

Advantages Micron SSDs Bring to Data Centers

Executive Summary

Most businesses depend on a core data center infrastructure for daily operations. The heart of a successful data center has several requirements; including, high performance, high availability for immediate access to mission-critical assets, and scalability and manageability to handle forecasted demand, growth or unforeseen spikes in activity. Having storage solutions built specifically for the data center is essential to meeting these requirements. High-performance storage is a great place to start as it can rapidly improve overall functionality.

[Micron's broad portfolio of SSDs](#) provides the right storage solutions to meet the diverse requirements of today's data centers and those of the future.

Data Center Infrastructure

A data center infrastructure is a combination of platforms that run information technology (IT) applications. These applications are central to user productivity and success. E-mail and internet access have become essential parts of our personal, social and economic worlds, and access for a business is viewed similarly but with orders of magnitude more importance.

Applications for managing communications, transactions, accounting, supply chains, human resources, sales, marketing, and their associated databases (such as SQL, NoSQL, MySQL and Oracle) are integral to data center operations. Just as transportation needs well-constructed roads, applications need a high-performance, stable, reliable data center infrastructure. Infrastructure is the engine of enterprise.

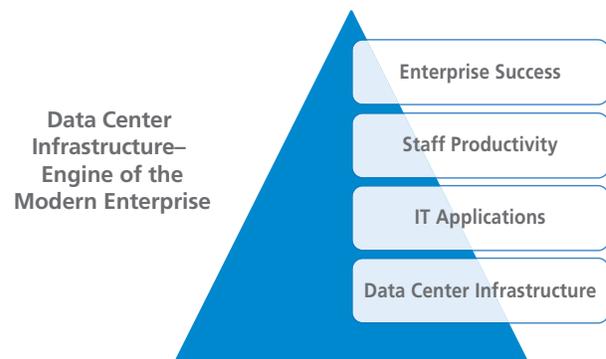


FIGURE 1: The modern data center is the foundation for business agility and success.

Data center infrastructure includes servers, storage systems, purpose-built appliances and networking equipment. Servers are computational workhorses powered by multicore processors and densely packed memory. High-performance storage systems provide rapid access to the data they manage, protect and serve. Purpose-built appliances—like firewalls and data archives—handle singular jobs, and 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 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 measures how much work is done in a set amount of time. Application performance depends on the response time and throughput of the underlying server, its storage and the network infrastructure. Any given system, and any application, is only as fast and responsive as its slowest component—be it the processor, memory, network or storage. Therefore, it's important to build a balanced system with high-performance components.

Availability

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

- 1. Reliable components** (storage, memory and others like power and cooling) that are designed, tested and validated for durability and low-field failure rates
- 2. Redundant systems** such as multiple servers sharing processing and serving loads through clustering; multiple paths to storage if the storage is remote; multiple network paths
- 3. Replication (of data)** through real-time management of various copies, near real-time remote mirroring, periodic backup or snapshot technology

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

Scalability

Data center infrastructure demands can expand and intensify with time. Greater responsiveness, faster and more I/O throughput, and increased capacity and network bandwidth are all needed to accommodate these demands. The scalability of a system depends on its architecture, the aggregate capacity of its components and how much it can expand in a scale-up or scale-out configuration. At the most basic level, higher-capacity components enable a more scalable infrastructure.

Manageability

Manageability is the resource commitment and level of complexity required to configure, manage and maintain a given system. For systems with good manageability, this commitment is low. Ease of management improves quality of life for IT administrators, 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** (for example, data center automation, IT service management)
- 2. Systems** (for example, managing an individual platform)
- 3. Components**

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

Cost Effectiveness

Cost effectiveness—or lower total cost of ownership (TCO)—reflects both acquisition costs and long-term operating costs. Acquisition costs are the price of the systems and parts combined with the cost of integration. Operating costs include management overhead, replacements, power, cooling and floor space. Less expensive devices and components can reduce acquisition costs while manageability, durability, incremental scalability, energy efficiency and density in a compact profile can reduce operating costs.

Power Efficiency and Density

Data center floor space and power are premium commodities. Data centers may simply run out of floor or rack space or become power-constrained. The option of building out or adding more power capacity may not be practical or affordable. Devices and components designed with greater density and power efficiency can help address these constraints.

