



2.6x
the number of
database VMs

The Dell EMC PowerEdge R940 supported 10 more database VMs with Intel Optane DC persistent memory

with Intel Optane



without Intel Optane



Support more VMs with large databases and memory footprints by adding Intel Optane DC persistent memory to your Dell EMC PowerEdge R940 server

Databases with large memory footprints can present challenges to organizations looking to upgrade server hardware. The goal is to support as many databases as possible on each new server to make the most of your investment, but memory constraints may force you to add more systems than necessary.

Adding Intel® Optane™ DC persistent memory (DCPMM) to new Dell EMC™ PowerEdge™ R940 servers can increase the number of virtual machines (VMs) with large databases and memory footprints each server can support. In the Principled Technologies data center, we compared the number of virtualized databases with large memory footprints that two new Dell EMC PowerEdge R940 configurations could support: one with Intel Optane DC persistent memory, and one without.

We found that by adding Intel Optane DC persistent memory to the Dell EMC PowerEdge R940, we increased the server memory footprint to support ten more transactional database VMs than the same new server without Intel Optane DCPMMs. Organizations on the market for an upgrade can extend the capabilities of their new Dell EMC PowerEdge R940 servers by adding Intel Optane DC persistent memory to support more VMs per server. This could translate into fewer servers to purchase, store, and manage.

About 2nd Generation Intel Xeon Scalable processors

The latest from Intel, the 2nd Generation Intel Xeon Scalable processor platform features a wide range of processors to support the workloads you run, including Bronze, Silver, Gold, and Platinum. According to Intel, the 2nd Generation Intel Xeon Scalable platform can handle a variety of workloads, including enterprise, cloud, HPC, storage, and communications.¹ This new processor line also supports a new memory and storage technology to further accelerate workloads, Intel Optane DC 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>.

Support more VMs with large databases when you use Intel Optane DC persistent memory

Straddling the line between memory and more traditional storage devices like NAND flash NVMe SSDs, Intel Optane DC persistent memory DIMMs are a new memory technology that can accelerate some data-intensive applications. So, is it memory, or is it storage? The answer is both—or either, depending on the strategy that works best for your particular workload.



Intel Optane DC persistent memory has two modes that offer flexibility for how the memory technology acts:

- **Memory Mode:** Intel Optane acts as large capacity, volatile DIMMs. Operations target DRAM first, but when DRAM is full, the Intel Optane DIMMs start handling operations themselves. Optane latency is higher than DRAM but has larger capacity for a larger overall memory footprint.
- **App Direct Mode:** The OS and applications see Intel Optane as a separate, persistent type of memory. Only applications that are persistent memory-aware, such as VMware® vSphere® or enlightened SQL Server on Linux®, can use Intel Optane in App Direct Mode.

In this study, we used Memory Mode.

To learn more about Intel Optane DC persistent memory, visit <https://www.intel.com/content/www/us/en/architecture-and-technology/optane-dc-persistent-memory.html>

How we tested Intel Optane DC persistent memory in our data center

To find out how many database VMs the Intel Optane DC persistent memory server configuration supported compared to a typical DRAM server configuration, we tested two solutions:

- Dell EMC PowerEdge R940 with DRAM and SATA SSDs
- Dell EMC PowerEdge R940 with Intel Optane DC persistent memory and SATA SSDs

We used the DVD Store 2.1 benchmark to generate our workload, and report the median of three runs. For all the details about our testing, see the [science behind the report](#).

About the Dell EMC PowerEdge R940 rack server

The four-socket Dell EMC PowerEdge R940 fits into just 3U of rack space and features the latest 2nd Generation Intel Xeon Scalable processors. With up to 24 2.5" drives and up to 12 NVMe SSDs, the R940 has ample storage and supports multiple memory types including RDIMM, LRDIMM, and DCPMM. For management, each PowerEdge server includes iDRAC9.

To learn more about the Dell EMC PowerEdge R940 rack server, visit <https://www.dell.com/en-us/work/shop/povw/poweredge-r940>.



More VMs running databases with large memory footprints

Databases are the backbone of the modern business, so fast access to data is paramount. One way to ensure strong database performance is an abundance of memory, so that more data is available for faster access to users. High-performing databases could bottleneck on RAM at peak times; we found that adding Intel Optane DC persistent memory could improve performance in situations where memory is in high demand. We used a memory-heavy application inside the VMs and found that the Dell EMC PowerEdge R940 configuration with Intel Optane DCPMM successfully supported 16 database VMs, while the regular DRAM configuration supported a maximum of 6 VMs (in three runs, it supported six, one, and three VMs respectively). This shows that adding Intel Optane DC persistent memory to the Dell EMC PowerEdge R940 could make a big difference for extending your server's ability to handle memory-intensive database workloads. By supporting more VMs on each server, your organization could reduce the number of servers you must purchase, maintain, and manage, ultimately helping your bottom line.

Number of database VMs each server supported

Higher is better



About our benchmark: DVD Store 2

To create a real-world database workload, we used DVD Store Version 2.1 (DS2). DS2 models an online store where customers log in, search for products, and make purchases. It measures the numbers of orders per minute the system can handle, which in turn demonstrates the kind of performance you could expect for your customers. DS2 also performs other actions, such as adding new customers, to exercise the wide range of database functions users require. DS2 is available for download at <https://github.com/dvdstore>.

Fit more database VMs with large memory footprints on Dell EMC PowerEdge R940 servers with Intel Optane DC persistent memory

Purchasing server hardware is a large undertaking that requires significant investment, so it's vital to plan for the most effective use of each server. We found that organizations moving to the new Dell EMC PowerEdge R940 server could support more memory-intensive databases by adding Intel Optane DC persistent memory. In our tests, adding Intel Optane DC persistent memory increased the number of database VMs by 10 compared to the server without it, which provides another option for effective resource management for hardware supporting databases with large memory footprints.



- 1 Intel, "2nd Gen Intel Xeon Scalable Processors Brief," accessed October 22, 2019, <https://www.intel.com/content/www/us/en/products/docs/processors/xeon/2nd-gen-xeon-scalable-processors-brief.html>.

Read the science behind this report at <http://facts.pt/kdqkdl9> ►



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