SSRLabs

Flash Memory System Redesigned for Big Data

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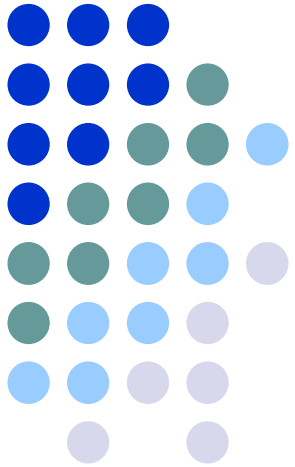
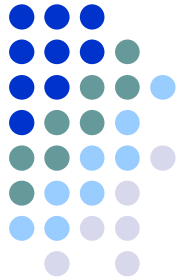
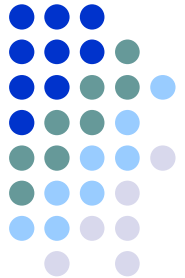


Overview



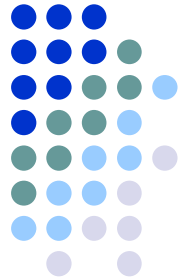
- Big Data is defined as
  - Large unstructured data with
  - High growth rate.

Big Data Implications



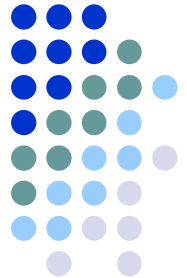
- Unstructured data equals random distribution of data across all addresses in the address space.
- Random accesses to random addresses decrease efficiency of caching strategies which rely on spatial and some degree temporal locality.

Technology Implications



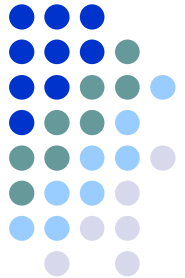
- Large unstructured data in large memory arrays -> very low spatial locality -> low caching efficiency.
- Multiple multi-core processors or many-core processors working on a large unstructured data set in multiple large memory arrays -> even lower spatial locality in each level of cache, including shared cache.
- Since caching is not as efficient in those applications, high bandwidth and low average latency to the entire memory array are crucial.

Theoretical Solutions



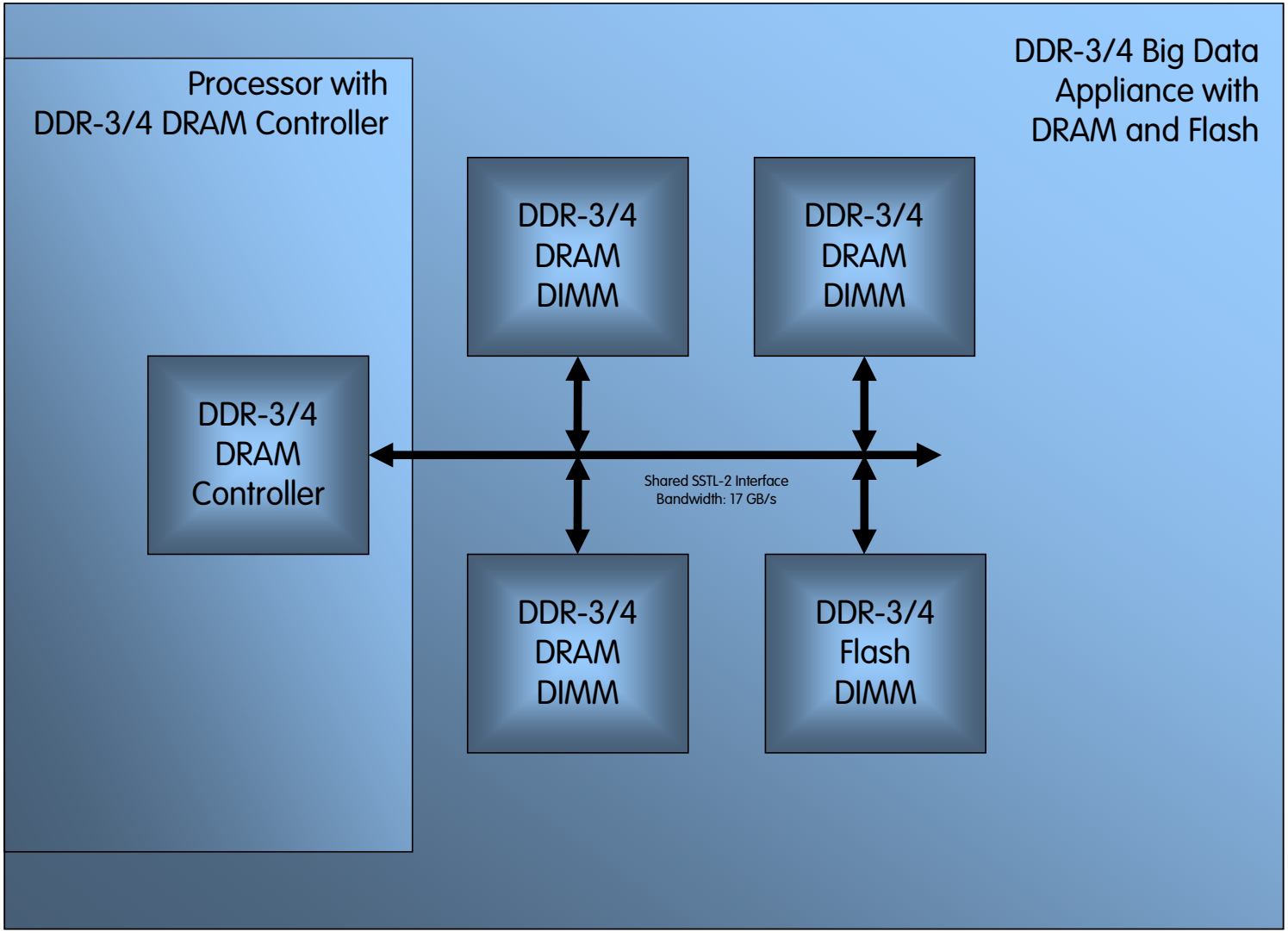
- Ideally, all data is held in registers. That requires new processors.
- The second-best solution would be all SRAM memory. This is prohibitive from a power and cost standpoint.
- The third-best solution would be a DRAM-lookalike solution.
- However, DRAM (particularly SSTL-2-attached) in the TB range still consumes too much power.

