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# Can Dell™ PowerEdge™ R450 and Dell PowerEdge R550 Servers Meet the Flexibility and Performance Needs of SMBs?

Prowess Consulting put these servers to the test to determine how well they would perform as hosts for the database and virtual machine (VM) workloads typically found in small to medium-sized businesses (SMBs).

## Executive Summary

When it comes to server infrastructure, small and medium-sized businesses (SMBs) have unique needs. They often need systems that can be jacks of all trades to handle all of their compute needs, from general business apps and services to database workloads to virtual desktop infrastructures (VDIs). While these servers need performance and reliability to handle these tasks, they don't need the extreme performance and headroom required by some enterprise workloads. SMB servers need to be efficient and reliable, and they need to fit into typically constrained footprints in the IT facility.

Prowess Consulting research and testing determined that Dell™ PowerEdge™ R450 and Dell PowerEdge R550 servers are well suited to meet these needs. The PowerEdge R550 server bested its PowerEdge R540 predecessor by up to 2.21x in HammerDB TPROC-C database benchmark testing.[1] Similarly, the PowerEdge R450 server outperformed an earlier-generation PowerEdge R440 server by up to 1.46x.[1]

Our testing also showed exceptional virtual machine (VM) capabilities for the two systems. The PowerEdge R550 server spun up 1.5x more VMs than the previous-generation PowerEdge R540 server.[1] The PowerEdge R450 server was able to spin up 1.33x more VMs at 100 percent utilization than the earlier-model PowerEdge R440 server.[1]

## Meeting the Unique Needs of SMBs

To compete in today's fast-paced environment, SMBs need modern, efficient infrastructure that can keep up with business needs. SMBs don't necessarily need the same levels of performance or scalability that are required by enterprise businesses, but they do need adaptable, affordable servers that can support changing initiatives and intelligently manage utilization. Utilization and affordability are particularly important in the face of fixed budgets, limited staff, and constrained space for infrastructure.

In other words, SMB IT admins want versatile workhorse servers with the flexibility to adapt to varied and occasionally shifting general-purpose computing needs that typically include virtualization and database workloads. Compact form factors are important, but the servers still need to provide recent-generation CPUs and modern features that can help the business compete effectively and operate efficiently—today and well into the future. Indeed, future-proofing is particularly important to cost-conscious SMBs looking to maximize return on investment (ROI).

We performed research and testing to determine what servers would be ideal for SMBs looking to affordably meet those needs. Our investigations uncovered two current-generation rack-mount servers from Dell Technologies that looked promising: the PowerEdge R450 server, which is a 1U rack-mount server, and the PowerEdge R550 server, which is a 2U version that offers more room for greater storage or add-on cards. Both servers are available with a range of Intel® Xeon® Scalable processors to choose from in order to meet a range of SMB workload needs.

We put these two servers to the test to see whether they could meet the unique needs of SMBs.

## Putting the Systems to the Test

To assess the two servers, we ran tests for two common workloads: databases and virtualization. We compared results for the following configurations:

- PowerEdge R450 server powered by 3rd Gen Intel Xeon Silver processors
- PowerEdge R550 server powered by 3rd Gen Intel Xeon Gold processors

We also wanted to see how current-generation servers performed in comparison to previous-generation servers, so we ran the same database and virtualization workload tests on the following older-generation servers:

- PowerEdge R440 server powered by 2nd Gen Intel Xeon Silver processors
- PowerEdge R540 server powered by 2nd Gen Intel Xeon Gold processors

The full system configurations are shown in Table 1.

**Table 1 | System configurations used for testing database and virtualization performance**

| | Dell™ PowerEdge™ R440 | Dell™ PowerEdge™ R450 | Dell™ PowerEdge™ R540 | Dell™ PowerEdge™ R550 |
|---|---|---|---|---|
| Hardware | | | | |
| Processor | Intel® Xeon® Silver 4214 processor | Intel® Xeon® Silver 4314 processor | Intel® Xeon® Gold 5217 processor | Intel® Xeon® Gold 5317 processor |
| Number of CPUs | 2 | 2 | 2 | 2 |
| Cores per CPU | 12 | 16 | 8 | 12 |
| Cores/threads total | 24/48 | 32/64 | 16/32 | 24/48 |

