



SNAP Composable Storage Made Simple

SmartNICs Make Composable Storage a SNAP!

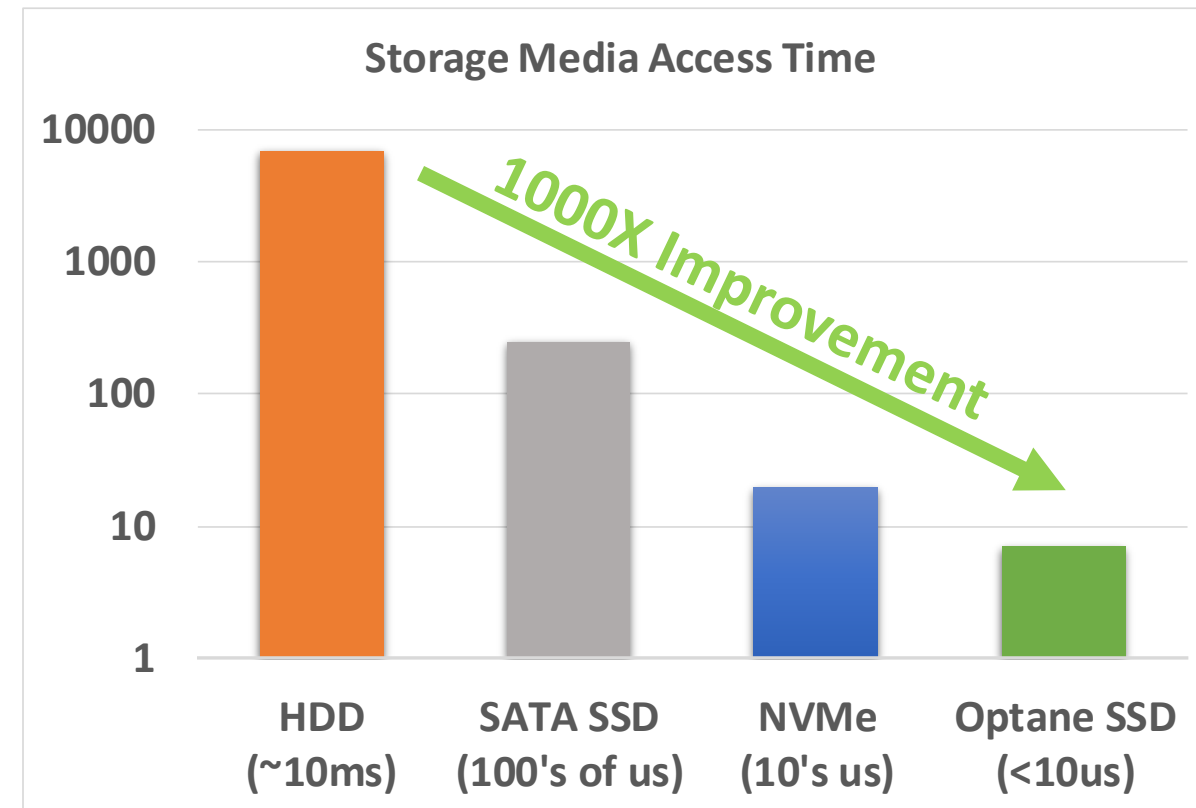
March 2019



NVMe Flash SSDs: The Worlds Fastest Storage



NVMe Flash SSD: 512GB – 1TB

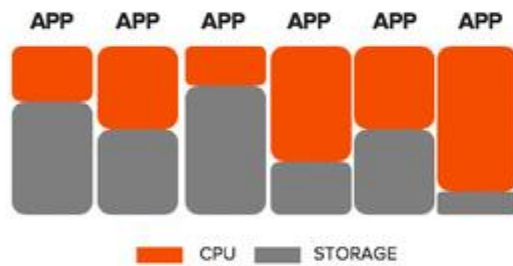


- NVMe improves storage latency 1,000x vs HDD
- Just 3 NVMe SSD saturates a 100G link
 - Fibre Channel not fast enough
 - Ethernet delivers 3X the performance of FC for 1/3 the price

Direct Attached Storage Challenges

THE CHALLENGES OF DAS

INFLEXIBLE ARCHITECTURE



CANNOT SCALE STORAGE AND COMPUTE SEPARATELY

INEFFICIENT CONSOLIDATION

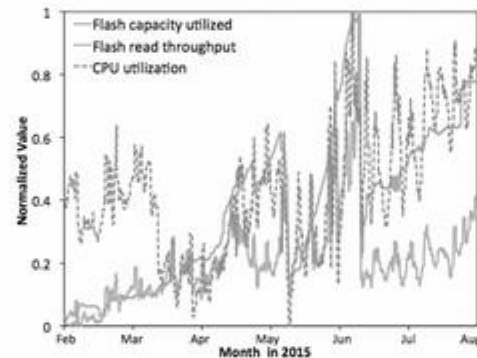


Figure 1: Sample resource utilization on servers hosting a Flash-based key-value store service at Facebook, normalized over a 6 month period. Flash and CPU utilization vary over time and scale according to separate trends.

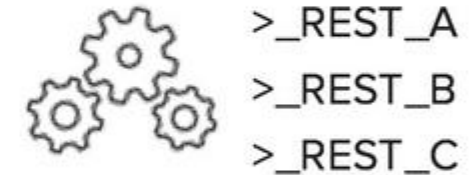
STRANDED CPU / STORAGE

MINIMAL DATA SERVICES



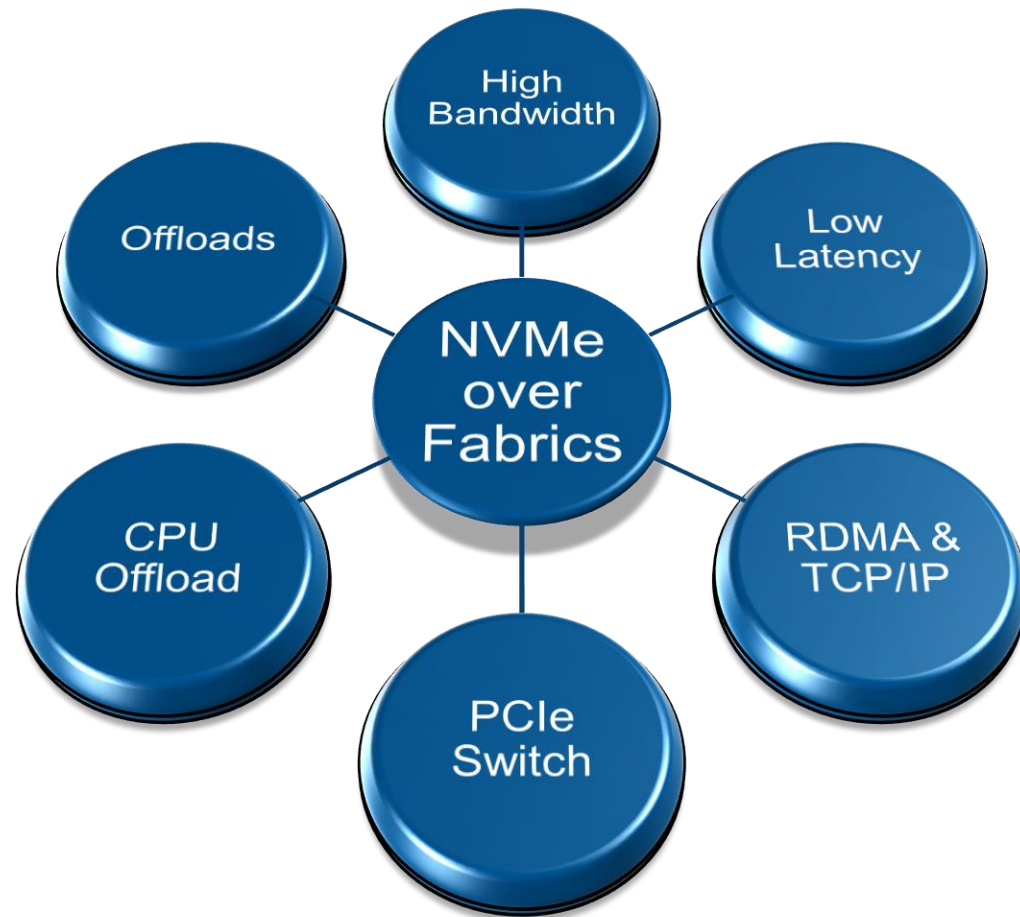
NO SNAPS / REPLICATION
NO GLOBAL DEDUPLICATION
NO THIN PROVISIONING
NO BUSINESS CONTINUITY

