Hybrid Storage Architecture Marries Performance and Efficiency

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1. What do I mean by “Hybrid Storage, vLUN”?

2. What do I mean by “performance”?

3. What do I mean by “efficiency”?

4. What do I mean by “green data storage”?
The Storage Dilemma

Increasing Performance Gap between Servers and Storage

- Increasing server performance
- Traditional disk performance
Compounding Pain Points

Explosive data growth in typical Fortune 1000 enterprise

Data centers are running out of power

2006 2010

800 TB

680 TB

87% CAGR

Source: InfoPro TIP Wave 9

33% of Data Centers expected to be out of power

2007

97% of Data Centers expect to be out of power

2011

Source: Liebert Systems, Inc.
“Performance Starved Applications”

PSAs are applications where performance is negatively impacted (bottlenecks) because:

a. CPU is I/O bound or,
b. Disk storage is I/O bound or,
c. Other
Potential Performance Starved Applications

1. Transaction dominated, data intensive database applications such as data mining and data warehousing
2. Web facing applications that support ecommerce
3. Enterprise messaging (email)
4. Virtual machine deployment (VMotion)
5. Virtual desktop deployment (VDI)
6. Analytics (financial, business, seismic, etc)
7. Decision support systems (BI)
8. Metadata indexing and logs
9. Digital media analytics
10. High-speed data acquisition
The “I/O Blender” Challenge

Physical Server

VM1

VM2

VM3

VM4

VM5

VM6...

I/O

I/O

I/O

I/O

I/O

I/O

VHBAs

VM I/O Blender

Storage Array

Blended, random I/O from multiple virtual machines

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Relationship between VDI Client Growth and Storage IOP Requirements

assumption: individual drive IOP = 200

VDI Clients

Spindles Required

Client Demand = 10 IOP's
The Energy Glutton
Projected 2008 Energy Consumption ($) by Component

Spinning Disk: 80%
Logic: 10%
Ports: 4%
Internal Switching: 2%
Cache: 1%
Other (e.g. Svc. Proc.): 3%

Source: Wikibon.org
Spinning disk delivers large block size bandwidth

SSD delivers high Data Access (IOPs) at low block sizes

What if we blended both SSD and HDD in a Hybrid Solution? And what if the system was autonomic and self-optimizing?
Intelligent Tiered Storage Management

Autonomic Management Optimizing Access to Data Exhibiting Unpredictable Access Patterns

Access Profiler
- Adaptive histogram, highly compressed, scales to PB
- Accelerates IO for high access content

TME (Tiered Management Engine)
- Dynamic block migration with access pattern change
- Mix profiling: block level and file level, very precise
Managing Disparate Workloads

Sequential
- Egress IO read-ahead

Hot-Spots
- Ingest IO reforming

Random

Fully Predictable (SLC/RAM FIFOs)

Semi-Predictable (Scalable Flash)

Non-Cacheable (High spindle density or SSD)
What is a Hybrid VLUN?

ApplicationSmart creates a high performance working copy of active blocks on SSD.

Data copied from HDD to SSD.

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Performance Increase with SSDs

- HDD IOPs
- SSD IOPs
- Bandwidth

IOPs (I/O/sec)

IO Request Size:
- 512b
- 4K
- 32K
- 64K
- 128K
- 512K
- 1MB

BW (MB/sec)

IOs:
- 400 K
- 20 K

2 GB/s
Key Attributes of Effective “Performance” Tier Management

- Eliminate Management Complexity
- Real Time Responsiveness
- Meaningful Granularity
- Synergistic Blending of the Attributes of Disparate Storage
**The Bottom Line - Flexibility to Solve Performance Problems**

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<tr>
<th>Performance</th>
<th>Capacity Scalability</th>
<th>Cost</th>
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- **Fundamental Storage Customer Requirements**

  - **Performance**
    - RAM Scaling: $$$$$
    - SSD Scaling: $$$
    - HDD Scaling: $
  - **Capacity Scalability**
    - SSD Scaling: $$$$
    - SSD + HDD Scaling: $$
  - **Cost**
    - Add HDD Back-end
    - Add SSD TME / IA
    - Add RAM TME / EA
Traditional thinking will not solve tomorrow's performance challenges!!

Can’t you see I’m busy!
Thank You!