17% faster

on average to complete seven simultaneous query streams*

*compared to a Dell EMC PowerEdge R740 without Intel Optane persistent memory

Get important data insights faster by adding Intel Optane persistent memory to Dell EMC PowerEdge R740 servers

A Dell EMC PowerEdge R740 server powered by Intel Xeon Gold 5215L processors returned query results faster with Intel Optane persistent memory than without it

New Intel® Optane™ persistent memory (PMem) offers a performance layer between memory and more traditional storage. Does this flexibility translate to improved data analytics performance? To find out, we compared the performance of a Dell EMC™ PowerEdge™ R740 server powered by Intel® Xeon® Gold 5215L processors with and without Intel Optane PMem.

Using the HammerDB test utility to simulate a TPC-H-like data warehouse workload, we measured the time it took each solution to process a single stream of 22 queries and to process seven simultaneous query streams. In both of these tests, adding Intel Optane persistent memory in App Direct mode sped up query completion times. By equipping Dell EMC PowerEdge R740 servers with Intel Optane PMem, small-to-medium businesses (SMBs) could get analysis from their data-intensive applications faster, which could lead to actionable insights sooner.

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 R740 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. 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.

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 R740 solution in two configurations—one with PMem (4x 128GB modules in App Direct Mode with DAX feature enabled) and one without PMem.

Because SMBs may be especially interested in the value proposition that PMem can offer, we used standard software including Windows Server 2019 Standard and SQL Server 2019 Standard Edition. We used a 1TB database and the TPC-H-like workload of the HammerDB utility to generate our workload. 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 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.

About the Dell EMC PowerEdge R740

The Dell EMC PowerEdge R740 is a two-socket rack server built on 2nd Generation Intel Xeon Scalable processors. With support for up to 16 2.5" drives (112.88TB max), eight PCIe slots, and support for Intel Optane PMem, the PowerEdge R740 provides plenty of options to target the appropriate performance for your specific workloads. To learn more about the advantages that the Dell EMC PowerEdge R740 can provide for your workloads, visit https://www.dell.com/en-us/work/shop/povw/poweredge-r740.

How adding Intel Optane PMem returned query results faster

First, we assessed the time it took for the Dell EMC PowerEdge R740 with and without Intel Optane PMem to complete a single 22-query stream. TPC-H comprises 22 queries that the test tool issues against the database. Each 22-query set is considered a stream; in this scenario, we executed a single stream. To test the PMem, we moved the database files from the SSDs to the PMem volumes and enabled the SQL Server Hybrid Buffer Pool feature. As Figure 1 shows, adding Intel Optane PMem to the Dell EMC PowerEdge R740 sped up the time to complete the single query stream by 6.1 percent.

Dell EMC PowerEdge R740 with Intel Optane persistent memory — 56m 26s

Dell EMC PowerEdge R740 — 59m 54s

3m 28s less time
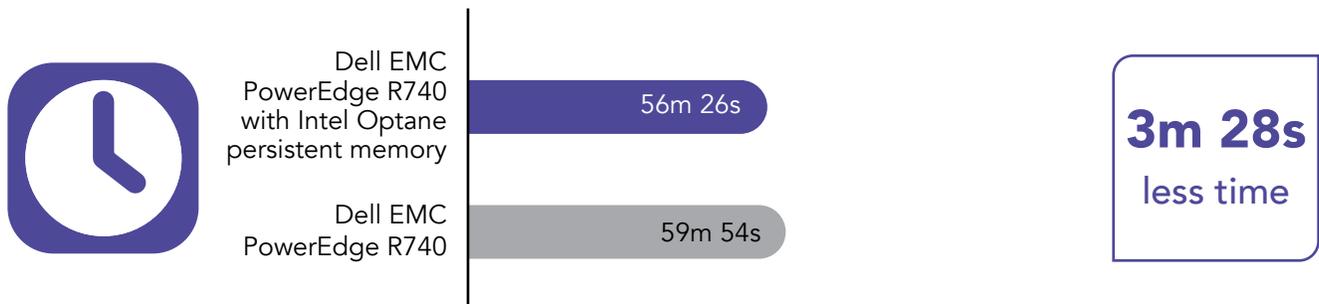
Figure 1: Time in minutes and seconds to complete a single 22-query stream. Lower is better.
Source: Principled Technologies

