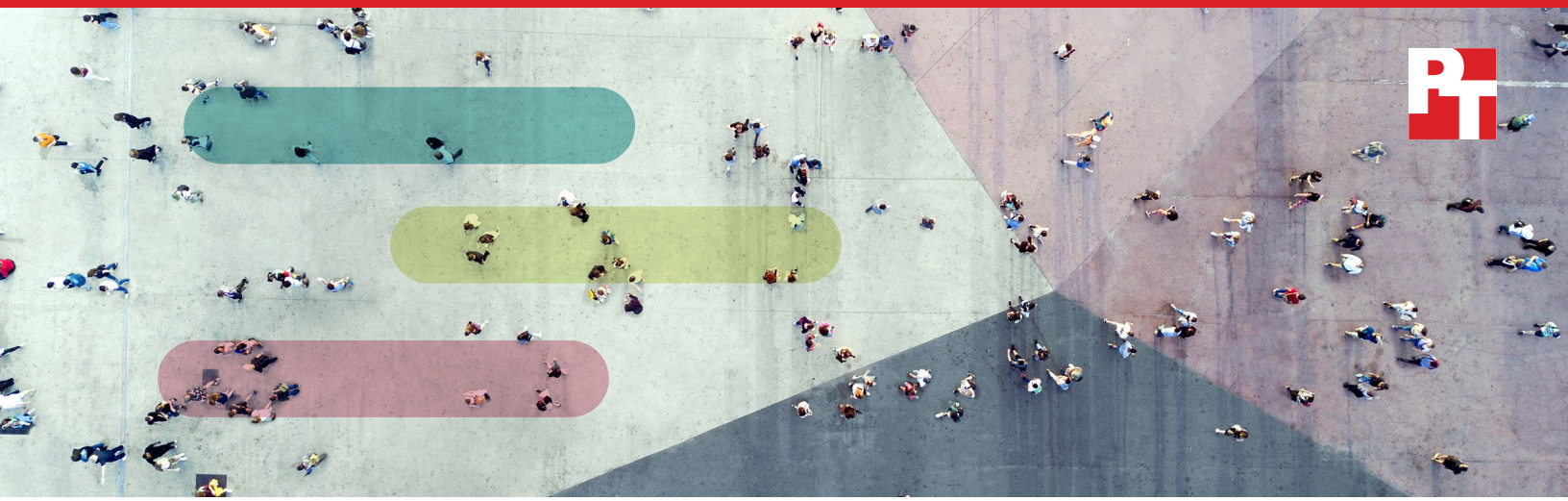


Improve decision support workload performance
Up to 45% less time to complete a 22-query set

Make decisions at a faster pace
Up to 86% lower average data read latency

More bang for your buck
Run more workloads to see a better return—up to 39% in our scenario

with data center NVMe SSDs from Toshiba Memory vs. enterprise SATA SSDs

Make business decisions faster with value SAS and data center NVMe SSDs from Toshiba Memory

RM5 Series value SAS and CD5 Series data center NVMe SSDs processed queries to a Microsoft SQL Server 2017 database significantly faster than enterprise SATA SSDs

HPE ProLiant DL385 Gen10 server running an analytics workload

Decision support systems provide useful data for analysis about your organization, products, and services. SATA SSDs may have been fast enough for these applications in the past, but newer, faster technologies can get you key business support data faster, so you can make precise, data-driven decisions sooner. Toshiba Memory RM5 Series value SAS and CD5 Series data center NVMe™ SSDs offer faster connection rates that can improve the performance of decision support system applications.

We set up an HPE ProLiant DL385 Gen10 server in three SSD configurations: current-generation enterprise SATA, value SAS, and data center NVMe. When we ran a TPC-H-like data analytics workload on each, the SAS and NVMe configurations completed the workload queries in less time and with lower latency than the SATA configuration. Running data analytics more quickly allows you and other leaders to make well-informed decisions, identify negative trends, and allocate business resources more quickly.

What can SAS and NVMe SSDs offer your organization?

