

ThinkSystem SR950 Performance Leadership Article

The Lenovo ThinkSystem SR950 server currently holds 47 Performance World Records as of November 8, 2017. The SR950 holds far and above more world records than any other competitive server. These World Records are in areas such as Business Processing, Big Data Analytics and Infrastructure Virtualization. The SR950 uses the Intel Xeon Scalable Family of processors for each of the benchmark configurations.



Figure 1. ThinkSystem SR950

Understanding Performance Benchmarks

Benchmarks provide objective information that can be used to compare computer platforms, components, operating systems, and specific system configurations. Performance benchmarks provide impartial information that can be used to evaluate and compare the performance of computer systems. Lenovo and the server industry promote objective and credible benchmarking in various ways, including participation in standards bodies such as the Transaction Processing Performance Council (TPC) and Standard Performance Evaluation Corporation (SPEC). The benchmarks produced by these and other groups help provide objective information that can be used to compare computer platforms, components, operating systems, and system configurations.

ThinkSystem SR950 – Designed for Performance

The ThinkSystem SR950 server was designed for performance. Several design factors went into the SR950 that helped achieve world records across a wide spectrum of well-known benchmarks.

Overall Design



Figure 2. The physical design of the SR950 provides easy access to components

- The performance architecture design began 3+ years before first customer shipment.
- The SR950 was designed for the highest performing Intel Xeon Scalable Processor CPUs.
- The design is optimized based on power delivery and thermal capability to deliver peak Intel turbo mode performance.
- The design is optimized based on signal integrity to deliver peak high speed bus performance with adequate design margins at the maximum operating speeds.
- The SR950 avoided bad design practices like poor topology, periodic system management interrupts (SMI) or excessive spread spectrum clocking (SSC)
- Lenovo selection of high quality and high performing components throughout the server design.
- Strictly followed all Intel Platform Design Guidelines to achieve max performance.

Software

- Advanced server firmware tuning research distilled hundreds of parameters into the most optimal settings that are packaged in 4 operating modes plus a custom mode that permits additional fine tuning. Most performance benchmarks used the Maximum Performance operating mode
- Resolve all test issues during development and in manufacturing test to ensure there are no retries and that RAS features are not invoked during normal operation that can affect performance
- All firmware updated to latest version to take advantage of performance improvements.
- Firmware optimized for best power consumption based on sensor inputs and configuration.



Optimal Cooling Design



Figure 3. The fans are close to the processors but still front-accessible for hot-swap removal

- Innovative mechanical hot swap fan design that allows fans to rotate into position from front of chassis and operate between storage and compute elements.
- No traditional backplane that impedes airflow. Instead, the SR950 uses small mid chassis interconnect boards for UPI and sideband and direct plug riser options for PCIe slots.
- Unique heatsinks for high end CPUs
- No CPUs or DIMMs sit behind each other that would preheat the cool air. All CPUs and DIMMs directly get cool air as it comes from the front of the server.

World Record Benchmarks by Workload

The Lenovo ThinkSystem SR950 currently holds 47 Performance World Records in the areas of Big Data Analytics, Server Side JAVA, General Computing, Infrastructure Virtualization, Business Processing and Technical Computing (as of November 8, 2017).

