



June 13-15, 2023

DoubleTree by Hilton San Jose

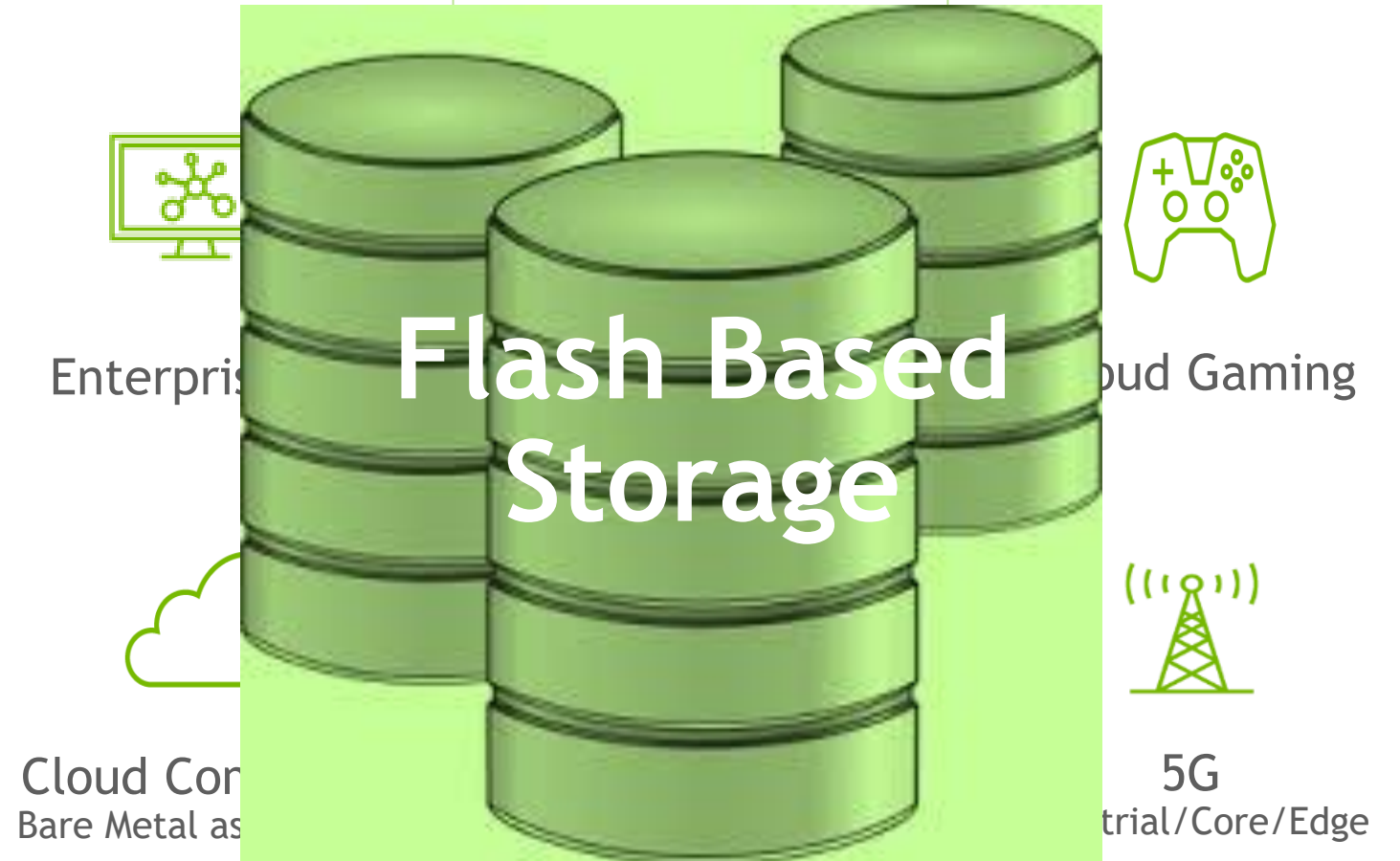
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SmartNIC (DPU) Storage Solutions and Use Cases

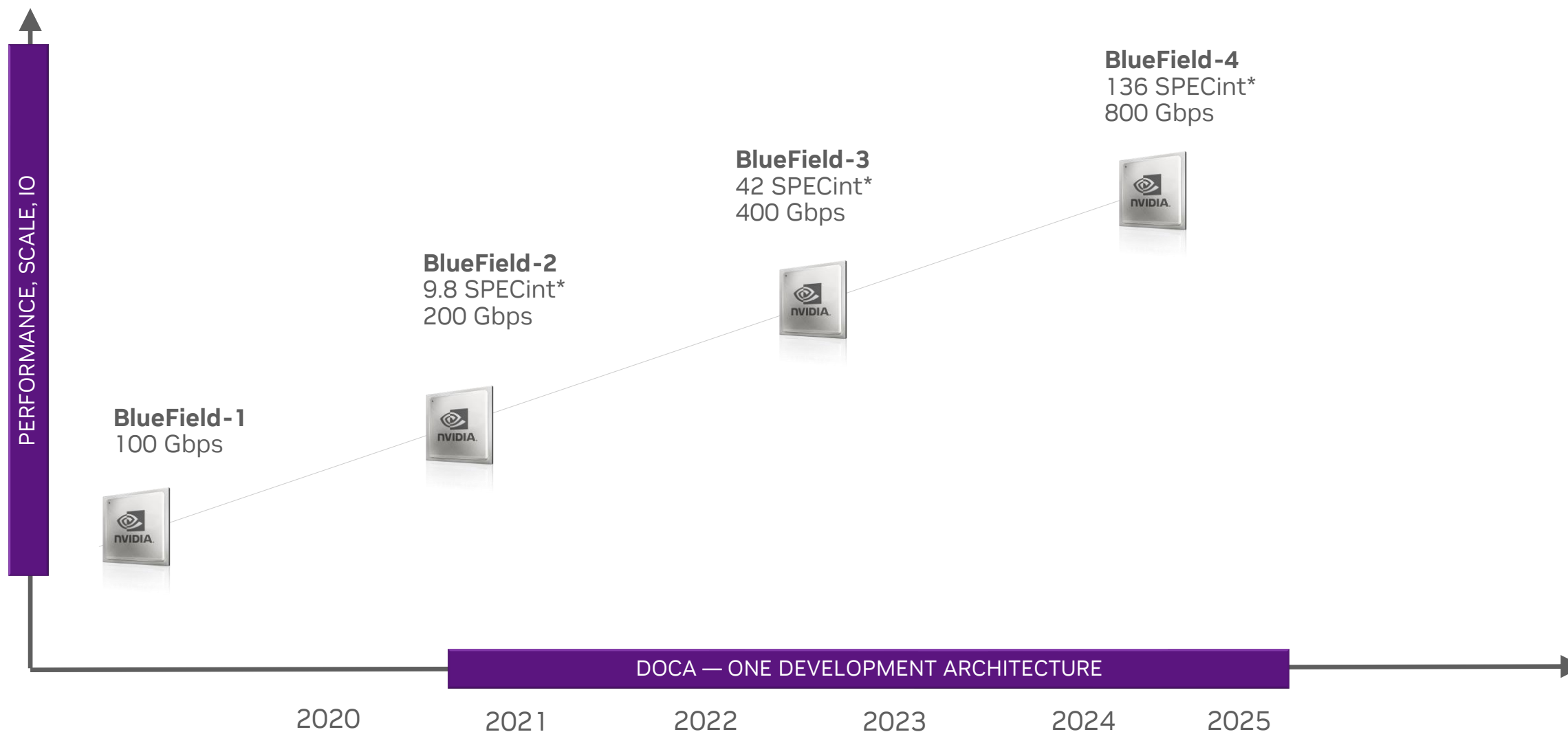
Rob Davis

VP Storage Technology, NVIDIA Networking
Platforms

What Are DPUs?



NVIDIA DPU BlueField Roadmap



Storage Companies Implementing DPU Storage Solutions

AIC



AirMettle



DELL
Technologies



CELESTICA™



EIDETICOM

HITACHI

ingrasy

KIOXIA

mercury

nebulon®

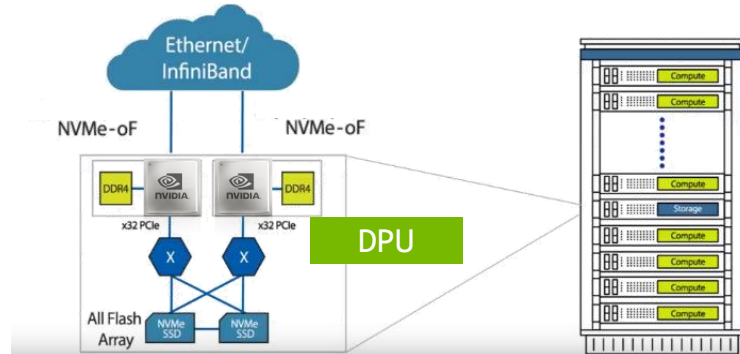


VAST

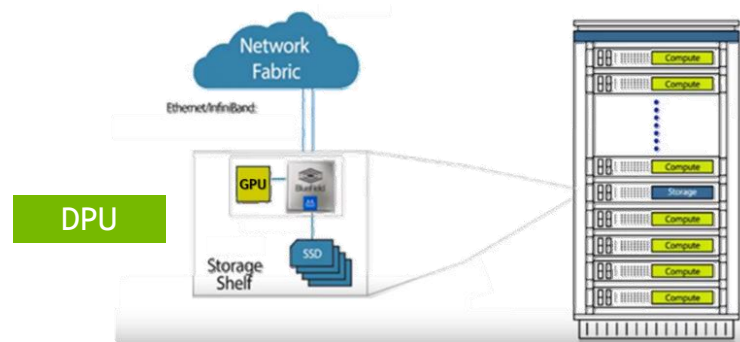


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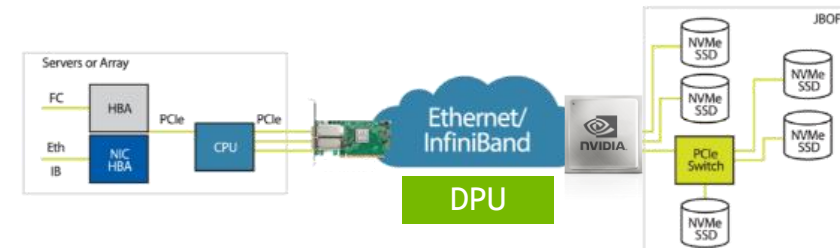
DPU Storage Use Cases



