Taking Full Advantage of SSD Technology

Chair

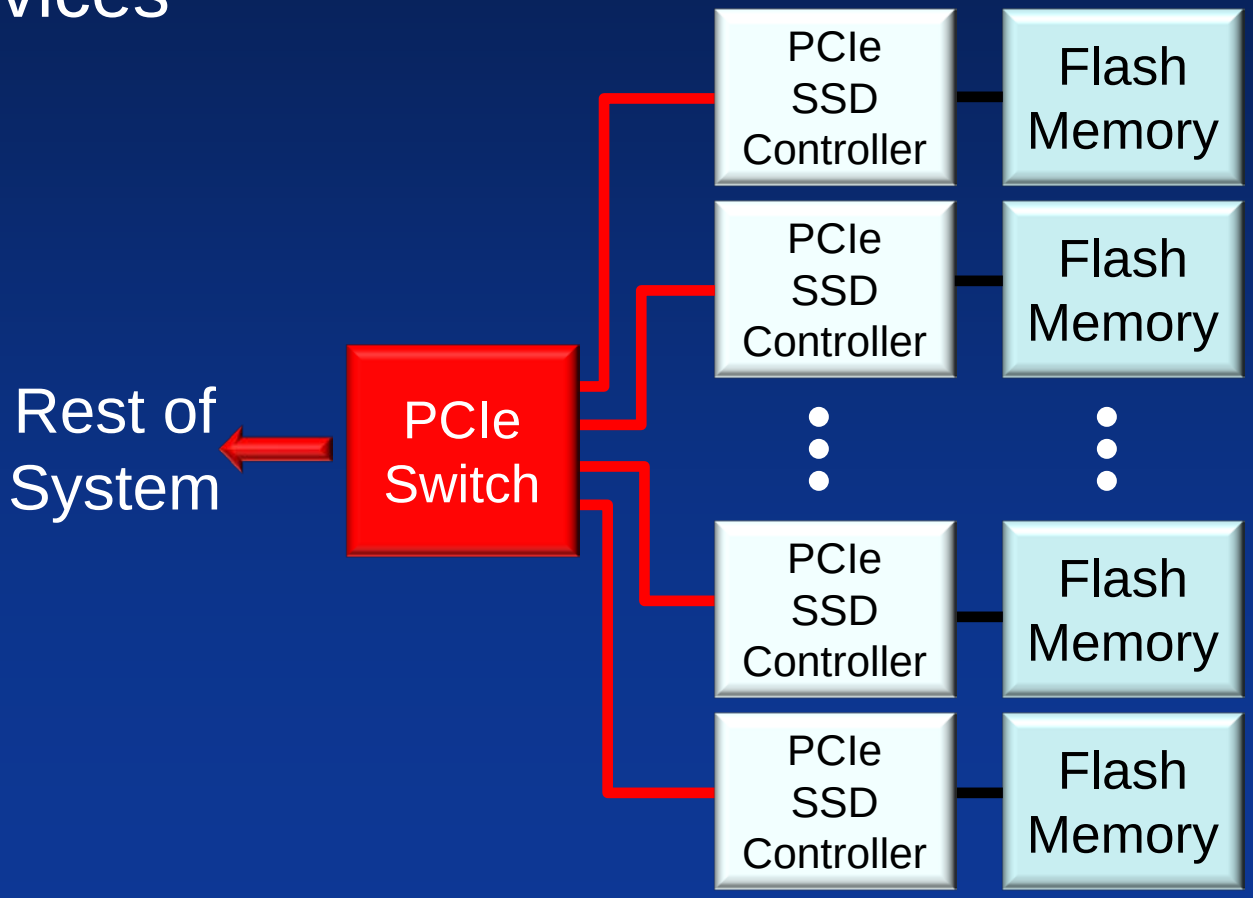
Larry Chisvin

VP of Strategic Initiatives

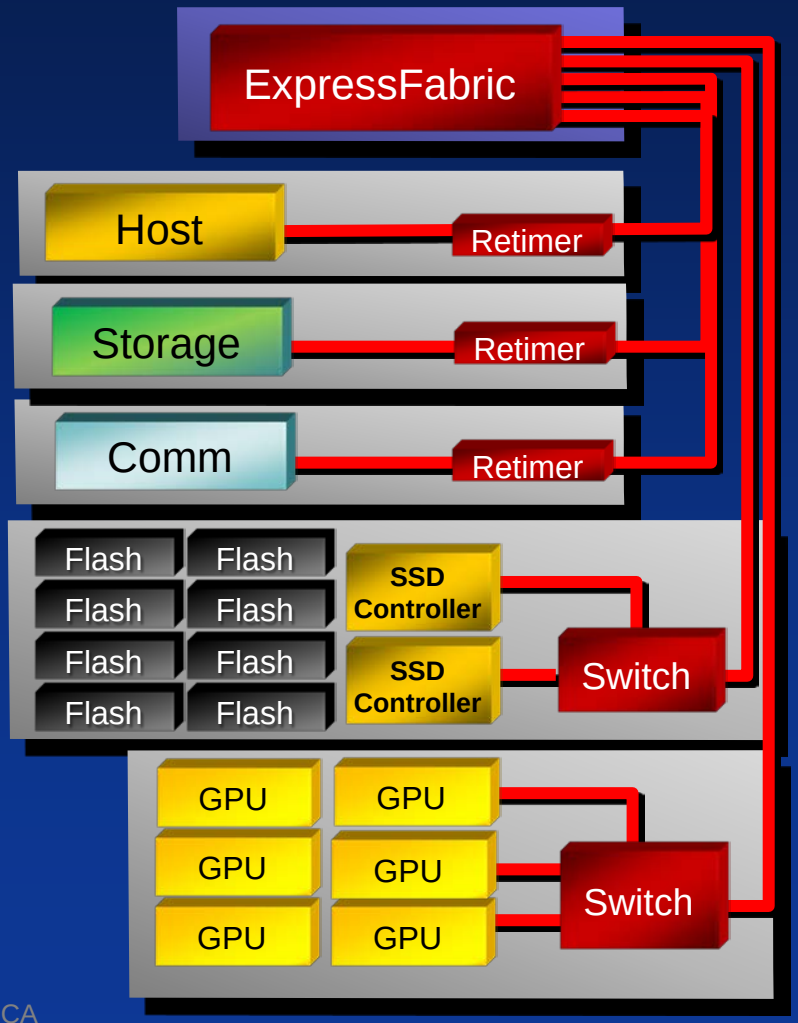
PLX Technology

Who is PLX?

- Leader in PCIe switching and bridging devices



Building Up Converged Storage



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

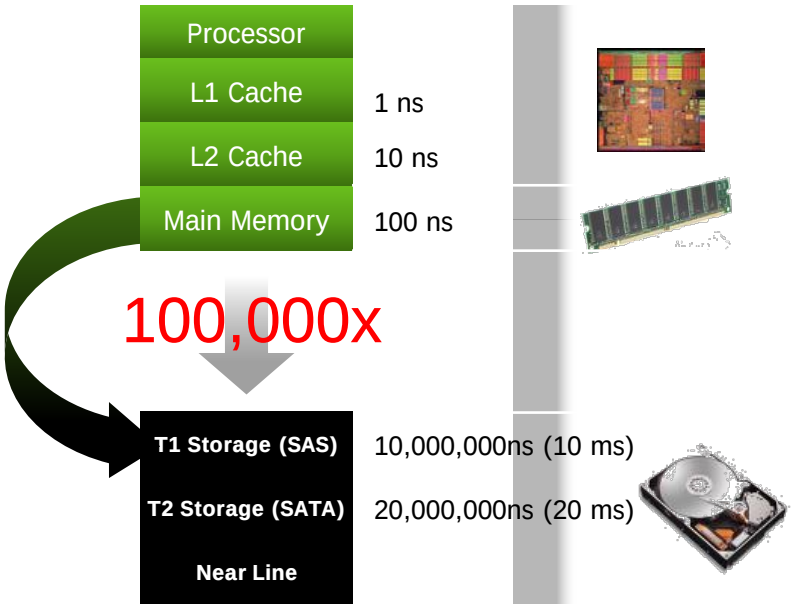
1. Doing things the “easy” way is…easy, but...
