

SNIA Solid State Storage Initiative







Mission

 Foster the Growth of SSDs in both the Enterprise and Client Markets

Methods

- Educate the Supplier and User Communities about solid state storage
- Promote and influence Standards for solid state storage
- Collaborate with other industry associations for success of solid state storage



NVDIMM – How it Works



NVDIMM combines DRAM and Flash onto a single DIMM

Operates as standard DRAM RDIMM

- Fast, low latency performance.
- Host only addresses the DRAM and has no direct access to the flash (NVDIMM-N classification)
- NVDIMM contains switches to switch control back and forth between host and NVDIMM controller
- NVDIMM controller moves data from DRAM to flash upon power loss or other trigger; can back up portions or all of DRAM upon command
- If power fails, Supercaps (or other power source) provide back up power while DRAM is backed up to Flash
- MRC (Memory Reference Code) configures NVDIMM controller to move data back from Flash to DRAM when recovery is needed
- All the benefits of SSD with none of the performance limitations and best endurance





NVDIMM gaining support from ecosystem

- Intel DDR4 NVDIMM support for Grantley
- Supermicro DDR4 NVDIMM support

JEDEC Hybrid Memory Task Group

- 12V and SAVE_n pins added to DDR4 DIMM socket
- 12V in DDR4 socket will simplify NVDIMM power circuitry and cable routing

SNIA NVDIMM SIG

• Established in 2014 to promote adoption of NVDIMMs





- Providing education on how system vendors can design in NVDIMMs
- Communicating existing industry standards, and areas for vendor differentiation
- Helping technology and solution vendors whose products integrate NVDIMMs to communicate their benefits and value to the greater market
- Developing vendor-agnostic user perspective case studies, best practices, and vertical industry requirements



SNIA NVDIMM SIG Members







JE diablo technologies[™]







💢 Inphi



cron

MONTAGE Technology



















Any type of non-volatile memory including:

- Block Accessible
 - > Disk form factor SSDs (SATA, SCSI, etc.)
 - > NVM PCIe cards (NVMe), SCSI-Express, SATA Express
 - > Vendor-specific
- Byte Accessible
 - > Emerging persistent memory (PM) hardware (e.g., NVDIMMs)

Persistent Memory:

- Future technologies bring memory-like access for NVM devices
- Access time comparable to RAM
- PM Brings Storage to Memory Slots
 - > Option for software to skip copying data from memory to disks
 - > No need for specialized "I/O"

Need for A New Programming Model



Current programming model

- Data records are created in volatile memory
 - > Memory operations
- Copied to HDD or SSD to make them persistent
 - \rightarrow I/O operations

Opportunities provided by NVM devices

- Software to skip the steps that copy data from memory to disks.
- Software can take advantage of the unique capabilities of both persistent memory and flash NVM

Need for a new programming model

 Application writes persistent data directly to NVM which can be treated just like RAM

Need for A New Programming Model



■ NVM Tread ■ NVM xfer ■ Misc SSD ■ Link Xfer ■ Platform + adapter ■ Software

- With Next Generation NVM, the NVM is no longer the bottleneck
 - Need optimized platform storage interconnect
 - Need optimized software storage access methods

Solid State Storage Initiative

Creators of the Specification



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- NVM Programming Technical Work Group is chartered to:
 - Deliver specifications describing the behavior of a common set of software interfaces that provide access to NVM
 - Encourage a common ecosystem for NVM-enabled software without limiting the ability to innovate





The SNIA NVM Programming Model defines new software programming models for NVM

- Describes extensions allowing software to utilize NVM features
- Enables designers to develop APIs that take advantage of NVM features and performance
- Defines software behavior for blockaddressable NVM (SSDs) and byteaddressable NVM (certain NVDIMMs)
- SNIA NVM Programming Model version 1 is available
 - Work on new NVM programming capabilities is ongoing





- Extensions to existing block addressable software stacks
- Provide effective and more uniform use of NVM features
- A new approach for persistent memory devices
- Two primary modes
 - Devices providing block storage behavior
 - > Block access
 - Devices providing memory behavior
 - > Byte access

File and Block Mode Extensions



NVM.BLOCK Mode

- Targeted for file systems and block-aware applications
- Atomic writes
- Length and alignment granularities
- Thin provisioning management

NVM.FILE Mode

- Targeted for file based apps.
- Discovery and use of atomic write features
- Discovery of granularities



Persistent Memory (PM) Modes



NVM.PM.VOLUME Mode

- Software abstraction for persistent memory hardware
- Address ranges
- Thin provisioning management

NVM.PM.FILE Mode

- Application behavior for accessing PM
- Mapping PM files to application address space
- Syncing PM files





Approved by SNIA in December 2013

Expose new features of block and file to applications

- Atomicity capability and granularity
- Thin provisioning management
- Targeted for application and file system developers

Use of memory mapped files for persistent memory

- Existing abstraction that can act as a bridge to higher value from persistent memory
- Limits the scope of re-invention from an application point of view



Programming Model - not an API specification

- NVM Programming Model defines behavior without specifying an API
- Implementations map actions and attributes to API elements
- Facilitates discovery of capabilities using attributes
- Usage illustrated as Use Cases



Additional Solid State Storage Initiative Focus Areas

Workload I/O Capture Program



- WIOCP software collects data which is used to determine the I/O characteristics of various applications
- Understanding the I/O characteristics can help to identify which SSDs perform best under particular user workloads
- No personal data is collected
- WIOCP software runs in the background on a Windows system and does not measurably impact performance
- Participate and be eligible to receive a gift card & win an SSD!





- Provides guidance to the marketplace on PCIe SSDs, which can take the form of educational materials, best practices documents & SNIA standards
- Coordinates with other industry organizations involved in PCIe SSD-related activities



Understanding SSD Performance Project



- Intended to educate users about how to use the SSS PTS to make intelligent decisions about SSD performance
- The webpage contains a summary of SSS PTS performance data from actual enterprise and client SSDs
- Also available:
 - White paper & presentation
 - Webcast & video about the PTS

SNIA PTS SSD Performance Test Comparison				
Products Tested	MLC-A 256 GB	MLC-B 160 GB	SLC-A 100 GB	SLC-B 100 GB
Test Platform Hardware/Software	Calypso RTP 2.0 Intel 5520HC, Intel Xeon 5580 12GB ECC DDR3 RAM, LSI 6GB/s HBA		Calypso CTS 6.5 Cent OS 5.6	
Tests Run	WSAT (FOB)	IOPS (Steady State)	TP (Steady State)	LAT (Steady State)

SSD Features Rating Project



- Project goal is to better understand what users expect from SSDs
- Surveyed a wide spectrum of users
- Survey results available
 - White paper: SSDs What's Important to You?
 - LinkedIn group of same name





- The SSS PTS defines a suite of tests and test methodologies necessary to enable comparative testing of individual SSD performance
- Developed by SSS TWG
- Latest Specifications:
 - PTS Client v1.1
 - PTS Enterprise v1.1





- SSSI recommends a testing service where interested parties may submit their SSD products for testing to the SSS Performance Test Specification
- Testing is conducted by Calypso Systems, a certified SSS PTS testing facility



SSS Standards Explained



A webpage on the SSSI site dedicated to the standards involved in the design and testing of SSDs



SSD Form Factors Webpage









- SSSI Blogroll List of blogs that are dedicated to, or at least occasionally mention SSDs
- SSS Glossary SSD technology and test terminology







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