Standardizing memory to memory data movement with SDXI v1.0

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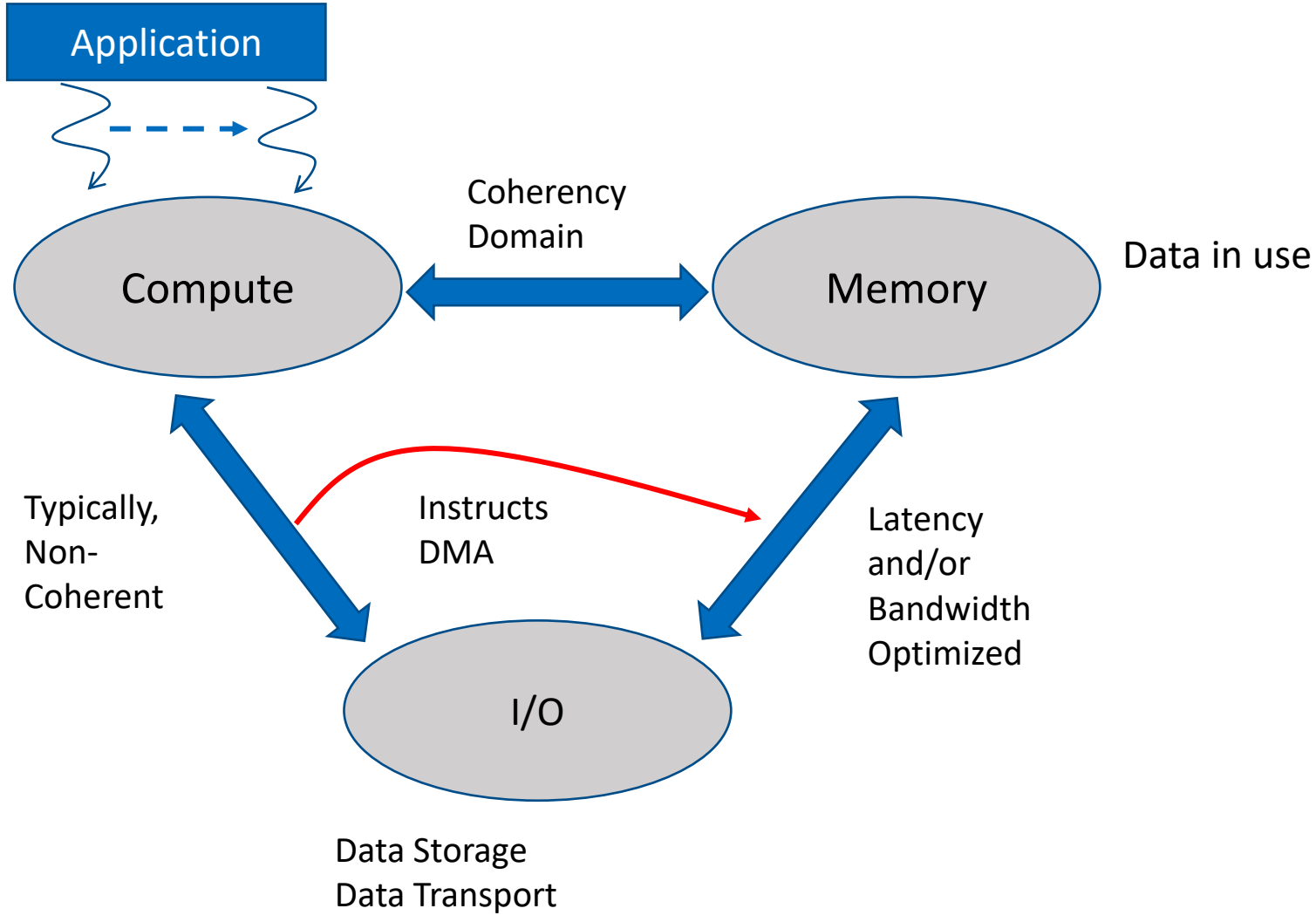
Legacy Compute, IO, Memory Bubbles



