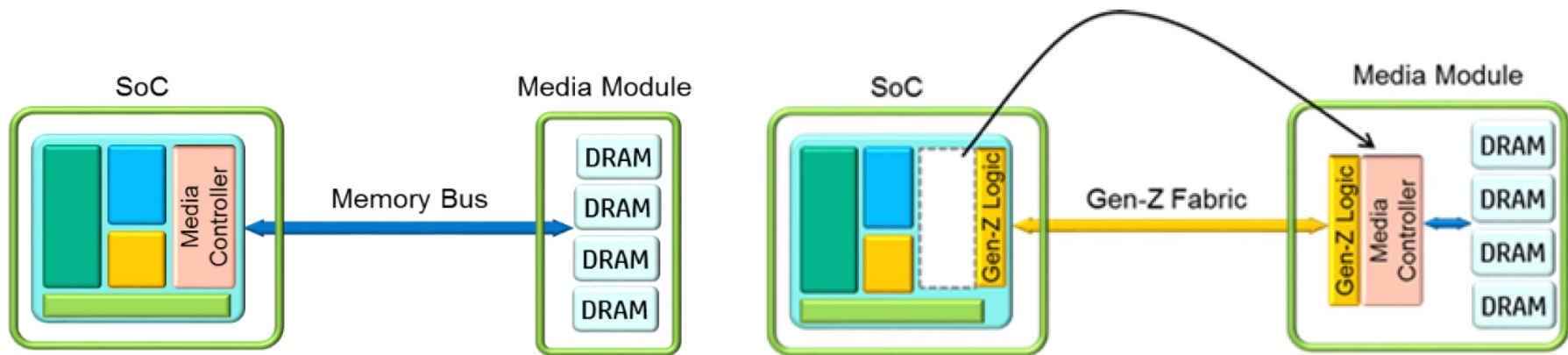- Gen-Z is the protocol for communication between devices
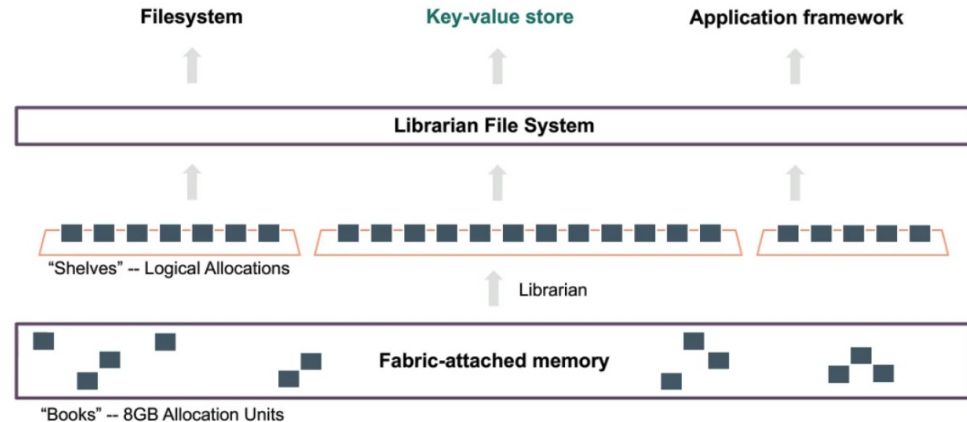
Sandbox and the Librarian File System