Practical Solutions

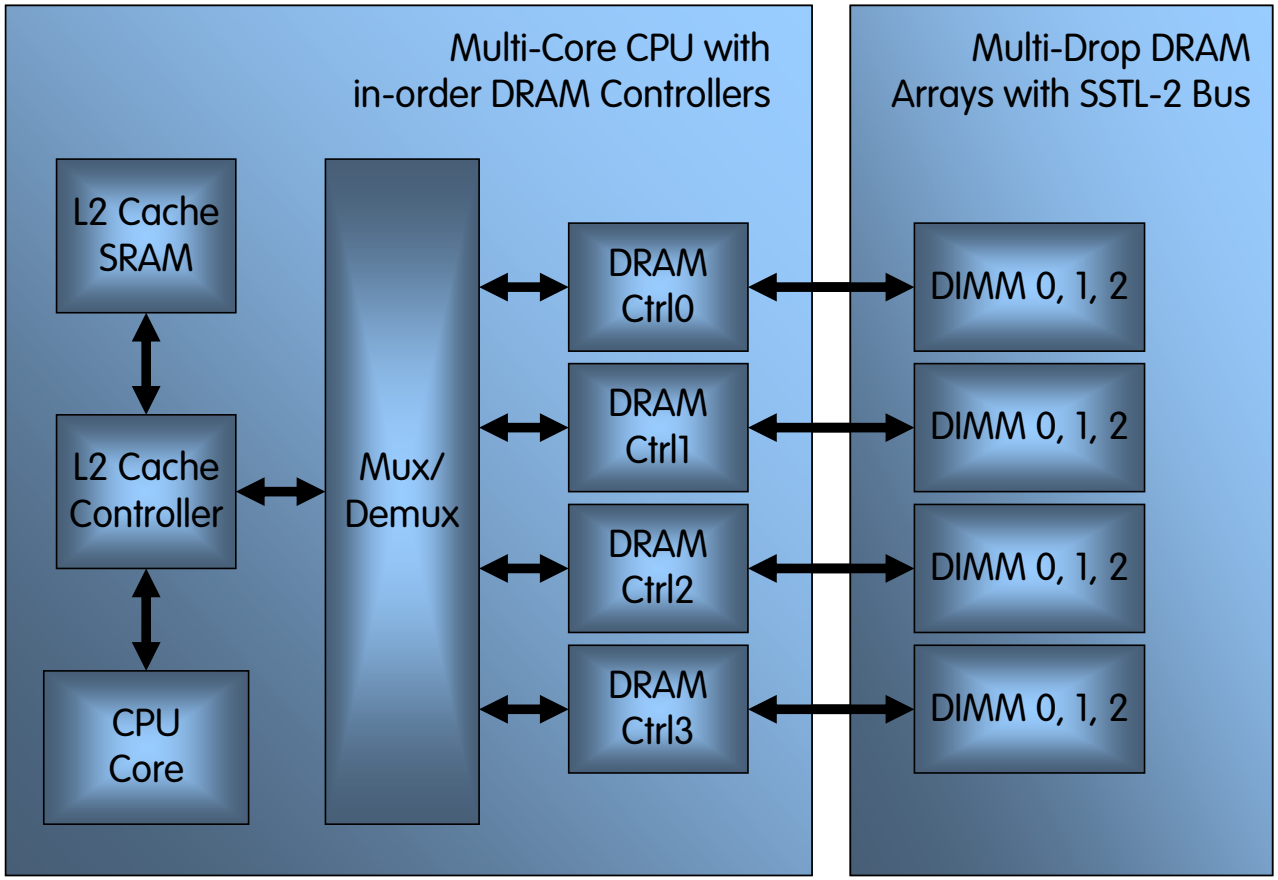


- DRAM-like memory arrays that consume less power at higher densities would solve the problem.
- Direct attachment to the CPU is preferred over SAS, SATA or PCIe for latency reasons.
- Even if a DRAM-like solution has a slightly higher latency than DRAM at a substantially higher density it can improve performance.
- Any mass storage access that is rendered unnecessary will improve performance.