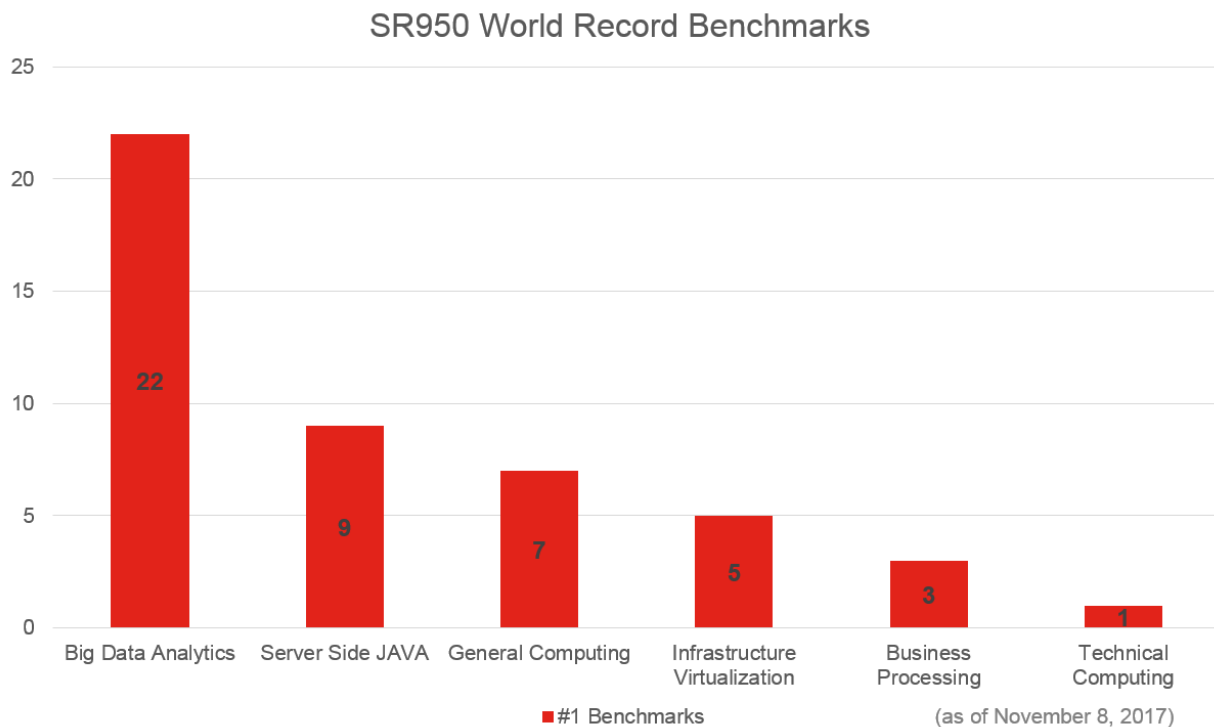


Figure 4. The Lenovo ThinkSystem SR950 currently holds 47 Performance World Records

The Lenovo ThinkSystem SR950 specific World Record Benchmarks are described in the following sections.

Big Data Analytics

The Lenovo ThinkSystem SR950 has 22 world record Big Data Analytics benchmarks.

SAP HANA (BWoH)

SR950 results: 4-Socket Performance - Six world records

The Lenovo ThinkSystem SR950 holds 6 performance world records with the 4 socket SAP HANA BWoH benchmark. This includes data load, query throughput and query runtime in two different data volumes.

About this benchmark: This benchmark is SAP's next-generation data warehouse solution, a new product that does not replace existing SAP Business Warehouse solutions, but that targets the modelling of an agile and flexible layered architecture of a modern data warehouse. The integrated data warehouse solution is optimized to fully leverage the SAP HANA in-memory platform. It empowers delivery of simple, open, flexible, and highly scalable solutions. This new benchmark is designed to fully utilize the new capabilities of SAP HANA to process the benchmark workload. The benchmark consists of three phases data load, query throughput and query runtime.

Why it matters? If you are running SAP HANA, a leadership benchmark score means this server is the highest performing server specifically for your SAP HANA memory intensive database and analytics workloads.

Read the new [SAP HANA BWoH 4-Socket 1.3 Billion Records benchmark report](#)

Read the new [SAP HANA BWoH 4-Socket 2.6 Billion Records benchmark report](#)

STAC-M3 Shasta Suite

SR950 results: 4-Socket performance - 16 world records

The Lenovo ThinkSystem SR950 holds 16 world records for the “big memory” STAC-M3 benchmark. This combines the SR950 new benchmark results and the ones previously published on July 11, 2017 that remain world records.

About this benchmark: The STAC-M3 Benchmark suite is the industry standard for testing solutions that enable high-speed analytics on time series data. The STAC-M3 benchmarks measures challenging areas such as time-series analytics, risk simulations, and processing of very high-speed data. The key metric is query response time. In particular, STAC benchmarks test high-speed analytics on time-series data -- tick-by-tick market data. The benchmark is used by large global banks, brokerage houses, exchanges, hedge funds, proprietary trading shops, and other market participants.

Why it matters: If you are processing high speed financial services or securities, a leadership benchmark score means this server is the highest performing server to process your high speed analytics and financial transactions.

Read the new [STAC-M3 4 Socket performance benchmark report](#)

Server-side Java

The Lenovo ThinkSystem SR950 has 9 World Records for the SPECjbb Server-side Java benchmark.

SPECjbb 2015

SR950 results:

- 8-Socket performance - Four world records
The Lenovo ThinkSystem SR950 holds 4 world records for 8P performance results for the SPECjbb2015-MultiJVM and SPECjbb2015-Distributed benchmarks.
- 4-Socket performance - Five world records
The Lenovo ThinkSystem SR950 holds 5 world records for 4P performance results for the SPECjbb2015-MultiJVM and SPECjbb2015-Distributed benchmarks.

About this benchmark: The SPECjbb2015 benchmark and is the next-generation JAVA server business benchmark. This benchmark shows a server's pure throughput as well as critical throughput under service-level agreements (SLAs) specifying response times from 10ms to 500ms. It exercises the CPUs, caches, memory hierarchy, and the scalability of shared memory processors (SMPs) as well as implementations of the Java Virtual Machine (JVM) and aspects of the operating system. The benchmark models a worldwide supermarket company handling point-of-sale requests, online purchases, and data-mining operations. It is relevant to all audiences who are interested in Java server performance, including JVM vendors, hardware developers, Java application developers, researchers and members of the academic community.

