Introduction

February 2010
Today’s Problematic Solutions

DISKS

MEMORY

SERVERS

SOFTWARE

POWER
ioMemory is a New Memory Tier

ACCESS DELAY IN TIME

- Nanosecond (10E-9)
- Millisecond (10E-3)

1. L1: 50µs (10E-6)
2. L2: 6 orders of magnitude
3. L3: 5 orders of magnitude
4. ioDrive: 5 orders of magnitude
5. SSDs, SAN, NAS, RAIDed DAS

ioDrive is a New Memory Tier
Application Acceleration

Raw Storage Performance

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Interface</th>
<th>RAID</th>
<th>Size</th>
<th>Flash Type</th>
<th>Bandwidth MB/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusion-io ioDrive</td>
<td>PCIe x4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Write</td>
<td>24 GB, Flash</td>
<td></td>
<td></td>
<td>3.0Gbps</td>
<td>583.1</td>
</tr>
<tr>
<td>Improved Write</td>
<td>40 GB, Flash</td>
<td></td>
<td></td>
<td>3.0Gbps</td>
<td>581.6</td>
</tr>
<tr>
<td>Maximum Capacity</td>
<td>80 GB, Flash</td>
<td></td>
<td></td>
<td>3.0Gbps</td>
<td>76.2</td>
</tr>
<tr>
<td>SSD SATA Vendor A</td>
<td>3.0Gbps</td>
<td>2.5</td>
<td>128 GB</td>
<td>SATA/300</td>
<td>217.5</td>
</tr>
<tr>
<td>SSD SATA Vendor B</td>
<td>3.0Gbps</td>
<td>2.5</td>
<td>64 GB</td>
<td>SATA/300</td>
<td>117.1</td>
</tr>
<tr>
<td>SSD SATA Vendor C</td>
<td>3.0Gbps</td>
<td>2.5</td>
<td>32 GB</td>
<td>SATA/300</td>
<td>117.1</td>
</tr>
</tbody>
</table>

Application Performance

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Interface</th>
<th>RAID</th>
<th>Size</th>
<th>Flash Type</th>
<th>Bandwidth MB/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusion-io ioDrive</td>
<td>PCIe x4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Write</td>
<td>24 GB, Flash</td>
<td></td>
<td></td>
<td>3.0Gbps</td>
<td>268.9</td>
</tr>
<tr>
<td>Improved Write</td>
<td>40 GB, Flash</td>
<td></td>
<td></td>
<td>3.0Gbps</td>
<td>104.9</td>
</tr>
<tr>
<td>Maximum Capacity</td>
<td>80 GB, Flash</td>
<td></td>
<td></td>
<td>3.0Gbps</td>
<td>29.6</td>
</tr>
<tr>
<td>SSD SATA Vendor A</td>
<td>3.0Gbps</td>
<td>2.5</td>
<td>128 GB</td>
<td>SATA/300</td>
<td>2.6</td>
</tr>
<tr>
<td>SSD SATA Vendor B</td>
<td>3.0Gbps</td>
<td>2.5</td>
<td>64 GB</td>
<td>SATA/300</td>
<td>2.2</td>
</tr>
<tr>
<td>SSD SATA Vendor C</td>
<td>3.0Gbps</td>
<td>2.5</td>
<td>32 GB</td>
<td>SATA/300</td>
<td>2.2</td>
</tr>
</tbody>
</table>

2x Faster Storage I/O

50x Faster Application I/O
Context Switching
In summary, host-based logical storage block mapping avoids the need for:

- Embedded offload CPU’s (that serializes I/O’s)
- Embedded memory *(prone to soft-errors)*
- Batteries or super caps for power hold-up *(maintenance issue)*
- RAID controllers (with their own CPU, memory, and battery issues)

As a result, Fusion’s cut-through logical storage block mapping achieves:

- Greater application acceleration due to lower latency
- Higher parallelism
- Better mixed read/write performance
- Less complexity
- Better reliability
- Lower cost
- Lower power consumption
- Less physical space required
Internet security company that protects over 1 billion inboxes

- 5x improvement to
  - Database replication performance
  - Data intensive query response
  - Analysis routines
- Eliminating 210 failure points from system
- Implemented full system redundancy
- Dramatically lowered power and cooling expenses
“Do you still need a SAN?”

XXX,
FORESTER QUOTE
Customer Examples

- **FedEx**: Does a 30 to 1 box reduction for their reliable messaging system
- **HMO**: Achieves a 200 HDD to 1 ioDrive reduction for their Data Warehouse
- **Department of Defense**: Takes NASTRAN from 3-days to 6-hours
- **Stock exchange**: Doubles the performance of their trading systems
- **Oracle**: Shows a 35x performance increase of unstructured search at OracleWorld
- **Demos Dynamics NAV**: Can get a 4x performance improvement
How Much Less Power?

- **97 kWh/yr**: ioDrive Fusion-io
- **3,013 kWh/yr**: SSD ZeusIOPS
- **133,493 kWh/yr**: 15,000 RPM FC HDD
<table>
<thead>
<tr>
<th>Storage Capacity</th>
<th>4k Read Packet Size</th>
<th>75/25 r/w Mix 4k Packet Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 GB</td>
<td>119,790</td>
<td>89,549</td>
</tr>
<tr>
<td>160 GB</td>
<td>116,046</td>
<td>93,199</td>
</tr>
<tr>
<td>320 GB</td>
<td>71,256</td>
<td>67,659</td>
</tr>
<tr>
<td>320 GB</td>
<td>185,022</td>
<td>129,699</td>
</tr>
<tr>
<td>640 GB</td>
<td>122,601</td>
<td>121,008</td>
</tr>
</tbody>
</table>
Questions?
THANK YOU