JANUARY 20, 2016, SAN JOSE, CA

NVDIMM Panel

SNIA SSSI | SOLID STATE STORAGE

Panel & Agenda

SNIA™ Solid State Storage Initiative

Amit Golander – Software Defined Memory (SDM)

- CTO and VP R&D, Plexistor – A technology leadership expert with experience at Primary Data, Tonian, and IBM. Amit has a rich R&D background, leading global hardware and software technical teams since 2000 and composing over 15 papers and 35 patents so far. Amit has a PhD in computer architecture and diverse work experience in storage, servers, and networking.

Alex Fuxa – Persistent Memory

- Persistent Memory R&D Manager, HPE – He manages the HP Servers Persistent Memory R & D team. The Persistent Memory R & D team is interested in finding innovative ways to bring emerging non-volatile memory products to market. Alex holds a BS in Electrical and Computer Engineering from University of Texas at Austin. Before joining the HP Servers Persistent Memory team Alex developed Firmware for HP Servers Smart array controller and developed Flash Translation Layers for enterprise solid state disks. Alex has been granted 11 patents related to RAID and Flash technologies.

Marc Schneider – NVDIMM Systems Update

- Senior Product Manager, Supermicro - He leads the IA Dual Processor Motherboard Group. He has launched multiple generations of award winning datacenter and enterprise products based on Intel's E5-2600 family of Xeon processors. With over 25 years of industry experience, he has held positions in product management, engineering management, and product design at various technology start-ups as well as Sun Microsystems and Philips Semiconductors. Marc holds a BSBA in High Tech Management from San Jose State University.

STORAGE INDUSTRY SUMMIT

Convergence of Storage and Memory Developing the Needed Ecosystem

JANUARY 20, 2016, SAN JOSE, CA

Amit Golander, PhD

Plexistor

CTO

Software Defined Memory (SDM)

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Background

IOPS
(even if random…)

Latency
(even under load…)

HDD **FLASH** **NVDIMM**

NVDIMM-N marries the best of both worlds:

Memory Speed + **Storage Persistency**

New amazing hardware technology

Motivation

SNIA™
Solid State Storage Initiative

- We all agree that
  Persistent memory is the ultimate high-performance storage tier

- But
  How does Joe, an IT Admin from Corporate X, leverage it?

Amazing technology will stay a niche if Joe can't use it

Existing Vs. Emerging Software

Traditional applications	NVM-aware applications
POSIX	NPM
Legacy storage software	FS-DAX
PM+SSD	PM

Pros:
- Works out of the box
- Multi tier solutions exist

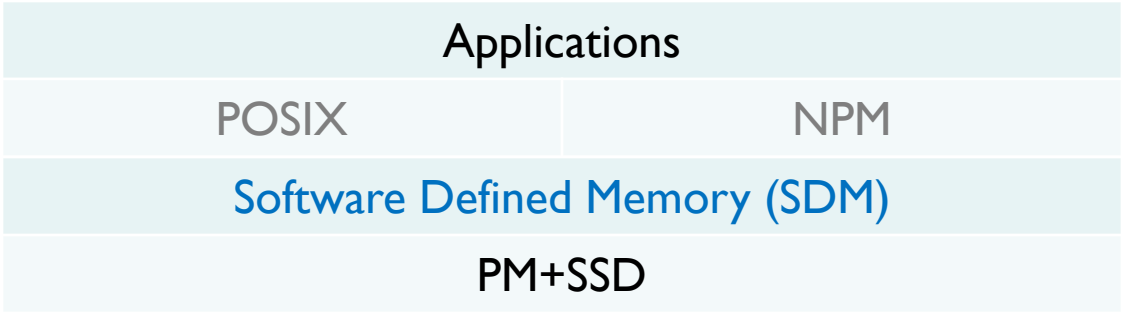
Cons:
- Performance compromise
- Expensive (low HW efficiency)

Pros:
- Very fast
- Byte addressable

Cons:
- Rewrite application & data services
- Expensive (single tier)

