PROWESS

Maximize Performance, Efficiency, and Usability for Enterprise Storage

Testing by Prowess Consulting weighed workload performance, latency impact from snapshot creation, data reduction, and management simplicity between Dell Technologies and IBM enterprise storage solutions.

Executive Summary

The enterprise storage market is projected to increase by $11.6 billion by 2028, reflecting a compound annual growth rate of 4.39%.[1] This growth is driven in part by a shift toward time-sensitive and high-performance apps, easy-to-use management, deployment flexibility, infrastructure scalability, and rising data volumes. To take full advantage of evolving storage technologies and get the most from their IT investments, enterprises need reliable information about critical areas such as storage performance, storage efficiency, and management simplicity.

Testing by Prowess Consulting examined these critical areas, comparing the Dell PowerStore™ 500T and IBM FlashSystem® 5300 enterprise storage solutions. Our analysis shows the PowerStore solution excels in important ways over the IBM FlashSystem solution and demonstrates many benefits that could make it a strong option for today's enterprise. For example, our test results confirm that the PowerStore 500T solution offers better data reduction, lower latency during snapshot creation, and higher input/output operations per second (IOPS) for small write workloads than the IBM FlashSystem 5300 solution. Additionally, the PowerStore dashboard simplifies management, requiring fewer steps and interfaces to provision volumes compared to the IBM FlashSystem solution. These advantages can translate into significant operational benefits, including improved performance, energy and space efficiency, and ease of use, which can all contribute to a lower overall total cost of ownership (TCO).

Highlights

Compared to the IBM FlashSystem® 5300 solution, the Dell PowerStore™ 500T solution provides up to:

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52x lower latency during snapshot creation

2.3x higher data reduction ratio (DRR)

1.66x the write performance

2.3x fewer steps to provision volumes
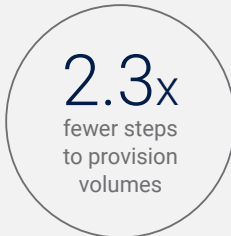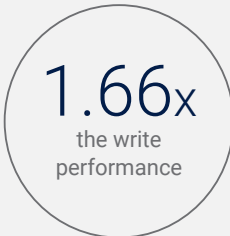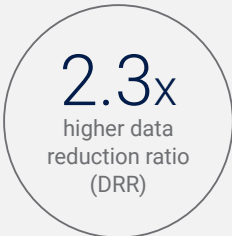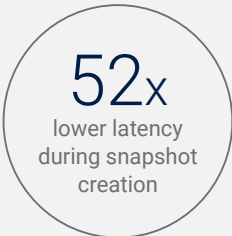
Today's Need for Speed: Your Business Adaptability Depends on Storage Performance and Efficiency

Businesses must move quickly to succeed in today's dynamically changing markets. The adaptability of your data-driven business depends on collecting, storing, and analyzing vast volumes of data. This means you need a data-storage platform that delivers high performance, high capacity, and low latency and that can accommodate the most complex, demanding workloads while also enabling you to consolidate infrastructures for space and energy savings. The ideal unified storage platform should remove the complexity of storing data from multiple sources and in a wide variety of formats—such as block, file, and VMware vSphere® virtual volumes (vVols). To help keep admin costs down, you need storage volumes that are easy to manage.

When analyzing the TCO benefits of any solution, you will look beyond initial capital expenses (CapEx) and consider your *total* costs, which are dependent on operational factors such as system reliability and application response times (both of which translate into customer experience or user productivity), physical and energy footprints, and administrative time and labor. Review these expenses over 2–3 years to gain a more complete picture of the true costs, rather than just the initial upfront cost.

How We Tested, What We Found

In order to find answers to these mission-critical considerations, Prowess Consulting examined two enterprise storage platforms: Dell PowerStore 500T and IBM FlashSystem 5300. Our engineers ran tests comparing workload performance during snapshot creation, overall workload performance, data reduction, and management ease of use.

For the test setup, our engineers created logical unit numbers (LUNs) on the Dell PowerStore and IBM storage systems and exposed the LUNs to the VMware ESXi™ host. We added the LUNs as raw device mappings to eight Linux®-based VMware virtual machines (VMs), and we then used Vdbench—an application that simulates a controlled input/output (I/O) load—to generate data on the LUNs.