DIFFERENT MANAGEMENT APIs



ADDED COMPLEXITY
NO CENTRALIZED MANAGEMENT

NVMe Over Fabrics Gets NVMe Out of the Box



NVMe OVER FABRICS
POWERED BY RoCE

- NVMe-over-Fabrics (NVMe-oF) extends local NVMe Flash storage across a network
- **Key Elements NVMe-oF Ethernet Storage Fabric**
 - RDMA & TCP
 - NVMe acceleration
 - **Zero Packet Loss**
- Mellanox fully offloads NVMe-oF to deliver the highest performance and lowest latency

NVMe-over-Flash – Worlds Best Networked Storage



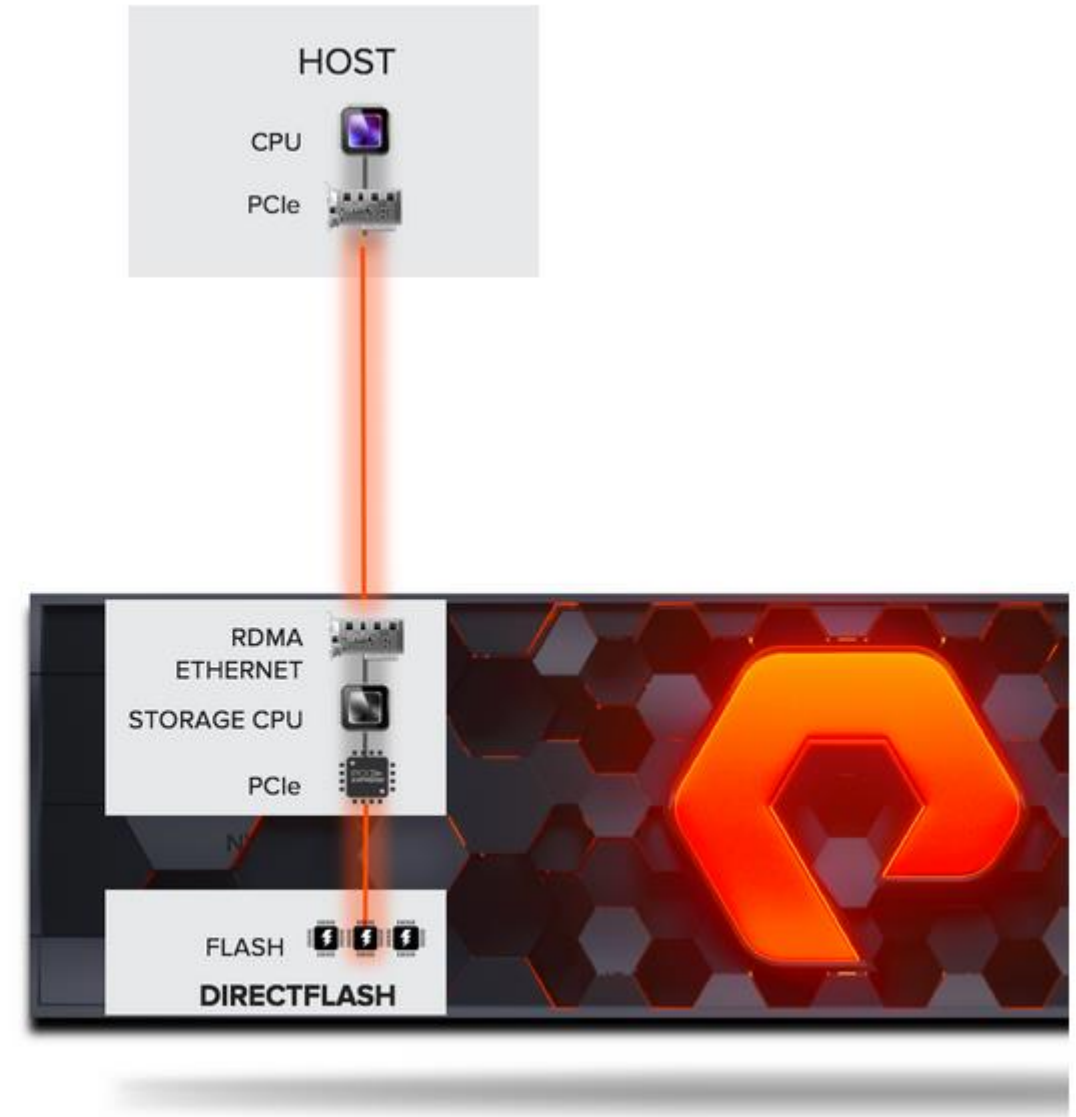
END-TO-END NVMe PERFORMANCE
WITH ENTERPRISE CLASS DATA SERVICES

UP TO
50%
LATENCY REDUCTION
COMPARED TO ISCSI

UP TO
20%
LATENCY REDUCTION
COMPARED TO FC

