Dell EMC™ PowerStore 7000T

Use less storage capacity for the same amount of data

36% less physical storage used*

Handle more simulated transactional database work

33% more max IOPS during an OLTP-like workload*

Retrieve data faster

21% more max IOPS with a read-heavy I/O profile*

*compared to Vendor B solution

Offer faster access to critical data and achieve greater inline data reduction with a Dell EMC PowerStore 7000T storage solution

Compared to a storage solution from another vendor, the PowerStore 7000T offered a better inline data reduction ratio and better performance during simulated OLTP and other I/O workloads

As IDC recently reported, enterprise data volumes will grow by an average of more than 42 percent from 2020 to 2022.[1] Organizations depend on users accessing data quickly, but the growth of those volumes could slow user access. A Dell EMC PowerStore 7000T storage solution could help enterprise-grade organizations limit data center sprawl, meet transactional database performance milestones, and satisfy user demands.

At Principled Technologies, we ran multiple tests on two different all-NVMe® storage solutions with 48 TB of useable capacity: a cluster of Dell EMC PowerStore 7000T arrays and a solution based on an array from another company we'll call Vendor B. Compared to the Vendor B solution, the PowerStore 7000T solution needed less rack space, used less storage capacity to store the same amount of data, and handled more input/output operations per second (IOPS) in a simulated database online transaction processing (OLTP) workload. In addition, the PowerStore 7000T solution handled more IOPS, processed more MB per second, and delivered shorter response times than the Vendor B solution when running three different I/O profiles. With a Dell EMC PowerStore 7000T storage solution, enterprises can maximize storage capacity and increase storage performance while maintaining fast response times.

How we tested

During our testing, both the Dell EMC PowerStore 7000T solution and the Vendor B solution were located in an offsite data center lab. We performed all testing remotely after traveling to the lab to inspect the server clients, the network implementation, and the storage arrays. We had full control over and unfettered access to the testbeds.

We began our test setup by creating multiple 1TB volumes (also known as logical unit numbers or LUNs) on each solution and mapped them to four VMware® ESXi™ servers connected to the arrays. We then added multiple raw device mapping (RDM) disks to Linux®-based virtual machines on both test beds. We tuned the hosts according to each storage vendor's best practices.

We tested each solution in three phases and ran each test separately three times. We use the median results for each phase for this report.

Dell EMC
PowerStore 7000T
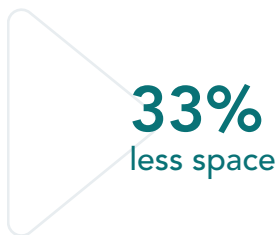
About the Dell EMC PowerStore 7000T array

The PowerStore 7000T presents an all-flash NVMe storage solution for enterprise organizations. The array supports up to 96 drives, including 25 2.5-inch NVMe drive slots, for up to 898.56 TB of raw storage capacity.[2] The Intel® Xeon® Scalable processor-powered array takes up just 2U of rack space, enabling enterprises to save on data center costs by delaying the need to expand to new rooms or even buildings. Organizations can scale up and out by clustering PowerStore 7000T arrays together and augmenting storage performance and capacity without increasing the management workload. Our PowerStore solution included two 2U arrays for a total 4U, just two-thirds of the 6U Vendor B solution.

In 2020, a PT study found that PowerStore 9000T and 9000X arrays delivered more IOPS for an OLTP-like workload, stored data more efficiently, and made it easier to provision new storage compared to an array from another vendor.[3]

To learn more about the PowerStore T series of arrays, visit https://www.delltechnologies.com/en-us/storage/powerstore-storage-appliance/powerstore-t-series.htm

Rack space

Lower is better

33%
less space

Dell EMC PowerStore 7000T solution

Vendor B solution

Figure 1: The amount of rack space each storage solution occupied: 4U for the Dell EMC solution and 6U for the Vendor B solution. Less is better. Source: Principled Technologies.

Phase 1: Data reduction. We started the test with each solution containing empty volumes. Using Vdbench, we simulated a data migration into the solutions; the 16TB dataset, which Vdbench created, had a sequential write input/output (I/O) profile using 128KB blocks, 2:1 compression and 2:1 deduplication ratios, and a single thread per volume. We collected capacity and data reduction information prior to and immediately after each test iteration to assess the inline data reduction capabilities of both solutions.

Phase 2: Simulated OLTP performance. We used Vdbench to allocate data to all logical space on the 64 1TB volumes using a sequential write I/O workload, a 2:1 compression ratio, and a 1:1 deduplication ratio. We then performed a long, fixed-rate OLTP simulation to condition the database. Finally, we ran a simulated OLTP workload with multiple I/O blocks to collect IOPS and latency data from the two storage solutions.

