



## Unlock more mixed storage performance on Dell PowerEdge R750 servers with Broadcom PCIe Gen4 RAID controllers

### Compared to Dell PowerEdge R740xd servers with Broadcom PCIe Gen3 RAID controllers

To explore the advantages of the 15G Dell PowerEdge R750 server in a mixed-storage environment, we compared its input/output operations per second (IOPS) and throughput to those from a 14G Dell PowerEdge R740xd server.

In our Flexible input/output (FIO) benchmark test of both servers with 16 SAS and 8 NVMe™ drives, the Dell PowerEdge™ R750 server with a Broadcom PCIe® Gen4 RAID controller handled over 7.5 million more IOPS in our 4KB random read workload and maintained over twice the gibibytes per second (GiB/s) in our 1MB sequential read workload.



#### Handle more storage requests

Up to 2.3x the raw IOPS on 4KB random read workloads\*

Up to 1.2x the raw IOPS on 4KB random write workloads\*



#### Maintain more concurrent throughput

Up to 2.0x the GiB/s on 1MB sequential read workloads\*

Up to 1.3x the GiB/s on 1MB sequential write workloads\*



\*vs a PowerEdge R740xd server with a Broadcom PCIe Gen3 RAID controller



## How we tested

We compared the server and mixed SAS/NVMe drive storage performance of a Dell PowerEdge R750 server with a Broadcom PCIe Gen4 RAID controller (Dell PERC H755) to that of a Dell PowerEdge R740xd server with a Broadcom PCIe Gen3 RAID controller (Dell PERC H740P).

In all of our FIO benchmark tests, we used the maximum number of cores per processor: 56 cores for the Dell PowerEdge R750 and 48 for the PowerEdge R740xd. Our final mixed-drive test included eight NVMe drives—filling all NVMe slots in the backpanes of the servers under test.



### Dell PowerEdge R750 server

The Dell PowerEdge R750 is a full-featured, general purpose 2U rack server powered by 3rd Gen Intel® Xeon® Scalable processors. According to Dell, this rack server is purpose-built to optimize application performance and acceleration with PCIe Gen 4.0 compatibility, eight channels of memory per CPU, and up to 24 NVMe drives. It also includes “improved air-cooling features and optional Direct Liquid Cooling to support increasing power and thermal requirements.”<sup>1</sup>



### Broadcom PCIe Gen4 technology in Dell PowerEdge servers

The Broadcom PCIe Gen4 RAID controller (Dell PERC H755) on the motherboard of the PowerEdge R750 server delivers twice the bandwidth (from 8GT/s to 16GT/s) of PCIe Gen3 RAID controllers.<sup>2</sup>

Go to the PT website to see the testing details



Go to the PT website to learn how PT tests



## What is the difference between random and sequential workloads?

Our FIO benchmark testing used random and sequential workloads, which use different patterns for accessing and storing data. Random workloads are those where data is pulled from multiple drives. Sequential workloads involve a continuous flow of data from one drive. Running both types of workloads can provide insight into how the server solution handles the access, retrieval, and saving of data.

### Random

A user who browses multiple web pages in an online store before making a purchase represents a read-heavy random workload because the application may have to pull data from multiple drives.



### Sequential

Streaming video necessitates that a server read that data sequentially in a single continuous stream. The same rule applies to storing data.



## Performance metrics

To measure each dual-processor solution's storage performance in four mixed-drive configurations, we captured FIO benchmark performance metrics, which offer insight into server and storage performance.



### **GiB/s**

The amount of information (in GiB) a solution can process per second (throughput) indicates how well it can process a high volume of data.



### **IOPS**

The number of IOPS a solution can handle indicates the degree to which it can process a high volume of storage requests at once.

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## Handle more storage requests

Based on the IOPS output we saw in random read workload testing, upgrading from 14G Dell PowerEdge R740xd servers to 15G Dell PowerEdge R750 servers could help companies grow their user base or achieve performance gains for I/O-intensive applications.

In our random write workload-based FIO benchmark testing, we found that the more SAS drives we used in the mixed SAS and NVMe configuration, the bigger the storage performance differences were between the PowerEdge R750 and the PowerEdge R740xd.