New amazing technology – Adds a new level of complexity

Software Defined Memory



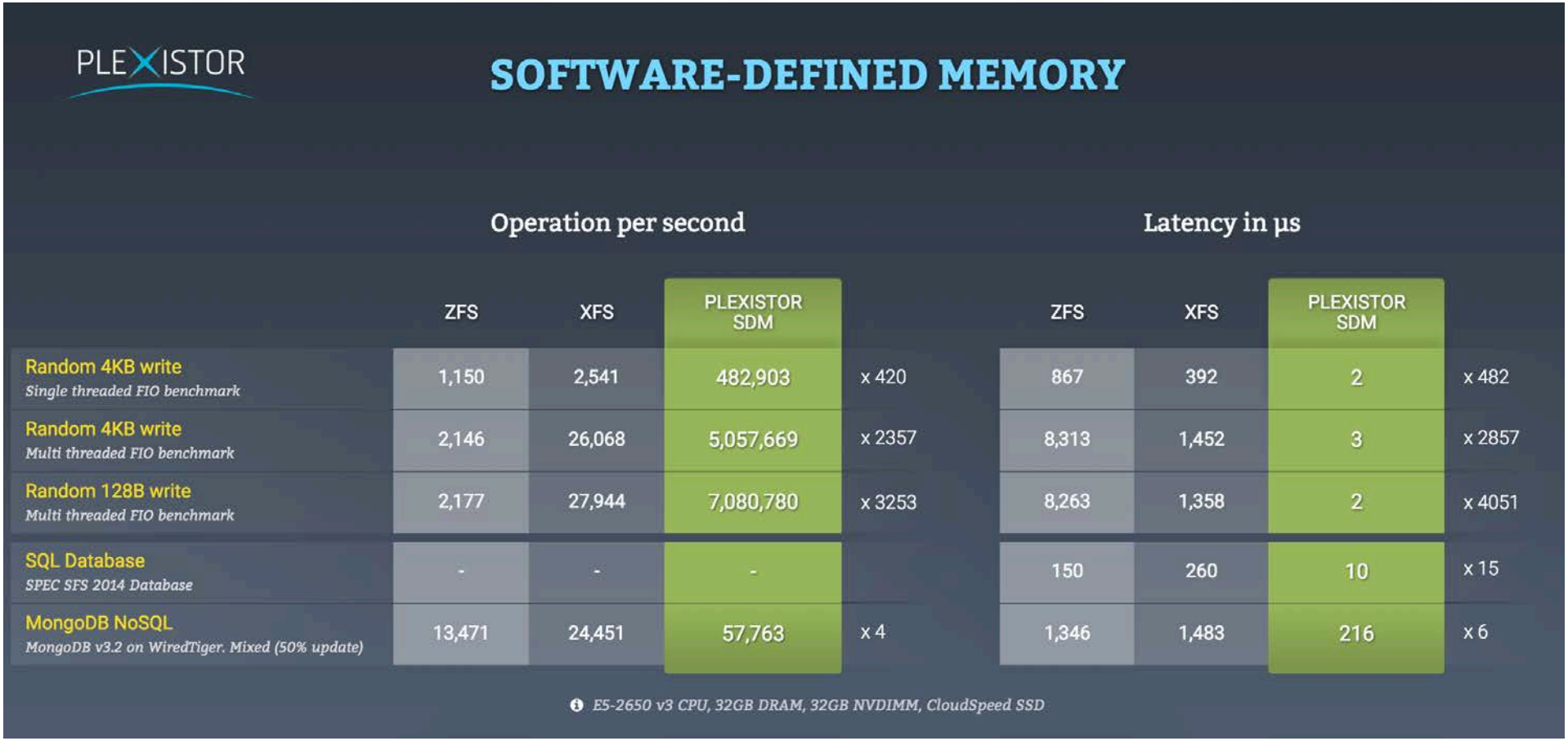
SDM:
A converged memory and storage architecture that enables applications to access storage as if it was memory and memory as if it was storage

Pros:
- Single storage for POSIX and NPM
- Fast, Byte addressable & Highly efficient
- Built-in data services

