SNIA Computational Storage Standards

Presented by

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SNIA COMPUTE, MEMORY, AND STORAGE SUMMIT

Solutions, Architectures, and Community

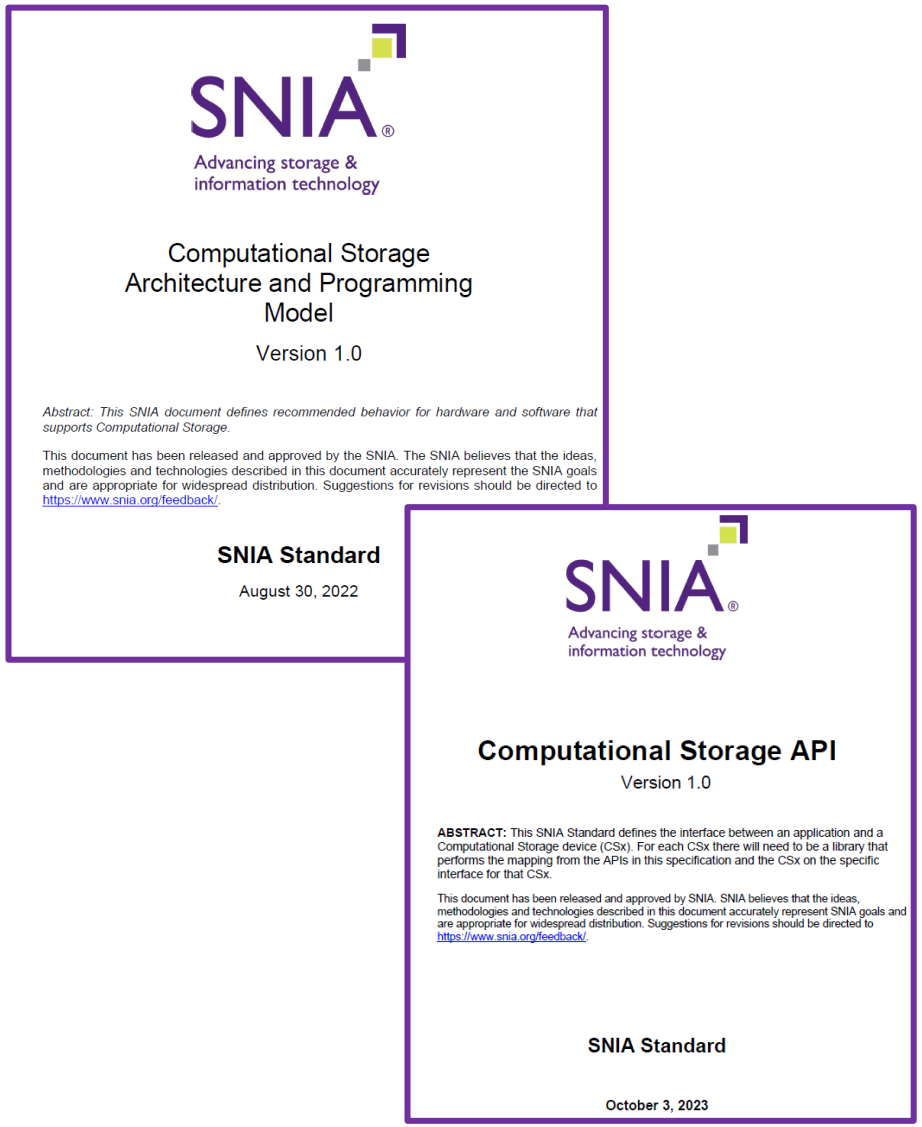
VIRTUAL EVENT, MAY 21-22, 2024

Agenda

- Current status of SNIA Computational Storage Standardization
- Overview of SNIA CS Architecture
- Overview of SNIA CS API
- SNIA and NVMe™ Computational Storage
- CS and SDXI