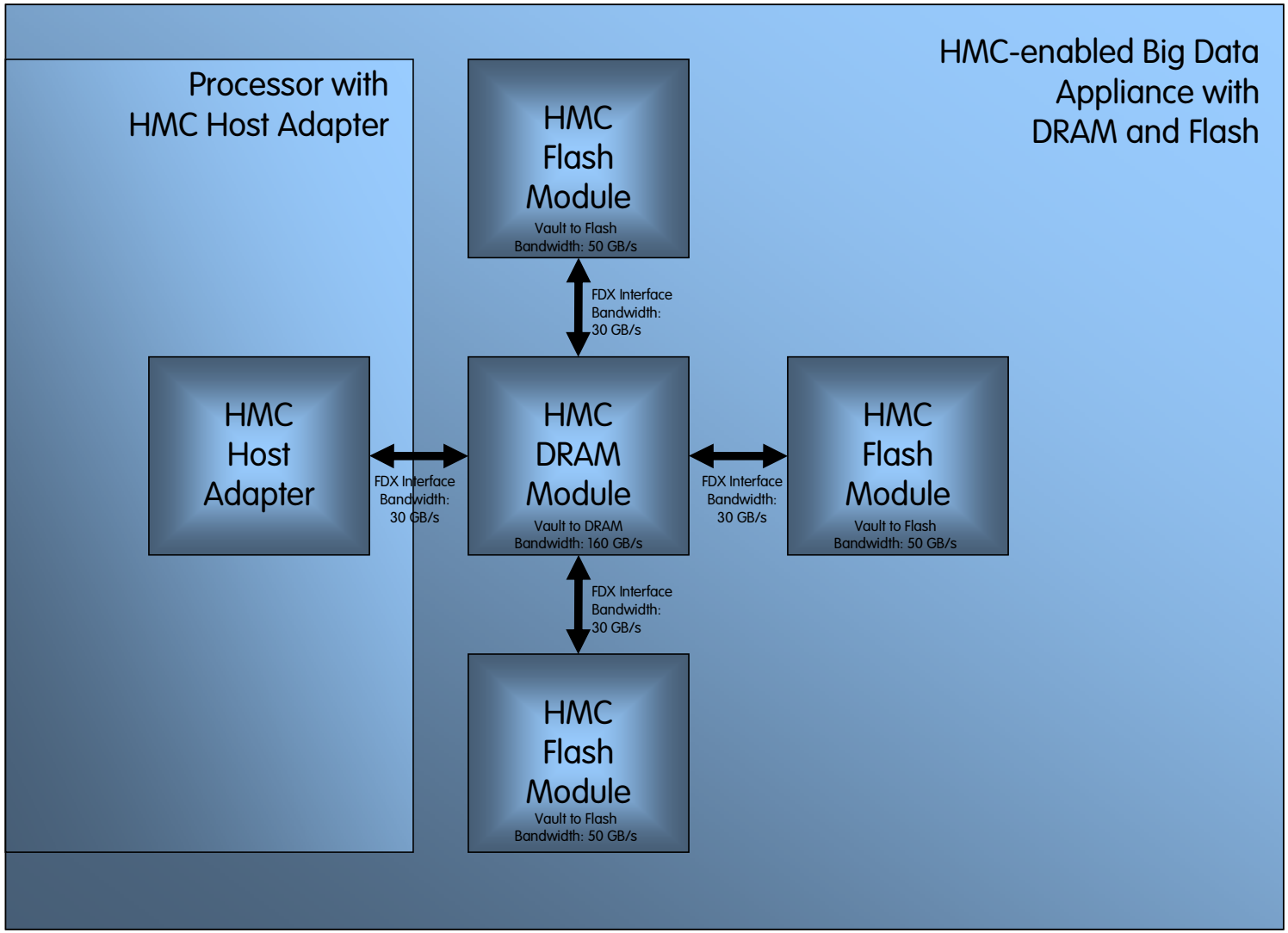
Current Processor and DRAM



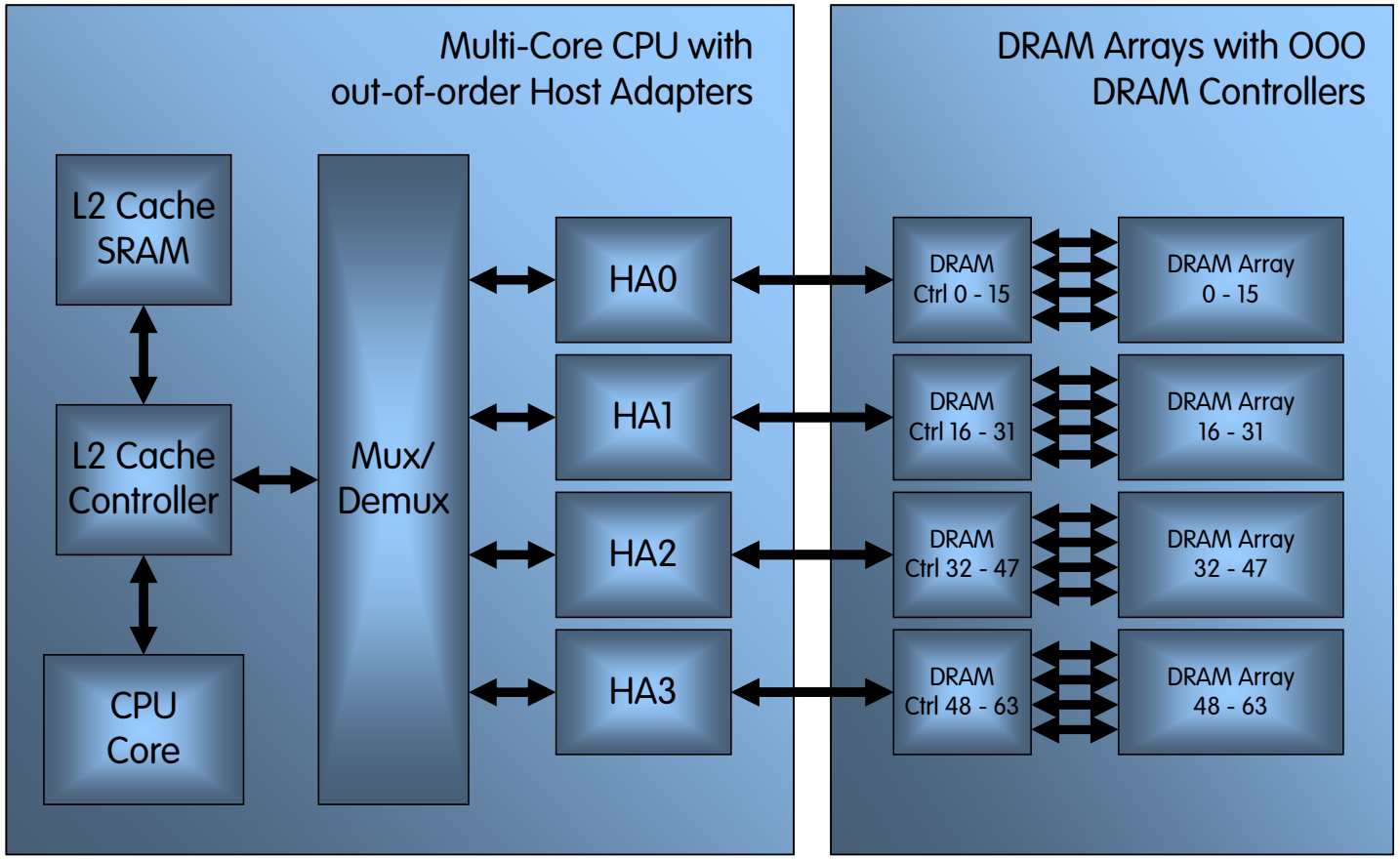