Phase 3: Four I/O profiles. We used Vdbench to assess the number of I/O operations each solution could handle using a mix of read and write I/O profiles. When we loaded the 64 1TB volumes, we used 2:1 compression and 2:1 deduplication ratios. We collected data on IOPS, latency, and data throughput to determine best performance.

We unmapped RDM disks and deleted volumes between each testing phase. After deleting the volumes, we let the storage solutions sit idle so they could reclaim space, and then we restarted the process of creating volumes and mapping RDM disks. Testing phases 2 and 3 used the same number of volumes and RDM disks.

Store data more efficiently

Efficient deduplication and compression free up space on storage solutions, allowing you to store more data on demand and potentially delay the need to purchase new hardware. The more usable storage capacity your storage solution offers, the more you get out of your investment.

Using its data reduction technology, which combines inline compression and inline deduplication,[4] the PowerStore 7000T solution needed 3.9 TB of physical space to store 16 TB of data. The Vendor B solution also used its data reduction technology but needed 6.15 TB of physical space to store the same 16 TB of data. The data reduction ratio for the Dell EMC solution was 4.2:1; the Vendor B solution offered a data reduction ratio of 2.6:1. Figure 2 shows the results from our data reduction testing.

36%
better data reduction

Storage capacity needed for 16 TB of data

Lower is better

Dell EMC PowerStore 7000T solution
3.90 TB — 16 TB
[Data reduction ratio 4.2:1]

Vendor B solution
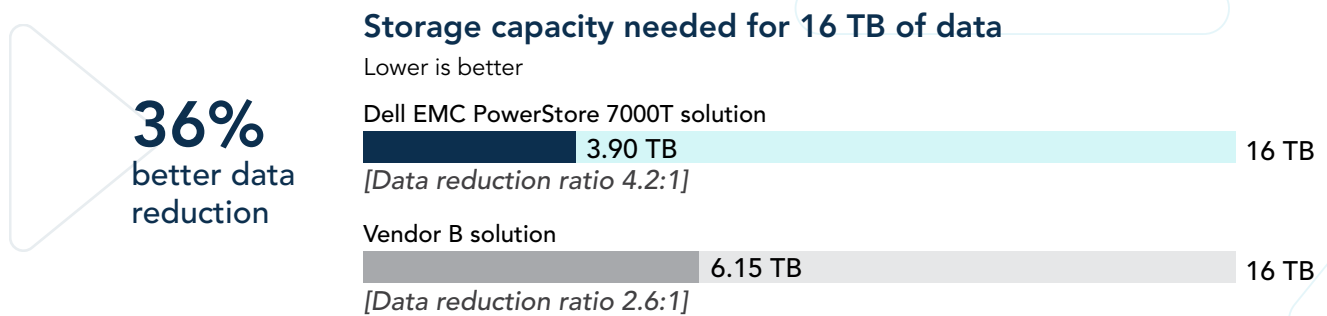6.15 TB — 16 TB
[Data reduction ratio 2.6:1]

Figure 2: Data reduction results after the Dell EMC PowerStore 7000T and Vendor B storage solutions stored 16 TB of data. Lower is better. Source: Principled Technologies.

Process more database transactions for OLTP workloads

If your company relies on OLTP databases for critical operations—as do many retail, financial, and customer service organizations—your storage solution must be able to keep up with the demands of high-performing databases quickly. Fast OLTP databases can help your business grow, while slowdowns in those databases risk frustrating users, causing delays, and affecting your business.

Running a simulated 32-thread-per-volume OLTP workload, the Dell EMC PowerStore 7000T solution achieved a max IOPS of 534,092 (133K more than the Vendor B solution achieved). Figure 3 shows the IOPS results from that workload.

33%
more
IOPS

Max IOPS with simulated 32-thread OLTP workload

Higher is better

Dell EMC PowerStore 7000T solution
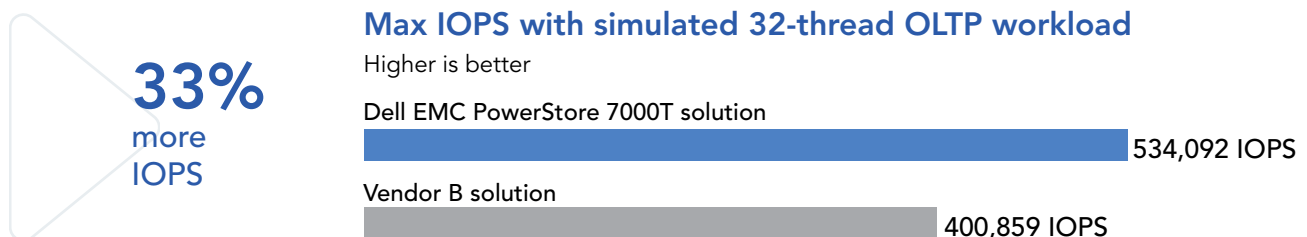534,092 IOPS

Vendor B solution
400,859 IOPS

Figure 3: IOPS results for the Dell EMC PowerStore 7000T and Vendor B storage array solutions running our simulated OLTP 32-thread workload. Source: Principled Technologies.