Current Progress of TWG Output

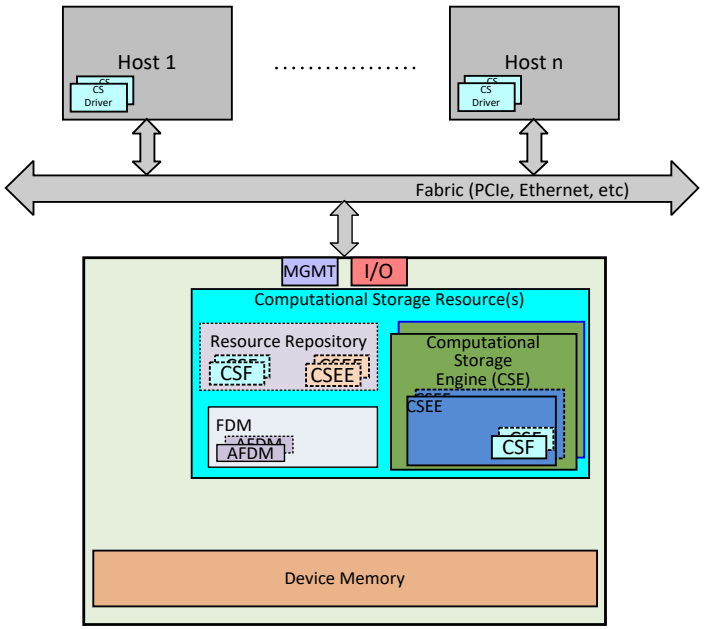
- Architectural Document
  - v1.0 Released August 2022
    - Received the Most Innovative Memory Technology award at FMS 2022
  - v1.1 under development
    - Security enhancements for multiple tenants (complete)
    - Sequencing of Commands (in-progress)
- API
  - v1.0 was released in October 2023
    - Received the Most Innovative Memory Technology award at FMS 2023
  - v1.1 under development