We configured and tuned the storage arrays and hosts of both systems according to each storage vendor's published best practices. We used Fibre Channel connections for optimal network performance. Because the PowerStore system has compression and deduplication enabled by default, we also enabled compression and deduplication on the IBM FlashSystem solution. To ensure manageable test times for both systems, and because the data reduction ratio (DRR) is not influenced by dataset size, we created a 1.6 TB dataset using Vdbench to test the solutions' DRR capabilities.

Our engineers ran the same Vdbench tests on both systems and measured:
- The latency of ongoing I/O workloads during snapshot creation
- The DRR achieved by storage arrays arrays following snapshot creation and expiration

For complete details on system configurations, step-by-step workflows, and configuration files, refer to the **Methodology**.

I/O Performance During Snapshot Creation

Organizations rely on high-performance enterprise applications to keep productivity high and meet customer expectations. These include critical data-protection mechanisms, such as snapshots, which should not generate extended I/O latencies. This type of performance gap has the potential to disrupt or even fail critical systems, and even the smallest amount of downtime can be costly due to lost productivity, delays to market, loss of customer trust, or missed revenue opportunities.

We designed our storage performance test to measure the impact of snapshot creation on active I/O performance. We used Vdbench to generate 50/50 read/write workloads, a common enterprise mixed workload type, and we created 10 hourly rolling snapshots, targeting an active workload of 50K IOPS and measuring the I/O latency in milliseconds (ms). The IBM FlashSystem solution demonstrated I/O workload latency during snapshot creation of up to 36.63 ms (30-second rolling average), far exceeding what we consider an acceptable latency of 1 ms or less for enterprise workloads. The PowerStore system latency, on the other hand, came in at 0.69 ms, or 52x lower than the IBM FlashSystem solution (see Figure 1).
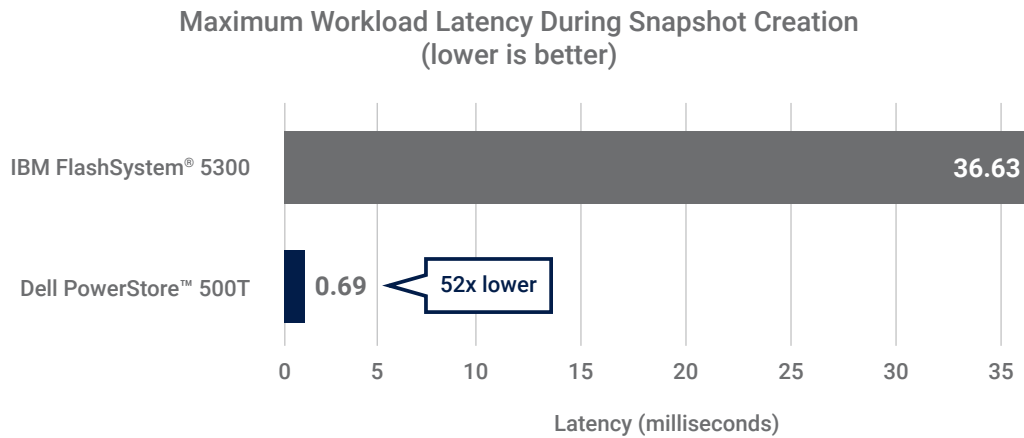
Maximum Workload Latency During Snapshot Creation
(lower is better)

Figure 1 | Comparison of maximum workload latency during snapshot creation

Data Reduction Ratio

When shopping for enterprise storage solutions, we recommend looking for a solution that provides a high DRR, which can help maximize storage and space efficiency. The DRR shows you the difference between a storage platform's physical capacity out of the box versus its effective capacity, which is measured after the storage operating system (OS) applies data compression and deduplication to the reducible data.

To test the data-reduction capabilities of both systems, each array contained empty LUNs (with no data stored) at the start of our testing. We used Vdbench to simulate the migration of an active workload into the arrays using a 1.6 TB dataset, a 2:1 deduplication ratio, and a 2.5:1 compression ratio.

We collected ongoing I/O latency and data-reduction results from simulated active workloads running on both storage arrays. To simulate a live production environment, we collected DRR measurements after allowing the snapshots to expire and waiting for the systems to settle.

Note: The IBM FlashSystem screen for Pool Properties shows a higher data reduction value than that displayed in Capacity Savings in the top-level dashboard view. To ensure a fair comparison of data reduction, we used the IBM FlashSystem Pool Properties report's value, the higher of the two, and compared this to the PowerStore Storage Capacity value.

