SNIA Seminar 4
Birds-of-a-Feather
Persistent Memory Futures

Flash Memory Summit 2018

Welcome to
SNIA Education Afternoon
at Flash Memory Summit 2018

Agenda

1:00 pm – 1:50 pm	**SNIA Tutorial 1** *A Case for Flash Storage* Dejan Kocic, NetApp
1:50 pm – 2:45 pm	**SNIA Tutorial 2** *What if Programming and Networking Had a Storage Baby Pod?* John Kim, Mellanox Technologies and J Metz, Cisco Systems
2:45 pm – 3:00 pm	**Break**
3:00 pm – 3:50 pm	**SNIA Tutorial 3** *Buffers, Queues, and Caches* John Kim, Mellanox Technologies and J Metz, Cisco Systems
4:00 pm – 5:00 pm	**SNIA Tutorial 4** *Birds-of-a-Feather – Persistent Memory Futures* Jeff Chang, SNIA Persistent Memory and NVDIMM SIG Co-Chair

SNIA. | SOLID STATE
SSSI | STORAGE

170
industry leading
organizations

2,500
active contributing
members

50,000
IT end users & storage
pros worldwide

@SNIA

Join SNIA at These Upcoming Events

Storage Developer Conference 2018

SDC 18

9/24-9/27 Santa Clara, CA

SDC discount registration cards in FMS bags & at **SNIA booth 820**

SNIA **PERSISTENT MEMORY** **PM SUMMIT**

JANUARY 24, 2019 | SANTA CLARA, CA

Complimentary registration now open at **snia.org/pm-summit**

Persistent Memory and NVDIMM SIG Charter

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◆ To accelerate the awareness and adoption of Persistent Memories and NVDIMMs for computing architectures

◆ The Persistent Memory and NVDIMM SIG will:

- Educate on the types, benefits, value, and integration of Persistent Memories
- Communicate usage of the NVM Programming Model developed to simplify system integration of current and future PM technologies
- Influence and collaborate with middleware and application vendors to support Persistent Memories
- Develop user perspective case studies, best practices, and vertical industry requirements
- Coordinate with industry standards groups and promote industry standards related to PM and NVDIMM
- Synchronize and communicate a common Persistent Memory taxonomy

A Brief History of the NVDIMM SIG

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BEFORE SIG

Proprietary Implementations
Different Messaging
No Common Taxonomy
No Ecosystem

WILD WEST

AFTER SIG

Common Specifications
Common Messaging
Common Taxonomy
Ecosystem Development

FUTURE?
- NVDIMM-P
- Emerging PM Tech
- ISV Adoption
- Interop/Test Specs
- Encryption Stds

January 27, 2014
NVDIMM SIG formerly announced

October'13
NVDIMM SIG started as open "incubator" program within SSSI

August 1, 2014
Officially joined SNIA/SSSI

September 12, 2013
NVDIMM Summit Meeting @ IDF
to discuss category mktg plan

SIG Activities/Accomplishments
- Wkly -> Mthly Calls
- Whitepapers/Articles
- Webinars/Tutorials
- Tradeshows/Demos
- Benchmarks
- JEDEC Specs

| < 2013 | 2013 | 2014 | 2015 | 2016 | 2017 |

NVDIMM-N Cookbook

Application

Storage Semantics

Memory Semantics

File System
- Page Cache
- Block-based FS

PM-based FS

DAX-enabled FS

OS
- bio
- Block wrapper

NVDIMM Driver

BIOS

MRC + BIOS
(Memory Ref. Code)

SMB

Server

Memory Controller

Power Supply

DIMM interface
(Inc. SAVE trigger)