- Speedup for astronomical framework CASA
- Input data held on regular ext4 file system and the LFS
- Program shows slowdown on ext4 when executed with more cores
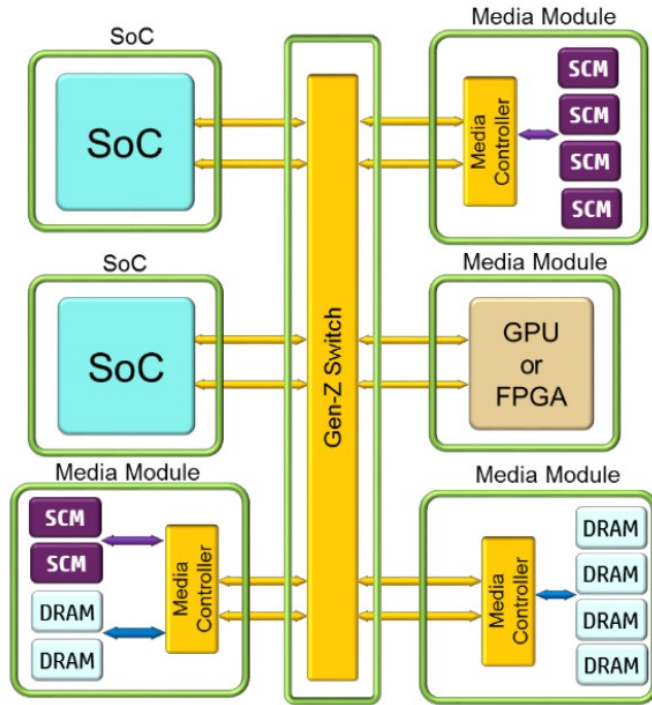- Program crashes when data lies on the LFS and uses more than 8 cores
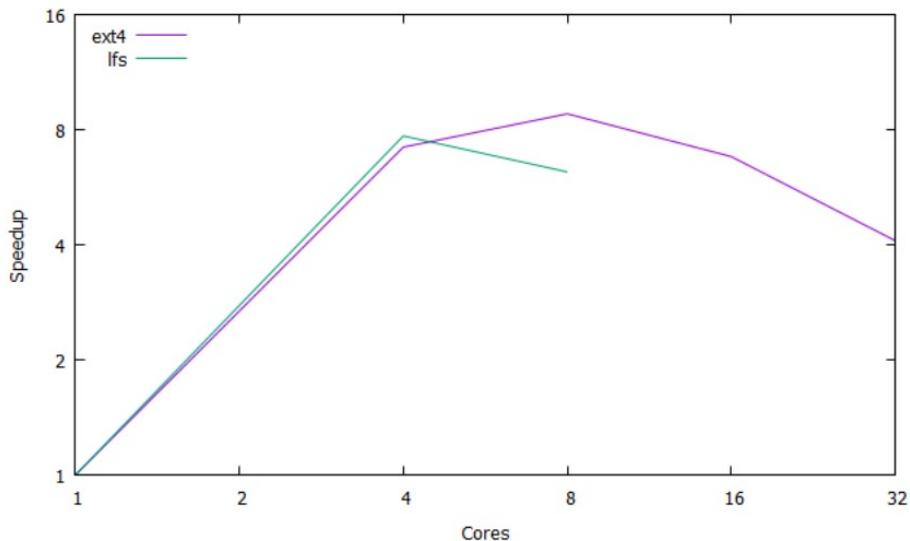
Gen-Z Open Standard

Traditional Design keeps the media controller with the CPU

Outsourcing of the media controller to the media module, i.e. DRAM

Gen-Z Memory Fabric

- Connection of the components through the Gen-Z Switch
- Increased modularity and therefore better scalability
- Creates a memory fabric in which the memory can be treated as a pool
- Peer-to-Peer connection, other than the tree-like topology of PCIe
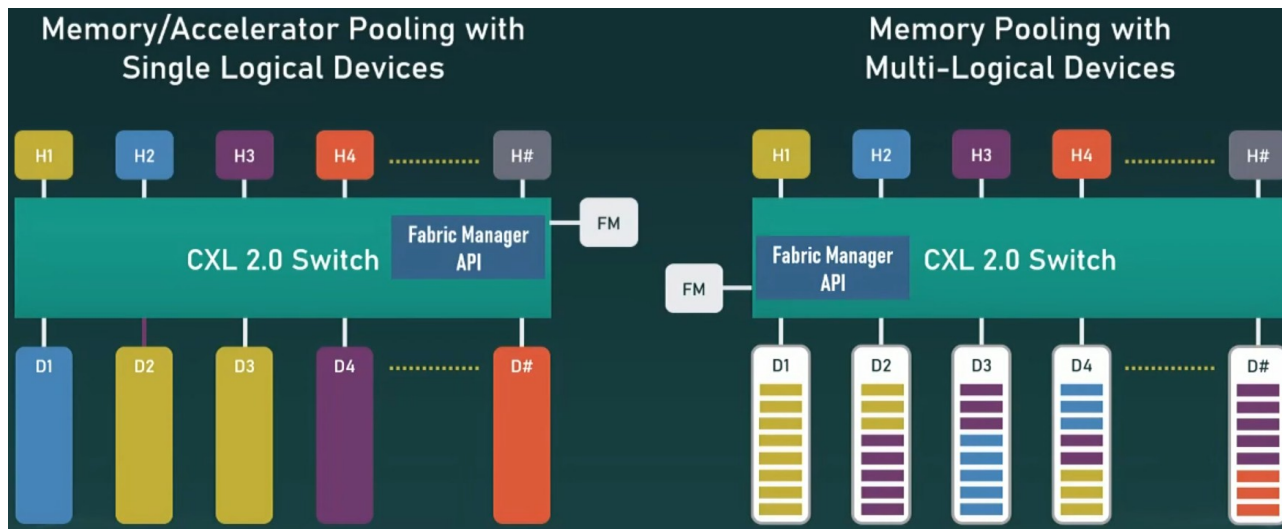- Fast connection through support of optical wiring