After hours of running I/O loads and rolling-snapshot operations on the Vdbench dataset, the PowerStore system delivered a DRR of 6.2:1, which is higher than the guaranteed DRR of 5:1.[2] Under the same test conditions, the IBM FlashSystem solution only achieved a DRR of 2.6:1, a difference of 2.3x (see Figure 2). This difference in DRR can mean greater savings in terms of rack space and electricity usage. We also noted the PowerStore 500T system supports up to 50,000 snapshots per system, compared to 15,863 snapshots per system for the IBM FlashSystem solution.
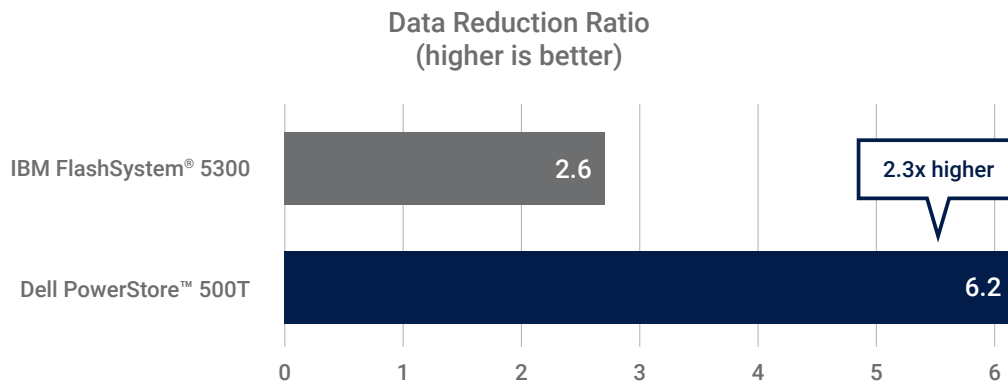
Data Reduction Ratio
(higher is better)

Figure 2 | Comparison of data reduction ratio (DRR)

Figure 3 shows how the PowerStore system's higher DRR enables data to be stored more efficiently than the IBM FlashSystem solution. High data-storage efficiency is important for calculating your true TCO—solutions that seem cheaper upfront might end up being more expensive over time because they require more physical infrastructure to store equivalent volumes of data, in addition to requiring more electricity to power and cool that infrastructure. High data-storage efficiency also reduces the number of drives needed to support future growth and helps conserve rack space and power usage over the lifetime of your storage systems. Another PowerStore feature that can help optimize cost savings is the solution's support of scale-outs in increments as small as one drive. This combination of efficiency and scalability enables you to fine-tune TCO as your storage needs grow.
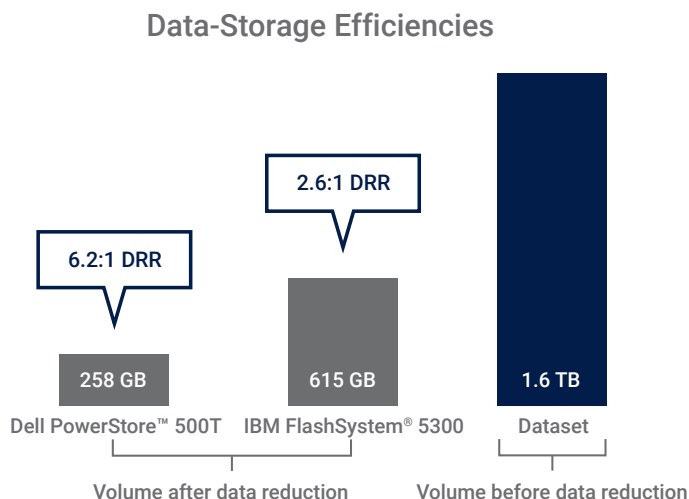
Data-Storage Efficiencies

2.6:1 DRR

6.2:1 DRR

258 GB
615 GB
1.6 TB

Dell PowerStore™ 500T   IBM FlashSystem® 5300   Dataset

Volume after data reduction   Volume before data reduction

Figure 3 | Comparison of data-storage efficiencies

Overall Workload Performance

We also analyzed both systems for overall workload performance. We tested small-write workloads because they represent the mainstay of many time-sensitive, high-performance enterprise database apps, such as online transaction processing (OLTP).