| | Dell™ PowerEdge™ R440 | Dell™ PowerEdge™ R450 | Dell™ PowerEdge™ R540 | Dell™ PowerEdge™ R550 |
|---|---|---|---|---|
| Frequency (base/SCT/MCT) | 2.20 GHz | 2.40 GHz | 3.00 GHz | 3.00 GHz |
| Storage controller 01 | Dell™ PowerEdge™ RAID Controller (PERC) H740P Adapter | Dell™ PowerEdge™ RAID Controller (PERC) H745 Front Adapter | Dell™ PowerEdge™ RAID Controller (PERC) H740P Adapter | Dell™ PowerEdge™ RAID Controller (PERC) H755 Front Adapter |
| Disk | 960 GB Micron® MTFDDAK960TDS | 960 GB Micron® MTFDDAK960TDS | 960 GB WD® WUSTVA196BSS200 | 960 GB WD® WUSTVA196BSS200 |
| Number of disks | 4 | 4 | 6 | 6 |
| Installed memory | 128 GB | 128 GB | 256 GB | 256 GB |
| Memory DIMM | Micron® 16 GB | Hynix® 16 GB | Micron® 32 GB | Micron® 32 GB |
| Memory speed | 2,400 MT/s | 2,666 MT/s | 2,666 MT/s | 2,933 MT/s |
| Number of memory DIMMs | 8 | 8 | 8 | 8 |
| BIOS version | 2.14.2 | 1.6.5 | 2.14.2 | 1.6.5 |
| Operating system (OS) performance profile | Oracle® | Oracle® | Oracle® | Oracle® |
| **Software** | | | | |
| OS | Red Hat® Enterprise Linux® 8.6 (Ootpa) | Red Hat® Enterprise Linux® 8.6 (Ootpa) | Red Hat® Enterprise Linux® 8.6 (Ootpa) | Red Hat® Enterprise Linux® 8.6 (Ootpa) |
| OS kernel | Linux® 4.18.0-372.16.1.el8_6.x86_64 | Linux® 4.18.0-372.16.1.el8_6.x86_64 | Linux® 4.18.0-372.16.1.el8_6.x86_64 | Linux® 4.18.0-372.19.1.el8_6.x86_64 |
| Database | MySQL® Community Server | MySQL® Community Server | MySQL® Community Server | MySQL® Community Server |
| **Benchmarking tools** | | | | |
| Database performance | HammerDB 4.4 | HammerDB 4.4 | HammerDB 4.4 | HammerDB 4.4 |
| VM performance | Stress-NG | Stress-NG | Stress-NG | Stress-NG |

# Measuring Database Performance

The goal of this testing was to generate performance data showing the new orders per minute (NOPM) performance of a MySQL® database running on each PowerEdge server. We also collected other performance data to verify that the two systems were operating as intended with comparable configurations.

For these tests, we ran HammerDB using the TPROC-C benchmark to assess online transaction processing (OLTP) performance against the MySQL database. Specifically, we ran the benchmark against 500- and 1,000-warehouse databases. For each warehouse scenario, we tested with 5, 10, 20, and 50 virtual users.

We selected the TPROC-C benchmark because it is derived from the industry-standard TPC-C® workload, and it offers a useful, repeatable test with results presented in NOPM.

First we compared the latest-generation PowerEdge R550 server powered by an Intel Xeon Gold processor to the latest-generation PowerEdge R450 server powered by an Intel Xeon Silver processor. As Figure 1 shows, the PowerEdge R550 server outperformed the PowerEdge R450 server by up to 2.22x when running 500 warehouses.[1]