2. If you take the road more traveled, you will leave money, power, features and performance on the table
3. You should redesign your system to take advantage of the unique properties of SSDs
4. Here are some ideas on how to do that

SSD Trends

Tom Heil
Senior Systems Architect & Distinguished Engineer
Avago Technologies

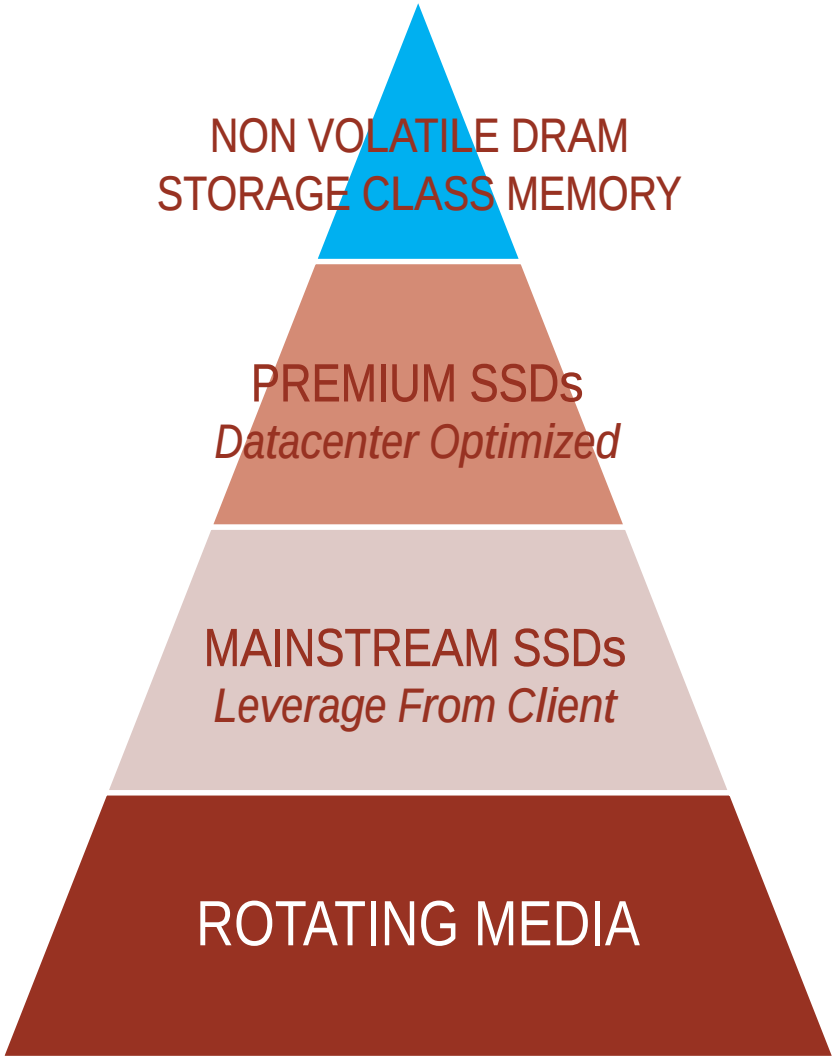
Datacenter Memory Hierarchy Latency circa 2008

