Open up new possibilities with higher transactional database performance from Amazon EC2 R7i instances featuring 4th Gen Intel Xeon Scalable processors

In our PostgreSQL tests, R7i instances boosted performance over R6i instances with previous-gen processors

As the most popular database among professional developers, PostgreSQL backs companies all over the world.[1] Organizations might use this open-source database to support customers looking up or purchasing items as well as staff members searching through business data or running mobile applications. IT teams that run PostgreSQL in the cloud have a host of options, but one non-negotiable for business-critical workloads is performance. Companies that choose instances that deliver higher online transaction processing (OLTP) performance can benefit by supporting more users, providing a better user experience, and doing a given amount of work with fewer instances.

In a study commissioned by Intel®, we compared the PostgreSQL performance of Amazon Elastic Cloud Compute (EC2) R7i instances, enabled by 4th Gen Intel Xeon® Scalable processors, to that of R6i instances with 3rd Gen Intel Xeon Scalable processors. We did so by running the HammerDB TPROC-C benchmark, which assesses a solution's performance on an OLTP workload and reports a metric of new orders per minute (NOPM). At all three sizes we tested, the R7i instances with newer processors sustained better performance than their predecessors, offering you the chance for a bigger customer base, higher user satisfaction, and greater productivity from your organization.

Process up to 13.5%
more new orders per minute on 4-vCPU R7i instances*

Process up to 13.8%
more new orders per minute on 16-vCPU R7i instances*

Process up to 8.5%
more new orders per minute on 64-vCPU R7i instances*

*compared to R6i instances

This project was commissioned by Intel.

How we tested

We compared the TPROC-C performance of two Amazon EC2 instances at three instance sizes:

- R7i instances with Intel Xeon Platinum 8488C processors
- R6i instances with Intel Xeon Platinum 8375C processors

Figure 1 highlights the size specifications of the instances we tested.

We ran the HammerDB TPROC-C workload, which simulates a system fulfilling customer orders from a company with multiple warehouses. This OLTP workload includes five types of transactions: receiving a customer order, recording a payment, delivering an order, checking an order's status, and checking stock in inventory.[2] Though the types of orders in this benchmark mimic the everyday work of a warehouse, organizations of many kinds run PostgreSQL and might be interested in TPROC-C benchmark results.

We stored the PostgreSQL database on Amazon Elastic Block Storage (EBS) volumes. Specifically, the database resided on IOPS Provisioned SSDs (io1) for 16- and 64-vCPU configurations, while 4-vCPU configurations utilized General Purpose SSDs (gp3). We chose to use 1GB huge pages for efficiency and configured the database to prioritize leveraging CPU and memory over storage. A separate 8-vCPU client VM sent the HammerDB queries.

Note that while HammerDB derived this workload from the specifications for the TPC-C benchmark, TPROC-C is not a full implementation of official TPC-C standards. Our TPROC-C results are not directly comparable to published TPC-C results.

For additional configuration information, see the science behind the report.

