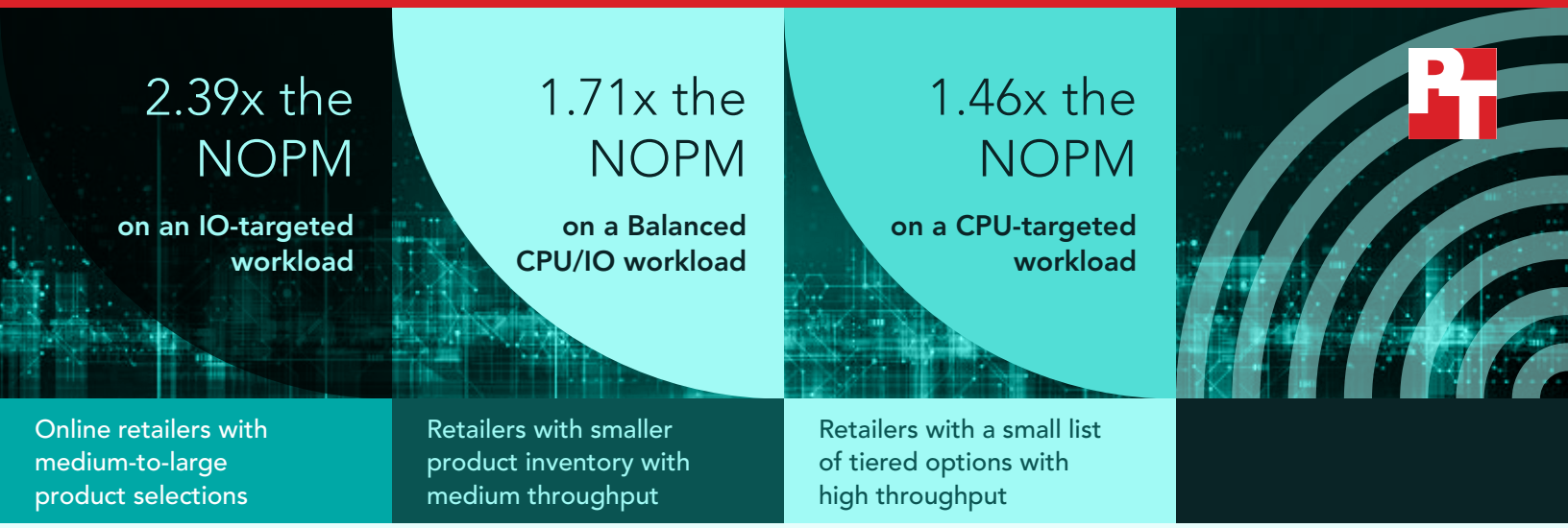

Get better Oracle Database performance when you upgrade to the Dell PowerEdge R7625 featuring the PowerEdge RAID Controller 12 Series (PERC 12)

Compared to the previous-gen Dell PowerEdge R7525 with PERC 11

Refreshing your Oracle Database servers with the latest generation of technology has the potential to dramatically improve your online transaction processing (OLTP) workloads. Whether you run retail, online banking, or reservation systems, upgrading to new servers with the latest processors and RAID controller technology can allow you to process more transactions and reduce wait times.

Connecting from the Principled Technologies data center to servers in a remote Dell lab, we compared the Oracle Database performance of two servers with identical core counts and memory footprints: a new Dell™ PowerEdge™ R7625 with PERC 12 and a previous-generation PowerEdge R7525 with PERC 11. We tested with the HammerDB TPROC-C workload using three different profiles to show that performance gains are possible for various types of OLTP workloads depending on your specific needs. While these profiles can map to different workload types, the goal was to show how the newer Dell PowerEdge R7625 outperformed the older server regardless of which subsystem we stressed: storage (IO) or CPU. These profiles don't represent real-world usage but rather give indications of the capability of each subsystem. Across all three workload profiles, the new PowerEdge R7625 server with PERC 12 handled more new orders per minute (NOPM) compared to the previous-gen solution, achieving up to 2.39 times the database performance using an IO-targeted workload.

