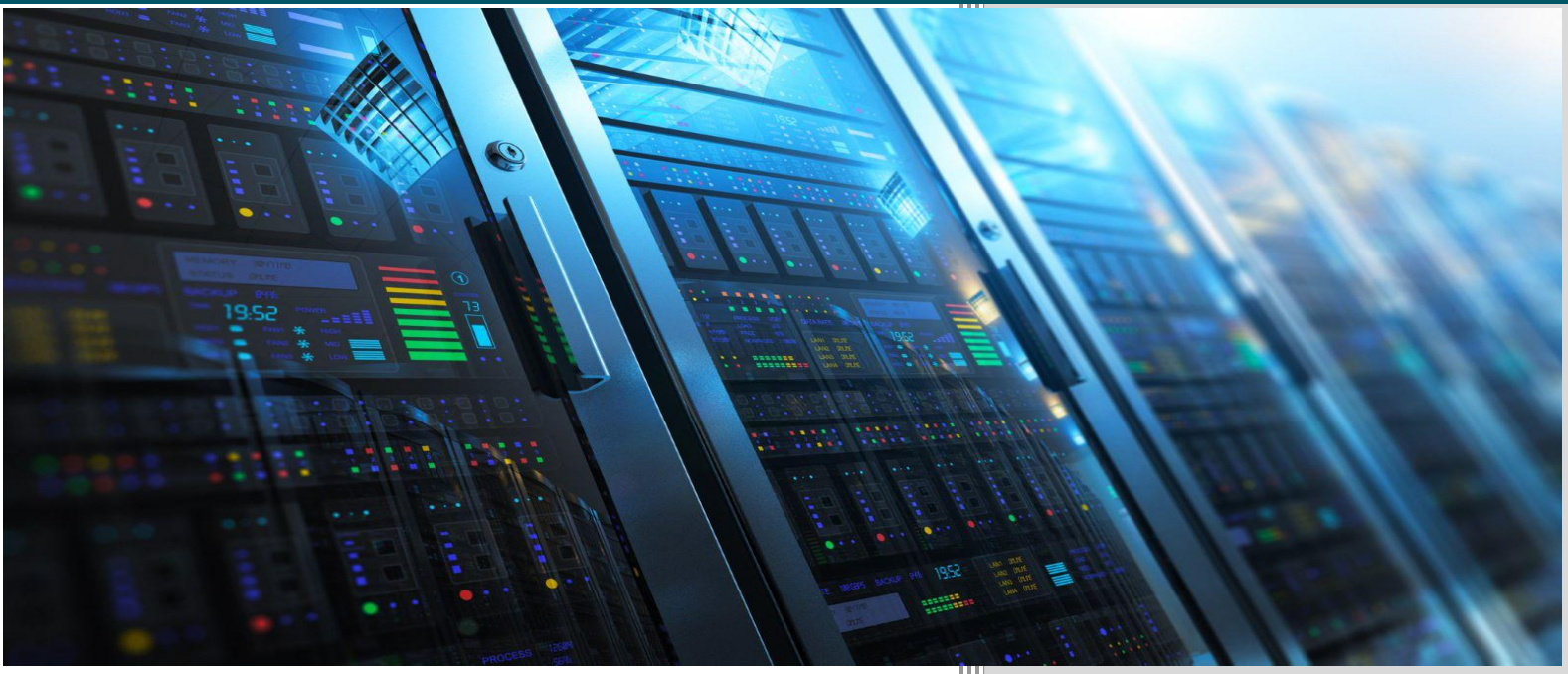
Nutanix™ NX Servers Deliver Scalable Performance for PostgreSQL Database



Looking to move from a bare metal to hyperconverged environment in your data center for database workloads?

Look no further. AMD EPYC™ processor-powered Nutanix-NX appliances are the answer!