UP TO
25%
HOST CPU OFFLOAD

NVME OVER FABRICS via RDMA over CONVERGED ETHERNET
PURITY 5.2 + FLASHARRAY//X + RDMA ENABLED CARD



NVMe-oF Ecosystem



SmartNIC Brings Cloud to a New Level

Storage



Machine Learning



Big Data



Efficient Data Transport



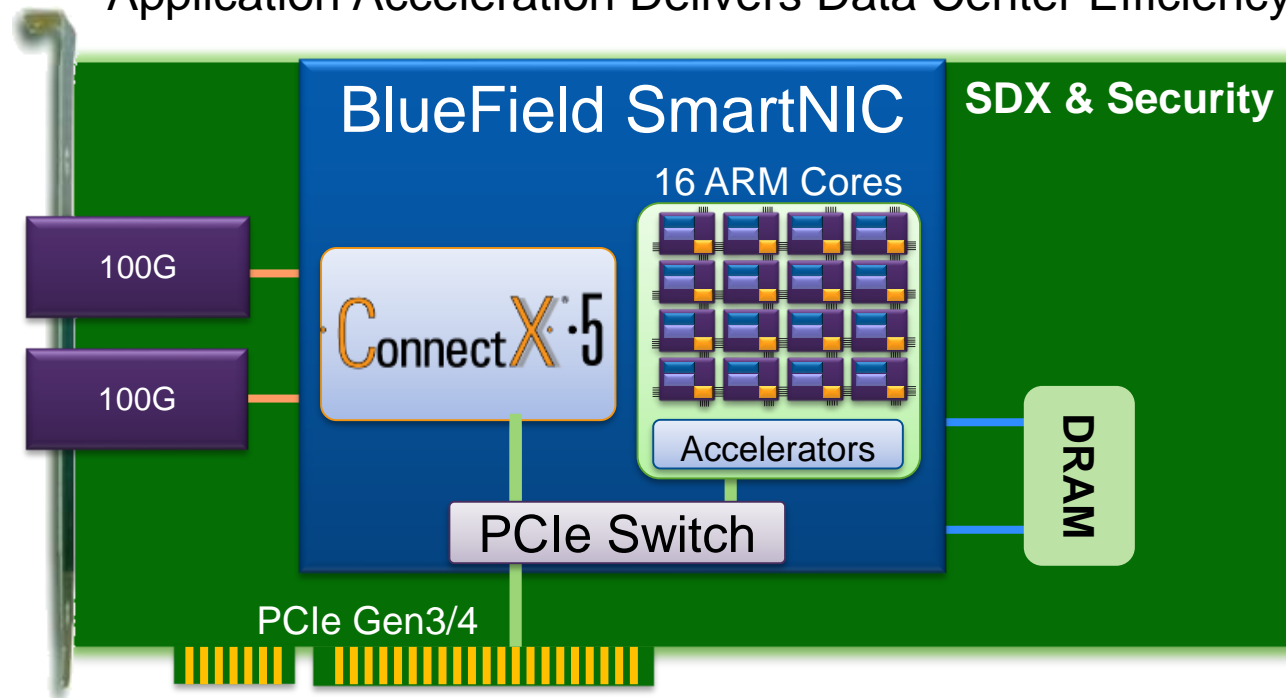
SDX & Security



Application Acceleration Delivers Data Center Efficiency



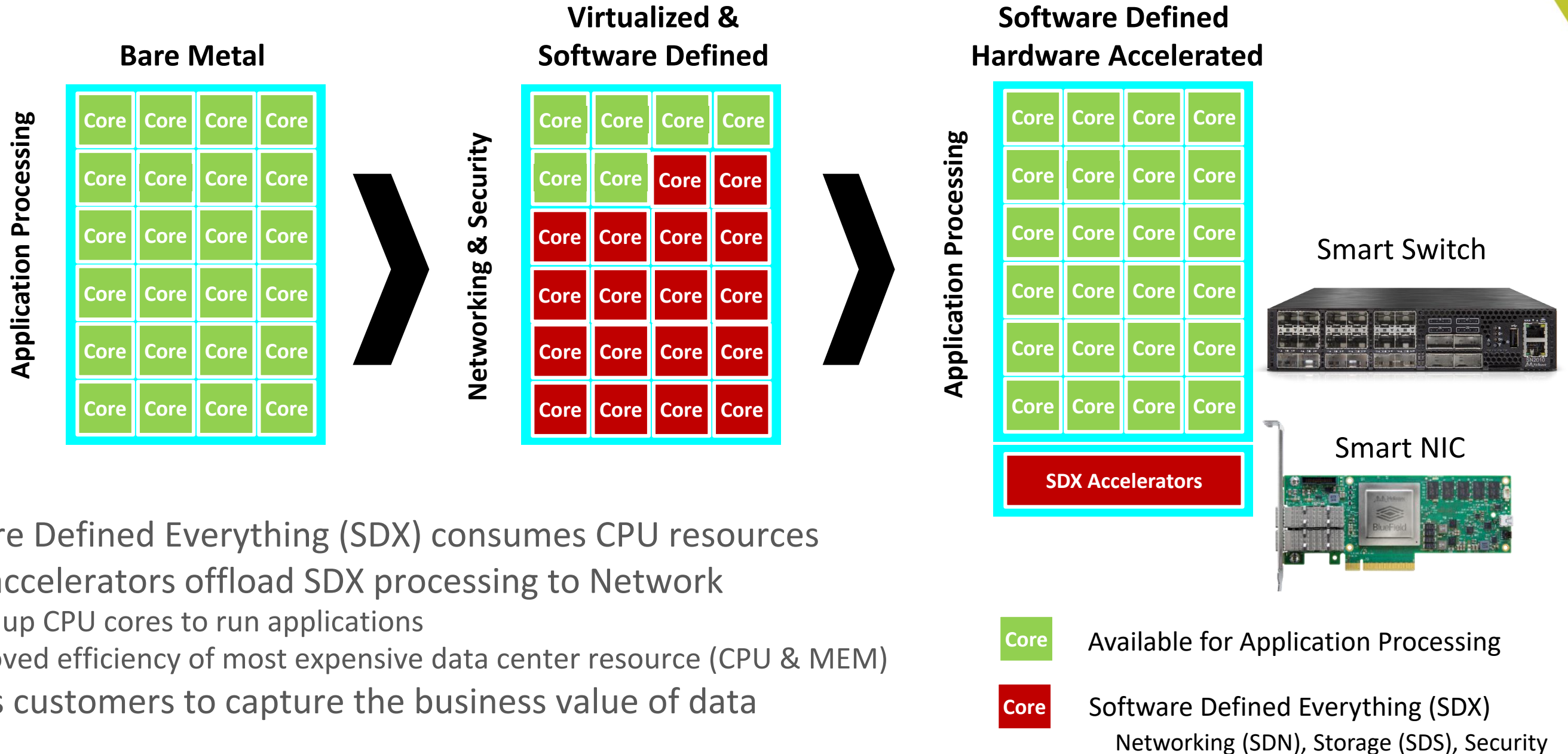
25, 50, 100 Gb/s



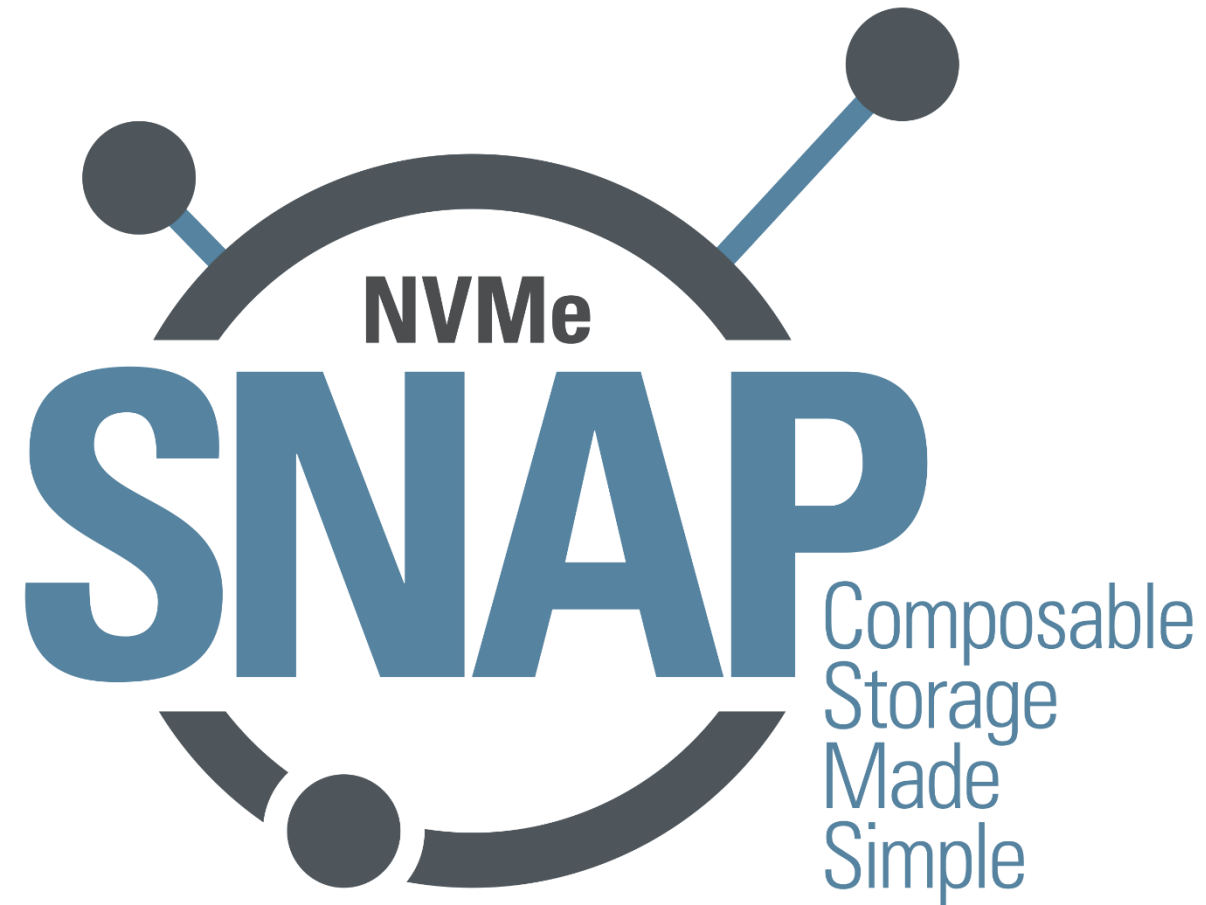
SmartNIC

- Fully programmable and extensible
- Virtual Switching & Routing
- Security: Application Isolation
- Telco application acceleration
- Software Defined Hardware Accelerated
