Realize better value and performance migrating from Azure Database for PostgreSQL – Single Server to Flexible Server with AMD EPYC

The upcoming retirement of Azure Database for PostgreSQL – Single Server, which is scheduled for March 28, 2025,[1] highlights the pressing need for organizations to shift to newer instances to continue running their databases. Through a simple migration progress, transitioning from Azure Database for PostgreSQL – Single Server to Azure Database for PostgreSQL – Flexible Server with AMD EPYC™ processors can help organizations maintain business continuity while simultaneously offering considerable performance advantages.

At Principled Technologies, we completed hands-on testing of both Flexible Server and Single Server, explored the performance and cost differences between the two solutions, and migrated a database to Flexible Server using the Azure offline migration tool. Using the HammerDB benchmark, we found that Azure Database for PostgreSQL – Flexible Server with AMD EPYC handled 4.71 times the NOPM of the Single Server instance while offering 2.85 times the IOPS and 3.88 times the performance/dollar. Completing the migration using the Azure migration tool made moving from Single Server to Flexible Server and reaping these performance benefits a simple task. These significant performance gains show that moving to Azure Database for PostgreSQL – Flexible Server makes business sense, as the newer solution offers the opportunity to boost performance to improve customer experiences.

Stronger OLTP performance for PostgreSQL databases

4.71x the new orders per minute (NOPM)*

Better database throughput

2.85x the input/output operations per second (IOPS)*

Improved value

3.88x the performance per dollar*

*Compared to the Azure Database for PostgreSQL - Single Server instance we tested

A look into the new features that Azure Database for PostgreSQL – Flexible Server provides

Azure Database for PostgreSQL – Flexible Server is a full managed, production-ready database service that stands out with its high-availability (HA) features, supporting single and multiple availability zones.[2] Its architecture separates compute and storage: the database engine runs in a Linux VM, with data files stored on Azure storage, maintaining three synchronous copies for data durability. For enhanced reliability, the service offers a zone-redundant setup, employing a standby server in a different availability zone for synchronous data replication and immediate activation during failovers.[3]

Automated maintenance is a key aspect of this service, including patching of the underlying hardware, the operating system, and the PostgreSQL database engine. The service also offers security and software updates and minor PostgreSQL version upgrades. Additionally, the service provides data safety through automatic backups stored in zone-redundant storage (ZRS), enabling server restoration during the backup retention period.

Flexible Server offers three compute tiers: Burstable, General Purpose, and Memory Optimized.[4] The Burstable tier caters to low-cost, low-concurrency workloads. The General Purpose and Memory Optimized tiers specifically target high-concurrency, scalable production workloads. The service enhances cost-efficiency through its on-demand server stop-start feature, which immediately stops compute tier billing when the server becomes inactive.

New features for Azure Database for PostgreSQL – Flexible Server

What does Azure Database PostgreSQL – Flexible Server have that Single Server doesn't? According to our research, plenty:

- Enhanced high-availability zone options like zone-redundant HA and same-zone HA, allowing for more robust data resilience and continuity; support for Geo-replication for regional redundancy
- A burstable compute tier and an automatic IOPS scaling feature called autoscale IOPS
- Support for Premium SSDv 2 storage, which is "designed for IO-intense enterprise workloads that require sub-millisecond disk latencies and high IOPS and throughput at a low cost"[5]
- Improved data security for data at rest using the Federal Information Processing Standards (FIPS) 140-2 validated cryptographic module, ensuring data encryption[6]
- Comprehensive, built-in performance monitoring and alerting, with metrics updated every minute and a 30-day history available. Users can configure slow-running query logs, which can be instrumental in pinpointing and resolving performance bottlenecks in database operations.[7]
- Granular backup features. The service automatically creates server backups and allows users to store them locally in redundant or geo-redundant storage, safeguarding against the loss of data in a variety of situations.[8]

For more information about Azure Database for PostgreSQL – Flexible Server, visit https://azure.microsoft.com/en-us/pricing/details/postgresql/flexible-server/.