## Dell™ PowerEdge™ R450 vs. Dell™ PowerEdge™ R550
### NOPM performance
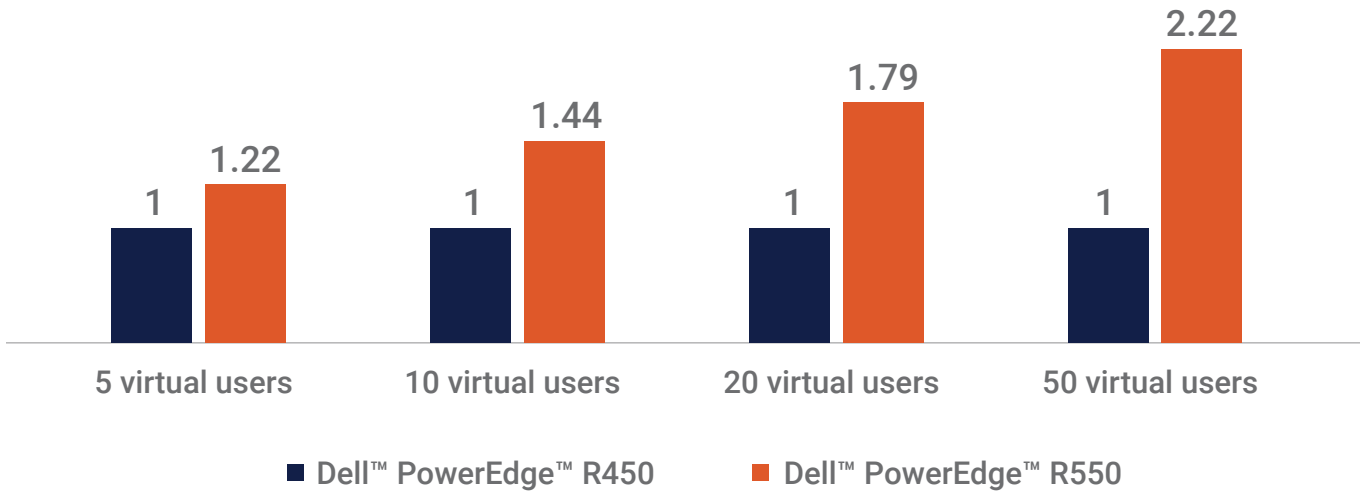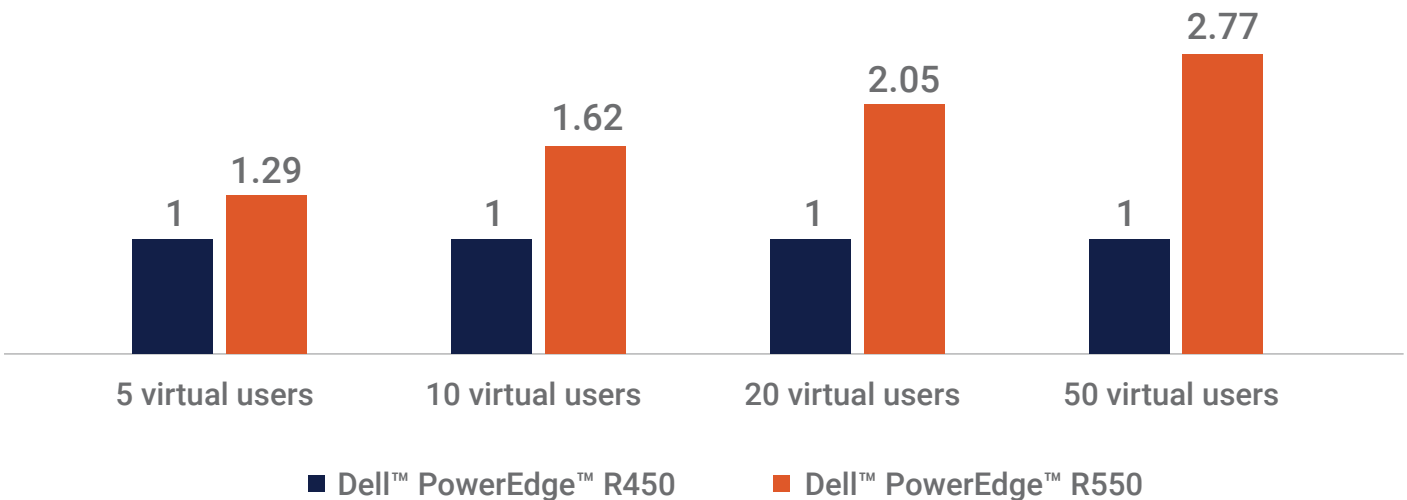### 500 warehouses (normalized)



**Figure 1 | Database performance with 500 warehouses, comparing a Dell™ PowerEdge™ R450 server to a PowerEdge R550 server[1]**

Figure 2 compares the same servers using a 1,000-warehouse scenario. In this case, the Dell™ server powered by the Intel Xeon Gold processor handled up to 2.77x more NOPM than the PowerEdge R450 server powered by the Intel Xeon Silver processor.[1]

## Dell™ PowerEdge™ R450 vs. Dell™ PowerEdge™ R550
### NOPM performance
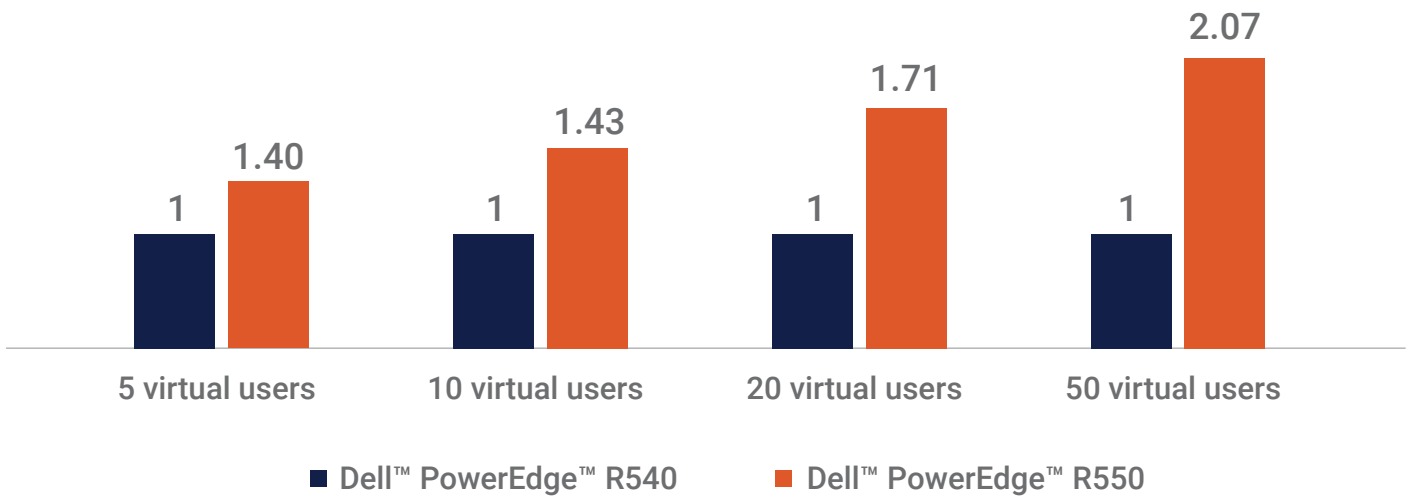### 1,000 warehouses (normalized)