Architecture Overview

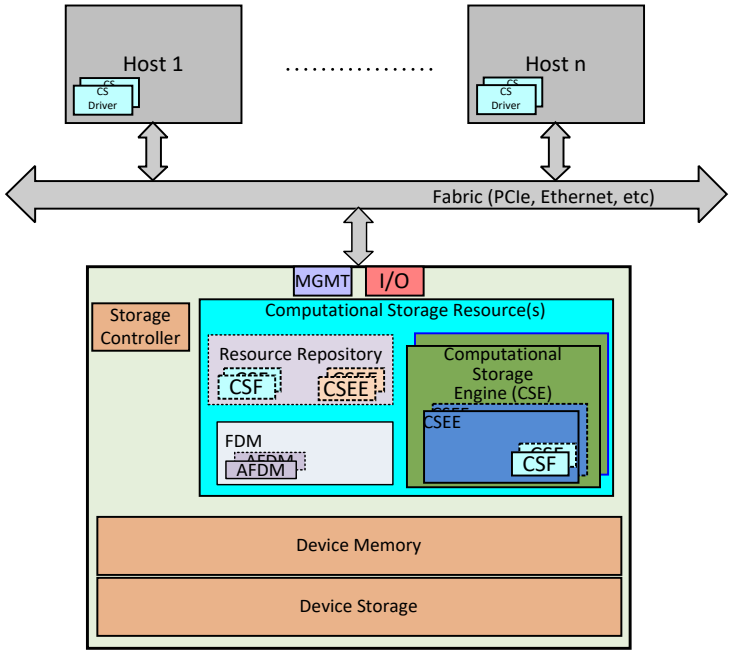
Computational Storage Architecture

Computational Storage Processor



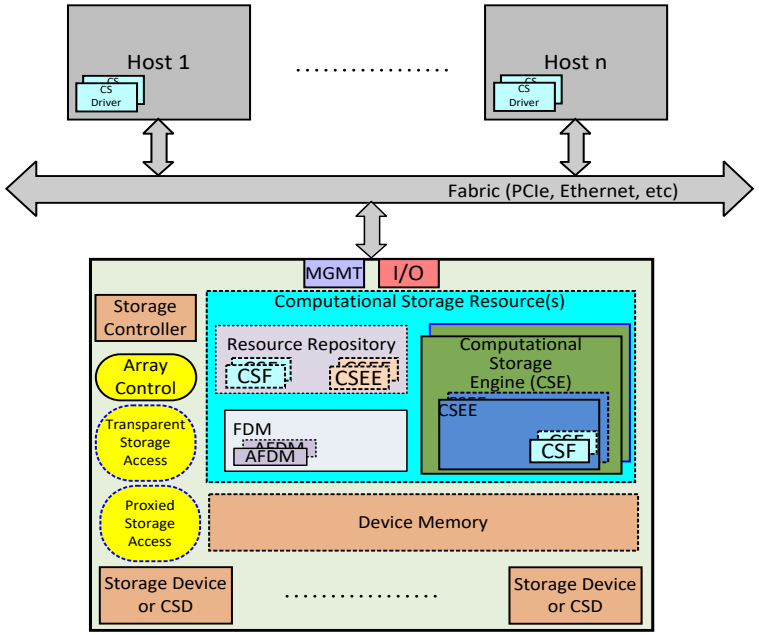
Computational Storage Processor (CSP)

Computational Storage Drive



Computational Storage Drive (CSD)

Computational Storage Array



Computational Storage Array (CSA)

CSx = Computational Storage **Device** – CSP or CSD or CSA

Sequencing of Commands

- Enables sequences of CSFs to execute in succession
  - Sequence executes in-order
  - Allows multiple CSFs to execute with minimal host involvement
- Aggregator CSF
  - Manages execution of the sequence
  - Tracks completion status of each CSF
  - May be downloaded or Pre-installed
  - Fixed Sequence or Variable Sequence defined by parameters passed by the host
- Error Handling
  - May be handled by the host or the aggregator CSF

Security Considerations for v1.0

- Assumptions
  - The environment consists of a single physical host or virtual host with one or more CSxes
  - The host is responsible for the security of the ecosystem that the CSxes operate within
  - CSx security requirements are comparable to the security requirements common to SSDs/HDDs
- Privileged Access
  - Elevated privileges necessary for operations

