



Lower storage costs and increase efficiency with the superior data reduction capabilities of Dell PowerStore

This document describes what we tested, how we tested, and what we found. To learn how these facts translate into real-world benefits, read the report Lower storage costs and increase efficiency with the superior data reduction capabilities of Dell PowerStore.

We concluded our hands-on testing on February 17, 2025. During testing, we determined the appropriate hardware and software configurations and applied updates as they became available. The results in this report reflect configurations that we finalized on February 17, 2025 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears.

# Our results

To learn more about how we have calculated the wins in this report, go to http://facts.pt/calculating-and-highlighting-wins. Unless we state otherwise, we have followed the rules and principles we outline in that document.

Table 1 shows the physical and effective capacity of the Dell PowerStore solution, the three competing array-based storage solutions, and the two HCI solutions.

Table 1: Logical and effective storage capacity of the Dell PowerStore 500T and the competing array-based storage solutions. Greater effective capacity is better. Source: Principled Technologies.

	Total logical data	Data reduction ratio	Physical space needed to store 6 TB of data	Percentage of physical space saved with PowerStore
		Higher is better	Lower is better	
Dell PowerStore solution	6 TB	5.4:1	1,116.51 GB	N/A
Storage vendor A solution	6 TB	2.9:1	2,071.87 GB	46.11%
Storage vendor C solution	6 TB	4.2:1	1,432.77 GB	22.07%
Storage vendor L solution	6 ТВ	4.1:1	1,467.51 GB	23.92%
HCI Vendor G solution	6 TB	2.0:1	3,002.00 GB	62.81%
HCI Vendor U solution	6 TB	1.7:1	3,531.11 GB	68.38%



# System configuration information

### Server

Table 2: Detailed information on the systems we tested.

ze (GB) 32 pe DDR4 DDRAM peed (MHz) 2,666	old 6126
on-default BIOS settings N/A ate of last OS updates/patches applied 10/30/24 Balanced occessor umber of processors 2 endor and model Intel® Xeon® G ore count (per processor) 12 ore frequency (GHz) 2.60 emory module(s) otal memory in system (GB) 256 umber of memory modules 8 endor and model Hynix® HMA84 ze (GB) 32 pe DDR4 DDRAM peed (MHz) 2,666	old 6126
ate of last OS updates/patches applied       10/30/24         power management policy       Balanced         occessor       2         umber of processors       2         endor and model       Intel® Xeon® G         pore frequency (GHz)       2.60         emory module(s)       256         umber of memory modules       8         endor and model       Hynix® HMA84         ze (GB)       32         pe       DDR4 DDRAM         peed (MHz)       2,666	old 6126
ower management policy       Balanced         occessor       2         umber of processors       2         endor and model       Intel® Xeon® G         ore count (per processor)       12         ore frequency (GHz)       2.60         emory module(s)       256         umber of memory modules       8         endor and model       Hynix® HMA84         ze (GB)       32         pe       DDR4 DDRAM         peed (MHz)       2,666	old 6126
ocessor umber of processors and model Intel® Xeon® G Intel® Xeon®	old 6126
umber of processors2endor and modelIntel® Xeon® Gore count (per processor)12ore frequency (GHz)2.60emory module(s)256otal memory in system (GB)256umber of memory modules8endor and modelHynix® HMA84ze (GB)32peDDR4 DDRANpeed (MHz)2,666	old 6126
endor and model Intel® Xeon® G ore count (per processor) 12 ore frequency (GHz) 2.60 emory module(s) otal memory in system (GB) 256 umber of memory modules 8 endor and model Hynix® HMA84 ze (GB) 32 pe DDR4 DDRAM peed (MHz) 2,666	old 6126
bore count (per processor) 12 2.60 emory module(s) otal memory in system (GB) 256 umber of memory modules 8 endor and model Hynix® HMA84 ze (GB) 32 ppe DDR4 DDRAM peed (MHz) 2,666	old 6126
pore frequency (GHz)       2.60         emory module(s)       256         ontal memory in system (GB)       256         umber of memory modules       8         endor and model       Hynix® HMA84         ze (GB)       32         pe       DDR4 DDRAM         peed (MHz)       2,666	
emory module(s) tal memory in system (GB) 256 umber of memory modules 8 endor and model Hynix® HMA84 ze (GB) 32 pe DDR4 DDRAM peed (MHz) 2,666	
bital memory in system (GB)     256       umber of memory modules     8       endor and model     Hynix® HMA84       ze (GB)     32       pe     DDR4 DDRAM       peed (MHz)     2,666	
umber of memory modules     8       endor and model     Hynix® HMA84       ze (GB)     32       pe     DDR4 DDRAM       peed (MHz)     2,666	
endor and model Hynix® HMA84 ze (GB) 32 pe DDR4 DDRAM peed (MHz) 2,666	
ze (GB) 32 pe DDR4 DDRAM peed (MHz) 2,666	
peed (MHz) 2,666	GR7JJR4N-VK
Deed (MHz) 2,666	
peed running in the server (MHz) 2,666	
ocal storage	
umber of drives 2	
rive vendor and model Samsung® MZ	7LH960HAJR0D3
rive size (GB) 960	
rive information (speed, interface, type) 6 Gbps SSD	
etwork adapter	
endor and model Broadcom® BC	M57416
umber and type of ports 2 x 10GbE	
river version bnxtnet	
poling fans	
endor and model Dell high perfo	
umber of cooling fans 6	ormance cooling fan

Dell PowerEdge 740	
Power supplies	
Vendor and model	CMPGM 0CMPGM
Number of power supplies	2
Wattage of each (W)	1,100

### Storage

Table 3: Information on the Dell PowerStore™ 500T we tested.