- Data Integrity, Compression, De-Dup & Thin-Provisioning

Intelligent Network Offloads = Data Center Efficiency



- Software Defined Everything (SDX) consumes CPU resources
- Smart accelerators offload SDX processing to Network
 - Frees up CPU cores to run applications
 - Improved efficiency of most expensive data center resource (CPU & MEM)
- Enables customers to capture the business value of data



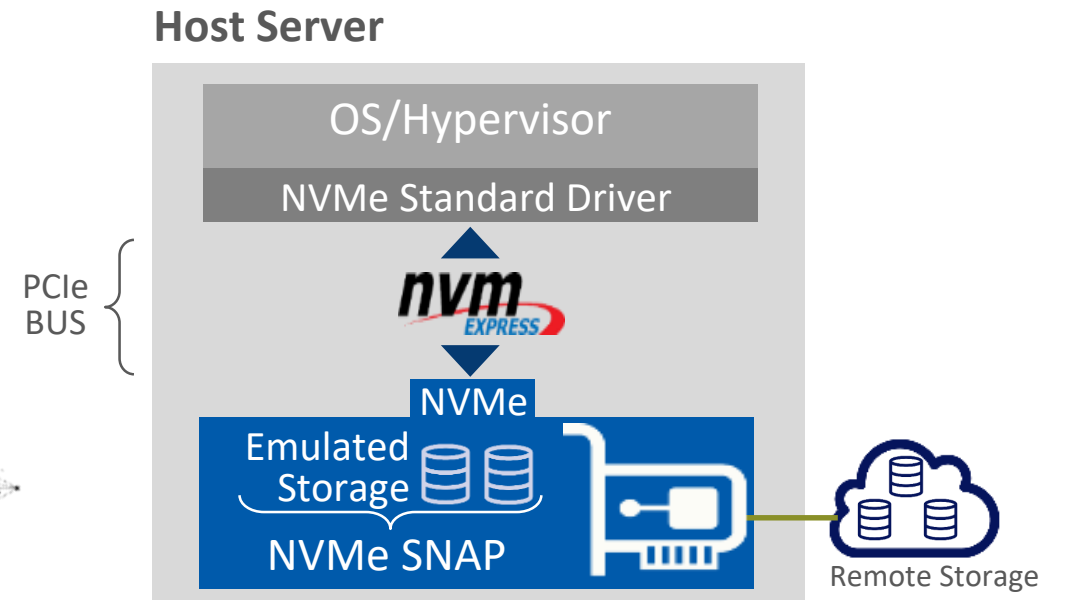
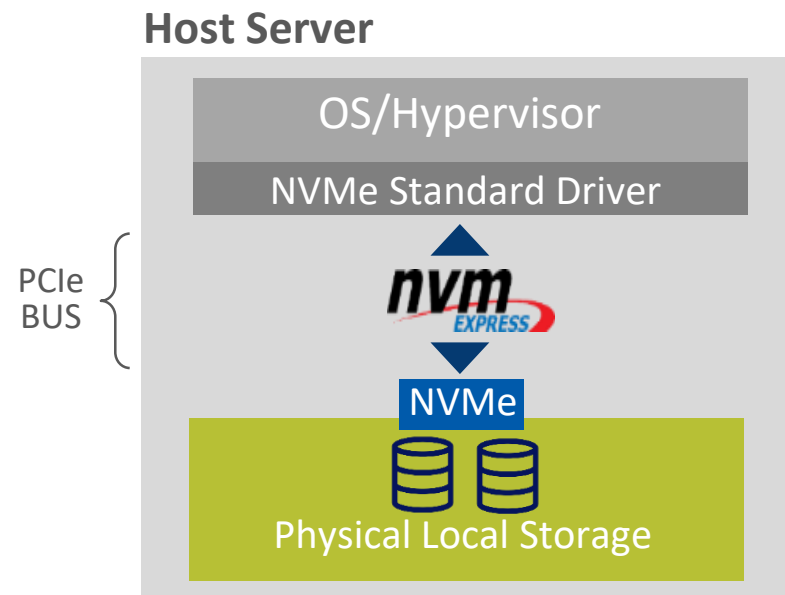
Software-defined, Network Accelerated Processing
Makes Composable Storage a SNAP

Introducing NVMe SNAP

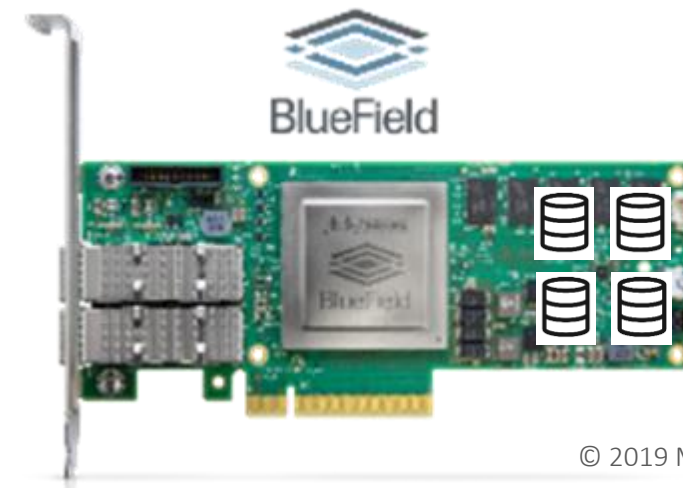
Software-defined Network Accelerated Processing