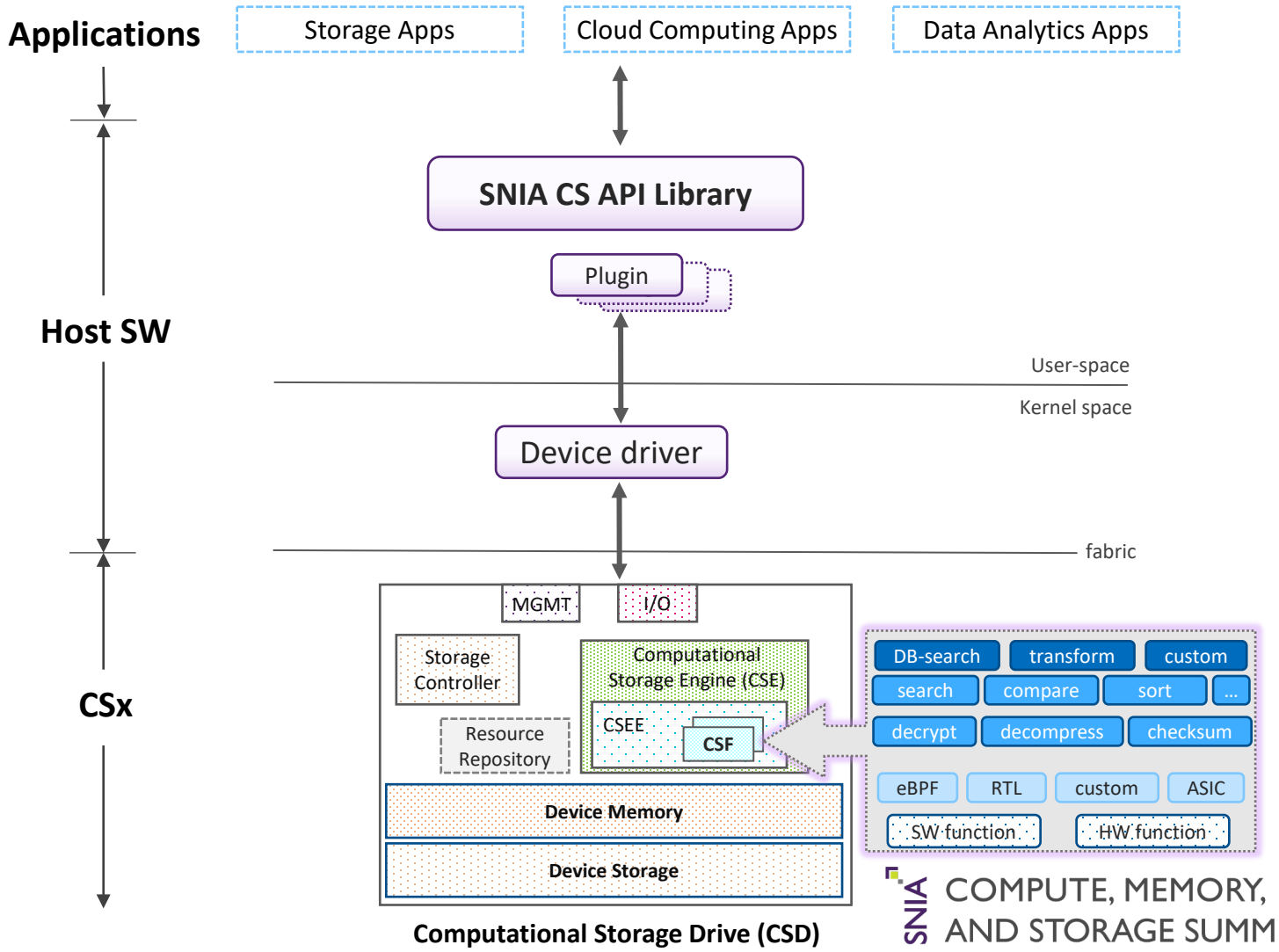
Security Considerations for v1.1

- Assumptions
  - The environment consists of multiple physical hosts or multiple virtual hosts with one or more CSxes
  - CSx security requirements are comparable to the security requirements common to SSDs/HDDs in a multi-tenant environment
- Trust Relationships
- Elements required for a trust relationship are
  1. Identification
     - Exchanged between participating parties
  2. Authentication
     - Is done following identification
     - Exchange of authentication information is done with the same element as Identification
  3. Authorization
     - Is done following authentication
     - Authorizes specific actions on specific resources
     - May be done at a lower-level element than the element that was authenticated
  4. Access Control
     - Controls access to elements of the CSx that are within the scope of the authorization
     - May be access to a CSE, a CSEE, or a CSF
- Different elements of the trust relationship may be at different levels
  - Identification and Authentication may be at the CSx
  - Authorization may be at the CSEE within the CSx
  - Access Control may be at the CSF activated in the CSEE

API Overview

SNIA Computational Storage APIs

- One set of APIs for all CSx types
- APIs hide device details
  - Hardware, Connectivity
- Abstracts device details
  - Discovery
  - Access
  - Device Management
  - Memory Management
    - alloc/free/init
  - Storage/Memory Access
  - Download
  - Execute CSFs
- APIs are OS agnostic



SNIA and NVMe Computational Storage

NVMe Computational Storage and SNIA Architecture

- NVMe Computational Storage ratified January 2024
- NVMe Computational Storage implements the SNIA Computational Storage Model
- SNIA API supports NVMe Computational Storage