Why it matters: If you are interested Java server performance, a leadership benchmark score means this server is the highest performing server for the latest Java application response time and throughput.

Read the new [SPECjbb 2015 8 Socket performance benchmark report](#)

Read the new [SPECjbb 2015 4 Socket performance benchmark report](#)

General Computing

The Lenovo ThinkSystem SR950 has seven world record General Computing benchmarks.

SPEC CPU2006 and CPU2017

SR950 results:

- 8-Socket performance - Five world records (3x SPEC CPU2017, 2x SPEC CPU2006)
The Lenovo ThinkSystem SR950 holds 8P world records for compute-intensive applications with the SPEC CPU benchmarks. This include SPECspeed2017_int_base, SPECspeed2017_fp_base, SPECrate2017_fp_base, SPECint_base_2006 and SPECfp_base2006
- 4-Socket performance - Two world records (SPEC CPU2017)
The Lenovo ThinkSystem SR950 delivered two 4P world records for compute-intensive applications with the SPEC CPU2017 benchmark. This includes SPECint_rate_base2017 and SPECfp_rate_base2017.

About these benchmarks:

SPEC CPU 2017 is the latest SPEC CPU benchmark focusing on computer-intensive performance by utilizing workloads based on real world applications to measure the performance of the CPU, the memory subsystem, and the compilers. SPEC CPU2017 includes rate and speed suites divided into integer and floating benchmarks, each having base and peak metrics (8 metrics total). With SPEC CPU2017 the rate and speed metrics are unique from each other since SPECrate metrics within SPEC CPU2017 allow multiple copies of each benchmark and forbid any and all compiler parallelism methods. SPEC designed these suites to provide a comparative measure of compute-intensive performance across the widest practical range of hardware using workloads developed from real user applications.

The SPEC CPU 2006 includes CINT2006 and CFP2006, two benchmarks suites that model rich compute-intensive environments in mathematics and sciences, with a small focus on business application workloads. The benchmark suites show a server's capability in running applications related to real-world problems of R&D environments or highly specialized scientific and technical fields. Each suite can show speed metrics and/or rate metrics. Speed metrics show the how fast a system can process and complete an individual task. Rate metrics show how fast a system can process and complete multiple, concurrently executing tasks

Why it matters: If you are running compute-intensive workloads, a leadership benchmark score means this server is the highest performing server for how fast a server completes a task (speed) and/or how much a server can accomplish in a certain time (throughput or rate measurement).

Read the new [SPECcpu 2017 - 8 Socket performance benchmark report](#)

Read the new [SPECcpu 2006 - 8 Socket performance benchmark report](#)

Read the new [SPECcpu 2017 4 Socket performance benchmark report](#)

Infrastructure Virtualization

The Lenovo ThinkSystem SR950 has five world record Infrastructure Virtualization benchmarks.

SPECvirt_sc2013

SR950 results:

- 8-Socket performance - Three world records
The Lenovo ThinkSystem SR950 delivered world record performance, performance per watt and server performance per watt on the 8P SPECvirt_sc2013 benchmark.
- 4-Socket performance - Two world records
The Lenovo ThinkSystem SR950 delivered two world record performance per watt and server performance per watt on the 4P SPECvirt_sc2013 benchmark.

About this benchmark:

The SPECvirt_sc2013 benchmark measures the end-to-end performance of all system components including the hardware, virtualization platform, and the virtualized guest operating system and application software. This benchmark shows a server's capability to consolidate multiple servers running different applications onto a single system with multiple virtual machines. The benchmark provides four workloads on real-world traffic faced by a web server, a Java application server, an IMPAP server, and a batch server. It models multi-tiered applications and database environments that require enterprise-class virtual machines. SPECvirt_sc2013 is the second-generation SPEC VIRT benchmark for evaluating the virtualization performance of datacenter server consolidation, including enterprise class workloads.

Why it matters: If you are virtualizing multiple workloads, a leadership benchmark score means this server is the highest performing server for memory intensive virtualized environments.

Read the new [SPECvirt 8 Socket performance benchmark report](#)

Read the new [SPECvirt 4 Socket performance benchmark report](#)

Business Processing

The Lenovo ThinkSystem SR950 has three world record benchmarks for Business Processing.

TPC-E benchmarks

SR950 results: Overall Performance and 4-Socket Price/Performance - Two world records

The Lenovo ThinkSystem SR950 delivered the best performance result ever (all servers) and the best ever 4P price/performance TPC-E benchmark result.