**Figure 2 | Database performance with 1,000 warehouses, comparing a Dell™ PowerEdge™ R450 server to a PowerEdge R550 server[1]**

We also wanted to see whether generational improvements to the Dell PowerEdge servers would result in an increase in performance and capabilities. To this end, we compared a PowerEdge R550 server to the previous-generation PowerEdge R540 server.

For the 500-warehouse test, our results show up to 2.07x gains for the newer PowerEdge R550 server powered by 3rd Gen Intel Xeon Scalable processors, compared to the previous-generation server powered by 2nd Gen Intel Xeon Scalable processors (see Figure 3).[1]

### Dell™ PowerEdge™ R540 vs. Dell™ PowerEdge™ R550
NOPM performance
500 warehouses (normalized)



| | 5 virtual users | 10 virtual users | 20 virtual users | 50 virtual users |
| --- | --- | --- | --- | --- |
| Dell™ PowerEdge™ R540 | 1 | 1 | 1 | 1 |
| Dell™ PowerEdge™ R550 | 1.40 | 1.43 | 1.71 | 2.07 |

■ Dell™ PowerEdge™ R540   ■ Dell™ PowerEdge™ R550

**Figure 3 | Database performance with 500 warehouses, comparing a Dell™ PowerEdge™ R540 server to a PowerEdge R550 server[1]**

The newer-generation server showed even larger gains—up to 2.21x—in the 1,000-warehouse test, as shown in Figure 4.[1]

### Dell™ PowerEdge™ R540 vs. Dell™ PowerEdge™ R550
NOPM performance
1,000 warehouses (normalized)



| | 5 virtual users | 10 virtual users | 20 virtual users | 50 virtual users |
| --- | --- | --- | --- | --- |
| Dell™ PowerEdge™ R540 | 1 | 1 | 1 | 1 |
| Dell™ PowerEdge™ R550 | 1.22 | 1.42 | 1.75 | 2.21 |

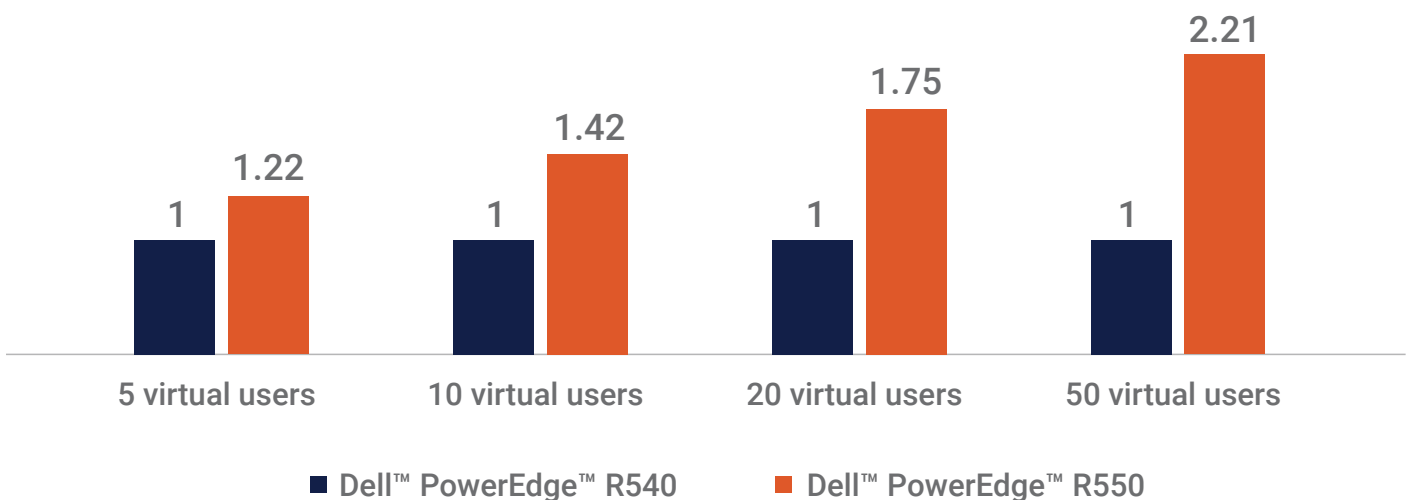■ Dell™ PowerEdge™ R540   ■ Dell™ PowerEdge™ R550

**Figure 4 | Database performance with 1,000 warehouses, comparing a Dell™ PowerEdge™ R540 server to a PowerEdge R550 server[1]**