Five Orders of Magnitude Hit to Leave Memory Hierarchy

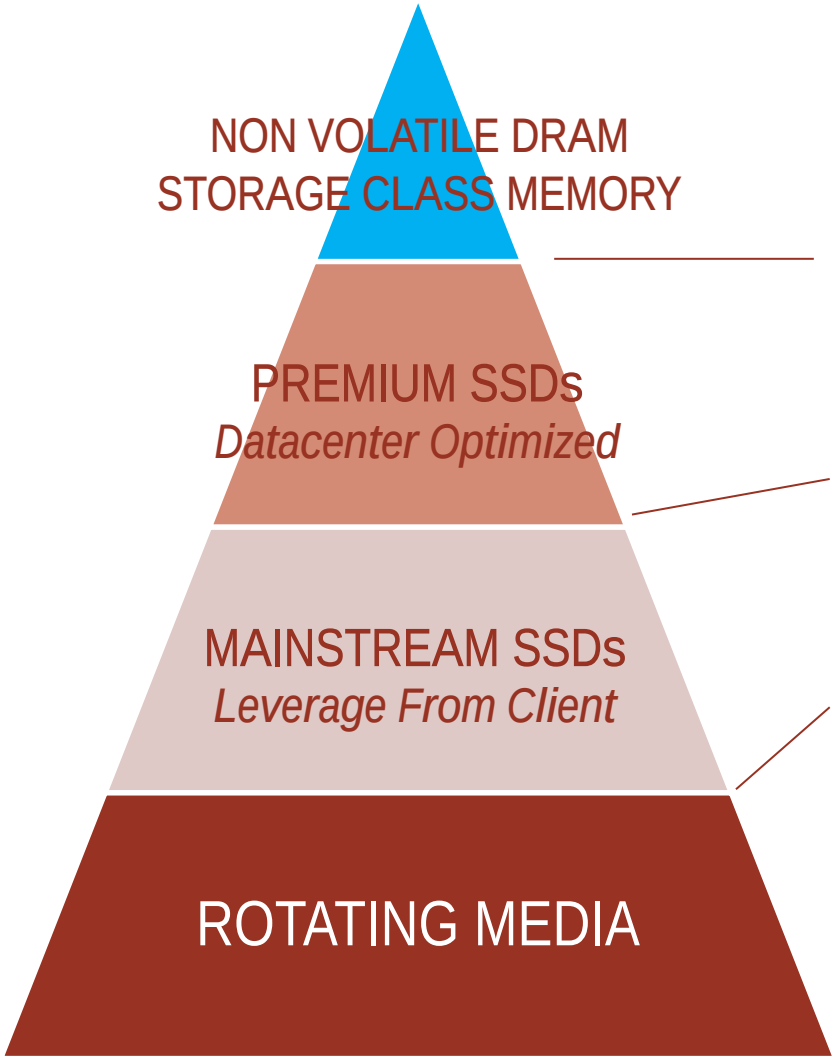


The Cause of it All !

