The right mix of compute, memory and storage.

Micron® 7500 and 7450 NVMe™ SSDs: Better performance and responsiveness for a wide range of server applications

Choosing the right SSDs for your data center can be a balancing act. You must consider many competing factors:

- Performance vs. cost
- Capacity vs. use case
- Futureproofing vs. immediate needs

If the SSD is too powerful, it can lead to underutilized compute resources. On the other hand, if it's not powerful enough, performance will suffer.

Mainstream data centers that need low latency, superior performance, and faster response times — without breaking the bank — can find balance with Micron 7000 series NVMe SSDs

In this tech brief, we examine test results using RocksDB and Ceph object storage to see exactly how Micron 7000 series NVMe SSDs — currently including the 7450 and 7500 — stack up to the competition. We demonstrate how choosing the right SSD solution can dramatically impact server performance and explore how these results translate into better performance for real-world situations.

- High-volume online transaction processing (OLTP)
- Recording user sessions using RocksDB, the Facebook-developed[1] database
- Supplying streaming data to content delivery networks (CDNs)

Micron 7000 Series NVMe SSDs

The world's most advanced mainstream data center SSDs.

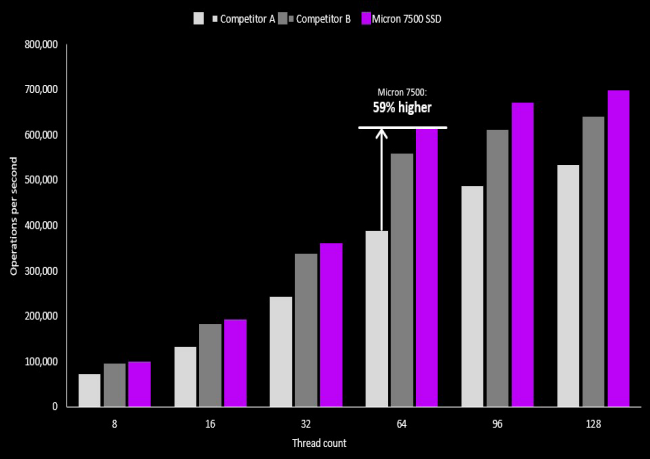
- Form factors: U.3, M.2, E1.S
- Secure execution environment
- Next-gen security features

Better embedded database performance

The Micron 7500 SSD consistently outperforms[2] other mainstream data center SSDs[3] when using RocksDB, the Facebook-developed embedded database.

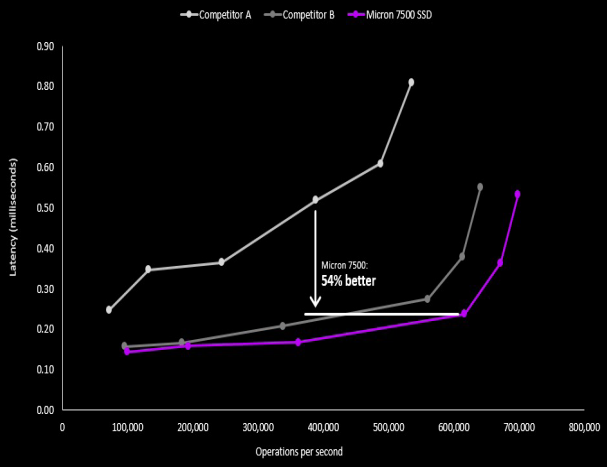
This results[4] in higher performance and better application responsiveness.

Figure 1: 7500 4KB random read performance scaling by thread count



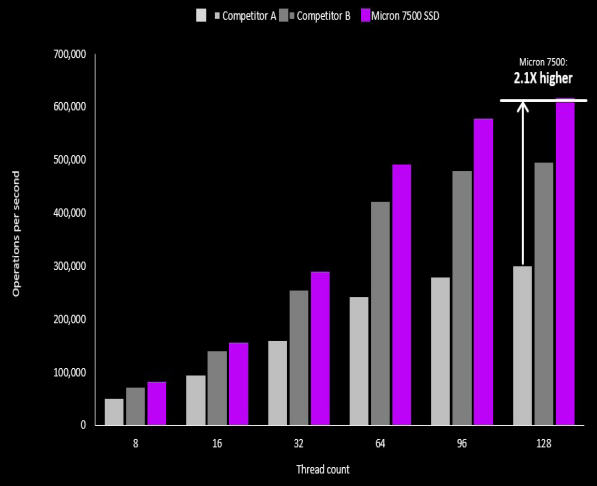
Random read:
59% higher[5] maximum performance

Figure 2: 7500 Application responsiveness vs. 4KB random read performance at various loads