Similarly, we compared the PowerEdge R450 server to the previous-generation PowerEdge R440 server to assess generational performance gains. As Figures 5 and 6 show, the newer Dell server powered by 3rd Gen Intel Xeon Scalable processors performed more NOPM than the older Dell server powered by 2nd Gen Intel Xeon Scalable processors.[1]

## Dell™ PowerEdge™ R440 vs. Dell™ PowerEdge™ R450
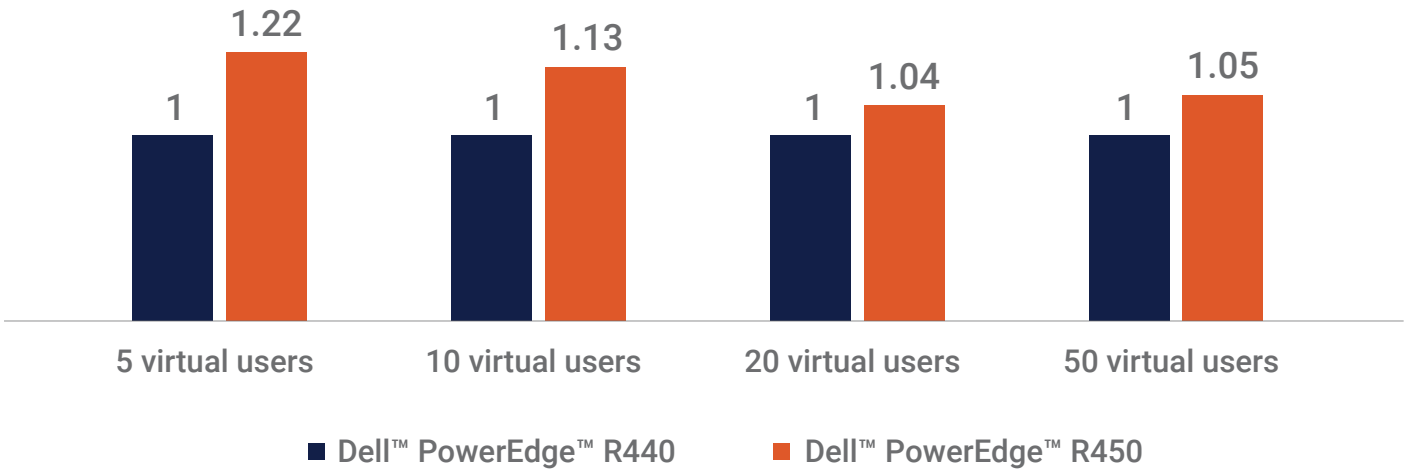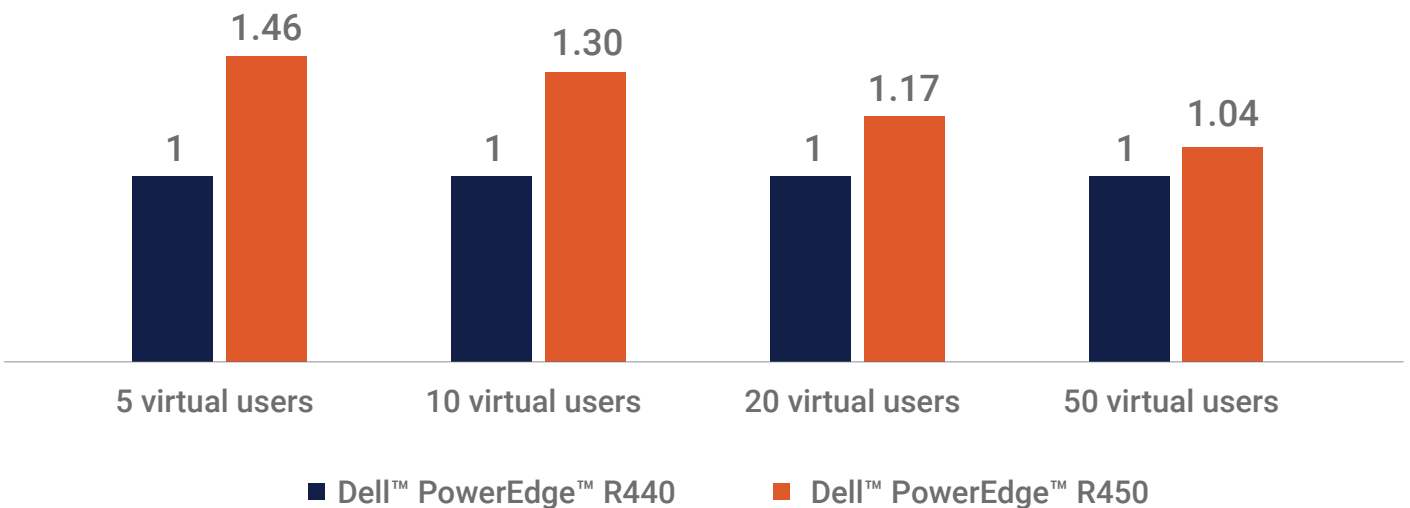### NOPM performance
### 500 warehouses (normalized)