In part because the PERC 12 allows the server to communicate faster with the internal storage the databases use, the updated PowerEdge R7625 with new 4th Gen AMD EPYC™ processors offered better Oracle Database performance than its predecessor in the same server line. This makes it a strong upgrade target for organizations seeking to get stronger performance for their Oracle Database workloads.

How we tested

We compared the virtualized Oracle Database performance of two servers:

- Dell PowerEdge R7625 with PERC 12
- Dell PowerEdge R7525 with PERC 11 (previous generation)

We kept the number of CPU cores and amount of memory equal across both systems to attempt to highlight the contribution that the PERCs can have on overall system performance.

Oracle Database is a relational database that Oracle states "offers market-leading performance, scalability, reliability, and security, both on-premises and in the cloud."[1] We performed our testing using Oracle Database 19c, which Oracle says provides the greatest release stability and highest level of support and bug fixes.[2] Note that, because the Oracle Database end-user license agreement does not permit us to publish exact results, we normalized the performance numbers between the two platforms to make our comparisons. To measure Oracle Database 19c performance, we used the TPROC-C workload of the HammerDB 4.6 benchmark framework, which simulates an ecommerce business. Though the activities in the workload mimic those of a warehouse, results from TPROC-C are useful across many industries. (Learn more in the About HammerDB 4.6 section.)

We wanted to target the IO and CPU subsystems separately to show that there are generational improvements in both subsystems, so that no matter which subsystem your specific workload stresses, you should see improvements by upgrading. We also tested a balanced configuration that targeted both subsystems at once to show overall performance differences. We used the host-reported %iowait metric to determine how to tune each profile to adjust stress on the disks. A higher %iowait meant that the CPU was spending more time waiting for the disks while a smaller %iowait meant that the CPU spent more time processing transactions. We tested the following three workload profiles:

- **CPU-targeted.** This workload mimics a transactional operation with a small inventory and high order throughput. One might see this type of activity in a virtual token sales environment, where many online customers are purchasing from a small list of tiered options. Some examples of this type of activity are virtual currency for online gaming or seat upgrades for an airline.
- **IO-targeted.** This workload mimics a more traditional transactional database environment. This type of activity would be typical for any online retailer with a medium-to-large product selection.
- **Balanced.** This workload mimics an environment where the product inventory is on the smaller side but has more than just a handful of options. This level of activity could reflect a restaurant menu for online ordering or a small manufacturer getting started with a debut product line.

To arrive at these configurations, we used the following parameters in the HammerDB TPROC-C workload:

Table 1: Parameters for the workload profiles we tested. Source: Principled Technologies.

Workload profile	Number of warehouses	Number of virtual users	Warehouse true/false
CPU-targeted	100	8	all_warehouse=false
IO-targeted	300	8	all_warehouse=true
Balanced	100	8	all_warehouse=true

Tweaking these parameters affects the workloads in the following ways:

- Number of warehouses
  - This determines the overall database size. We used both 100- and 300-warehouse configurations. Because a database size of 100 warehouses fits inside the 18GB of memory in each VM, it isn't taxing to the IO subsystem. 300 warehouses, however, fills the virtual memory and spills over onto disk, causing increased IO traffic. Thus, we used 300 warehouses for the IO-targeted profile and 100 for the others.
- Number of virtual users
  - This determines the number of incoming requests.
- Use all warehouse true/false
  - This is a workload setting that, when set to true, will send requests to any warehouse, resulting in a larger data footprint. If set to false, each virtual user selects a single warehouse at random and sticks with it for the test period. When set to false, this setting results in a small data footprint, ideal for CPU-targeted testing. We set this to false for the CPU-targeted profile and true for the others.

We used TPROC-C to determine the new orders per minute, or NOPM, the servers processed for Oracle Database using the three different workload profiles. To learn more about how we tested, including detailed configuration information and step-by-step test details, read the science behind the report.

