

Newer Dell EMC™ PowerEdge™ Servers Significantly Increase Microsoft® SQL Server® Performance

Prowess testing showed significantly higher and more balanced performance running virtual machines with SQL Server databases on a Dell EMC PowerEdge C6520 server, compared to an older Dell EMC PowerEdge C6420 server.

Executive Summary

Beyond being able to run more virtual machines (VMs) per server cluster, testing conducted by Prowess Consulting uncovered that virtualized instances of Microsoft® SQL Server® databases running on the latest-generation Dell EMC™ PowerEdge™ C6520 servers also enjoyed significant performance and efficiency advantages compared to SQL Server VMs running on older Dell EMC PowerEdge C6420 servers.

Introduction: Industry Landscape and Reasons to Modernize

In today's highly competitive environment, businesses expect more from their infrastructure. Analysts and line-of-business (LOB) managers want faster processing for large and growing datasets. IT managers strive to meet those needs by increasing performance for database applications and other demanding workloads, while staying within their constrained budgets and limited data center space. To better meet those needs affordably and efficiently, IT looks to maximize resource utilization and—wherever possible—increase consolidation of VMs and workloads.

For IT decision makers facing these challenges, the question is often whether to stretch more life out of existing hardware or to expend capital dollars today. However, in return for spending today, IT organizations can get levels of performance, utilization, and consolidation that help their businesses in the short term and reduce total cost of ownership (TCO) in the long term.

To help evaluate this decision, Prowess Consulting ran a series of benchmark tests comparing system utilization, VM density, and SQL Server performance between older-generation and newer-generation Dell EMC PowerEdge servers.

Highlights

Up to **2.2x**
VMs

Up to **67%**
lower latency

Up to **3.1x**
input/output
operations
per second
(IOPS)

Up to **4.6x**
new orders per
minute (NOPM)

Up to **13%**
less power
consumed
per VM

Dell EMC PowerEdge servers were chosen because they are one of the most common and respected hardware brands found in data centers today (Dell Technologies held the top worldwide server-market ranking in 1Q21), and because these servers are built on ubiquitous Intel® Xeon® Scalable processors and commodity storage.

For this study, we selected the Dell EMC PowerEdge C6520 server and its predecessor, the Dell EMC PowerEdge C6420 server. The Dell EMC PowerEdge C6520 server includes several significant upgrades, including newer-generation Intel Xeon Scalable processors, support for more memory, faster PCIe® 4.0 RAID controllers, and lower-latency, higher-performing KIOXIA PM6 Series enterprise Serial-Attached SCSI (SAS) solid-state drives (SSDs) for storage.

Testing the Two Systems

For testing, we configured the Dell EMC PowerEdge C6420 server as shown in Table 1.

Table 1. Dell EMC™ PowerEdge™ C6420 server configuration

System	Dell EMC™ PowerEdge™ C6420
Processor	2 x Intel® Xeon® Gold 6130 processor (16 cores, 2.1 GHz), with support for up to 6 memory channels
Memory	16 x 16 GB 2,666 megatransfers per second (MT/s) (maximum 2,933 MT/s) dual-rank error correcting code (ECC) DDR4
RAID controller	Dell™ PowerEdge RAID Controller (PERC) H330 Mini (Mezzanine) PCIe® 3.0
Storage	2 x Samsung® triple-level cell (TLC) SATA® 3.84 TB

We configured the Dell EMC PowerEdge C6520 server as shown in Table 2.