After using Vdbench to generate an I/O load, our engineers recorded workload performance as IOPS and latency as milliseconds for both systems. Again, the PowerStore system significantly outperformed the IBM FlashSystem solution. Figure 4 shows that the IBM FlashSystem solution delivered 79,498 write IOPS performance and 1.60 ms latency, whereas the Dell PowerStore system delivered 132,290 write IOPS performance and 0.96 ms latency—1.66x the performance in both categories.
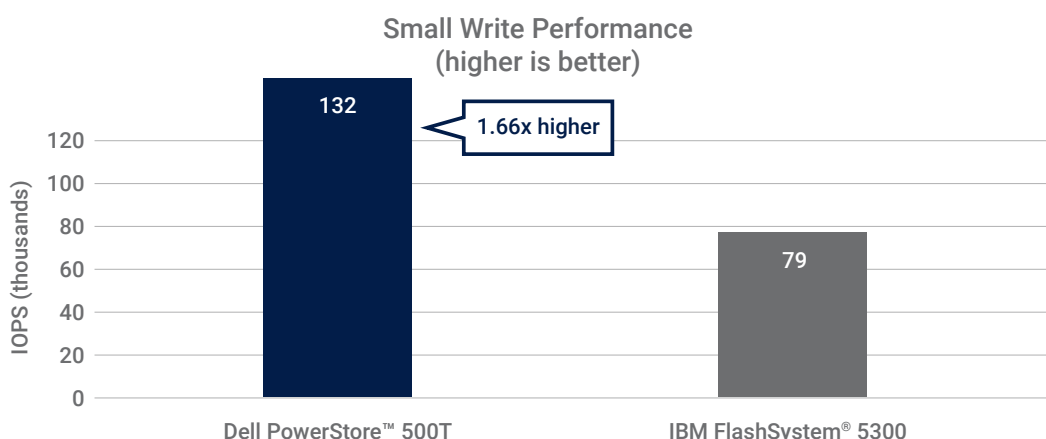
Small Write Performance
(higher is better)

IOPS (thousands)

132
1.66x higher
79

120
100
80
60
40
20
0

Dell PowerStore™ 500T   IBM FlashSystem® 5300

Figure 4 | Comparison of small write workload performance

Ease of Management

The ideal management dashboard should offer deep visibility into your storage volumes and present the information in an easy-to-understand graphical interface. A unified storage platform that can handle multiple data types can help streamline storage management chores. Having a single graphical user interface (GUI) that gives you all the controls you need with a few mouse clicks can be a huge time-saver when you need to provision volumes or migrate datasets. And if it's easy to use, you can cut down on costly tech support calls.

The PowerStore system can handle block, file, and vSphere vVols on one unified platform. The PowerStore system can handle block, file, and vSphere vVols on one unified platform. The IBM FlashSystem solution, on the other hand, does not support file storage, though it does support block and vSphere vVols storage.

To quantify ease of management, our engineers measured the number of mouse clicks and interface windows they needed to create LUNs on each system. We found that the PowerStore system required only 10 clicks, all performed in a single GUI, to provision a LUN (Figure 5). By comparison, the IBM FlashSystem solution required 2.3x more clicks—23 clicks—and three dialog screens.
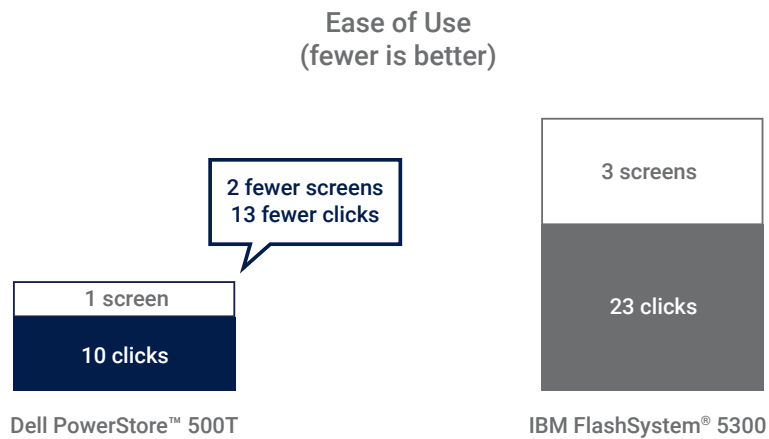
Ease of Use
(fewer is better)

Figure 5 | Comparison of management ease of use

The PowerStore solution's GUI allows you to quickly "drag and zoom in" to a specific time range within any performance report. The IBM FlashSystem solution requires opening multiple windows to view similar details.