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Introduction

Hyperconverged Infrastructure (HCI) simplifies IT and data center operations. Enterprises have been implementing HCI technologies in IT ecosystems for many years, deploying and managing IT resources and software to help improve TCO and scalability in their business environments. EPYC™ CPU-based Nutanix® NX appliances are the result of a collaboration between industry leaders. These appliances simplify and modernize data centers to run applications at scale.

PostgreSQL® is widely used in various applications, from small-scale personal projects to large-scale enterprise systems. It serves as the backend for web applications, data warehouses, analytical systems, and geospatial databases. Its versatility and strong community support make it a popular choice for developers and organizations seeking a reliable and flexible database solution. PostgreSQL is the most advanced open-source relational database that supports both relational (SQL) and non-relational (JSON) queries. It delivers exceptional performance and ease of use for on-premises, cloud, and hybrid workloads. Nutanix NX servers powered by AMD EPYC™ 9004 processors and running Nutanix Acropolis® software deliver high Online Transaction Processing (OLTP) performance and exceptional scaling on PostgreSQL 17.5.

AMD EPYC Powered Nutanix NX Appliance Offers:

- Flexibility – Custom-sized VMs based on your requirements.
- High Availability – Nutanix includes powerful self-healing, data protection, and disaster recovery capabilities to keep databases and applications running and helping protect your critical data.
- Performance – High frequency processors (ending in the letter "F") bring the highest base frequency, max boost, and all-core boost frequency in the 4th Gen EPYC series, optimizing per core performance compared with AMD EPYC 3rd Gen and license costs.
- Scalability – Scale up by increasing the CPU/Memory in the same VM to meet DB requirements or scale out by spinning up more VMs or adding more nodes/cores as your needs evolve.
- Cost-effective - Create multiple databases in the same cluster farm to help reduce TCO.

Dual-socket Nutanix NX servers powered by AMD EPYC 9004 Series Processors are an excellent choice for deploying PostgreSQL Database in a hyperconverged environment, thanks to their high clock speeds, memory bandwidth, and transactions per VM.

If you are looking to transition from a bare-metal to a hyperconverged environment in your data center for database workloads, then AMD EPYC 9004-powered Nutanix NX appliances are your answer. This combination brings you the power, performance, scalability, value, and freedom of choice needed to fit your datacenter requirements.

AMD EPYC 9004 Series Processors with PostgreSQL Demonstrate Exceptional Performance on Transaction Processing Workloads with PostgreSQL 17.5

AMD EPYC 9004 Series Processors provide a leadership throughput computing foundation for Nutanix HCI. Scaling is critical to HCI applications. AMD EPYC 9004 Series Processors provide high bandwidth between nodes with support for PCIe® Gen 5-enabled network devices. AMD and Nutanix collaborated to thoroughly test solutions that deliver excellent workload performance and help improve availability and scalability.

Performance Benchmarking

In our AMD internal testing performed during August 2025, we measured the throughput scaling between 8 vCPUs (24 VMs), 16 vCPUs (12 VMs), and 24 vCPUs (8 VMs). This kind of transaction throughput scaling can help a business start at an appropriate level for its current needs and grow with consistent and predictable performance as needs expand.

