

## Achieve more MySQL database transactions per minute for less cost with newer Amazon Web Services instances featuring 2nd Generation Intel Xeon Scalable processors – Cascade Lake

Newer R5 instances that featured Cascade Lake processors handled more transactions per minute than older R4 instances that featured Broadwell processors

If your organization uses the cloud to run its MySQL database workloads, you should know that the type of cloud instance you choose can have a large influence on the amount of work your databases can perform. While you might reasonably assume you'd save money with slightly older instances, you may be surprised by the cost and performance benefits that newer instances which feature 2nd Generation Intel Xeon Scalable processors can offer.

At Principled Technologies, we tested an online transaction processing (OLTP) database workload on two memory-optimized instance series for Amazon Elastic Cloud Compute (Amazon EC2): newer R5 instances featuring 2nd Generation Intel Xeon Scalable processors—also known as Cascade Lake processors—and older R4 instances featuring Intel Xeon E5 v4 processors, also known as Broadwell processors. Not only did the R5 instances process transactions more quickly than the R4 instances—they also cost less, making the R5 instances a definitively more cost-effective choice for OLTP workloads.



**Small instances:**  
Support 1.45x the transactions per minute



**Medium instances:**  
Support 1.47x the transactions per minute



**Large instances:**  
Support 1.64x the transactions per minute

## How we tested

### Our cloud solution

We purchased instances from two memory-optimized Amazon EC2 series:

- Newer R5 series featuring Cascade Lake processors
- Older R4 series featuring Broadwell processors

Even though the R5 series instances are available in a few different CPU configurations, we used exclusively Cascade Lake processors in our testing. Note that we ran all instances in the US-east-1f region.

### Database sizing

Figure 1 shows the specifications for the instances we tested. To represent the needs of different organizations, we tested three instances from each series: small instances comprising 8 vCPUs and a 52GB database, medium instances comprising 16 vCPUs and a 105GB database, and large instances comprising 64 vCPUs and a 424GB database.

We determined database size based on two key factors. First, we wanted to represent a realistic workload scenario for each compute level. Second, we wanted to ensure the processors were working harder than the disk drives—so, we made sure each database could fit within each instance’s allocated RAM. While not always possible, sizing a database to fit within RAM is one accepted method to ensure good performance and help to lower the cost of cloud storage.

### The workload

To test the instances, we used an OLTP workload from the HammerDB benchmarking suite. OLTP workloads assess how well an environment can handle online transactions like those you would find in online banking, retail, or other ecommerce sites.

The HammerDB developers derived their OLTP workload from the TPC-C benchmark specifications; however, as this is not a full implementation of the official TPC-C standards, the results in this paper are not directly comparable to published TPC-C results.

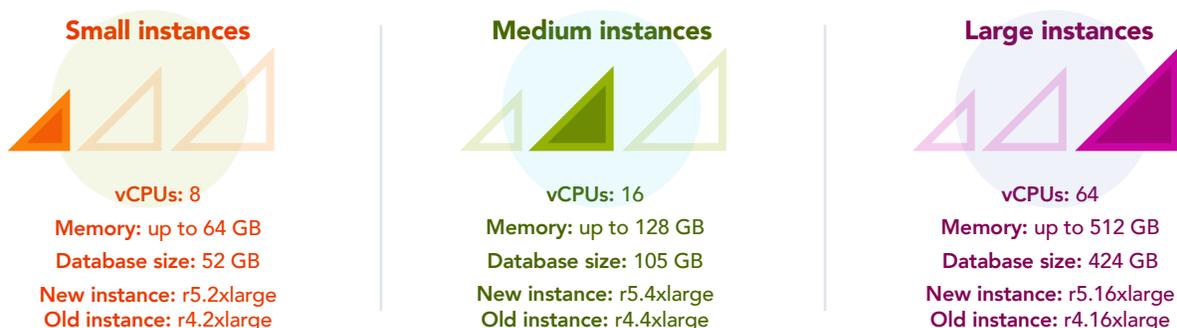


Figure 1: Amazon EC2 R-series instance specifications for our testing. Source: Principled Technologies.

