Advantages of Micron SSDs for Data Centers

Executive Summary

Most businesses depend on a core data center infrastructure to be successful. A highly functioning data center has several requirements, including high performance, availability, scalability, and manageability. Having a storage solution that is built specifically for data center needs is key to meeting these requirements. High-performance storage can improve functionality by leaps and bounds.

Micron’s broad portfolio of solid state drives (SSDs) provides the right storage solutions to meet the diverse requirements of today’s data centers and data centers of the future.

Data Center Infrastructure

A data center infrastructure is the platform that runs information technology (IT) applications and, in turn, applications that facilitate and enable the productive activities of an enterprise. Who today can get along without email and Internet access? It’s the same for a business but more so—with applications for managing transactions, accounting, supply chains, human resources, sales, and marketing and their associated databases, such as SQL Server, MySQL, and Oracle. These applications empower staff productivity and enterprise success. Like transportation needs roads and cuisine needs a kitchen, applications need data center infrastructure. It’s the engine of the modern enterprise.

Data center infrastructure includes servers, storage systems, purpose-built appliances, and networking equipment. Servers are computational workhorses powered by microprocessors and memory, and storage systems persistently store and protect data. Purpose-built appliances—like firewalls or data archivers—handle singular jobs, while networking equipment connects all of the devices together, enabling them to communicate with each other and the outside world.

Data Center Requirements

CIOs and IT administrators have a fairly common, consistent set of requirements when designing or extending a data center. While priorities may vary between deployments, all of the attributes discussed below are key to a high-performance, highly available data center infrastructure.

Performance

Performance fundamentally measures how much work can be done per unit of time. Application performance depends on the response time and throughput of the underlying server, network, and storage infrastructure. System performance is only as fast as the slowest component—be it the processor, memory, network, or storage array. Therefore, it is important to have a balanced system with high-performance components.
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FIGURE 2: It's important to consider all aspects of a storage solution to achieve the optimum balance of cost and performance.

Availability
Computer systems only perform work when they are online, and when business production relies on these systems, high availability is a critical requirement. Availability depends on “the three Rs of resilience”:

1. Redundant systems (e.g., server clustering, dual-pathing, RAID)
2. Replication of data (e.g., backup, point-in-time copies, remote mirroring)
3. Reliable components that are designed and tested for durability and low-field failure rates

Component reliability and durability is the first line of defense for highly available systems; redundant systems and data replication are backstops in case components and/or systems fail.

Scalability
The demands placed on a data center infrastructure only expand and intensify with time. Greater I/O throughput, network bandwidth, storage capacity, and fast response times are needed. The scalability of a system depends on its architecture, how much it can expand in a scale-up or scale-out configuration, and the aggregate capacity of its components. At the most basic level, higher-capacity components enable a more scalable infrastructure.

Manageability
Manageability is the amount of time and complexity required to configure, manage, and maintain a system in good working order. Ease of management not only improves quality of life for IT administrators, but it makes them more productive, frees up their time for more strategic tasks, saves training and maintenance costs, and minimizes administrative errors that can potentially cause downtime or data loss. Manageability occurs at three levels:

1. Infrastructure (e.g., data center automation, IT service management)
2. Systems (e.g., managing an individual platform)
3. Component

Note: Smart components that are self-managing and/or expose more information to consoles improve system-to-system manageability.

Cost Effectiveness
Cost effectiveness—or total cost of ownership (TCO)—reflects both acquisition costs and long-term operating costs. Acquisition costs are made up of the cost of the system’s parts plus the cost of integration. Operating costs include management overhead, replacements, power, cooling, and floor space. Less costly devices and components reduce acquisition costs while manageability, durability, incremental scalability, energy efficiency, and density in a compact profile reduce operating costs.

Power Efficiency and Density
Data center floor space and power are premium commodities. Data centers may fill up or become power-constrained, and the option of building out more space or power capacity may not be practical or affordable. Devices and components designed with greater density and power efficiency help address these constraints.
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Micron SSDs for Data Center Infrastructure

Micron designs and manufactures a family of enterprise-class SSDs for data center infrastructure needs. From SATA and SAS hard disk drive (HDD) replacements to ultra low-latency PCIe Flash storage solutions, we deliver performance, capacity, durability, and power advantages for the data center. Our enterprise SSD solutions are suitable for server storage and caching, appliances, network-based caching, and mid- to large-scale storage systems—and as tier-one primary storage or cache behind DRAM memory in enterprise storage arrays.

By using solid state media instead of physically spinning disks, SSDs deliver random I/O performance that is orders of magnitude faster than HDDs—at a lower cost per IOPS. While magnetic disks and flash media wear out with use, the SSD lifespan is far more predictable. Micron’s SSDs use sophisticated techniques to manage media and can even track and report how much life is left in a drive at any point. Superior performance, better performance-to-power characteristics, predictable lifespan, standard form factors, and design/technology maturity have secured the SSD’s place in the modern, high-performance data center.

