



# Running PostgreSQL on Lenovo ThinkAgile HX V3 Servers with 4th and 5th Gen Intel Xeon Scalable Processors

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**Highlights Lenovo on-prem and hybrid cloud infrastructure solutions for PostgreSQL deployment**

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**PostgreSQL performance on Lenovo ThinkAgile HX V3 systems with 4th and 5th gen Intel® Xeon® Scalable Processors and Nutanix software stack**

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**Includes benchmark results and Bill of Material**

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# Running PostgreSQL on Lenovo ThinkAgile HX V3 Servers with 4<sup>th</sup> and 5<sup>th</sup> Gen Intel Xeon Scalable Processors

## Modernize Database Infrastructure

Organizations today face increasing challenges related to managing growing data volumes, meeting heightened user expectations for performance, and simplifying complex database environments. PostgreSQL, a leading open-source object relational database, addresses these challenges by offering advanced capabilities, high reliability, scalability and speeds up Generative AI applications development with support for vector operations. Lenovo ThinkAgile HX V3 hyperconverged infrastructure (HCI) servers powered by Nutanix software stack, provide an optimized and unified platform that complements PostgreSQL databases by enhancing performance, simplifying management, scaling deployment and improving reliability.

## About PostgreSQL

PostgreSQL is an advanced, enterprise-class open-source object relational database management system (ORDBMS) known for its exceptional performance, powerful feature set, and robust scalability. is free, open-source software released under the terms of the permissive PostgreSQL License. Renowned for its reliability and integrity, PostgreSQL supports complex transactions, extensible data types, vector database, indexing, and replication, making it a preferred choice for demanding workloads across diverse industries. pgvector enables efficient vector database and similarity searches directly within PostgreSQL, eliminating the need for separate vector databases and it leverages existing PostgreSQL infrastructure, offering cost-efficiency and unified data storage for both structured and vector data. Its vibrant global community ensures continuous innovation, regular updates, and comprehensive support, providing businesses with a secure, flexible, and cost-effective database solution.

## Lenovo ThinkAgile HX V3 Servers

Lenovo ThinkAgile HX Series V3 servers powered by 4<sup>th</sup> and 5<sup>th</sup> Gen Intel Xeon Scalable processors provide increased performance, bandwidth and speed.



Lenovo ThinkAgile HX630 V3 (1U)



Lenovo ThinkAgile HX650 V3 (2U)

Lenovo ThinkAgile HX V3 servers are available as Integrated Systems and Certified Nodes. Both are pre-validated and factory integrated systems with Lenovo hardware, Nutanix software, and deployment services. Integrated systems provide a quick and convenient path to implement a hyperconverged solution powered by Nutanix and a single point of contact provided by Lenovo for purchasing, deploying, and supporting the solution. HX Certified Nodes come with optional Nutanix software and services. All ThinkAgile HX V3 models support configurations for all flash and hybrid storage deployment.

## Key Advantages of PostgreSQL on Lenovo ThinkAgile HX V3

- **Software Defined Infrastructure:** Nutanix's HCI solution reduces latency and maximizing resource utilization for optimal PostgreSQL performance. ThinkAgile HX V3 servers with 4<sup>th</sup> and 5<sup>th</sup> Gen Intel Xeon Scalable Processors provide superior performance and higher consolidation ratio for Postgres deployments.
- **Simplified Management:** Nutanix Prism, Nutanix Cloud Platform (NCI) and Nutanix Kubernetes Engine (NKE) provides centralized management capabilities for streamlined database deployment across on premise and clouds, monitoring, automation, and scalability, significantly reducing operational complexity and administrative overhead.
- **DBaaS:** Nutanix Database Service (NDB) is a hybrid multicloud database-as-a service for PostgreSQL to deliver a seamless developer experience, simplified database management, and end-to-end support. It provides self-service provisioning, large scale database deployments and Postgres life cycle management and data protection.

