

NVMe: Four Key Trends Set to Drive Its Adoption in 2019 and Beyond

Storage vendors hype NVMe for good reason. It enables all-flash arrays (AFAs) to fully deliver on flash's performance characteristics. Already NVMe serves as an interconnect between AFA controllers and their back end solid state drives (SSDs) to help these AFAs unlock more of the performance that flash offers. However, the real performance benefits that NVMe can deliver will be unlocked as a result of four key trends set to converge in the 2019/2020 time period. Combined, these will open the doors for many more companies to experience the full breadth of performance benefits that NVMe provides for a much wider swath of applications running in their environment.

Many individuals have heard about the performance benefits of NVMe. Using it, companies can reduce latency with response times measured in few hundred microseconds or less. Further, applications can leverage the many more channels that NVMe has to offer to drive throughput to hundreds of GBs per second and achieve millions of IOPs. These types of performance characteristics have many companies eagerly anticipating NVMe's widespread availability.



To

date, however, few companies have experienced the full breadth of performance characteristics that NVMe offers. This stems from:

- The lack of AFAs on the market that fully support NVMe (about 20%).
- The relatively small performance improvements that NVMe offers over existing SAS-attached solid-state drives (SSDs); and,
- The high level of difficulty and cost associated with deploying NVMe in existing data centers.

This is poised to change in the next 12-24 months with four key trends poised to converge that will open up NVMe to a much wider audience.

1. **Large storage vendors getting ready to enter the NVMe market.** AFA providers such as Tegile (Western Digital), iXsystems, Huawei, Lenovo, and others ship products that support NVMe. These vendors represent the leading edge of where NVMe innovation has occurred. However, their share of the storage market remains relatively small compared to providers such as Dell EMC, HPE, IBM, and NetApp. As these large storage providers enter the market with AFAs that support NVMe, expect market acceptance and adoption of NVMe to take off.

2. ***The availability of native NVMe drivers on all major operating systems.*** The only two major enterprise operating systems that have currently native NVMe drivers for their OSes are [Linux](#) and [VMware](#). However, until [Microsoft](#) and, to a lesser degree, [Solaris](#), offer native NVMe drives, many companies will have to hold off on deploying NVMe in their environments. The good news is that all these major OS providers are actively working on NVMe drivers. Further, expect that the availability of these drivers will closely coincide with the availability of NVMe AFAs from the major storage providers and the release of the NVMe-oF TCP standard.
3. ***NVMe-oF TCP protocol standard set to be finalized yet in 2018.*** Connecting the AFA controller to its backend SSDs via NVMe is only one half – and much easier part – of solving the performance problem. The much larger and more difficult problem is easily connecting hosts to AFAs over existing storage networks as it is currently difficult to setup and scale NVMe-oF. The establishment of the NVMe-oF TCP standard will remedy this and facilitate the introduction and use of NVMe-oF between hosts and AFAs using TCP/IP over existing Ethernet storage networks.
4. ***The general availability of NVMe-oF TCP offload cards.*** To realize the full performance benefits of NVMe-oF using TCP, companies are advised to use NVMe-oF TCP offload cards. Using standard Ethernet cards with no offload engine, companies will still see high throughput but very high CPU utilization (up to 50 percent.) Using the forthcoming NVMe-oF TCP offload cards, performance increases by anywhere from 33 to 150 percent versus native TCP cards while only introducing nominal amounts of latency (single to double digit microseconds.)

The business need for NVMe technology is real. While today's all-flash arrays have tremendously accelerated application performance, NVMe stands poised to unleash another round of up

to 10x or more performance improvements. But to do that, a mix of technologies, standards, and programming changes to existing operating systems must converge for mass adoption in enterprises to occur. This combination of events seems poised to happen in the next 12-24 months.