4KB random read FIO results  
with 16 SAS and 8 NVMe drives

IOPS | Higher is better

Dell PowerEdge R750



Dell PowerEdge R740xd

5.5 million

Up to  
2.3x the  
raw IOPS

4KB random write FIO results  
with 16 SAS and 8 NVMe drives

IOPS | Higher is better

Dell PowerEdge R750



Dell PowerEdge R740xd

7.0 million

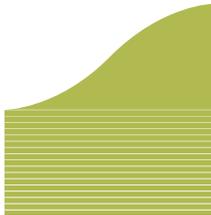
Up to  
1.2x the  
raw IOPS

In addition to these, we also tested with three more mixed SAS/NVMe drive configurations. [See the results →](#)

## Upgrading your capabilities

Dell Technologies made some big changes with the 15G refresh of its 2U workhorse. While we only compared server and mixed SAS and NVMe drive storage performance, the redesigned PowerEdge R750 chassis with its multi-vector cooling is a significant upgrade from its predecessor.

According to Dell, the PowerEdge R750 is purpose-built to optimize application performance and acceleration with PCIe Gen 4.0 compatibility, eight channels of memory per CPU, and up to 24 NVMe™ drives. It also includes “improved air-cooling features and optional Direct Liquid Cooling to support increasing power and thermal requirements.”<sup>3</sup>



The PowerEdge R750 server takes advantage of PCIe Gen4, which **doubles the bandwidth available** on the PowerEdge R740xd server.<sup>4</sup>

Compare server capabilities →

## Maintain more concurrent throughput

Based on the higher volume of outgoing large blocks of data (1 MB) we saw in the sequential read workload testing, upgrading to the 15G Dell PowerEdge R750 server could benefit applications that stream video, allow end users to import large amounts of data in less time, and enable staff to access large files more quickly.

In this FIO benchmark comparison, the higher volume of incoming large blocks of data processed by the Dell PowerEdge R750 server could speed applications that render video, allow end users to export large amounts of data in less time, and enable staff to copy information from one file to another more quickly.

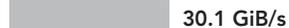
1MB sequential read FIO results  
with 16 SAS and 8 NVMe drives

*Throughput | Higher is better*

Dell PowerEdge R750



Dell PowerEdge R740xd



Up to  
2.0x the  
GiB/s

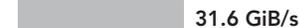
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Dell PowerEdge R750



Dell PowerEdge R740xd



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## The importance of concurrent throughput

Upgrading to server solutions with high throughput and IOPS could have a direct impact on a company's profit margin.

According to Data Center Knowledge, "[t]hroughput is the result of IOPS and the block size for each I/O being sent or received. Since a 256KB block has 64 times the amount of data as a 4K block, size impacts throughput. In addition, the size and quantity of blocks impacts bandwidth on the fabric and the amount of processing required on the servers, network and storage environments."<sup>5</sup>

All of these items can have a big impact on application performance.



[Learn more](#)[▸ Server comparison](#)[Examples](#)[Conclusion](#)

