



SNIA’s Solid State Storage Initiative Advances the Industry at Flash Memory Summit.

A classic case of SNIA Solid State Storage Initiative (SSSI) member collaboration for industry advancement was on display in the SSSI booth for NVDIMM-N demonstration at the Flash Memory Summit (FMS) 2015. Under the direction of SSSI Chair Jim Ryan and coordinated by NVDIMM SIG co chairs Arthur Sainio and Jeff Chang and TechDev Committee chair Eden Kim, the SSSI was able to update and include NVDIMM-N storage performance in the SSSI marketing collaterals on the Summary Performance Comparison by Storage Class charts.

2015 - Summary Performance Comparison by Storage Class										
Storage Class			IOPS FOB T4Q32	IOPS Steady State PTS-C T2Q16; PTS-E T4Q32; NVDIMM T128Q4				Bandwidth T1Q32; NVDIMM T32Q1		Response Time T1Q1
Category	Device Type	Capacity	RND 4KiB 100% W	RND 4KiB 100% W	RND 4KiB 65.35 RW	RND 4KiB 100% R	SEQ 128KiB 100% W	SEQ 128KiB 100% R	RND 4KiB 100% W Ave	RND 4KiB 100% W Max
HDD & SSHD - PTS-C v1.2										
1	SSHD	7,200 RPM 2.5" SATA Hybrid	500 GB	3,398	77	62	113	79 MB/s	76 MB/s	12.55 mSec
2	SAS HDD	15,000 RPM 2.5" SAS HDD	146 GB	652	133	248	514	147 MB/s	174 MB/s	2.24 mSec
CLIENT SSDs - PTS-C v1.2										
3	mSATA	mSATA 1.8" MLC	250 GB	63,127	5,927	13,545	79,423	300 MB/s	526 MB/s	0.13 mSec
4	M.2 x4 AHCI	M.2 x4 Gen 3 2280 MLC	128 GB	77,757	6,307	17,041	172,881	623 MB/s	1,895 MB/s	0.16 mSec
5	SATA	SATA6Gb/s 2.5" MLC	400 GB	52,723	34,406	50,646	61,178	428 MB/s	475 MB/s	0.082 mSec
ENTERPRISE SSDs - PTS-E v1.1										
6	SATA	SATA 12Gb/s 2.5" eMLC	800 GB	63,185	38,478	46,911	83,648	430 MB/s	507 MB/s	0.05 mSec
7	M.2 x4 NVMe	M.2 x4 Gen3 2280 eMLC WCE	256 GB	29,210	12,155	31,695	248,929	1,100 MB/s	2,158 MB/s	0.09 mSec
8	SAS	SAS 12Gb/s 2.5" eMLC	400 GB	149,731	97,167	133,738	187,262	651 MB/s	1,051 MB/s	0.072 mSec
9	U.2 NVMe	SFF 8639 4 lane 2.5" MLC	1600 GB	470,122	113,260	238,143	585,884	1,286 MB/s	2,232 MB/s	0.032 mSec
10	PCIe x8 AHCI	PCIe 8 Lane Edge Card MLC	1400 GB	160,164	83,021	234,205	750,846	614 MB/s	2,903 MB/s	0.014 mSec
NVDIMM-N - PTS-E v1.1										
11	NVDIMM-N x4	Memory Channel DDR4 x4 Modules	32 GB	2,384,692	2,792,176	2,789,921	3,002,085	35,453 MB/s	55,111 MB/s	0.0022 mSec

All measurements (rows 1-10) taken by Calypso on the RTP/CTS pursuant to SNIA PTS-E v1.1 / PTS-C v1.2.
IOPS Thread and Queue settings are T2Q16 for HDD/SSHD & Client SSDs, T4Q32 for Enterprise SSDs and T128Q4 for NVDIMM-N.
NVDIMM-N data taken on SuperMicro X10DR, dual E5 2670V3 8 core cpus, 16GB DRAM using Intel Open Source block IO driver.

Five SSSI member companies – AgiA Tech, Calypso, Micron, SMART Modular, and Viking Technology – collaborated over a four week period on the introduction of a new NVDIMM-N storage performance demonstration. While it is rare to have potential competitors collaborate in such a fashion, NVDIMM-N storage represents a new paradigm for super fast, low latency, high IO/watt storage solutions. The NVDIMM-SIG has taken a leadership position by evangelizing the technology and developing the industry infrastructure necessary for large scale deployment.

This collaboration highlighted a classic blend of technical, marketing and industry association cooperation.

In the weeks leading up to FMS, the NVDIMM-SIG planned for an in-booth demonstration of the NVDIMM-N storage modules. To pave the way for universal adoption, the team worked together to dial in the Intel Open Source block IO development driver to meet the standards of the SNIA Performance Test Specification (PTS). An added goal was inclusion of NVDIMM-N modules as a new line item on the Summary Performance Comparison by Storage Class chart which lists PTS performance for various storage technologies. Under the guidance of NVDIMM-SIG, a rush project was instigated to get NVDIMM-N performance data tested to the PTS for the trade show.

Micron took the lead by lending a Supermicro server with Micron NVDIMM-N to Calypso for testing. Calypso then installed CTS test software on the server to allow full testing to the PTS. Viking and SMART Modular contributed by helping dial in the drivers, as well as sending modules from Viking and SMART Modular to cross reference with the Micron modules. The test plan was comprised of several test iterations using single, dual and finally quad modules using each of the vendor contributed modules.

The early single and dual module tests ran into repeatability and stability issues. NVDIMM-SIG consulted with Intel on the nuance of the Intel block IO driver while Calypso continued testing. The team successfully completed a test run that met the PTS steady state requirements on the quad module in time to release data for the show.

We had a solid demonstration at the SNIA SSSI Flash Memory Summit Booth on NVDIMM-N Performance complete with marketing collateral available for review and a handout. NVDIMM-SIG members responded to the many questions and interest in the NVDIMM-N storage technology.

“Once again,” said SSSI Chair Jim Ryan, “we can see the value and benefit of SNIA SSSI to its members, the SNIA educational community and the NVDIMM industry. I believe this is a great case study in how we all can contribute and benefit from working within the SSSI for the betterment of individual companies, market development and the Solid State Storage industry at large.” SSSI provides educational and marketing materials free of charge on its public website while SNIA SSSI members may join the NVDIMM-SIG and other SSSI committees. Anyone interested to find out more about the SSSI or any of its many committees can go to the following link <http://www.snia.org/sssi>.

All Meetings.

- **General Members** call every other Wednesday at 8:30AM PT
- **PCIe SSD Committee** meets 2nd Monday of each month at 4PM PT
- **Marketing Committee** meets the 2nd & 4th Monday of each month at 2PM PT
- **NVDIMM Special Interest Group** meets every other Friday at 9AM PT
- **Solid State Storage TWG** meets 3rd Monday of each month at 4PM PT
- **Solid State Storage System TWG** meets weekly on Tuesday 10AM PT
- **NVM Programming TWG** meets weekly on Wednesday at 12:00PM PT

For WebEx/dial-in information go to <https://snia.webex.com>



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