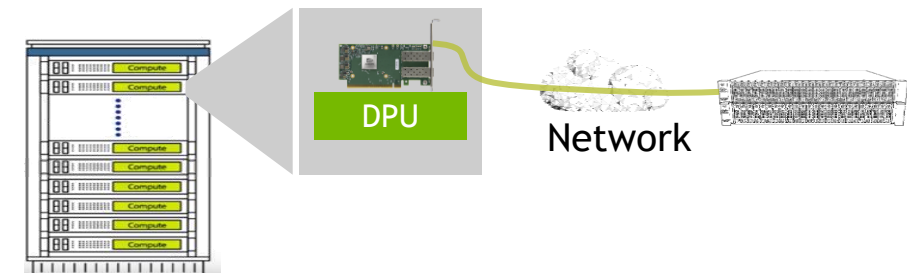
All Flash Array/JBOF for Storage Area Networks



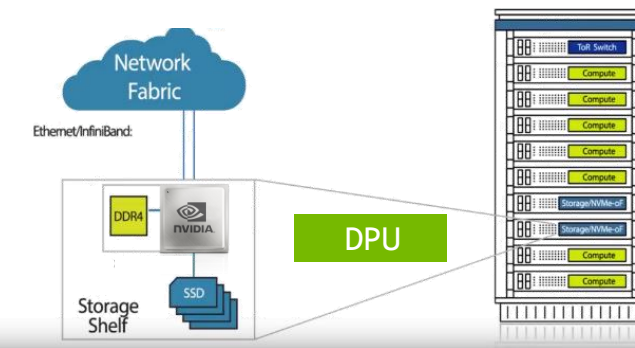
Computational Storage



Backend NVMe-oF Cluster

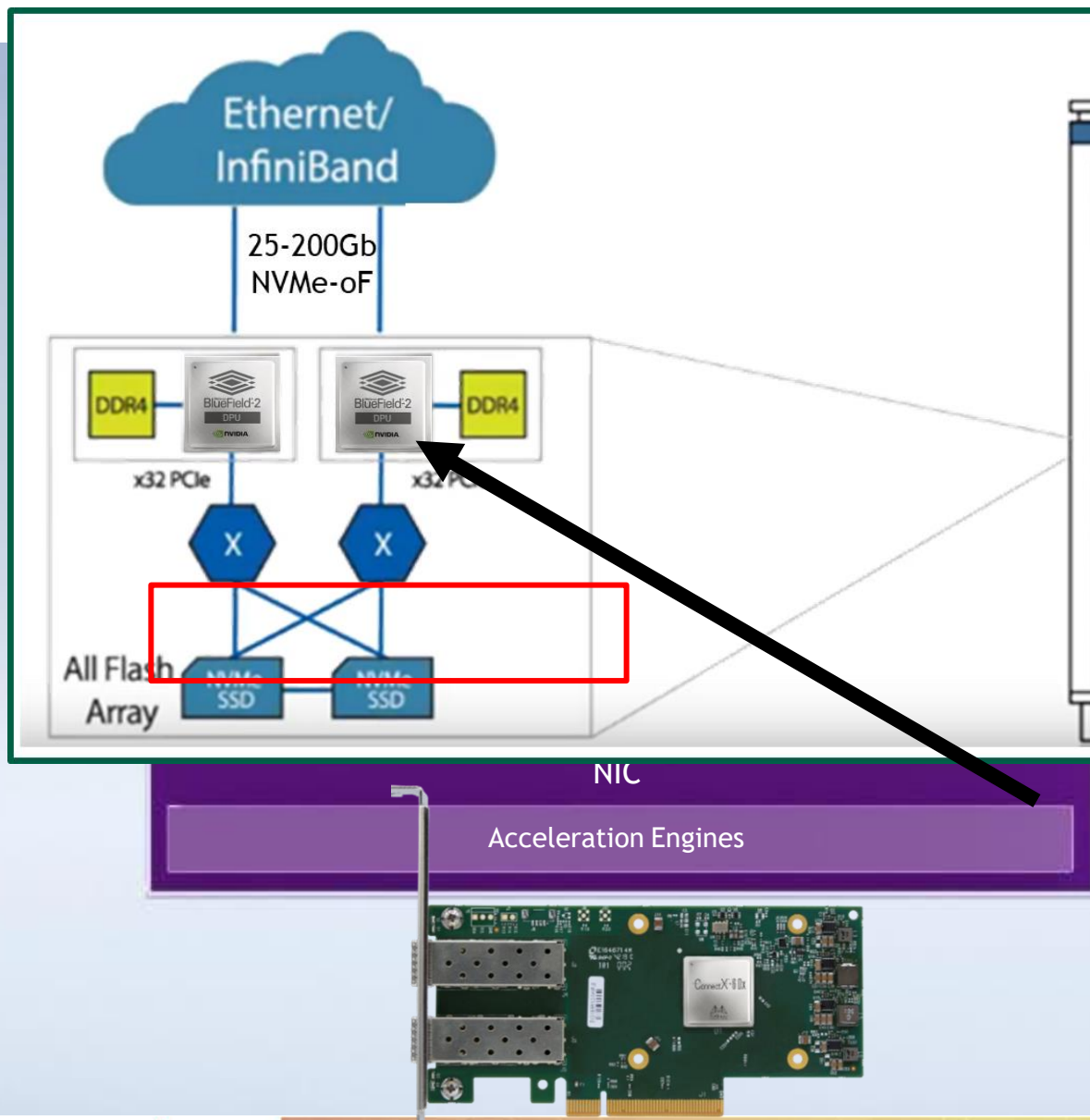


Server Based Storage / SDS



Compute and Storage Disaggregation

How: DPUs Offload, Accelerate and Secure Storage



NVIDIA DPU Architecture

CPU(s)

- ARM/RISC-V

HW Offloads

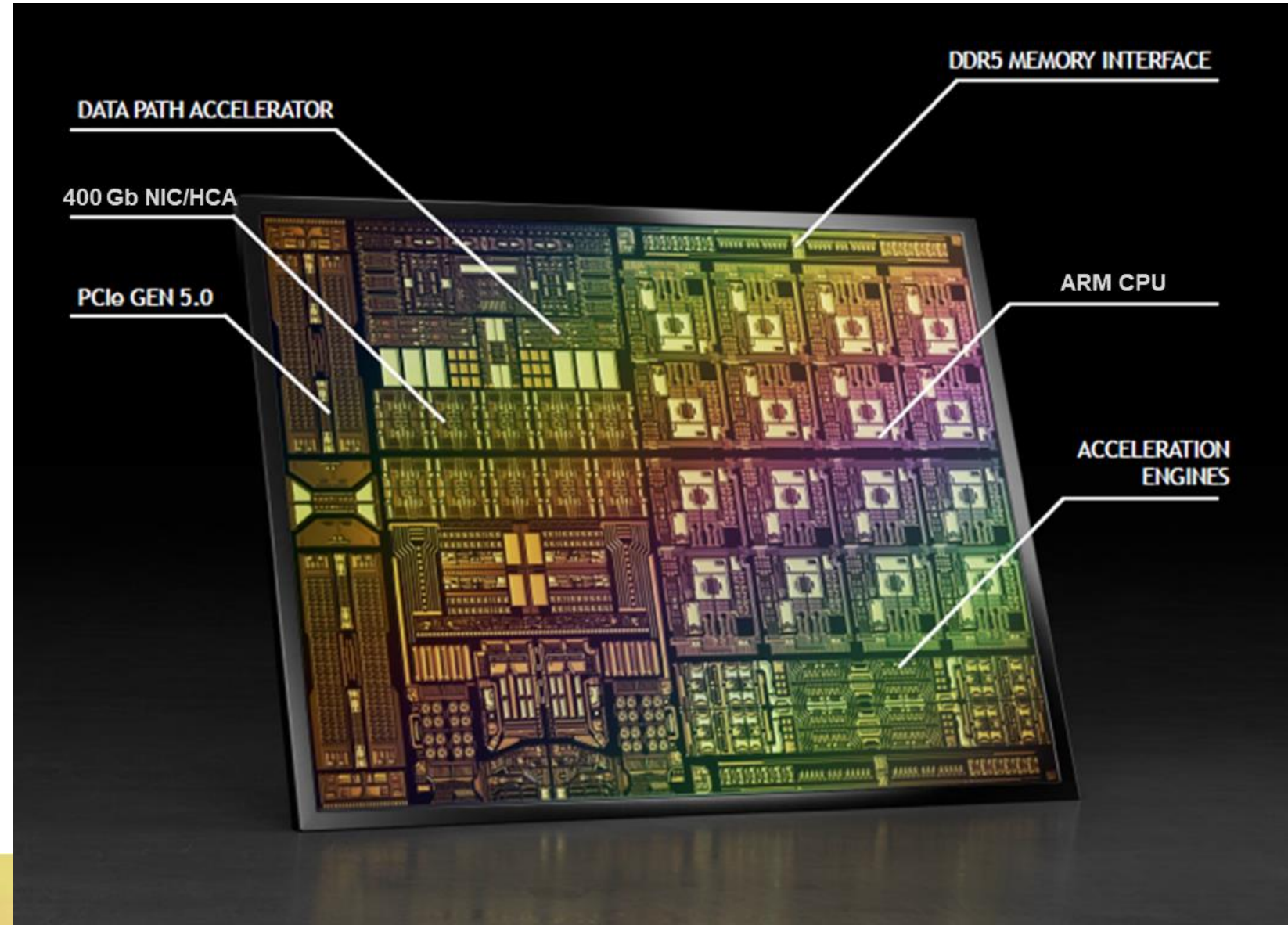
- CPU cycle intensive or latency sensitive functions