Table 2. Dell EMC™ PowerEdge™ C6520 server configuration

System	Dell EMC™ PowerEdge™ C6520
Processor	2 x Intel® Xeon® Gold 6330 processor (28 cores, 2 GHz, maximum 4 GHz), with support for up to 8 memory channels
Memory	16 x 32 GB 2,933 MT/s (maximum 3,200 MT/s) dual-rank ECC DDR4
RAID controller	Dell™ PERC H345 PCIe® 4.0
Storage	2 x KIOXIA PM6-R TLC SAS 3.84 TB

We configured both systems with VMware vSphere® 7.0 Update 2. We installed SQL Server on Windows Server® 2019 Datacenter Eval guest operating systems on 50 GB VMs, and we used HammerDB to test transaction performance on each instance. Because we standardized on 50 GB/VM and maximized the number of VMs per node that vSphere 7 with high availability (HA) enabled would allow, the greater memory on the PowerEdge C6520 servers accommodated more VMs than could the PowerEdge C6420 servers (44 VMs per cluster versus 20 VMs per cluster).²

Prowess engineers collected metrics for both the underlying systems and the VMs to measure utilization for each system. Metrics included latency, IOPS, NOPM, and power consumption per VM.

For complete configuration details and test procedures, see “Behind the Report: Newer Dell EMC™ PowerEdge™ Servers Significantly Increase Microsoft® SQL Server® Performance.”

Resource Utilization

Dell EMC PowerEdge C6520 servers in Prowess testing demonstrated impressively greater resource utilization than Dell EMC PowerEdge C6420 servers, proving themselves able to accommodate more than twice as many VMs per blade than the older servers (44 VMs per cluster versus 20 VMs per cluster, see Figure 1).²

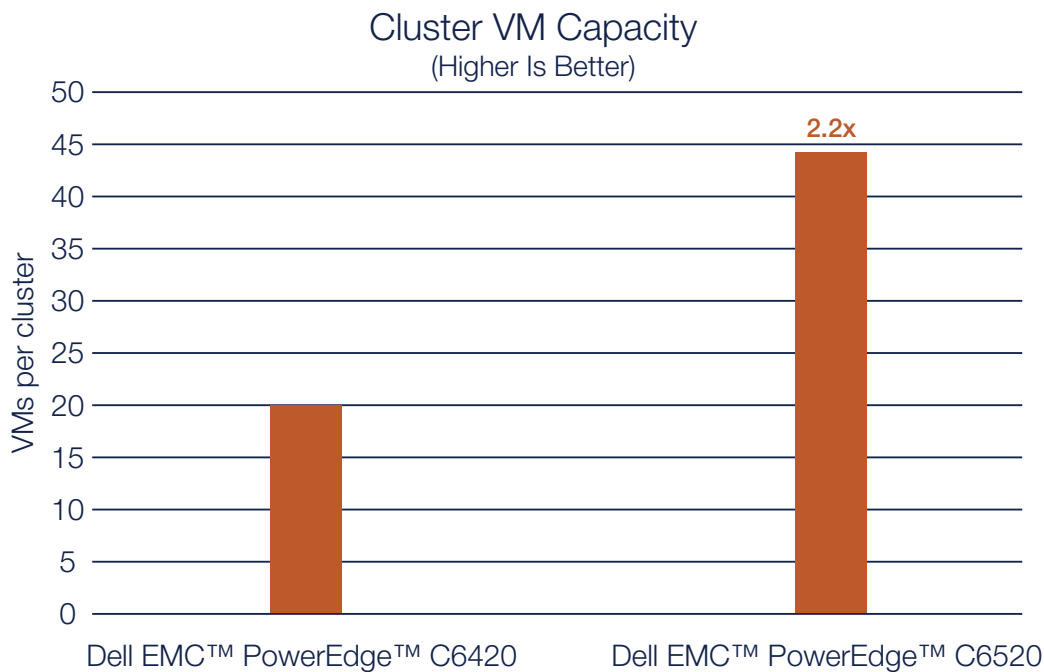


Figure 1. Comparison of the number of VMs accommodated by Dell EMC™ PowerEdge™ C6420 clusters versus Dell EMC PowerEdge C6520 clusters

Drive latency was also significantly lower on the PowerEdge C6520 servers, running between 65 percent and 67 percent lower for read/write operations than on the PowerEdge C6420 servers (see Figure 2). This improvement in latency was due to the difference in performance between the SATA drives in the PowerEdge C6420 servers and the KIOXIA SAS drives in the PowerEdge C6520 servers.