About the Dell PowerEdge R7625 server

The PowerEdge R7625 is a two-socket, 2U server equipped with 4th generation AMD EPYC processors. According to Dell, the PowerEdge R7625 is suited for advanced data analytics, AI, HPC, and virtualization workloads.[3] The PowerEdge R7625 features:

- Dell PowerEdge RAID Controller 12 (PERC 12)
- DDR5 memory up to 4,800 MT/s
- Multiple drive options: 24 x 2.5", 12 x 3.5", or 32 x E3.S

To learn more about the PowerEdge R7625 server, visit https://www.dell.com/en-us/dt/servers/amd.htm#tab0=2&tab1=0&accordion0&accordion1.

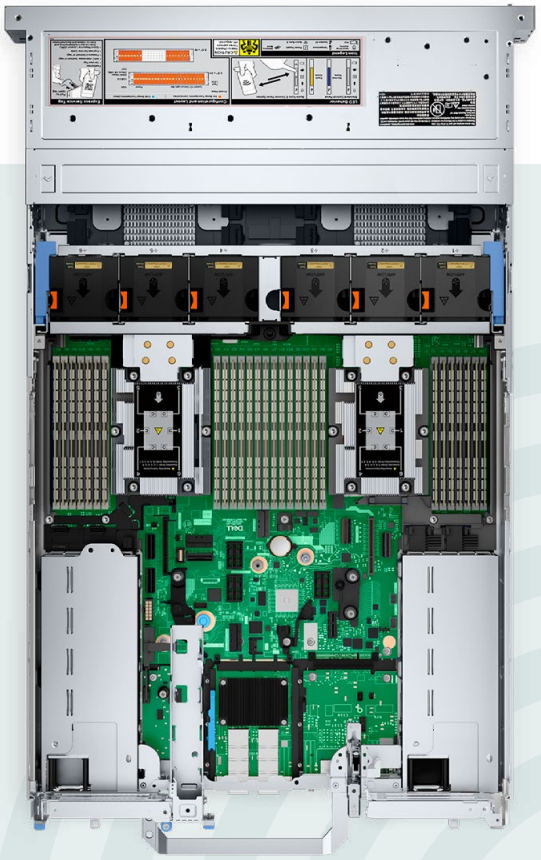

Image provided by Dell. Configuration may differ from the server we used for testing.

About HammerDB 4.5

HammerDB is an open-source benchmarking tool that tests the performance of many leading databases. The benchmark tool includes two built-in workloads derived from industry standards: a transactional (TPROC-C) workload and an analytics (TPROC-H) workload. We chose the TPROC-C (TPC-C-like) workload to demonstrate the online transaction processing performance capabilities of each server, which benefit from high core counts and fast memory. TPROC-C runs a transaction processing workload that simulates an ecommerce business with five types of transactions: receiving a customer order, recording a payment, delivering an order, checking an order's status, and checking stock in inventory.[4] Note that our test results do not represent official TPC results and are not comparable to official TPC-audited results. To learn more about HammerDB, visit https://www.hammerdb.com/.

Handle more transactions with a new Dell PowerEdge R7625 server featuring the PERC 12

Online retailers of all stripes and sizes want strong database performance so large numbers of customers can make their purchases or reservations quickly. Because online transactional processing (OLTP) workloads can vary in size and purpose, we used three workload profiles to show that upgrading an older sever like the legacy PowerEdge R7525 to the newest 16G Dell PowerEdge R7625 can offer strong performance benefits no matter the details. Figure 1 shows the relative NOPM that the servers achieved across the three workload profiles. The PowerEdge R7625 offered the greatest performance boost using the IO-targeted profile, which mimics a retailer with a medium-to-large selection, achieving 2.39 times the NOPM that the legacy server achieved. Using the Balanced profile, which targets both IO and CPU subsystems simultaneously, the PowerEdge R7625 with PERC 12 delivered 1.71 times the NOPM. On the CPU-targeted workload, the new PowerEdge R7625 also significantly outperformed the legacy server, achieving 1.46 times the NOPM.

Processing more orders in the same amount of time means that the PowerEdge R7625 can allow you to support more customers at once, or enable you to consolidate your data center by housing and running fewer systems to support your user base.