CS and SDXI Collaboration

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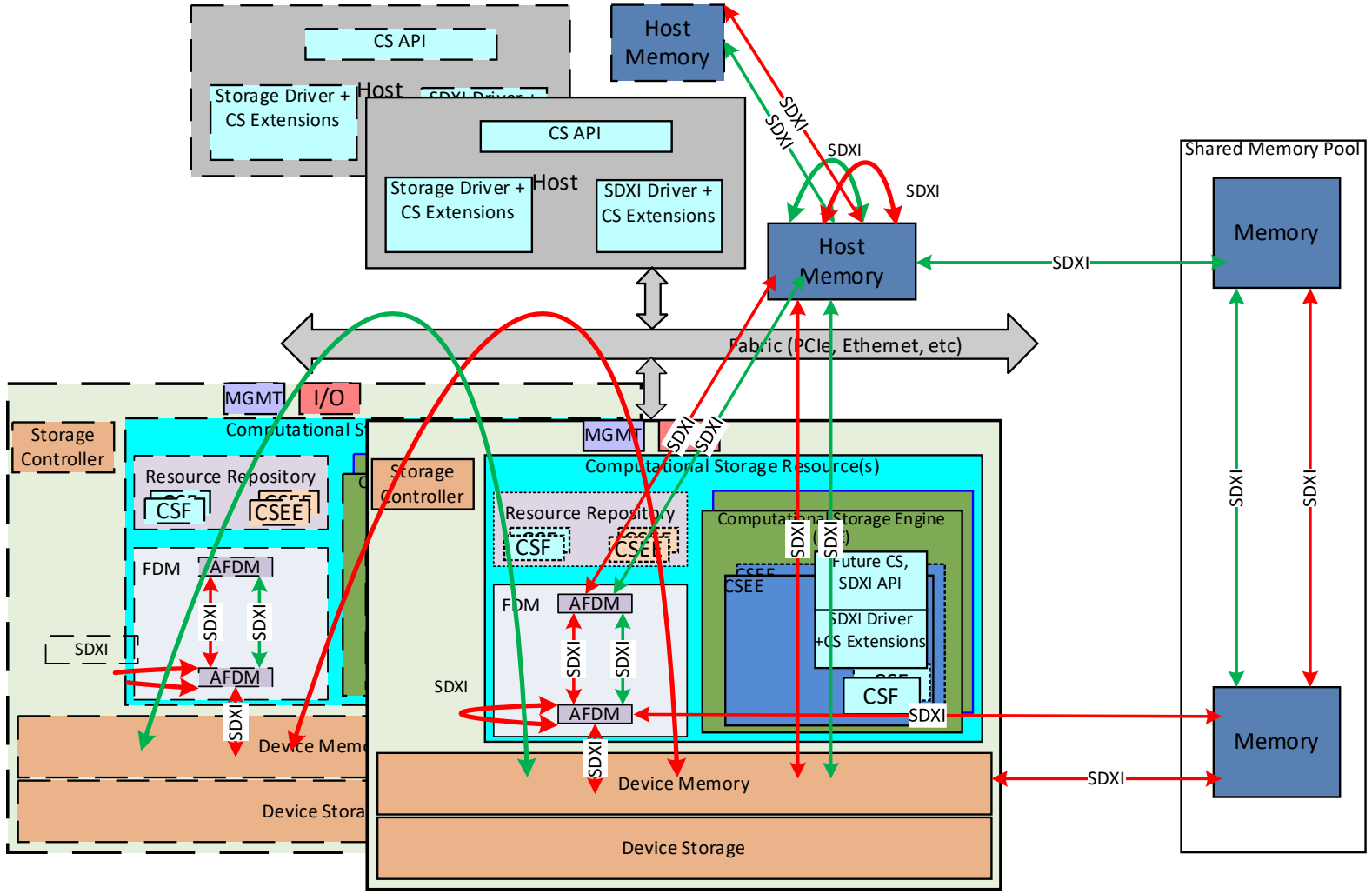
SDXI (Smart Data Accelerator Interface)

- Smart Data Accelerator Interface (SDXI) is:
  - A SNIA standard for a memory to memory data movement and acceleration interface
  - Extensible
  - Forward-compatible
  - Independent of I/O interconnect technology
  - Provides data transformation features
- v1.0 was published November 2022
  - https://www.snia.org/sdxi

Combined SDXI+CS Architecture



- SDXI used for data movement with Computational Storage used for compute
- Multiple SDXI producers in a CS Architecture
- SDXI enables data movement across multiple AFDM regions

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- Join the Computational Storage TWG: https://members.snia.org/workgroup/index

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