How To Get The Most Out Of Flash Deployments

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Flash: A Must Have

- Storage performance req’ts very different in virtual infrastructure
  - VM I/O blender effect

- Managing data growth is driving new economic considerations
  - Infrastructure cost, floor space, power, cooling

- Effective flash cost continuing to drop
  - The rise of new storage metrics: IOPS/watt, IOPS/TB not $/TB
VM I/O Blender Effect

- OS sequentializes each individual VM’s I/O stream
- Hypervisor multiplexes all VM’s I/O streams together
- Creates extremely random I/O pattern
- Spinning disks do not handle random I/O well
- Increased rotational latencies and seek times
- End result: each HDD produces up to 10x lower IOPS than before
- Apps run more slowly
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Storage Administrator Insomnia

Most Pressing Storage Challenges

- Meeting SLAs on performance, availability or recovery: 42.0%
- Successfully troubleshooting potentially storage-related problems: 30.9%
- Time and/or budget to implement advanced storage features: 28.3%
- Time in planning/doing storage migrations/refreshes: 28.0%
- Quickly fulfilling storage provisioning requests: 26.4%
- Complexity in managing too many storage product architectures: 23.8%
- Other: 2.6%

Managing data growth is the #1 pressing challenge.
Legacy Flash Concerns

COST

ENDURANCE

PREDICTABLE PERFORMANCE

FLASH OPTIMIZED ARCHITECTURES

Required for optimal flash utilization/benefits
Flash Cost Projections

Worldwide Enterprise All Flash Array Average $/GB, 2012 - 2016

Add’l Factors Driving Down Effective Flash $/GB

- Write minimization
- Increasing endurance
- Compression
- Deduplication
- Shift from SLC to MLC
High Expected Growth in Flash

- Flash-optimized array shipments will grow at a rapid rate
  - Hybrid array market grows at 21.1% CAGR through 2016 to $12.3B
  - All flash array market grows at 58.5% through 2016 to $1.6B
- Hybrid arrays will become the new enterprise storage workhorse
  - By 2017 45% of shipping storage capacity will be flash-based
Does Flash Optimization Matter?

Flash is flash.

How you deploy it DOES matter.
Flash Optimized Architectures

- Write minimization and wear leveling
- Garbage collection does not impact write performance
- Tiered storage environments with caching and volume pinning
- In-line data reduction that does not impact performance
- Thin provisioning, space-efficient snapshots and clones
- QoS controls for consistently predictable performance in high density storage environments

Look for a storage architecture that has been designed with flash in mind.
Other FOA Considerations

- Scale out or scale up
- VM-centric storage management
  - Dedicated storage administrators disappearing
  - Line of business rising to prominence
  - Dialing in to meet application performance req’ts
  - Manage virtual disks not LUNs
  - Industry examples (Tintri, VVOLs, etc.)
- Maturity of enterprise-class data services
  - Thin provisioning, snapshot, replication, etc.
Support For Mixed Workloads (1)

- High storage density drives low TCO
- Storage consolidation must support mixed workloads
  - Flash with QoS
- Balanced scalability with predictable performance
  - Scale-out architectures
- Multi-protocol support

Mean % of Raw TB by Protocol (External)

- Fibre Channel: 31.0%
- NFS: 20.5%
- iSCSI: 15.7%
- iSCSI: 10.6%
- CIFS: 8.9%
- DAS: 6.6%
- Infiniband: 6.2%
- Other: 0%

Fibre Channel
NFS
iSCSI
DAS
CIFS
FCoE
Infiniband
Other
Support For Mixed Workloads (2)

- Aggressive CAGR for object based storage (OBS)
- Scale out and OBS often go together
- 80% of new data creation by 2017 will be unstructured
  - Big Data/Analytics play
- Importance of block, file and object on the same platform
  - Maximizes density potential
- Increasing importance of NoSQL databases

**Storage Systems & OBS Spending ($B)**

- **Aggressive CAGR** for object based storage (OBS)
- **Scale out and OBS often go together**
- **80% of new data creation by 2017 will be unstructured**
  - Big Data/Analytics play
- **Importance of block, file and object on the same platform**
  - Maximizes density potential
- **Increasing importance of NoSQL databases**
Q: Where do you deploy flash today?

- Easy deployments were first (existing HDD array)
- PCIe-based deployments have increased significantly
- Industry moving in the direction of flash optimization
- Emerging memory bus attached flash options

<table>
<thead>
<tr>
<th>Option</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Don't know</td>
<td>7.0%</td>
</tr>
<tr>
<td>All flash SSD array</td>
<td>18.4%</td>
</tr>
<tr>
<td>New hybrid SSD/HDD array</td>
<td>23.4%</td>
</tr>
<tr>
<td>Existing HDD array with SSD added as a tier</td>
<td>37.3%</td>
</tr>
<tr>
<td>Existing HDD array with SSD added as a cache</td>
<td>12.0%</td>
</tr>
<tr>
<td>PCIe-based flash in servers</td>
<td></td>
</tr>
</tbody>
</table>
Flash Location Issues

- **Latency**
  - Having compute near the data
  - Host vs network latencies

- **High availability/recovery**
  - Data loss issues
  - Performance vs recovery trade-offs

- **Cost**
  - Shared storage has higher entry cost

- **Application considerations**
Choosing A Solution

The “best” architecture for any given environment will be selected by trading off these three considerations:

- **PERFORMANCE**
- **COST**
- **CAPACITY**

All Flash or Hybrid?
Business Benefits

- **Performance**
  - Higher IOPS, lower latencies to meet SLAs
  - Flash can deliver 1000x the performance of HDD

- **Increased storage density**
  - Ability to host more workloads increases value

- **Lowers infrastructure costs**
  - Lowers floor space, capacity, and energy requirements
  - “3rd platform” CAPEX and OPEX profile
Deployment Recommendations

- Consider flash for all new apps but especially...
  - Virtual infrastructure, databases, VDI
- Consciously select deployment model
  - Host, array or appliance
  - Legacy or flash-optimized
- Plan for increasing storage density over time
  - QoS, multi protocol support, balanced scalability
- Consider scale-out architectures
  - As a long term approach to managing high data growth
- Balance performance, cost, capacity in your choice
  - There is no “best” solution for all needs
## Example Flash Players

<table>
<thead>
<tr>
<th><strong>HOST FLASH</strong></th>
<th><strong>ALL FLASH ARRAYS</strong></th>
<th><strong>HYBRID ARRAYS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusion-io</td>
<td>Dell Compellent</td>
<td>Coraid</td>
</tr>
<tr>
<td>Samsung/SanDisk</td>
<td>EMC XtremIO</td>
<td>Fusion-io (NexGen)</td>
</tr>
<tr>
<td>Toshiba</td>
<td>HDS HUS VM/VSP</td>
<td>Nimble Storage</td>
</tr>
<tr>
<td></td>
<td>HP 3PAR</td>
<td>Tegile</td>
</tr>
<tr>
<td></td>
<td>IBM FlashSystem</td>
<td>Tintri</td>
</tr>
<tr>
<td></td>
<td>Kaminario</td>
<td>Many legacy</td>
</tr>
<tr>
<td></td>
<td>NetApp E-Series</td>
<td>arrays…</td>
</tr>
<tr>
<td></td>
<td>Nimbus Data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pure Storage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Skyera, SolidFire</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Violin, WhipTail</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Cisco)</td>
<td></td>
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</tbody>
</table>

**SCALE OUT FLASH**

- Coho Data
- DDN
- Gridstore
- VMware VSAN
- Many others…

**NOTE:** Not a comprehensive list.
Thank You!

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