NVDIMM

NVDIMM-N

Energy Module

Legend:
- Software
- Hardware

8
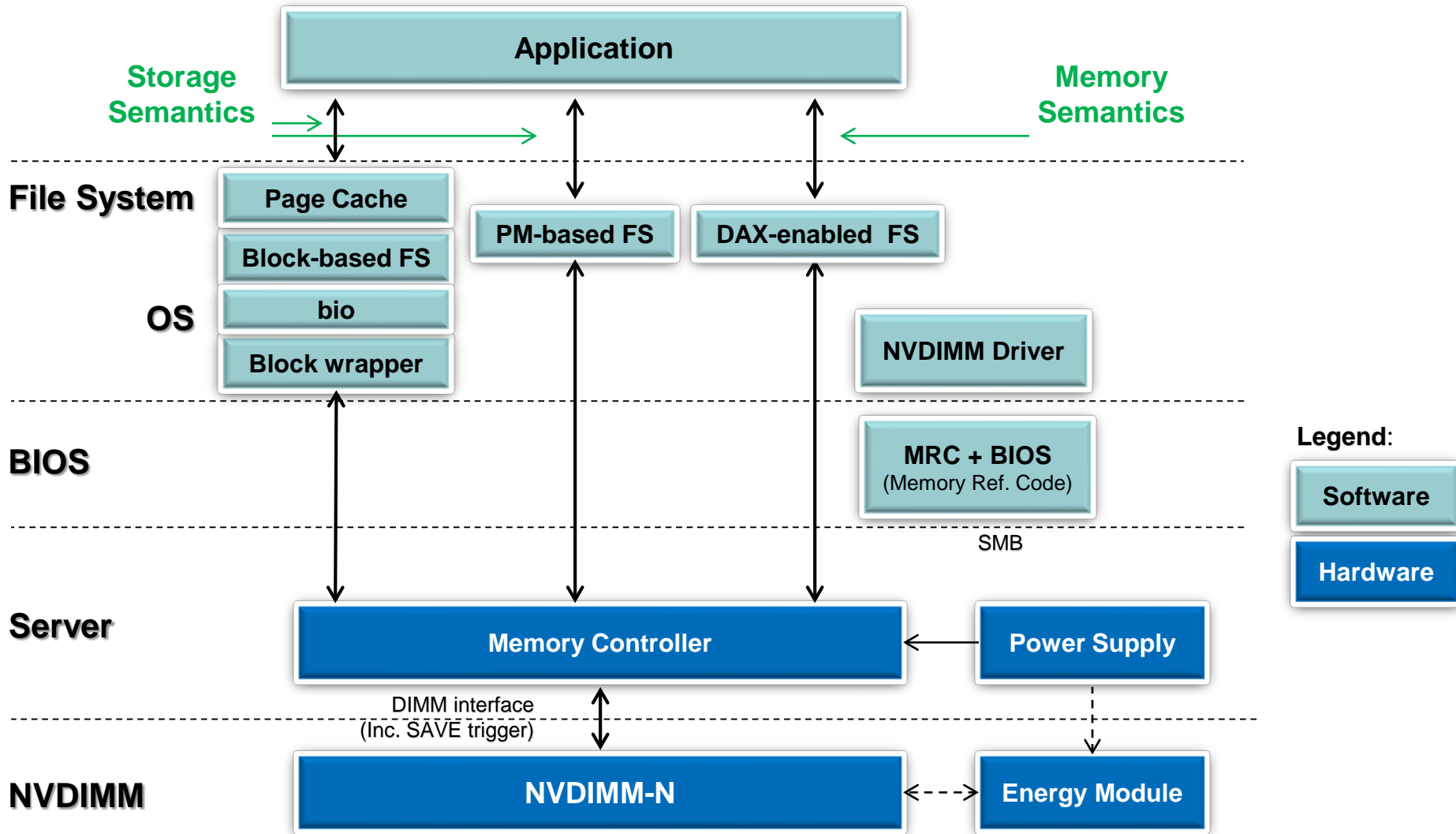
NVDIMM Benchmarks

IOPS RND 4K Writes & Reads: NVDIMM-N v U.2 v SAS

- IOPS RND 4K W
- IOPS RND 4K R

IOPS = I/O Operations Per Second

Device	IOPS RND 4K W	IOPS RND 4K R
SAS 12Gb/s 400GB	96,857	200,494
U.2 x4 NVMe 1.6TB	108,778	596,609
NVDIMM-N 32GB	2,741,262	3,077,639
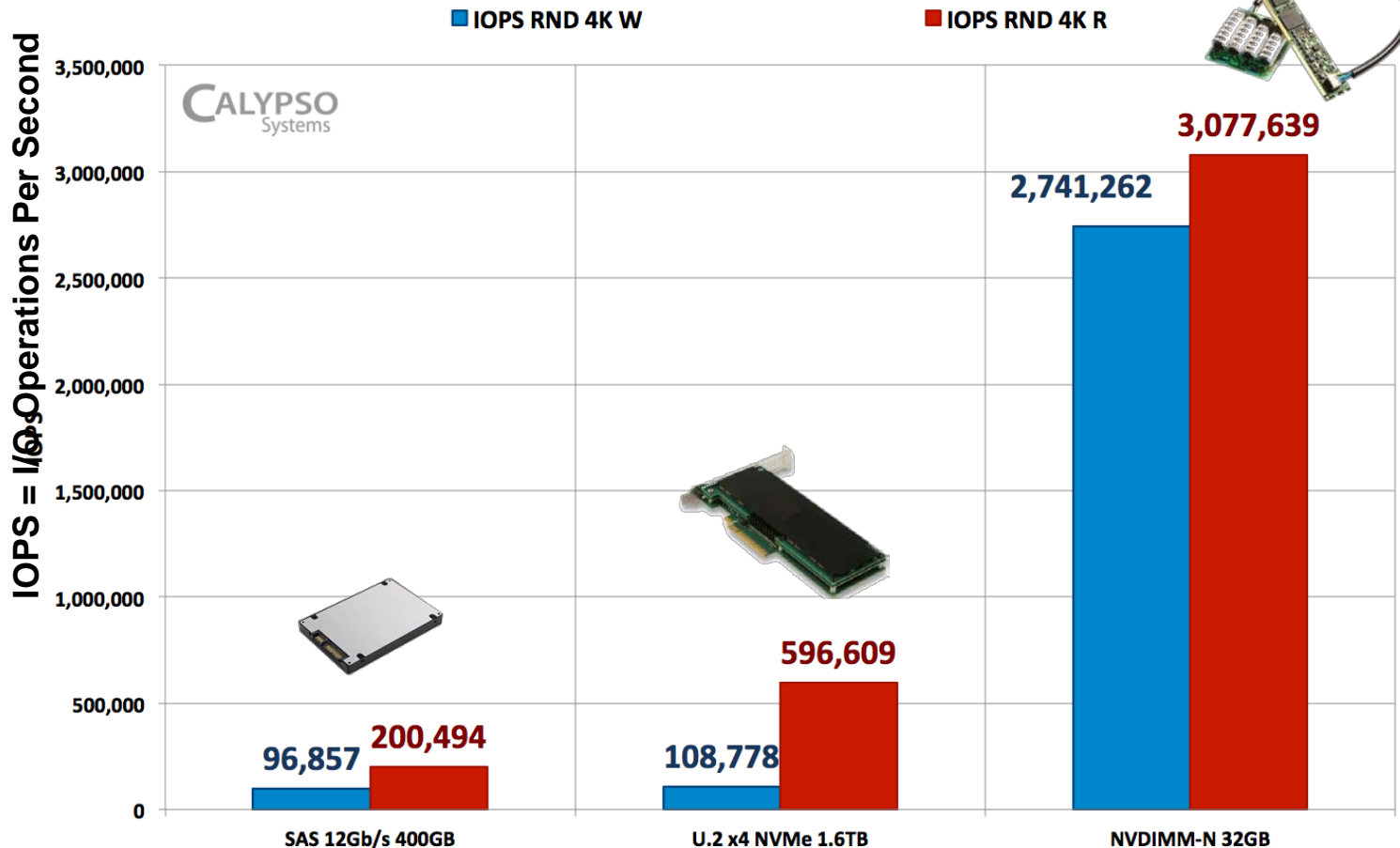
All data taken from PTS-E v1.1 DIRTH Tests using CTS test software. SAS and U.2 SSDs tested on Calypso RTP Intel S2600COE, Dual 2687W 8 core 3.2 Ghz, 32GB DDR3 RAM. Four NVDIMM-N Modules tested on SuperMicro X10DRI, Dual E5 2670V3, 32GB DDR4 RAM with Intel Open Source NVDIMM-N Development Block IO Driver and CTS test Software.

9

JEDEC Specs Now Publicly Available

Persistent Memory and NVDIMM SIG Roster

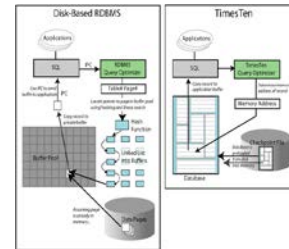## ◆ Help drive PM adoption by:

- ◆ Clearing the path of all obstacles
  - › Promote & coordinate standards for the software interface
  - › Coordinate with JEDEC to ensure that the hardware interface is standardized
    - – This includes protocols for firmware upgrades

- ◆ Promote/Inform the world about PM technology
  - › Host webcasts and tutorials on the use of PM
  - › White papers and other collateral

You're Invited to Contribute!

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◆ SNIA Persistent Memory & NVDIMM SIG is advancing the awareness & adoption of Persistent Memory and NVDIMMs for computing architectures

◆ We're looking for companies and individuals to identify work items and activities including

