Mainstream NVMe SSDs for Lightning-Fast, Power-Efficient Analytics

Micron's 7300 MAX SSDs Make SQL Database Analytics Thrive

Overview

Enterprise IT and cloud managers want fast, low-latency analytics — without breaking the budget.

Micron introduced the 7300 series of mainstream NVMe SSDs for highly demanding businesss-critical workloads.

The 7300 series leverages the low power consumption and price-performance efficiencies of 3D NAND technology and the immense bandwith of the NVMe interface for fast analytics that stay within budget.

This technical brief highlights the Microsoft SQL Server analytics performance[1] of a 7300 MAX-based platform compared to legacy platforms using enterprise SATA SSDs.[2]

Our performance tests comparing a 7300 configuration to a SATA SSD configuration show that the 7300 delivers:

- 3.5X on average faster complex query processing
- Better energy usage, consuming 60% less power
- 3.3X higher storage throughput

And the 7300 configuration uses *half* as many SSDs versus the SATA configuration.

Fast Facts

3.5X 7300 query processing advantage

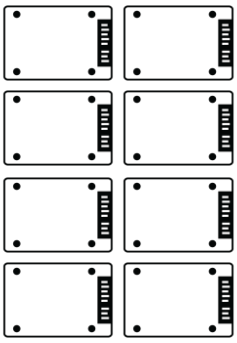
60% Energy efficiency improvement — systems and data centers run cooler

3.3X 7300 storage throughput advantage

Tested Configurations

4X 7300 NVMe

8X SATA SSD



1. We use the term performance to indicate queries per hour (QPH), a common measurement of a BI platform's ability to deliver results (completed queries per hour). See Configuration Details for system-specific testing information.
2. Analytics based on BI/DSS is a highly read-focused workload. We chose enterprise SATA SSDs that are designed for this IO profile as the baseline configuration against which the 7300 configuration is compared.

Micron 7300 Completes Complex Queries 3.5X Faster

When comparing BI/DSS platforms, the primary metric of interest is stream run time (time to process a set of queries). Faster query processing results in quicker analytics and shorter time to answers. It also enables interative querying to fine-tune results (run additional queries in the same timeframe).

Figure 1 shows the relative stream run time for each configuration. The SATA configuration's stream run time is the baseline, and the 4X 7300 configuration's stream run time is shown relative to this baseline.

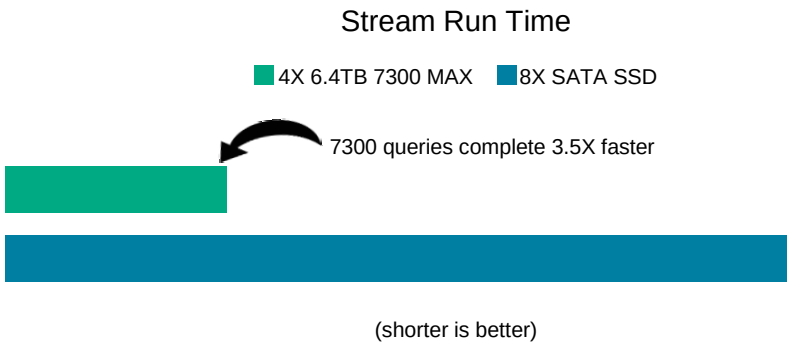


Figure 1: Stream Run Time

The 7300 configuration provides a significant performance boost over the SATA configuration, completing the test stream 3.5 times faster.

Realize 60% Higher Energy Efficiency

The Micron 7300 drives these impressive results with far greater energy efficiency (expressed as the amount of energy consumed to complete the test query set. To calculate energy efficiency, we recorded the power each configuration consumed (watts) executing the queries and the time it took to complete each query set.

Figure 2 shows energy consumed (in kWh) by each configuration to complete the test query set (lower is better). Note that Figure 2 reflects the total energy consumed for the SSDs, platform CPUs, memory and system — not just the energy consumed by the SSDs.

Energy consumption and energy efficiency are related as shown below:

60% less energy consumed = 60% higher energy efficiency

The 7300 configuration consumed about 60% less energy to process the same query set, resulting in a 60% higher energy efficiency.