Then, we compared the data analytics performance of the Dell EMC PowerEdge R740 with and without Intel Optane PMem when running seven simultaneous query streams, as seven streams is the TPC-recommended number of simultaneous query set streams for a 1000-scale database. Simultaneous query streams each have the same number of queries as the single stream query set (22), but the orders are shuffled for each user. As Figure 2 shows, the addition of Intel Optane PMem offered an even greater performance boost on this test, improving completion time by 17.6 percent on average compared to the Dell EMC PowerEdge R740 without it. These performance advantages mean that adding Intel Optane PMem to your 2nd Generation Intel Xeon Scalable processor-powered Dell EMC PowerEdge R740 can enable you to get insight from data faster than without using PMem.

Dell EMC PowerEdge R740 with Intel Optane persistent memory — 1h 33m 50s

Dell EMC PowerEdge R740 — 1h 50m 27s

16m 37s less time
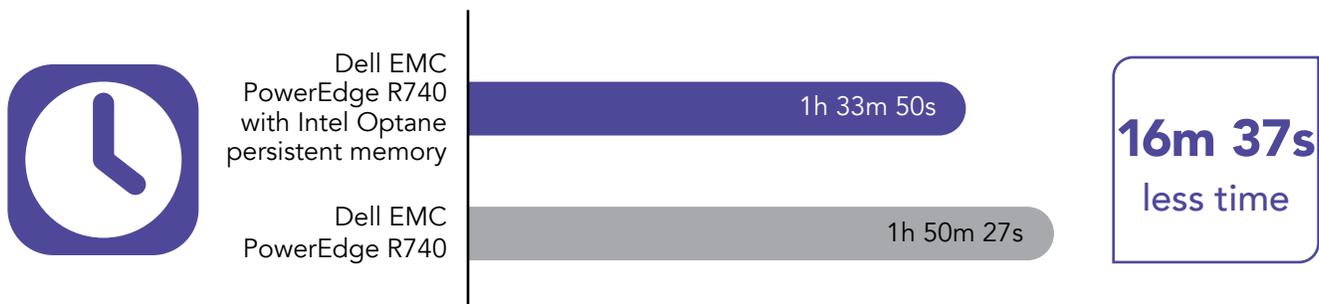
Figure 2: Average time in hours, minutes, and seconds for a query stream to complete with seven simultaneous streams running. Lower is better.
Source: Principled Technologies

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.

Boost data analytics performance by adding Intel Optane PMem to your Dell EMC PowerEdge R740

The insights your company stands to gain from data analytics are valuable, which means the faster you can get that knowledge and take action, the better. We explored one way of increasing the time-to-value of your data analysis insights: adding Intel Optane PMem to a 2nd Generation Intel Xeon Scalable processor-powered Dell EMC PowerEdge R740.

We found that adding Intel Optane PMem—which works as a performance layer between memory and storage— sped up query times on a SQL Server 2019 Standard database for both tests we performed. For a single 22-query stream, adding Intel Optane PMem to a Dell EMC PowerEdge R740 improved completion time by 6.1 percent. When running seven simultaneous query streams, the Dell EMC PowerEdge R740 with Intel Optane PMem analyzed the data in 17.6 percent less time on average than the server without it. If your SMB seeks to boost your data analysis times, adding Intel Optane PMem alongside 2nd Generation Intel Xeon Scalable processors could speed up query times and help you get valuable insights sooner.

1   Intel, "2nd Gen Intel Xeon Scalable Processors Brief," accessed July 2, 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 2, 2020,
    https://itpeernetwork.intel.com/intel-optane-dc-persistent-memory-operating-modes/#gs.1cpqsk.

3   Microsoft, "Hybrid Buffer Pool, accessed July 8, 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/4ek1495 ▶

Principled Technologies®

Facts matter.®

This project was commissioned by Dell EMC.