- Developing user perspective case studies, best practices, and vertical industry requirements
- Synchronizing and communicating a common Persistent Memory taxonomy

Persistent Memory Adds Value Across Diverse Applications

Relational Database	Scale-out Storage	Virtual Desktop Infrastructure	Big Data	In Memory Database	Middleware	HPC
MSFT SQL	Vmware VSAN	Vmware VDI	Mongo DB	SAP HANA	Java	HPC
MySQL		Citrix HDI	Cloudera	MSFT SQL Hekaton	.NET	
Maria DB	MSFT Azure		HortonWorks			
Oracle	Store Virtual		Hadoop	XAP Gigaspace		
			Cassandra			
			MSFT SQL Hadoop			

Log acceleration: write combining and caching	Tiering, caching, write buffering, meta-data storage	Higher VM consolidation	Higher performance	Journaling, Transaction logs	Optimized abstraction	Check point acceleration

What's in it for new members?

❖ Draft off the success of SSSI: recognized as the most successful Initiative within SNIA

❖ Marketing:
  - Vendor neutral and multi-vendor messaging, collateral, webinars and so on
  - "Category Marketing": recognizing a class of technology components with vendor-specific differences minimized, for these specific purposes
  - Seamless integration with the recognized NVDIMM SIG
  - We can engineer a relationship or taxonomy between each set of vendors, to the benefit of each, and more powerful than if we did nothing

❖ Standards
  - Single, recognized voice to standards organizations such as JEDEC
  - Complementary, recognized and appreciated role of a marketing organization and a purpose-built standards organization

Thank You!

Learn more about SNIA's work in Persistent Memory at snia.org/PM