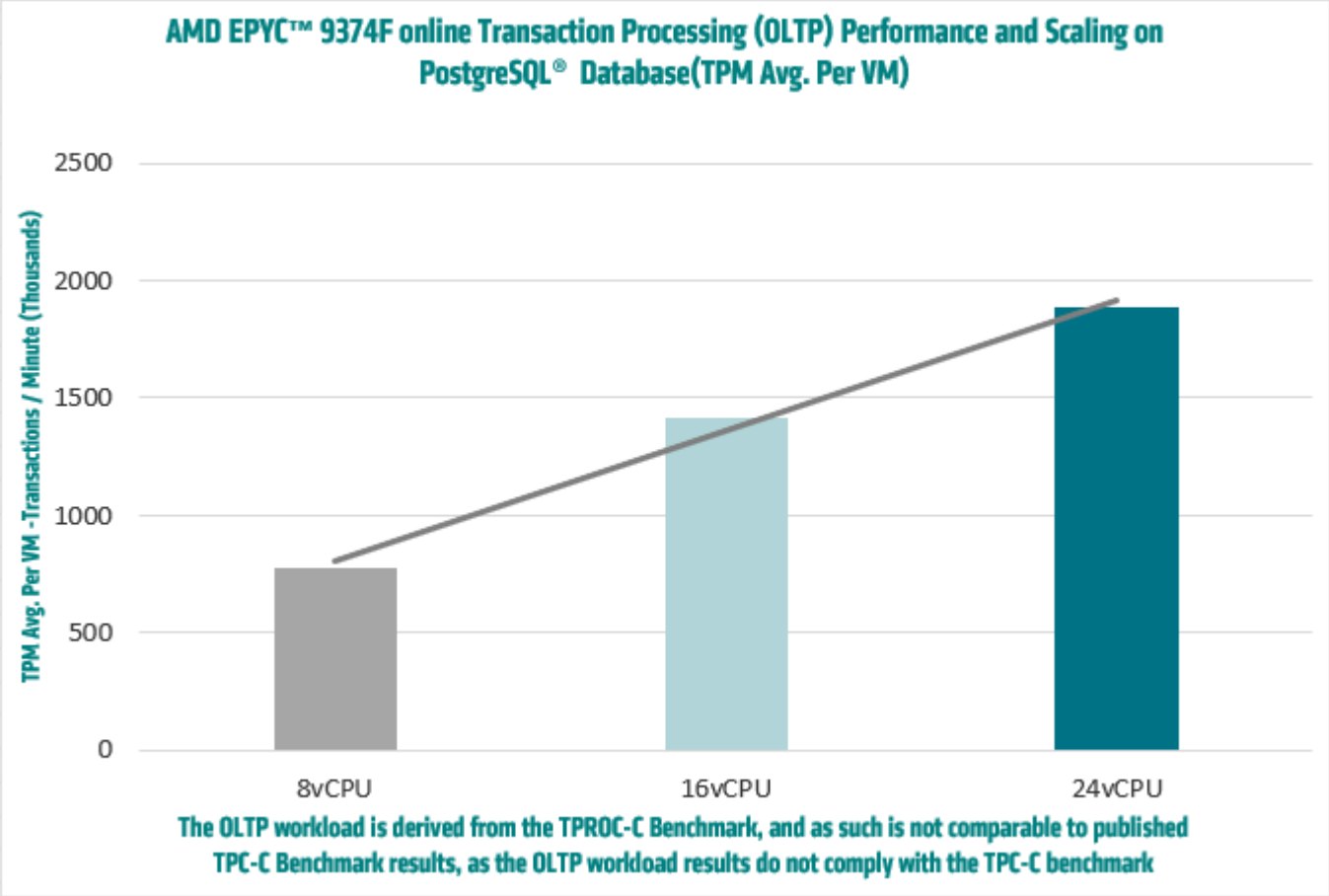

Figure 1 AMD EPYC 9374F OLTP performance scaling on PostgreSQL 17.5 on two sockets, 4 host Nutanix NX servers.

Workload

The OLTP workload is derived from the TPROC-C Benchmark using the widely accepted open-source benchmarking tool HammerDB. Note: The HammerDB TPROC-C workload is an open-source workload derived from TPC Benchmark™ Standard, and as such is not comparable to published TPC-C™ results, as the results do not comply with the TPC-C Benchmark Standard. The TPROC-C benchmark models an order fulfillment system where the database receives requests for data, adds new data, and makes multiple changes to the data from many users.

Figure 1 shows the TPM Avg. Per VM . AMD engineers ran tests derived from industry-standard benchmarks on PostgreSQL Linux®-based VMs in a Nutanix environment. Five tests were performed on three instance types with different vCPU and memory configurations. All benchmark runs for all configurations used the same Online Transaction Processing (OLTP) workload. These results demonstrate the effectiveness of the VMs at optimizing the I/O throughput for database applications.