Features	PowerEdge R750 <sup>6</sup>	PowerEdge R740xd <sup>7</sup>
Processor	Up to two 3 <sup>rd</sup> Generation Intel Xeon Scalable processors, with up to 40 cores per processor	Up to two 2 <sup>nd</sup> Generation Intel Xeon Scalable processors, with up to 28 cores per processor
Memory	<ul style="list-style-type: none"><li>• 32 DDR4 DIMM slots, supports RDIMM (2TB max) / LRDIMM (8TB max), speeds up to 3200 MT/s</li><li>• Up to 16 Intel Persistent Memory 200 series (BPS) slots, (8TB max)</li><li>• Supports registered ECC DDR4 DIMMs only</li></ul>	<ul style="list-style-type: none"><li>• 24 DDR4 DIMM slots, supports RDIMM / LRDIMM, speeds up to 2666MT/s, 3TB max</li><li>• Up to 12 NVDIMM, (192GB max)</li><li>• Supports registered ECC DDR4 DIMMs only</li></ul>
Storage controllers	<b>Internal controllers:</b> <ul style="list-style-type: none"><li>• PERC H745</li><li>• HBA355I</li><li>• PERC S150 (SWRAID)</li><li>• PERC H345, H755, H755N (HWRAID)</li><li>• BOSS-S2 (HWRAID) 2 x M.2 SSDs 240 GB or 480 GB</li><li>• BOSS-S1 (HWRAID) 2 x M.2 SSDs 240 GB or 480 GB</li></ul> <b>External controllers:</b> <ul style="list-style-type: none"><li>• PERC H840 (RAID)</li><li>• HBA355e (non-RAID)</li></ul>	<b>Internal controllers:</b> <ul style="list-style-type: none"><li>• PERC H730P, H740P</li><li>• PERC S140 (SWRAID)</li><li>• BOSS (HWRAID) 2 x M.2 SSDs 120 GB or 240 GB</li><li>• HBA330 (non-RAID 12Gbps SAS HBA)</li></ul> <b>External controllers:</b> <ul style="list-style-type: none"><li>• PERC H840 (RAID)</li><li>• 12Gbps SAS HBA (non-RAID)</li></ul>
Storage	<b>Front bays:</b> <ul style="list-style-type: none"><li>• Up to 12 x 3.5-inch SAS/SATA drives (192TB max)</li><li>• Up to 8 x 2.5-inch NVMe drives (122.88TB max)</li><li>• Up to 16 x 2.5-inch SAS/SATA/NVMe drives (245.76TB max)</li></ul> <b>Mid bay:</b> <ul style="list-style-type: none"><li>• Up to 24 x 2.5-inch SAS/SATA/NVMe drives (368.84TB max)</li></ul> <b>Rear bays:</b> <ul style="list-style-type: none"><li>• Up to 2 x 2.5-inch SAS/SATA/NVMe drives (30.72TB max)</li><li>• Up to 4 x 2.5-inch SAS/SATA/NVMe drives (61.44TB max)</li></ul>	<b>Front bays:</b> <ul style="list-style-type: none"><li>• Up to 24 x 2.5-inch SAS/SATA/NVMe drives (153TB max) or up to 12 x 3.5-inch SAS/SATA drives (144TB max)</li></ul> <b>Mid bay:</b> <ul style="list-style-type: none"><li>• Up to 4 x 2.5-inch SAS/SATA/NVMe drives (25TB max) or up to 4 x 3.5-inch SAS/SATA drives (48TB max)</li></ul> <b>Rear bays:</b> <ul style="list-style-type: none"><li>• Up to 4 x 2.5-inch SAS/SATA/NVMe drives (25TB max) or up to 2 x 3.5-inch SAS/SATA drives (24TB max)</li></ul>
PCIe	8 x PCIe Gen4 slots (up to 6 x 16) with support for SNAP I/O modules	8 x PCIe Gen3 slots (up to 6 x 16)

## Comparing server capabilities

Some of the most notable 15G performance and storage-related features include upgraded RAID, PowerEdge RAID controller (PERC), boot-optimized storage subsystem (BOSS), and host bus adapter (HBA) storage controllers.

Learn more

Server comparison

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## Real world benefits

In today's digital era, big data—which includes unstructured media, imaging, audio, sensor, and text data—has dramatically increased the need for efficient storage and computing capabilities. Dell PowerEdge R750 servers with Broadcom PCIe Gen4 RAID controllers have the potential to help companies deal with evolving demands.



No matter how enticing NVMe performance gains are, investing in all NVMe drives can be an expensive proposition—both economically and operationally. So, it comes as no surprise that “IDC estimates that SAS is found in over 70 percent of enterprise storage drives and expects it to reach more than 85 percent of enterprise storage capacity by 2022.”<sup>8</sup> Dell PowerEdge R750 servers include Broadcom PCIe Gen4 RAID controllers, which not only deliver twice the bandwidth (throughput) of previous generation servers with Gen3 technology, but also support SAS, NVMe, and mixed-drive environments.<sup>9</sup>

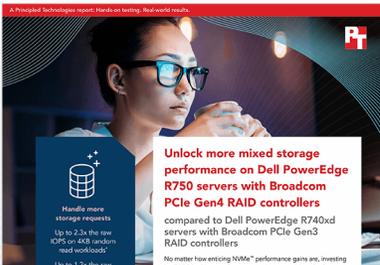


With worldwide retail commerce sales estimated “to grow by 50 percent over the next four years, reaching about 7.4 trillion dollars by 2025,”<sup>10</sup> the higher IOPS processing capabilities we found in the Dell PowerEdge R750 server with a Broadcom PCIe Gen4 RAID controller can enable retail data centers to handle more orders at once. This could, in turn, reduce the number of discarded shopping carts and increase the number of successful sales.



