CASE STUDY
Intel® Xeon® processor 5600 series
High-Performance Computing

Advancing research

Leading research university enhances high-performance computing resources with Intel® Xeon® processor 5600 series

The University of Erlangen-Nürnberg is Bavaria's second biggest state university, with over 27,000 students and 12,000 members of staff. A key driver of the University's research capabilities is the computing resources provided by its dedicated IT support service, Erlangen Regional Computing Centre (RRZE). This oversees the high-performance computing (HPC) platform researchers use to process complex calculations and applications. Recently, RRZE decided to replace its existing HPC platform with new hardware to increase the capacity and efficiency of the computing resources it provides.

"Upgrading our high-performance computing platform with the Intel® Xeon® processor 5600 series has enabled us to better support research activities within the University. Researchers can now perform more complex computing tasks in significantly reduced timeframes, allowing them quicker access to the information they need for their studies."

Prof. Dr. Gerhard Wellein
Head of HPC group at
Erlangen Regional Computing Centre

CHALLENGES

- **Expediting research:** The University needed an HPC platform that could process applications faster and enable researchers to run more complex calculations
- **Increasing capacity:** It also wanted to boost the overall capacity of its platform to allow more people to use it at the same time
- **Simplification:** It wanted to replace the mixture of hardware and processors used in its existing HPC system with a homogeneous computing environment that would be easier to manage and easier for researchers to use

SOLUTIONS

- **Testing the options:** RRZE invited vendors to optimize code samples for the hardware they were proposing and used the results to benchmark the performance of the different options
- **Capacity:** It also considered the total number of server nodes in the proposed deployments, with the aim of maximizing the overall capacity of the new platform
- **Picking the winner:** Following this evaluation process, the University chose to implement a new platform based on the NEC LX2400 cluster series* consisting of 500 compute nodes, with the Intel® Xeon® processor 5600 series used throughout

IMPACT

- **Speed boost:** The new platform allows researchers at the University to run more complex applications at up to five or six times previous speeds[1]
- **Greater use:** With more compute nodes, the new system enables a greater number of researchers to pursue their numerical research projects at a highly competitive level
- **Esteem:** By improving its HPC resources, the University has been able to enhance its standing as one of the world's leading learning and research centres

World-class research

The University of Erlangen-Nürnberg has an international reputation as a leading research and teaching university. As the second largest state university in Bavaria, it has students and staff who cover a wide range of subjects in the humanities and sciences. An important part of the University's research offering is its HPC platform, maintained by its IT services department, RRZE. Researchers use the platform to perform complex calculations that require high levels of computing resources. The HPC system is used to support a wide range of applications, including drug design, quantum chemistry, and studies into Alzheimer's disease in the University's life sciences department as well as testing the properties of materials and nuclear physics and fluid dynamics modeling by physical sciences researchers.

Since 2003, the University's HPC platform had been based on previous-generation, 32-bit Intel® Xeon® processors. The University augmented this with additional hardware as further resources became available, including several variants of 64-bit Intel Xeon processors and those from competitors. While adding new hardware boosted the platform's overall performance, the mixture of processors required users to familiarize themselves with the different processor environments in order to get the most out of the system.

The University of Erlangen achieves five or six times faster computing speeds with the Intel® Xeon® processor 5600 series

Streamlining

Recently, the University decided to upgrade its HPC platform to increase performance and boost overall capacity. It also wanted a platform based on a single type of processor, making it easier for users to run applications effectively than on its existing heterogeneous processing environment. It also wanted to reduce the administrative burden associated with managing the platform.

The University invited vendors to provide details of the hardware they were able to supply within its fixed budget. The tender specified that vendors could submit solutions that used general-purpose computing on graphics processing units (GPGPU) as well as a standard CPU-based implementations. As part of the evaluation process, the University provided four sample applications to prospective vendors, who were asked to optimize the code for their particular hardware offering. This enabled the University to identify which hardware configurations offered the greatest performance benefits. It was also interested in maximizing the total number of servers in the platform to increase the overall capacity of the system.

Enhanced capabilities

After assessing the vendor's solutions, the University chose one supplied by NEC and powered by the Intel Xeon processor 5600 series. This consists of 500 identical NEC servers running NEC cluster stack software, providing a more streamlined, homogeneous operating environment for the platform. Despite the tender allowing GPGPU-based solutions, none of the vendors submitted compatible hardware. This was because the general-purpose nature of the calculations performed by the University's researchers meant that hardware with a broader range of applications was more suited to the needs of users.

Since implementing the new platform, the University has recorded a five-to-six fold increase in the overall speed at which applications can be run. With the Intel Xeon processor 5600 series, the new server hardware offers five or six times more memory bandwidth for applications and similar improvements in peak computational speed over the previous platform. The platform's increased processing capabilities addressed the significant growth in demand for compute resources at the University. This trend has been fueled both by scientists steadily increasing the complexity of their simulations and by new HPC user groups from areas such as economics, medicine and linguistics, which had not benefited in the past from HPC technologies.

Besides enabling users to process more advanced calculations in less time, the greater number of server nodes in the new platform extends its overall capacity. This allows more users to access the system at the same time, helping reduce waiting times for the system.

The exclusive use of Intel Xeon processor 5600 series throughout the updated platform ensures an easier to use computing environment than the mixture of hardware in the previous system. The new system allows researchers to focus on optimizing their applications to run with Intel's processors instead of having to adapt them to work with a number of different models. The unified processor environment is also easier to manage from an administrative perspective. This has reduced the time RRZE staff members need to spend advising researchers on how best to use the technology, and on maintaining the platform.

Staying at the forefront

With its new HPC platform powered by the Intel Xeon processor 5600 series, the University of Erlangen has ensured its continued standing as one of the world's leading research institutions. By enhancing the IT resources available to researchers, it has helped further their research activities, improving the caliber of its overall research output.

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Spotlight on the University of Erlangen

With over 39,000 students and staff, the University of Erlangen-Nürnberg is one of the largest universities in Germany and a leading centre for teaching and research. Its faculties cover a wide range of subject areas including natural sciences, engineering, medicine, law, the humanities, economics, and social sciences. The University encourages the transfer of ideas between departments, an approach that has given rise to an almost unique range of interdisciplinary courses.

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