Figure 6 illustrates the PowerStore dashboard's more granular view, showing reducible and nonreducible data at the system and volume level. This level of detail enables you to easily identify nonreducible, low-priority workloads that could be migrated to economical, low-power storage.
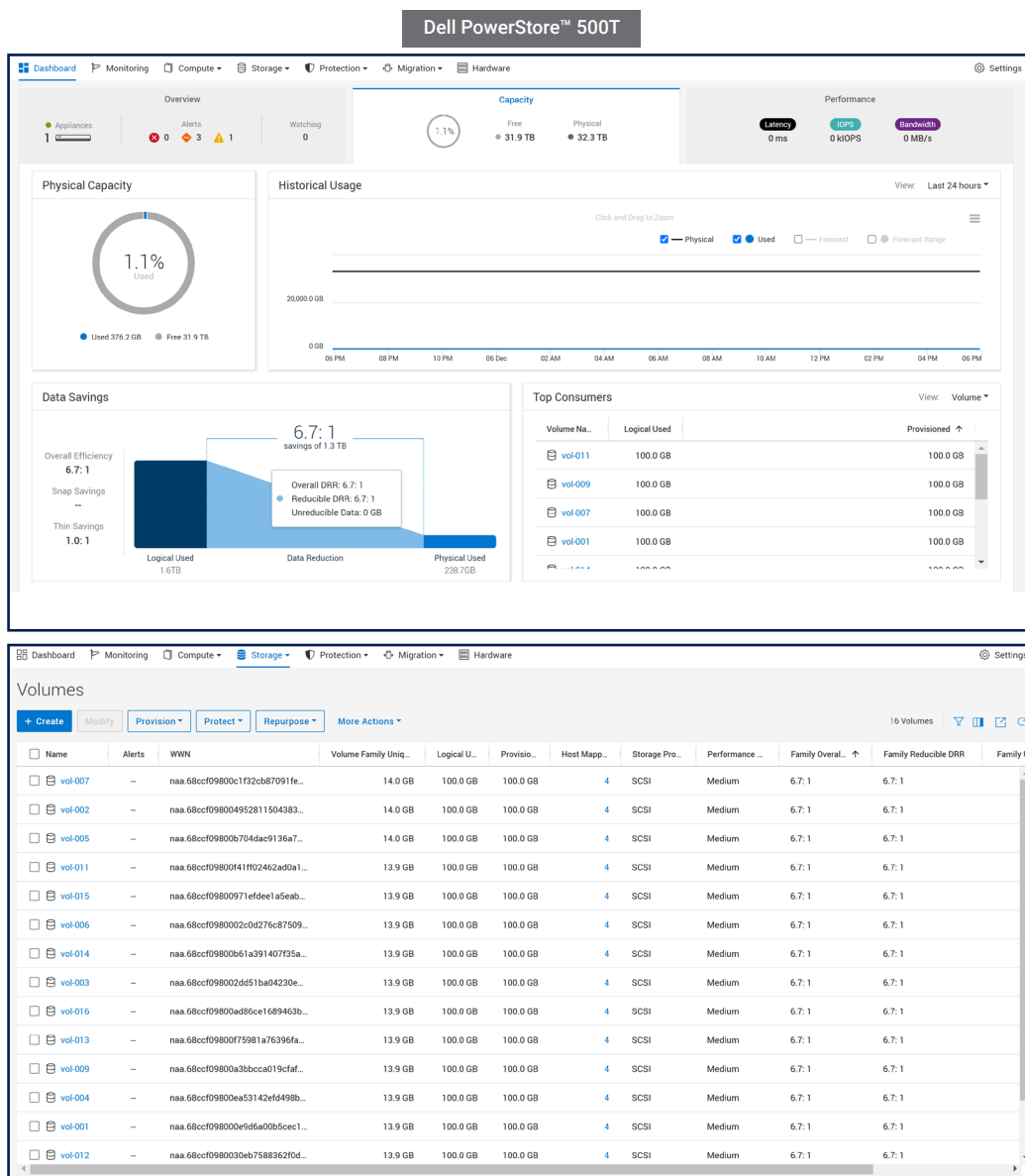
Management Dashboards
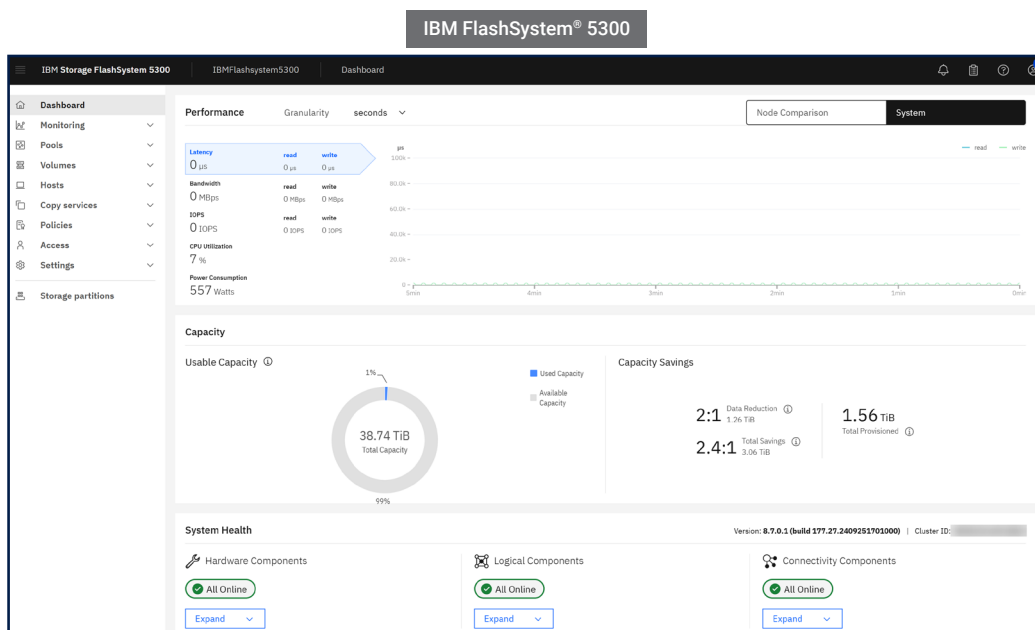
Figure 6 | Comparison of the management dashboards