How we tested

Using the HammerDB benchmark, we compared the OLTP performance of two solutions:

- a Flexible Server instance (Standard_D16ads_v5) with AMD EPYC processors and a 1TB Premium SSD version 2 volume configured with 51,200 IOPS and throughput of 768 MBps. Dadsv5-series instances utilize 3rd Generation AMD EPYC processor in a multi-threaded configuration.
- a Single Server instance (GP_Gen5_16) with a 6.5TB volume, which allowed us to utilize the instance's maximum disk IOPS of 20,000.

After our performance testing, we used the offline Azure migration tool to complete an example migration of a 525GB database from Single Server to Flexible Server. For more information about the configurations we used, as well as step-by-step performance and migration details, read the science behind the report.

About HammerDB

To test OLTP performance, we used the TPROC-C workload from HammerDB—an open-source tool that tests the performance of many leading databases including PostgreSQL. While HammerDB developers derived their TPROC-C workload from the TPC-C standard, it is not a full implementation of TPC-C specifications. As such, the results we cite in this paper are not directly comparable to those officially published by TPC. HammerDB reports results in both transactions per minute (TPM) and new orders per minute that a system can handle. For more information about HammerDB, visit www.hammerdb.com.

Flexible Server offered stronger database performance: HammerDB testing results

One reason you may have postponed your organization's migration from Azure Database for PostgreSQL – Single Server to Azure Database for PostgreSQL - Flexible Server is uncertainty about how performance levels might change. We compared the database performance of both solutions using the HammerDB TPROC-C benchmark using a 10-minute runtime and 64 virtual users. We tested with the HammerDB option of "All warehouses," which ensures the workload exercises nearly all the data instead of a portion. We did this to ensure data was not cached in memory, which caused more IO. We ran each test three times and report the median of three runs. Table 1 shows a summary of our test results, which we expand on below. Note: These results reflect the actual IOPS the instances achieved during the tests. For the Flexible Server instance, we captured IOPS directly from the Metrics section of Azure portal. For the Single Server instance, we calculated IOPS achieved by 1) taking the IO percent from the Metrics section and 2) multiplying that IO percent by the number of configured IOPS, which was 20K.

Table 1: HammerDB results for both 16vCPU Azure Database for PostgreSQL solutions. Higher numbers are better.
Source: Principled Technologies

HammerDB testing – 16vCPU configurations	Flexible Server	Single Server	Improvement with Flexible Server
NOPM	30,605	6,490	4.71x
CPU utilization	52.4%	22.1%	-
IOPS	37.7K	13.2K	2.85x

Figure 1 shows the NOPM that the two solutions achieved during HammerDB testing. The performance of the Azure Database for PostgreSQL – Flexible Server instance with AMD EPYC processors dwarfed that of the Single Server solution, delivering 4.71 times the database performance.

Selecting an instance that handles more NOPM means that you can have more customers on your ecommerce site searching, making purchases, and more—which could only be good for business.

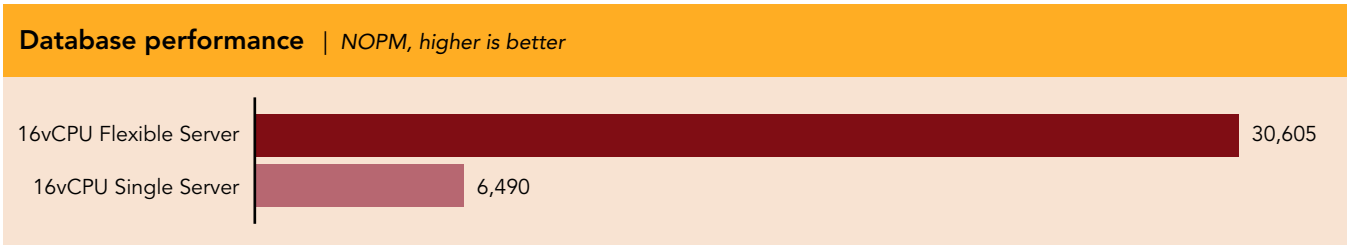

Figure 1: Database performance, in NOPM, that the Azure Database for PostgreSQL solutions achieved in our HammerDB testing. Higher is better. Source: Principled Technologies.