IO

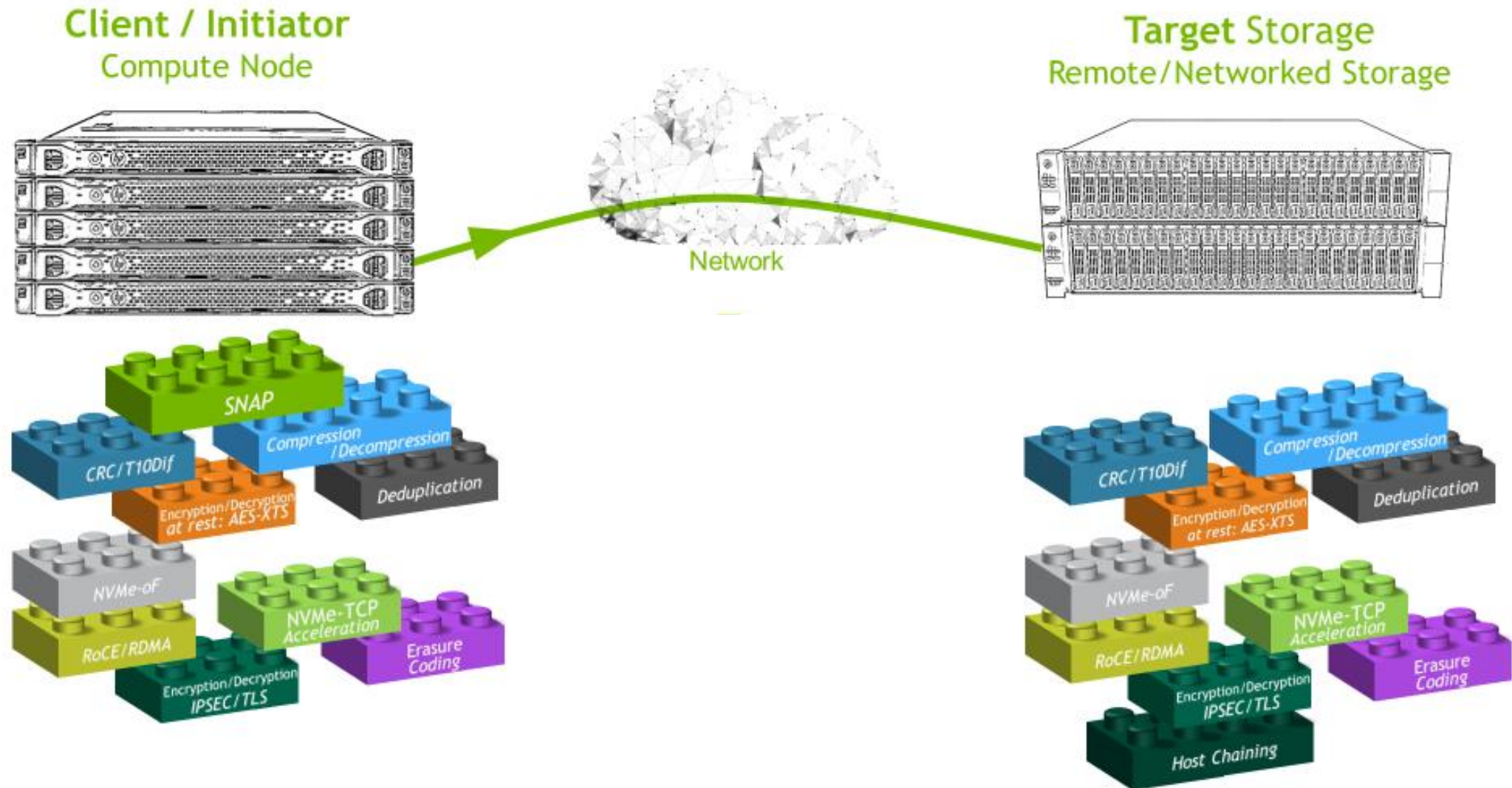
- PCIe, Ethernet, IB

SDK

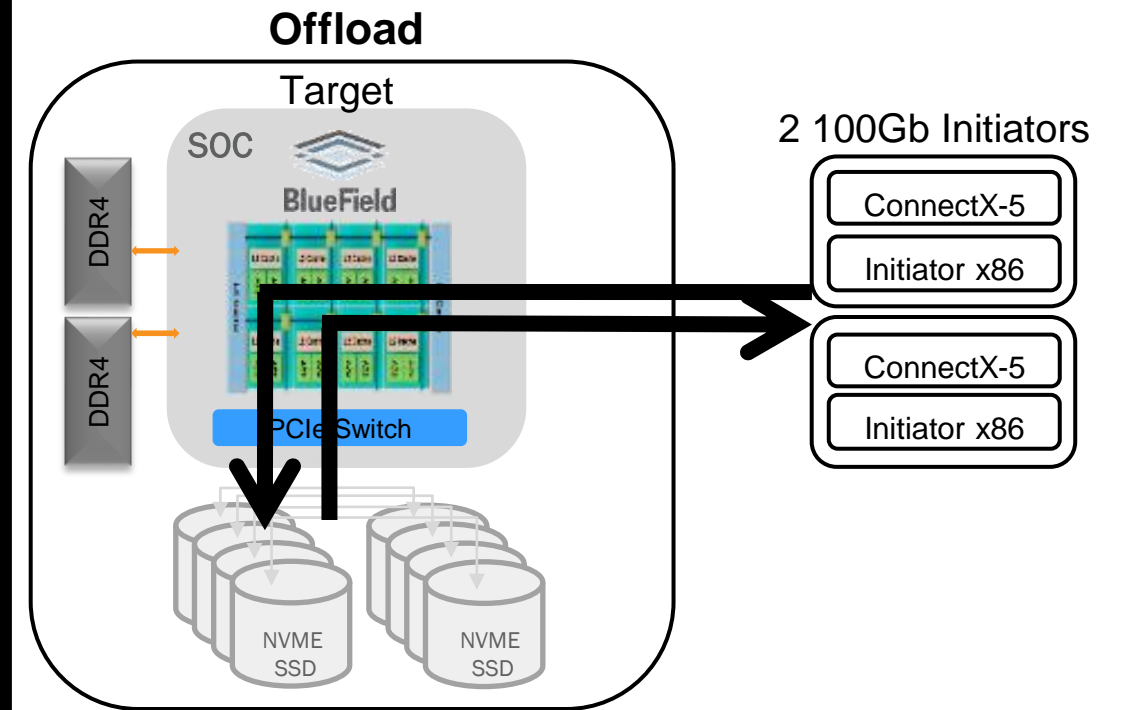
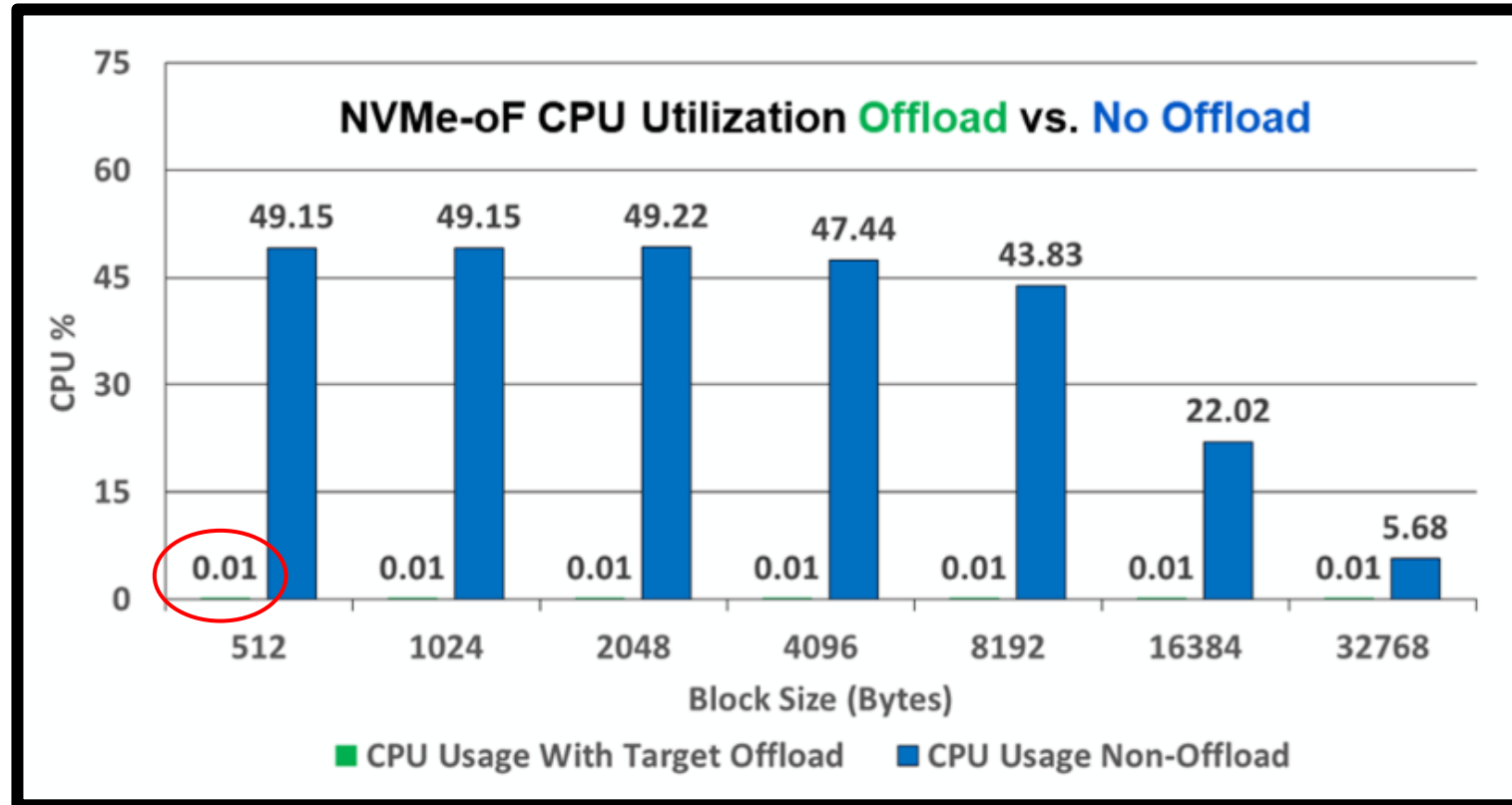
- DOCA (OPI)