Current Processor and DRAM 2



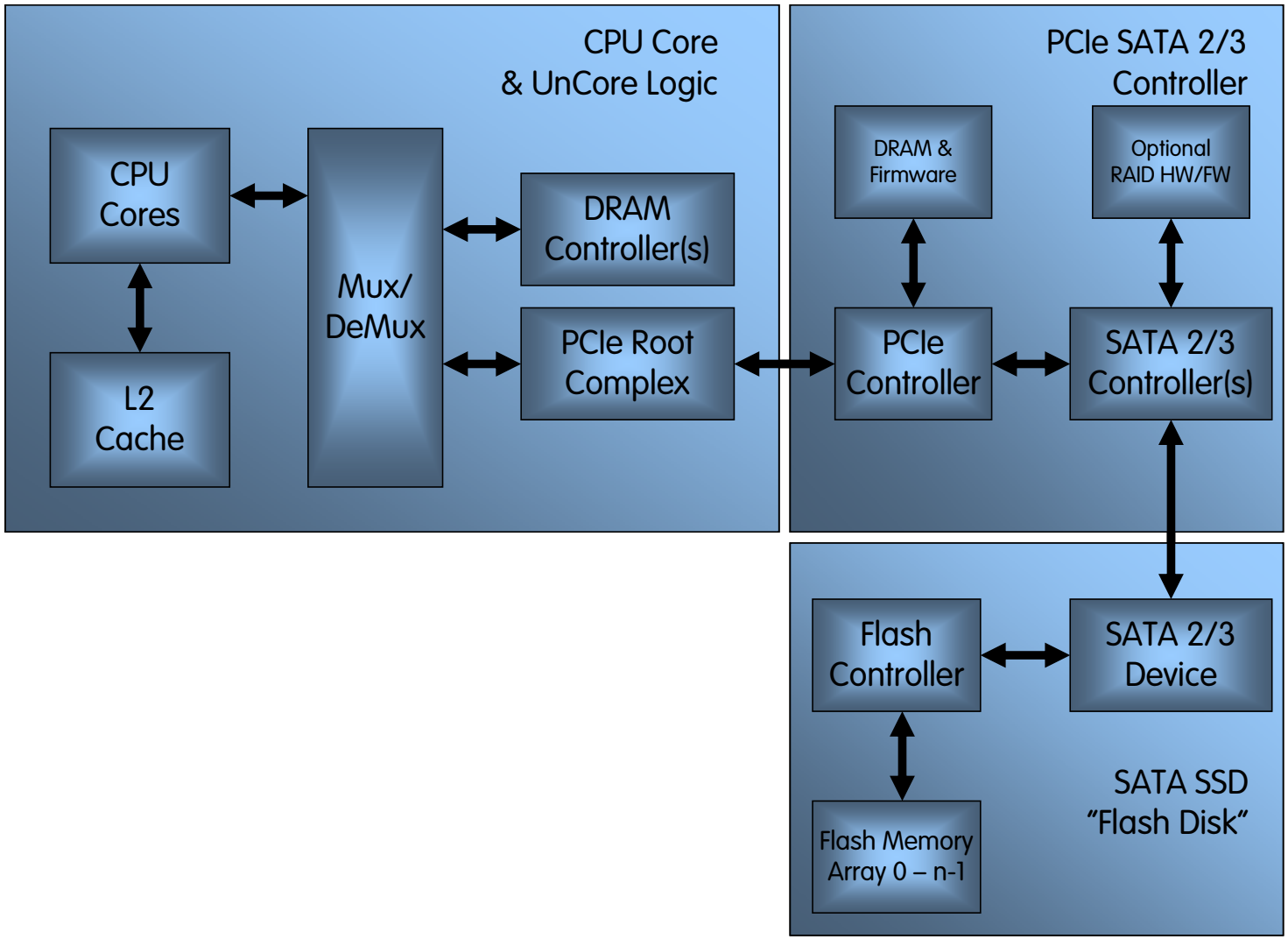
HMC Processor and Memory