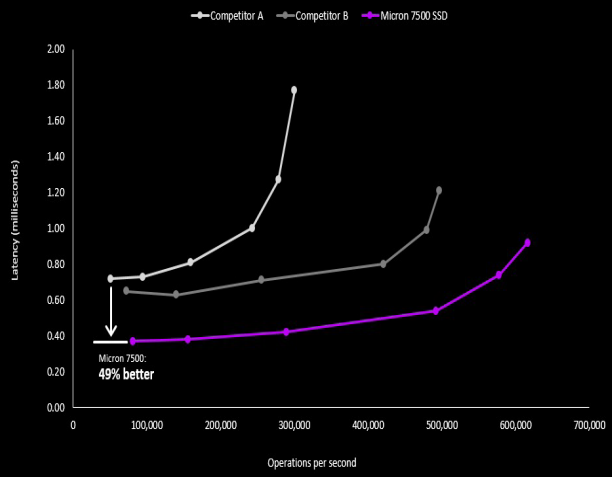
Random read:
54% better[6] application response time

Figure 3: 7500 4KB random read while writing performance scaling by thread count



Random read while writing:
2.1x higher maximum performance

Figure 4: 7500 Application responsiveness vs. 4KB random read while writing performance at various loads



Random read while writing:
49% better[7] application response time

View full test results: Micron 7500 NMe SSD RocksDB Performance

Use case: Spam detection application

Integrating the Micron 7500 SSD and RocksDB into a spam detection application can enhance the system's ability to quickly identify and filter incoming spam.

- Higher maximum performance accelerates the spam detection process
- Better application response time ensures spam is detected and managed more swiftly
- Consistent responsiveness to maintain reliable spam detection even during peak times

Better mixed workload performance

The Micron 7450 NVMe SSD excels in scenarios using 50% read and 50% write, which represents one of today's most challenging use cases — recording user sessions.

RocksDB tests show[8] leading latency quality of service (QoS), which enables responsive and predictable workload performance:

- 99.99% latency improvement (reduction) at 40,000 operations per second compared to the first-gen SSD
- 95% higher performance than the first-gen SSD

Figure 5: 7450 99.99% latency vs. operations per second at various loads - 40,000 ops/sec

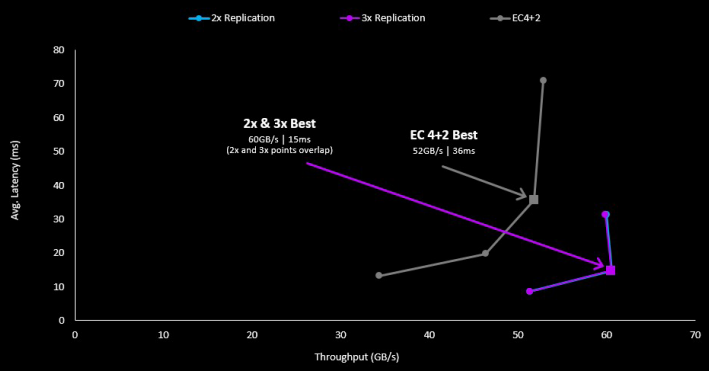
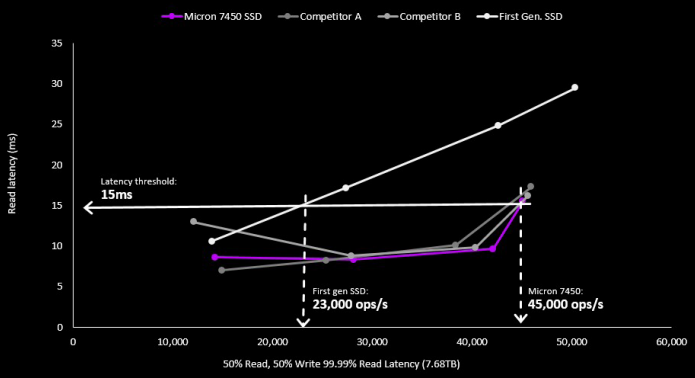


Figure 6: 7450 99.99% latency vs. operations per second at various loads - 15 milliseconds



View full test results: [The Micron 7450 SSD Delivers Impressive Performance For Complex, Mixed Workloads]

Use case: Recording user sessions

The Micron 7450 NVMe SSD provides a capable solution for recording user sessions with a balanced IO (50% read, 50% write).

- Superior mixed-workload performance for simultaneous read and write
- Enhanced database efficiency to keep pace with large scale user sessions
- Low latency for smooth, real-time data processing

Better object storage

When using Ceph[9] for object storage, the Micron 7450 NVMe SSD shows[10] consistently high throughput and low latency. This results in better performance[11] when managing unstructured data, cloud storage and content delivery.

