SNAP
Composable Storage Made Simple
SmartNICs Make Composable Storage a SNAP!
March 2019
NVMe Flash SSDs: The Worlds Fastest Storage

- 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

<table>
<thead>
<tr>
<th>INFlexible Architecture</th>
<th>INefficient Consolidation</th>
<th>MINimal Data Services</th>
<th>DIFFerent Management APIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CANNOT SCALE STORAGE AND COMPUTE SEPARATELY</td>
<td>STRANDED CPU / STORAGE</td>
<td>NO SNAPs / REPLICATION NO GLOBAL DEDUPLICATION NO THIN PROVISIONING NO BUSINESS CONTINUITY</td>
<td>&gt;_REST_A &gt;_REST_B &gt;_REST_C</td>
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</tbody>
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NVMe Over Fabrics Gets NVMe Out of the Box

- 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

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

25, 50, 100 Gb/s

BlueField SmartNIC
- 16 ARM Cores
- DRAM
- PCIe Gen3/4
- PCIe Switch
- ConnectX-5
- Accelerators

Application Acceleration Delivers Data Center Efficiency

Storage
- NVMe Over Fabrics
- RoCE
- RDMA

Machine Learning
- InfiniBand

Big Data
- Apache Spark

Efficient Data Transport
- DPDK

SDX & Security
- ASCAP2
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

Host Server

OS/Hypervisor
NVMe Standard Driver

NVMe

Physical Local Storage

NVMe SNAP Drive

Host Server

OS/Hypervisor
NVMe Standard Driver

NVMe

Emulated Storage
NVMe SNAP

Remote Storage

PCIe BUS

PCIe BUS

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

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?

- 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

Smart Ethernet Cloud Fabric
SmartNICs & SNAP Makes Storage Composable

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

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

- 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

- 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-5** 100G
**ConnectX-4 50G**
**ConnectX-4 Lx 25G**

**Optical Transceivers**
**Breakout Cables**
**Copper Cables**

**Spectrum 25, 50, 100G Switches**

**Active Optical Cables**
**Multimode & Single Mode**

**BlueField SoC**

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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

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