DPU Storage Accelerator



NVMe-oF Target Offload

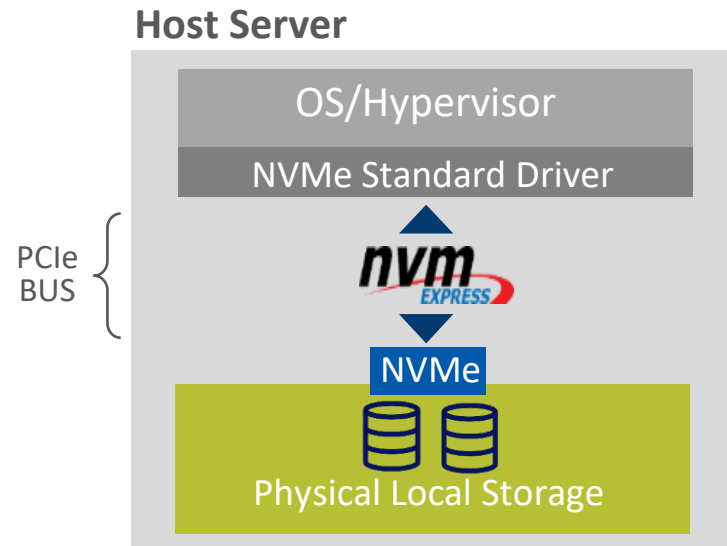


- 6M IOPs, 512B block size
- 2M IOPs, 4K block side
- ~15 usec latency (not including SSD)

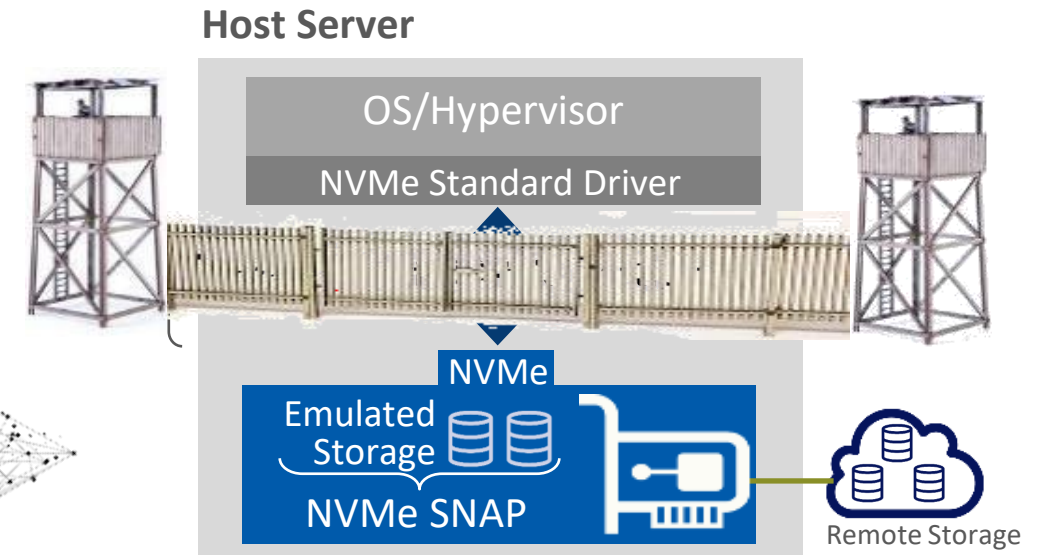
- 8M IOPs, 512B block size
- 5M IOPs, 4K block side
- ~5 usec latency (not including SSD)

Server Side Offload – SNAP Example

Physical Local NVMe Storage



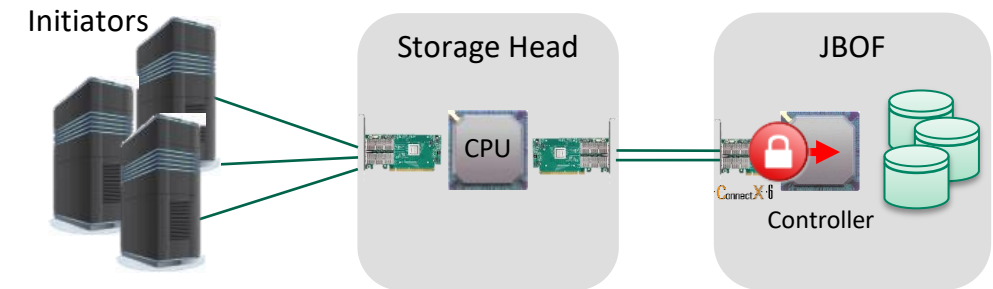
NVMe SSD Emulation



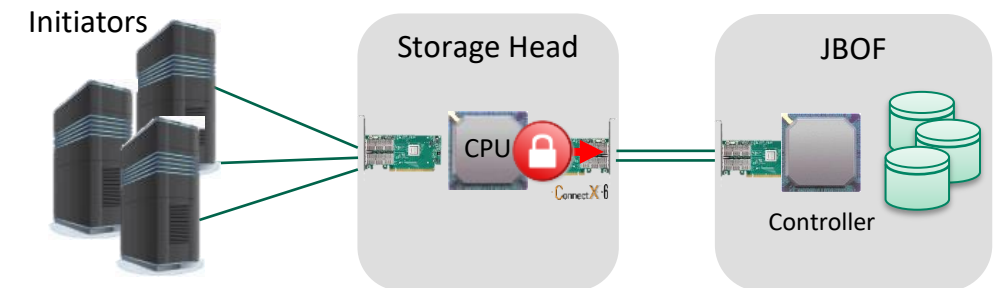
**Local Physical Storage to
Hardware Emulated Storage**

Encryption Offload

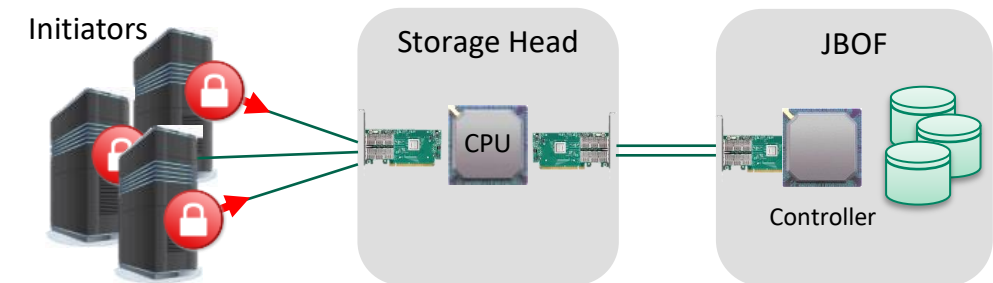
- ▶ At the Target JBOF
- ▶ Secure data at rest on drives with AES