Cons:
- Requires new kernel versions

New amazing technology & Invisible to Joe √

Plexistor SDM – (POSIX) Performance

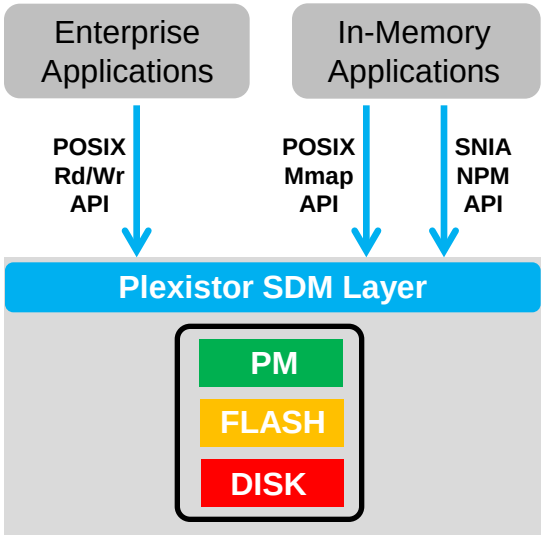


SDM delivers

Plexistor SDM – Main Features

SDM CE v1.7.0:

- Unified for POSIX and NPM
  - Performance for POSIX
  - Capacity for NPM
- Auto-tiering
  - 1st tier: PM / DRAM
  - 2nd tier: SSD / NVMoF / AFA…
- Data migration across platforms
- NUMA optimized



Performance, flexibility and efficiency

Plexistor SDM – Availability

On-Premise deployment

You can download free Community Edition (CE) of Plexistor SDM software to run on any server in two configurations: persistent and ephemeral computing.

In a persistent configuration you will need to purchase NVDIMM from the following list to be used as SDM first storage tier.

An ephemeral computing configuration is very similar to an Amazon instance. SDM will use DRAM as the first storage tier and will NOT maintain persistency in case of a power failure. This configuration is relevant in cases where the application maintain it's own persistent (logging) schedule.

Currently SDM is supported by Linux kernel 4.x and above and tested on Ubuntu and Centos distributions.

RHEL/CentOS 7.1

Download Plexistor SDM install script

Ubuntu 15.10

Download Plexistor SDM install script

Public Cloud deployment

Install free Community Edition (CE) of Plexistor SDM software on Amazon EC2 in minutes. No configuration or set up is required. You can get an EC2 instance with SDM capacity ranging from 64GB to 2.6TB at near-memory speed.