Datacenter Non-volatile Storage Device Hierarchy

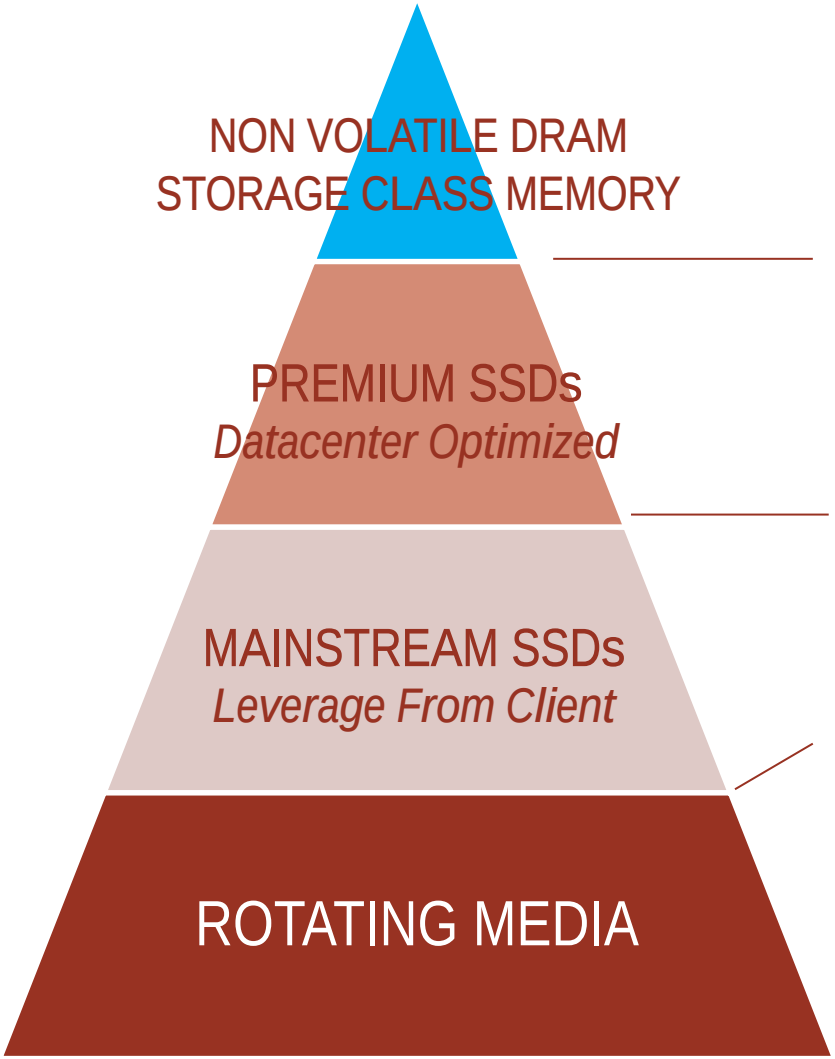


Datacenter Non-volatile Storage Device Hierarchy



OLD NEWS	NEW NEWS
PCIe Flash Adapters	
SAS SSDs	
SATA SSDs	
Micro SATA Cards	

Datacenter Non-volatile Storage Device Hierarchy



OLD NEWS	NEW NEWS
PCIe Flash Adapters	Enterprise PCIe SSDs* (SFF-8639)
SAS SSDs	Multi-link SAS SSDs
SATA SSDs	SATA Express SSDs*
Micro SATA Cards	M.2 Cards*

* PCIe Form Factors Moving to NVMe

SATA Express not getting much attention today, but …

	Price	Performance	Serviceable
Flash Adapter	$$$$	+ + + + + +	No
SFF-8639	$$$	+ + + + +	Yes
SAS	$$	+ + + +	Yes
SATA Express	$	+ + +	Yes
M.2	$	+ + +	No
SATA	$	+	Yes

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

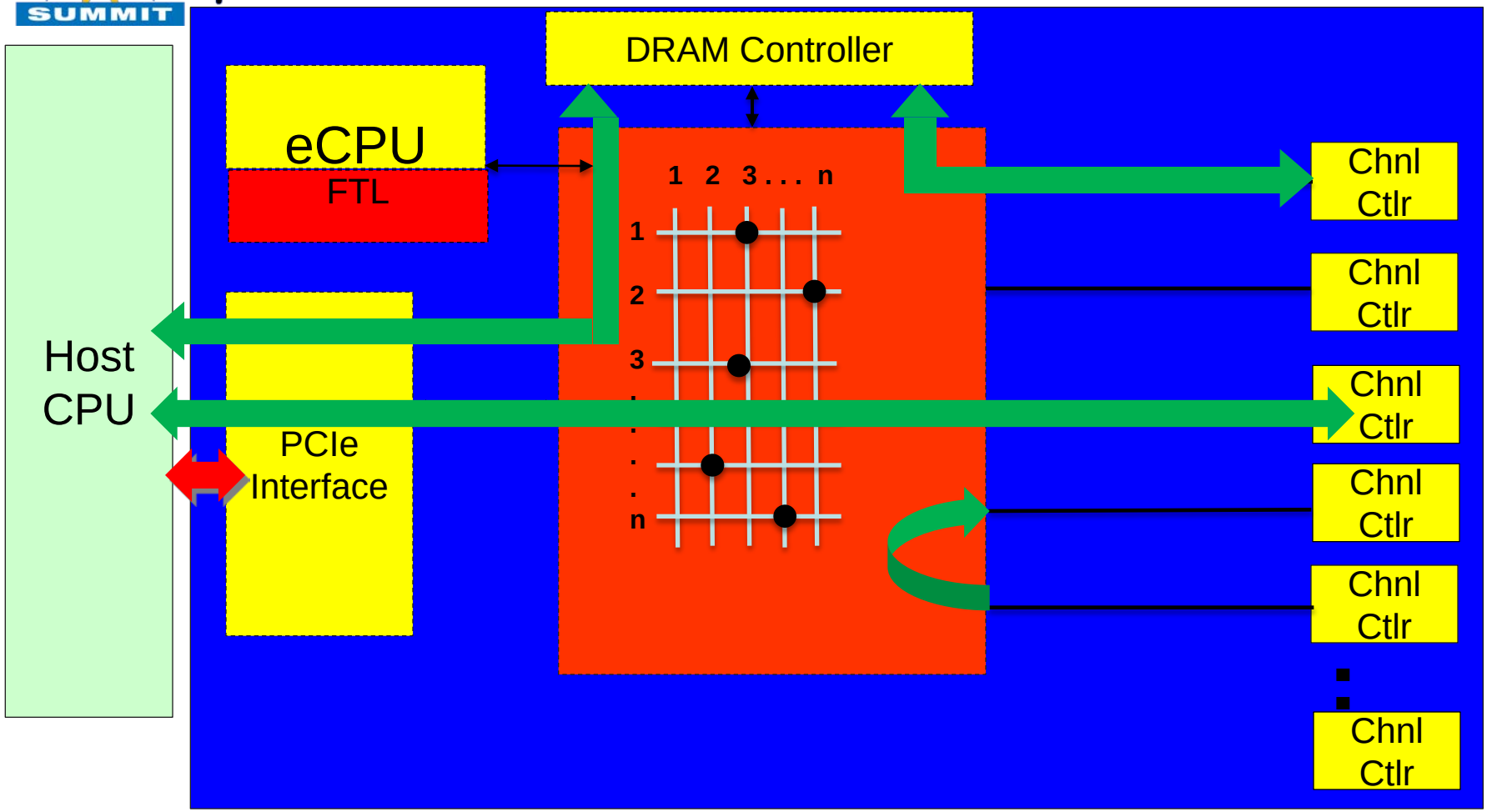
Ajoy Aswadhati
Founder & CTO
Fastor Systems

