Data and Intelligence in Storage
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MEGATRENDS

CLOUD
CLOUD ECONOMICS

AI & ANALYTICS
INTELLIGENT DATA PRACTICES

5G
NETWORK TRANSFORMATION
“Digital Fusion” Across All Industries

TRADITIONAL ECONOMY

DIGITAL ECONOMY

“Digital Fusion”
Blending of Traditional and Digital Business

Smart Agriculture
Artificial Intelligence
Wearables (Industrial/Lifestyle)
Robotic Warehouse
Autonomous Cars
Smart Retail

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DATA IS THE NEW OIL

INTELLIGENCE IS THE NEW ENGINE

STORAGE WILL BE THE FUEL TANK
REQUIREMENTS ARE EVOLVING

- Performance
- Storage Needs & Durability
- Security Demands
- Data Throughput
- System Efficiency

- Power Consumption
- Latency
- Re-Provisioning Time
- Total Cost of Ownership
WE NEED TO GET SMARTER

Internet of Things

Enterprise

Media Transition

Scale Up

Scale Out

Orchestration

Cloud

Fog
Digital Transformation Is Driving “Systems Approach” to Data Center Design

Hyper-Connected World

- Deluge of Data
- 5G Wireless and Optical Networking
- Cloud Processing and Analytics
- 50B Connected Devices by 2020

Physical Resource Pools

- Compute pool
- Hot Storage pool
- Warm Storage pool
- Accelerator pool
- FPGA pool

Optimized Interconnect

“...a revolutionary, new architecture that fundamentally changes the way a data center is built, managed, and expanded over time”

1. Source: Intel® 2017 Investor Meeting
New Approach: Rack Scale Design

Standard Server Design
Fixed configuration

Intel® Rack Scale Design
Disaggregated & Composable
Resources Pooled as Needed

Workload 1
Compute
Storage
Accelerator

Workload 2
New Approach: Rack Scale Software Management

• Resource Discovery
• System Composability
• Resource Telemetry
• Resource & System Management

Flexible management architecture allows a range of implementation options

FLEXIBLE MANAGEMENT ARCHITECTURE ALLOWS A RANGE OF IMPLEMENTATION OPTIONS

** Intel® provides reference code only for PODM, RMM & PSME. OEM expected to productize RSD software for their platforms
ADVANCES @ HARDWARE LEVEL

- Scalable Processors
- FPGA's
- Accelerators
- Quick Assist Technologies (QAT)
- Compute
- Storage
- Comms

3D XPoint™ technology & NAND SSD’s & DIMMs
EDSFF*
NVMe
RSD Storage Pooling
Volume Mgmt Device (VMD)

Networking Fabrics
Silicon Photonics
Ethernet
Network Function Virtualization

*EDSFF = Enterprise & Datacenter Storage Form Factor
ADVANCES @ SOFTWARE LEVEL

Compute
- AVX512
- FPGA SDK for Open CL
- Math Kernel Library
- Data Analytics Acceleration Library (DAAL)
- BigDL
- Neon & DL Optimized Frameworks
- CoFluent™ Studio
- Hyperscan

Storage
- Intelligent Storage Acceleration Library (ISA-L)
- Persistent Memory over Fabrics (PMoF)
- NVM Library
- Storage Performance Dev Kit (SPDK)
- Cache Acceleration SW (CAS)
- Advanced Encryption Std New Instructions (AES-NI)

Comms
- Data Plane Dev Kit (DPDK)
- Network Function Virtualization
- Single Root I/O Virtualization
HOW CAN STORAGE BECOME SMARTER?

Modernize

<table>
<thead>
<tr>
<th>Hard Drive</th>
<th>Solid State Drive</th>
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<tbody>
<tr>
<td>Erasure Coding</td>
<td>SSD Moore’s Law</td>
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<tr>
<td>De-duplication</td>
<td>Storage Primitives</td>
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<tr>
<td>Compression</td>
<td>Performance – NVMe, NVMe-oF</td>
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<tr>
<td>Encryption</td>
<td>New storage arrays:</td>
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<tr>
<td></td>
<td>- All Flash</td>
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<tr>
<td></td>
<td>- Hybrid</td>
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<tr>
<td></td>
<td>- 3D XPoint™ technology</td>
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Automate & Orchestrate

Unifying Cloud & Enterprise

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<th>Scale Out Architecture</th>
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<tr>
<td>Hyperconverged</td>
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<tr>
<td>Software Defined Storage</td>
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<tr>
<td>Network Function Virtualization</td>
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<tr>
<td>Software Defined Infrastructure</td>
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Intelligent Data Management

Standard & Dynamic Workloads

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<th>Hybrid Cloud</th>
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<tr>
<td>Machine &amp; Deep Learning</td>
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<tr>
<td>Predictive Analytics</td>
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<tr>
<td>Self-Diagnostics</td>
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<td>Dynamic Capacity Planning</td>
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Storage Modernization, Automation and Orchestration will provide the foundation for Intelligent Data Management and enable seamless data services in the datacenter
SUPPORT STANDARDS INITIATIVES...

- Redfish: Address all data center components w/ a consistent API
- SNIA Swordfish: Unified management of servers & storage
- NVMe Over Fabrics: NVMe Over Fabrics
CALL TO ACTION

Refuel your tank:

• Try out the new HW & SW technologies
• Join Intel Storage Builders
• Provide your feedback to Jim Pappas (jim@intel.com)

JOIN US IN DRIVING DATA INTELLIGENCE E2E AND FUELING THE FUTURE!