Plexistor SDM can be deployed in any i2 machine,

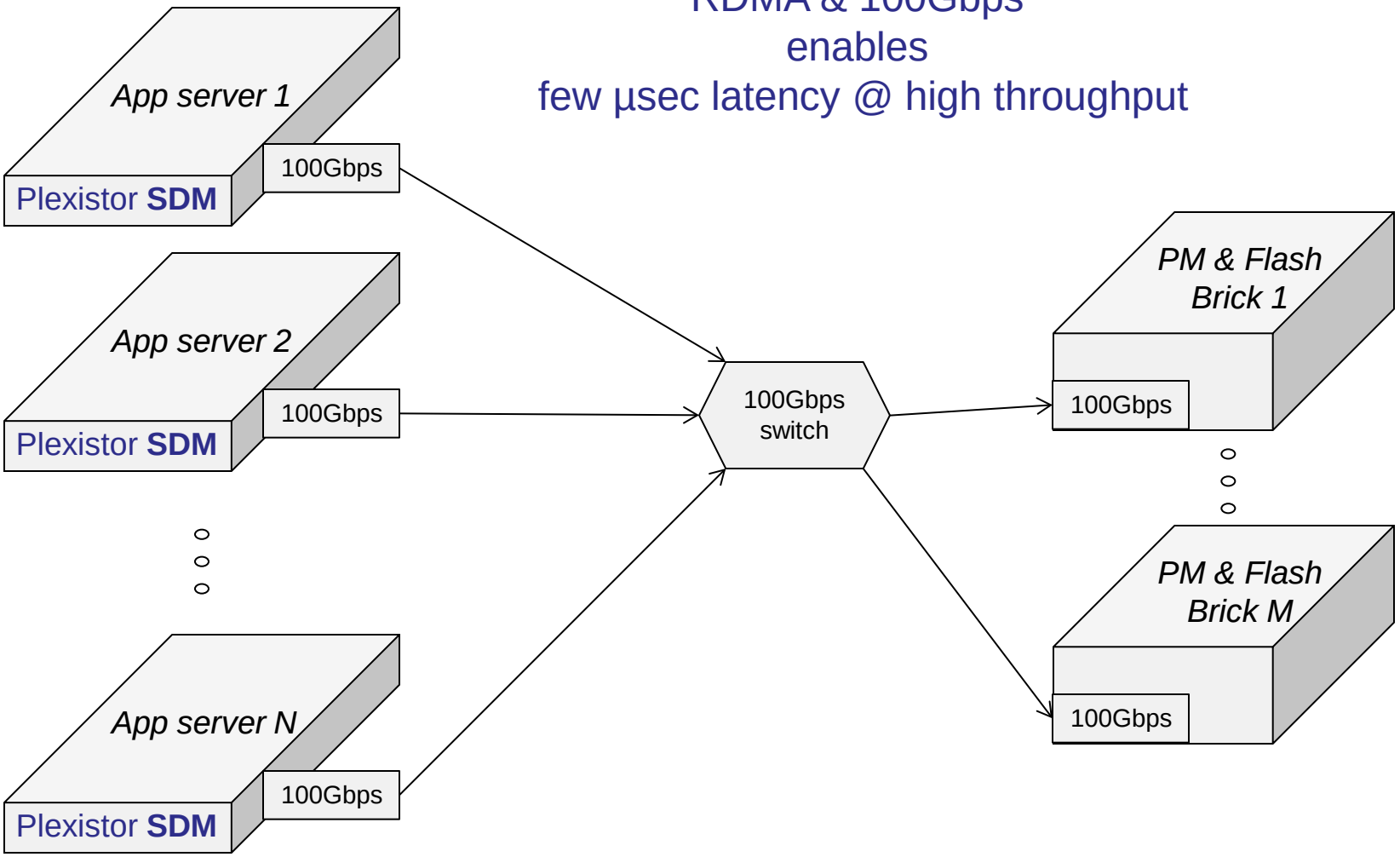
Install Plexistor SDM on Amazon EC2

Install MongoDB with Plexistor SDB on Amazon EC2

Free download available on www.plexistor.com/download/

Plexistor HA Architecture

RDMA & 100Gbps
enables
few µsec latency @ high throughput



Thank You

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Alex Fuxa

Hewlett Packard Enterprise

Persistent Memory R&D Manager

HPE Persistent Memory

Hewlett Packard Enterprise

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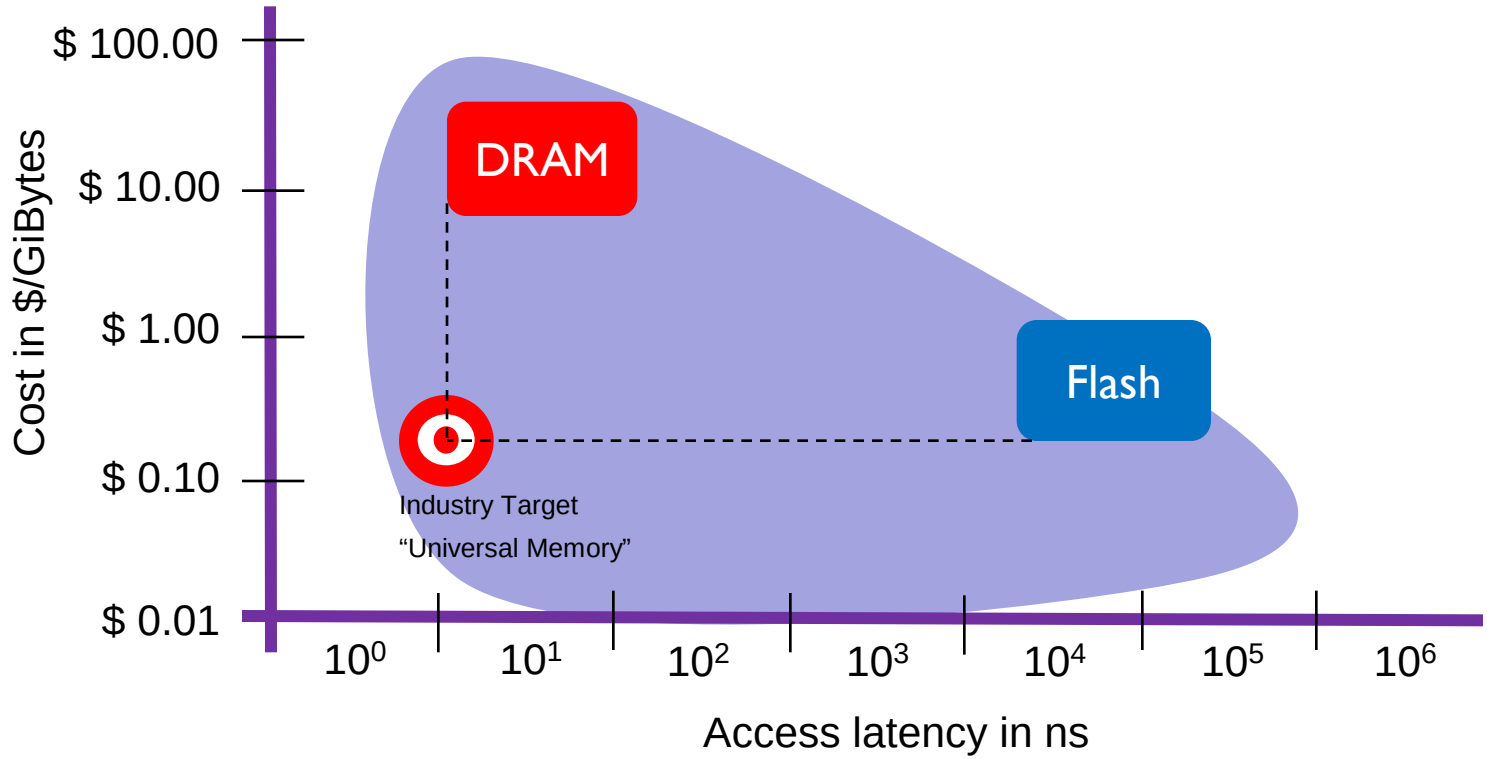
Persistent Memory Mediums