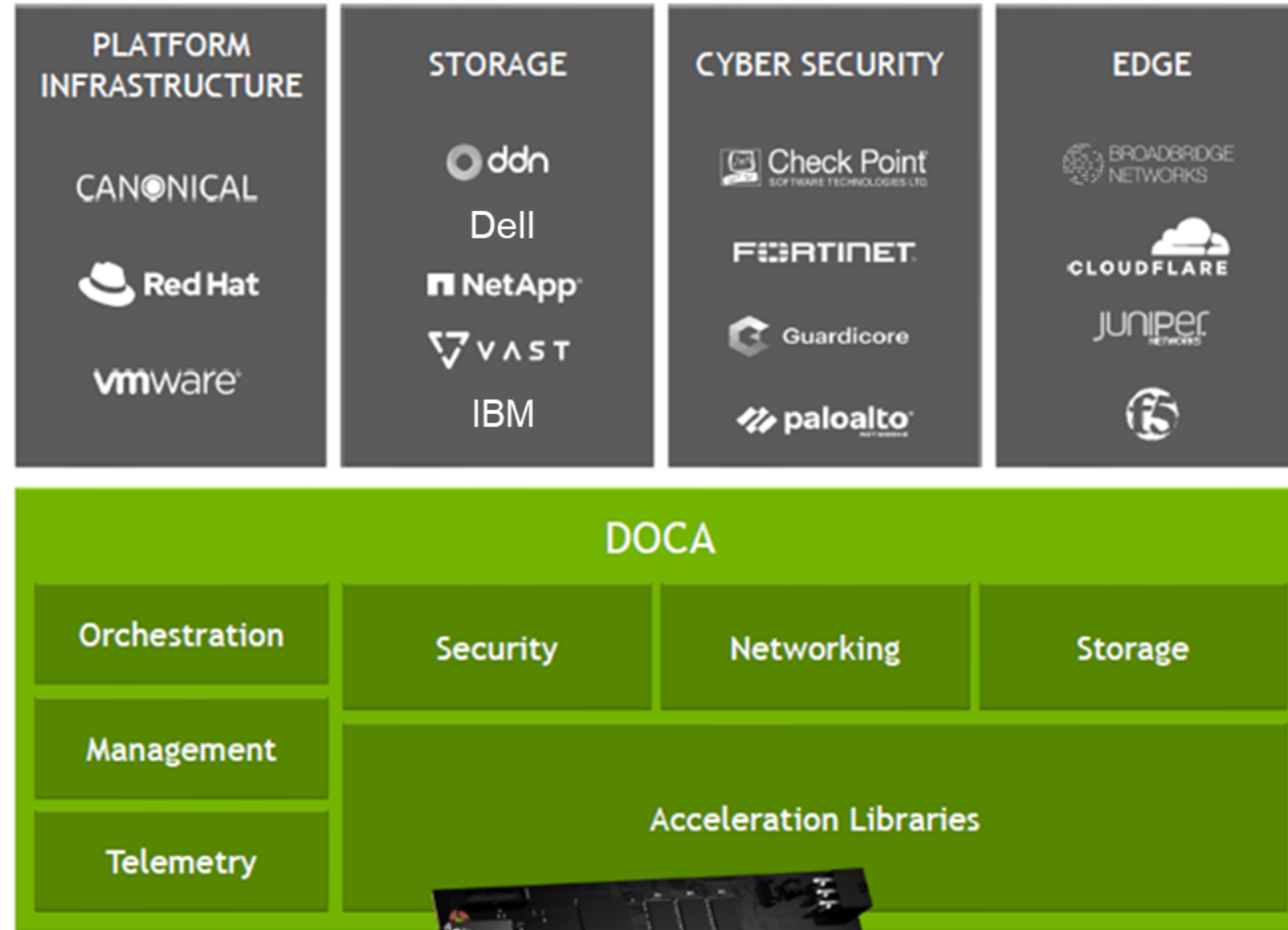
- ▶ At the Front-End Controller
- ▶ Secure data on drives and in-flight to JBOFs and AFAs with AES, TLS, MACsec, and IPsec



- ▶ At the Initiator (Server)
- ▶ Secure data across entire storage data path
- ▶ Owner of the data controls the keys



Programing DPUs



Open Programmable Infrastructure Project



Community Driven Open Ecosystem for frameworks based on DPU enabled systems

- Originated as Diamond Bluff in late 2021
 - rapid growth in 2022, 20+ companies, 100+ individuals
- OPI Project is now a Linux Foundation project
 - <https://opiproject.org/>
 - <https://github.com/opiproject>
 - Announcement 21-JUN-2022

Current Working Areas
Organization & Administration + Legal/Governance
Vision Statement/Goals + requirements
Events, Outreach, Orientation
Provisioning and Platform Management
Open Programmable Infrastructure API and Behavioral Model
Use Case
Developer Platform/POC/Reference Platform

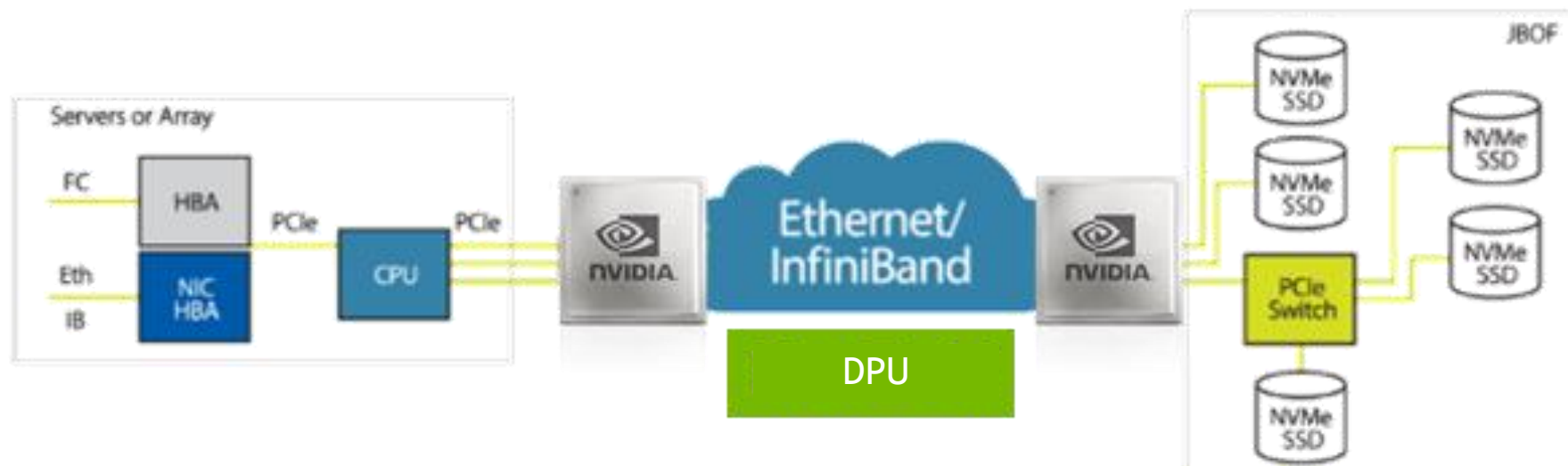
“Founding members of OPI include Dell Technologies, F5, Intel, Keysight Technologies, Marvell, **NVIDIA** and Red Hat with a growing number of contributors representing a broad range of leading companies in their fields ranging from silicon and device manufactures, ISVs, test and measurement partners, OEMs to end users.”

OPI Project Goals

- Create community-driven standards-based open ecosystem for DPU/IPU-like technologies
- Create vendor agnostic framework and architecture for DPU/IPU-based software stacks
- Reuse existing or define a set of new common APIs for DPU/IPU-like technologies when required
- Provide implementation examples to validate the architectures/APIs

OPI Project Deliverables

- Open Source Projects
- Specifications/Standards
- Reference Platforms
- Test Suites & Cases
- POC/Prototypes