Physical Local NVMe Storage

NVMe SNAP Drive

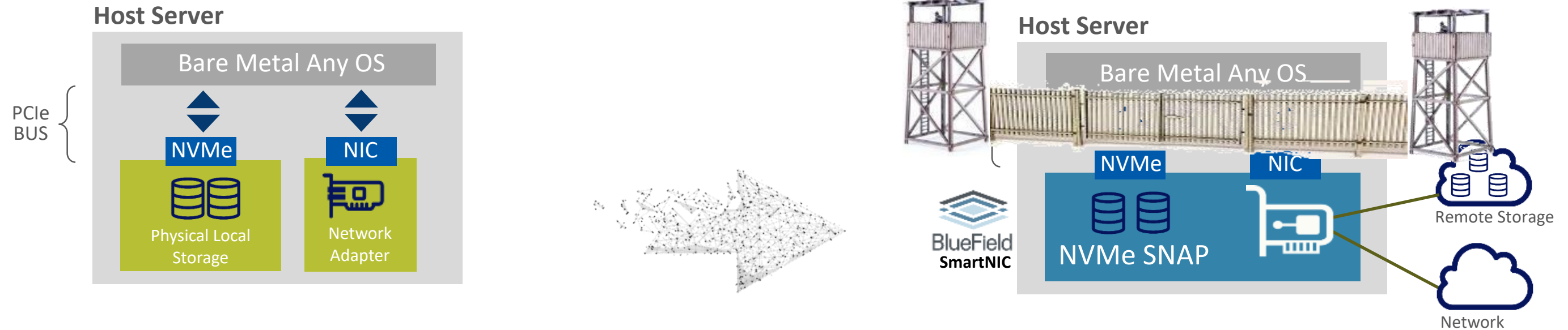


Hardware Acceleration Maps Remote Storage to Local Storage



SNAP Storage: Powerful & Simple

Networked Storage Capabilities with Local Storage Simplicity



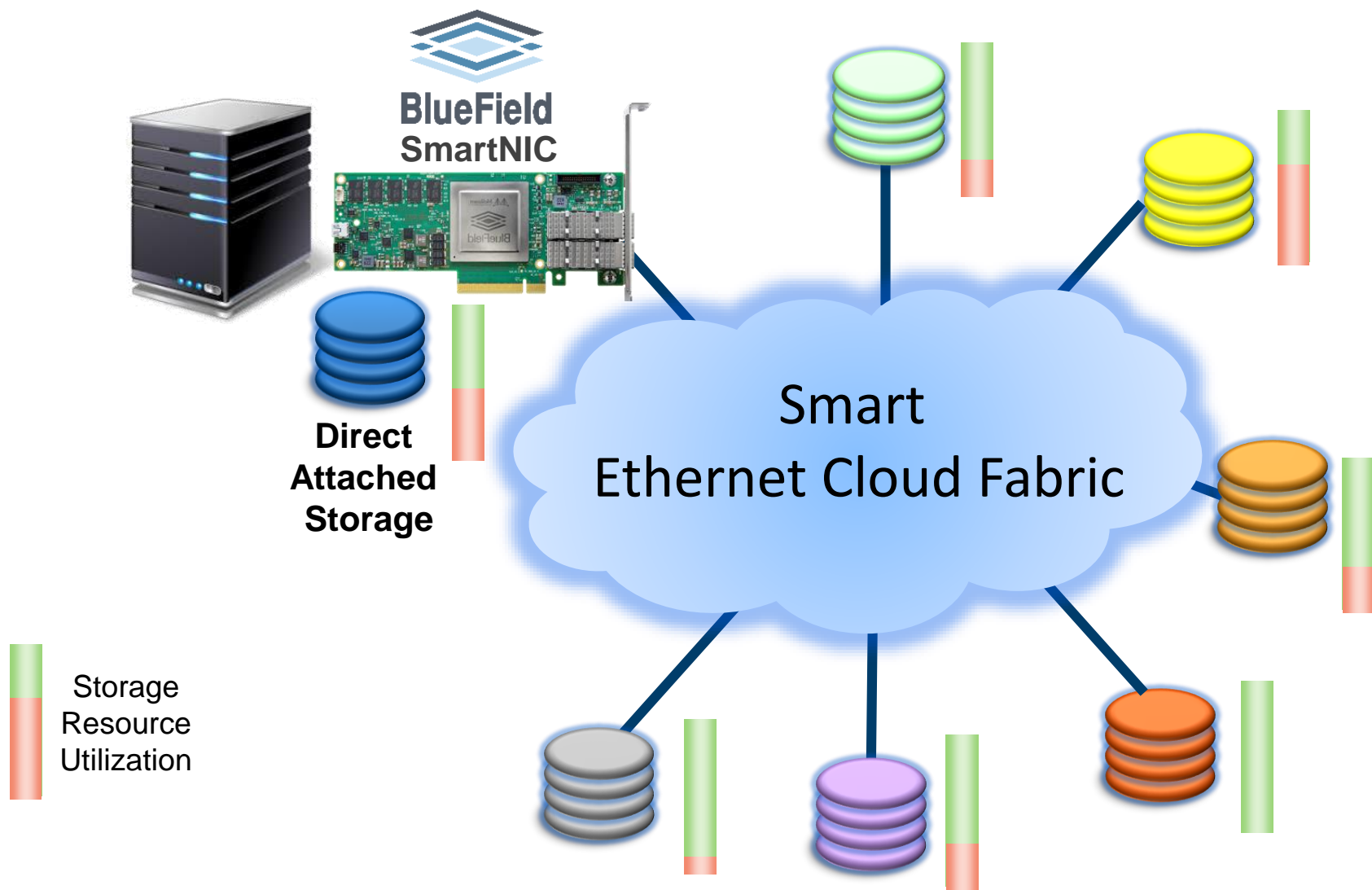
Local Physical Drive in Bare Metal Server

- Local storage is easiest to insure OS and application software compatibility, performance and security
- Limited by local storage capacity
- Difficult to manage local storage remotely
- High Availability (HA) limited to local RAID

NVMe SNAP Drive For Bare Metal

- Performs like local storage
- OS and application agnostic
- Network storage advantages
- Any wire protocol & storage management
- Same adapter for storage and networking
- Improved security isolation