Nutanix Acropolis Software

Nutanix Acropolis software converges compute and storage to provide a cloud-like infrastructure that can run applications at scale. Nutanix Hyperconverged Infrastructure (HCI) software tightly integrates storage,

networking, and compute resources into a powerful software-defined virtualized pool with a single point of management. Integrating these resources into a single infrastructure building block avoids having to manually stitch together separate, discrete computing devices. Nutanix software enables databases and application workloads that deliver excellent user performance and scalability.

Test Methodology

HammerDB is a database load testing and benchmarking tool. AMD used HammerDB to create a test schema, load it with data, and simulate a workload of multiple virtual users against the database for both transactional and analytic scenarios. This workload can then be used to derive meaningful information about an environment, such as hardware performance comparisons and software configurations. The benchmark involves a mix of five concurrent transactions of different types and complexity that are executed either online or queued for deferred execution. AMD performed TPROC-C benchmarking with PostgreSQL 17.5 using the widely accepted open-source benchmarking tool HammerDB.

Table 1 lists the test sizes:

Size	Small	Medium	Large
CPU Per VM	8vCPU	16vCPU	24vCPU
Host1	6VM X 8vCPU	3VM X 16vCPU	2 VM X 24vCPU
Host2	6VM X 8vCPU	3VM X 16vCPU	2 VM X 24vCPU
Host3	6VM X 8vCPU	3VM X 16vCPU	2 VM X 24vCPU
Host4	6VM X 8vCPU	3VM X 16vCPU	2 VM X 24vCPU
Memory (GB) Per VM	128	256	512

Table 1 Test Methodology and Benchmarking

- The TPROC-C (OLTP) test was performed with 64-192 warehouses with a test duration of 30 minutes and a ramp-up time of 2 minutes. This technical brief shows the average of five runs.
- The PostgreSQL workloads were performed with 64 warehouses for 8vCPU, 128 warehouses for 16vCPU and 192 warehouses for 24vCPU.
- OS HugePages memory and PostgreSQL.conf parameters need tuning for optimum performance. Please see the details of these parameters in the Nutanix Best Practice Guide for Virtualizing PostgreSQL*.

Test Configurations

AMD configured four dual-socket servers with AMD EPYC 9374F processors with 32 cores per socket and 1.5 TB of memory per host was added in a high-throughput, dual-DIMM-per-channel configuration. The storage configuration used Nutanix software with 12 SATA SSD drives for data per server. Each disk capacity was 7.6 TB for a total of ~320 TB of high-speed usable storage. Nutanix deduplication and erasure coding were disabled, and compression was enabled. 100 Gbps switches connected the servers.

Component	Details
Server	4 x Dual-Socket Server (Nutanix NX Appliance NX-8155A-G9)
CPU	2 socket, AMD EPYC 9374F 32 Core @ 3.85 GHz
RAM	1.5 TB (24 x 64GB DDR5 4800MHz)
Network adapter	Adapter1- Mellanox AOC-623106AS-CDAT-MCX623106ASCDAT PCIe2-port 100GbEGen4x16 CX-6

Disks	12 x 7.6 TB SATA SSD
Hypervisor	AHV v.10.3
Nutanix AOS	7.3
PostgreSQL Database Version	17.5
BIOS Version	10.009
HammerDB	5.0
Linux®	Red Hat Enterprise Linux release 9.6 (5.14.0-570.26.1.el9_6.x86_64)

Table 2 Hardware and Software versions

PostgreSQL Database Configuration

Testing used the following Per-VM PostgreSQL configuration variations:

- vCPU Counts: 8, 16, 24
- Memory GB: 128, 256, 512
- 8 Disks
    - 1 OS Boot (Size: 1 x 100 GB)
    - 4 Data (Size: 4 x 400 GB)
    - 2 Redo Log (WAL) (Size: 2 x 100 GB)
    - 1 Backup (Size: 1 x 150 GB)

For this test, the following PostgreSQL database configurations were used:

- PostgreSQL Instance parameter file postgresql.conf
- Linux HugePages

PostgreSQL Database Instance parameters (e.g.) postgresql.conf

Table 4 shows the settings used during PostgreSQL database testing. AMD recommends using Huge Pages to optimize performance, because it can substantially improve virtual memory management. A PostgreSQL parameter file (postgresql.conf) was created to define the overall instance configuration, such as how much memory should be allocated to the instance, the file locations, and internal optimization parameters.