Figure 2 shows the IOPS that the instances reported during testing. Again, Flexible Server outperformed Single Server by a wide margin, delivering 2.86 times the IOPS. The IOPS metric measures the number of reads and writes that storage can handle. Every application is different, but typically higher IOPS numbers indicate that users can perform more database actions at once without degrading user experience.

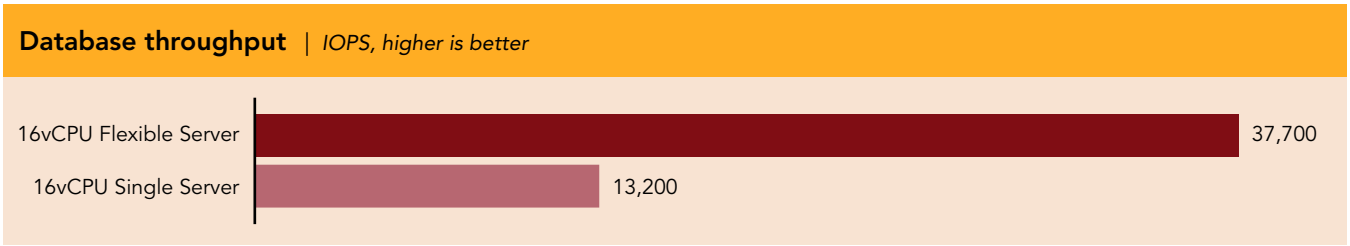

Figure 2: IOPS that the Azure Database for PostgreSQL solutions achieved in our HammerDB testing. Higher is better. Source: Principled Technologies.

Looking at processor utilization while running a database workload can give insight into how efficiently your instance is using its available resources. Processor utilization that's too low might indicate performance bottlenecks elsewhere (often the storage) and means that you aren't reaping the performance benefits of the processors powering your workloads.

As Figure 3 shows, the Azure Database for PostgreSQL – Flexible Server instance made better use of its available processing resources than did the Single Server solution.

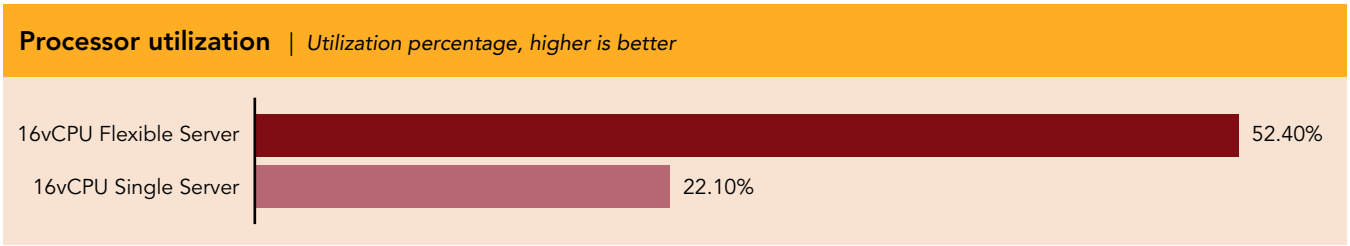

Figure 3: CPU utilization for both Azure Database for PostgreSQL solutions during our HammerDB testing. Higher is better. Source: Principled Technologies.

About the AMD EPYC 7763 processor

In our tests, the Flexible Server instance used the 3rd Gen AMD EPYC 7763v processor—a version of the 7763 model. The AMD EPYC 7763 features 64 cores, 128 threads, and 256MB cache. Its base speed is 2.45 GHz with a maximum boost clock speed of up to 3.5 GHz.[9]

The AMD EPYC 7763v processor powers both General Purpose and Memory Optimized Flexible Server instances for Azure Database for PostgreSQL. Both instance types offer a range of 2 to 96 vCores, and up to 900 MB/s of I/O bandwidth, while the General Purpose instances have up to 384 GB of memory, and Memory Optimized have up to 672 GB of memory.

To learn more about the AMD EPYC 7763 processor, visit https://www.amd.com/en/products/cpu/amd-epyc-7763.