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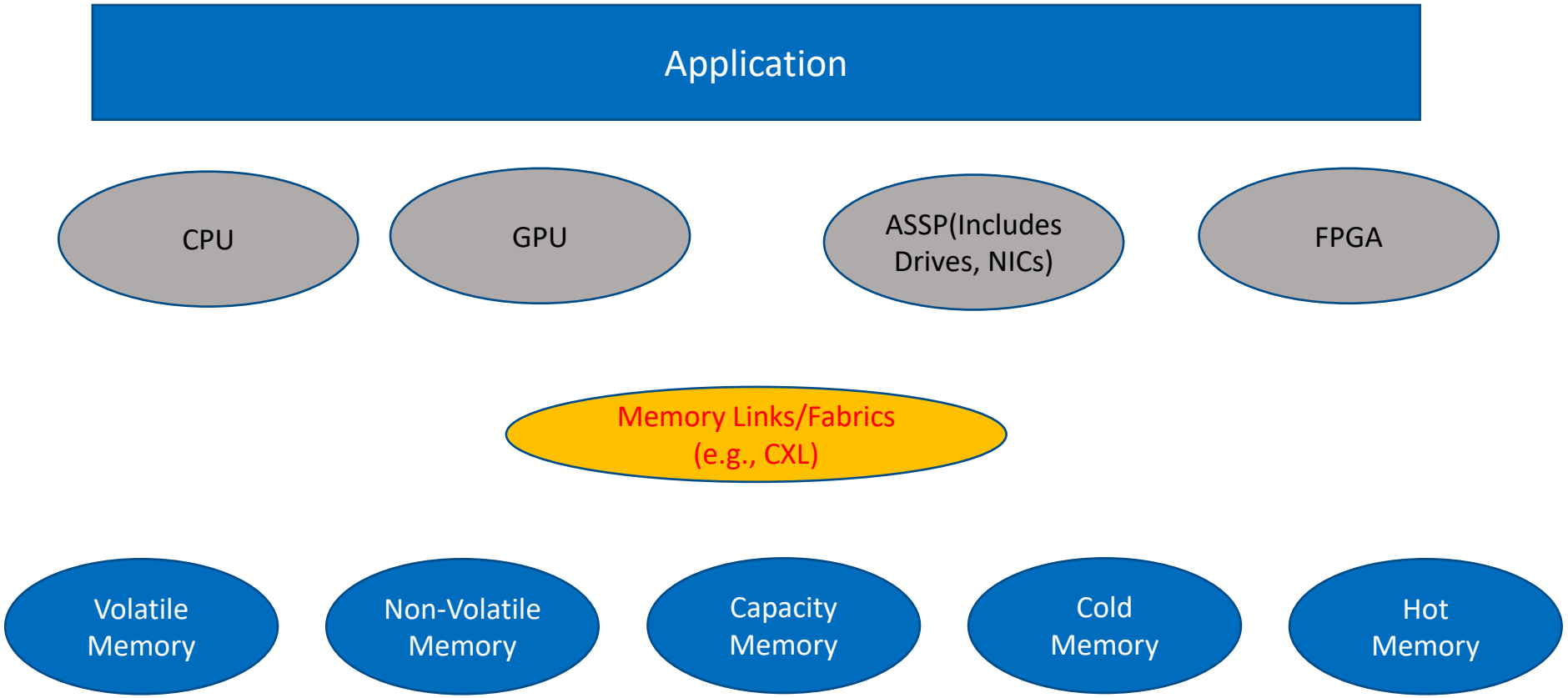
Emerging Bubbles



Shared Design constraints

- Latency
- Bandwidth
- Coherency
- Control

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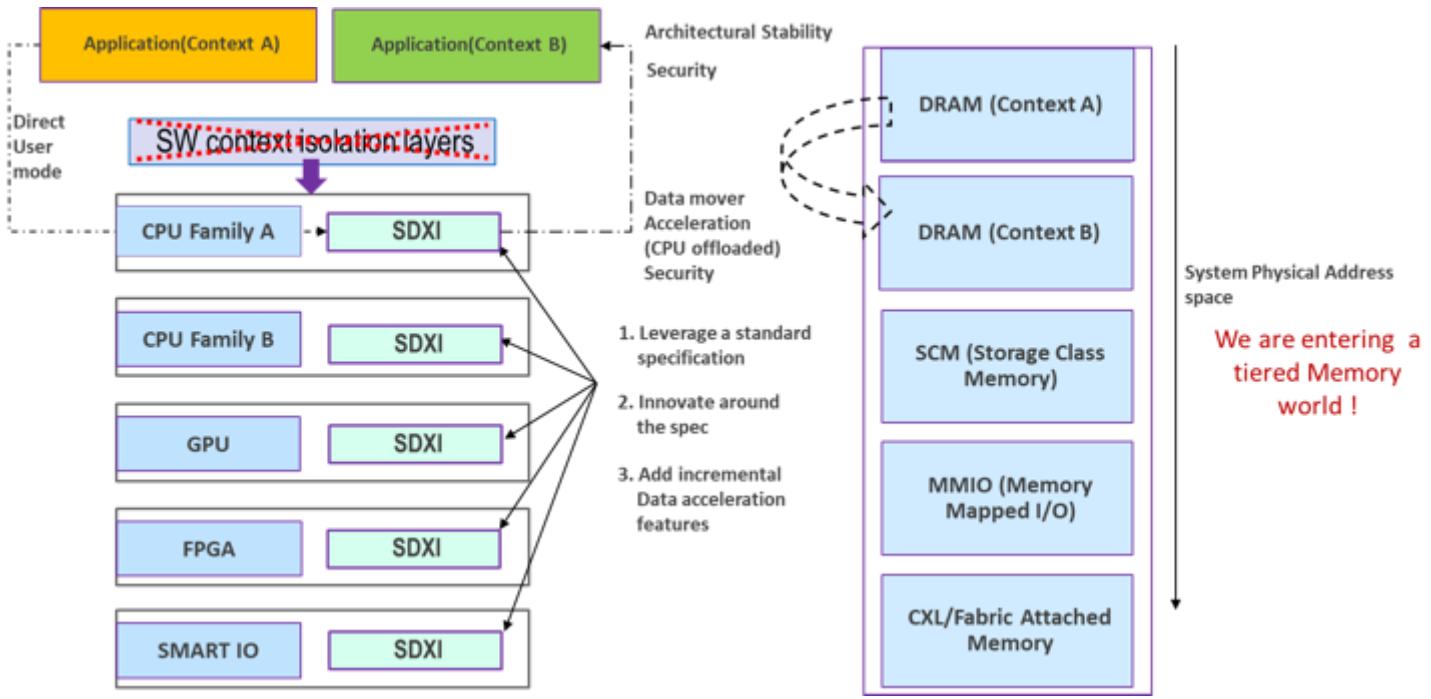
SDXI