Figure 5 | Database performance with 500 warehouses, comparing a Dell™ PowerEdge™ R440 server to a PowerEdge R450 server[1]

## Dell™ PowerEdge™ R440 vs. Dell™ PowerEdge™ R450
### NOPM performance
### 1,000 warehouses (normalized)



Figure 6 | Database performance with 1,000 warehouses, comparing a Dell™ PowerEdge™ R440 server to a PowerEdge R450 server[1]

Overall test results show generational performance gains across all test scenarios. In addition, our tests show that businesses can expect significant performance gains when purchasing a Dell PowerEdge server powered by Intel Xeon Gold processors, compared to the capable but lower performing Intel Xeon Silver processors.

Note that either Intel Xeon Scalable processor family (Gold or Silver) can be purchased with both the PowerEdge R450 and PowerEdge R550 servers; we tested with only one processor option per Dell server SKU to limit scope.

# Measuring Virtualization Capacity and Performance

For virtualization testing, we used the Red Hat® Enterprise Linux® environment and spun up VMs continuously while measuring CPU utilization. We noted how many VMs could be run when the CPU reached first 80 percent utilization, and then 100 percent utilization.

We chose 80 percent utilization as the first break point because it represents a threshold that an admin might realistically select for maximizing CPU utilization with 20 percent headroom. However, we also looked at 100 percent utilization as a direct comparison of maximum performance that we could achieve for the tested systems.

When we spun up as many VMs as possible, we found that the PowerEdge R550 server was able to spin up 1.46x more VMs before reaching 80 percent utilization, compared to the PowerEdge R540 server, showing significant generational improvements (see Figures 7 and 8).[1] At 100 percent utilization, the gains for the PowerEdge R550 server were similar: 1.50x.[1]
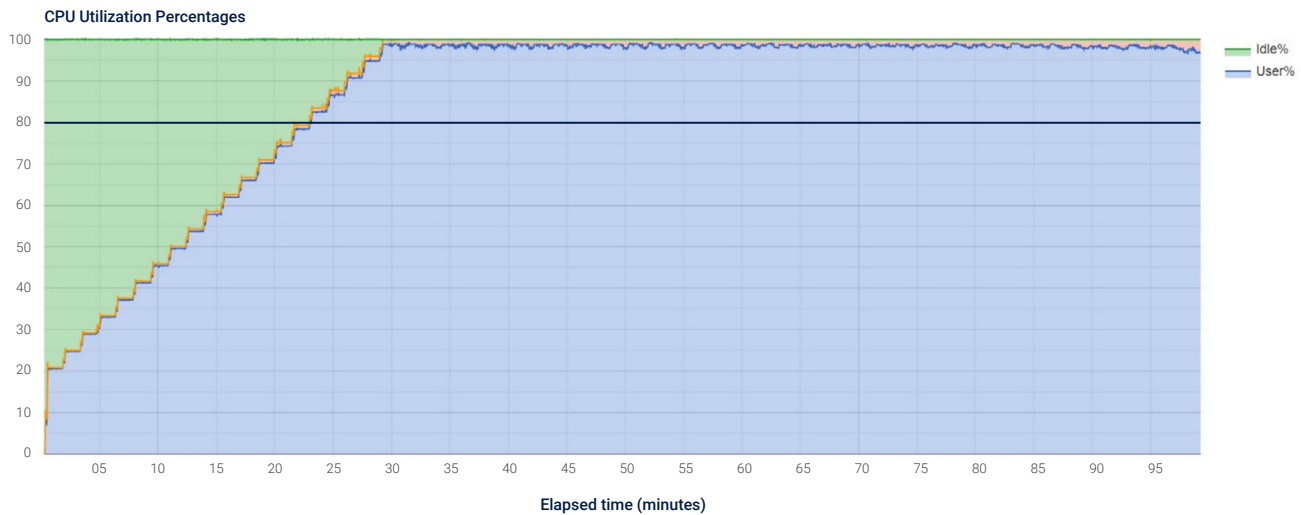