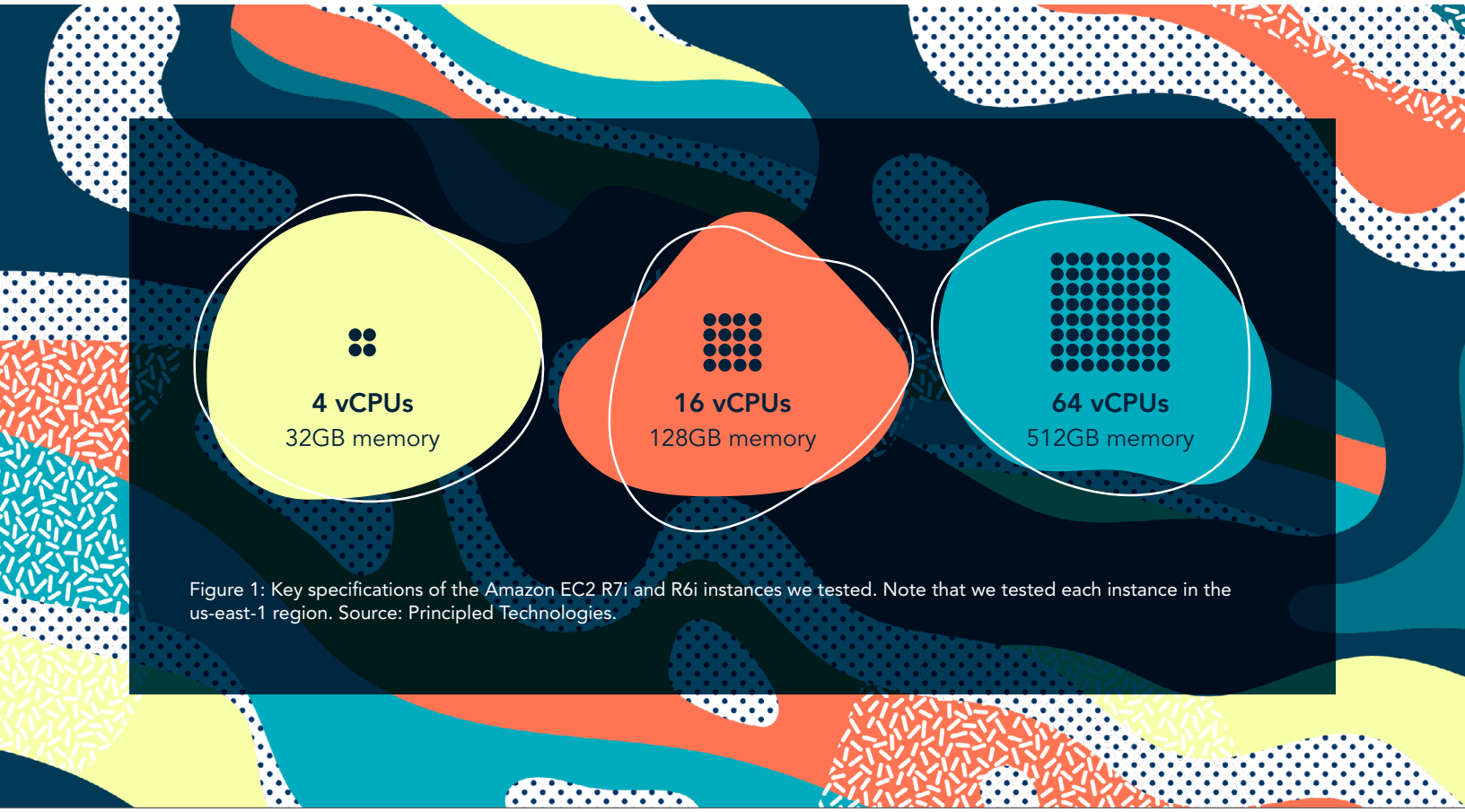

Figure 1: Key specifications of the Amazon EC2 R7i and R6i instances we tested. Note that we tested each instance in the us-east-1 region. Source: Principled Technologies.

Grow your business with better OLTP performance

Public cloud usage continues to grow, with worldwide public cloud revenue surpassing $300 billion in the first half of 2023.[3] To address this growing market, public cloud providers offer a wide range of instance types, allowing organizations to select the instances that best fit their workloads, budgets, and other requirements. However, the sheer scope of the options available can be overwhelming—Amazon EC2 alone offers over 750 instance types.[4] In this crowded marketplace, hands-on test results can help you hone in on the performance your company needs.

In the following sections, we present the results of our testing at three different instance sizes. These results indicate that regardless of the size of the instances you select, your company could benefit by choosing an R7i instance with a 4th Gen Intel Xeon Scalable processor instances. These more capable instances could let you provide a speedier experience for users, save by carrying out a given amount of database work with fewer instances, or support more customers with a given number of instances.

Better performance on small instances

Figure 2 shows the test results with 4-vCPU instances. (For ease of comparison, we normalize our findings by setting the lower result to one and showing the higher result in relation.) The R7i instance with a 4th Gen Intel Xeon Scalable processor achieved 13.5 percent more new orders per minute than the R6i instance.