- Introduction to SNIA SDXI v1.0
- Use Cases
  - Application Patterns and benefits of Data Movement & Acceleration
- SDXI: The path ahead
  - SDXI v1.1
  - SDXI Ecosystem

SDXI(Smart Data Accelerator Interface)

- Software `memcpy` is the current data movement standard
  - Stable ISA
  - However,
    - Takes away from application performance
    - Incurs software overhead to provide context isolation.
    - Offload DMA engines and their interfaces are vendor-specific
    - Not standardized for user-level software.
- Smart Data Accelerator Interface (SDXI) is a SNIA standard for a memory to memory data movement and acceleration interface that is -
  - Extensible
  - Forward-compatible
  - Independent of I/O interconnect technology
- SNIA SDXI TWG was formed in June 2020 and tasked to work on this proposed standard
  - 23 member companies, 89 individual members
- **v1.0 released!**
  - https://www.snia.org/sdxi

SDXI Memory-to-Memory Data Movement



- Data movement between different address spaces.
- Data movement without mediation by privileged software.
- Allows abstraction or virtualization by privileged software.
- Capability to quiesce, suspend, and resume the architectural state of a per-address-space data mover.
- Forward and backward compatibility across future specification revisions.
- Additional offloads leveraging the architectural interface.
- Concurrent DMA model.

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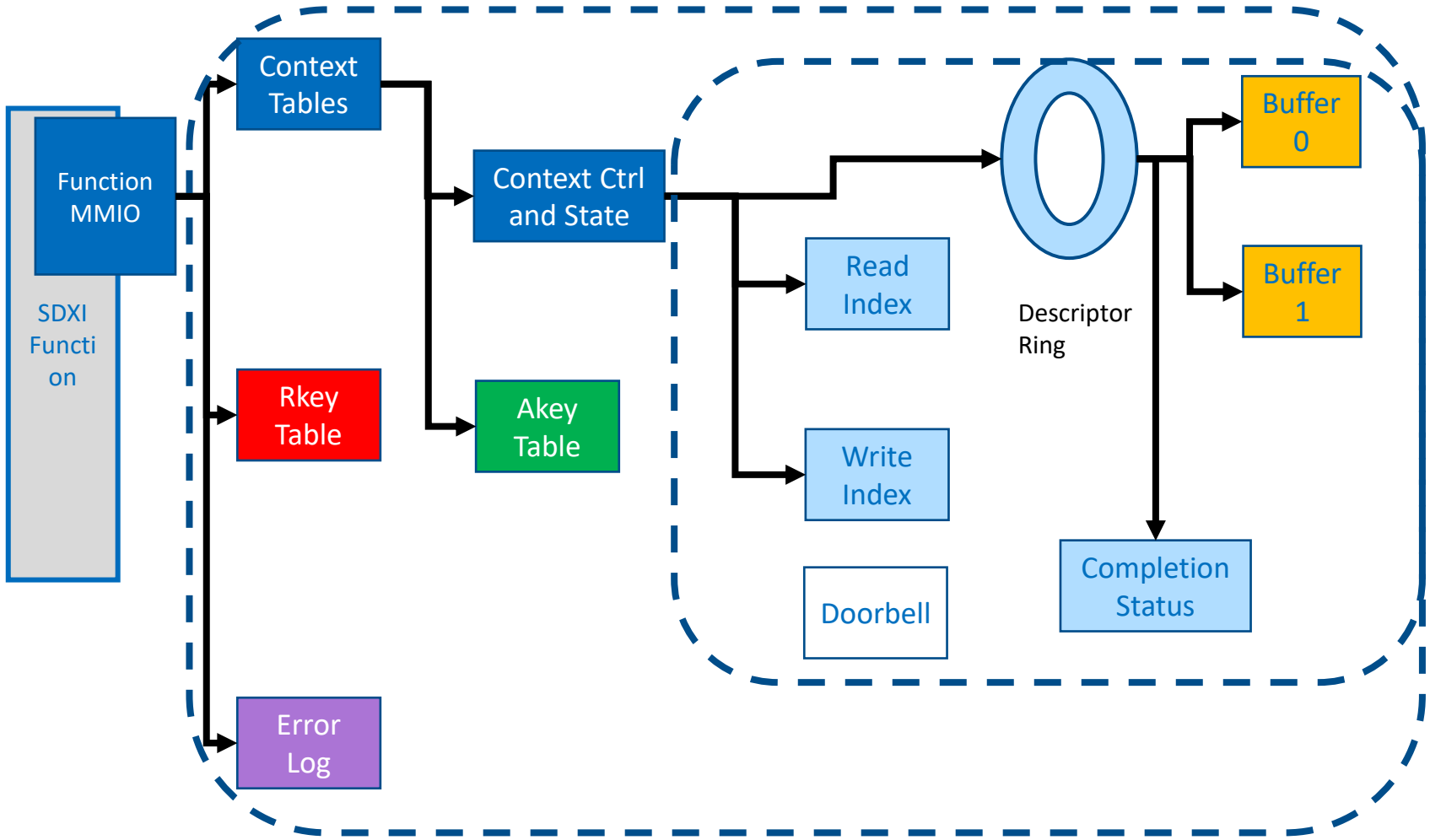
Memory Structures(1) – Simplified view