Choosing SAS and NVMe SSDs for your data analytics workloads can help you and other decision-makers get the precise, up-to-date data you need more quickly. Both technologies offer better connection rates than SATA. Toshiba Memory RM5 Series value SAS SSDs deliver a 12Gb/s connection,[1] and CD5 Series data center NVMe SSDs push transfer speeds to 32 gigatransfers per second (GT/s).[2] SATA drives offer only a 6Gb/s connection.[3] In addition, SAS and NVMe SSDs have higher queue depths than SATA SSDs, which means they can handle more commands and queries and thus help boost performance.

In addition to helping your organization by working faster and harder than SATA SSDs, SAS and NVMe technologies could have more to offer in the years to come. The SCSI Trade Association, a "recognized and trusted authority on Serial Attached SCSI (SAS) technology,"[4] published a roadmap in 2018 that shows the availability of 12Gb/s SAS through at least 2021.[5] Similarly, the NVM Express Organization board estimated in 2017 that the next version of the NVMe base specification will be available in 2019. The group also has over 50 ongoing projects in their technical working groups with over 130 companies working on them.[6] In contrast, there won't be any further advances for SATA SSDs that improve their transfer rates.[7]

Toshiba Memory
Data Center NVMe SSD

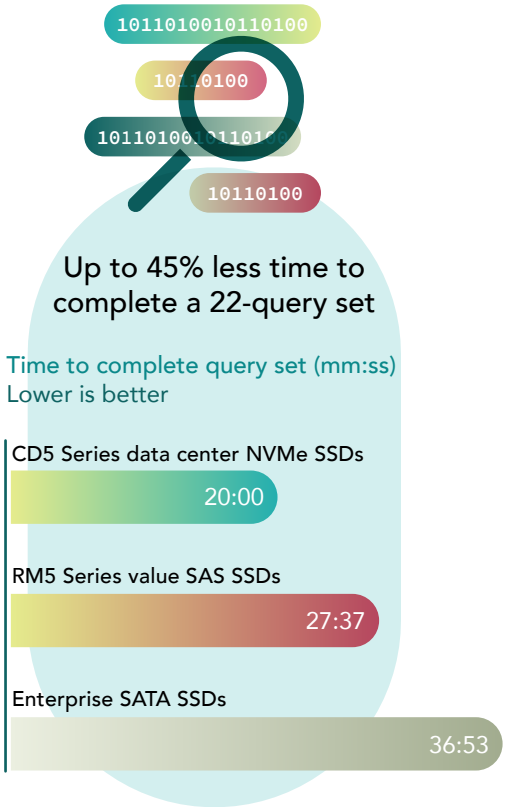
About the HPE ProLiant DL385 Gen10 server

The HPE ProLiant DL385 Gen10 features AMD EPYC™ 7000 Series processors and can support up to 24 Toshiba Memory value SAS or data center NVMe SSDs.[8]

How we tested

We assessed how fast each solution could answer complex database queries using HammerDB, a tool that generates various benchmarking workloads. HammerDB's TPC-H-like data warehouse workload ran a set of 22 read-only queries to simulate a user querying a database for data such as shipping information. We ran the workload on three storage configurations of an HPE ProLiant DL385 Gen10 server that used Microsoft SQL Server 2017 Enterprise and Microsoft Windows Server 2016 Datacenter edition. These storage configurations were:

- Eight 960GB enterprise SATA SSDs
- Eight 960GB RM5 Series value SAS SSDs from Toshiba Memory
- Eight 960GB CD5 Series data center NVMe SSDs from Toshiba Memory