Room for multiple mediums



Evolving the Software

Applications must change

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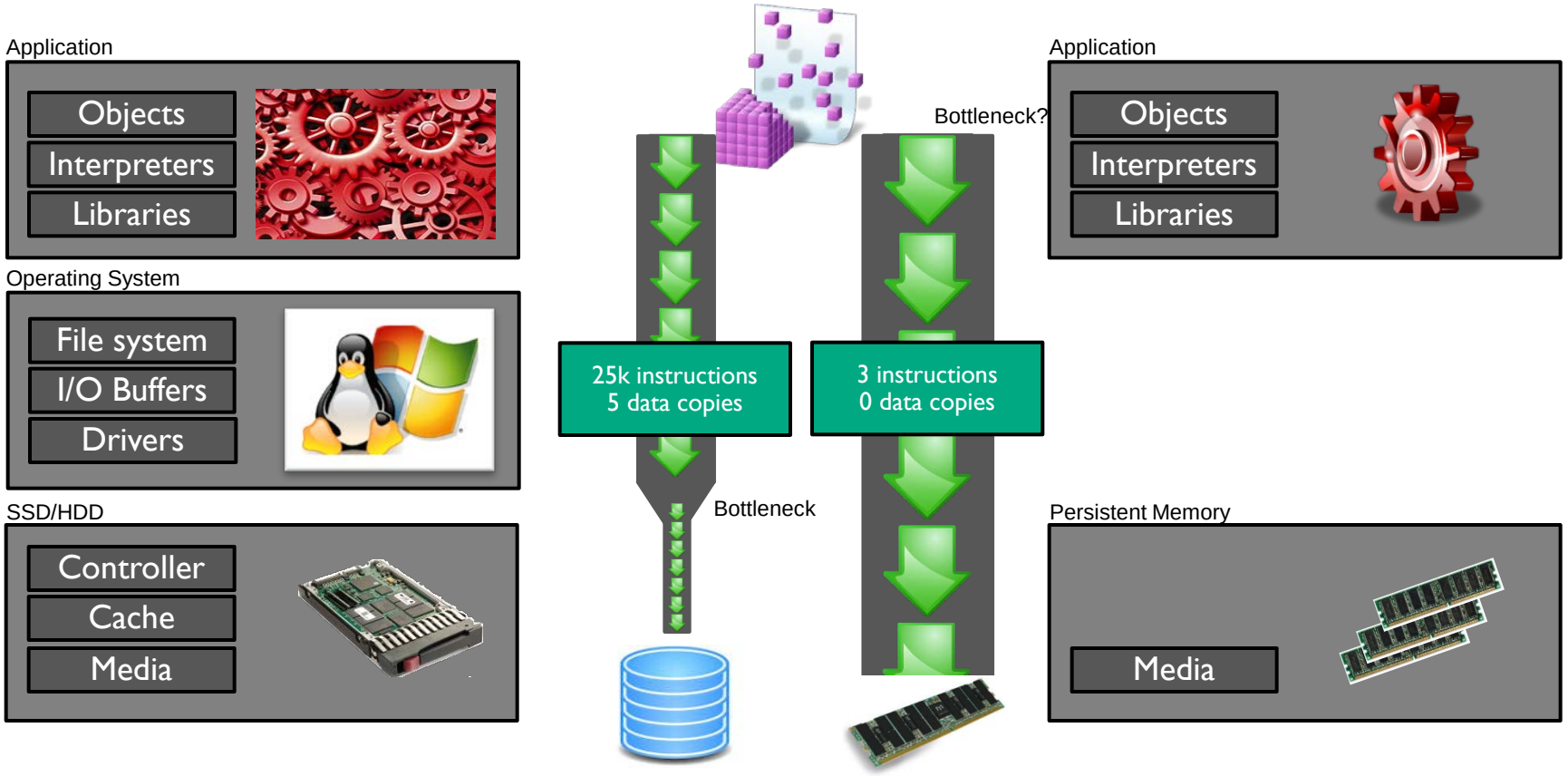