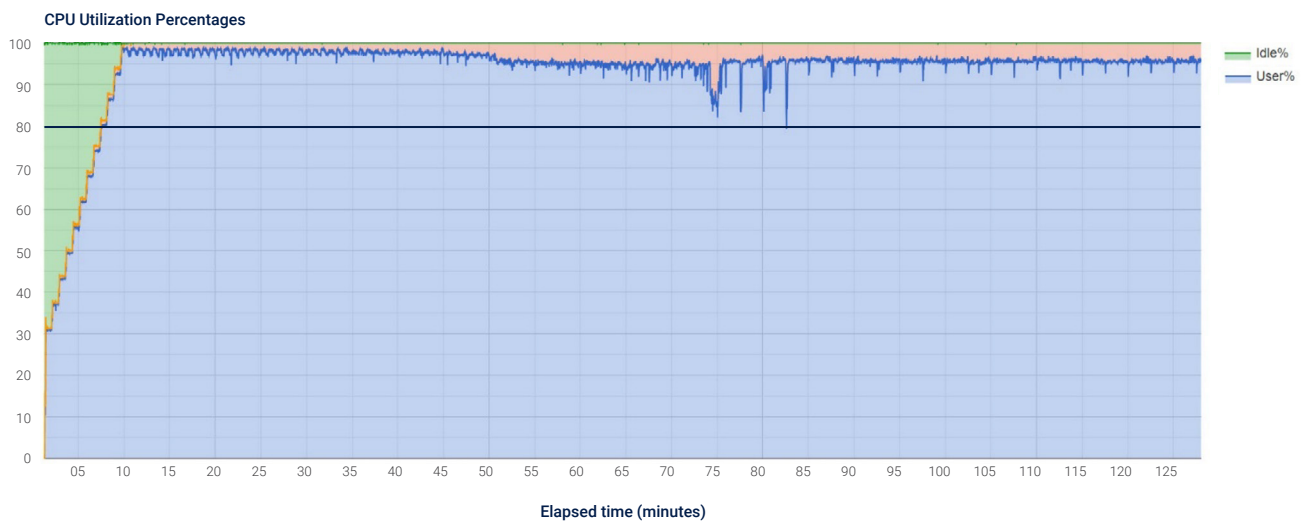**Figure 7 | CPU utilization as VMs start on the Dell™ PowerEdge™ R550 server[1]**



**Figure 8 | CPU utilization as VMs start on the Dell™ PowerEdge™ R540 server[1]**

Similarly, the PowerEdge R450 server was able to support 1.37x more VMs at 80 percent utilization and 1.33x more VMs at 100 percent utilization, compared to the older-generation PowerEdge R440 server (see Figures 9 and 10).[1]
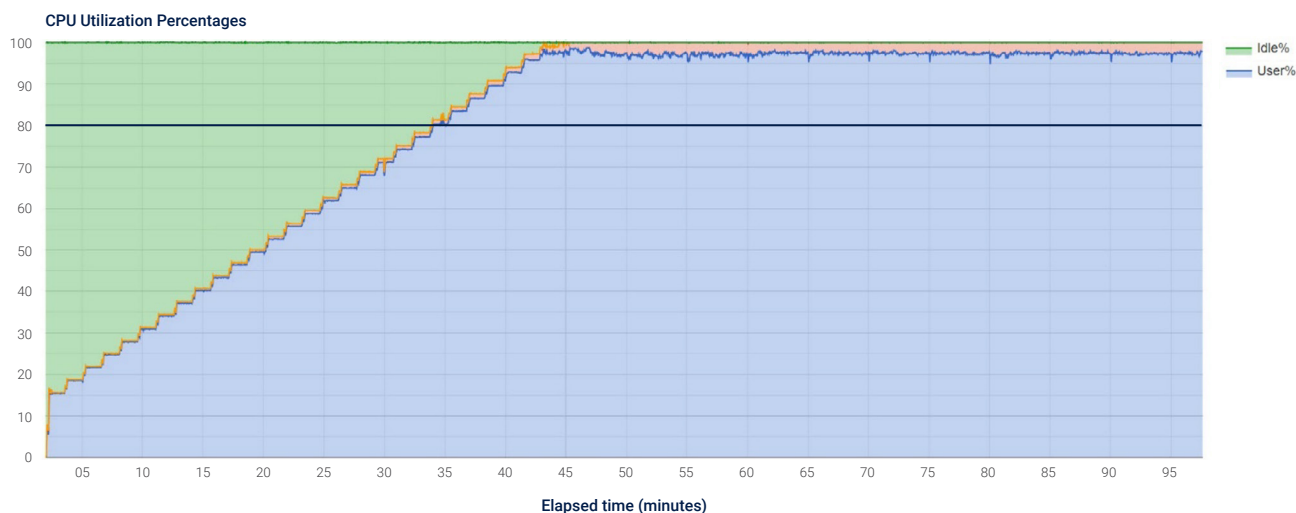


