Enterprise Solid State Drives
Defining characteristics of Enterprise Storage

UCSD Non-volatile Memories Workshop 2010

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STEC Introduction

Company
- Building SSD’s from 1994
- Focus on Enterprise, Military and Industrial customers
- Extensive FC, SAS, SATA interface skill & experience

Technology
- In-House Controller Development
- Interface Expertise
- SSD Firmware and Logic Design
- A significant I.P. portfolio with patents in key SSD technologies
  - Flash management
  - Controller Technology
  - Power backup
SSD Markets

Consumer and Enterprise segments are fastest growing markets with 200-300% CAGR

Consumer = high volume / low capacities
Enterprise = good volume/high capacities

Source IDC Q1-2010
WW Enterprise SSD TAM – by Interface

SSD Forecasts

Enterprise units show over 200% CAGR Year-to-Year Through 2012
The Rise and Fall of Storage Vendors

History tends to repeat itself

SSD vendors are still on the fast ramp with 163 vendors as of October 2009

HDD Vendors peaked and started consolidation in 1986

“Time to Market” and “Technology Leadership” are critical to survival
Consumer vs. Enterprise SSD’s

Raw Performance

• Consumer SSDs are effective in laptops but…

• Consumer grade SSDs struggle under heavy workloads

• Testing has shown that consumer grade SSDs even underperform rotating HDDs in server workloads
Consumer vs. Enterprise SSD’s

Performance loss in enterprise applications

• A much discussed issue with many consumer grade SSD’s is slow down as drive is used and fills with data

• “Enterprise SSD’s” implement features & algorithms to maintain consistent IOPS over time

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Where do SSD’s have Impact

Gaining optimum value from SSD

Survey of IT managers indicating where they see the largest benefit from implementing EFD technology

In your organization, which business application(s) do you believe require the improved performance of flash-based SSDs? (Percent of respondents, N=317)

- Database / OLTP: 41%
- E-mail: 32%
- High-performance computing (HPC): 31%
- Business intelligence / data warehouse / OLAP: 29%
- Financials / ERP: 26%
- Video / audio / image: 25%
- Office productivity applications (word processing, spreadsheets, etc.): 25%

Source: Enterprise Strategy Group, 2009
End User: OLTP

Sports Stadium
issues with ‘Point of Sales’
keeping customers from
their beer and nachos

Improvements

• Savings    Avoided $75K in new SAN
• Performance No slow downs at the registers
• Cust Sat. Reduced wait for Beer and Nacho’s
• Next…     Adding SSD to business intelligence
End User: Email

STEC is consuming its own technology with an Exchange email deployment

Noted Improvements

- 75% faster response times
- Write Latencies are the big winner
- Daily backup reduced from 6 hrs to 2 hrs
- Significant reduction in support calls from end users

Noted Increase in Customer Satisfaction
End User: Business Intelligence

- Financial services
- SSD’s deployed in stock tracking and market intelligence application.

Improvements
- Easy to Integrate “…Plug it in and it works”
- Performance “Time is money” – do it faster
- 15 to 1 ratios “Replace 15 HDDs w/1 SSD”
- Killer Application “Automated Data Migration”
# SSD’s Save I.T. Acquisition Costs

## HDD Deployment

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
<th>TCO (estimated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>120ea – 300GB HDDs</td>
<td>36TB</td>
<td></td>
</tr>
<tr>
<td>8ea – 15 bay arrays</td>
<td>24U rack space</td>
<td></td>
</tr>
<tr>
<td>16 – 450watt supplies</td>
<td>1yr power&lt;br&gt;1yr cooling</td>
<td>9,500&lt;br&gt;4,700</td>
</tr>
<tr>
<td>(power &amp; cooling)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>aggregate IOPS 36K</strong></td>
<td>$6.50 / IO</td>
<td><strong>$ 234,200</strong></td>
</tr>
</tbody>
</table>

## SSD & HDD Deployment

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<tr>
<th>Description</th>
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<th>TCO (estimated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>32ea – 1TB SATA HDDs&lt;br&gt;10ea – 300GB 15K HDDs&lt;br&gt;+3ea – 200GB SSDs</td>
<td>35.6TB</td>
<td></td>
</tr>
<tr>
<td>3ea – 15 bay arrays</td>
<td>9U rack space</td>
<td></td>
</tr>
<tr>
<td>6 – 450watt supplies</td>
<td>1yr power&lt;br&gt;1yr cooling</td>
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<tr>
<td><strong>aggregate IOPS 158K</strong></td>
<td>$0.56 / IO</td>
<td><strong>$ 88,200</strong></td>
</tr>
</tbody>
</table>
SSD Acquisition Savings Summary

- **Lower Acquisition Cost**
  - 60% Lower cost to purchase
  - 62% Lower cost to operate per year

- **Higher Aggregate Performance**
  - 77% Higher IOPS
  - 158K IOPS vs. 36K IOPS

- **Smaller Footprint**
  - 62% Fewer Disks
  - 60% less rack space

**Chart Details:**
- HDD Only vs. SSD & HDD
- Cost breakdown:
  - Hardware
  - Pwr & Cool
  - 15K HDDs
  - 1TB SATA
  - Zeus SSD

**Numbers:**
- 250K savings
- 200K savings
- 100K savings
- 150K savings
- 50K savings
- 432K Hardware
- 107K Pwr & Cool
- 15K 15K HDDs
- 1TB 1TB SATA
- 50K Zeus SSD

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Summary

SSD’s are having a profound impact

- Unit growth in the Consumer space
- Revenue and capacity growth in the Enterprise
- Customer adoption is growing in data centers
- SSD’s are driving successful TCO improvement
Thank You

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