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Four reasons NVMe is right for business

Businesses can now access an unprecedented amount of data to help drive insights and improve decision-making. A top priority for data-driven organizations is efficiently storing data, making it easier (and faster) to access and understand, and using it to develop better business decisions.

It's not just the largest companies or those with the most complex data centers that are investing in storage technology innovation to make the best use of these resources. Modernizing legacy IT has also become a critical and savvy move for medium and smaller business. That's why Micron® solid state drives (SSDs) with NVM Express™ (NVMe™) make good business sense. Micron NVMe SSDs, offered in industry-leading storage densities, provide strong security and performance at a compelling value for businesses of all sizes. With Micron's approach, SSDs are optimized for key workloads and applications.

SSDs have proven to be fast and power-efficient options for data centers and client devices, becoming a mainstay of business-critical storage for multiple applications, workloads, and use cases. However, when the first SSDs were offered, they used legacy protocols designed decades ago when hard disk drives (HDDs) dominated the field. These protocols didn't fully take advantage of NAND flash storage's inherently faster performance and lower latency, which result from the significantly more parallel pathways for data flow between the host and flash media (i.e., parallelism).

That changed in 2011 when the NVMe protocol was built to exploit the fast PCI Express (PCIe®) bus connecting SSDs to the host. Since then, NVMe has become the preferred way to connect SSDs to servers via multiple form factors (like U.3, M.2, and EDSFF). When your customer's organization asks for better performance from real-time applications and for more storage flexibility, NVMe SSD storage should be the first step. Here are four good reasons.

Designed for next-generation data centers, enterprises, and workforces

NVMe optimizes many of today's highly data-driven workloads and applications, such as:

- Online transaction processing (OLTP)

- VDI and virtualization

- Public and private cloud storage

- Artificial intelligence (AI), machine learning (ML) and deep learning (DL)

- Video editing, entertainment and streaming services

- Training and caching

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1 Overcome the limitations of legacy storage

Businesses and consumers alike expect near-instant application response times. When SSDs were first introduced into data center workloads, they added speed and stability. The legacy protocols at the time (SAS and SATA) eased SSD adoption by enabling installation directly into existing servers (using the same storage device slots that were used to connect mechanical HDDs).

While servers already had fast PCIe bus connections (typically used for network cards or RAID controllers), this connection wasn't widely used for SSDs until the NVMe protocol was invented. PCIe with NVMe was designed to mesh the high-speed, parallel nature of flash (i.e. many queues supporting thousands of commands each) into the high-speed, parallel PCIe bus.

Sequential writes for NVMe storage vs. SATA storage

NVMe delivers

2x

more MB/s per watt
than SATA[1]

For road warriors with data-intensive workloads, NVMe SSDs launching 1GB Photoshop PSD files[2] can be:

up to

24x

faster than SATA SSDs

nearly

92x

faster than HDDs

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Comparison of protocols for flash storage

Max performance	NVMe	SATA	SAS
I/O queues (messaging)	65,535	1	2 (1 per port)
Outstanding commands	64,000 per queue	32 per queue	256 per queue (128 per port)
Time to reach un-cached data	Short	Long	Long
Latency	<10µ – 225µs	<1ms – 100ms	<100µ – 100ms

Table 1: High parallelism in NVMe supersedes previous protocols

The NVMe protocol was a storage revelation. Designed from the ground up for a PCIe interconnect (high performance, high parallelism, and low latency), it enabled the host to prioritize I/O requests. To this end, NVMe combines a streamlined command set with a flexible command queueing architecture that is superior to SATA or SAS (see Table 1 for a comparison taken from TechTarget). Because NVMe reduces I/O overhead and enables optimized command processing, reducing latency and significantly improving performance.

Plus, NVMe SSD capacity continues to expand. The Micron 6550 ION NVMe SSDs reaches capacities of 61.44TB (unformatted). The sharing standard called NVM Express over Fabric (NVMe-oF™) provides a way to connect and aggregate remote NVMe devices over a high-bandwidth network and create centrally managed, shared pools with little cost to latency or speed. For organizations that require large pools of NVMe storage, this is simpler to set up and operate than physically installing all NVMe SSDs directly into servers without sharing.

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Accelerate your workloads

NVMe delivers the sequential reads of SATA. Many of the new drivers for explosive data growth require fast, high-capacity storage. Data-intensive applications like artificial intelligence (AI), machine learning (ML), and 5G infrastructure are latency-sensitive and make high-throughput storage critical. Again, NVMe delivers. The Micron 9550 NVMe SSD consistently reads up to 14GB/s of sequential data (see Figure 1) and offers up to 3.3 million IOPS for random data[3].

The growth trend of PCIe is expected to continue, with the transfer rate for four lanes of I/O generally doubling the bandwidth and transfer rate of the previous version of each new release in the PCIe bus (see Figure 2). To access the benefits of the speed increases, optimize your infrastructure now with Micron's easy-to-deploy purpose-built storage.

Sequential read (MB/s)

14000

540

SATA SSD   NVMe SSD

Figure 1: Sequential reads Micron 9550 NVMe SSD vs. Micron 5300 SATA SSD[2].