## R5 series instances for Amazon EC2

Compared to the R4 series, the Amazon EC2 R5 series features:<sup>1</sup>

- Up to 3.1 GHz processor speed (versus 2.3 GHz)
- A greater variety of sizes to better suit your needs
- Five percent more memory capacity
- The AWS Nitro System, which Amazon says improves security and performance relative to older AWS hypervisors

To learn more, visit <https://aws.amazon.com/ec2/instance-types/r5/>.

## Our results

Our small instance testing could represent database sizes and cloud budgets for smaller businesses that still rely on good performance. Figure 2 shows the results of our small instance testing. On average, the newer r5.2xlarge MySQL database instances processed 1.45x the transactions per minute of the older r4.2xlarge instances.

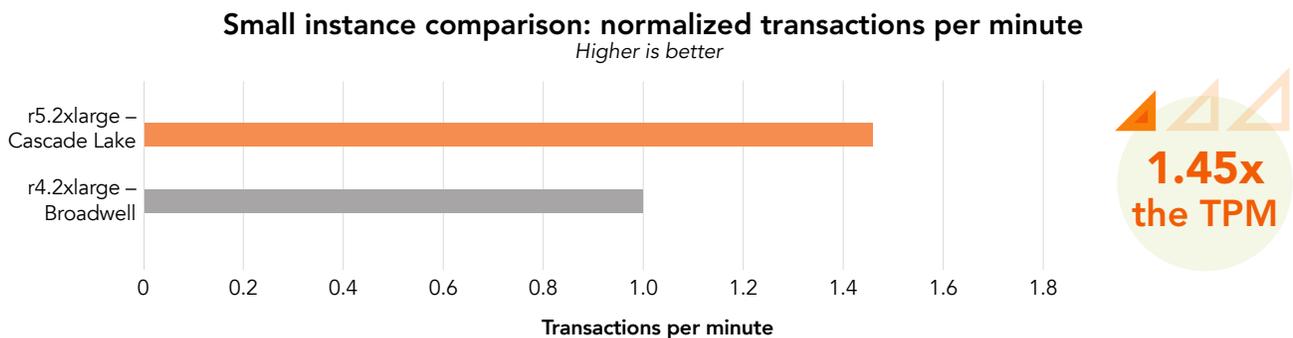


Figure 2: Normalized comparison of the average number of TPC-C-like transactions per minute each small database instance achieved during the HammerDB workload. Higher rate is better. Source: Principled Technologies.

## Medium instances

Newer r5.4xlarge instances that featured Cascade Lake processors handled 1.47x the average transactions per minute as the older r4.4xlarge instances which featured Broadwell processors.

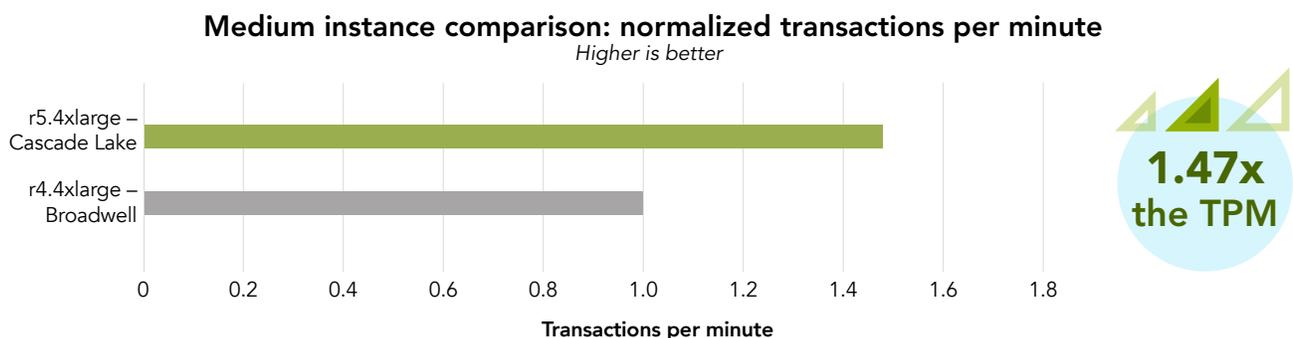


Figure 3: Normalized comparison of the average number of TPC-C-like transactions per minute each medium database instance achieved during the HammerDB workload. Higher rate is better. Source: Principled Technologies.



