

Now is the time to transition to PCIe/NVMe Storage



Taking advantage of the Best Performing SSD Storage

- » Do your workloads require the fastest storage for optimal performance?
- » Are you looking for the best performing, lowest latency SSD storage?

Optimizing each workload is a challenge for the data center. To meet this challenge, Intel's PCIe/NVMe SSD solutions provide the lowest latency of all data center solid-state storage solutions.

NVMe and PCIe in the Data Center

The enterprise market for server storage has seen a revolution. Server's DRAM has increased in density and solid-state disks (SSD) have cost effectively provided lower latency and significantly faster access to data in the data center.

While volatile DRAM is a server's best performing storage, it is expensive. Affordable SSD storage attached via the PCIe bus using the NVMe logical protocol, with its direct access to the CPU, high bandwidth, and low latency, provides servers with the best performing non-volatile storage.

Why NVMe/PCIe over SAS

NVMe/PCIe offers the best storage bandwidth and lowest latency for SSD storage, in part because the PCIe connection offers direct lanes to the server's Intel CPU that allows for advanced data coordination. In addition, since the NVMe protocol was designed scratch for SSDs, it is optimized for the non-mechanical SSD storage. NVMe replaces older technology designed to address the needs of traditional mechanical disk drives – at times purposely adding latency to 'wait' for the mechanical operations of the drive to complete – making them inefficient for the newest SSD storage solutions.

What are the advantages of PCIe/NVMe over the SAS interface for SSDs in the data center?

- » NVMe provides lower latency and increased efficiency: lower CPU utilization, lower power, lower TCO
- » Allows applications to 'talk' directly to SSD storage via the PCIe bus
- » Increased bandwidth: 1 GB/s per lane with up to 16 lanes per drive
- » Directly attached to the CPU, eliminates HBA cost and overhead

Highlights

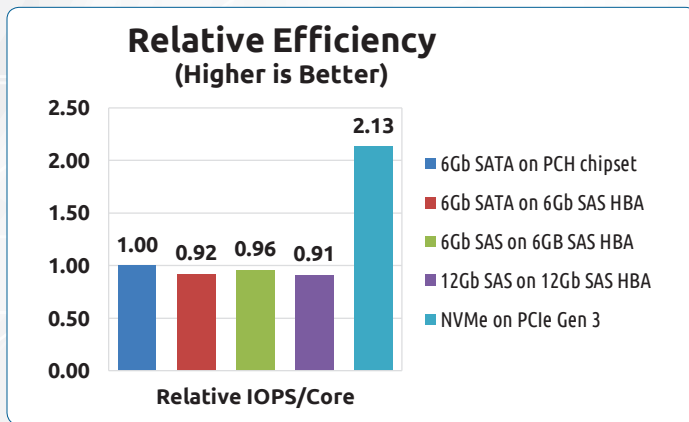
- » **Best Performing Server SSD Storage**
- » **PCIe Provides Direct Path to Intel CPU to Increase Performance**
- » **NVMe is Designed for SSD Storage to Optimize Efficiency**

- » PCIe used for scalable performance, flexible form factors and industry stability
- » Low power features from both PCIe and NVMe—typically less than 2W idle and less than 9W maximum
- » Designed to scale beyond current standards
- » Reinvents storage stack—moves latency to software
- » Replaces legacy interfaces (SATA or SAS) designed for spinning disks

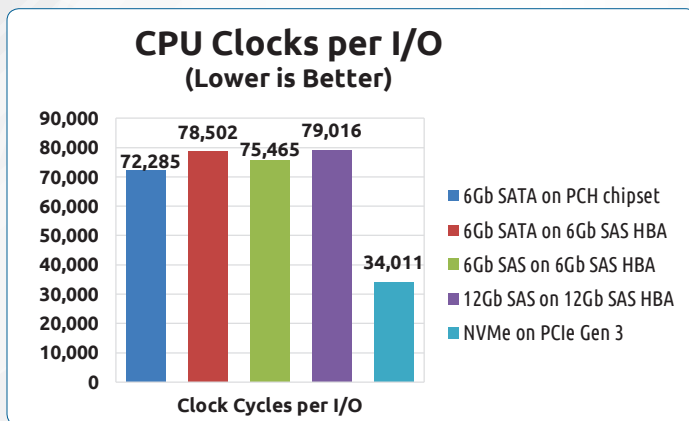
NVMe has streamlined and simplified the command set providing two major benefits.

The first, shown in this chart, is that NVMe provides higher IOPS per instruction cycle and lower I/O latency in the host software stack. Relative efficiency is determined by the interface that provides the most IPOS per CPU core. NVMe on PCIe leads the pack by providing more than 2x of those provided by either their SATA or SAS counterparts.

The second major benefit is NVMe/PCIe uses less than half the number of CPU instructions to process an I/O request when compared to SAS or SATA.



In this chart, CPU Clock Cycles per I/O is shown. NVMe on PCIe uses less CPU resources by about 50% when compared to SAS and SATA.



Best Workloads for PCIe/NVMe Storage

PCIe/NVMe storage is the fastest, lowest latency access to data available to servers. This makes it ideal for any data-heavy, low-latency content when the increased responsiveness and performance is required.

PCIe/NVMe storage is commonly used to accelerate active I/O either by using it as a cache or as a tier of storage. These are the most popular uses of PCIe/NVMe SSD storage. Using a combination of tiered storage type's increases performance over a solution made up entirely with 'slower' SATA or SAS

SDDs or traditional HDDS for most applications. It also reduces the storage investment over purchasing an entire storage solution made up entirely of the 'fastest' and more expensive PCIe/NVMe storage.

Online Transaction Processing (OLTP) and Online Analytical Processing (OLAP) applications take advantage of fast storage performance and make good candidates for the PCIe/NVMe SSD storage. In fact, PCIe/NVMe storage may offer the performance need for those looking to invest in in-memory solutions such as SAP HANA or IBM's DB2 in memory database – at a substantially reduced cost.

OLTP applications handle many short transitions in quick, random bursts, making these solutions well suited to the boost PCIe/NVMe SSDs can provide. Typical applications include:

- » Analytics
- » Content delivery (streaming media, video on demand)
- » Critical infrastructure applications
- » Database query acceleration
- » Financial and Ledgers
- » Gaming
- » Video Surveillance
- » Real-time billing
- » Real-time monitoring
- » Trading

OLAP applications handle bigger chunks of data, typically received from multiple sources. They require quick response to complex queries is necessary - making them prime candidates to benefit from the performance PCIe/NVMe storage offers. OLAP application workloads include:

- » Business intelligence
- » HPC workloads
- » Batch processing
- » Data warehousing and report generation
- » ERP systems
- » High transaction processing
- » Massive data feeds and reporting

Leveraging SSD Technology

Enterprise storage has undergone a dramatic performance boost with SSD storage. SAS and SATA SSDs use old technology designed for spinning hard drives to connect to the server. The NVMe industry standard, developed specifically for SSD storage, eliminates the inefficiencies of older technology and the PCIe bus interfaces directly with the CPU. This makes PCIe/NVMe SSD storage the fastest SSD storage possible for a server.