

NVMe Unleashing Performance and Storage System Innovation

Mainstream enterprise storage vendors are embracing NVMe. [HPE](#), [NetApp](#), [Pure Storage](#), [Dell EMC](#), [Kaminario](#) and [Tegile](#) all offer all-NVMe arrays. According to these vendors, the products will soon support storage class memory as well. NVMe protocol access to flash memory SSDs is a big deal. Support for storage class memory may become an even bigger deal.

NVMe Flash Delivers More Performance Than SAS



Using the NVMe protocol to talk to SSDs in a storage system increases the efficiency and effective performance capacity of each processor and of the overall storage system. The slimmed down NVMe protocol stack reduces processing overhead compared to legacy SCSI-based protocols. This yields lower storage latency and more IOPS per processor. This is a good thing.

NVMe also delivers more bandwidth per SSD. Most NVMe SSDs connect via four (4) PCIe channels. This yields up to 4 GB/s bandwidth, an increase of more than 50% compared to the 2.4 GB/s maximum of a dual-ported SAS SSD. Since many all-flash arrays can saturate the path to the SSDs, this NVMe advantage translates directly to an increase in overall performance.

The newest generation of all-flash arrays combine these NVMe benefits with a new generation of Intel processors to deliver more performance in less space. It is this combination that, for example, enables [HPE](#) to claim that its new Nimble Storage arrays offer twice the scalability of the prior generation of arrays. This is a very good thing.

The early entrants into the NVMe array marketplace charged a substantial premium for NVMe performance. As NVMe goes mainstream, the price gap between NVMe SSDs and SAS SSDs is rapidly narrowing. With many vendors now offering NVMe arrays, competition should soon eliminate the price premium. Indeed, Pure Storage [claims](#) to have done so already.

Storage Class Memory is Non-Volatile Memory

Non-volatile memory (NVM) refers to memory that retains data even when power is removed. The term applies to many technologies that have been widely used for decades. These include EPROM, ROM, NAND flash (the type of NVM commonly used in SSDs and memory cards). NVM also refers to newer or less widely used technologies including 3D XPoint, ReRAM, MRAM and STT-RAM.

Because NVM properly refers to a such wide range of technologies, many people are using the term Storage Class Memory (SCM) to refer to emerging byte-addressable non-volatile memory technologies that may soon be used in enterprise storage systems. These SCM technologies include 3D XPoint, ReRAM, MRAM and STT-RAM. SCM offers several advantages compared to NAND flash:

- Much lower latency
- Much higher write endurance
- Byte-addressable (like DRAM memory)

Storage Class Memory Enables Storage System Innovation

Byte-addressable non-volatile memory on NVMe/PCIe opens up a wonderful set of opportunities to system architects. Initially, storage class memory will generally be used as an expanded cache or as the highest performing tier of persistent

storage. Thus it will complement rather than replace NAND flash memory in most storage systems. For example, HPE has [announced](#) it will use Intel Optane (3D XPoint) as an extension of DRAM cache. Their tests of HPE 3PAR 3D Cache produced a 50% reduction in latency and an 80% increase in IOPS.

Some of the innovative uses of SCM will probably never be mainstream, but will make sense for a specific set of use cases where microseconds can mean millions of dollars. For example, E8 Storage uses 100% Intel Optane SCM in its [E8-X24](#) centralized NVMe appliance to deliver extreme performance.

Remain Calm, Look for Short Term Wins, Anticipate Major Changes

We humans have a tendency to overestimate short term and underestimate long term impacts. In a recent [blog article](#) we asserted that NVMe is an exciting and needed breakthrough, but that differences persist between what NVMe promises for all-flash array and hyperconverged solutions and what they can deliver in 2018. Nevertheless, IT professionals should look for real application and requirements-based opportunities for NVMe, even in the short term.

Longer term, the emergence of NVMe and storage class memory are steps on the path to a new data centric architecture. As we have previously [suggested](#), enterprise technologists should plan technology refreshes through 2020 around NVMe and NVMe-oF. Beyond 2020, enterprise technologists should plan their technology refreshes around a composable data centric architecture.