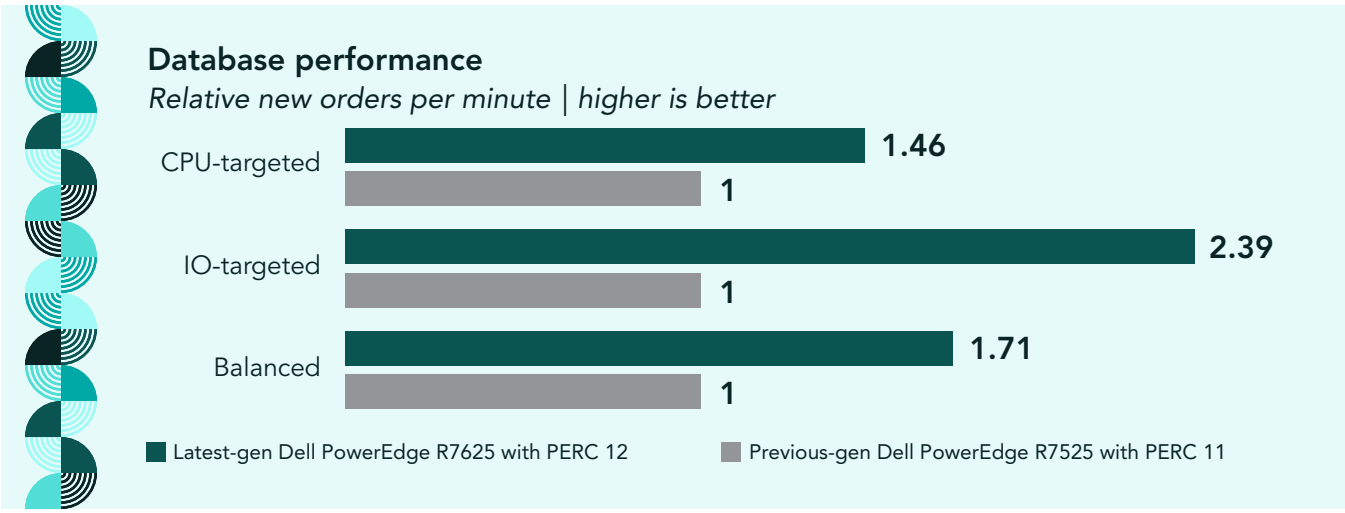

Figure 1: Database performance comparison, in relative NOPM, that the two servers achieved for three workload profiles. Higher numbers are better. Source: Principled Technologies.

About the Dell PowerEdge RAID Controller 12

The latest generation in the PERC series, PERC 12, comes standard in the latest-generation PowerEdge R7625 server we tested. According to documentation we received from Dell, PERC 12 offers support for 24Gbps SAS drives, have 3,200MHz cache memory speed, support the 16-lane host bus type, and support both NVMe® and SAS on the front controller.

To learn more about PERC offerings, visit https://www.dell.com/support/kbdoc/en-us/000131648/list-of-poweredge-raid-controller-perc-types-for-dell-emc-systems.

For information about PERC 12, visit https://infohub.delltechnologies.com/p/dell-poweredge-raid-controller-12/.

Another metric that can help assess database performance is the average CPU %iowait a system reports while processing database requests. This statistic is the percentage of time that the processor has to wait for disk access, or more simply, a measure of idle time where the CPU is waiting for requests. A higher %iowait could mean that storage is limiting performance. During exploration as we developed our test methodology, we used %iowait statistics to indicate which subsystems the benchmark was stressing and used this data to develop accurate workload profiles for HammerDB testing. We confirmed we were adequately stressing the disk for the IO-targeted profile because the %iowait was higher than the other profiles. Conversely, we confirmed that we were stressing the CPU in the CPU-targeted profile, when the %iowait hovered around 1 percent. As expected, the Balanced profile %iowait was in between the two other profiles. As Figure 2 shows, the Dell PowerEdge R7625 with PERC 12 had lower %iowait across all three workload profiles compared to the legacy server with PERC 11.

