Taking Full Advantage of SSD Technology

Chair
Larry Chisvin
VP of Strategic Initiatives
PLX Technology
Who is PLX?

- Leader in PCIe switching and bridging devices

PCIe Switch

PCIe SSD Controller

Flash Memory

PCIe SSD Controller

Flash Memory

PCIe SSD Controller

Flash Memory

PCIe SSD Controller

Flash Memory

Rest of System
The Panel to End All Panels

- Tom Heil
  - Senior Systems Architect & Distinguished Engineer
    -- Avago
- Ajoy Aswadhati
  - CTO & Founder -- Fastor Systems
- Mike Jochimsen
  - Director, Product Marketing and Alliances -- Emulex
- Anil Vasudeva
  - President & Chief Analyst -- IMEX Research
Today’s Theme
More Specifically

• Change is good

1. Doing things the “easy” way is…easy, but…
2. If you take the road more traveled, you will leave money, power, features and performance on the table
3. You should redesign your system to take advantage of the unique properties of SSDs
4. Here are some ideas on how to do that
SSD Trends

Tom Heil
Senior Systems Architect & Distinguished Engineer
Avago Technologies
Datacenter Memory Hierarchy Latency circa 2008

Five Orders of Magnitude Hit to Leave Memory Hierarchy

The Cause of it All!
Datacenter Non-volatile Storage Device Hierarchy

- **Non Volatile DRAM**
- **Storage Class Memory**
- **Premium SSDs**
  - Datacenter Optimized
- **Mainstream SSDs**
  - Leverage From Client
- **Rotating Media**
Datacenter Non-volatile Storage Device Hierarchy

<table>
<thead>
<tr>
<th>OLD NEWS</th>
<th>NEW NEWS</th>
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<tbody>
<tr>
<td>PCIe Flash Adapters</td>
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<tr>
<td>SAS SSDs</td>
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## Datacenter Non-volatile Storage Device Hierarchy

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<tr>
<td>PCIe Flash Adapters</td>
<td>Enterprise PCIe SSDs* (SFF-8639)</td>
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<tr>
<td>SAS SSDs</td>
<td>Multi-link SAS SSDs</td>
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<tr>
<td>SATA SSDs</td>
<td>SATA Express SSDs*</td>
</tr>
<tr>
<td>Micro SATA Cards</td>
<td>M.2 Cards*</td>
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* PCIe Form Factors Moving to NVMe
SATA Express not getting much attention today, but …

<table>
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<tr>
<th></th>
<th>Price</th>
<th>Performance</th>
<th>Serviceable</th>
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<tr>
<td>Flash Adapter</td>
<td>$$$$$</td>
<td>++ + + + + +</td>
<td>No</td>
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<tr>
<td>SFF-8639</td>
<td>$$$</td>
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<td>SAS</td>
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SATA Express uniquely delivers PCIe/NVMe performance, SATA SSD economics, and enterprise serviceability in “standard” (SFF-8680) storage device bays.
Taking Full Advantage of SSD Technology
Exploiting Flash for System Design

Ajoy Aswadhati
Founder & CTO
Fastor Systems
About Fastor Systems

Fastor Systems is focused in bringing future-proof solutions to the rapidly growing Cloud and Enterprise SSD markets. Fastor’s disruptive architecture will provide our customers with vastly enhanced application performance, reduced TCO and lower power consumption.

Fastor’s architecture is applicable to all types of storage class memory media.
Fabric Based SSD Architecture

- Non-Blocking Fabric coupled to Individual Channel Controllers
SSD Form Factor Evolution

- Started with non-HDD form factor
- Mass adoption with HDD form factor
- Proliferating in different form factors
Typical Flash Storage Array

Pros
• Using a HDD form factor for SSDs lends itself to plugging into current ecosystems

Cons
• Is wasteful in terms of:
  – Space utilization
  – Power
  – Capacity
  – Cost
Re-architect System for SSD Array

- Modular Flash Blades
- Serviceable
- Energy Efficient
- Lower Cost
- Use PCIe as interconnect for Flash modules

Oracle SUN Netra ATCA chassis
Increased Margins for Cloud Providers

- Storage appears as in-server DAS
- Capacity and IOPS reservations with guaranteed QOS
- Facilitates Service Level Agreements (SLAs)

