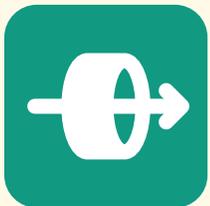## Analyze more data at once

50% more

more simultaneous query streams

3.2% faster*

Gain important data insights sooner

26% faster

*to analyze a single query stream***

**compared to a Dell EMC PowerEdge R740xd without Intel Optane persistent memory*

Analyze more data at once, faster, when you add Intel Optane persistent memory to Dell EMC PowerEdge R740xd servers

A Dell EMC PowerEdge R740xd server powered by Intel Xeon Gold 6240L processors analyzed more data and returned query results faster with Intel Optane persistent memory than without it

Sifting through large amounts of data to gain insights takes time. New Intel® Optane™ persistent memory (PMem) offers a performance layer between memory and traditional storage that can improve data analytics performance. We compared the performance of a Dell EMC™ PowerEdge™ R740xd server powered by Intel® Xeon® Gold 6240L processors with and without Intel Optane PMem to quantify the performance boost PMem could deliver.

Using the HammerDB test utility to simulate a TPC-H-like data warehouse workload, we recorded results as two metrics: the number of simultaneous query streams each solution could process in roughly the same amount of time as well as the time it took to process a single stream of 22 queries. In both of these tests, adding Intel Optane persistent memory in App Direct mode improved data analytics performance, enabling the server to process 50 percent more query streams 3.2 percent faster and cutting single-stream processing time by 26 percent. By equipping Dell EMC PowerEdge R740xd servers with Intel Optane PMem, medium businesses and enterprises could analyze data faster, turning insights into action that furthers business initiatives.

2nd Generation Intel Xeon Scalable Processors

The latest from Intel, the 2nd Generation Intel Xeon Scalable processor platform offers Bronze, Silver, Gold, and Platinum processors to support the applications you run. According to Intel, the 2nd Generation Intel Xeon Scalable platform can handle a variety of workloads, including enterprise, cloud, high-performance computing (HPC), storage, and communications.[1] This new processor line also supports a new memory and storage technology to further accelerate workloads, Intel Optane persistent memory.

To learn more about the 2nd Generation Intel Xeon Scalable processor family, visit https://www.intel.com/content/www/us/en/products/docs/processors/xeon/2nd-gen-xeon-scalable-processors-brief.html.

Boosting data analytics capabilities on your Dell EMC PowerEdge R740xd with Intel Optane PMem

If your organization deals with large quantities of data as part of doing business, speeding up analysis can help you learn from your data and act on insights sooner. Adding servers, memory, or faster storage solutions can help, but with each addition comes a (sometimes prohibitive) cost. Intel Optane PMem is another arrow in the quiver of performance boosting technology for servers built on 2nd Generation Intel Xeon Scalable processors.

Intel Optane PMem is a new technology that looks and fits into your server like memory DIMMs, but can act more like storage, depending on what your workload needs. In Memory Mode, Intel Optane PMem acts as large capacity DIMMs that handle operations like typical memory while using the DRAM as cache and providing a larger memory footprint. In App Direct Mode, the OS and apps treat PMem as a separate, persistent type of memory that applications can use in a variety of ways, from storing files to using the direct-access (DAX) feature to enhance performance.[2] For this data analytics study, we used App Direct Mode which we formatted in direct-access mode. To learn more about how Intel Optane PMem works, visit https://www.intel.com/content/www/us/en/architecture-and-technology/optane-dc-persistent-memory.html.

About HammerDB

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 analytics (TPC-H-like) workload. For this study, we used the analytics 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.

How we tested Intel Optane persistent memory

To find out whether adding Intel Optane PMem to a server improved data analytics performance, we tested a Dell EMC PowerEdge R740xd solution in two configurations: one with PMem (8 x 128GB modules in App Direct Mode with DAX feature enabled) and one without PMem.

To show the data analytics performance PMem can offer for medium businesses and small enterprises, we used Windows Server 2019 Standard and SQL Server 2019 Enterprise Edition. We used a 3TB database and the TPC-H-like workload of the HammerDB utility to generate our workload.

The HammerDB workload comprised a set of 22 queries that it issued against the database. Each query set is considered a stream. We conducted both single-stream and multi-stream tests.

To test the PMem, we moved the database files from the SSDs to the PMem volumes. We also enabled the SQL Server Hybrid Buffer Pool feature, which works with DAX-enabled hardware to help increase performance.[3]

For all test results, we report the median of three runs. For all the details about our testing, see the science behind the report.