- All states in memory
- One standard descriptor format
  - Scope for future expansion
- Easy to virtualize
- Architected function setup and control
  - *layered model for interconnect specific function management
  - SDXI class code registered for PCIe implementations

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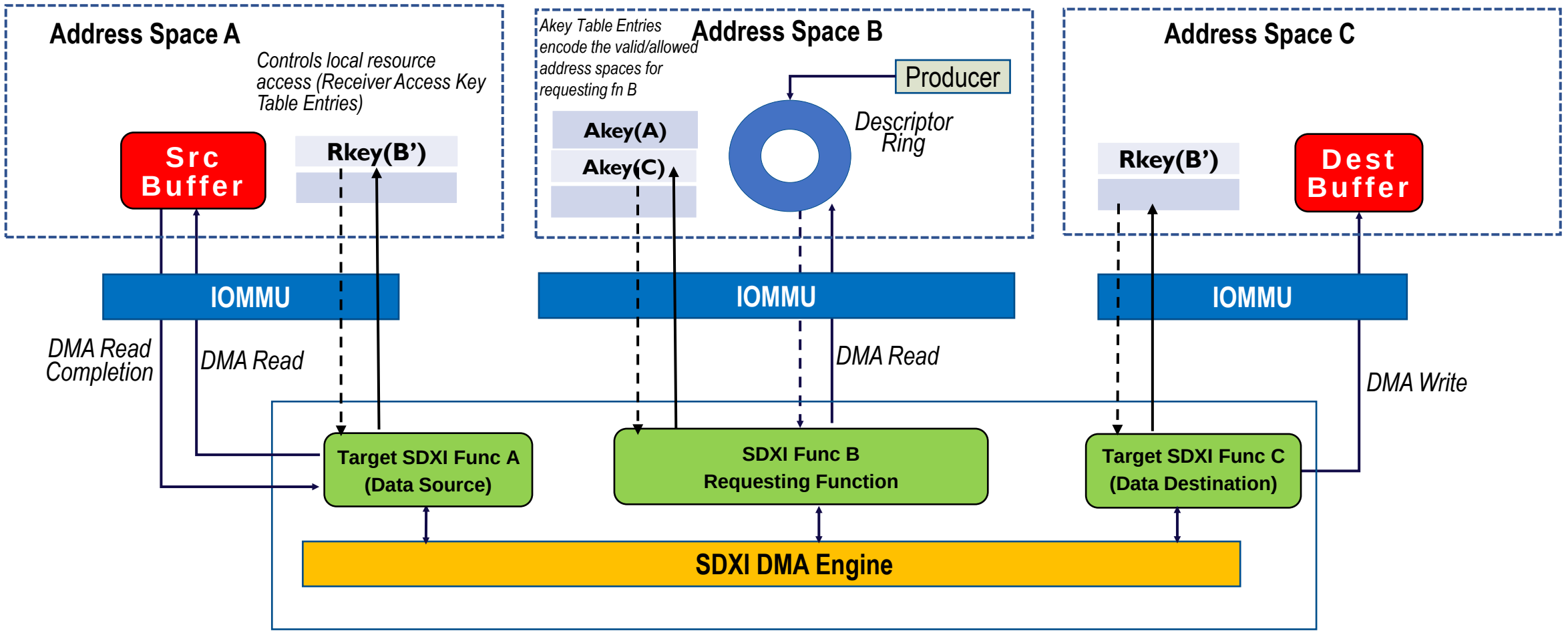
Multi-Address Space Data Movement within an SDXI function group (2)