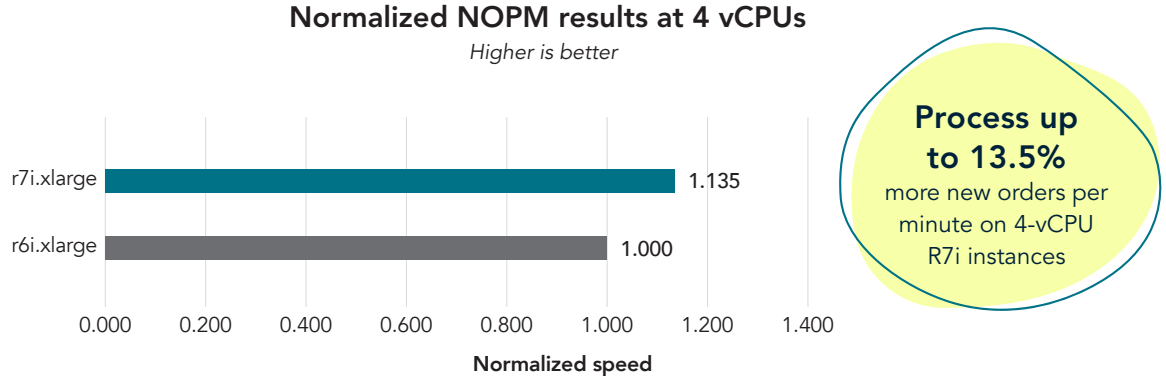

Figure 2: Normalized comparison of the number of new orders per minute that the small (4-vCPU) R7i instance completed, relative to the number of new orders per minute that the small (4-vCPU) R6i instance completed. Higher is better. Source: Principled Technologies.

About 4th Gen Intel Xeon Scalable processors

According to Intel, 4th Gen Intel Xeon Scalable processors feature "the most built-in accelerators of any CPU on the market to help improve performance efficiency for emerging workloads, especially those powered by AI."[5] Along with PCIe® Gen5 technology, DDR5 memory, and CXL 1.1 capabilities, 4th Gen Intel Xeon Scalable processors also offer Intel Accelerator Engines for a variety of workloads.[6]

For more information, visit https://www.intel.com/content/www/us/en/products/docs/processors/xeon-accelerated/4th-gen-xeon-scalable-processors.html.

Better performance on medium-sized instances

As we see in Figure 3, the 16-vCPU R7i instance with a 4th Gen Intel Xeon Scalable processor outperformed the R6i instance by 13.8 percent.

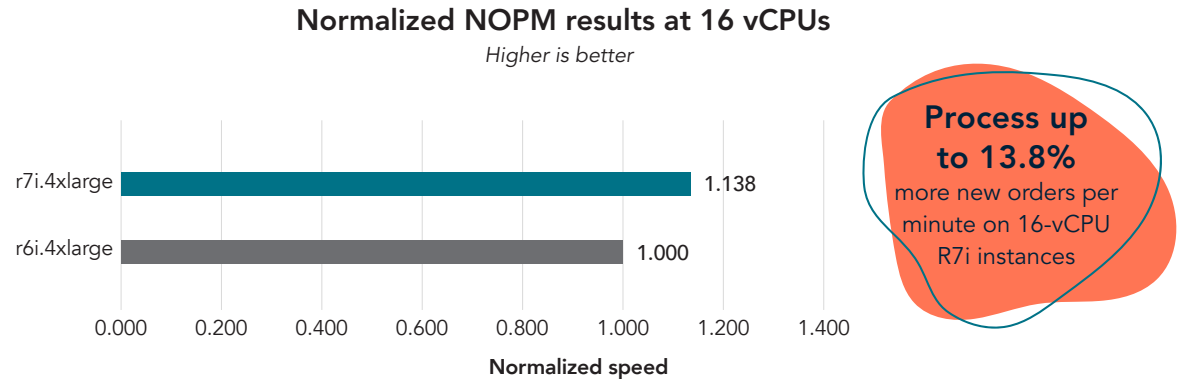

Figure 3: Normalized comparison of the number of new orders per minute that the medium (16-vCPU) R7i instance completed, relative to the number of new orders per minute that the medium-sized (16-vCPU) R6i instance completed. Higher is better. Source: Principled Technologies.

Better performance on large instances

The 64-vCPU R7i instance with a 4th Gen Intel Xeon Scalable processor achieved 8.5 percent more new orders per minute than the R6i instance (see Figure 4).