Opportunities for Acceleration

Not every device will impact every software stack

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Relational Database

- MSFT SQL
- MySQL
- Maria DB
- Oracle

Scale-out Storage

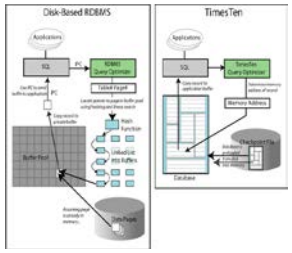
- VSAN
- MSFT Azure
- Store Virtual

Virtual Desktop Infrastructure

- Horizon view
- Citrix HDI
- VMware VDI

Big Data

- Mongo DB
- Cassandra
- Hadoop
- MSFT SQL Hadoop



In Memory Database

- SAP HANA
- MSFT SQL Hekaton
- XAP Gigaspace

Middleware

- Java
- .NET
- SanDisk FDF

Key Takeaways

- No universal memory
- Many mediums and use cases
- Need an open standard for connecting devices
- Latencies force software to fundamentally change
- HPE is innovating through standards like JEDEC 2233.22
- Database-like applications will be early adopters
- HPE is ready to work with you

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Convergence of Storage and Memory Developing the Needed Ecosystem

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Marc T. Schneider

Supermicro

Sr. Product Manager

Supermicro NVDIMM Update

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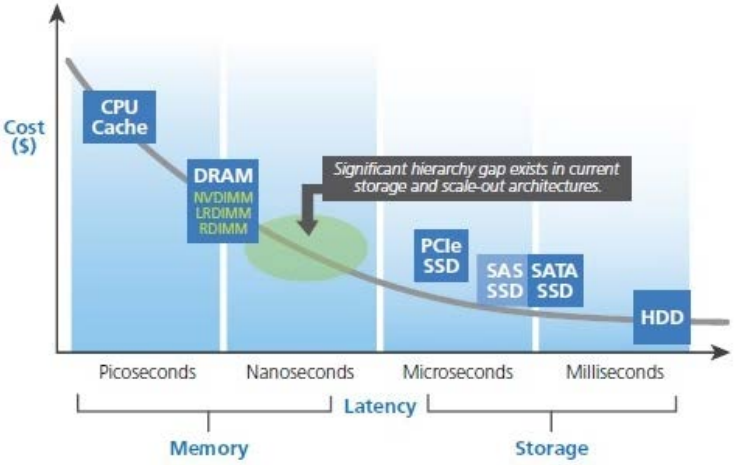
Agenda

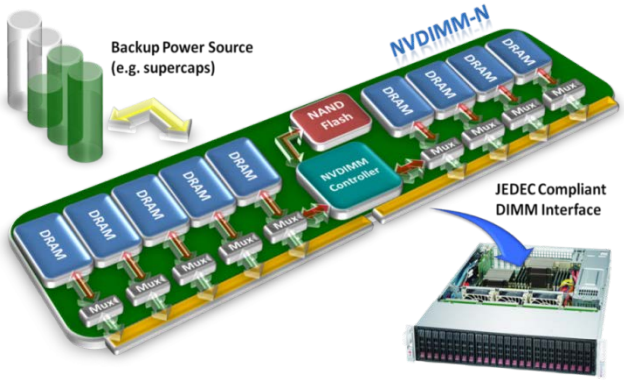
- NVDIMM Advantages
- Development Update
- NVDIMM-enabled Systems
- Next Steps