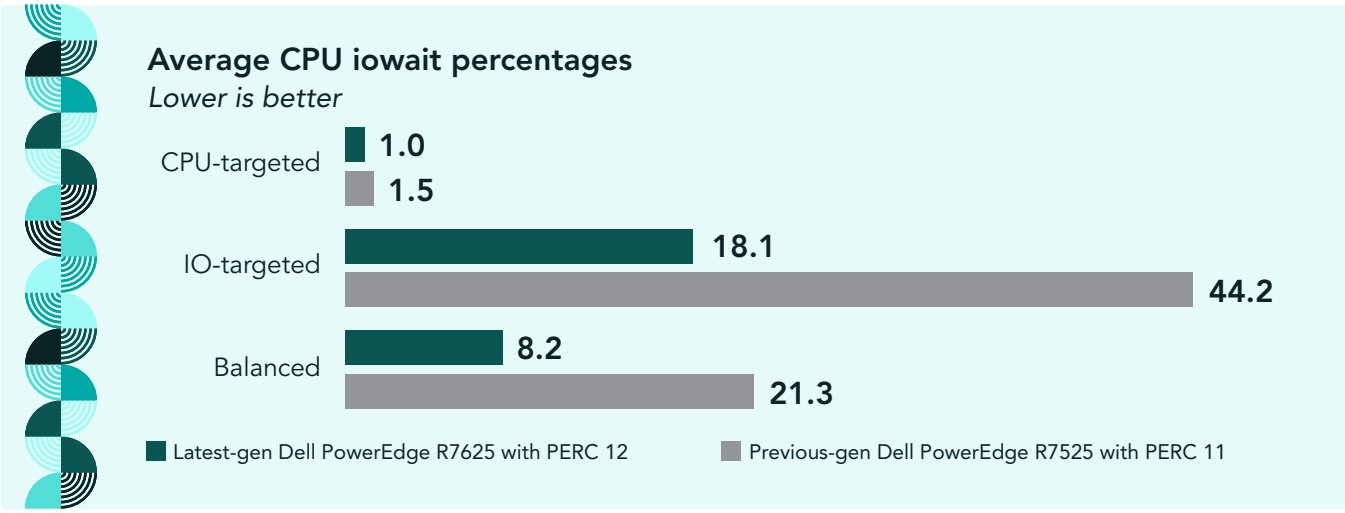

Figure 2: Average CPU %iowait the servers registered over the course of our HammerDB tests. Lower numbers are better. Source: Principled Technologies.

Conclusion

Even if your Oracle Database servers are running well, you could improve performance by switching out previous-generation hardware for the latest technology. Our testing found that this was true for various OLTP workload types, including a CPU-targeted database workload, an IO-targeted workload, and a Balanced CPU/IO workload, with the Dell PowerEdge R7625 with PERC 12 offering as much as 2.39 times the Oracle Database performance that the previous-gen PowerEdge R7525 with PERC 11 did. In addition, the PowerEdge R7625 with PERC 12 had lower %iowait across the board, again showing that upgrading to the latest-generation server can improve database performance for various workload profiles. By moving to a new PowerEdge R7625, your organization can support more customers and realize better system efficiency, which ultimately provides the opportunity to consolidate onto fewer systems to reduce operating costs.

1. Oracle, "Oracle Database Technologies," accessed February 10, 2023, https://www.oracle.com/database/technologies/.
2. Oracle, "Oracle Database Technologies," accessed February 10, 2023.
3. HPCWire, "Dell Technologies Announces Dell PowerEdge Servers with 4th Gen AMD EPYC Processors," accessed February 13, 2023, https://www.hpcwire.com/off-the-wire/dell-technologies-announces-dell-poweredge-servers-with-4th-gen-amd-epyc-processors/.
4. HammerDB, "Understanding the TPROC-C workload derived from TPC-C," accessed February 13, 2023, https://www.hammerdb.com/docs/ch03s05.html.

Read the science behind this report at https://facts.pt/fjJ8lrM ▶

Principled Technologies®

Facts matter.®

This project was commissioned by Dell Technologies.