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

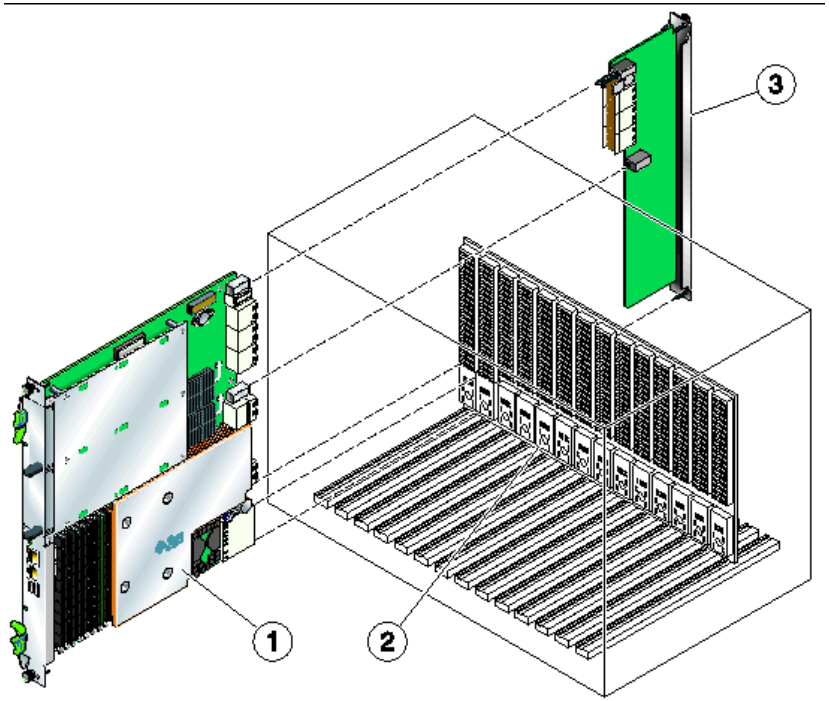
Typical Flash Storage Array

Legacy 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

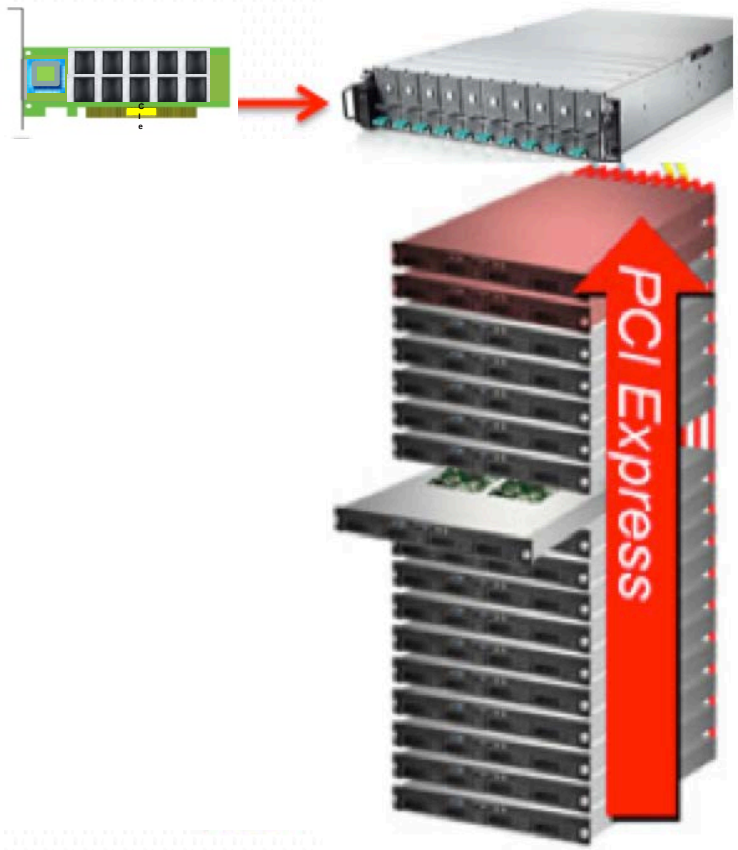
- Modular Flash Blades
- Serviceable
- Energy Efficient
- Lower Cost
- Use PCIe as interconnect for Flash modules