NVDIMM Advantage

Technology Benefits

- **Higher Performance** – Accelerates business applications by increasing metadata performance
- **Cost-Effective** – Improves TCO compared to batteries or UPS solutions
- **Reliable** – Preserves critical data in the event of a power loss
- **Compatible** – Integrates into x86 server and Storage architectures
- **Eco-Friendly** – Lead Free Supercaps





Typical Applications

- Server RAID Storage, Storage cache tiering, Metadata persistent storage, Data logging, De-duplication, system/application checkpoints

Development Update

What's New

- JEDEC DDR4 Standardization
  - Supercap recharge times have been greatly reduced
  - SAVE_n pin sets a efficient interface to signal a backup
  - EVENT_n asynchronous event notification pin
  - I²C Device Addressing
  - JEDEC defined SPD/Registers to comply with DDR4 RDIMM
  - NVDIMM firmware interface table (NFIT) added in ACPI 6.0
- Supermicro
  - Supermicro continues to lead the industry in NVDIMM adoption on the Intel Xeon™ E5-2600 v3 platform
  - Five vendors supported via Intel MRC with more to come!
  - 20+ X10 DP Motherboards currently enabled
  - 60+ X10 DP Servers now support NVDIMM, including over 20 SuperStorage solutions

NVDIMM-N Enabled Models

X10 Motherboard

Market Segment	X10 Model	Available Configurations
Channel	X10DRC/i-LN4+/T4+, X10DRi(T), X10DRX, X10DRH-C/I(T), X10DRH-C/iLN4	Motherboard, barebones or complete server
Enterprise	X10DRU-i+ (Ultra Series)	Complete server-only
HPC	X10DRT-H/HIBF, X10DRT-P/PT/PIBF, X10DRT-L/LIBQ/LIBF, X10DRT-PS, X10DRFR(N)(T), X10DRFF(-C), X10DRFF(C/TG)	Motherboard or complete server
Data Center	X10DRD-L/I(N)T, X10DRD-LTP/I(N)TP, X10DDW-I(N), X10DRW-I(T), X10DRW-E/N(T)	Motherboard, barebones or complete server
Storage	X10DRS-2U/3U/4U, X10DSC+, X10DSC-TP4S, X10DRH-C/I(T), X10DRH-C/iLN4	Motherboard, barebones or complete server
GPU	X10DRG-Q	Motherboard, barebones or complete server

NVDIMM-N Enabled Models

X10 SuperStorage

SUPERMICRO

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U Height	2U		3U	4U		
Disk qty	2.5" x **24**	3.5" x **12**	3.5" x **16**	3.5" x **24**	3.5" x **36**	3.5" x **72**
Hardware RAID (LSI3108)	 2028R-ACR24H					
		 6028R-E1CR12T				
	 2028R-E1CR24N	 6028R-E1CR12N	 6038R-E1CR16N	 6048R-E1CR24N	 6048R-E1CR36N	
	 2028R-E1CR24H	 6028R-E1CR12H	 6038R-E1CR16H	 6048R-E1CR24H	 6048R-E1CR36H	
IT Mode (LSI3008)	 2028R-ACR24L					
	 2028R-E1CR24L	 6028R-E1CR12L	 6038R-E1CR16L	 6048R-E1CR24L	 6048R-E1CR36L	 6048R-E1CR72L
UP		 5028R-E1CR12L			 5048R-E1CR36L	

Next Steps

Calls to Action

- Hardware
  - Data encryption/decryption with password locking JEDEC standard
  - “Write-back” feature to meet RDIMM performance
  - Standardized set of OEM automation diagnostic tools
  - JEDEC support of NMI trigger method alternative to ADR trigger
  - Improve Supercap performance, size, and cost
- Software
  - O/S recognition of APCI 6.0 (NFIT) to ease end user application development
  - JEDEC standardize NVDIMM C library to speed up the OEM and end user development cycle

Thank You

Questions?