The insurance market's need to constantly improve the customer experience is driving innovation and changing the way companies do business. PwC reports that 63 percent of insurance company CEOs think the Internet of Things (IoT) is important to their business strategy.<sup>11</sup> The PCIe Gen4 capabilities (doubled bandwidth per lane) in the Dell PowerEdge R750 server can enable companies to handle more or heavier traffic from connected devices already in place.

A Principled Technologies report: hardware testing, real-world results.



**Handle more storage requests**  
Up to 2.5x the IOPS on 4GB random read workloads

**Handle 1.5x the IOPS on 4GB random write workloads**

**Maintain more concurrent throughput**  
Up to 2.2x the GB/s on 1MB sequential read workloads

Up to 1.5x the GB/s on 1MB sequential write workloads

See the full report for more details.

**Unlock more mixed storage performance on Dell PowerEdge R750 servers with Broadcom PCIe Gen4 RAID controllers**

compared to Dell PowerEdge R740xd servers with Broadcom PCIe Gen3 RAID controllers

No matter how exciting NVMe™ performance gains are, investing in all NVMe drives can be an expensive proposition—both economically and operationally. So it comes as no surprise that IDC estimates that SAS is found in over 70 percent of enterprise storage drives and expects it to reach more than 80 percent of enterprise storage capacity by 2022.™ Dell PowerEdge® R750 servers include Broadcom PCIe® Gen4 RAID controllers, which not only deliver twice the bandwidth/throughput of previous-generation servers with Gen3 technology, but also support SAS, NVMe, and mixed-drive environments.

To explore the advantages of the 15U Dell PowerEdge R750 server in a mixed storage environment, we compared its input/output operations per second (IOPS) and throughput to those of a 14U Dell PowerEdge R740xd server.

In our 16 SAS and 8 NVMe, drive-mixed storage test configuration, the Dell PowerEdge R750 server with a PCIe Gen4 RAID controller handled over 7.5 million more IOPS in our 4GB random read workload and maintained over twice the IOPS/ops per second (GB/s) in our 1MB sequential read workload compared to the previous-generation server.

Unlock more mixed storage performance on Dell PowerEdge R750 servers with Broadcom PCIe Gen4 RAID controllers. May 2022 (Revised)

Read the full report at  
<https://facts.pt/4XwOEX6>



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Facts matter.™

## Conclusion

Upgrading to or investing in the latest generation of servers could help you better deal with evolving demands, grow your business, and keep customers happy. We found that a 15G Dell PowerEdge R750 server with a Broadcom PCIe Gen4 RAID controller processed significantly more storage requests and sustained more concurrent throughput in four mixed SAS and NVMe drive configurations than a 14G Dell PowerEdge R740xd server with a Broadcom PCIe Gen3 RAID controller.

- 1 Dell, "Dell EMC PowerEdge R750 Spec Sheet," accessed April 21, 2022, [https://i.dell.com/sites/csdocuments/Product\\_Docs/en/poweredge-R750-spec-sheet.pdf](https://i.dell.com/sites/csdocuments/Product_Docs/en/poweredge-R750-spec-sheet.pdf).
- 2 MiniTool Partition Wizard, "PCIe 3.0 vs. 4.0: What's the Difference and Which is Better [Clone Disk]," accessed April 21, 2022, <https://www.partitionwizard.com/clone-disk/pcie-3-vs-4.html>.
- 3 Dell, "Dell EMC PowerEdge R750 Spec Sheet."
- 4 MiniTool Partition Wizard, "PCIe 3.0 vs. 4.0: What's the Difference and Which is Better [Clone Disk]," accessed April 21, 2022, <https://www.partitionwizard.com/clone-disk/pcie-3-vs-4.html>.
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- 8 Data Center Dynamics, "SAS or NVMe? That is the question," accessed April 21, 2022, <https://www.datacenterdynamics.com/en/opinions/sas-or-nvme-that-is-the-question/>.
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- 10 Statista, "Retail e-commerce sales worldwide from 2014 to 2025," accessed April 28, 2022, <https://www.statista.com/statistics/379046/worldwide-retail-e-commerce-sales/>.
- 11 Tipalti, "Chart-Topping FinTech Stats for 2022," accessed April 28, 2022, <https://tipalti.com/fintech-stats-for-2022/>.