Choose Better Performance for Better Business Value

Our testing revealed that the Dell PowerStore 500T solution is an enterprise-grade storage platform that can help organizations handle today's massive data volumes and latency-sensitive enterprise apps. In our side-by-side analysis, the PowerStore storage solution outperformed the IBM FlashSystem solution in multiple categories, with:

- Dramatically lower I/O latencies during snapshot creation, up to 52x lower
- Up to 2.3x higher DRR—6.2:1 versus 2.6:1
- Significantly higher performance for small write workloads—up to 1.66x the write performance
- 2.3x fewer steps needed, using a single GUI, to provision volumes

The Dell PowerStore storage solution's significantly better DRR can help reduce TCO in the short and long term compared to the IBM FlashSystem solution.

Learn More

Visit **Dell PowerStore** to explore the broad portfolio of Dell Technologies enterprise storage solutions.

Learn more about Dell PowerStore by reading the **Dell PowerStore Manager Overview** white paper.

Appendix

Table 1 shows the storage system configurations used for testing. For complete details on system configurations, workflow, and configuration files, refer to the **Methodology**.

Table 1 | Storage platform configurations

Component	Testing VM	Dell PowerStore™ 500T	IBM FlashSystem® 5300
Number of CPUs	6 virtual CPUs	1 per node, 2 nodes per storage system	1 per node, 2 nodes per storage system
Total Cores		24	24
CPU Clock Rate		2.2 GHz	2.0 GHz
Storage Controller 1: Number of Drives	1 (operating system [OS])		
Storage Controller 2: Number of Drives	2 (test volumes)	12 x NVM Express® (NVMe®) solid-state drive (SSD) TLC 3.8 TB	12 x 4.8 TB 2.5-inch IBM FlashCore® Module (FCM) field-replaceable unit (FRU)
Memory	24 GB	96 GB per node	128 GB per node
Number of DIMMs		6 x 16 GB per node	
OS	Red Hat® Enterprise Linux®		
OS Version	8.3		
OS Kernel	5.4.17-2102.201.3.el8uek. x86_64		

Endnotes

[1] Technavio. "**Enterprise Data Storage Market Analysis North America, Europe, APAC, South America, Middle East and Africa - US, Germany, China, UK, Japan - Size and Forecast 2024-2028**." June 2024.

[2] Dell Technologies. "**Future-Proof Your Savings with PowerStore's Advanced Data Reduction**." October 2024.