SmartNICs & SNAP Makes Storage Composable



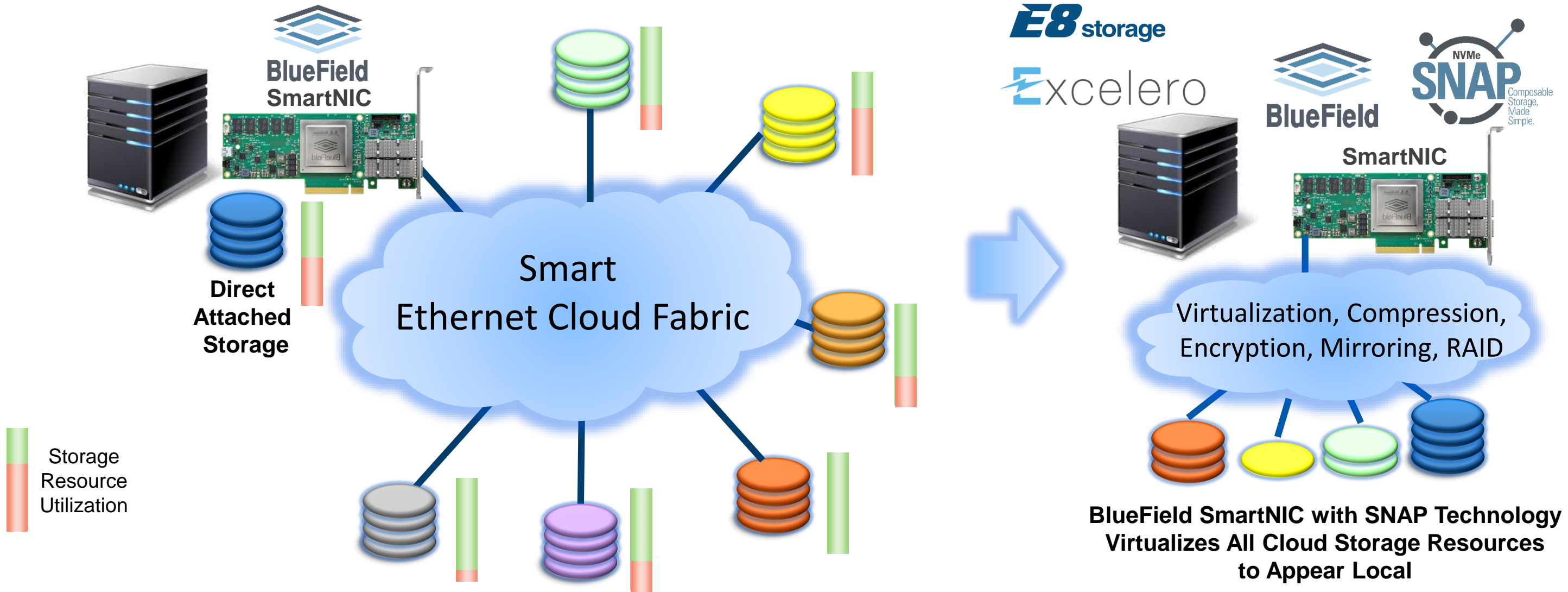
- Most apps use local storage
 - Results in poor resource utilization
 - Overprovisioning is expensive!

- NVMe-oF is the ideal SAN
- But there are challenges ...
 - Not all platforms supported
 - Different clients, drivers, APIs

What if we could combine the best of local & networked storage:

- Server storage was dynamically composable to match workloads?
- All cloud storage could appear as local?
- Local storage with advanced networked services?
 - Encryption, compression, ECC, thin-provisioning, dedup, mirroring, high availability
- Remote storage access was transparent to OS, Hypervisor, and underlying protocol?

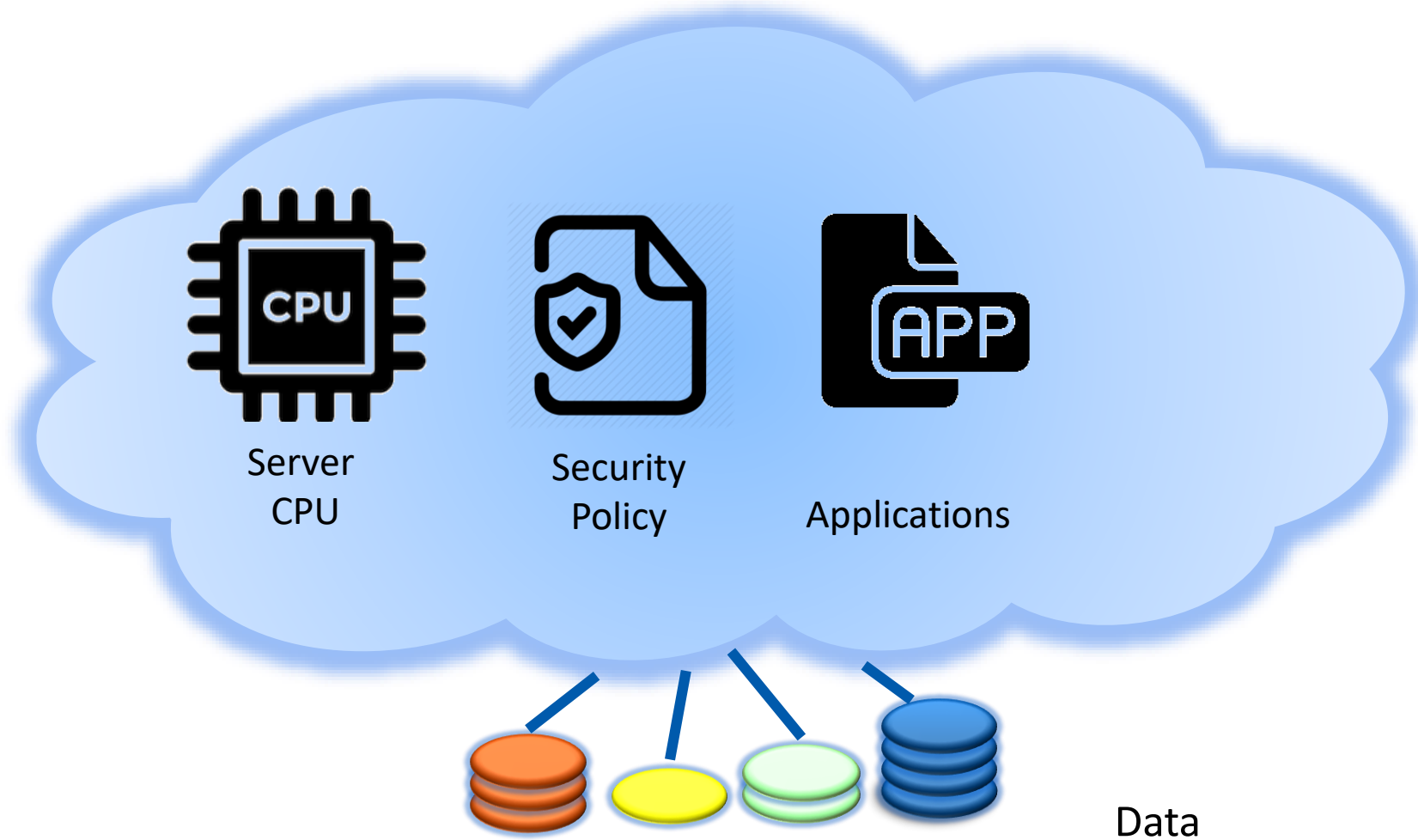
SmartNICs & SNAP Makes Storage Composable



BlueField SmartNIC with SNAP Technology Virtualizes All Cloud Storage Resources to Appear Local

- BlueField SmartNIC Virtualization
 - Makes all cloud storage resources local
 - Better utilization & efficiency
 - No software disruption