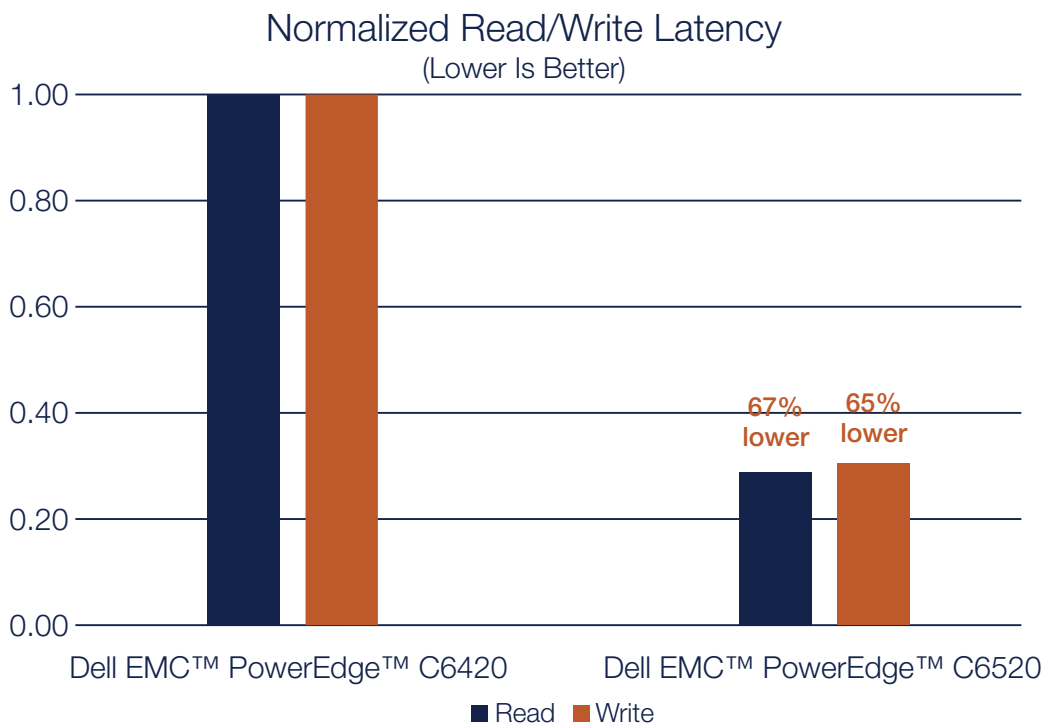


Figure 2. Normalized comparison of Dell EMC™ PowerEdge™ C6420 server versus Dell EMC PowerEdge C6520 server read/write latency

SQL Server Performance

The PowerEdge C6520 servers also posted strong performance gains over the PowerEdge C6420 servers in Prowess testing. Read/write IOPS were 2.8x to 3.1x those recorded for the PowerEdge C6420 servers (see Figure 3).