SSD comparisons for throughput, latency and average I/O request size

	Read			Write		
	Disk throughput	Object reads average request size	Average read latency	Disk throughput	Object writes average request size	Average write latency
3x replication	1.28 GB/s	752 KB	0.87ms	1.27 GB/s	540KB	1.2ms
2x replication	1.29 GB/s	791 KB	0.87ms	1.57 GB/s	496KB	0.83ms
EC 4+2	1.13 GB/s	534 KB	0.55ms	816 MB/s	188KB	0.74ms

Figure 7: 7450 RHCS performance vs. latency for 4MB object 100% random read

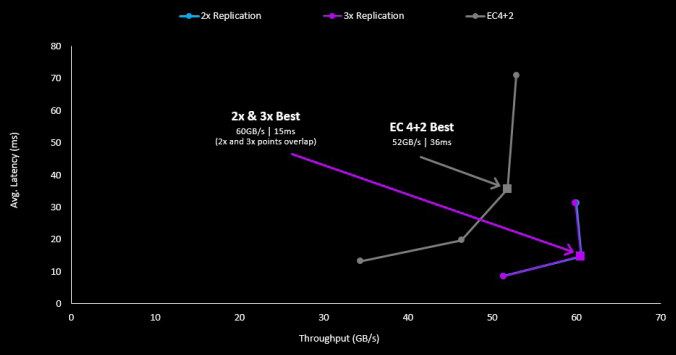
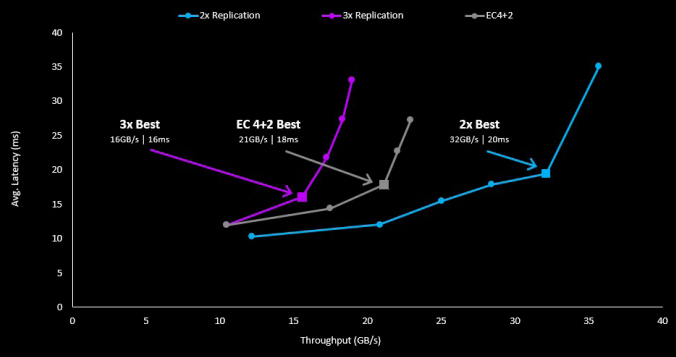


Figure 8: 7450 RHCS performance vs. latency for 4MB object 100% random write



View the full test results: Low-Latency NVMe SSDs Unlock High-Performance, Fault-Tolerant Ceph Object Stores

Use case: Content delivery networks (CDNs)

The Micron 7450 NVMe SSD brings high throughput and low latency to data centers, which helps CDNs deliver a steady stream of high-quality content.

- High throughput for faster content retrieval and distribution
- Efficient data management using systems such as Ceph object storage
- Low latency for smooth, real-time data processing

Build balanced servers with Micron

With more than 45 years of memory and storage innovation and execution, Micron's experts are uniquely qualified to provide guidance on the optimal mix for data center servers:

- Performance
- Capacity
- Features

Our experts work with teams across the ecosystem to rigorously test configurations on a wide range of platforms with an even wider range of workloads.

Using test data and expert insights, we can help you choose the right solution for your workload, integrate it seamlessly and transform your data into a competitive edge.

Learn more at micronpg.com/balance

Footnotes:

1. Additional details are available on the RocksDB Github page: https://github.com/facebook/rocksdb/
2. This document uses the terms performance and operations per second interchangeably.
3. Class and leading competitors are defined as mainstream, data center, NVMe SSD suppliers with at least 10% data center NVMe SSD market share as of August '23 as noted in Forward Insights analyst report FI 202308 SSD Supplier Status_Q223_P. Competitor A uses three bits per cell (TLC) NAND while competitor B uses four bits per cell NAND (QLC). All tested SSDs rated at 7.68TB capacity and intended for mainstream use. Unformatted capacity. 1GB = 1 billion bytes, formatted capacity is less.
4. Additional details on the RockDB benchmark available here: https://github.com/EighteenZi/rocksdb_wiki/blob/master/Benchmarking-tools.md
5. Note: 616,344 operations per second divided by 388,751 operations per second = 1.59, a 59% improvement.
6. Note: Percentage improvement = (Micron 7500 SSD latency – Competitor A latency) / Competitor A latency; (0.24ms – 0.52ms) / 0.52ms = -54%
7. Note: Percentage difference = (Micron 7500 SSD latency – Competitor A latency) / Competitor A latency; (0.37ms – 0.72ms) / 0.72ms = -49%
8. We used a Micron 7450 SSD, two current, competitive PCIe Gen4 SSDs with NVMe and a popular first-generation U.2 PCIe Gen4 SSD with NVMe (ca. 2021) for this comparison. All SSDs tested used 7.68TB capacities.
9. Learn about all of our Ceph reference architectures by visiting our Micron Accelerated Ceph solutions page.
10. The Micron 7450 SSD consistently delivers 2ms and lower latency for 99.9999% Quality of Service 1Up to queue depth - 32 for 4KB, 100% random, 90% read workload; up to queue depth = 32 for 4KB, 100% random, 70% read workload
11. Additional details on performance benchmarking is available here: https://access.redhat.com/documentation/en-us/red_hat_ceph_storage/1.3/html/administration_guide/benchmarking_performance