Where Does Solid State Storage Fit?

Jim Handy

OBJECTIVE ANALYSIS – Semiconductor Market Research
The Problem: A Growing HDD/DRAM Speed Gap!
The DRAM/HDD Speed Gap

From: *Solid State Drives in the Enterprise*
Solving the Problem

• Keep more data in DRAM
  – Use maximum main memory in each server
  – Spread problem across multiple servers
• Use accelerated HDDs to fill the gap
  – Enterprise HDDs - $300+ each
  – Striped HDD arrays: JBOD, RAID
  – Short Stroking
HDD Hierarchy

- Capacity HDDs
- Enterprise HDDs
- Abused HDDs

Increasing Speed/Cost
In 2004 NAND Shot Past DRAM’s Price per GB

Average Price per Gigabyte

$10,000

$1,000

$100

$10

$1

From: Hybrid Drives: How, Why, & When?
Now NAND Fits in Computers

From: *Solid State Drives in the Enterprise*
How Much Flash?

• Sept 20: Violin announces 40TB SSD!
  – “Put the whole database into flash!”

• Many CIOs try to get by with less
  – Manual approach
    • Journals, Indexes, Roots…
  – Automatic approach
    • Let the system decide

• This question could use some research!
Automatic Tier Management

• Autonomous
  – Seagate Momentus XP Hybrid HDD
  – LSI CacheCade
  – Adaptech HYBRID RAID
  – NVELO Dataplex

• Operating system support
  – Sun – ZFS
  – EMC – Symetrix
  – IBM – z/OS

Many more to come!
SSDs Must Be Understood

Performance is not always intuitive

From: *Putting SSDs to the Test!*

*OBJECTIVE ANALYSIS – www.OBJECTIVE-ANALYSIS.com*
Where Do SSDs Fit?

Direct-Attached SSD, reduces requests to SAN

SSD in the SAN speeds SAN’s response time

Either accelerates network data access
SSDs in the Enterprise

- SSDs growing rapidly in this new space
  - 89% unit CAGR 2010-2015
- Will displace numerous enterprise HDDs
- Reasons this is happening:
  - Certain markets need SSDs
  - One SSD can replace 10+ HDDs
  - Cost savings, performance improvements
What About PCs?
Benefits of SSDs in PCs

• Longer Battery Life
  – Intel finds that battery life improves by 13%+
    • Lower SSD active power consumption
    • More time spent powered down

• Faster boot & program launch
  – Keeps users engaged
  – Improves employee productivity

• Faster execution in disk-intensive programs

• More rugged
  – If PC is smashed, move SSD to a new PC
    • User back to work *pronto*!
NAND Unlikely to Match HDD $/GB

From: Understanding the NAND Market

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# PCs Are Unlike Data Centers

<table>
<thead>
<tr>
<th><strong>PC</strong></th>
<th><strong>Data Center</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>One HDD</td>
<td>Thousands of HDDs</td>
</tr>
<tr>
<td>Don’t currently use a storage hierarchy</td>
<td>Storage hierarchy is common</td>
</tr>
<tr>
<td>Speed is nice to have</td>
<td>Speed is money</td>
</tr>
<tr>
<td>Modest battery life improvement</td>
<td>Significant collateral savings</td>
</tr>
<tr>
<td></td>
<td>– Reduced server count</td>
</tr>
<tr>
<td></td>
<td>– Fewer racks</td>
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<td></td>
<td>– Power/cooling</td>
</tr>
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<td></td>
<td>– Etc.</td>
</tr>
</tbody>
</table>
PC Architectures Will Follow the Data Center Example

• Main storage cached by flash
  – Large HDD – Small flash

• This has been tried before
  – Robson/Turbo Memory
  – Hybrid HDDs of 2007

• It is being tried again
  – Seagate Momentus XP
  – NVELO Dataplex
  – (Intel Braidwood)

Eventually NAND will become standard in PCs!
Thank You!

Jim Handy