Table 4 shows the relevant parameters and their values for the tests performed.

Parameters	8 vCPU	16 vCPU	24 vCPU
shared_buffers	80 GB	163 GB	347 GB
max_worker_processes	8	16	24
max_parallel_workers	8	16	24
max_parallel_maintenance_workers	2	4	6
max_parallel_workers_per_gather	2	4	6
temp_buffers	4000MB	4000MB	4000MB
work_mem	4000MB	4000MB	4000MB
maintenance_work_mem	512MB	512MB	512MB
max_files_per_process	4000	4000	4000
effective_io_concurrency	32	32	32
effective_cache_size	750GB	750GB	750GB

Table 3 Instance Parameters

HugePages

The HugePages parameter in /etc/sysctl.conf was used in addition to PostgreSQL's recommended OS's sysctl parameters.

Please see Configuring HugePages for PostgreSQL Database* for information on calculating the vm.nr_hugepages parameter via PostgreSQL's script hugepages_settings.sh.

Parameter	8 vCPU	16 vCPU	24 vCPU
vm.nr_hugepages	44032	87040	209920

Table 4 HugePages Parameter

HammerDB Client Configuration

The performance benchmarks were executed in parallel execution mode, i.e., running multiple HammerDB clients (Linux user1 to user24) pointing to specific PostgreSQL Database Instances respectively according to the individual ip address and its associated PostgreSQL listener at any given point in time. All the PostgreSQL database instances brought up at the same time and connected to the HammerDB clients respectively.

The HammerDB resource configuration used for testing was:

- vCPU 128
- Memory 256 GB

Test Result Summary

Creating multiple instances on the cluster, as shown in Figure 1, demonstrates the value of maximizing performance per VM by achieving high efficiency across both the hosts and the cluster at the same time. Three database sizes were tested as part of the performance test:

- Small with 8 vCPUs
- Medium with 16 vCPUs
- Large with 24 vCPUs.

AMD test validation demonstrates that testing AMD EPYC processors on Nutanix HCI software shows that providing more CPU resources to the entire PostgreSQL Database VM is the most effective way to boost performance. The performance results are shown in Figure 1, where database instances and performance are scaled based on allocated compute resources. PostgreSQL-based OLTP applications show excellent performance and scalability when Nutanix HCI leverages an AMD EPYC 9004 high-frequency x86-architecture server processor.

Conclusion

Nutanix NX Appliance NX-8155A-G9 servers integrated with Nutanix Software can help customers optimize their IT infrastructure and streamline operations. Servers powered by AMD EPYC processors deliver outstanding performance with over 500 world records across a broad range of workloads[2]. The above performance results clearly show that customers can benefit from small, medium, and large PostgreSQL database instances in both SMB and SME organizations. High availability features available with Nutanix software offer powerful self-healing, data protection, and disaster recovery capabilities. This solution also offers a high degree of flexibility and scalability that allows you to cost-effectively optimize your IT infrastructure and seamlessly scale as your organization grows.

Related Links

- AMD Data Center Products & Solutions
- AMD EPYC™ Tech Docs and White Papers Library
- Nutanix*
- PostgreSQL

FOOTNOTES

1. Install PostgreSQL client software on the client machine and configure as per the below instruction https://www.hammerdb.com/docs/ch04s02.html#d0e699
2. For a complete list of AMD EPYC world records see https://www.amd.com/en/products/processors/server/epyc/epyc-world-records.html
3. PostgreSQL 17.5

DISCLAIMER

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