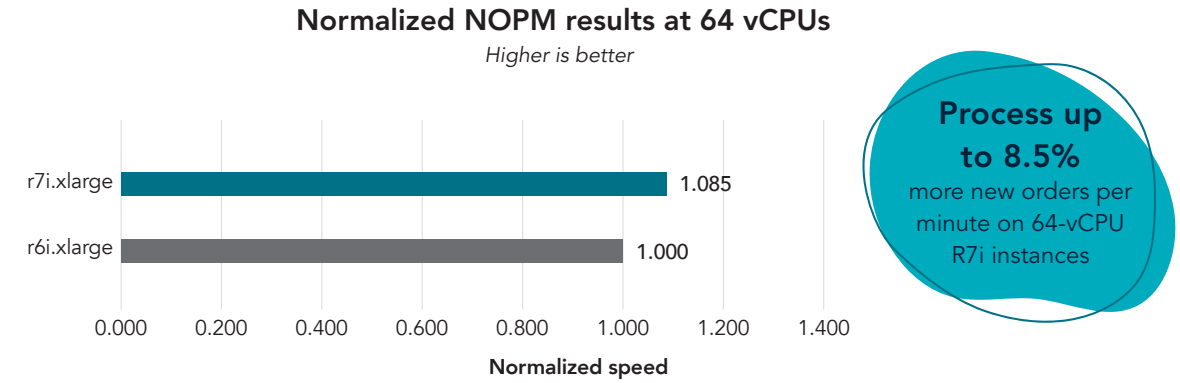

Figure 4: Normalized comparison of the number of new orders per minute that the large (64-vCPU) R7i instance completed, relative to the number of new orders per minute that the large (64-vCPU) R6i instance completed. Higher is better. Source: Principled Technologies.

About Amazon EC2 R7i instances

Apart from featuring 4th Gen Intel Xeon Scalable processors, memory-optimized Amazon EC2 R7i instances offer several advantages. They are built on the AWS Nitro System, SAP-certified, and available in 11 sizes (including two bare-metal sizes).[7] According to Amazon, they are "ideal for all memory-intensive workloads (SQL and NoSQL databases), distributed web scale in-memory caches (Memcached and Redis), in-memory databases (SAP HANA), and real-time big data analytics (Apache Hadoop and Apache Spark clusters)."[8]

Learn more at https://aws.amazon.com/ec2/instance-types/r7i/.

Conclusion

If you use the open-source PostgreSQL database to run your critical business operations, you have many cloud options from which to choose. While many of these instances can do the job, some can deliver stronger performance, which can mean getting a greater return on your cloud investment.

We conducted hands-on testing with the HammerDB TPROC-C benchmark to see how the PostgreSQL performance of Amazon EC2 R7i instances, enabled by 4th Gen Intel Xeon Scalable processors, stacked up to that of R6i instances with previous-generation processors. We learned that small, medium-sized, and large R7i instances with the newer processors delivered better OLTP performance, with improvements as high as 13.8 percent. By choosing the R7i instances, your organization has the potential to support more users, deliver a better experience to those users, and even lower your cloud operating expenditures by requiring fewer instances to get the job done.

1. Stack Overflow, "2023 Developer Survey," accessed January 23, 2024, https://survey.stackoverflow.co/2023/.
2. HammerDB, "Understanding the TPROC-C workload derived from TPC-C," accessed January 23, 2024, https://www.hammerdb.com/docs/ch03s05.html.
3. James Bourne, "Global public cloud services revenues hit $315bn in first half of 2023," accessed January 23, 2024, https://www.cloudcomputing-news.net/news/2023/dec/15/global-public-cloud-services-revenues-hit-315bn-in-first-half-of-2023/.
4. Amazon, "Amazon EC2," accessed January 24, 2024, https://aws.amazon.com/ec2.
5. Intel, "4th Gen Intel Xeon Scalable Processors with Built-In Accelerators," accessed January 23, 2024, https://www.intel.com/content/www/us/en/products/docs/processors/xeon-accelerated/4th-gen-xeon-scalable-processors.html/.
6. Intel, "4th Gen Intel Xeon Scalable Processors with Built-In Accelerators."
7. Amazon, "Amazon EC2 R7i instances," accessed January 23, 2024, https://aws.amazon.com/ec2/instance-types/r7i/.
8. Amazon, "Amazon EC2 R7i instances."

Read the science behind this report at https://facts.pt/EBn8Qpk ▶

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This project was commissioned by Intel.