Compute Express Link
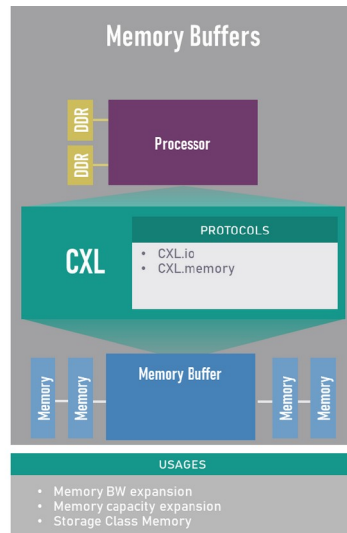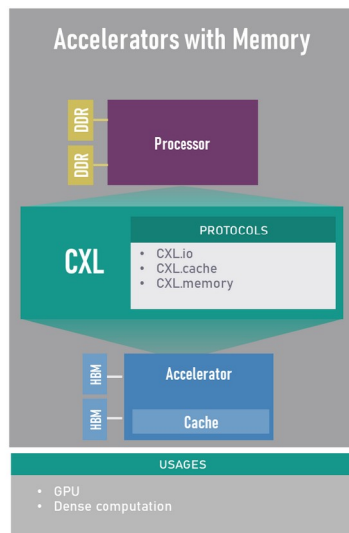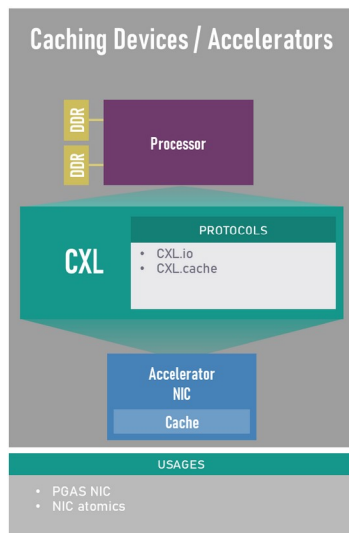
Three protocols for different use-cases:
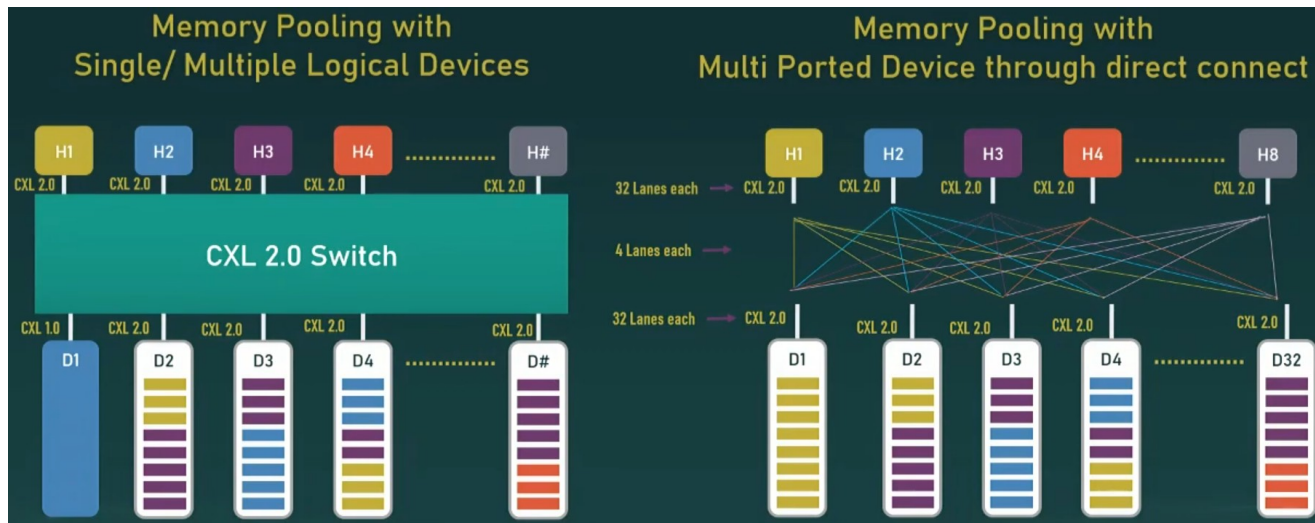CXL.io – CXL.mem – CXL.cache