Support more storage I/O, deliver shorter response times, and process more data at a higher throughput

Support more IOPS

To determine each solution's ability to handle a high volume of I/O requests, we ran two Vdbench workloads on the Dell EMC PowerStore 7000T solution and the solution from Vendor B:

- An 8KB random 100 percent read workload at 32 threads, which shows how quickly each solution could retrieve information
- A 4KB random 100 percent write workload at 32 threads, which indicates how quickly the solutions could commit or save data

The Dell EMC PowerStore 7000T solution outperformed the Vendor B solution on both tests, delivering 21 percent and 37 percent more IOPS on the tests, respectively (see Figures 4 and 5). On the 8KB random read workload, the Dell EMC PowerStore 7000T solution supported 1,231,617 IOPS (the largest amount achieved in these tests). If you look at these two tests together, the Dell EMC PowerStore 7000T solution outperformed the Vendor B solution on two different workloads and could better support periods of heavy activity than the Vendor B solution.

21%
more IOPS

Max IOPS with 8KB 32-thread random read workload
Higher is better

Dell EMC PowerStore 7000T solution

1,231,617 IOPS

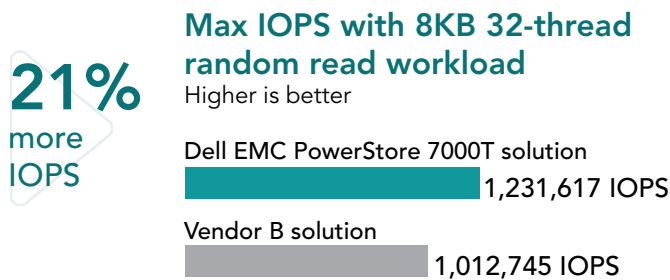Vendor B solution

1,012,745 IOPS

Figure 4: Number of IOPS supported by each solution while running an 8KB 32-thread random read workload on the Vdbench benchmark. Higher is better. Source: Principled Technologies.
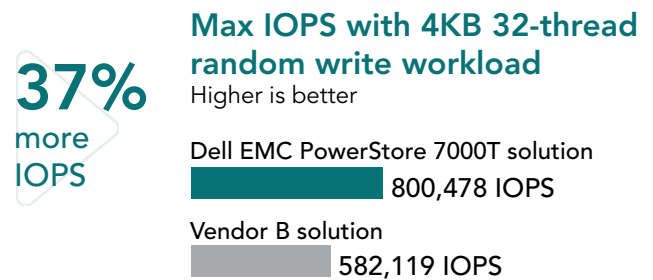
37%
more IOPS

Max IOPS with 4KB 32-thread random write workload
Higher is better

Dell EMC PowerStore 7000T solution

800,478 IOPS

Vendor B solution

582,119 IOPS

Figure 5: Number of IOPS supported by each solution while running a 4KB 32-thread random write workload on the Vdbench benchmark. Higher is better. Source: Principled Technologies.

About Vdbench

Vdbench is an open-source benchmarking tool that generates I/O loads to stress storage arrays and simulate real-world workloads. It shows the maximum rate of IOPS a solution can handle along with the latency and bandwidth it delivers while processing those IOPS. For details on the workloads we configured and used in our testing, see the science behind the report.

Deliver shorter response times

While running a 32KB 70 percent read workload at four threads, we also measured each storage solution's response time. The Dell EMC PowerStore 7000T solution reported submillisecond latencies, but the Vendor B solution did not (see Figure 6). Compared to the Vendor B solution, the PowerStore 7000T solution supported 30 percent more IOPS (see Figure 7) at a 23 percent lower latency. These results indicate that the Dell EMC PowerStore 7000T could process heavy user request loads while still delivering fast response times, potentially improving application response times.
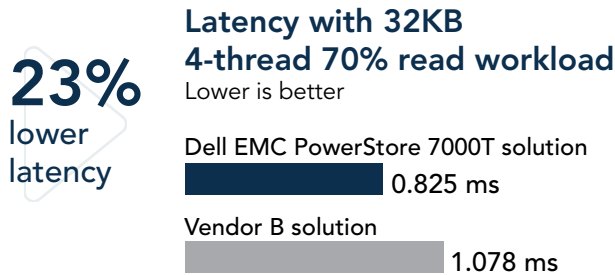
23%
lower latency

Latency with 32KB 4-thread 70% read workload
Lower is better

Dell EMC PowerStore 7000T solution
0.825 ms

Vendor B solution
1.078 ms

Figure 6: Response time (milliseconds) delivered during the 32KB 70 percent read workload. Lower is better. Source: Principled Technologies.