Micron SSDs for Data Center Infrastructure

Micron designs and manufactures a complete line of enterprise-class SSDs for data center infrastructure needs. From SATA and SAS HDD replacements to ultra-low-latency NVMe storage, we deliver performance, capacity, durability and power efficiency for all aspects of the data center. Our enterprise SSDs excel in Mode 2 distributed platforms using server-side storage and I/O acceleration through tiering, as well as in Mode 1 mid- to large-scale storage systems as primary storage or storage accelerators.

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 with use, an SSD’s lifespan is far more predictable. Micron’s SSDs use sophisticated techniques to manage their media wear and track and report their remaining lifespan. This enables planned replacement with scheduled downtime.

Superior performance, better performance-to-power characteristics, a more predictable lifespan, standard and innovative form factors, and design/technology maturity have secured the SSD’s place in the modern, high-performance data center.

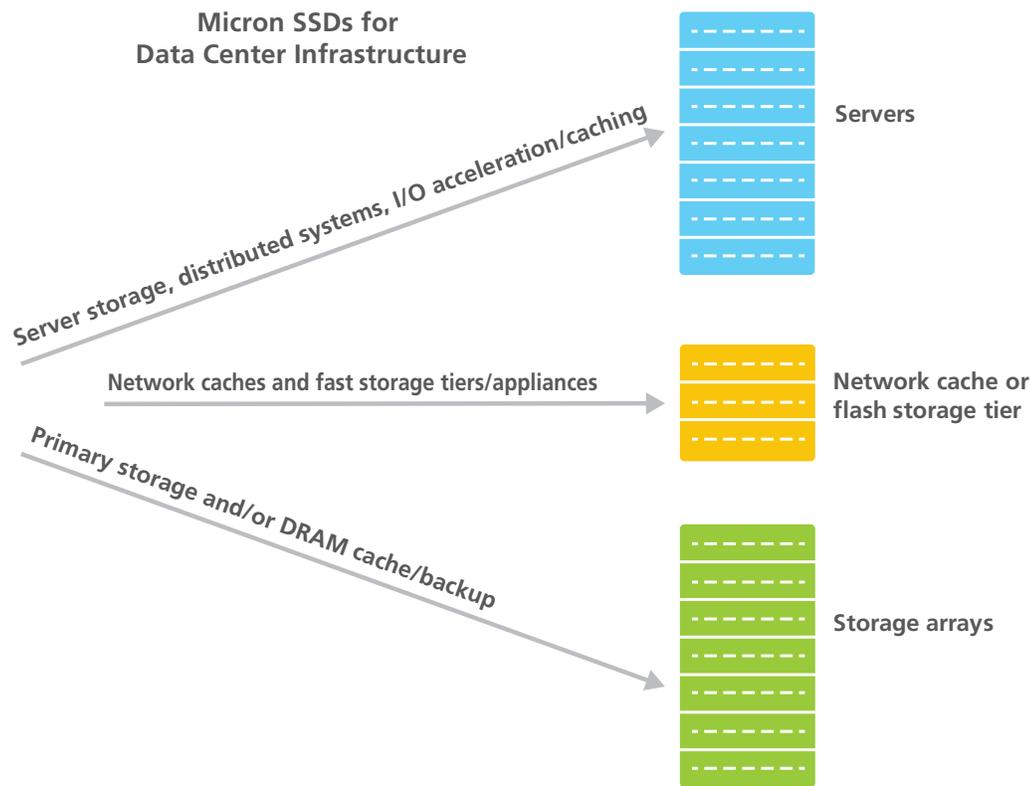


FIGURE 3: Micron’s SSDs deliver superior throughput and latency to accelerate storage applications throughout the enterprise.

Micron SSD Advantages for the Data Center

Micron is a world leader in nonvolatile media design, manufacturing and qualification/testing. In addition, Micron has in-house expertise developing custom SSD controllers and firmware, leveraging this design knowledge for tight integration and deep insight to the entire SSD design, manufacturing, qualification and support process. Our vertical integration enables far more stringent quality control and deeper, tighter integration among the media, the SSD using it, and the system into which the combination is integrated. The results are 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 suite of powerful enhancements enables Micron’s design and engineering teams to build enterprise SSDs optimized for data center-specific workloads.