FIGURE 3: Micron’s SSDs deliver superior throughput and latency to accelerate storage applications throughout the enterprise.
Micron SSD Advantages for the Data Center

As a world leader in NAND flash media design and development and a developer of custom SSD controllers and firmware, Micron brings tight integration and deep insight to the entire SSD design and manufacturing process—from flash media design, fabrication, and testing, to writing firmware for the SSD controller and assembling and qualifying the finished device. This vertical integration enables far more stringent quality control and deeper, more functional integration between the media and the drive. The result is truly high-performance, highly reliable enterprise-class SSDs.

Micron has also developed a suite of proprietary SSD architecture enhancements called eXtended Performance and Enhanced Reliability Technology (XPERT). XPERT enables enterprise-level reliability, endurance, and performance with superior data protection. This palette of powerful enhancements enables Micron’s design and engineering teams to build enterprise SSDs that support the widest variety of data center workloads.

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Micron’s engineering and manufacturing expertise offers numerous real-world advantages for forever-growing data centers looking to SSDs as a way to keep pace with constant data growth and user productivity.

**Performance Advantage**

The XPERT feature, adaptive read management/optimized read (ARM/OR), dynamically tunes read settings for optimized performance and reliability as the NAND wears and optimal READ settings change over time. Reduced command access latency (ReCAL) substantially reduces write latency by managing background operations, like garbage collection, more efficiently and nondisruptively.

Unlike some SSD manufacturers that rely heavily on host CPU cycles to execute storage I/Os, Micron PCIe Flash storage solutions manage I/Os on the card, in the hardware. Our approach minimizes host CPU overhead and provides consistently low latency. It eliminates dependency on host-specific configurations and frees up CPU cycles to run applications and more virtual machines rather than managing storage I/O.

These performance capabilities contribute to faster storage response times and I/O throughput, which ultimately results in more productive applications.

**Availability Advantage**

Taking advantage of in-house NAND fabrication, Micron’s engineers specify media customizations—like additional testing and custom features—based on SSD design. For example, media precycling virtually eliminates the early-life failure phase of flash media and enhances drive durability and reliability. The XPERT feature, redundant array of independent NAND (RAIN), uses real-time parity protection, similar to RAID 5, to protect data from media failure. DataSAFE embeds memory protection ECC (MPECC) and the logical block address (LBA) as metadata with sector data to
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ensure integrity as this information travels from the host, through the drive’s internal data, to the media path, and back.

Micron offers SATA, SAS, and PCIe SSDs that are hot-swappable and can be replaced or upgraded without downtime or system reboot. The SAS dual-port interface offers the high availability and accessibility needed for applications that require uninterrupted, 24/7 data access. Several Micron enterprise drives guarantee 10 drive fills per day for 5 years to ensure reliable operation over a long lifetime.

This combination of features ensures drive reliability and durability, which data centers rely on for application uptime.

Scalability Advantage
Micron offers high-capacity SSDs with dense packaging. Our P420m PCIe half-height, half-length (HHHL) form factor delivers up to 1.4TB of high-performance storage in a single device. The M500DC SATA SSD provides up to 800GB in a 2.5-inch form factor that is just 7mm high, helping to enable state-of-the-art platforms like EchoStreams’ FlacheSAN2, which can bundle 48 of Micron’s M500DC drives for up to 38.4TB in a 2U chassis.

Power and Density Advantage
Micron PCIe SSDs deliver excellent IOPS per watt and the HHHL form factor is ideal for dense deployments with small footprints.

Manageability Advantage
Because Micron writes the specification for the NAND Flash components inside our SSDs; fabricates, qualifies, and validates the components; and writes every line of firmware and validates each finished SSD, we understand and deliver manageability on a granular level. Several of our SSDs utilize the self-monitoring, analysis, and reporting technology (SMART) feature set that monitors and tracks critical performance metrics and wear parameters. These attributes can be used for storage management and alerting. For example, the percentage of lifetime remaining attribute indicates how much of a drive’s rated life is left based on drive use. This number is calculated using different formulas to ensure that an accurate figure is reported, which enables administrators to be confident that they have conservative, reliable information and makes it easier for them to prepare for scheduled replacements.

Cost Advantage
Most SSD vendors don’t design and manufacture NAND flash memory for their own drives; they have to buy memory components on the open market, which is subject to swings in component pricing and availability, along with the added margins of middlemen. Because Micron designs and manufactures our own NAND Flash, we have the advantage of a stable, direct supply and are able to consistently offer competitively priced SSDs.

Conclusion
Micron’s vertical integration as a NAND flash fabricator and SSD developer, combined with a broad offering of technology features, helps our enterprise SSD portfolio deliver:

» Faster application response times and higher I/O throughput
» Higher staff productivity
» Faster time to market with new products and services
» More satisfied customers
» Higher revenues and lower costs

Micron’s SSDs do more than meet data center requirements—they enable enterprise success. Learn more at micron.com/enterprisestorage.