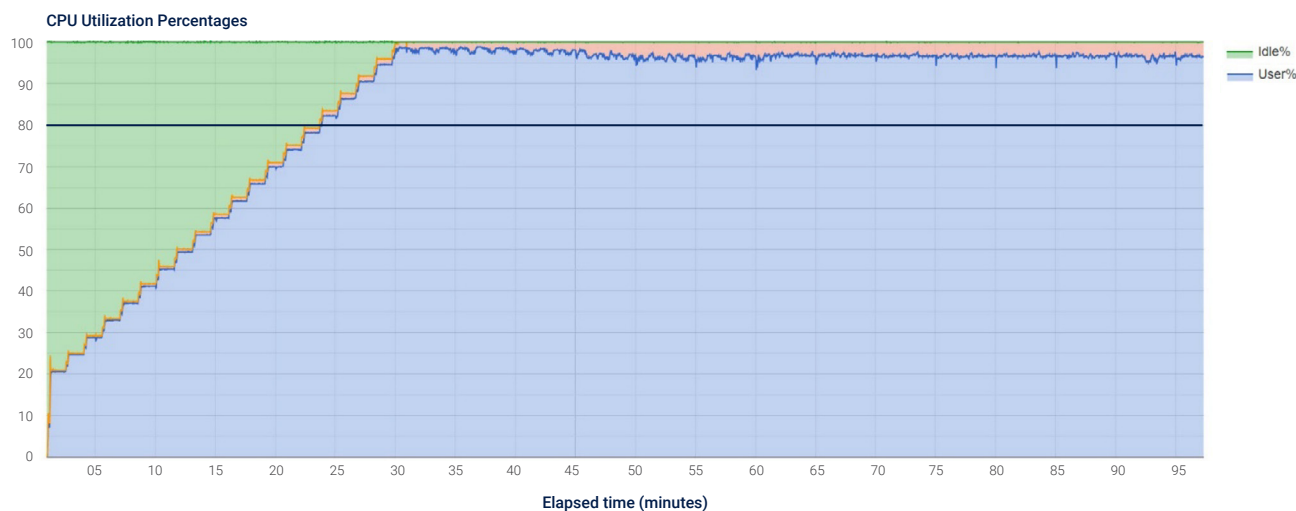Figure 9 | CPU utilization as VMs start on the Dell™ PowerEdge™ R450 server[1]



Figure 10 | CPU utilization as VMs start on the Dell™ PowerEdge™ R440 server[1]

Interestingly, when we compared the PowerEdge R550 server to the PowerEdge R450 server, the PowerEdge R450 server was able to spin up 1.37x more VMs at 80 percent utilization and 1.33x more VMs at 100 percent utilization, as shown in Figures 7 and 9.[1] This is likely because the PowerEdge R450 server has two Intel Xeon Silver 4314 processors, with 16 cores and 32 threads each, compared to the PowerEdge R550 server's two Intel Xeon Gold 5317 processors, with only 12 cores and 24 threads each. The higher core and thread count in the PowerEdge R450 server played a greater role in rapidly ramping up simultaneous VMs than the higher base performance provided by the Intel Xeon Gold processor in the PowerEdge R550 server.

It's reasonable to assume that a comparison of two systems with equal cores and threads would yield similar or higher performance for a system built with Intel Xeon Gold processors, compared to Intel Xeon Silver processors.

## Technology Behind the Results

Several factors likely account for the improved performance identified in the newer-generation PowerEdge R450 and PowerEdge R550 servers we tested. The PowerEdge R450 and PowerEdge R550 servers feature 3rd Gen Intel Xeon Scalable processors, compared to the 2nd Gen Intel Xeon Scalable processors found in the previous-generation PowerEdge R440 and PowerEdge R540 servers. The newer 3rd Gen Intel Xeon Scalable processors support higher-speed memory, which was likely a contributing factor in the results shown in the HammerDB benchmark tests. The newer-generation PowerEdge R550 and PowerEdge R450 servers also provide PCIe® Gen4 interfaces, compared to PCIe Gen3 interface speeds found in the PowerEdge R540 and PowerEdge R440 servers.

In addition, we found utilization advantages in the servers built on processors with higher core and thread counts, as pointed out in the "Measuring Virtualization Capacity and Performance" section above. Indeed, the higher core count outweighed any advantages provided by the higher-end Intel Xeon Gold processors powering the PowerEdge R550 and PowerEdge R540 servers we tested, compared to the Intel Xeon Silver processors powering the PowerEdge R450 and PowerEdge R440 servers.

## Latest-Generation Dell™ Servers Are a Good Fit for SMBs

Prowess testing and analysis found that the PowerEdge R450 and PowerEdge R550 servers are good choices for SMBs looking for high value and performance for their virtualization and database needs. Both of these servers offer low-profile chassis for minimizing their footprint in smaller SMB data centers. Additionally, both server families are available with a wide range of Intel Xeon Scalable processors to choose from, which enables SMBs to hone performance levels to their workloads.

The previous-generation PowerEdge R540 and PowerEdge R440 servers can also offer good value and performance, but our testing found that refreshing to newer PowerEdge R550 and PowerEdge R450 servers can boost performance for database workloads or support larger numbers of VMs efficiently. Overall, we conclude that either of these newer-generation servers can be deployed as the versatile workhorse solution required by most SMBs.

For detailed testing methodology and configurations used in this study, see "Behind the Report: Can Dell™ PowerEdge™ R450 and PowerEdge R550 Servers Meet the Flexibility and Performance Needs of SMBs?"



## Learn more about the current-generation Dell PowerEdge servers discussed in this study:

- PowerEdge R450
- PowerEdge R550