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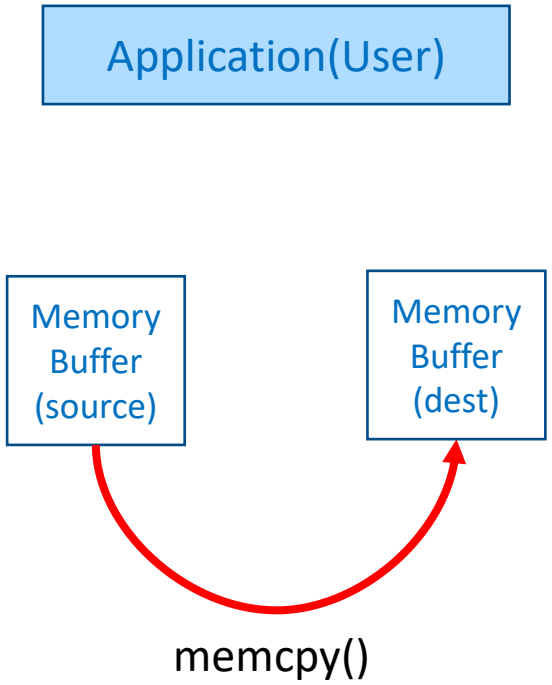
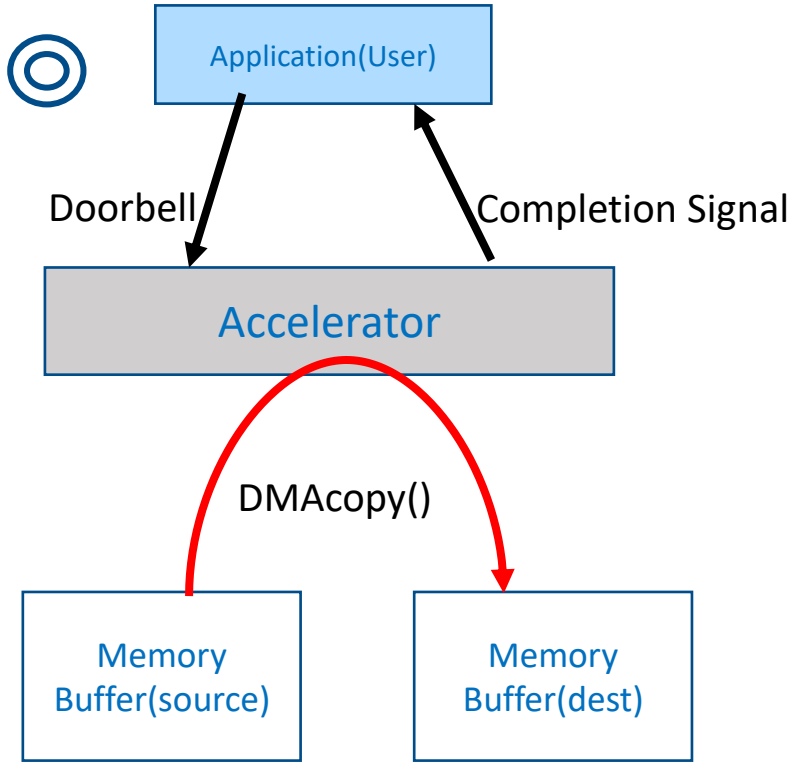
Application Pattern 1 (Buffer Copies)



- Takes away from application performance



- HW based memory copies can be offloaded without affecting application performance

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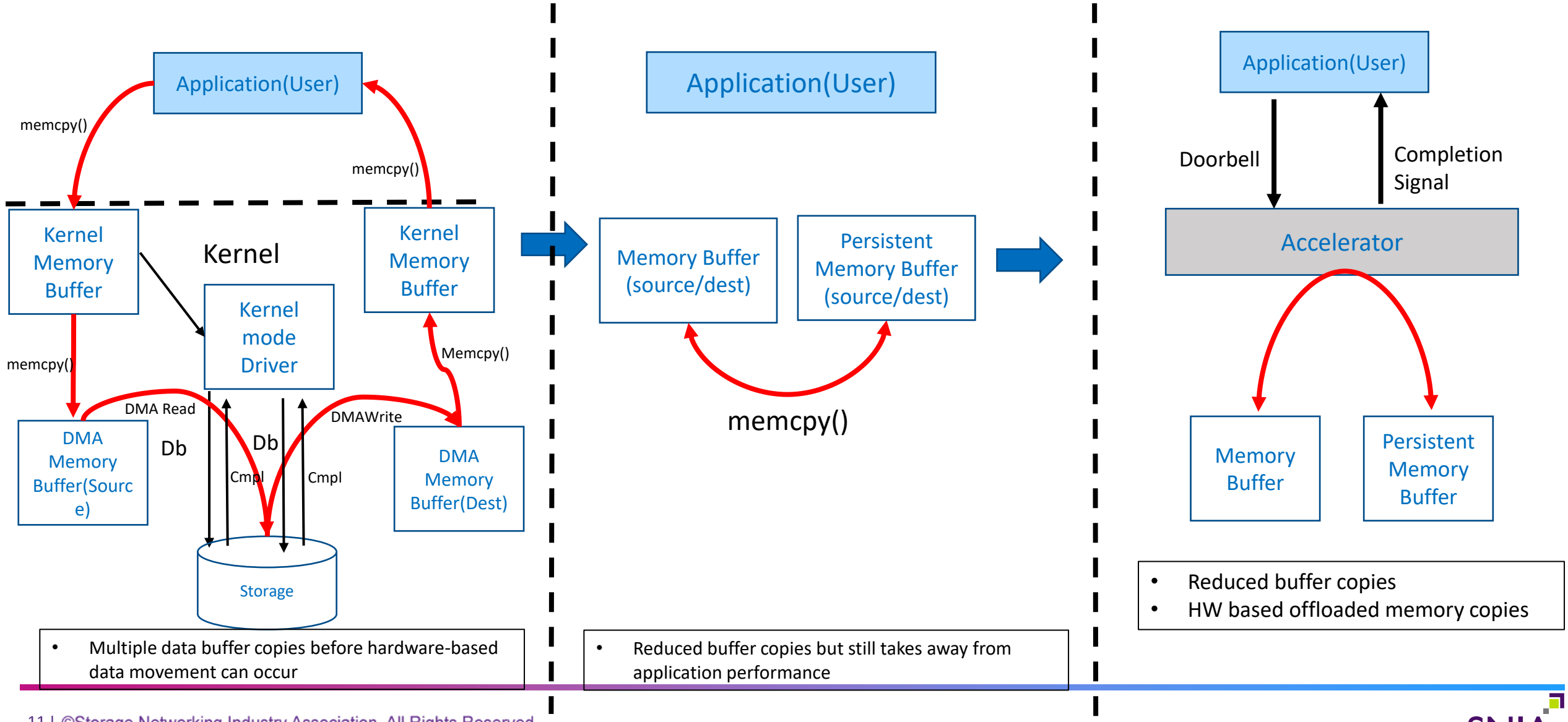
Application Pattern 2