Monetizing managed and cloud storage services
Summary

- Ultimate potential of flash can be leveraged by breaking away from legacy HDD array architectures and protocols.
- Newer SSD architecture and storage interconnects using PCIe are well suited to exploit potential of flash.
- Opportunity to define a standards based storage array.
Taking Full Advantage of SSD Technology
Overcoming Bottlenecks in Software

Mike Jochimsen
Director, Product Marketing and Alliances
Emulex
Emulex Corporation Overview

- Founded in 1978
- Based in Costa Mesa, CA
- ~1,200 Employees
- NYSE Listed under the symbol ELX
- FY13 Revenue $478.6 MM (June-July FY)
- Top OEM Customers – IBM, HP, Dell
- Installed in 95% of Fortune 1000
Emulex Market Share Leadership

Fibre Channel¹
- #2 in total FC revenue
- #1 in 16GFC revenue

Ethernet¹
- #1 in Total FCoE
- #2 in Total 10GbE Revenue

Network Recording²
- #2 in 10Gb Network Recording
- #1 in 40/100 Network Recording

Sources:
¹ Crehan Research Server-class Adapter and LOM Market Share Report 1Q2014, May 2014
² Frost & Sullivan Network Recording Market Report, June 2013
Trends Impacting I/O

- Virtualization density
- Cloud computing
- VDI growth
- Big data repositories
- Enterprise analytics
- Growth, growth, growth
Flash in the I/O path

- Server DAS
- Server cache
- Array cache
- Fabric cache
- Flash array
What’s the problem?

Let’s play a game of Hot Potato!

- What problem am I trying to solve?
- Where is the bottleneck (today)?
- Where am I moving it by placing flash in the architecture?
Solutions? Anyone?

- Complete system view
- Dissect the transaction
- Seek to understand
- Can’t we all just get along?
Taking Full Advantage of SSD Technology
SSDs: A New Storage Platform

Anil Vasudeva
President & Chief Analyst
IMEX Research
Apps: Key to Infrastructure Architecture

Workloads need Infrastructure > Optimized for Cost, Availability, Performance …
RAID – First SW Defined Storage 1988
RAID SW Creates Specific Storage Capabilities (HA, Performance, Cost)

Sources: Vasudeva, Anil “A Case for Disk Arrays” Presented at LAN Conference, Santa Clara, CA Aug 1988
Need: A New Storage Architecture

1 Key Tenets of Virtualization (VZ)

Resources Utilization Costs

2 Storage Performance Issues in VZ
The VM I/O Blender – A key Culprit

Storage Underperforms in VM Environments

- Very Random, Write intensive I/Os from some VMs get blended with Sequential, Read Heavy I/Os from other VMs resulting in:
  - Degraded Storage Performance by 30-50%
- Legacy Soln: Larger, more expensive storage configs created to meet needed IOPs
  - Storage Capacity wastage
- Other Effects
  - Poor Thin Provisioning & Snapshots/Cloning
  - Inefficient VM Management

3 Solution: Storage Defined Storage
Improves Perf., Mgmt, Cost/Provisioning, Snaps

- Create a storage abstraction layer
  - Do for Storage like Hypervisor for Compute
    - Virtualizes Storage for Optimum Mgmt.
- Unlock the Performance & Wasted Capacity of Existing Storage by provisioning Storage as fast as VMS can be created
  - Improves storage performance by 10x
  - Improves Thin Provisioning & Snapshots
  - Reduces capacity consumption up to 90%
- Provide a VM-Centric Management paradigm
  - VM-Centric Management
- Integrate Seamlessly into existing Hypervisor
SDS leverages App-Centric Data Services

- Storage Efficiency
- Performance, Cost
- Data Protection
- Data Availability

Storage Policy (at VM Level)

- De-Dupe
- Replication
- Snapshots
- Caching
- Compression
- Encryption
- Back Up
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Questions & Discussion

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Five Orders of Magnitude Hit to Leave Memory Hierarchy

100,000x

The Cause of it All!

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Apps: Key to Infrastructure Architecture

Workloads need Infrastructure > Optimized for Cost, Availability, Performance...