Apache Cassandra on Lenovo ThinkSystem SR665 V3
Solution Brief

Data growth challenge and a solution

Modern businesses are increasingly challenged by the exponential growth of data generated through digital transformation and process optimization. Each improvement in operational efficiency often results in additional data that must be effectively managed and stored. Selecting the right database solution is critical to ensuring reliable performance, scalability, and cost-effective data handling across the organization

This solution brief features Apache Cassandra version 4.1.8 installed on a high-performance Lenovo ThinkSystem SR665 V3 dual-socket 2U rack-mount enterprise server. The server supports AMD EPYC™ 5th Gen 9005 and 4th Gen 9004 series processors, DDR5 memory up to 6400 MHz, Compute Express Link (CXL) v1.1, and high-performance NVMe drives. Offering a broad range of storage options, it delivers cutting-edge I/O performance with support for PCIe 5.0 devices and integrates seamlessly with the industry-standard OCP 3.0 adapter for enhanced scalability and flexibility. With up to up to 192 cores and 384 threads per socket, these CPUs are ideally suited for high-performance, high-density computing environments.

Figure 1. Lenovo ThinkSystem SR665 V3

The SR665 V3 server is a storage-dense platform, supporting up to 40 2.5-inch SAS/SATA/NVMe hot-swap drive bays through a combination of front-accessible (up to 24 bays), mid-accessible (8 bays), and rear-accessible (8 bays) configurations. It also supports up to 20 3.5-inch SAS/SATA/NVMe drives (12 front, 4 mid, 4 rear). Additionally, the server includes support for M.2 drives for operating system boot or data storage, and 2x 7mm hot-swap SAS/SATA/NVMe drives with optional RAID support.

Business database solutions with faster time-to-value

Lenovo ThinkSystem SR665 V3 systems are rigorously tested and tuned to save you months of configuration, setup, testing, and tuning. With these new servers, you get the following advantages:

- The AMD EPYC 9004 series is built on the Zen 4 and Zen 4c architectures, while the AMD EPYC 9005 series is built on Zen 5 and Zen 5c architectures.
- By using the chiplet-based design they are achieving up to 192 cores and 384 threads per socket
- The supported DDR5 memory can be selected with up to 6400Mhz and it supports a total of 24 DIMM's and by using 256GB 3DS RDIMMs it can go as high as 6TB of system memory
- The combination of compute and storage makes this server an ideal choice for database consolidation and enhanced performance.

Apache Cassandra

Apache Cassandra is an open-source NoSQL database designed to manage large volumes of data. By design, it provides high availability and eliminates single points of failure.

From the initial release in 2007 and becoming an open-source project in 2008 it gained traction within organizations that had to manipulate large amounts of data.

Key features of Cassandra include the following:

- High write throughput
- Fault tolerance
- Global distribution
- Linear scalability
- Multi-primary replication

For more information about Cassandra see the following web page:
https://cassandra.apache.org/doc/latest/cassandra/architecture/overview.html

ThinkSystem SR665 V3 hardware configuration

This configuration is tailored for small businesses seeking reliable, high-performance infrastructure for data-centric workloads.

To cover a higher range of CPUs we used two processor models, the AMD EPYC 9174F and AMD EPYC 9175F. The main differences between these processors is the cache size and frequency, while the core number and threads are the same.

This configuration features the following main components:

- **Server:** Lenovo ThinkSystem SR665 V3
- **Processor:**
  - 2x AMD EPYC 9175F up to 5GHz (4,2 GHz base)
  - 2x AMD EPYC 9174F up to 4.4GHz (4.1 GHz base)
  - Both processors have 16 cores and 32 threads
- **Memory:** 5 TB of DDR5 4800 MT/s memory
- **Storage pool:** 8x ThinkSystem 2.5" U.3 PM1743 3.84TB Read Intensive NVMe PCIe
- **OS Storage:** 2x 240GB ThinkSystem Read Intensive SATA SSD (RAID 1)
- **Software:**
  - Ubuntu 24.04.3 LTS
  - Cassandra 4.1.8

To ensure optimal performance, the “High Performance Mode” profile was selected from the UEFI menu. Additionally, the determinism slider was set to “Power,” and both SMT and CPPC parameters were enabled

ThinkSystem SR665 V3 software configuration

deployed Apache Cassandra 4.1.8. The CPU governor on the systems was set to “performance” to achieve the highest speeds available.