Enterprise Data Center Security was all about Walls



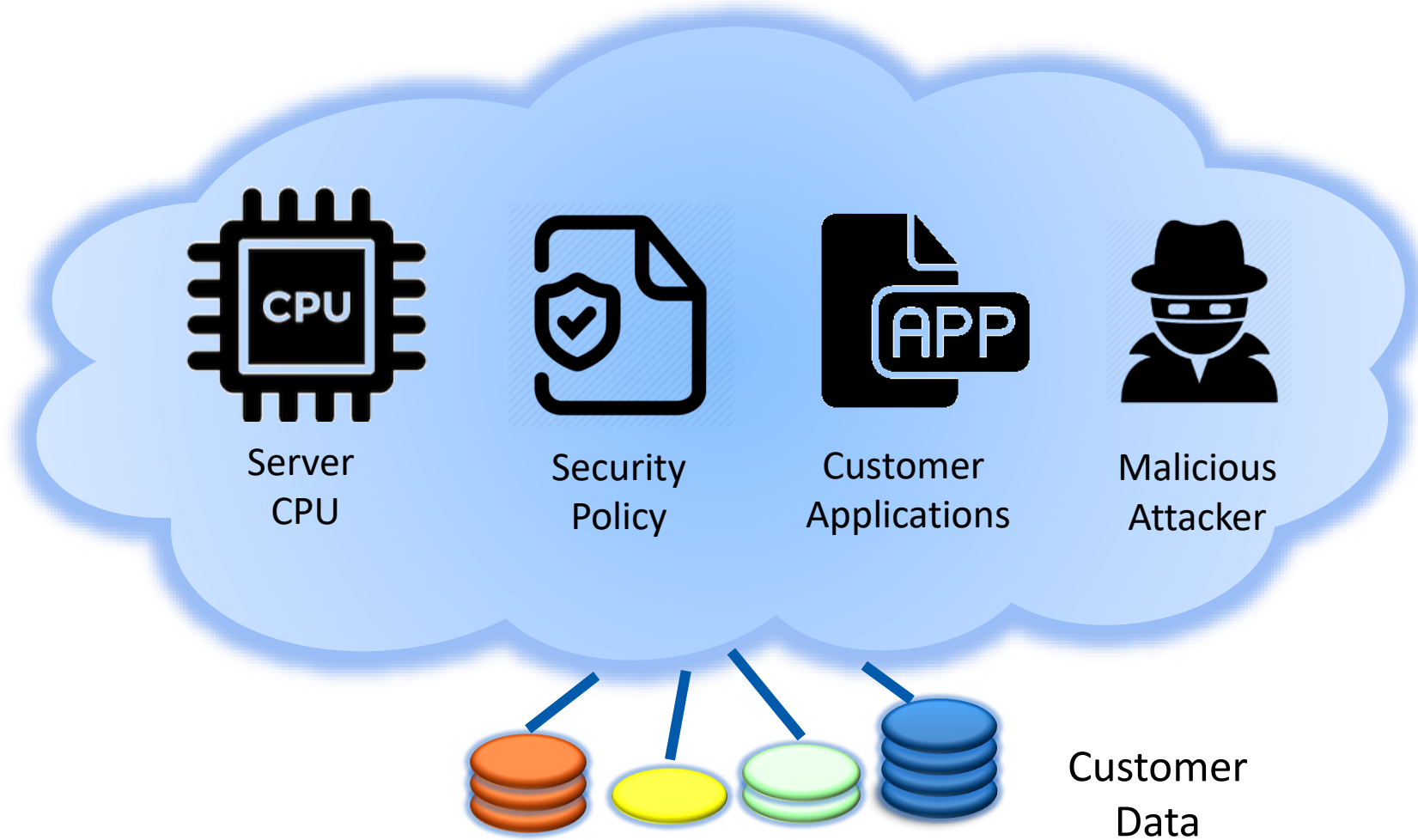
Security Model



M&Ms

Hard on the outside,
Soft on the inside
Okay for Enterprise
But not for Cloud

Cloud Creates Data Center Security Vulnerabilities



Security Models



M&Ms

Hard on the outside,
Soft on the inside
Okay for Enterprise
But not for Cloud



Jawbreakers

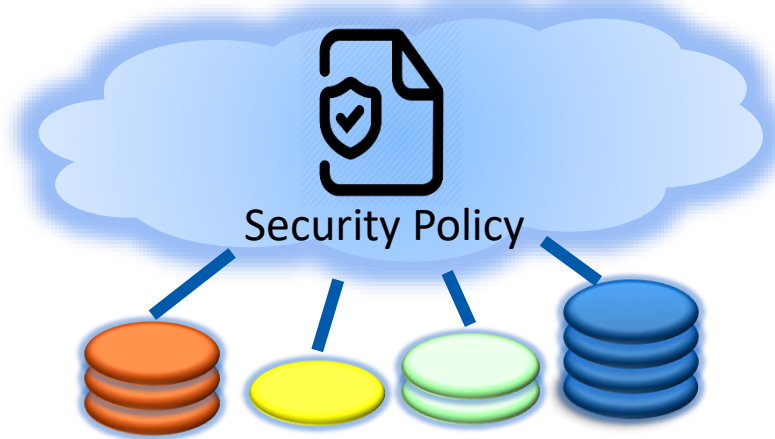
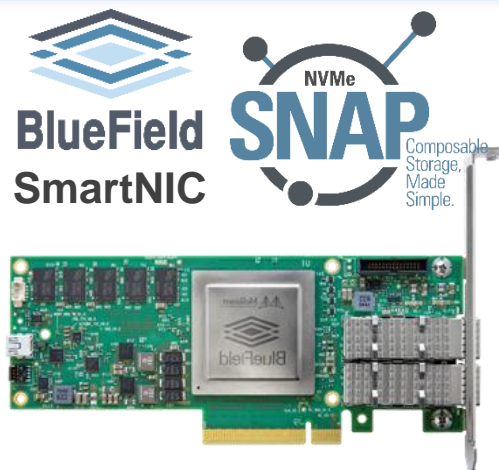
Hard on the outside,
Hard on the inside
Needed for Cloud

- The X86 CPU runs both customer applications and cloud provider security policy
- Combined application/security domain presents huge attack surface vulnerability
- Cloud model much worse than enterprise as malicious apps are welcomed into data center
- Compromise the CPU and the entire cloud becomes compromised

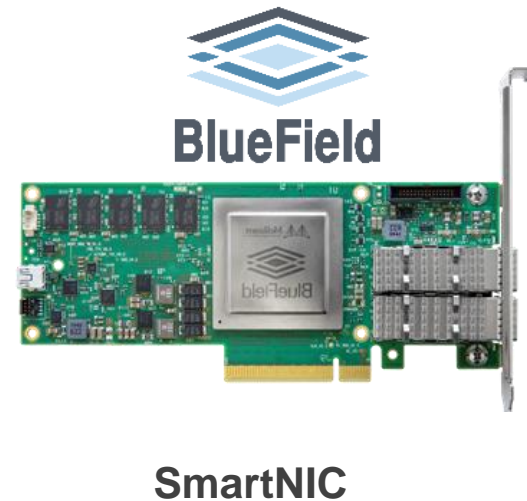
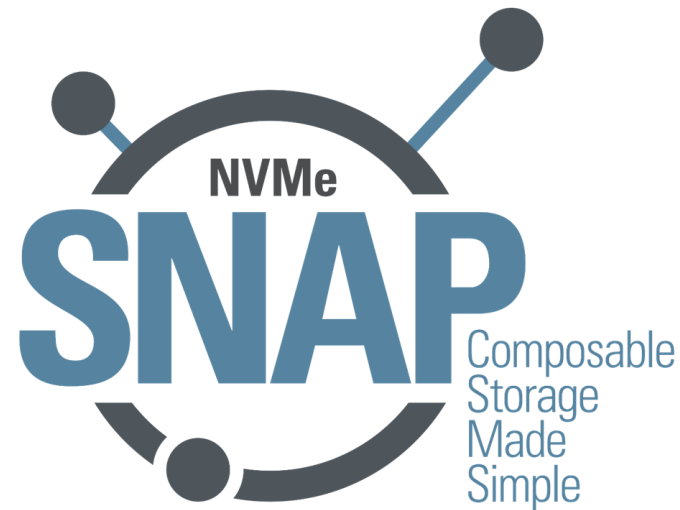
SmartNICs & SNAP Improves Security