About the Dell EMC PowerEdge R740xd

The Dell EMC PowerEdge R740xd is a two-socket rack server built on 2nd Generation Intel Xeon Scalable processors that fits into just 2U of rack space. With extra drive slots for storage scalability, the PowerEdge R740xd supports up to 24 x NVMe drives, 32 x 2.5" drives—or 18 x 3.5" drives—as well as Intel Optane PMem. The PowerEdge R740xd supports demanding workloads including HPC, software-defined storage, and Big Data. To learn more about the advantages that the Dell EMC PowerEdge R740xd offers, visit https://www.dell.com/en-us/work/shop/povw/poweredge-r740xd.
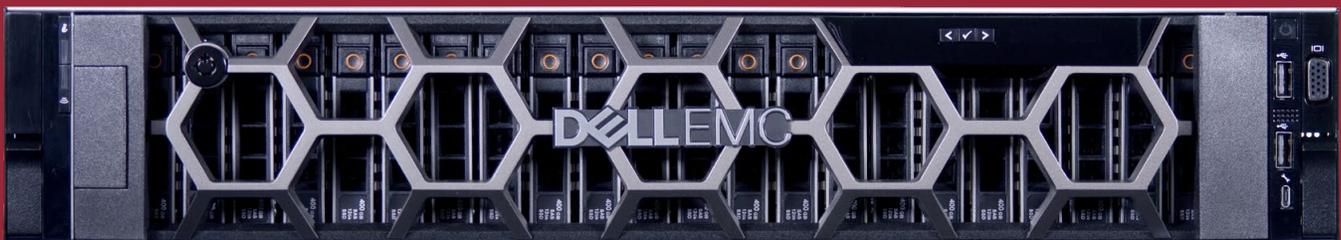
How adding Intel Optane PMem analyzed more data and returned query results faster

One way to assess data analytics performance is to look at the amount of data that a solution can analyze at a time. To that end, we compared the number of simultaneous data query streams that the Dell EMC PowerEdge R740xd solution could process in roughly the same time, with and without Intel Optane PMem.

Documentation from HammerDB and TPC states that TPC-H-like workloads should run eight simultaneous query streams for a 3,000 scale database. To see how Intel Optane PMem could increase performance, we increased the number of streams until the server without Intel Optane PMem completed the query streams in roughly the same time as the server that lacked Intel Optane PMem. As Figure 1 shows, the Dell EMC PowerEdge R740xd with Intel Optane PMem supported 12 simultaneous query streams, a 50 percent increase over the same solution without PMem—3.2 percent faster. This means that, for organizations seeking to move quickly on insights gleaned from large quantities of data, adding Intel Optane PMem to the Dell EMC PowerEdge R740xd could help by sifting through more data simultaneously.

50% more simultaneous query streams

12 query streams

8 query streams

Dell EMC PowerEdge R740xd with Intel Optane persistent memory — 2h 25m 23s

Dell EMC PowerEdge R740xd — 2h 30m 06s
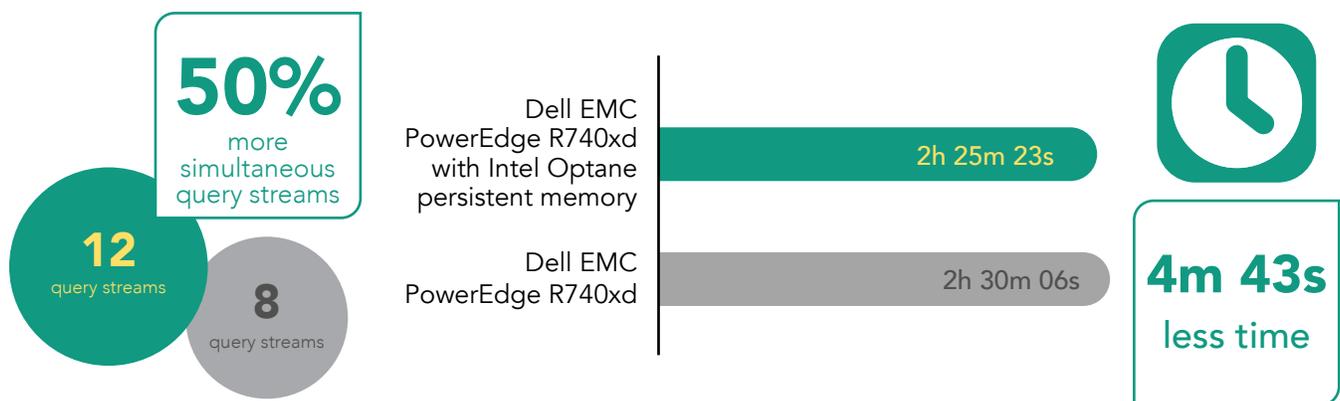
4m 43s less time