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

Micron XPERT Enhancements for SSDs	
ARM/OR	NAND read points dynamically tuned for optimal data reliability
RAIN	RAID-like protection for NAND components; LBA embedding and SOC buffer and FIFO protection for data accuracy and power-loss resilience
DataSAFE	LBA embedding, SOC buffer, FIFO protection for data accuracy and power-loss resiliency
ReCAL	Reduced MAX write latency
Media Customizations	SSD-specific NAND designs and custom manufacturing and test flows
Power Holdup	Power-loss protection for all data (at rest and in flight)

Performance Advantage

XPERT’s adaptive read management/optimized read (ARM/OR) feature dynamically tunes read settings for optimized performance and reliability during an SSD’s natural lifespan, providing optimal output while being transparent to the host system. Reduced command access latency (ReCAL) substantially reduces write latency by managing background operations (such as garbage collection) more efficiently and non-disruptively.

Unlike some SSD manufacturers that rely heavily on host CPU bandwidth for storage operations, Micron SSDs manage I/Os on the SSD, in the hardware. Our approach minimizes host CPU overhead—enabling the host CPU to perform additional work—and provides consistently low latency. It eliminates dependency on host-specific configurations and frees up CPU cycles to run applications or manage virtual machines rather than storage I/O. These performance capabilities contribute to faster storage response times and I/O throughput, which ultimately results in more productivity and value.

Availability Advantage

Taking advantage of in-house media design and fabrication, Micron’s engineers specify media customizations—like additional testing and custom features—based on SSD design requirements.

For example, media precycling (where the media is cycled at the factory before the SSD is shipped) greatly reduces early-life failures and enhances drive durability and reliability. The XPERT feature redundant array of independent NAND (RAIN) uses real-time parity protection (similar to how arrays use RAID) to protect data from media failure. DataSAFE embeds memory protection ECC (MPECC) and the address in which data is to be stored (its logical block address [LBA]) as metadata to ensure integrity as this information travels from the host, through the drive’s internal data path, to the media, and back.

Micron offers SATA, SAS and PCIe SSDs that are hot-swappable and can be replaced or upgraded without downtime or system reboot. SAS and U.2 dual-port interfaces offer the high availability and accessibility needed for applications that require uninterrupted, 24/7 data access. In addition, Micron enterprise SSDs come in a wide variety of endurance ratings, enabling you to select drives tuned for read-intensive, write-intensive or mixed-mode use

Scalability Advantage

Micron offers high-capacity SSDs with dense packaging across a wide range of interfaces and form factors. With multi-terabyte capacities, our NVMe, SAS and SATA SSDs enable both high performance and high capacity in single device packages.

Manageability Advantage

Because Micron writes the specification for the media components inside our SSDs, we understand and deliver manageability on a granular level. Micron also has experience in designing/fabricating/qualifying/validating those components, and has in-house expertise in controller and firmware development.

Our SSDs monitor and track critical performance metrics and wear parameters, enabling the host to query and report on them at a moment's notice. These attributes can be used for storage management and alerting. For example, an attribute monitoring the percentage of lifetime remaining indicates how much of a drive's rated lifespan remains based on historic drive use. Calculated using design-optimized algorithms, this number ensures accurate reporting, which enables administrators to be confident that they have accurate, reliable information, making it easier to prepare for scheduled replacements.

Cost Advantage

Most SSD vendors do not have the capability to design and manufacture memory for their own drives; they have to buy memory components on the open market, which can be subject to swings in component pricing and availability along with added margins. Because Micron designs and manufactures our own memory, we have the advantage of a stable, direct supply, enabling us to consistently offer competitively priced SSDs.

Power and Density Advantage

All Micron SSDs—NVMe, SAS and SATA—deliver excellent IOPS per watt, and their combination of performance, density and low-power draw make them ideal for dense deployments with small footprints.

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:

- > Fast application response times and high I/O throughput
- > High productivity
- > Fast time-to-market with new products and services
- >>> High revenues and lower costs

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

micron.com

No hardware, software or system can provide absolute security under all conditions. Micron assumes no liability for lost, stolen or corrupted data arising from the use of any Micron products, including those products that incorporate any of the mentioned security features.

Products are warranted only to meet Micron's production data sheet specifications. Products, programs and specifications are subject to change without notice.

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