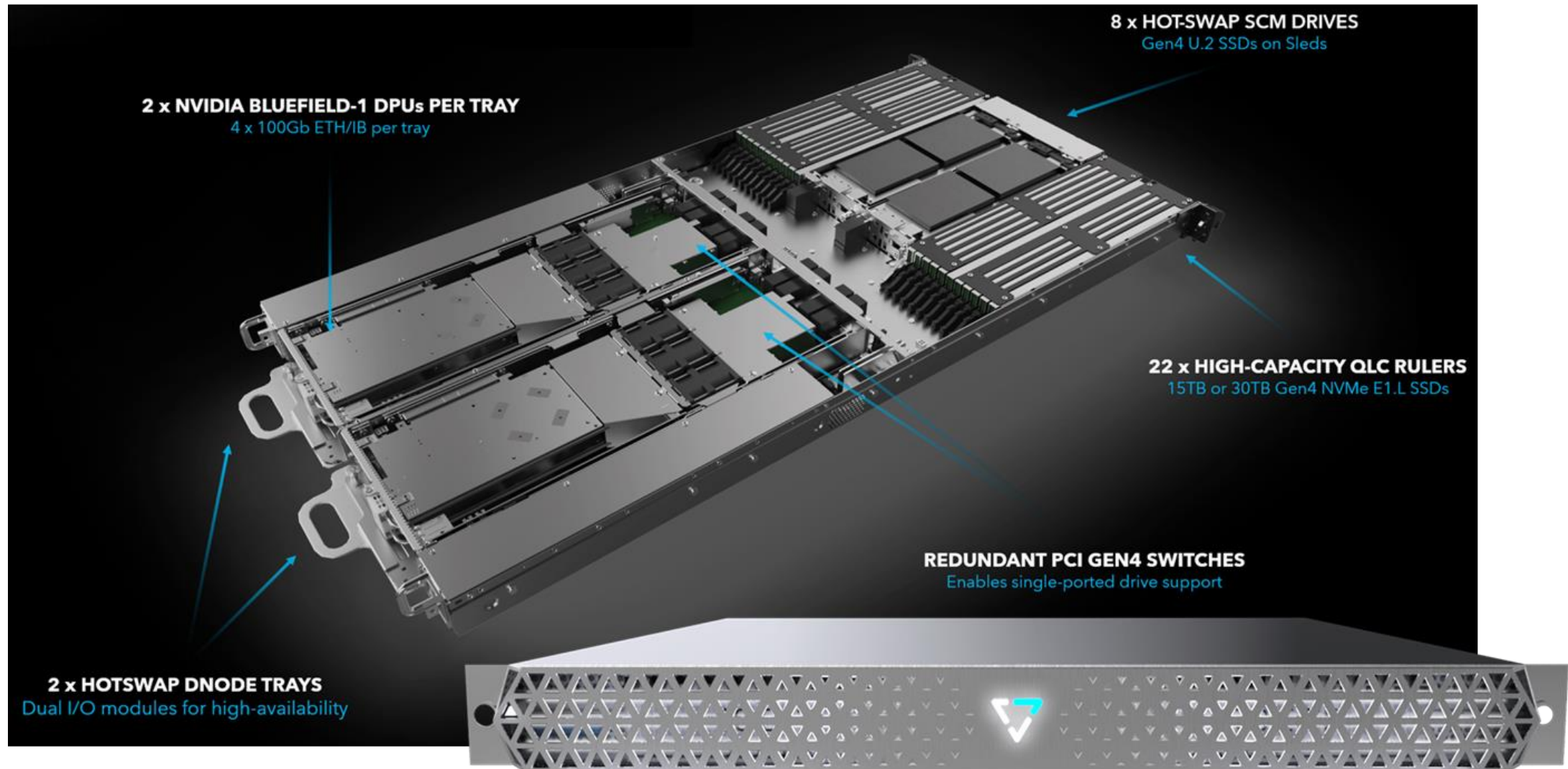


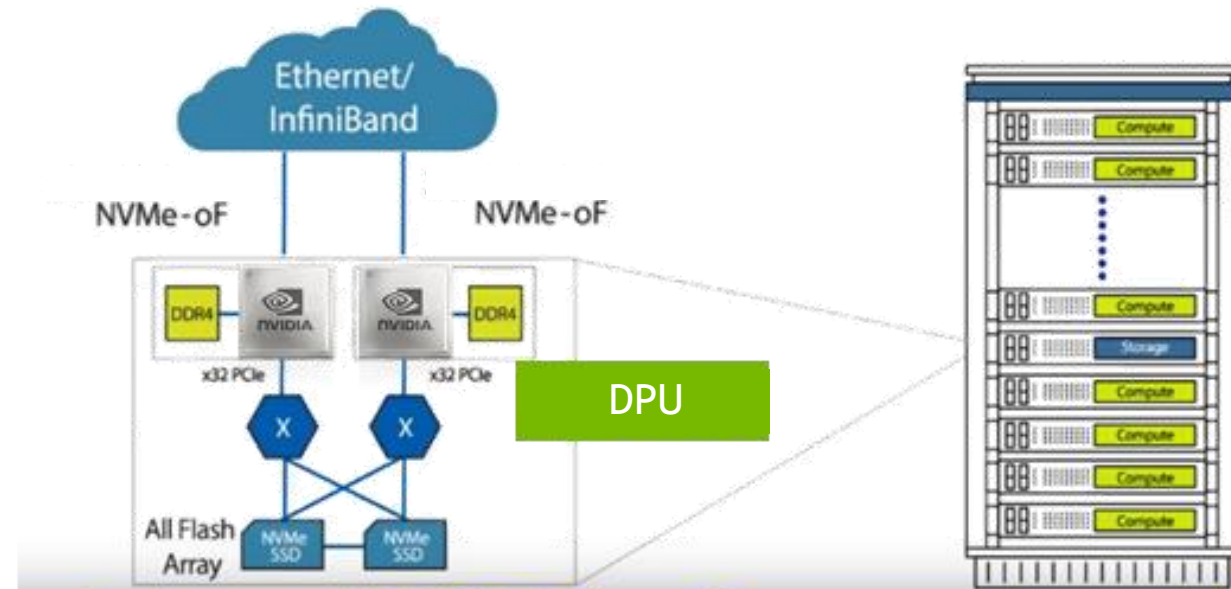
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Example of Embedded Scale Out Back End





All Flash Array/JBOF for Storage Area Networks

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Autonomous Vehicle High Speed Storage