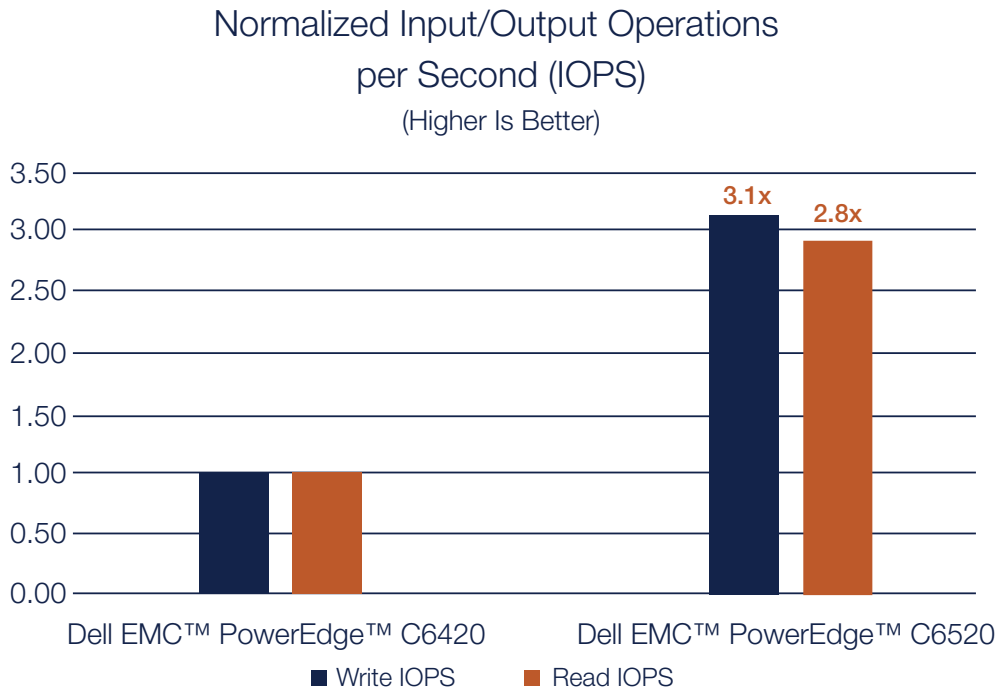


Figure 3. Normalized comparison of Dell EMC™ PowerEdge™ C6420 server versus Dell EMC PowerEdge C6520 server read/write IOPS

NOPM on the Dell EMC PowerEdge C6520 servers were even higher, clocking in at more than 4.6x that of the Dell EMC PowerEdge C6420 servers (see Figure 4).

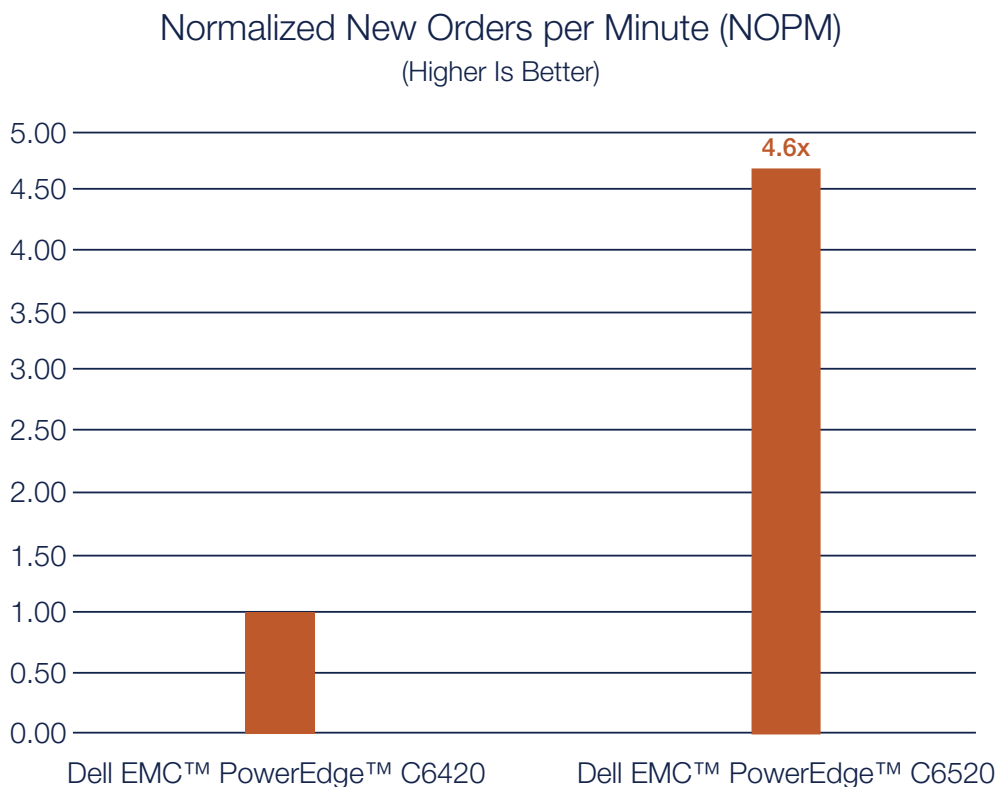


Figure 4. Normalized comparison of Dell EMC™ PowerEdge™ C6420 server versus Dell EMC PowerEdge C6520 server NOPM

Power Usage

Even with the PowerEdge C6520 servers' greater utilization and performance capabilities (and concurrently greater power consumption), our analysis uncovered an overall reduction in power usage on a per-VM basis for those servers. Despite the newer-generation system having a slightly higher power rating, it drew 13 percent less power per running VM than did the older PowerEdge C6420 platform (see Table 3 and Figure 5).