Get up to speed sooner with the latest data

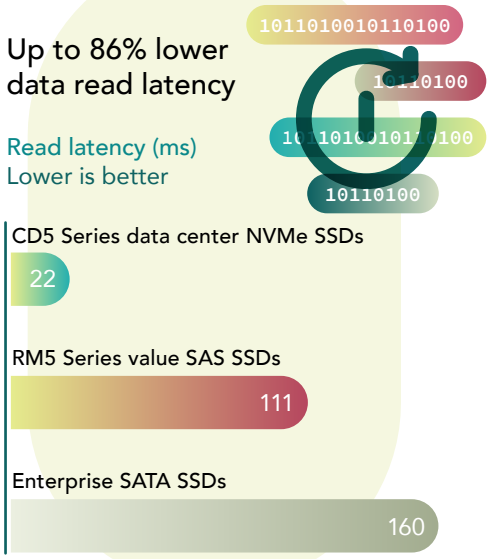
Insight from data analysis helps you understand how to stay competitive—for example, it can show you how to offer goods and services more efficiently and effectively. Servers with storage that speed data retrieval enable you to see these helpful patterns sooner. Our testing revealed that the Toshiba Memory value SAS and data center NVMe SSD configurations delivered better business analytics database performance than the enterprise SATA SSD configuration, completing a single query set in just under 28 and in 20 minutes, respectively. The enterprise SATA SSD configuration completed the query set in under 37 minutes. The chart on the left compares the total time to complete all 22 queries for each configuration.

About the HammerDB workload

HammerDB is an open-source tool that tests the database performance of many leading databases, including Oracle® Database, Microsoft SQL Server, PostgreSQL®, and MySQL™. The benchmark includes two built-in workloads derived from industry standards: a transactional (TPC-C-like) workload and an analytic (TPC-H-like) workload. Our test results do not represent official TPC results and are not comparable in any manner to the official TPC-audited results. For more information about HammerDB, visit www.hammerdb.com.

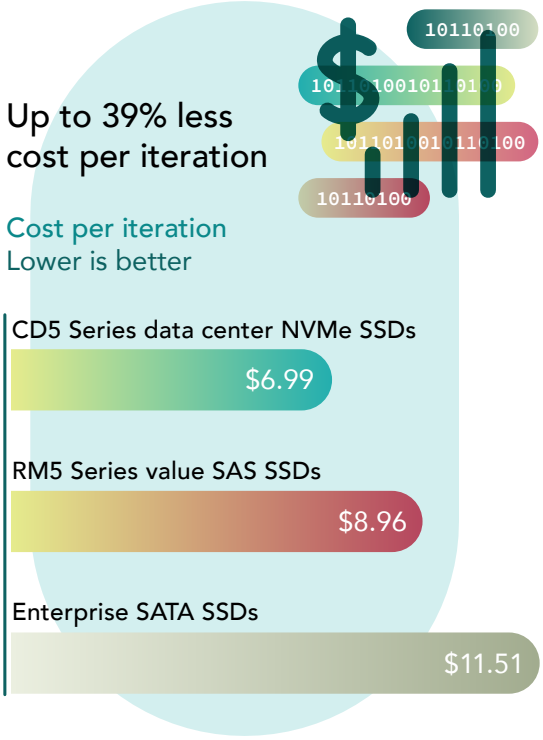
Keep reading time to a minimum

You can save time executing a data analytics workload using Toshiba Memory value SAS and data center NVMe SSDs rather than SATA SSDs, but where does that time savings come from? A significant part of the savings comes from lower read latency. Our analytics workload used only read queries—the virtual user did not edit or create data. The value SAS and data center NVMe SSDs had average read latencies of 111 and 22 milliseconds (ms), respectively. The enterprise SATA SSDs had an average read latency of 160 ms. Lower read latency indicates that the server needed less time to access and pull necessary data. Over the course of the 22-query workload, the savings adds up and contributes to a shorter overall completion time. This could also mean a better experience for the user.



The speed of value SAS and data center NVMe SSDs can promote overall server resource efficiency, too. Fast storage forces resources such as CPU to be less idle, which helps maximize the value of the server's processors. The enterprise SATA SSD configuration had the lowest average CPU utilization during our testing. The storage-intensive portions of the workload took longer for the SATA SSDs to complete, so the processors spent more time idle. In contrast, the data center NVMe SSD configuration forced the CPU to be less idle because the drives completed the storage-intensive portions more quickly.