- Multiple data buffer copies before hardware-based data movement can occur

- Reduced buffer copies but still takes away from application performance

- Reduced buffer copies
- HW based offloaded memory copies

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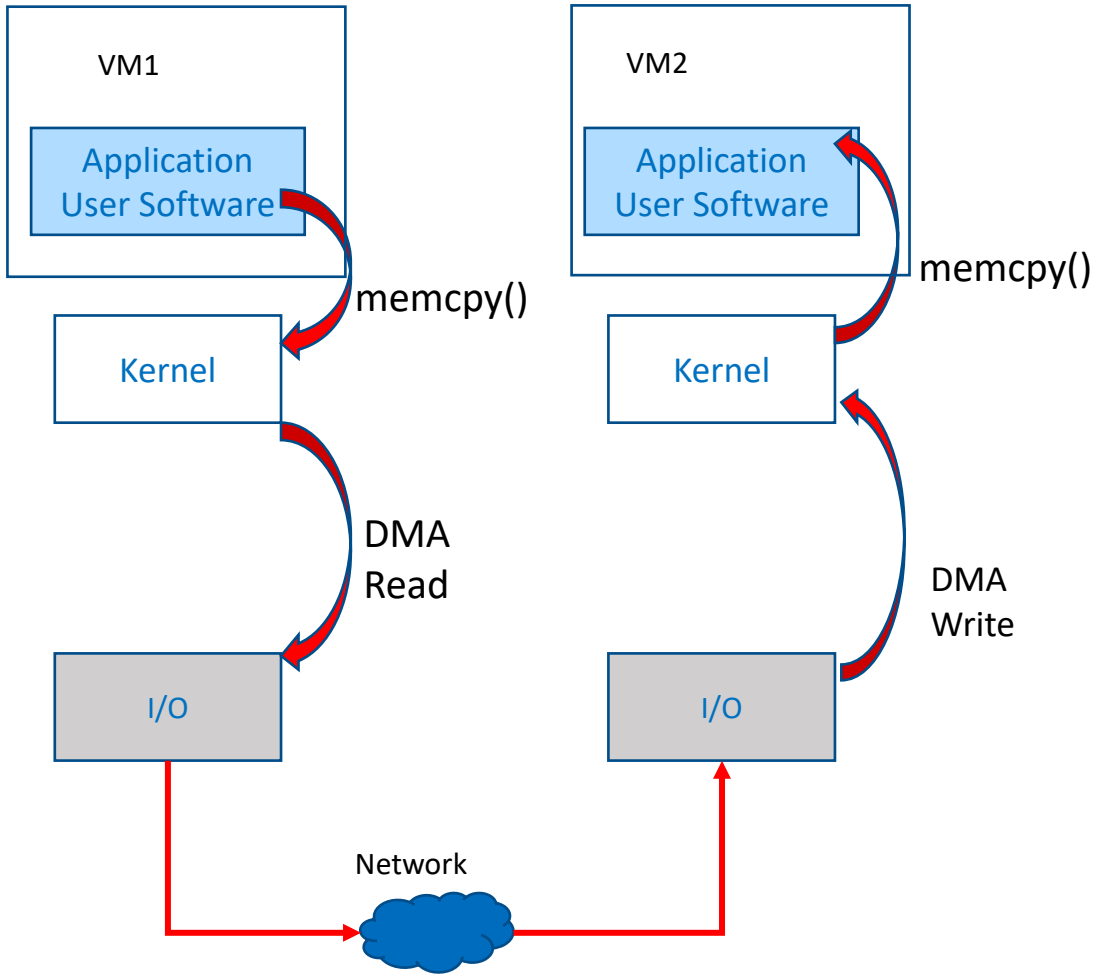
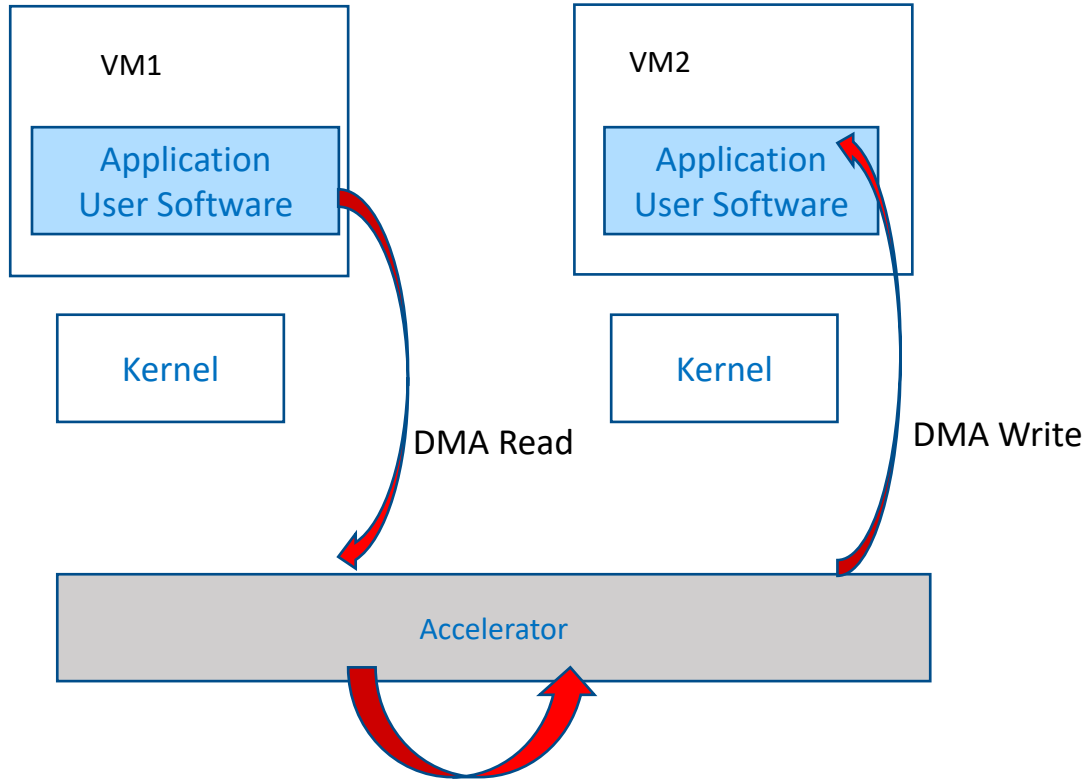
Application Pattern 3



