Annual Update on Flash Arrays

2019
Key Technology Trends and
Marketplace Drivers

Ken Clipperton – Lead Analyst, Storage
What Businesses Want From Their Technology Investments

Create more revenue
Reduce expenses

… with an “Easy” button
Advances in Front-end Connectivity

Speed

- FC
- Ethernet
- InfiniBand
## Advances in Front-end Connectivity

### Speed

<table>
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<th>Connectivity</th>
<th>AFA Models</th>
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<tr>
<td>32 Gb FC</td>
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<tr>
<td>100 Gb Ethernet</td>
<td>17</td>
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<tr>
<td>100 Gb InfiniBand</td>
<td>10</td>
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Advances in Front-end Connectivity

NVMe-oF over Multiple Transports

- NVMe-oF (RoCE, iWARP)
- FC/NVMe
- NVMe/TCP
- PCIe
Advances in Back-end Connectivity

- 12 Gb SAS
- NVMe
- PCIe AIC
- NVDIMM
Storage Class Memory Integration

SCM Form Factors

- NVDIMM
- SSD
Storage Class Memory Integration

SCM Uses in Arrays

- Caching
- Tiering
Storage Class Memory Integration

SCM Technology
- Optane
- MRAM
- Low-latency NAND
- Other SCM variants
Data Center Integration

- Applications
- Automation & Orchestration
- Containers – persistent storage
- Data protection
- Management
Data Center Integration

Data Protection

▪ ISVs
▪ Backup appliances
▪ Cloud
Delivery Models

- Appliance
- Cloud-based
- Cloud-hosted
- Software-defined Storage
  - Reference architecture
  - Solution sale through distributor or VAR
Cloud Connectivity

- Snapshots
- Replication
- Multi-cloud
Storage-as-a-Service (OpEx)

- Basis
- Duration
- End-of-term options
Storage-as-a-Service (OpEx)

Lenovo TruScale

- **NO REQUIRED MINIMUM CAPACITY COMMITMENT**
  Scale from 0%-100% based on customer needs

- **DEDICATED CUSTOMER SUCCESS MANAGER**
  Consistent service on any commercial, technical or operational issues

- **PROPRIETARY METERING SOLUTION BASED ON POWER CONSUMPTION**
  Customer’s data plane remains untouched, giving the advantages of cloud-like economics with the security of on-premise hardware

- **REAL TIME DASHBOARD PROVIDING ACTUAL USAGE, BILLING, ETICKETING SERVICES**
  Control and predict costs

- **ENTIRE THINKSYSTEM AND THINKAGILE PORTFOLIOS AVAILABLE AS HAAS DEPLOYMENTS**
  Flexibility and scalable options
Predictive Analytics

- Array vs global installed base
- Array health
- Avoiding downtime
  - Configuration issues
  - Issue identification and remediation
Predictive Analytics

- Forecasting capacity requirements
- Modeling impact of adding applications
- Recommendations
Proactive Support

- Based on alerts
- Based on predictive analytics
- Notify
- Intervene
Licensing

- All-inclusive
- Bundles + a-la-carte
- Perpetual
Guarantee Programs

- Availability
- Data efficiency
- Durability
Near-term Future Developments

Standards Evolution

- DDR5
- NVDIMM-P
- NVMe
- NVMe-oF
Near-term Future Developments

Technical Innovations

▪ Accelerators on the NVMe-oF fabric
▪ Faster front-end & back-end connectivity
▪ Composability
Near-term Future Developments

TO TERABIT SPEEDS

- Highly Parallel Speeds (e.g., QSFP-DD)
- Quad Speeds (e.g., QSFP)
- Duo Speeds (e.g., SFP-DD)
- Serial Speeds (e.g., SFP)

Link Speed (b/s)

- 10T
- 1T
- 400G
- 200G
- 100G
- 50G
- 25G
- 10G

Standard Completed

- Ethernet Speed
- Speed in Development
- Possible Future Speed

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Near-term Future Developments

MEMORY AND STORAGE HIERARCHY GAPS

MEMORY

DRAM HOT TIER
CAPACITY GAP
10s GB <100ns

STORAGE

STORAGE PERFORMANCE GAP
3D NAND SSD WARM TIER
10s TB <100μsecs

COST PERFORMANCE GAP
HDD / TAPE COLD TIER
10s TB <10 msecs

SOLUTION MUST MEET:
• CAPACITY
• SYSTEM PERFORMANCE
• SYSTEM FIT

Source: Intel
Near-term Future Developments

MRAM Brings Native Persistence to Memory Workloads

Source: Kevin Conley’s presentation at the PM Summit
Questions?

Thank you

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