30%
more IOPS

IOPS with 32KB 4-thread 70% read workload
Higher is better

Dell EMC PowerStore 7000T solution
308,984 IOPS
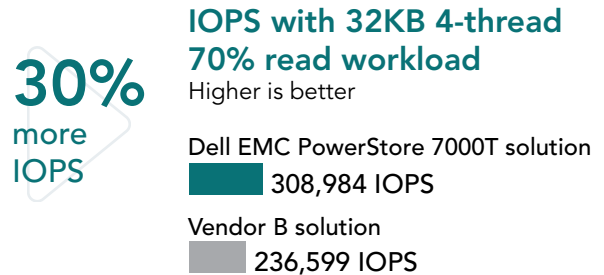
Vendor B solution
236,599 IOPS

Figure 7: Number of IOPS supported by each solution during the 32KB 70 percent read workload. Higher is better. Source: Principled Technologies.

Process more data at a higher throughput

To test how much data each solution could transfer per second, we ran another Vdbench workload with large 256KB blocks of data in a sequential 100 percent read I/O profile. The Dell EMC PowerStore 7000T solution outperformed the Vendor B solution, supporting up to 5.2 times the bandwidth by processing up to 48,850 MB/s (see Figure 8). A storage solution with high bandwidth capabilities helps process more data for large requests such as streaming video or in big data applications.

5.2X
more MB/s

Max throughput with 256KB 32-thread sequential read workload
Higher is better

Dell EMC PowerStore 7000T solution
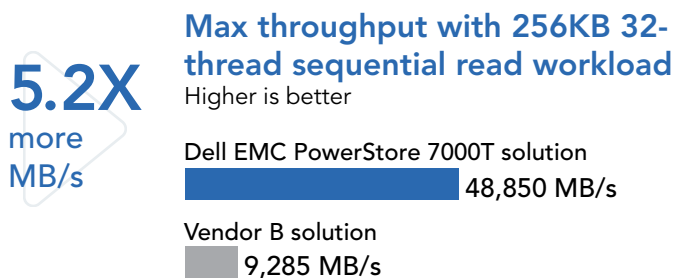48,850 MB/s

Vendor B solution
9,285 MB/s

Figure 8: Amount of bandwidth (MB/s) while running a Vdbench workload with 256KB blocks of data. Higher is better. Source: Principled Technologies.

Dell EMC PowerStore 7000T

Conclusion

Storing critical data for continued use and growth can require significant storage capacity. Enterprise-grade storage solutions can meet your raw capacity needs, but they offer varied data reduction capabilities and levels of performance. In a head-to-head comparison against a similar all-NVMe solution from Vendor B that required more rack space, the Dell EMC PowerStore 7000T solution offered better inline data reduction capabilities. It also supported better simulated OLTP database performance than the Vendor B solution (up to 33 percent more IOPS), and delivered better performance in IOPS, throughput, and latency for four other I/O profiles. Choosing the Dell EMC solution could allow you to make better use of your storage, better support ecommerce and similar transactional database workloads, and help control data center sprawl.

1   Stephanie Condon, "Enterprises are collecting more data, but do they know what to do with it?" accessed September 23, 2021, https://www.zdnet.com/article/enterprises-are-collecting-more-data-but-do-they-know-what-to-do-with-it/.

2   Dell Technologies, Dell EMC PowerStore Storage Family, accessed September 23, 2021, https://www.delltechnologies.com/en-us/storage/powerstore-storage-appliance.htm#tab0=0&pdf-overlay=//www.delltechnologies.com/asset/en-us/products/storage/technical-support/h18143-dell-emc-powerstore-family-spec-sheet.pdf

3   Principled Technologies, "Enable greater data reduction, storage performance, and manageability with Dell EMC Power-Store storage arrays," accessed September 23, 2021, https://www.principledtechnologies.com/Dell/PowerStore-9000T-9000X-storage-arrays-0520.pdf.

4   Dell Technologies, "Dell EMC PowerStore: Data Efficiencies," accessed September 30, 2021, https://www.delltechnologies.com/asset/en-us/products/storage/industry-market/h18151-dell-emc-powerstore-data-efficiencies.pdf.

Read the science behind this report at http://facts.pt/yon14zf ▶

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