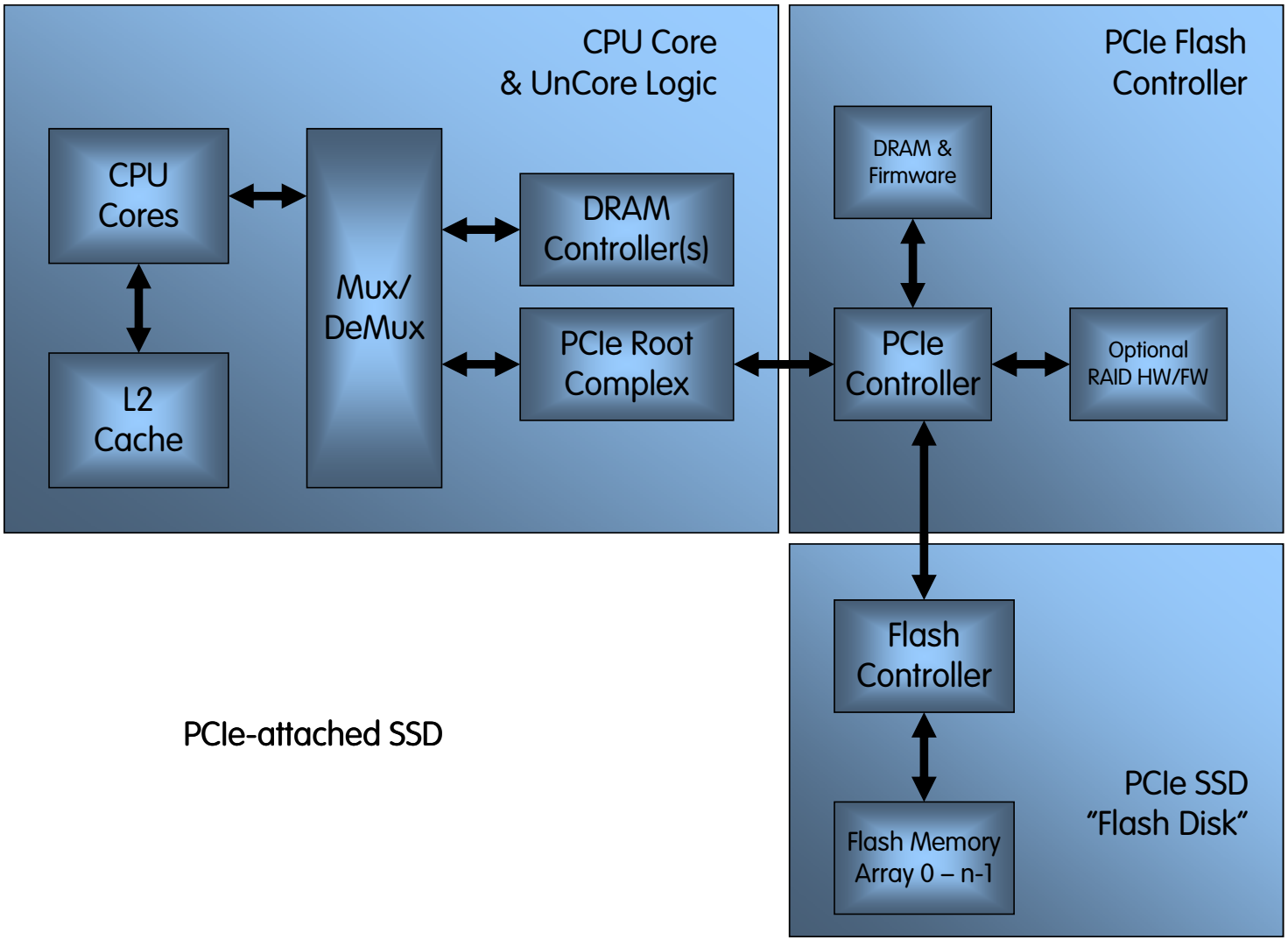
HMC Processor and Memory 2



SATA-attached SSD