## Large instances

Businesses that need to meet the demands of a large user base may require instances with 64 vCPUs or more. In our tests, r5.16xlarge instances processed 1.64 times the average transactions per minute of the r4.16xlarge instances.

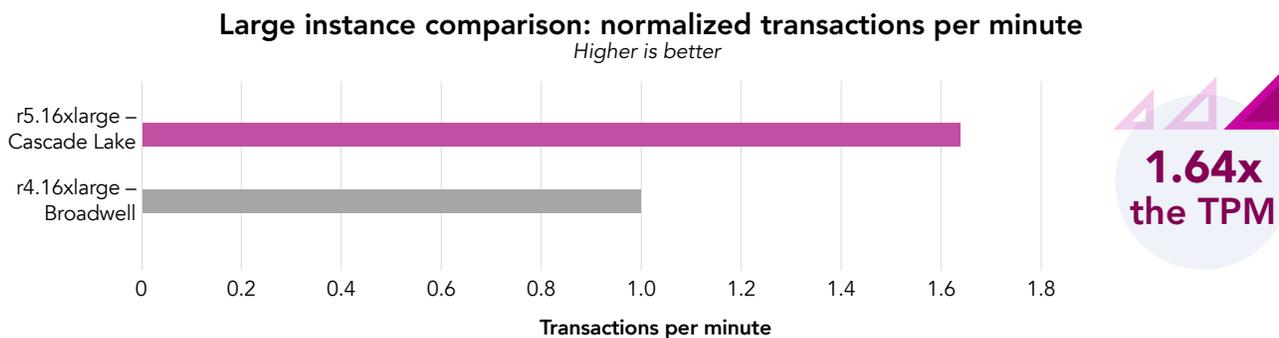


Figure 4: Normalized comparison of the average number of TPC-C-like transactions per minute each large database instance achieved during the HammerDB workload. Higher rate is better. Source: Principled Technologies.

## Performance that scales with more resources

In our tests, the margin by which R5 instances outperformed the older R4 instances increased with larger vCPU counts. While the small 8vCPU R5 instances processed 1.45 times as many transactions per minute as the small R4 instances, that advantage grew to 1.47x for the medium 16vCPU instances and 1.64x for the large 64vCPU instances.

**1.45 times the TPM**  
for small instances

**1.47 times the TPM**  
for medium instances

**1.64 times the TPM**  
for large instances

## Better performance for less cost

As a responsible business leader with a budget to consider, you can't always chase the latest and greatest tech—especially if a newer product performs only marginally better than its predecessor. That's not the case with R5 instances for Amazon EC2. In addition to having better performance, the new R5 instances are less expensive, carrying 0.94x the cost of the older instances.<sup>2</sup>



## Conclusion

In our OLTP tests on MySQL databases running in the Amazon EC2 cloud, newer R5-series instances featuring Cascade Lake processors handled up to 1.64 times the TPC-C-like transactions per minute compared to older R4-series instances which featured Broadwell processors. We tested three sizes of instances that map broadly to small, medium, and large business needs, finding that the R5 instances brought significant performance advantages for each use case. Furthermore, R5 series instances actually cost less than their R4 predecessors, meaning these newer instances are a better investment for OLTP workloads.

With newer instances at the heart of your organization's cloud-based ecommerce work, you could better handle requests during peak business hours and offer a smoother experience to your users.

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- 1 "Amazon EC2 R5 instances," accessed November 24, 2020, <https://aws.amazon.com/ec2/instance-types/r5/>.
  - 2 "Amazon EC2 On-Demand Pricing," accessed November 24, 2020, <https://aws.amazon.com/ec2/pricing/on-demand/>.

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