Figure 1: (Left) Number of simultaneous 22-query streams the Dell EMC PowerEdge R740xd supported with and without Intel Optane PMem (More streams is better). (Right) Time required to complete all query streams (Less time is better). Source: Principled Technologies

Another way to assess data analytics performance is to look at how quickly a solution can analyze a set of data. To that end, we also assessed the time it took for the Dell EMC PowerEdge R740xd with and without Intel Optane PMem to complete a single 22-query stream. As Figure 2 shows, adding Intel Optane PMem to the Dell EMC PowerEdge R740xd sped up the time to complete the single query stream by 26.7 percent.
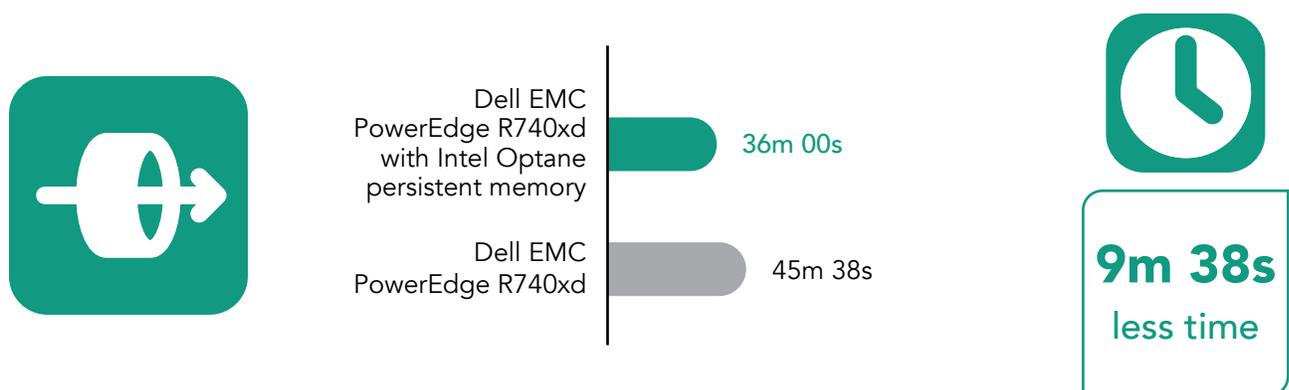

Dell EMC PowerEdge R740xd with Intel Optane persistent memory — 36m 00s

Dell EMC PowerEdge R740xd — 45m 38s

9m 38s less time

Figure 2: Time in minutes and seconds to complete a single 22-query stream. Less time is better. Source: Principled Technologies

Reaping the benefits of Intel Optane persistent memory is simple—learn how

One of the benefits of Intel Optane PMem is that it's easy to set up and start seeing accelerated performance. To add Intel Optane PMem to your Dell EMC PowerEdge server, follow these steps:

1. Install your Intel Optane PMem in the server according to stipulations in the Dell EMC DCPMM User's Guide.
2. Download and install the DCPM Software for Intel Optane DC Persistent Memory for Windows Server 2019 from https://downloadcenter.intel.com/download/29380/DCPM-Software-for-Intel-Optane-DC-Persistent-Memory-for-Windows-Server-2019?v=t.
3. Set the Intel Optane PMem to either App Direct or Memory Mode and create the interleaved PMem regions you desire (we used App Direct Mode and created two interleaved regions).
4. Create disks from the interleaved regions you created in step 3.
5. Initialize the disks, create a new partition on each disk, and format the disks, setting file systems to direct access (DAX) mode.
6. Configure your applications or databases to use the newly created PMem volumes.