About this benchmark:

This benchmark shows a server's capability to process business and financial transactions in a complex OLTP scenario. A database models a brokerage firm with customers who generate transactions related to trades, account inquiries, and market research. The brokerage firm interacts with financial markets to execute orders and update account information. The benchmark can be configured to represent the workloads of different-sized businesses. Although the underlying business model of TPC-E is a brokerage firm, the database schema, data population, transactions, and implementation rules have been designed to be broadly representative of modern OLTP systems. Performance and price/performance information are obtained.

Why it matters: If you are running On-Line Transaction Processing workloads and databases, a leadership benchmark score means this server is the highest performing server for your data-intensive OLTP transactions.

Read the new [TPC-E 4 Socket performance benchmark report](#)

SAP Sales and Distribution (SAP SD) Benchmark

SR950 results: 4-Socket Performance - World Record on Windows

The Lenovo ThinkSystem SR950 delivered the best 4P performance result on Windows in the SAP Sales and Distribution Benchmark.

About this benchmark:

SAP Sales and Distribution (SD) Standard Application Benchmarks test the hardware and database performance of SAP applications and components. This benchmark shows a server's capability in enterprise resource planning environments processing business line items. The benchmark models a sell-from-stock scenario creating a customer order with five line items and corresponding delivery with subsequent goods movement and invoicing. Results show the number of users, response time, and the amount of fully business processed line items per hour (SAPS), helping to determine sizing requirements.

Why it matters? If you are running SAP Business Suite applications, a leadership benchmark score means this server is the highest performing server for processing business transaction workflows in an SAP environment.

Read the new [SAP Sales and Distribution 4 Socket performance benchmark report](#)

Technical Computing

The Lenovo ThinkSystem has one world record Technical Computing benchmark.

SPECCompG 2012

SR950 result: 4-Socket performance - World record

The Lenovo ThinkSystem SR950 delivered a world record for the SPEC OMP2012 benchmark.

About this benchmark: measures the performance of the processor, memory architecture, parallel support libraries and compilers using applications based on the OpenMP 3.1 standard for shared-memory parallel processing. The benchmark includes 14 scientific and engineering codes covering everything from computational fluid dynamics (CFD) to molecular modeling to image manipulation.

Why it matters: If you are running scientific or engineering applications, a leadership benchmark score means this server is the highest performing server for these workloads.

Read the new [SPECCompG – performance benchmark report](#)

Further reading

For further reading, see these resources

- [Lenovo Press product guide on the SR950](#)
- [SR950 product web page](#)

This article is one in a series on the ThinkSystem SR950 and SR850 servers:

- [Five Highlights of the ThinkSystem SR950](#)
- [Five Highlights of the ThinkSystem SR850](#)
- [Choosing between Lenovo ThinkSystem SR850 and SR950](#)
- [Workloads for 4-Socket and 8-Socket Servers](#)
- [Usability in the Design of the ThinkSystem SR950](#)
- [The Value of Refreshing Your 4-Socket Servers with the ThinkSystem SR950](#)
- [ThinkSystem SR950 Memory Decisions](#)
- [ThinkSystem SR950 Server Configurations](#)
- [The Value of Refreshing Your 8-Socket Servers with the ThinkSystem SR950](#)
- [Lenovo ThinkSystem SR950 New Options and Features - December 2017](#)
- **[ThinkSystem SR950 Performance Leadership](#)**
- [Lenovo Servers for Mission Critical Workloads](#)
- [Microsoft and Lenovo ThinkSystem SR950 – A Perfect Match](#)
- [Accelerate Your 4- and 8-Socket Server Refresh Cycle](#)
- [SAP Business Process Applications and Lenovo ThinkSystem SR950 – A Perfect Match](#)
- [ThinkSystem SR950 New Options - March 2018](#)
- [SAP HANA and Lenovo ThinkSystem SR950 – A Perfect Match](#)
- [ThinkSystem SR950 Performance Leadership Continues](#)
- [New Solution for SAP HANA - Lenovo ThinkAgile HX](#)
- [The Advantages of Keeping Mission Critical Workloads On-Premises vs Going to the Cloud](#)
- [SQL Server Migration and Lenovo ThinkSystem SR950](#)

About the author

Randall Lundin is a Senior Product Manager in the Lenovo Infrastructure Solution Group. He is responsible for planning and managing ThinkSystem servers. Randall has also authored and contributed to numerous Lenovo Press publications on ThinkSystem products.

Related product families

Product families related to this document are the following:

- [4-Socket Rack Servers](#)
- [8-Socket Rack Servers](#)
- [Mission Critical Servers](#)
- [ThinkSystem SR950 Server](#)

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