- Accelerators without memory
- Accelerators with memory
- Memory extension

CXL 2.0

- Devices can be assign to hosts according to individual needs
- Partitioning of devices into Multi-Logical Devices

CXL 2.0

- Combination of Single and Multiple Logical Devices in one system
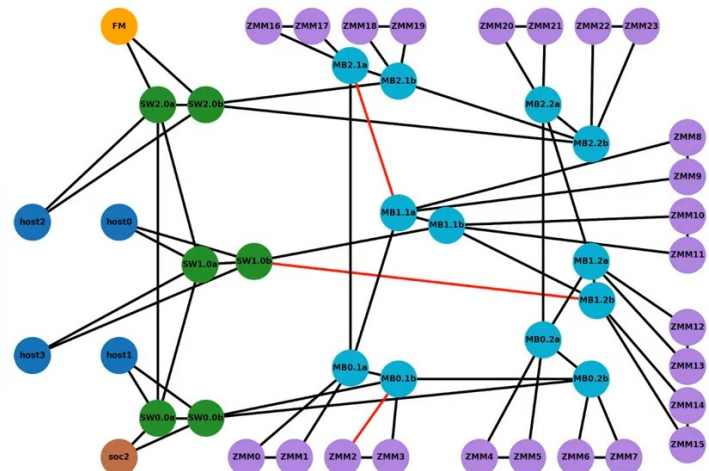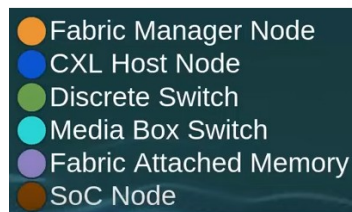- Direct connection from hosts to devices possible

IntelliProp Demo SC21

- Presentation of the company IntelliProp
- Combination of CXL with Gen-Z
- Disaggregation of the server architecture
- Connecting computing nodes to memory through Gen-Z fabric
- CXL is in the hosts and everything outside is Gen-Z
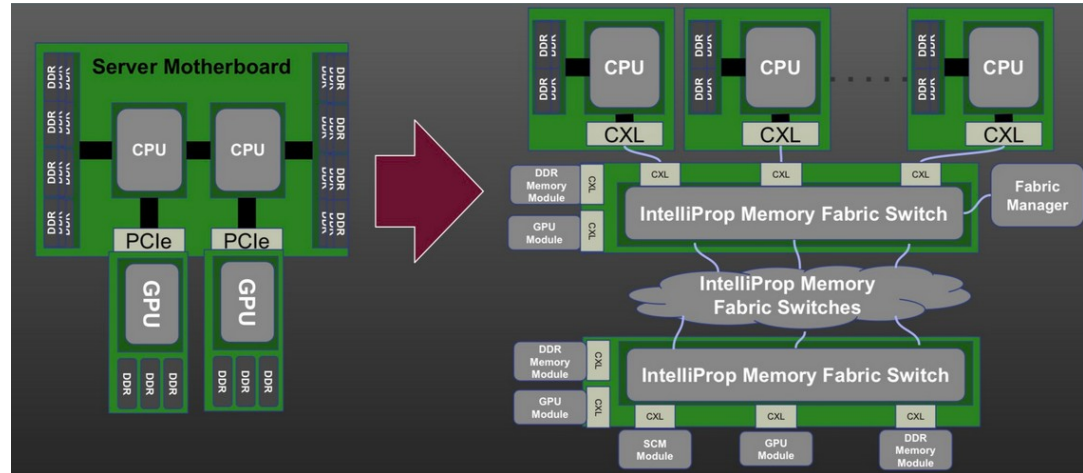
IntelliProp Demo SC21

- Fabric Manager manages the topology of the system
- Connecting CPUs through multiple switches to memory
- Alternative routes available
- Components can be added or removed without problems
- The fabric manager registers disconnects or newly established connections

Bildquellen

- https://www.gazettabyte.com/home/2021/12/24/data-centre-disaggregation-with-gen-z-and-cxl.html
- https://www.youtube.com/watch?v=sCQHxe72kuw
- https://www.youtube.com/watch?v=FaIK_SFe_i8
- https://www.hpe.com/us/en/newsroom/blog-post/2017/05/memory-driven-computing-explained.html
- https://genzconsortium.org/wp-content/uploads/2018/05/Gen-Z-Overview-V1.pdf
- https://www.computeexpresslink.org/_files/ugd/0c1418_14c5283e7f3e40f9b2955c7d0f60bebe.pdf
- Elsa Buchholz. "Untersuchung eines astronomischen Workflows im memory-based Computing". MA thesis. University of Applied Sciences, 2020.

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