## Best Practices for PostgreSQL deployment

- Set the BIOS UEFI operating mode to Maximum performance
- Use separate disks for data, WAL and archive files
- Size CVM resources appropriately
- Exercise and set appropriate WAL Logging level and checkpoint based on the application data integrity and recovery objectives.
- Use Postgres clustering to achieve high availability.
- Implement connection pooling for manage connections efficiently.
- Tune shared buffer and effective cache size to optimize disk I/O for high-speed reads and writes.
- Table partitioning can significantly improve query performance for large databases.

## Performance Testing Details and Results

## HammerDB Configuration

[HammerDB](#) is an open-source database transactional and analytics load testing/benchmarking tool for databases. The OLTP workload is derived from the TPC-C Benchmark standard, and it is not comparable to published TPC-C and do not comply with the TPC-C benchmark standards. The testing described below used HammerDB instance running on a separate server. The testing was performed with the following configuration parameters for operating system and Postgres database.

## CentOS Configuration

```
sysctl -w vm.nr_hugepages=52600
sysctl -w vm.swappiness=1
sysctl -w vm.max_map_count=3112960
sysctl -w net.core.somaxconn=1024
bash -c "echo deadline > /sys/block/sdc/queue/scheduler"
blockdev --setra 8192 /dev/sdc
bash -c "echo never > /sys/kernel/mm/transparent_hugepage/enabled"
bash -c "echo never > /sys/kernel/mm/transparent_hugepage/defrag"
```

## PostgreSQL Configuration

```
shared_buffers = 100GB
max_connections = 1000
min_wal_size = 20GB
max_wal_size = 100GB
checkpoint_timeout = 900
maintenance_work_mem = 1GB
checkpoint_completion_target = 0.9
effective_io_concurrency = 200
synchronous_commit = on
log_checkpoints = on
wal_compression = on
```

Table 1. TPC-C performance testing details and results

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Database tested	PostgreSQL 17.0
Processors	2 x Intel(R) Xeon(R) Platinum 8468, 48C, 2.1GHz
Hardware Configuration	512GB (8x64GB DDR5 4800 MT/s) 1 x Broadcom 57414 10/25GbE SFP28 2-port OCP Ethernet Adapter 2 x Micron 960GB M.2 NVMe SSD 2 x Intel 960GB 6Gbps SATA 2.5" SSD
Nutanix	AOS 7.0, AHV 10.0
CVM	12 VCPU, 64 GB RAM
Database size	100 GB, 500 warehouses
OLTP run time parameters	Virtual users = 400 User delay = 1 ms Ramp up = 5 mins
Transactions Per Minute (TPM)	14.2 million (3 VMs)

## Bill of Materials: ThinkAgile HX630 V3 Integrated System

Part number	Product Description	Qty
7D6MCTO1WW	Server : ThinkAgile HX630 V3 Integrated System	1
BRP2	ThinkAgile HX630 V3 Base	1
BVGL	Data Center Environment 30 Degree Celsius / 86 Degree Fahrenheit	1
B0W3	XClarity Pro	1
B15S	Nutanix SW Stack on Nutanix AHV	1
B0W1	3 Years	1
BM84	ThinkAgile HX Remote Deployment	1
BVKV	Nutanix Cloud Platform (NCP) Pro Software License with Mission Critical Support	1
BYW8	Intel Xeon Gold 6538Y+ 32C 225W 2.2GHz Processor	2
BWHS	ThinkSystem 64GB TruDDR5 5600MHz (2Rx4) RDIMM	8
BCQQ	ThinkSystem 1U 10x2.5" NVMe Backplane	1
B0SW	Nutanix Flash Node Config	1