Storage configuration information	Dell PowerStore 500T
Controller firmware revision	4.0.0.1 Release, Build 2334337
Number of storage controllers	2
Number of storage shelves	1 base enclosure
Number of drives per shelf	12 on base enclosure
Drive vendor and model number	Dell 005054042
Number of drives	12
Drive size (TB)	3.8
Drive information (speed, interface, type)	NVMe® SSD TLC

Table 4: Information on the HCI Vendor G solution we tested.

Storage configuration information	HCI Vendor G solution
Number of drives	48
Drive size (TB)	3.2
Drive information (speed, interface, type)	PCle 4.0 x4, NVMe

Table 5: Information on the HCI Vendor U solution we tested.

Storage configuration information	HCI Vendor U solution
Number of drives	48
Drive size (TB)	3.2
Drive information (speed, interface, type)	PCIe 4.0 x4, NVMe

Table 6: Information on the Storage Vendor A solution we tested.

Storage configuration information	Storage Vendor A solution
Number of storage controllers	2
Number of storage shelves	1 base enclosure
Number of drives per shelf	24 on base enclosure
Number of drives	24
Drive size (TB)	1.92
Drive information (speed, interface, type)	NVMe

Table 7: Information on the Storage Vendor C solution we tested.

Storage configuration information	Storage Vendor C solution
Number of storage controllers	2
Number of storage shelves	1 base enclosure
Number of drives per shelf	10 on base enclosure
Number of drives	10
Drive size (TB)	18.6
Drive information (speed, interface, type)	NVMe

Table 8: Information on the Storage Vendor L solution we tested.

Storage configuration information	Storage Vendor L solution
Number of storage controllers	2
Number of storage shelves	1 base enclosure
Number of drives per shelf	12 on base enclosure
Number of drives	12
Drive size (TB)	4.8
Drive information (speed, interface, type)	NVMe

## How we tested

#### Setting up our test beds

For our Dell PowerStore 500T, competitor arrays, and HCI solution tests, we used one or more Dell PowerEdge servers for housing our load generation VM. Each host was equipped with dual 100GbE uplinks and two dual-port 32GB Emulex Fibre Channel adapters. We conducted all testing for the PowerStore 500T and competitor array solutions using the Fibre Channel storage protocol, configuring the array to use 16 ports connected to a 48-port Fibre Channel switch. We employed 100GbE switches for testbed management and VM traffic. We also ensured that the setups for the Dell PowerStore 500T, competitor arrays, and HCI solution closely followed the best practices published by each storage vendor.

#### Testing data reduction

For all our tests, we used a CentOS 7 VM with eight vCPUs and 48 GB of RAM running Vdbench 5.04.07. For Dell PowerStore, we provisioned twelve 500GB LUNs to the virtual machine as a raw device mapping (RDM disks). For HCI Vendor U, we created twelve 500GB thin virtual disks on the software-defined storage layer.

We ran write tests with 256KB blocks, filling each 500GB disk with data on both solutions. After completing each test, we analyzed deduplication and compression efficiency by reviewing data reduction ratios reported in each system's management console. This allowed us to assess how well each platform identified and eliminated redundant data, as well as how effectively it compressed stored data.

To evaluate data reduction performance we ran the following test on each solution using Vdbench:

# 2C/2D (2:1 compression, 2:1 deduplication representing moderately compressible and deduplicable data)

```
compratio=2
dedupratio=2
dedupunit=4096
hd=default,shell=ssh,master=192.168.1.200,user=root,jvms=1
hd=hd1,system=localhost
sd=default,openflags=0 direct
sd=sd1,hd=hd1,lun=/dev/sdb
sd=sd2,hd=hd1,lun=/dev/sdc
sd=sd3,hd=hd1,lun=/dev/sdd
sd=sd4,hd=hd1,lun=/dev/sde
sd=sd5,hd=hd1,lun=/dev/sdf
sd=sd6,hd=hd1,lun=/dev/sdg
sd=sd7,hd=hd1,lun=/dev/sdh
sd=sd8,hd=hd1,lun=/dev/sdi
sd=sd9,hd=hd1,lun=/dev/sdj
sd=sd10,hd=hd1,lun=/dev/sdk
sd=sd11,hd=hd1,lun=/dev/sd1
sd=sd12,hd=hd1,lun=/dev/sdm
wd=default,sd=*
wd=wd prefill,sd=sd*,xfersize=256k,seekpct=eof,rdpct=0
rd=default
rd=rd prefill,wd=wd prefill,elapsed=20h,interval=10,iorate=max,forthreads=(1)
```



This project was commissioned by Dell Technologies.





Principled Technologies is a registered trademark of Principled Technologies, Inc. All other product names are the trademarks of their respective owners.

#### DISCLAIMER OF WARRANTIES; LIMITATION OF LIABILITY:

Principled Technologies, Inc. has made reasonable efforts to ensure the accuracy and validity of its testing, however, Principled Technologies, Inc. specifically disclaims any warranty, expressed or implied, relating to the test results and analysis, their accuracy, completeness or quality, including any implied warranty of fitness for any particular purpose. All persons or entities relying on the results of any testing do so at their own risk, and agree that Principled Technologies, Inc., its employees and its subcontractors shall have no liability whatsoever from any claim of loss or damage on account of any alleged error or defect in any testing procedure or result.

In no event shall Principled Technologies, Inc. be liable for indirect, special, incidental, or consequential damages in connection with its testing, even if advised of the possibility of such damages. In no event shall Principled Technologies, Inc.'s liability, including for direct damages, exceed the amounts paid in connection with Principled Technologies, Inc.'s testing. Customer's sole and exclusive remedies are as set forth herein.