Table 3. Dell EMC™ PowerEdge™ C6420 server versus Dell EMC PowerEdge C6520 server—VM capacity and power-draw per VM

Dell EMC™ PowerEdge™ C6420	Dell EMC™ PowerEdge™ C6520
20 supported VMs per cluster	44 supported VMs per cluster
55.5 watts per VM	48.1 watts per VM

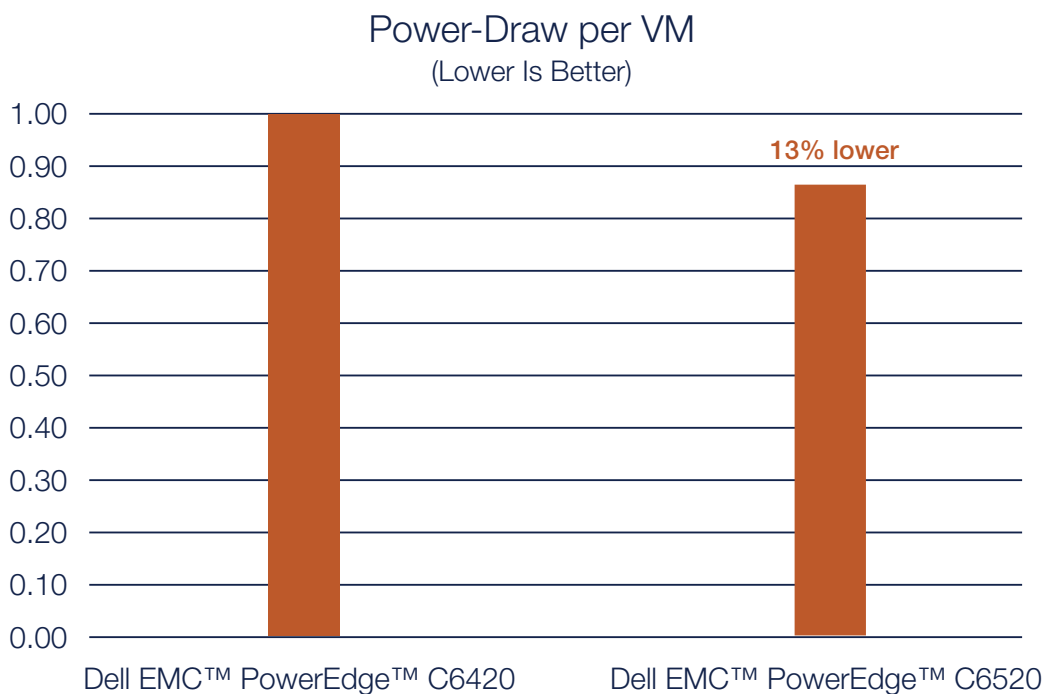


Figure 5. Normalized comparison of Dell EMC™ PowerEdge™ C6420 server versus Dell EMC PowerEdge C6520 server power-draw per VM

Technology Drivers Behind the Results

As these results show, with the new Dell EMC PowerEdge platform, users get better resource utilization and improved and more balanced VM performance with lower latencies. Several technologies help account for these gains, as discussed in the following sections.

3rd Generation Intel® Xeon® Scalable Processors

The upgraded CPU architecture in 3rd Generation Intel Xeon Scalable processors provides a higher core count and support for more DIMMs, with the Dell EMC PowerEdge C6520 server supporting eight channels per CPU versus six channels per CPU for the Dell EMC PowerEdge C6420 server. Key differences between the systems are shown in Table 4.