- Context isolation layers introduce multiple buffer copies



- Best of both: Context isolation layers and optimized HW based memory buffer copies

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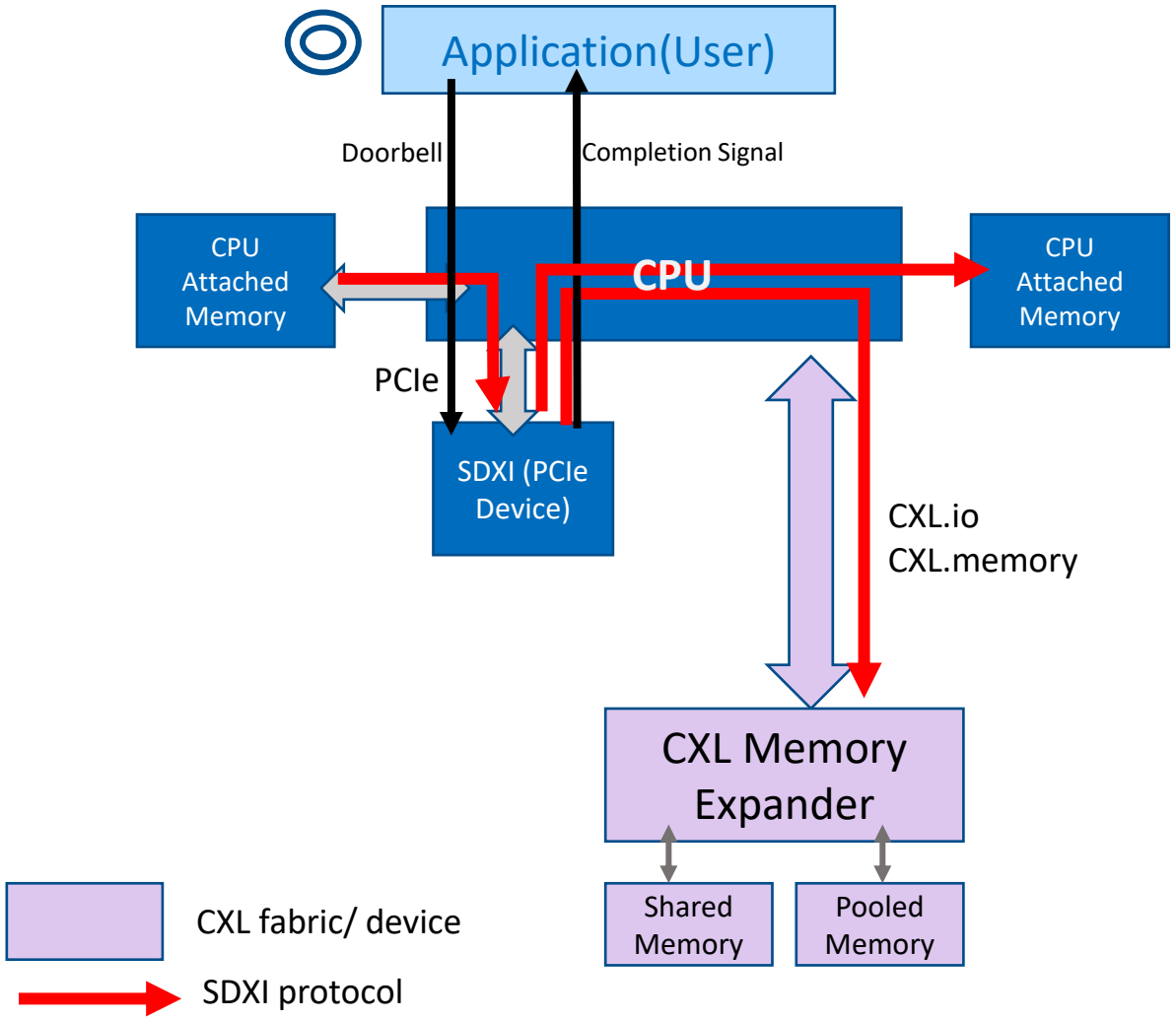
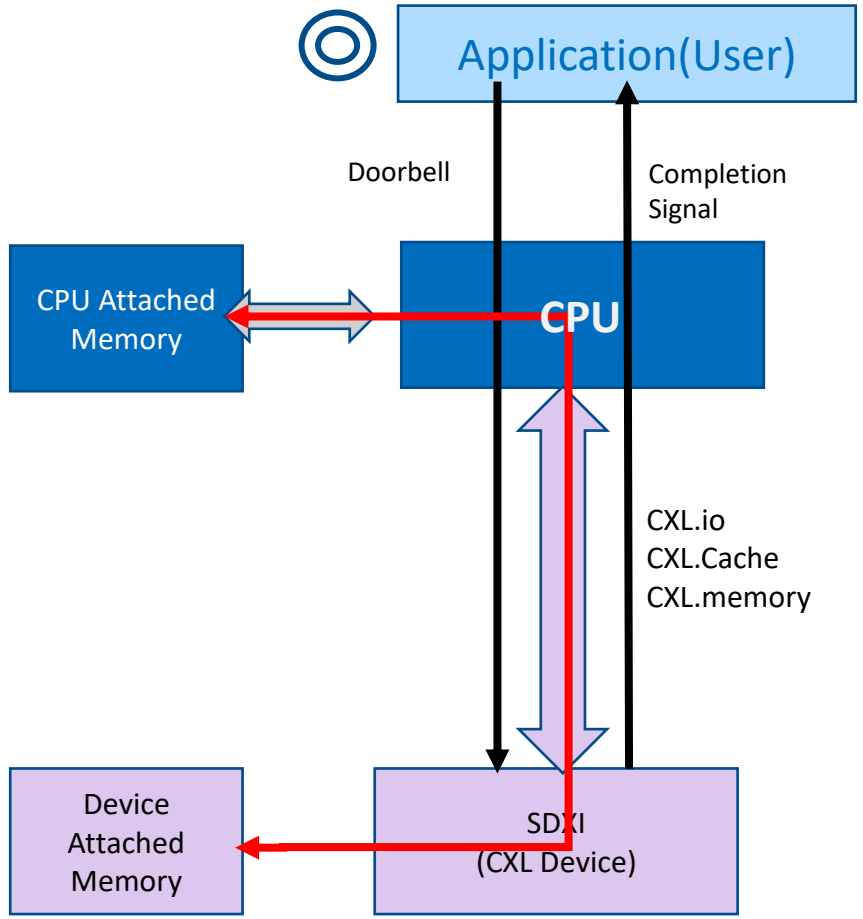
Emerging use cases: SDXI Assisted Data Movement in a CXL Architecture





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SDXI v1.1 investigations

- Management architecture for data movers(includes connection manager)
- New data mover operations for smart acceleration
- SDXI Host to Host investigations
- Scalability & Latency improvements
- Cache coherency models for data movers
- Security Features involving data movers
- Data mover operations involving persistent memory targets
- QoS
- CXL-related use cases
- Heterogenous environments

Additional SDXI Ecosystem activities

- SDXI Software group
  - Libsdxi project
    - OS agnostic user space library development
  - Linux Upstream driver efforts
    - SDXI TWG members are supporting this effort outside SNIA as a community
  - SDXI emulation project investigation for ecosystem development
  - Investigations to enable SDXI compliance for SW and HW interoperability
- SNIA's CS+SDXI Subgroup:
  - Envision SDXI in a Computational Storage Architecture
  - Implement features in SDXI to support Computational Storage use cases

Active Contributors and growing…

Call to Action

- Join the TWG to influence the next version of the specification
- Join the software development activities
- v1.0 is available for implementation
  - Feedback via SNIA feedback portal
  - https://www.snia.org/feedback
- Participate in the SDXI Ecosystem

Q&A