- SmartNIC puts a computer in front of the computer
- Creates a new isolated security domain
 - Limits attack surface
 - Improves control
 - Isolates malicious apps from security policy
 - Protects customer data
 - Prevents data center wide attacks



SNAP: Composable Storage Made Simple



- SNAP: Composable Storage Made Simple
 - Simple: All the benefits of external storage with simplicity of local storage
 - Efficient Offloads CPU from software defined storage overhead
 - Advanced Feature: Compression, Encryption, Fault Tolerance
 - Transparency: Works with any OS, hypervisor, or application
 - Security: Isolates application processing from security and storage policy enforcement

Networking Leadership Accelerates Key Workloads

HPC



Enterprise



Storage



Cloud



Big Data



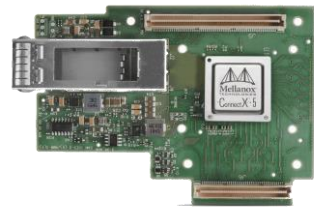
Security



ConnectX[®] Spectrum[™] LinkX[™]



Spectrum 25, 50, 100G Switches



ConnectX-5 100G



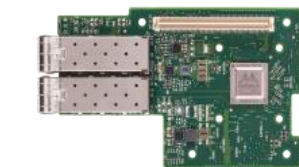
Optical Transceivers



ConnectX-4 50G



Breakout Cables



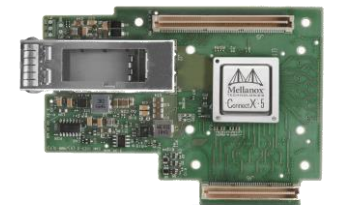
ConnectX-4 Lx 25G



Copper Cables



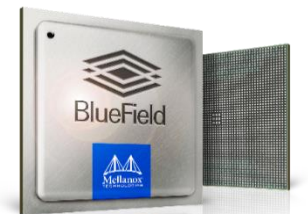
Active Optical Cables



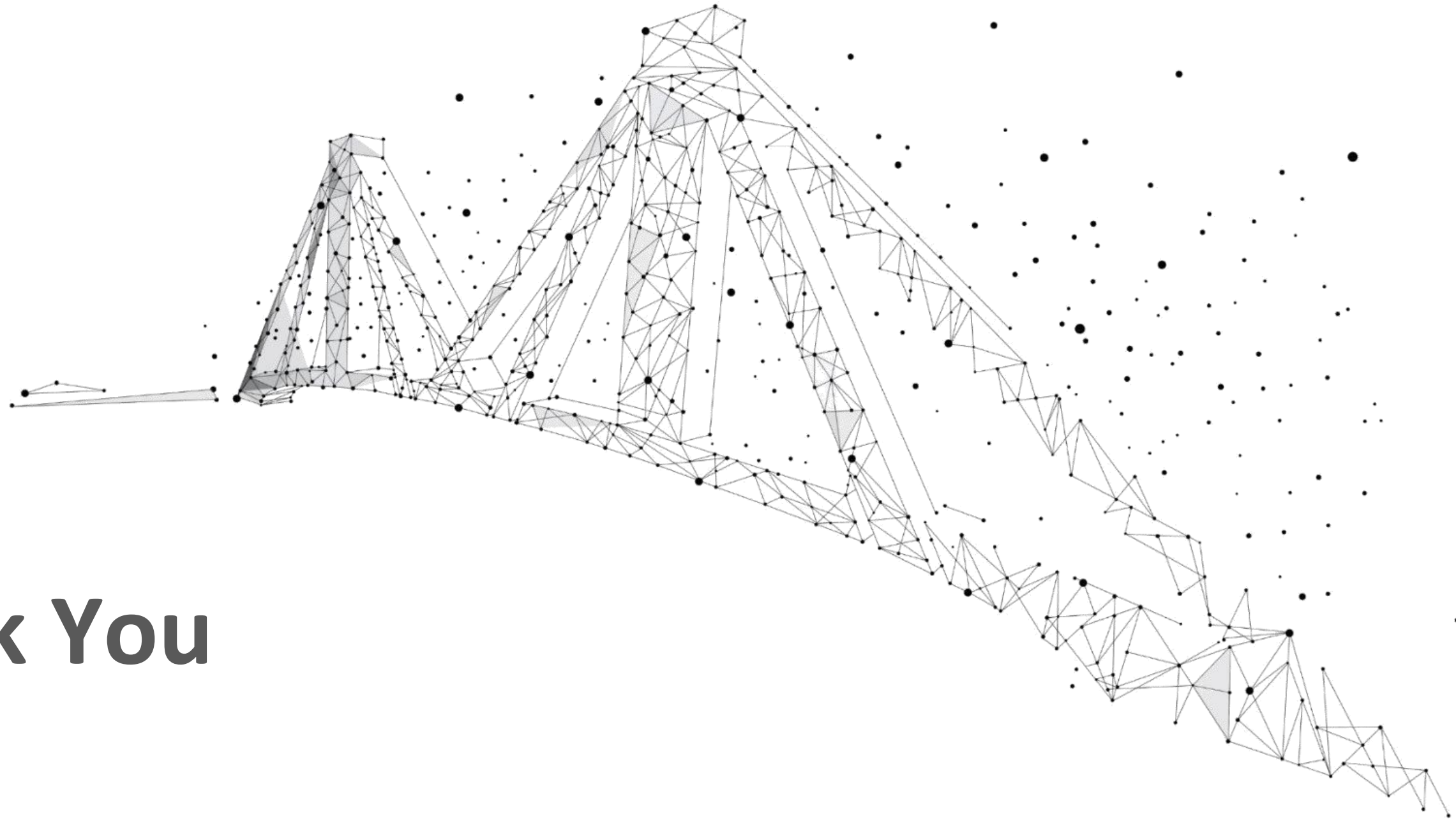
ConnectX-5



Multimode & Single Mode



BlueField SoC



Thank You



Benefits of NVMe SNAP

Plug-n-Play

No special installations or proprietary drivers required

Performance & Direct Storage Access

Near-Local NVMe Performance with VM -SR-IOV drivers

Simple

No NVMe-oF Drivers Required

Flexible Protocol Support

Enables even proprietary network storage protocols

Secure

Isolate Storage Control and Data Paths

Transparent & OS Agnostic

Storage Initiator-Side Software Onboard

Advanced Storage Functionality VMs using

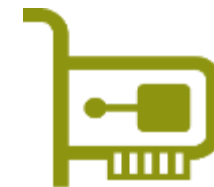
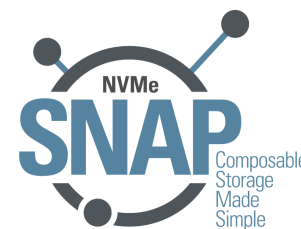
Enables Network RAID, Compression, Encryption, & HA

One solution for all Use Cases

Virtualized and Bare-Metal Data Clouds



Remote Storage



NVMe SNAP