For step-by-step configuration details, see the science behind the report.
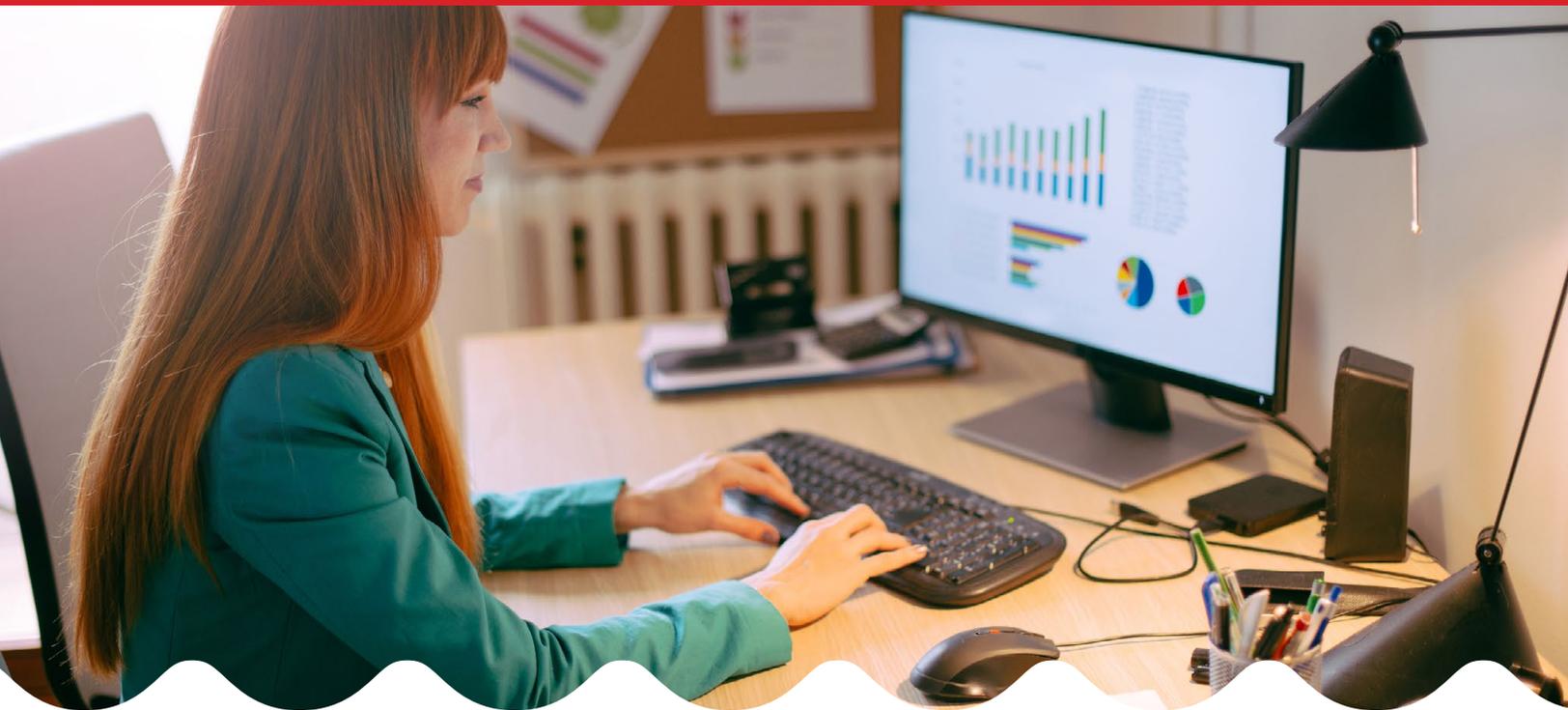
Analyze more data and gain insights faster by adding Intel Optane PMem to your Dell EMC PowerEdge R740xd

The amount of data that organizations must now analyze is enormous, and selecting solutions that complete the job faster—by either processing more data in a set amount of time or by analyzing a set amount of data faster—can improve the agility of business initiatives. We tested one way to boost data analysis: adding Intel Optane PMem to a Dell EMC PowerEdge R740xd server powered by Intel Xeon 2nd Generation Scalable processors. We found that adding Intel Optane PMem enabled a Dell EMC PowerEdge R740xd server to analyze 50 percent more query streams than a server without PMem and sped up single-stream query completion times on a SQL Server 2019 Enterprise database by 26.7 percent. If your organization seeks to bolster your data analysis capabilities, adding Intel Optane PMem alongside 2nd Generation Intel Xeon Scalable processors could get you the answers you seek faster.

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1   Intel, "2nd Gen Intel Xeon Scalable Processors Brief," accessed July 13, 2020, https://www.intel.com/content/www/us/en/products/docs/processors/xeon/2nd-gen-xeon-scalable-processors-brief.html.

2   Alper Ilkbahar, "Intel® Optane™ DC persistent Memory Operating Modes Explained," accessed July 13, 2020, https://itpeernetwork.intel.com/intel-optane-dc-persistent-memory-operating-modes/#gs.1cpqsk.

3   Microsoft, "Hybrid Buffer Pool," accessed Jul 13, 2020, https://docs.microsoft.com/en-us/sql/database-engine/configure-windows/hybrid-buffer-pool?view=sql-server-ver15.

Read the science behind this report at http://facts.pt/21wme4c ▶

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