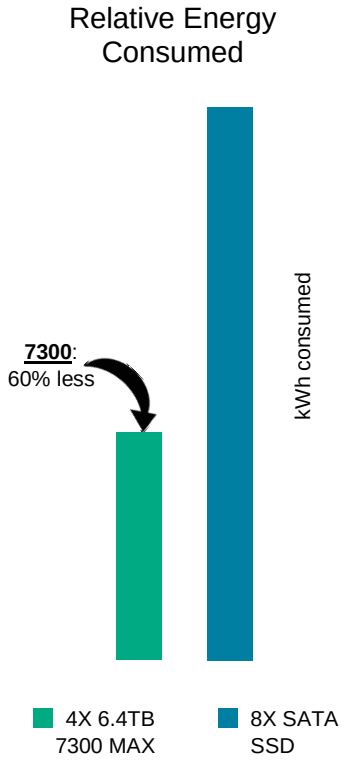


Figure 2: Energy Efficiency

Higher Storage Throughput Drives Results

The Micron 7300 configuration showed much higher storage throughput compared to the SATA configuration, driving both lower stream run time and higher energy efficiency. Figure 3 shows relative storage throughput for each configuration.

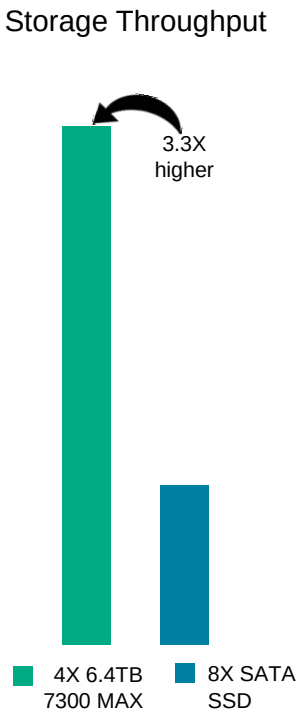


Figure 3: Storage Throughput

Summary

We compared two BI/DSS platforms — one with four Micron 7300 NVMe SSDs and the other with eight enterprise SATA SSDs — by measuring how long it took each platform to complete a single stream of 22 queries and the resulting calculated energy effieciency. We found the 7300 configuration completed the query set 3.5 times faster while consuming 60% less energy.

The Micron 7300 NVMe SSDs offer both extreme performance and power efficiency — even when compared to twice as many current enterprise SATA SSDs.

Build new analytics platforms with Micron's affordable, high-performance 7300 SSD to help you manage the growing demand for more detailed analytics and the increasing pressure for energy efficiency — and do it more affordably than ever before.

Learn more

- About Micron's 7300 Series of NVMe SSDs
- See how the 7300 Series brings new value to NVMe storage
- Keep up to date with the latest in Micron storage news, follow us on Twitter @Micron Storage

How We Tested

We used the TPC-H benchmark tools for all query performance tests.[3] It uses a series of 22 business-oriented, ad-hoc queries and concurrent data modifications to gauge platform capability. We tested each configuration with one stream and Max DoP = 96.[4]

Configuration Details

Table 1 summarizes the hardware and software configurations. Note that the total database size exceeds available memory to ensure a storage-centric workload.

Item	7300 Platform
System	x86 dual CPU, rack mount
CPU	Intel® Xeon® Platinum 8168 (x2)
DRAM	384 GB
Database Storage	Micron 7300 MAX 6.4TB NVMe SSD (x4)
OS	Microsoft Windows Server 2019 Datacenter Edition (x64)
Configuration	Parity Storage Spaces
Database Software	Microsoft SQL Server 2017 Enterprise Core Edition (x64)

Item	SATA Platform
System	x86 dual CPU, rack mount
CPU	Intel® Xeon® Platinum 8168 (x2)
DRAM	384 GB
Database Storage	Enterprise SATA SSDs (x8)
OS	Microsoft Windows Server 2016 Datacenter Edition (x64)
Configuration	Parity Storage Spaces
Database Software	Microsoft SQL Server 2017 Enterprise Core Edition (x64)

Table 1: Hardware and Software Configuration

3. For additional details on the TPC-H benchmark see: http://www.tpc.org/tpc_documents_current_versions/pdf/tpc-h_v2.17.3.pdf. All tests have not been certified by the Transaction Processing Council.
4. Maximum degree of parallelism (Max DoP) is an adjustable parameter that tells the database Server Planner how many parallel operations it can use for a given query. Different deployments may use different values for Max DoP.

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