Autonomous Vehicle Training Data Collection

An autonomous vehicle can generate as much as 64 TB/day



SSDs are removed by hand from vehicles and sent to the data center

Sometimes days later



Here they are installed into servers and uploaded for training and analysis

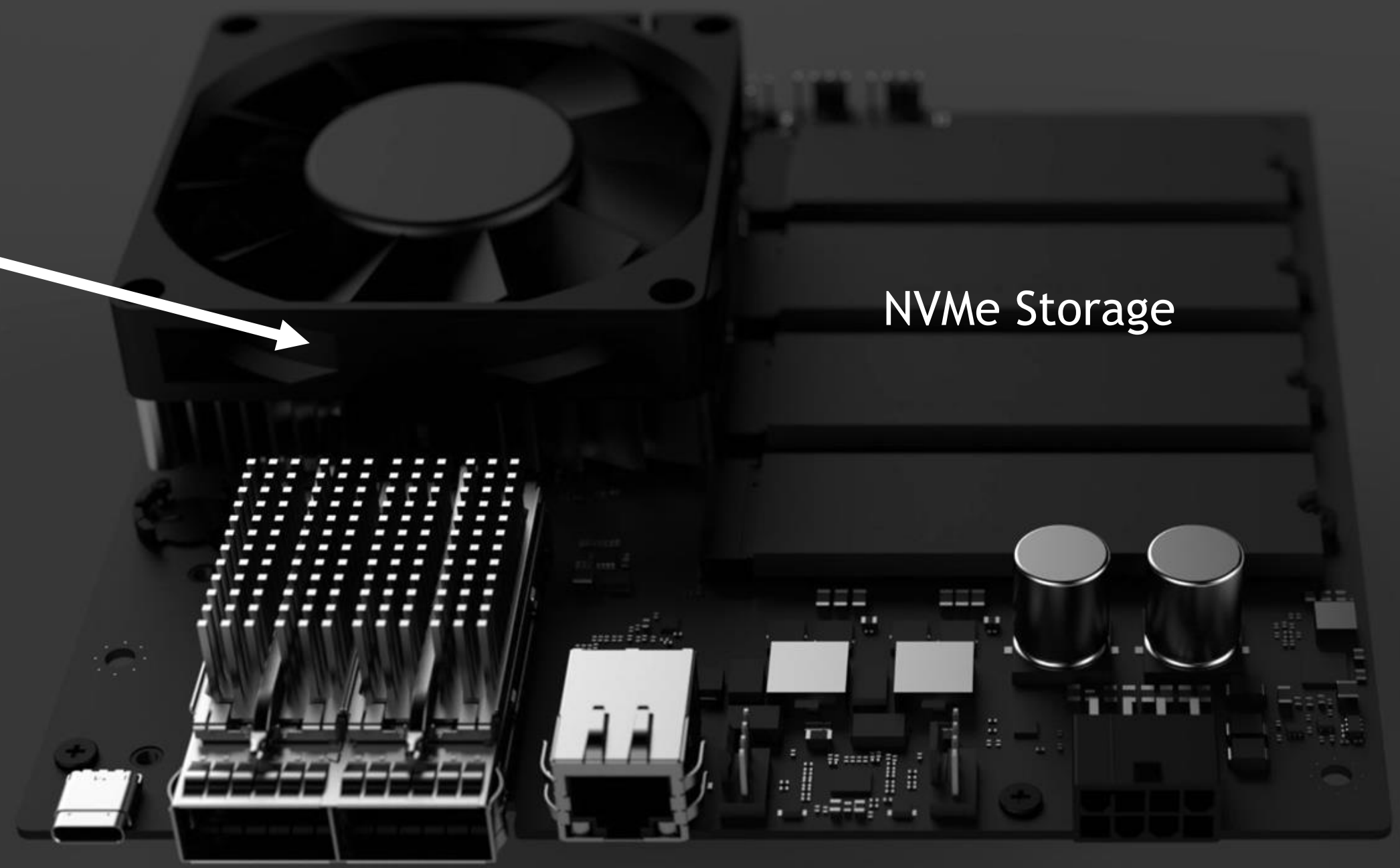


DPU

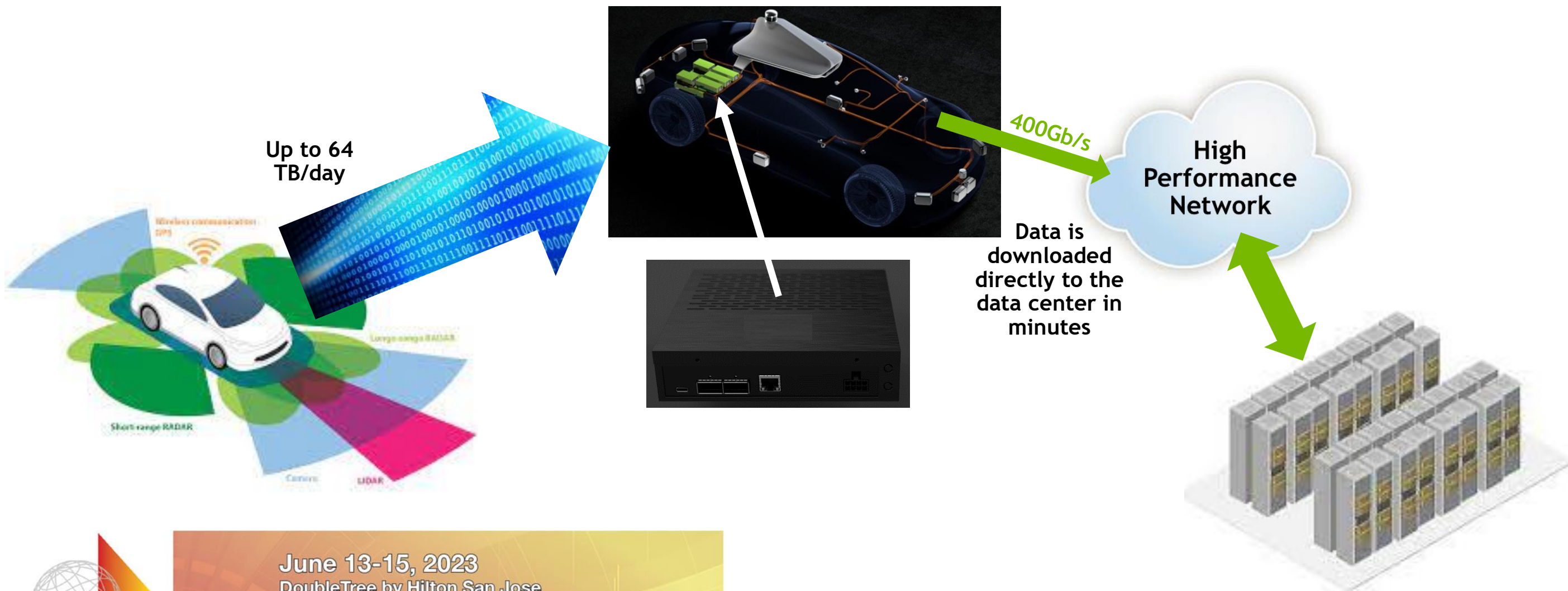


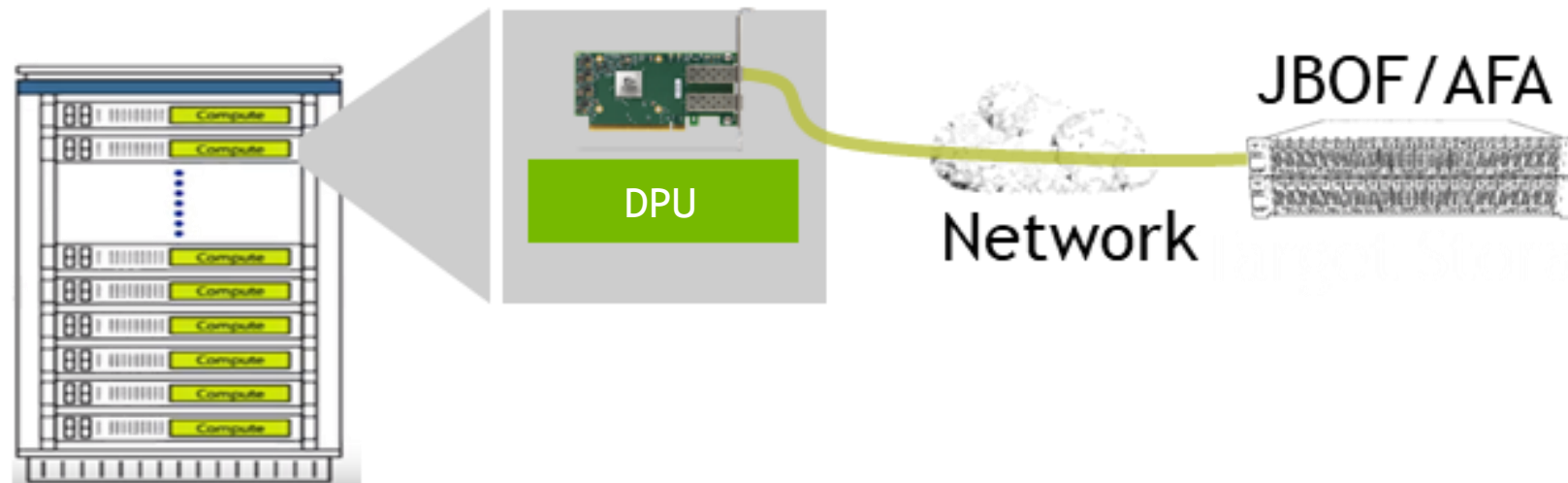
NVMe Storage

2x200 GbE



DPU Autonomous Vehicle Training Data Collection Solution





Server Based BlueField Storage Solution



KIOXIA

Example of a SDS DPU Solution

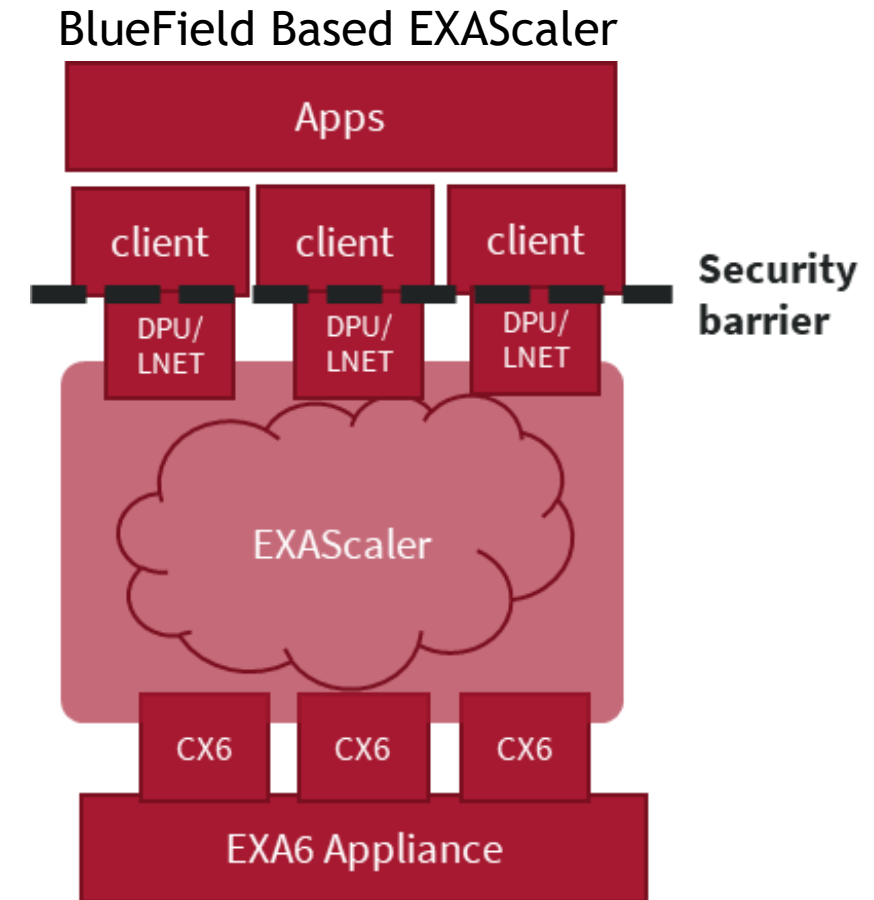
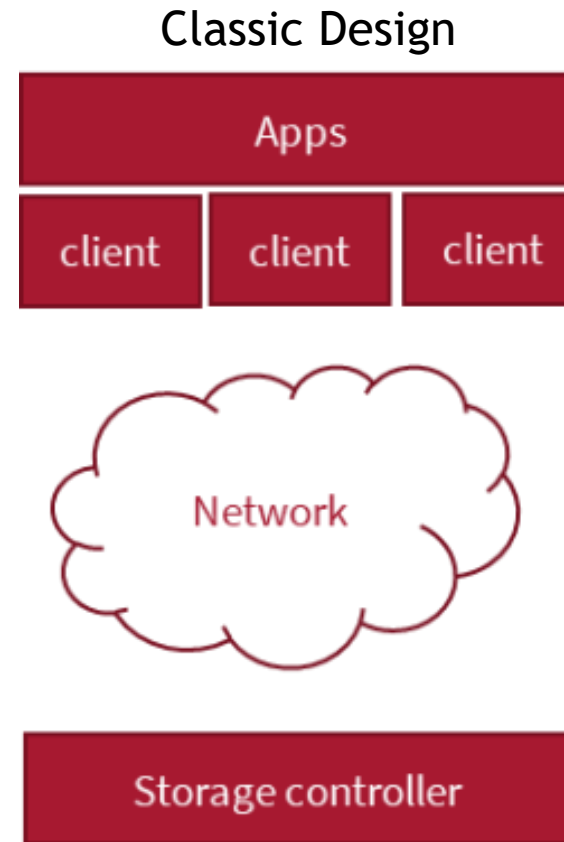
Attack vectors are significantly reduced