Transfer rate (GB/s) for 4 lanes

32

16

8

4

1   2

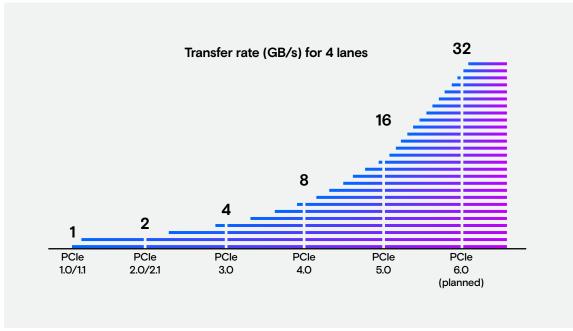| PCIe 1.0/1.1 | PCIe 2.0/2.1 | PCIe 3.0 | PCIe 4.0 | PCIe 5.0 | PCIe 6.0 (planned) |

Figure 2: Growth of maximum PCIe transfer rates (actual and predicted)
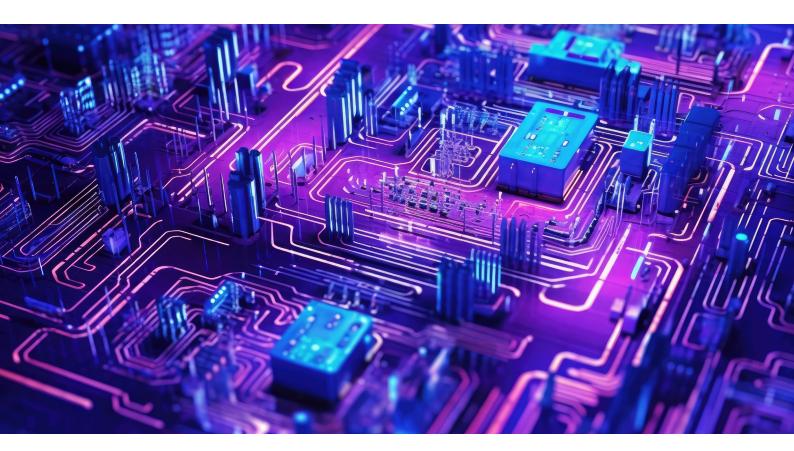*Source PCIe 6.0 spec announced | TechSpot*

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Get power efficiency and data security

Yesterday's data center infrastructure, with its sprawling racks and huge, growing numbers of bulking HDD-based servers, is being replaced by a smaller footprint with more efficient hardware. With higher density NVMe SSDS, organizations can store more data in fewer servers, helping tame data center complexity. NVMe SSDs can also improve power efficiency over the mechanical design of HDDs[4].

With Micron's high-capacity 30.72TB 6500 ION SSD you have a solution that makes it possible to reduce storage footprints by packing much higher storage densities into each server while also reducing power consumption. This reduces the number of racks, significantly lowering your infrastructure costs, which is a cornerstone of long-term sustainability. The 6500 also reduces power consumption, delivering up to 57% better power efficiency than the competition[5].

NVMe SSDs are also at the leading edge of security[6] with hardware-driven performance. At Micron, our enterprise SSDs can include support for TCG Opal 2.01 and TCG Pyrite 2.01 as well as hardware write protect. The one-time programmable (OTP) flash blocks programmed at the Micron factory help prevent accidental or purposeful attacks and loss of data.
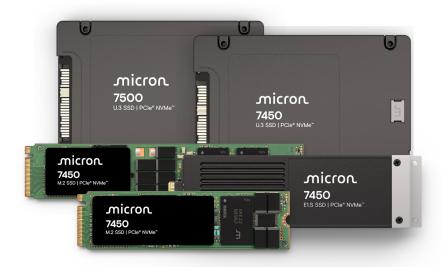
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Improve performance now and position business for the future

Various benefits are now available to savvy system builders at NVMe. At the top of the list? It's a great way to futureproof IT. Upgrading servers simply to catch up with the competition is counterproductive. Instead, the forward-thinking performance of NVMe helps position organizations for what is soon to come in data center evolution.

Another evolution from legacy storage is the flexibility that NVMe helps provide. This enables organizations to balance their evolving capacity, power, and thermal needs for next-gen data centers. The Micron 7000-Series is a perfect example, offering the world's broadest portfolio of PCIe Gen4 NVMe SSDs for data center infrastructure. The mainstream Micron 7000-Series SSD form factors support standard server storage (U.3 – with full U.2 interoperability), cloud and 1U server platforms (performance and density focused, using the E1.S form factor) and even system boot (with a power-loss-protection enabled M.2 SSD).

As workload diversity grows and data sets become even more complex, extreme capacity, real-time performance, and the ability to process entire data sets are already helping data center managers find positive ROI quickly for fast storage investment. Choosing NVMe now also positions organizations to take advantage of the benefits of NVMe 2.0, which is focused on gaining extra throughput for compute-intensive workloads such as AI and ML.

