All Flash Array Market Segmentation

Manish Agarwal
Director of Product Management at NetApp
AFA Market Can Appear Chaotic…

Other Notable Events:
- Violin Memory went from ~40% share to <5%
- HGST buys Skyera
- Nimbus Data went from ~15% share to <5%

This is typical of new technologies
Opportunity and Challenge of Flash

- Performance
  - 50X IOPS*
  - 1/40th Latency*
- Density & Power
- Cost
  - 3X – 6X $/GB*
- Wear Life
  - Getting Worse

All Flash Arrays

Storage Reqmnts
- Performance
- Cost
- Availability
- Flexibility
- Reliability
- Scalability

* Comparing SSDs with SATA, NL-SAS and SAS HDDs
# Storage Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Performance</strong></td>
<td>Latency, IOPS, and throughput (GB/s)</td>
</tr>
</tbody>
</table>
| **Availability** | • Maintain data access through HW and SW failures (HA features)  
• Non-disruptive HW and SW upgrades  
• Non-disruptive operations (e.g. capacity & performance balancing) |
| **Resiliency** | Ability to protect data against:  
• System failures – SSDs (e.g. RAID, RAIN), controller (multiple local copies)  
• Site failures: Async or sync replication for disaster recovery  
• User errors, corruptions: Snapshots, backup/recovery (to HDDs/cloud) |
| **Scalability** | • Start small, then pay as your needs grow  
• Seamless scaling of performance and capability |
| **Flexibility** | • Ability to choose storage services – SAN, NFS, SMB/CIFS  
• Ability to share storage for multiple applications and tenants – secure access, quality of service to manage service level objectives  
• Test and development copies – clones |
Storage Attributes

- **High Performance**
  Low latency and high IOPS

- **Availability**
  HA, non-disruption upgrade & operations

- **Resiliency**
  Snapshots, replication, backup/recovery

- **Scalability**
  Performance and capacity

- **Flexibility**
  SAN & NAS, Multi-workload, multi-tenancy

- **Cost**
  Total solution cost, cost/TB, cost/IOPS

- Common for all storage solutions
- Elevates the discussion to customer value
Comparison of Architectures

- Performance
- Density & Power
- Cost
- Wear Life

Storage Reqmts
- Performance
- Cost
- Availability
- Flexibility
- Reliability
- Scalability

Flash Memory Summit 2015
Santa Clara, CA
Performance Optimized Architectures

Use the Flash Performance strength to deliver high IOPS, low latency and high throughput

Storage Reqmts

Performance

Cost

Availability

Reliability

Scalability

Flexibility

NetApp® (EF)
Use the Flash Performance strength to deliver high IOPS, low latency and high throughput.

Use cheaper NAND, Storage Efficiency to address cost.

Flash Optimized Stack (e.g. Log structured layout) to reduce flash wear.

Storage Reqs
- Performance
- Cost
- Availability
- Flexibility
- Reliability
- Scalability
Framework for Evaluating Storage Architectures

**Storage Attributes**

- **High Performance**
  Low latency and high IOPS

- **Availability**
  HA, non-disruption upgrade & operations

- **Resiliency**
  Snapshots, replication, backup/recovery

- **Scalability**
  Performance and capacity

- **Flexibility**
  SAN & NAS, Multi-workload, multi-tenancy

- **Cost**
  Total solution cost, cost/TB, cost/IOPS

**Performance Optimized**

- No native capability or high perf impact
- Capacity Scaling Only
- Limited
- $/IOPS, $/GB raw

**Shared Storage Architectures**

- Focus area but capabilities vary today
- Scale Out / Scale Up
- Focus area but capabilities vary today
- $/GB effective
<table>
<thead>
<tr>
<th>AFA Segments</th>
<th>Performance Optimized</th>
<th>Feature Rich Shared Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployment</td>
<td>Small number of performance sensitive applications</td>
<td>Large number of applications sharing the storage services</td>
</tr>
<tr>
<td>Data Management</td>
<td>Done at the application layer</td>
<td>Consolidated at storage layer</td>
</tr>
<tr>
<td>Scaling</td>
<td>Scale Up</td>
<td>Scale Up or Scale Out</td>
</tr>
<tr>
<td>Performance</td>
<td>500K – 1M IOPS @ 0.5ms or lower</td>
<td>200 – 500K IOPS @ &lt; 1ms</td>
</tr>
<tr>
<td>$/GB Range</td>
<td>$2 - $4/GB (raw)</td>
<td>$6 - $8/GB (raw)</td>
</tr>
<tr>
<td>Density</td>
<td>1 - 2RU for 20TB</td>
<td>5-6RU for 20TB</td>
</tr>
<tr>
<td>Storage Eff</td>
<td>Generally no native storage efficiency</td>
<td>Dedupe, compression, thin provisioning</td>
</tr>
<tr>
<td>Features</td>
<td>low data mgmt features or have perf impact</td>
<td>Storage level snapshot, clones, replication, backup, etc</td>
</tr>
</tbody>
</table>
Need for Scale Out

- AFAs deliver high performance density (IOPS/GB)
  - Given dual socket server can power limited capacity
  - Scaling up CPUs is not attractive from a cost & thermal envelope point of view
  - Avoid array sprawl

- Without scale out the solution is either:
  - Overpowered (i.e. higher cost) for lower capacity points, OR
  - Underperforming for higher capacity points

- Capacity and performance scaling
  - Expect linear scaling for virtualized environments, structured workloads
  - Often times non-linear scaling (capacity grows faster than performance needs) is a result of lack of data migration or tiering on primary
Road Ahead

- Growing AFA adoption (at the expense of SAS HDDs) for primary data
- Feature-rich shared storage arrays
  - Adopt PCIe connected 3D/TLC NAND to reduce costs and improve perf
  - Scale out will become the differentiating capability
- Performance-only AFAs:
  - Continued pressure
    - Feature rich arrays on cost / value
    - Host forms of flash for performance
  - Integration with Protocol “Gateways” and storage efficiency appliances
- Flash solutions exploiting high density, low power advantage of flash
Thank You!