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 Channel[1]

LightPulse™

- **#2** in total FC revenue
- **#1** in 16GFC revenue

Ethernet[1]

OneConnect™

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

Network Recording[2]

endace

EMULEX

- **#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?

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connect • monitor • manage

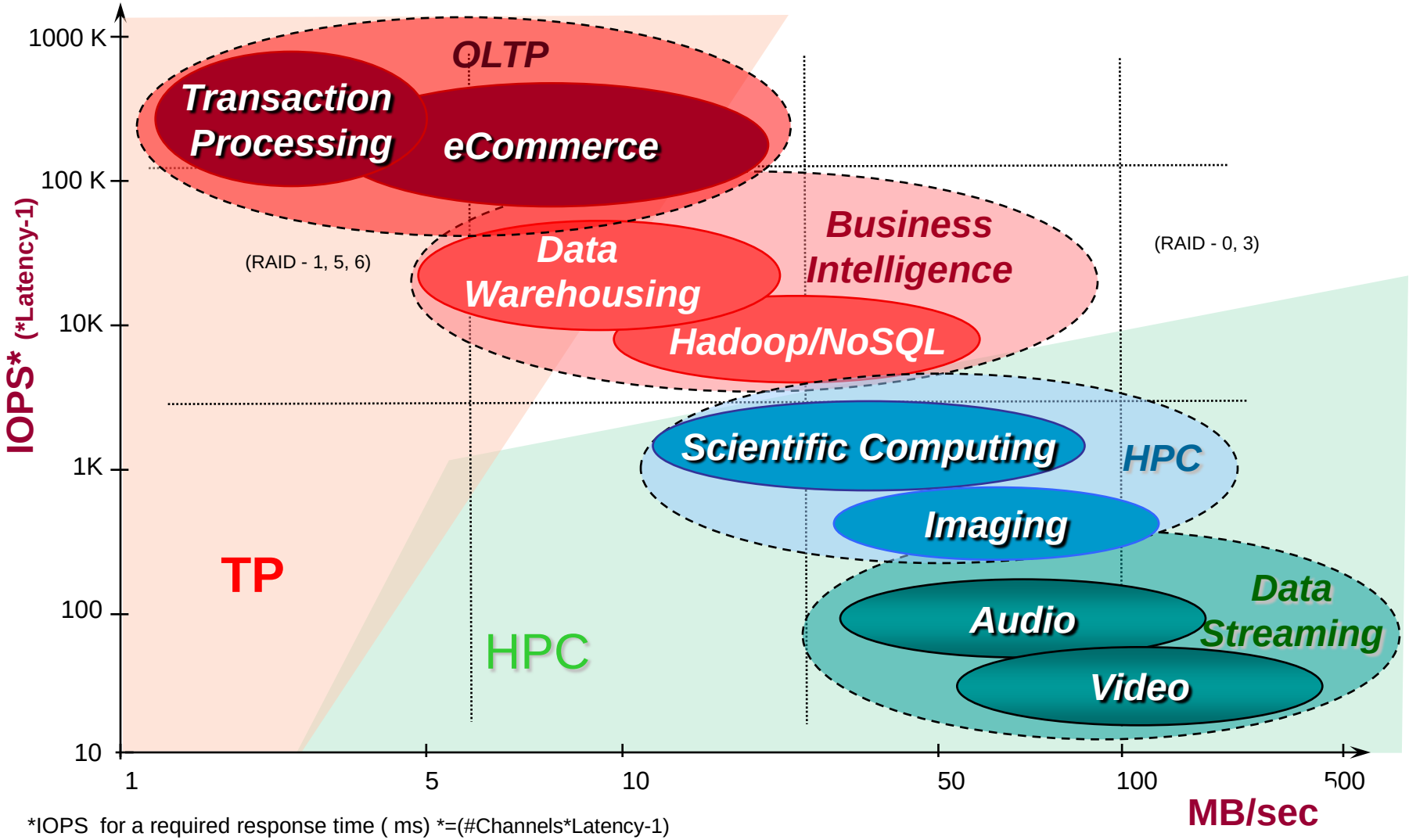
Taking Full Advantage of SSD Technology

SSDs: A New Storage Platform

Anil Vasudeva
President & Chief Analyst
IMEX Research

