



Deepening our understanding of the universe.

How **Nikhef** uses Lenovo ThinkSystem servers, powered by AMD EPYC™ CPUs and AMD Radeon™ GPUs, to support trailblazing subatomic physics research.

Lenovo Infrastructure Solutions
for The Data-Centered

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Background

Nikhef, the Dutch National Institute for Subatomic Physics, conducts research into the elementary building blocks of our universe, their mutual forces, and the structure of space and time. Centered around accelerator-based particle physics and astroparticle physics, other major research areas include gravitational waves and the existence of dark matter.

Roel Aaij, Scientific Staff Member at Nikhef, confirms: “We perform blue-sky research to learn more about the nature of the universe and the building blocks of matter.”

A large part of Nikhef’s research takes place at the Large Hadron Collider (LHC) at CERN. The organization provided computing resources that helped with the discoveries of gravitational waves in 2016, the Higgs boson, and the fundamental physics in between.

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Challenge

Nikhef is involved in many different research projects, including the [ALICE](#), [ATLAS](#), and [LHCb](#) experiments at CERN. Another major project is Auger, in partnership with the Pierre Auger Cosmic Ray Observatory in Argentina. An area covering several thousand square kilometers of La Pampa province is equipped with detectors to search for air showers caused by extremely high-energy particles that arrive from space.

Other ongoing projects include the neutrino physics experiment [KM3NET](#) and dark-matter research with the [XENON1T](#) experiment. Finally, there is a large gravitational waves physics group that is a member of the [Virgo](#) experiment collaboration.

What do all these experiments have in common? The high level of computing power they require and the enormous amounts of data that they produce.

Tristan Suerink, IT Architect at Nikhef, says: “The scientists always want more data. I think there are few experimental physics papers that do not end with ‘we need more data.’ And in this field of physics, to get more data you build a more sensitive experiment.”

In the case of the Large Hadron Collider at CERN, the increase in data produced will be particularly high. “In about five years the LHC will increase the number of collisions detected by about a factor of 10,” says Aaij. “This means that the experiments will start producing a similarly increasing amount of data. If we look at the growth of storage space and compute capacity over time, then we do not expect to even get close to a factor of 10 in increase of performance for a flat budget. We need to deal with that because we need to process the data. Otherwise, we can’t do science with it.”



Why Lenovo? World-class performance with next-generation AMD processors.

Anticipating an increase of incoming data streams from CERN, Nikhef decided to extend its high-throughput computing (HTC) cluster with Lenovo ThinkSystem SR655 servers featuring AMD EPYC™ 7002 “Rome” family CPUs and AMD Radeon™ GPUs.

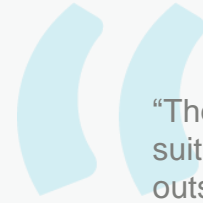
Lenovo ThinkSystem SR655 with 2nd generation AMD EPYC™ 7002 processors are among the first servers available with support for PCIe Express 4.0 for I/O, offering exceptional single-socket server performance.

“Of the solutions we considered, Lenovo’s offering was the only one that was fully compatible with PCIe 4.0 express lanes,” says Suerink. “The whole system runs completely on PCIe 4.0. This was important to us, as it sets us apart from competitors who typically use a mixture of PCIe Gen 4 and Gen 3.”

Turbocharging performance.

Nikhef worked with a team from Lenovo to install the new cluster extension. Comprising 67 Lenovo ThinkSystem SR655 servers equipped with more than 3,800 AMD compute cores and 14 AMD Radeon™ Instinct™ MI50 GPU Accelerator cards, and featuring 31 TB of memory, the extension ticks all the boxes for Nikhef.

The winning combination of PCIe Express 4.0, high core density, and high memory bandwidth deliver excellent performance for data-intensive workloads at an extremely competitive price-performance ratio.



“The Lenovo ThinkSystem SR655 is perfectly suited to our needs. Not only does it deliver outstanding performance, but it also offers impressive reliability, availability, and flexibility.”

Tristan Suerink
IT Architect, Nikhef

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Results

With the Lenovo cluster extension in place, Nikhef can provide researchers with the HTC resources they need to process ever-increasing amounts of experimental data.

Suerink comments: “The fundamental goal of this institute is to find the universal building blocks everything is made from. The Lenovo ThinkSystem SR655 servers, powered by AMD processors, support cutting-edge research projects that aim to do just that.”

Nikhef’s new Lenovo ThinkSystem SR655 servers are not just being used for physics experiments. The Lenovo team was in the process of installing the servers when the COVID-19 crisis hit, so Nikhef offered its newfound processing power to support coronavirus research.

“We were able to be the worldwide number one in a few public projects like Rosetta@home and Worldwide Community Grid with the Lenovo-AMD EPYC™ cluster,” says Aaij. “There are also some projects working on experimental hadron therapy for cancer treatment, and Project MinE, which is ALS research.”

Suerink adds: “This cluster is also part of the Dutch National e-Infrastructure coordinated by SURF, the goal of which is that every scientist can get easy access to a lot of compute power, data, storage, and networking.”



**Exceptional
single-socket
server performance**



**Support for new PCIe
Express 4.0 standard**



**Extremely competitive
price-performance ratio**



“Many of the latest scientific discoveries are as much about the computing power used to analyze experimental data as they are about the theories behind them. Our new Lenovo cluster, featuring AMD EPYC™ CPUs and AMD Radeon™ GPUs, delivers the capacity and performance researchers need to seek answers to questions about our universe.”

Roel Aaij
Scientific Staff Member, Nikhef

What will you do with Lenovo ThinkSystem solutions?

The Data-Centered empower scientists to answer big questions about our universe with Lenovo smarter infrastructure solutions, powered by AMD.

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