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

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:00 pm – 1:50 pm</td>
<td>SNIA Tutorial 1</td>
<td>A Case for Flash Storage</td>
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<td></td>
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<td>Dejan Kocic, NetApp</td>
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<tr>
<td>1:50 pm – 2:45 pm</td>
<td>SNIA Tutorial 2</td>
<td>What if Programming and Networking Had a Storage Baby Pod?</td>
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<td>John Kim, Mellanox Technologies and J Metz, Cisco Systems</td>
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<td>2:45 pm – 3:00 pm</td>
<td>Break</td>
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<tr>
<td>3:00 pm – 3:50 pm</td>
<td>SNIA Tutorial 3</td>
<td>Buffers, Queues, and Caches</td>
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<td>John Kim, Mellanox Technologies and J Metz, Cisco Systems</td>
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<tr>
<td>4:00 pm – 5:00 pm</td>
<td>SNIA Tutorial 4</td>
<td>Birds-of-a-Feather – Persistent Memory Futures</td>
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<td></td>
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<td>Jeff Chang, SNIA Persistent Memory and NVDIMM SIG Co-Chair</td>
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170 industry leading organizations
2,500 active contributing members
50,000 IT end users & storage pros worldwide
Join SNIA at These Upcoming Events

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

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

BEFORE SIG
Proprietary Implementations
Different Messaging
No Common Taxonomy
No Ecosystem

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

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

AFTER SIG
Common Specifications
Common Messaging
Common Taxonomy
Ecosystem Development

January 27, 2014
NVDIMM SIG formerly announced

August 1, 2014
Officially joined SNIA/SSSI

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

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

< 2013
2013
2014
2015
2016
2017
NVDIMM Benchmarks

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

IOPS = I/O Operations Per Second

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<tr>
<th></th>
<th>IOPS RND 4K W</th>
<th>IOPS RND 4K R</th>
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<tbody>
<tr>
<td>SAS 12Gb/s 400GB</td>
<td>96,857</td>
<td>200,494</td>
</tr>
<tr>
<td>U.2 x4 NVMe 1.6TB</td>
<td>108,778</td>
<td>596,609</td>
</tr>
<tr>
<td>NVDIMM-N 32GB</td>
<td>2,741,262</td>
<td>3,077,639</td>
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</tbody>
</table>

All data taken from PTS-E v1.1 DIRT Test Using CTS test software. SAS and U.2 SSDs tested on Calypso RTP Intel S2600CQ2, 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.
JEDEC Announces Support for Hybrid NVDIMM Modules

TORONTO — JEDEC Solid State Technology Association has approved the first standards for support of hybrid DDR4 memory modules.

The standards work is being done by JEDEC’s JC-45 Committee for Memory Modules, which developed the non-volatile DIMM (NVDIMM) taxonomy in collaboration with Storage Network Industry Association’s NVDIMM Special Interest Group (SIG), a sub-committee of SNIA’s Solid State Storage Initiative.

The new standard defines hybrid DDR4 memory modules as those that plug into standard DIMM sockets and appear like a DDR4 SDRAM to the system controller, yet contain non-volatile memories such as NAND flash on the module. These hybrid module families may share the memory channel with other standard DDR4 DIMMs. Publication of the standard is expected later this year, said Bill Gervasi, co-vice-chair of the JEDEC JC-45 Committee for DRAM Modules, in an interview EE Times.
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!

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

<table>
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<tr>
<th>Relational Database</th>
<th>Scale-out Storage</th>
<th>Virtual Desktop Infrastructure</th>
<th>Big Data</th>
<th>In Memory Database</th>
<th>Middleware</th>
<th>HPC</th>
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<tbody>
<tr>
<td>MSFT SQL</td>
<td>Vmware VSAN</td>
<td>VMware VDI</td>
<td>Mongo DB</td>
<td>SAP HANA</td>
<td>Java</td>
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<tr>
<td>MySQL</td>
<td>MSFT Azure</td>
<td>Citrix HDI</td>
<td>Cloudera</td>
<td>MSFT SQL Hekaton</td>
<td>.NET</td>
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<tr>
<td>Maria DB</td>
<td>Store Virtual</td>
<td></td>
<td>HortonWorks</td>
<td>XAP Gigaspace</td>
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<tr>
<td>Oracle</td>
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<td>Hadoop</td>
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<td>HPC</td>
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- Log acceleration: write combining and caching
- Tiering, caching, write buffering, metadata 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