Apps: Key to Infrastructure Architecture

IMEX RESEARCH.COM

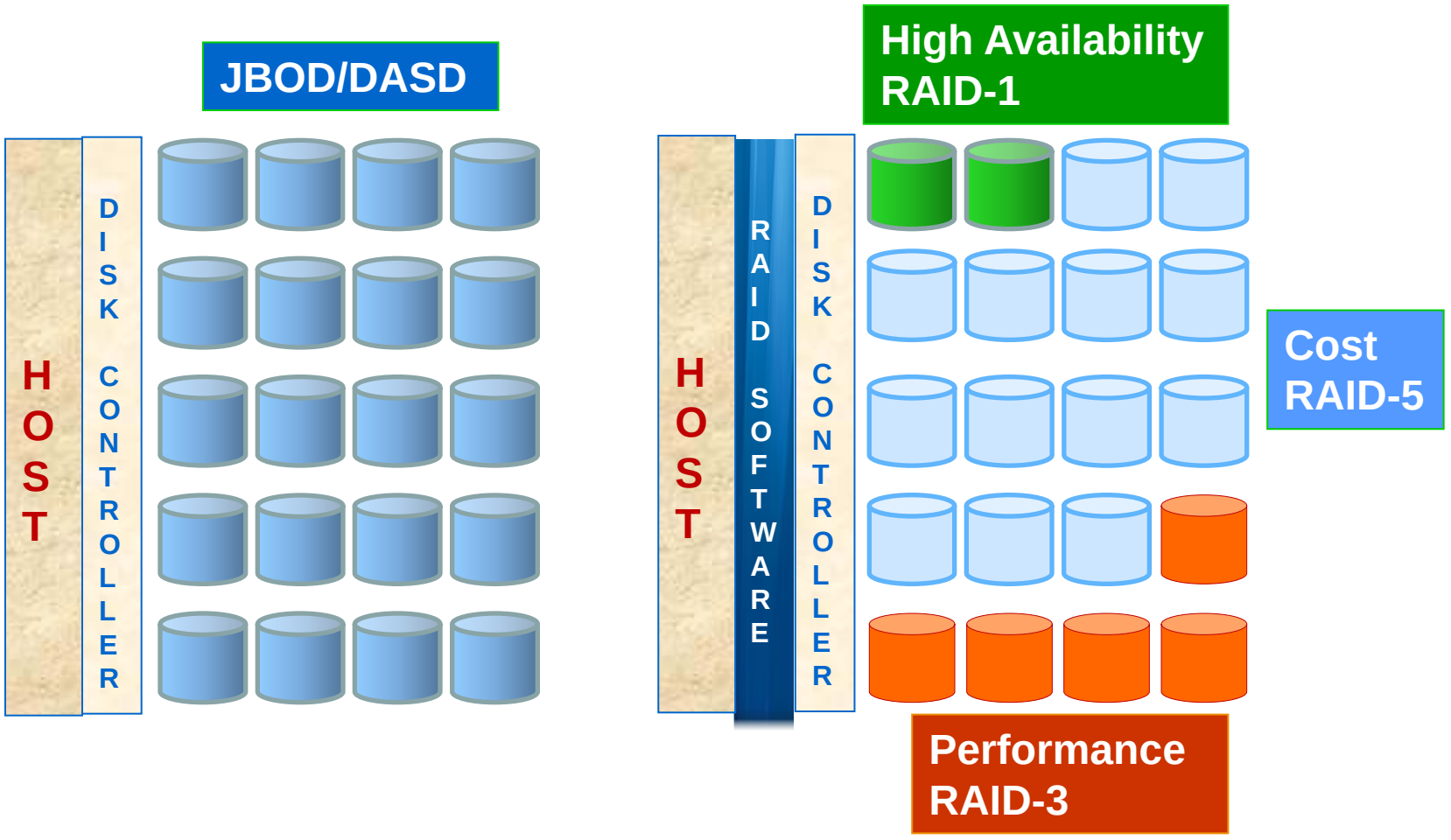


*IOPS for a required response time (ms) *=(#Channels*Latency-1)

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

RAID – First SW Defined Storage 1988

RAID SW Creates Specific Storage Capabilities (HA, Performance, Cost)



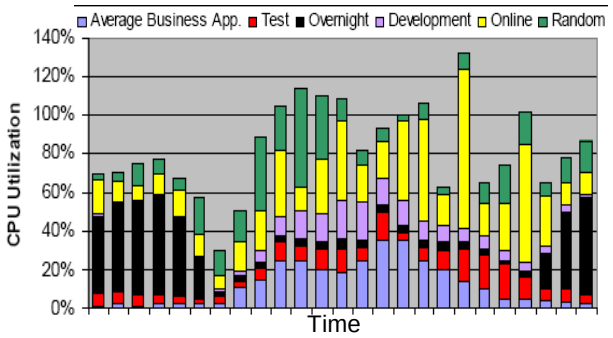
Sources: Vasudeva, Anil "A Case for Disk Arrays" Presented at LAN Conference, Santa Clara, CA Aug 1988
Patterson D., Katz R, Gibson G " A case for Redundant Array of Inexpensive Disks (RAID) UC Berkeley 1988