See increased performance/dollar with Flexible Server

Azure Database for PostgreSQL – Flexible Server outperforms the Single Server option, but how much does a similarly configured Flexible Server instance cost? Our research shows that Flexible Server offers this significant database performance jump without incurring a large cost increase. The total monthly cost (using the maximum monthly hours of 730 hours) for Flexible Server was $2,172.72, while Single Server cost $1788.60. To learn details about where we sourced this information and how we arrived at our performance per dollar calculations, read the science behind the report.

As Figure 4 shows, Flexible Server offers an impressive 3.88 times the performance per dollar that a Single Server instance can provide. This data shows that organizations moving to Flexible Server could expect better value than you're currently getting by continuing to use Single Server instances.

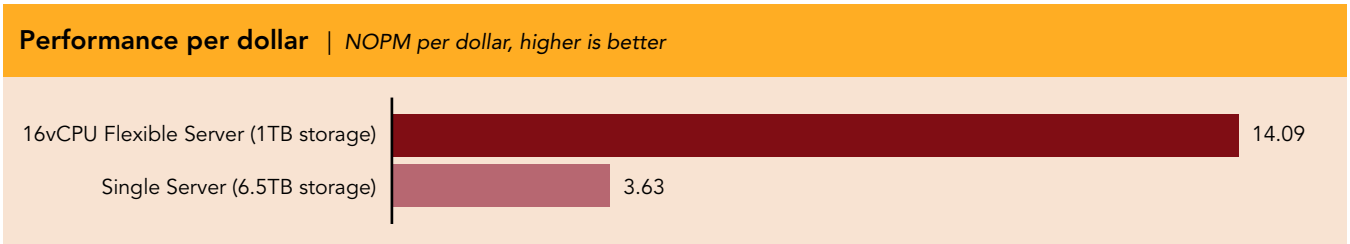

Figure 4: Performance per dollar comparison of Azure Database for PostgreSQL – Flexible Server vs. the Single Server offering. Higher numbers are better. Source: Principled Technologies.

Energy usage with AMD EPYC processors

Recent tests have shown that two-socket AMD EPYC 7763 processor-powered servers demonstrated up to 85% better energy efficiency than the most comparable non-AMD-based servers.[10] AMD studies show organizations were able to consolidate multiple servers onto fewer servers, reducing energy and green house gas emissions and thereby reducing operating expenditures including power usage, rack footprint, and more.[11]

To learn about AMD energy efficiency initiatives, visit https://www.amd.com/en/campaigns/epyc-energy-efficiency.

Moving to Flexible Server is easy using the migration tool in the Azure UI

Thoughts of migration woes may be holding your IT team back from making the move to Flexible Server. We found that using the offline migration tool in the Azure UI makes it easy to move your databases onto the newer solution.

In our tests, we were able to easily migrate a 525GB database from a 16vCPU Single Server instance to a 16vCPU Flexible Server instance based on AMD EPYC. While we used the offline migration option in our tests, Azure offers both offline and online options, and users can monitor the entire process using the Azure portal. A benefit to this migration tool is its ability to migrate the entire server, including users; roles and privileges; schema; and data, in a secure and reliable way.

To see how we completed our migration, read our step-by-step guide in the science behind the report.

To learn more about how to use the Azure migration tool visit https://learn.microsoft.com/en-us/azure/postgresql/migrate/concepts-single-to-flexible.

Azure Database for PostgreSQL – Flexible Server offers performance and cost benefits

It's time to move your databases from Azure Database for PostgreSQL – Single Server instances now, before March 2025 when Microsoft Azure retires the service. Our hands-on testing shows that moving to Azure Database for PostgreSQL – Flexible Server is a simple process that can offer significantly better database performance and value. With as much as 4.71 times the NOPM on HammerDB and up to 3.88 times the performance per dollar compared to Single Server, moving to Azure Database for PostgreSQL – Flexible Sever with AMD EPYC processors can give you higher performing databases for lower relative cost.

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Read the science behind this report at https://facts.pt/AK7am5k ▶

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