Table 4. Comparison of the processor and memory supported by the two Dell EMC™ PowerEdge™ server models

System	Dell EMC™ PowerEdge™ C6420	Dell EMC™ PowerEdge™ C6520
Processor	Up to two Intel® Xeon® Scalable processors per node, with up to 28 cores per processor	Up to two 3rd Generation Intel® Xeon® Scalable processors per node, with up to 40 cores per processor
Memory	12 DIMM slots for up to 512 GB per sled, DDR4 2,666 MT/s RDIMMs	16 DDR4 DIMM slots, supports RDIMM of 1 TB maximum or LRDIMM of 2 TB maximum, DDR4 3,200 MT/s

3rd Generation Intel® Xeon® Scalable processors offer several advantages over the previous generation of Intel Xeon processors:

Up to **1.60x**
memory bandwidth³

Up to **2.66x**
memory capacity⁴

Up to **1.33x**
PCIe® lanes
per processor⁵

3rd Generation Intel Xeon Scalable processors can provide even greater advantages when compared to 1st Generation Intel Xeon Scalable processors.

PCIe® Gen4 Versus PCIe Gen3 Performance

The newer-generation Dell EMC PowerEdge C6520 server includes a PCIe Gen4 interface, which doubles the data transfer speed of the previous-generation PCIe Gen3 interface from 1 GB/s per lane to 2 GB/s per lane. As a result, PCIe Gen4 provides workloads with a total of 32 GB/s in a 16-lane configuration. This equates to up to 16 GT/s per lane, in comparison to 8 GT/s for PCIe Gen3.

12GB/s SAS Versus SATA III

The newer-generation Dell EMC PowerEdge C6520 server also benefits from the increased performance provided by the SAS-based storage of the KIOXIA PM6 Series Enterprise SAS SSD compared to the SATA-based storage used in the Dell EMC PowerEdge C6420 server. The 12Gb/s SAS interface used in the KIOXIA SSDs provides 12 Gb/s transfer speed versus 6 Gb/s provided by the SATA III interface, providing an additional boost to overall server performance.

Out with the Old, in with the New

With exceptional performance gains, increased system utilization, and a lower TCO, the newer Dell EMC PowerEdge C6520 server presents a convincing case to organizations that are considering an upgrade. Although some businesses might focus on initial capital costs as an incentive to stretch the lifespan of their older servers, our testing and analysis show a clear advantage to upgrading to Dell EMC PowerEdge C6520 servers. Conversely, businesses that continue to accept lower performance might well be at a disadvantage as their competitors process more data and benefit from faster times to results and insights by making use of the latest technologies that are built into Dell EMC PowerEdge C6520 servers.

¹ IDC. "Servers Market Share." September 2021. www.idc.com/promo/servers.

² Prowess tested these servers with HA enabled on the clusters, which capped the amount of memory available to run VMs. Cluster configurations without HA enabled would be able to support more VMs per cluster.

³ 3rd Generation Intel® Xeon® Platinum 8380 processor: 8 channels, 3,200 MT/s (2 DPC) versus 2nd Generation Intel Xeon Platinum 8280 processor: 6 channels, 2,666 MT/s (2 DPC) and 1st Generation Intel Xeon Platinum 8180 processor: 6 channels.

⁴ 3rd Generation Intel® Xeon® Platinum 8380 processor: 8 channels, 2 DPC (256 GB DDR4) versus 2nd Generation Intel Xeon Platinum 8280 processor: 6 channels, 2 DPC (128 GB DDR4) and 1st Generation Intel Xeon processor: 4 channels.

⁵ 3rd Generation Intel® Xeon® Platinum 8380 processor: 64 lanes of PCIe® Gen4 per processor versus 2nd Generation Intel Xeon Platinum 8280 processor: 48 lanes of PCIe Gen3 per processor and 1st Generation Intel Xeon processor: 48 lanes.



The analysis in this document was done by Prowess Consulting and commissioned by Dell Technologies.

Results have been simulated and are provided for informational purposes only.

Any difference in system hardware or software design or configuration may affect actual performance.

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