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Investigate our NVMe-based storage

Micron Technology serves the global memory and storage market with two distinct and complementary brands: Micron for enterprise, cloud, and data center applications, and Crucial for home, office, and gaming systems. Micron's Commercial Products Group offers the industry leading B2B solutions to mid-sized and smaller organizations that IT giants depend on. Crucial NVMe SSDs for the client/consumer market can unlock the performance of laptops and workstations to deliver quicker load times and faster data transfers.

Upgrade your system with NVMe storage solutions that are optimized from the storage core to the application level (see Table 2). When data security is critical, reinforce your system with SEDs that deliver some of the strongest data storage security6 available — without compromising performance or affordability. Learn which Micron storage solutions are right for you and your customers.

Table 2: Microns NVMe SSDs

Legend: ● Best fit ◐ Good fit ○ Other options are ideal

SSD series/model	Form factor	Capacity (TB)	Caching	AI/ML/DL	Streaming CDN	Primary storage	Analytics	Digital workflow	Boot
9550 Series MAX	U.2 / 15mm	3.20 to 25.60	●	●	○	◐	○	○	○
9550 Series PRO	U.2 / 15mm	3.84 to 30.72	◐	◐	●	●	◐	○	○
7500 Series MAX	U.3 / 15 mm	0.96 to 12.80	●	●	○	◐	○	○	○
7500 Series PRO	U.3 / 15 mm	0.8 to 15.36	◐	◐	●	●	●	●	◐
7450 Series MAX	U.3 / 7 mm	0.96 to 7.68	●	●	○	◐	○	○	○
7450 Series PRO	U.3 / 7 mm	0.8 to 6.4	◐	◐	●	●	●	●	◐
7450 Series MAX	E1.S	0.96 to 3.84	●	○	○	◐	○	○	○
7450 Series PRO	E1.S	0.80 to 3.2	◐	◐	●	○	●	○	◐
7450 Series MAX	M.2 / 2280	0.48 to 3.84	●	○	○	◐	○	○	◐
7450 Series PRO	M.2 / 2280	0.40 to 3.2	○	○	●	◐	○	●	●
7450 Series MAX	M.2 / 22110	0.48 to 3.84	●	○	○	◐	○	○	◐
7450 Series PRO	M.2 / 22110	0.40 to 3.2	○	○	●	◐	○	●	●
6550 ION	U.2 / 15mm	30.72 to 61.44	○	●	●	○	○	○	○

MAX – Highest performance
PRO – High performance
ION – Best capacity per $

● Best fit ◐ Good fit ○ Other options are ideal

Tiering storage while SSDs and HDDs approach price parity?

HDDs allow high capacity at a budget, but can't deliver the performance needed for 5G, AI and other cutting-edge, data-intensive applications. Analysts like Wikibon predict that the investments in flash fabs and hybrid flash/tape technologies will complete the takeover of HDD by the end of the 2020s. What can you do for your most price-sensitive customers now to prepare them to join the data economy? Hybrid HDD and SSD data infrastructure, or NVMe SSDs paired with SATA SSDs, can help. When SSDs were first introduced, their higher prices and smaller capacities vs. hard drives tended to limit their use to specialized, high-performance workloads with smaller datasets. As the switch to flash progresses, high-capacity SSDs like the 61.44TB 6550 ION SSD help bridge the gap between HDDs and HDDs with high-density storage.
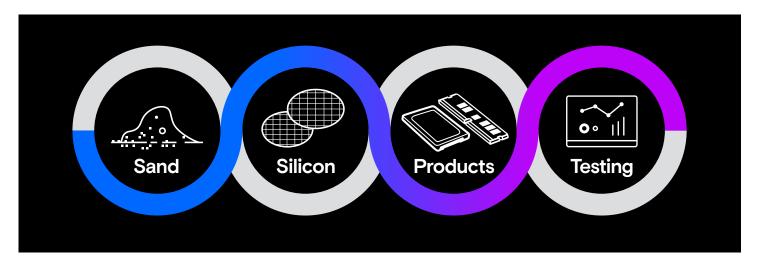
In addition, cache-tier NVMe SSDs like the mainstream 7500 and high-performance 9550 can deliver high speed, low latency, and endurance by bringing data closer to the processor. They minimize latency and provide consistently fast throughput. Even a few low-latency NVMe SSDs in the cache tier with high-capacity SATA   SSDs in the capacity tier can help optimize performance for virtualized data centers, including a variety of platform deployments.

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Why Micron? We're built different

Decision makers for storage can leverage our in-house expertise and vertically integrated storage manufacturing. From sand to NAND, every phase of Micron development stays in-house — from design to manufacturing to testing — to help mitigate a volatile market. We infuse purpose into everything we touch — from our people to our products to our partners. We are built different for your business to thrive in the tech forward world.

Sand | Silicon | Products | Testing

For more info: Sign up on our Business Partner Portal at microncpg.com or contact your Micron salesperson.

The Micron difference

Customer support | Web support and 1:1 assistance from an experienced sales network

45 years of excellence | Micron's world-class leadership in innovative memory and storage solutions

Consistent inventory | Consistent supply from a trusted, experienced manufacturer

Quality assurance | Committed to both quality and innovation

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