C6MB	ThinkSystem 2.5" U.2 Solidigm P5520 3.84TB Read Intensive NVMe PCIe 4.0 x4 HS SSD	4
B8P9	ThinkSystem M.2 NVMe 2-Bay RAID Adapter	1
BTTY	M.2 NVMe	1
BXMH	ThinkSystem M.2 PM9A3 960GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD	2
BN2T	ThinkSystem Broadcom 57414 10/25GbE SFP28 2-Port OCP Ethernet Adapter	1
BLKB	ThinkSystem V3 1U x16/x16 BF PCIe Gen5 Riser1	1
BLK8	ThinkSystem V3 1U LP+FH BF Riser Cage	1
BNFH	ThinkSystem 1100W 230V/115V Platinum Hot-Swap Gen2 Power Supply v3	2
6400	2.8m, 13A/100-250V, C13 to C14 Jumper Cord	2
B8LA	ThinkSystem Toolless Slide Rail Kit v2	1
BLKD	ThinkSystem 1U V3 10x2.5" Media Bay w/ Ext. Diagnostics Port	1
BH9M	ThinkSystem V3 1U Performance Fan Option Kit v2	8
BPKR	TPM 2.0	1
B7Y0	Enable IPMI-over-LAN	1
BLK5	ThinkSystem SR630 V3 MB	1
BVMC	Trigger MFG to scan the SN from the CPU Board via this MI	1
BHSS	MI for PXE with RJ45 Network port	1
B6C1	Node Cores	64
B6C2	Node Tebibytes	14
5977	Select Storage devices - no configured RAID required	1
BRPJ	XCC Platinum	1
BK14	Low voltage (100V+)	1
B8KJ	ThinkSystem 1U 10x2.5" NVMe HDD Type Label	1
AUTQ	ThinkSystem small Lenovo Label for 24x2.5"/12x3.5"/10x2.5"	1
BS3A	ThinkSystem SR645 V3 M.2 Signal & Power Cable, SLx4 with 2X10/1X6 sideband, 730/300/250mm	1
BPCS	ThinkSystem SR630 V3 MCIO8x 3in1 flat PCIe4 Cable from PCIe3/4/5 to 10AnyBay	1
BPCQ	ThinkSystem SR630 V3 MCIO8x flat 2in1 PCIe4 Cable from PCIe1/2 to 10AnyBay	1
BMJE	ThinkSystem SR630 V2 10x2.5" BP Power Cable v2	1
BE0E	N+N Redundancy With Over-Subscription	1
AVEN	ThinkSystem 1x1 2.5" HDD Filler	6

AUWG	Lenovo ThinkSystem 1U VGA Filler	1
AURS	Lenovo ThinkSystem Memory Dummy	24
B8NK	ThinkSystem 1U Super Cap Holder Dummy	1
BKD9	HX All-NVMe configuration	1
BQBP	ThinkSystem MCC CPU Clip	2
B989	ThinkSystem V2 1U Package	1
BTS6	ThinkAgile HX630 V3 IS	1
BYQN	ThinkSystem SR630 V3 Firmware and Root of Trust Security Module v2	1
B984	ThinkSystem 1U PLV Top Cover Sponge	1
B0SQ	HX Badge 1	1
BU8P	ThinkAgile HX630 V3 - Nutanix IP	1
C1QN	Warranty Services Upgrade	1
BP50	ThinkSystem SR630 V3 Performance Heatsink	2
ATSB	Nutanix Solution Code MFG Instruction	1
7S0XCTO5WW	XClarity Controller Platin-FOD	1
SBCV	Lenovo XClarity XCC2 Platinum Upgrade (FOD)	1
5641PX3	XClarity Pro, Per Endpoint w/3 Yr SW S&S	1
1340	Lenovo XClarity Pro, Per Managed Endpoint w/3 Yr SW S&S	1
3444	Registration only	1
7S0PCTO3WW	Nutanix P&P Software for ThinkAgile HX	1
SAPU	Nutanix Cloud Platform Pro, Mission Critical Support Per Core, 3Yr	64
5WS7B98757	3Yr Premier 24x7 4Hr Resp ThinkAgile IS HX630 V3	1
5PS7B98766	3Yr KYD Add-On ThinkAgile IS HX630 V3	1
5MS7B00045	ThinkAgile HX Remote Deployment (up to 3 node cluster)	1

## References:

Lenovo ThinkAgile HX650 V3 Integrated System and Certified Node

<https://lenovopress.lenovo.com/lp1668>

Lenovo ThinkAgile HX630 V3 Integrated System and Certified Node

<https://lenovopress.lenovo.com/lp1667>

PostgreSQL on Nutanix Best Practices

<https://portal.nutanix.com/page/documents/solutions/details?targetId=BP-2061-PostgreSQL-on-Nutanix:BP-2061-PostgreSQL-on-Nutanix>

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