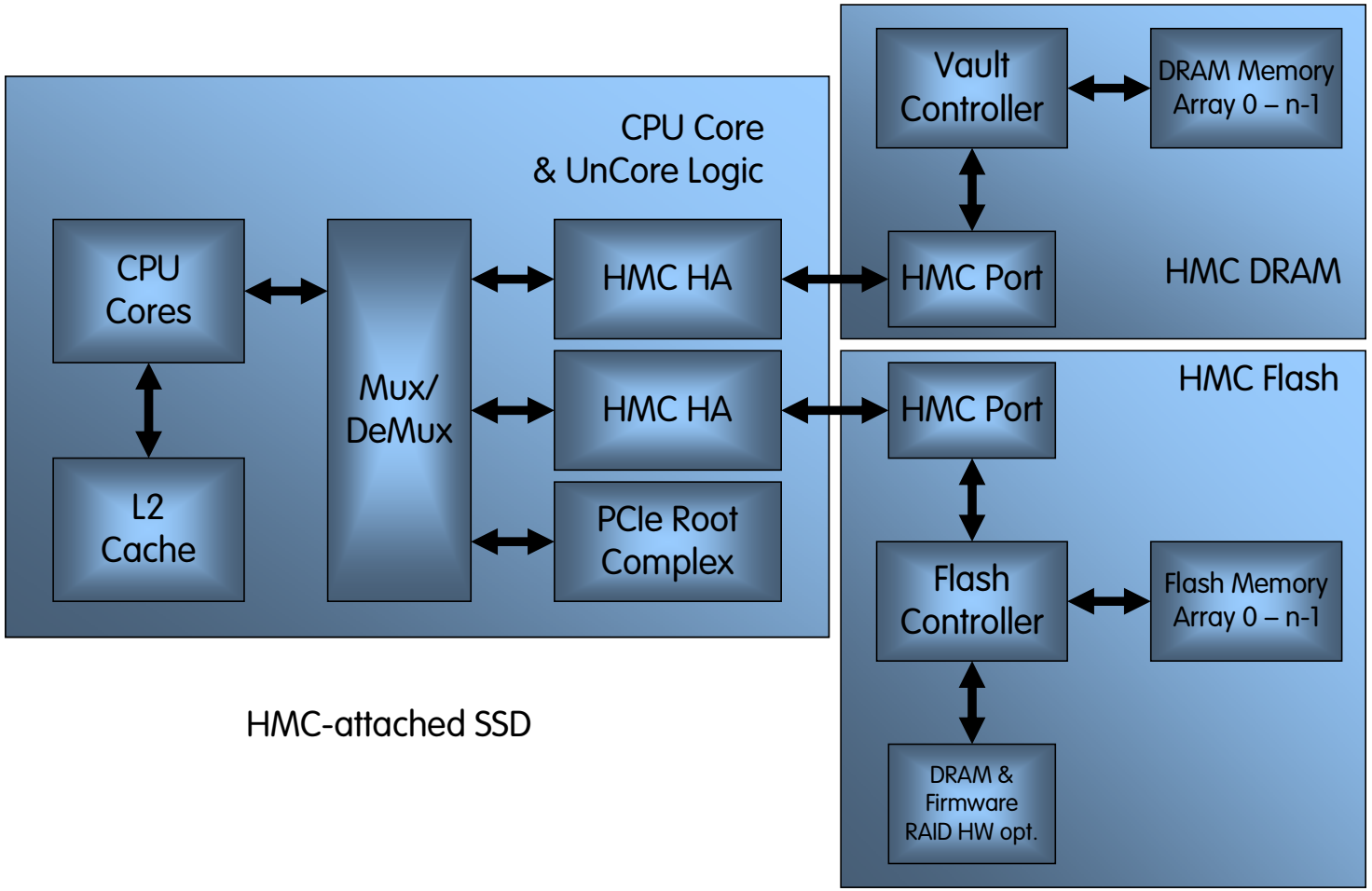


PCIe-attached SSD



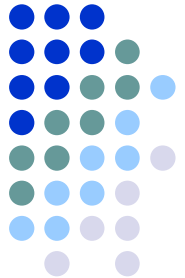
PCIe-attached SSD

HMC-attached "SSD"



HMC-attached SSD

Legalese



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