Maximizing the Efficiency and Endurance of Solid State Drives

The Storage System Perspective

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All-flash arrays have been at a tipping point...

- **Speed**
- **Affordability**
- **Enterprise Resiliency & Data Services**

- Wave 1 focused on performance
- Wave 2 tried to displace disk
- Mainstream adoption
The future is an all-flash data center

Changes will enable new business models and increase productivity

- Workloads combined to share data using NAND flash as the active storage media
- Cloud-enabled converged infrastructure, this will reduce IT budgets, increase productivity
- Minimize physical copies, increase logical copies deployed from data
- Combine transactional, data warehouse & development data initially

Cost is a key driver

- All-flash solution costs have declined significantly over the past few years
- Systems are looking to be cheaper and denser
- Being able to ride that cost curve is a significant advantage

Source: http://wikibon.org/wiki/v/Evolution_of_All-Flash_Array_Architectures
System architecture matters

Performance acceleration
Eliminate system bottlenecks

**Efficiency Optimization**
Extend life and utilization of Media

System resiliency
Provide constant application access

Enterprise Features
Proven data services and interoperability

To be successful an all flash architecture needs to possess all these attributes
How can you be efficient?

1. Make efficient use of capacity
2. Write intelligently to the media
How can you be efficient?

1. Make efficient use of capacity
   - Avoid “reserved pools” of capacity
   - Just in time space allocation
   - Optimum allocation unit
   - Reclaim unused space

2. Write intelligently to the media
How can you be efficient?

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<tr>
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<th>Make efficient use of capacity</th>
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<tbody>
<tr>
<td>1</td>
<td>Use compaction technologies to avoid duplicate writes and reduce writes overall</td>
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<td>2</td>
<td>Write intelligently to the media</td>
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<td>Spread the load evenly – “wide striping”</td>
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<td>Adapt media writes to host IO sizes</td>
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..and when you are efficient

- An efficient architecture allows you to be at the leading edge of SSD cost decline
- Bringing the benefits of all-flash to a broader market

The future is indisputably in this direction
• Some insights from our journey from MLCs to cost effective commercial MLCs - based on data from our installed base

Customers deployment patterns and workload patterns same across drive types (one is >10 DWPD MLC, the other is ~1 DWPD cMLC)

Performance levels are similar… actually data shows higher overall throughput delivered by cMLC drives

Overall average flash wear for both cMLC and MLC is < 1%
A picture is worth a thousand words…

SSD % Life Left over 12 Months

% of remaining write endurance

Age of drive population. 4 months, 10 months, 11 months, 12 months
It’s how you use it

- All-flash is rapidly becoming mainstream
- Cost and reliability are key in fueling this change
- Moving to newer and cost effective media is investable
- An architecture that can take advantage of this is critical

There can be economy only where there is efficiency
- Benjamin Disraeli
Architecture. Matters

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