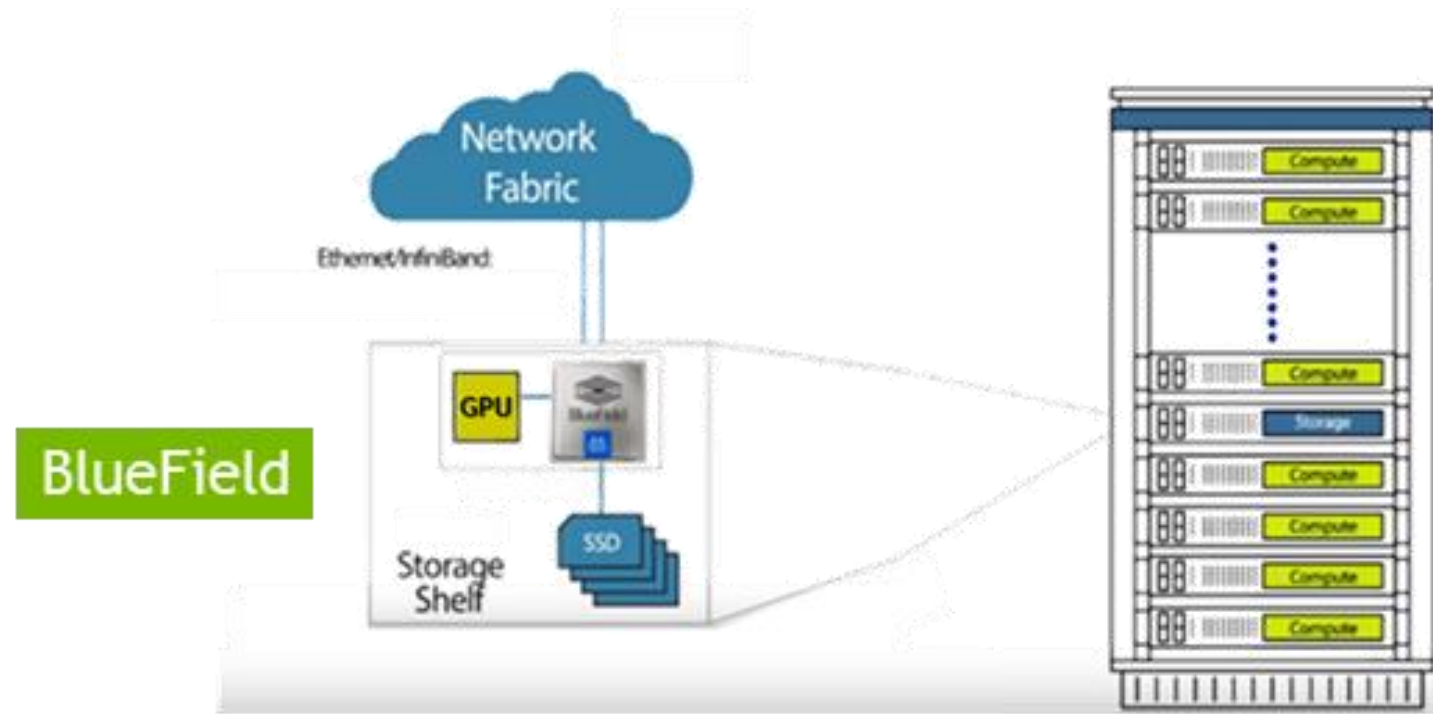
Introduce strict security barrier that separates applications from the storage environment

Reduce the API between app and storage to that of a Lustre aware Router (LNET)

Only the DPU can communicate with Backend Storage

Much stronger security than any storage and network in isolation has today





Computational Storage

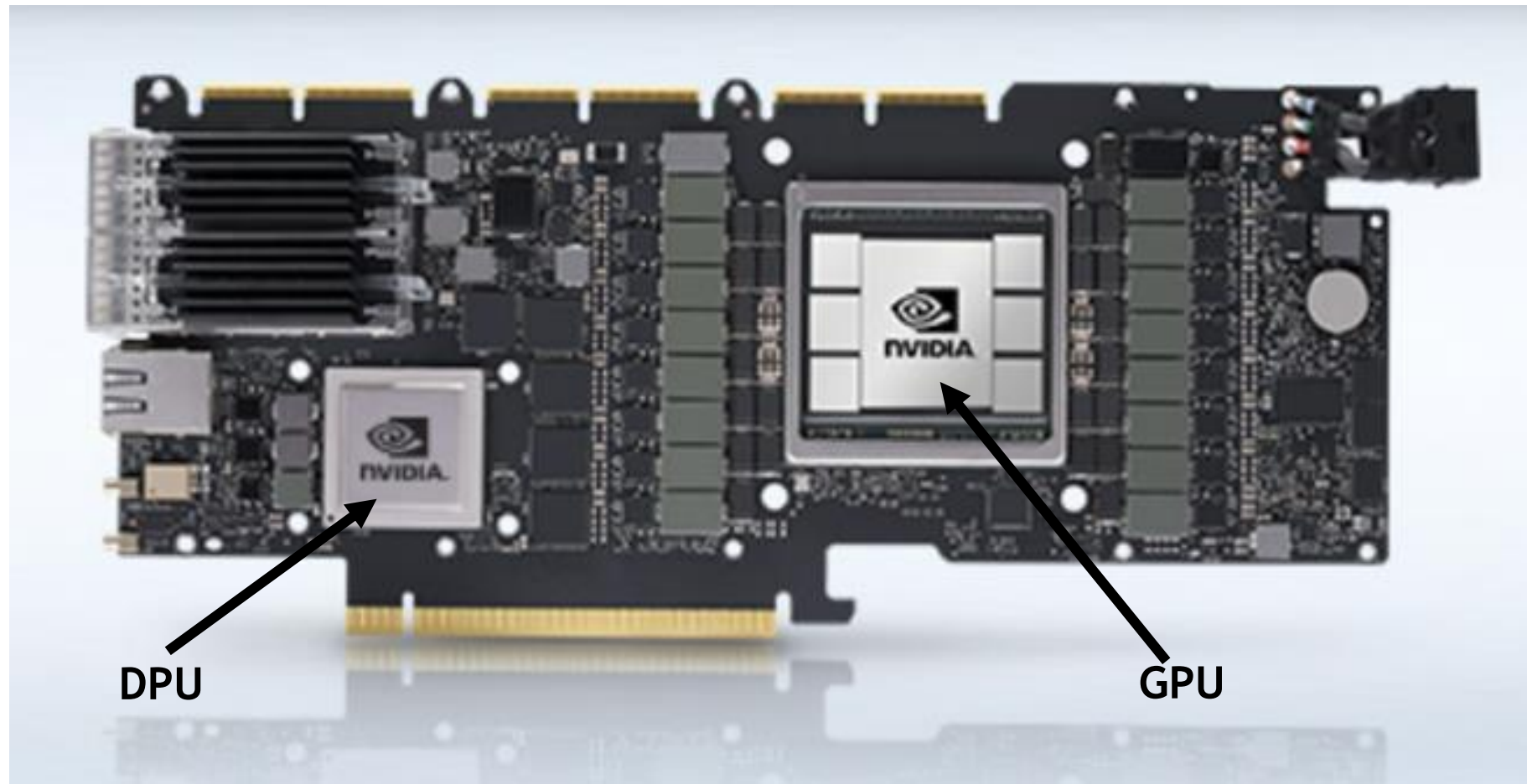


AirMettle



EIDETICOM

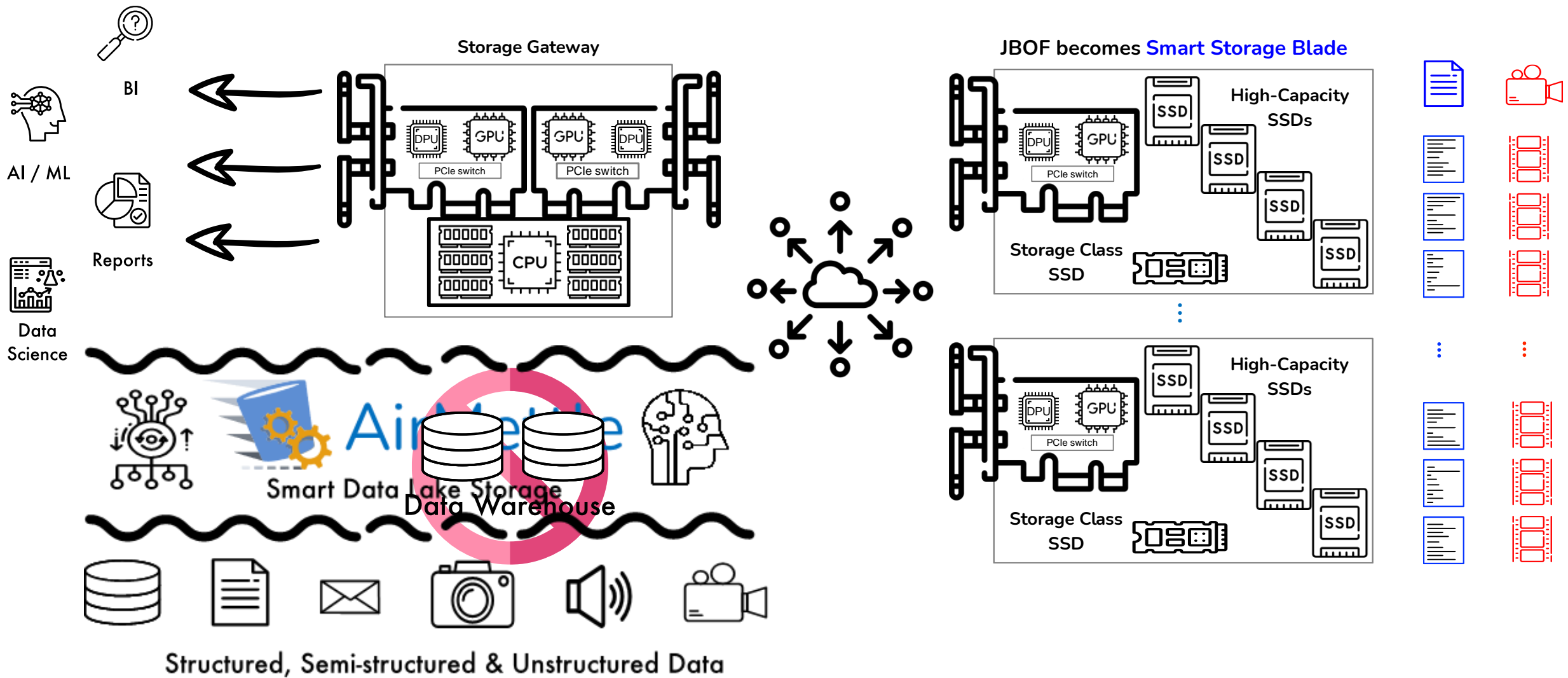
Example of a DPU Computational Storage Platform



DPU

GPU

Example of a DPU Computational Storage Solutions



DPUUs in Use Cases Across Storage Today!





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Thank You!