A total of four Cassandra instances were deployed on the system, with each database utilizing two striped drives for storage.

To optimize operating system performance, the following sysctl parameters were adjusted:

```
"vm.dirty_ratio=0"
"vm.dirty_background_ratio=0"
"vm.dirty_background_bytes=10485760"
"vm.dirty_bytes=1073741824"
"net.ipv4.tcp_rmem=4096 87380 16777216"
"net.ipv4.tcp_wmem=4096 65536 16777216"
"vm.max_map_count=1048575"
"vm.swappiness=0"
```

Performance Testing and Results

The testing process was initiated by running remotely Cassandra-stress with the following parameters:

```
cassandra-stress write n=10000000 -rate threads="$i" -node <xx.xxx.xxx.xx>
```

(where $i was set to 64, 128, and 256 thread counts)

During the testing phase, each Cassandra instance was provisioned with 16 processing threads. The system demonstrated strong performance characteristics and scaled efficiently as the number of instances increased.

The results indicate excellent scalability for both CPUs, showcasing their ability to handle demanding workloads effectively.

For the AMD EPYC 9175F the results are the following:

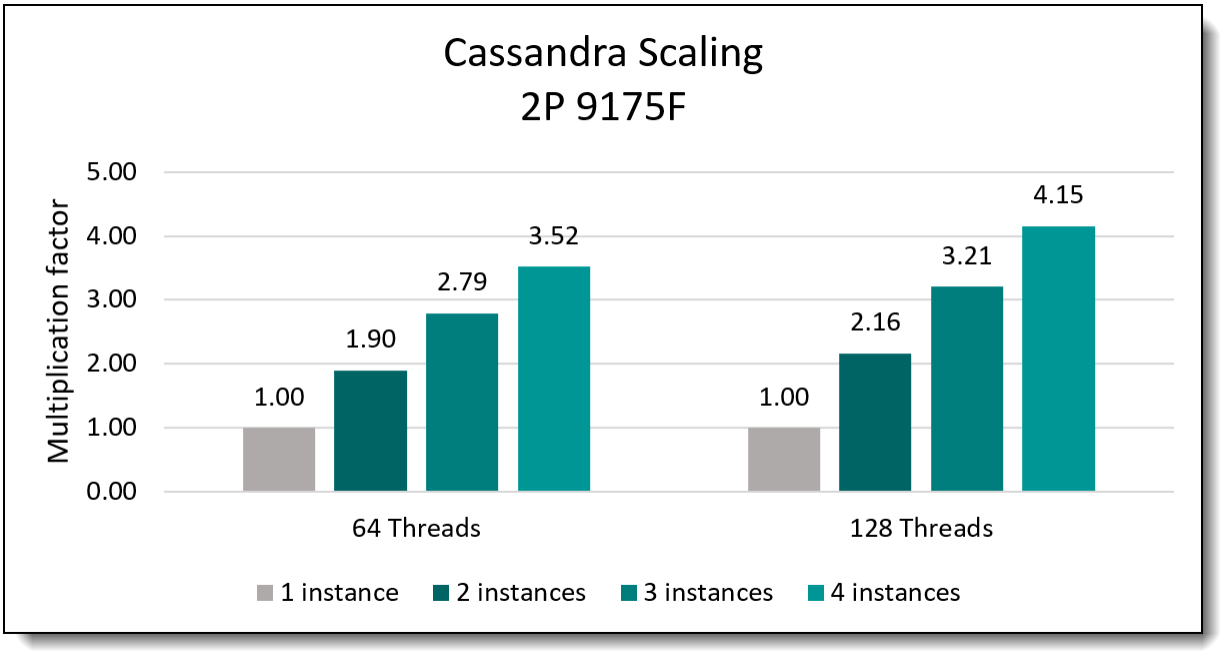

Figure 2. Performance scalability for AMD EPYC 9175F

And similar results were obtained on the AMD EPYC 9174F:

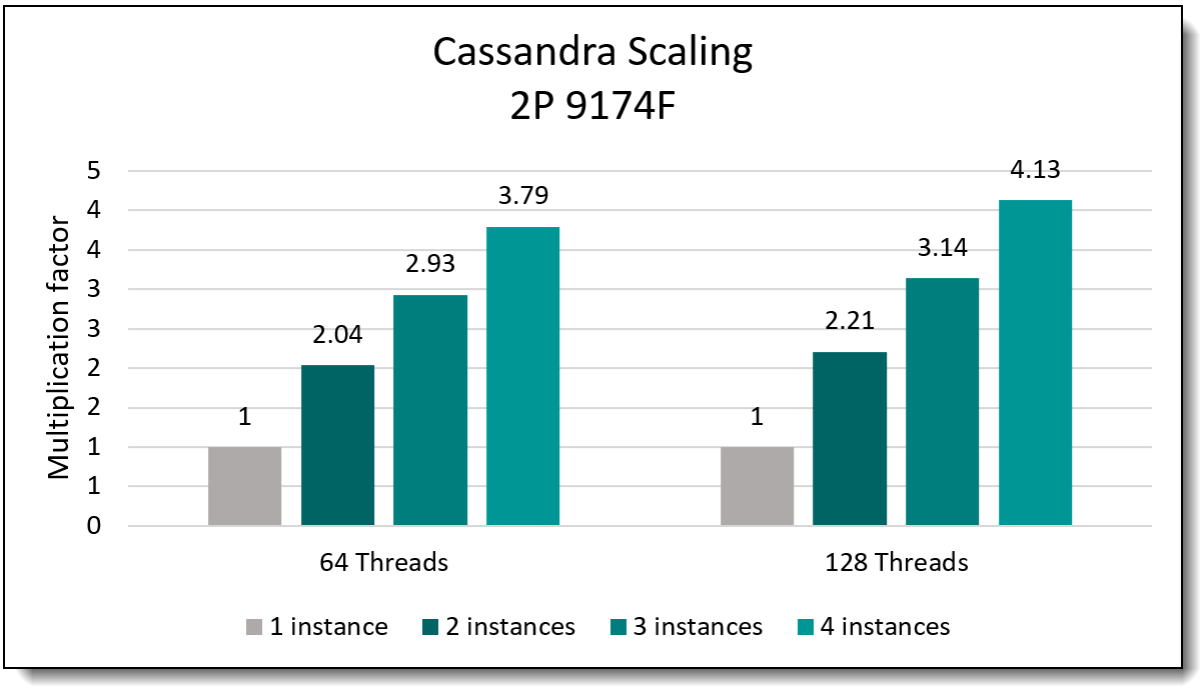

Figure 3. Performance scalability for AMD EPYC 9174F

By comparing the two CPU's we're seeing the EPYC 9175F getting ahead helped by the higher cache amount and higher clock speeds:

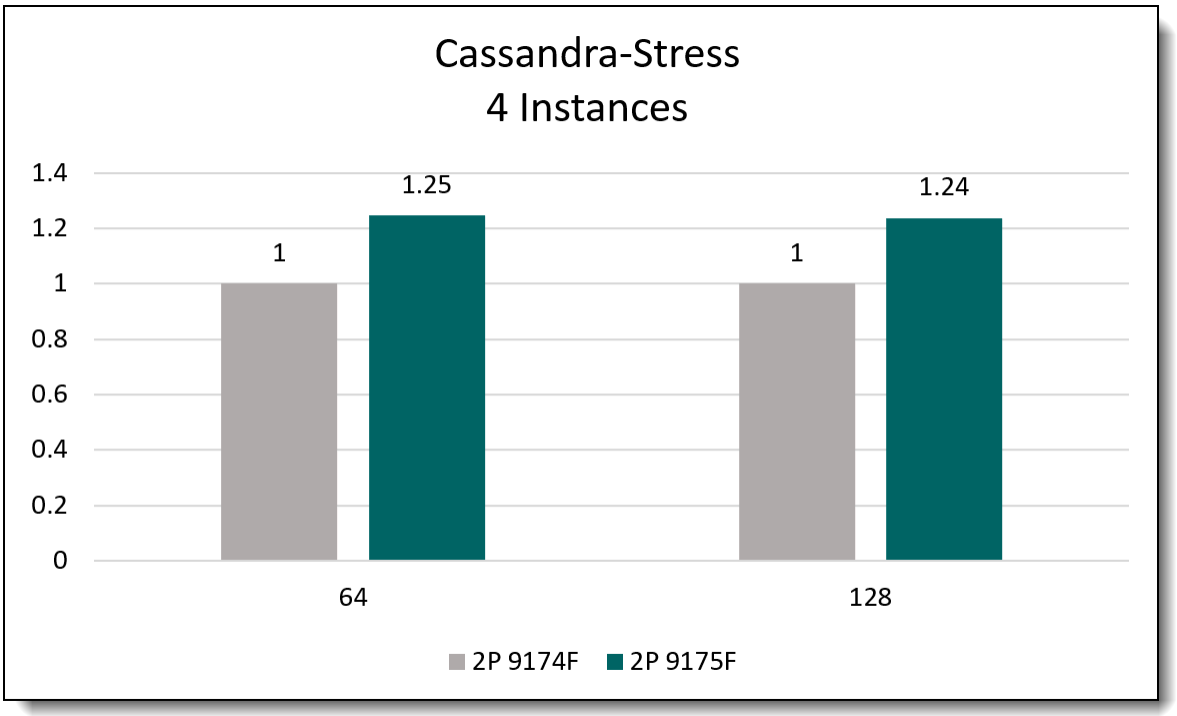

Figure 4. AMD EPYC 9174F and 9175F compared

The Lenovo ThinkSystem SR665 V3, equipped with AMD EPYC 9175F or 9174F processors, offers robust performance and efficiency for modern workloads. These processors, built on AMD's advanced "Zen 4" & "Zen 5" architectures, provide high core density, support for DDR5 memory, and PCIe Gen5 connectivity—making them well-suited for scalable, data-intensive applications such as Apache Cassandra.

With strong multi-threaded performance and optimized power consumption, the SR665 V3 delivers a balanced solution for organizations looking to improve throughput, reduce latency, and manage operational costs effectively in their data center environments.

Bill of Materials

The following table shows the bill of materials for our test environment.

Table 1. Bill of Materials

Part Number	Product Description	Qty
7D9ACTO1WW	Server : ThinkSystem SR665 V3-3yr Warranty	1
C1XE	ThinkSystem V3 2U 24x2.5" Chassis	1
C2AR	AMD EPYC 9175F 16C 320W 4.2GHz Processor	2
C1XJ	ThinkSystem SR665 V3 2U Advanced Heatsink	2
BQ3D	ThinkSystem 64GB TruDDR5 4800MHz (2Rx4) 10x4 RDIMM-A	24
BTQ0	ThinkSystem 2.5" U.3 PM1743 3.84TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	8
B8P9	ThinkSystem M.2 NVMe 2-Bay RAID Adapter	1
CAC9	ThinkSystem M.2 VA 240GB Read Intensive SATA 6Gb NHS SSD	2
BE4T	ThinkSystem Broadcom 57504 10/25GbE SFP28 4-Port OCP Ethernet Adapter	1
C0U4	ThinkSystem 750W 230V/115V Platinum Hot-Swap Gen2 Power Supply v3	2
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
7Q01CTS4WW	SERVER PREMIER 24X7 4HR RESP	1

For more information

To learn more about this Lenovo solution contact your Lenovo Business Partner or visit:
https://www.lenovo.com/us/en/servers-storage/solutions/database/

Apache Cassandra:
https://cassandra.apache.org

Lenovo ThinkSystem SR665 V3 Server:
https://lenovopress.lenovo.com/lp1608-thinksystem-sr665-v3-server

Authors

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Vinay Kulkarni is a Principal Technical Consultant in the Software and Solutions Development group at ISG, Lenovo. His current focus is on solution architectures in the areas of cloud, database analytics and AI. Vinay has more than 20 years' experience with Lenovo, and IBM. During this time, Vinay has led diverse projects ranging from performance benchmark publications to solutions development, as well as business and technical strategy.

Jagan Mohanarao Porana is a Performance Engineer with AMD in their Datacenter Ecosystems & Application Engineering Group, with more than 15 years of deep expertise in database workloads, performance optimization, and IT infrastructure. He specializes in a wide range of database technologies, including RDBMS platforms such as Oracle, SAP HANA, and MySQL, as well as NoSQL systems like Cassandra, Redis, and MongoDB. At present, Jagan concentrates on creating cutting-edge solutions for databases and big data analytics tailored to enterprise and cloud ecosystems.

Related product families

Product families related to this document are the following:

- ThinkSystem SR665 V3 Server

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