Need: A New Storage Architecture

IMEX RESEARCH.COM

1 Key Tenets of Virtualization (VZ)

↑ Resources Utilization ↓ Costs



2 Storage Performance Issues in VZ

The VM I/O Blender – A key Culprit

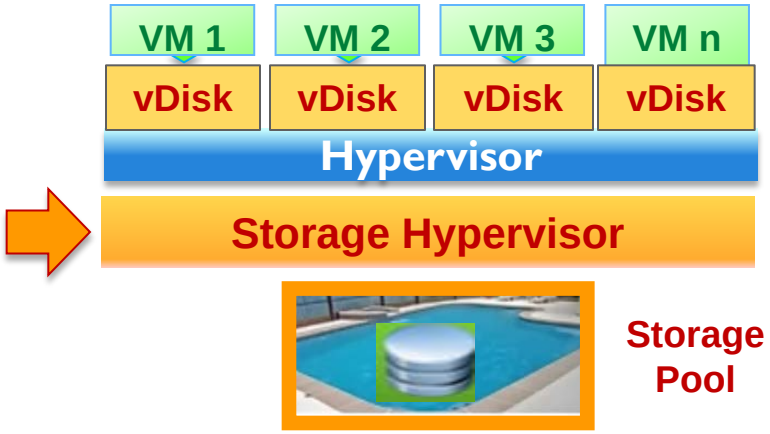
Storage Underperforms in VM Environments

- 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

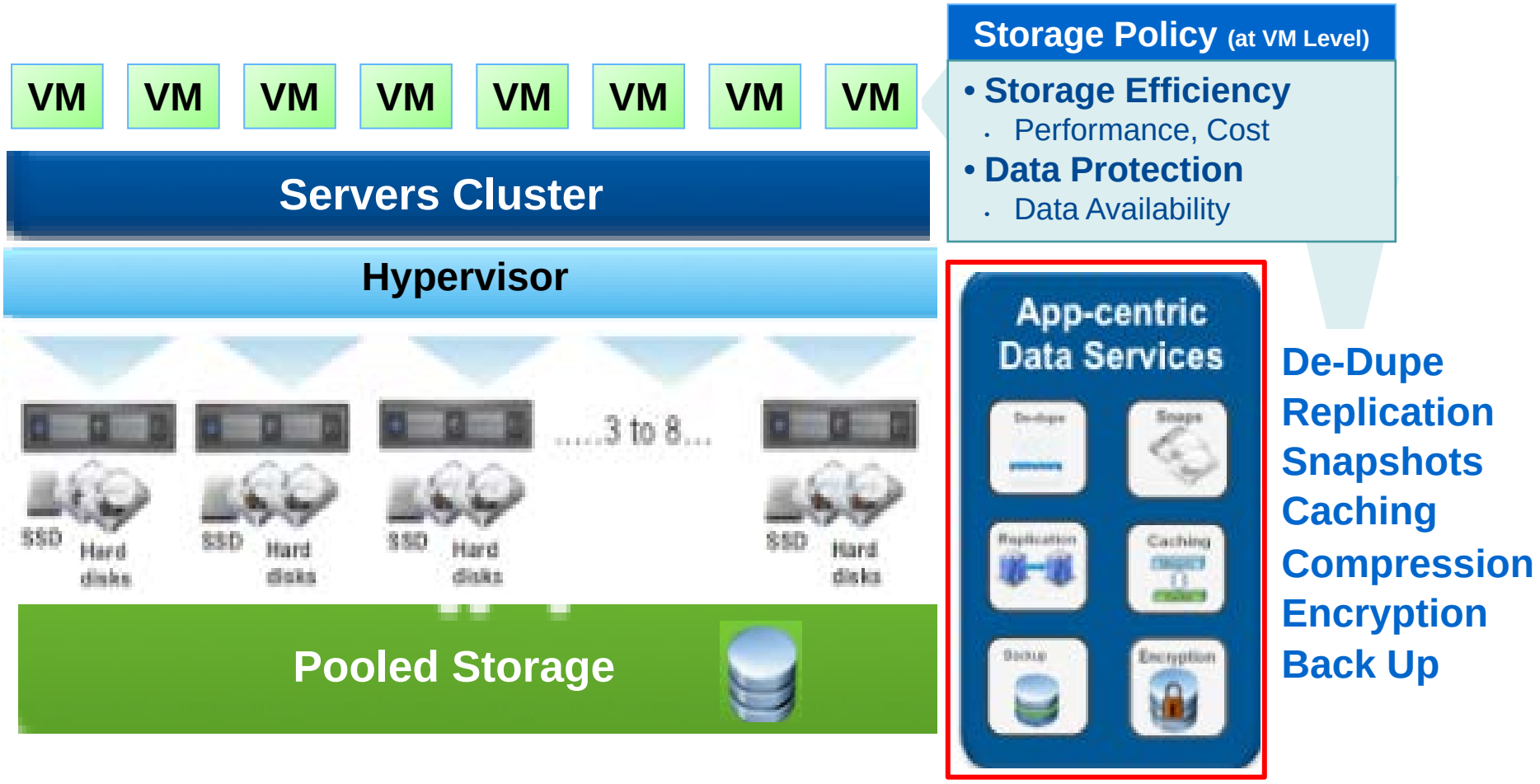
3 Solution: Storage Defined Storage

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



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Questions & Discussion