In addition, the data center NVMe SSDs had greater throughput on average, transferring data off the disk more quickly than the enterprise SATA SSDs. Quicker data pulls caused the solution to utilize the CPU more often to process the data, making better use of the system's compute resources. Check out the science behind this report to see the storage throughput for each configuration during testing.



Invest wisely in a more productive data center

If you're worried about getting a CFO on board with upgrading enterprise SATA SSDs to Toshiba Memory value SAS and data center NVMe SSDs, here's a point to consider: Value SAS and data center NVMe SSDs can provide greater value because they run more data analytics workloads in a given time than the enterprise SATA SSDs.

We created a hypothetical scenario to examine how the workload rates could impact each configuration's value. Many analytics and reporting jobs run during maintenance windows, so we first calculated how many times each configuration could run our analytics workload during four-hour overnight maintenance windows over a two-year server lifecycle. Then to derive a cost per iteration for the life of the server, we divided the single-node price for each configuration by the workload iterations for a week. In this analysis, the value SAS and data center NVMe SSD configurations had 22 and 39 percent lower costs per iteration. The chart on the left compares the costs per iteration from our hypothetical scenario.

These numbers don't represent a true cost savings, but they highlight how your organization could see a better value on its purchase of servers with value SAS or data center NVMe SSDs from Toshiba Memory. See the science behind this report for pricing and analysis details.

Conclusion

The less you wait for data analysis, the sooner you can make a data-driven decision about your organization's or team's next move. Value SAS SSDs and data center NVMe SSDs from Toshiba Memory can run data analytics workloads faster than outdated enterprise SATA SSDs. In hands-on testing in our data center, the Toshiba Memory value SAS and data center NVMe SSDs completed a 22-query data analytics workload in 25 and 45 percent less time, respectively, than the enterprise SATA SSDs. When you consider the limitations of enterprise SATA SSDs, Toshiba Memory RM5 Series value SAS and CD5 Series data center NVMe SSDs in your servers could help your organization now and in the future.

1 "Toshiba Memory America First to Deliver Value SAS SSDs Targeting SATA Applications," accessed May 30, 2019, https://business.toshiba-memory.com/en-us/company/tma/news/2018/06/storage-20180619-1.html

2 "Data Center SSD: CD5 Series," accessed May 30, 2019, https://business.toshiba-memory.com/en-emea/product/storage-products/data-center-ssd/cd5.html

3 The Serial ATA International Organization (SATA-IO), which describes itself as "an independent, non-profit organization developed by and for leading industry companies" ("About SATA-IO," accessed May 16, 2019, https://sata-io.org/about-sata-io), last announced a doubling of maximum transfer speeds on SATA (from 3Gp/s to 6Gp/s) in August 2008. "New SATA Spec Will Double Data Transfer Speeds to 6 Gb/s," accessed May 16, 2019, https://sata-io.org/system/files/member-downloads/SATA_6Gb_Phy_PR_Finalv2.pdf

4 "2019 Board of Directors Announced by SCSI Trade Association as SAS Remains the Dominant Storage Interconnect Technology for Data Centers," accessed June 3, 2019, http://www.scsita.org/content/

5 "Serial Attached SCSI Technology Roadmap," accessed June 3, 2019, http://www.scsita.org/content/library/serial_attached_scsi_technology_roadmap/

6 "The Evolution and Future of NVMe™," accessed June 3, 2019, https://nvmexpress.org/wp-content/uploads/NVMe-Roadmap-Webinar-2017.Final_.v2.pdf

7 "SATA-IO Frequently Asked Questions," accessed June 3, 2019, https://sata-io.org/sata-io-frequently-asked-questions

8 "HPE ProLiant DL385 Gen10 Server," accessed May 30, 2019, https://h20195.www2.hpe.com/v2/GetDocument.aspx?docname=a00026913enw

Read the science behind this report at http://facts.pt/amu10us ►

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