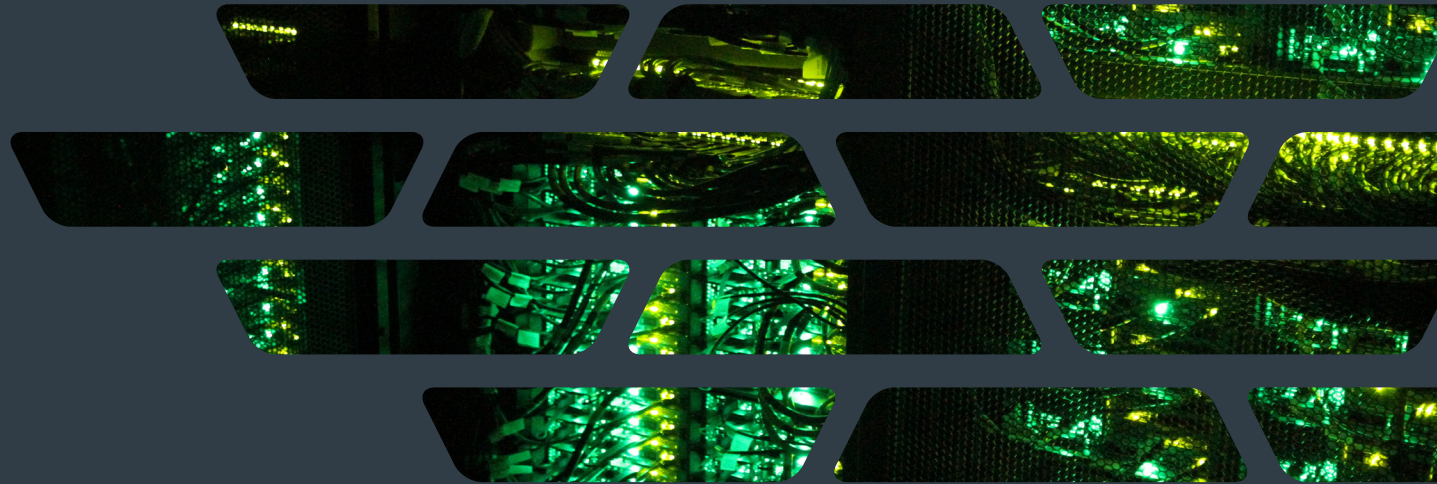




UMEÅ
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Umeå University

Supercharging research to enable ground-breaking innovation

Satisfying researchers' appetite for bigger, better, faster computing resources is never easy. With its new Lenovo supercomputer, High Performance Computing Center North (HPC2N) at Umeå University can deliver on these demands – boosting performance fivefold to support innovative computational and data-intensive research.





Research powered by high-performance computing (HPC) changes lives. From space exploration to quantum physics, the ability to carry out large sets of parallel computations improves our understanding of the world around us in unprecedented ways. Organizations such as Umeå University are leading the way, arming researchers with Lenovo's latest HPC technology so they can discover the answers to humanity's greatest challenges.

Founded in 1965, Umeå University is the fifth-oldest university in Sweden. It employs around 4,000 staff, and has a student body of around 31,000 people. High Performance Computing Center North (HPC2N) is an important national research infrastructure at Umeå University.

HPC2N provides state-of-the-art HPC resources and expertise for Swedish eScience and is a prominent part of the Swedish National Infrastructure for Computing (SNIC), a distributed metacenter under the Swedish Research Council.

Professor Bo Kågström, Director of HPC2N, takes up the story: "Demand for more, faster computational resources is constantly growing, and it's our job to do our best to satisfy researchers within our budgets. Analyzing previous usage of our infrastructure, it was clear that we needed new HPC nodes with lots of memory and some GPUs [graphics processing units] to unlock the next level of innovation. We worked with Umeå University and SNIC to secure funding for the procurement of a new HPC system."

Partnering with Lenovo

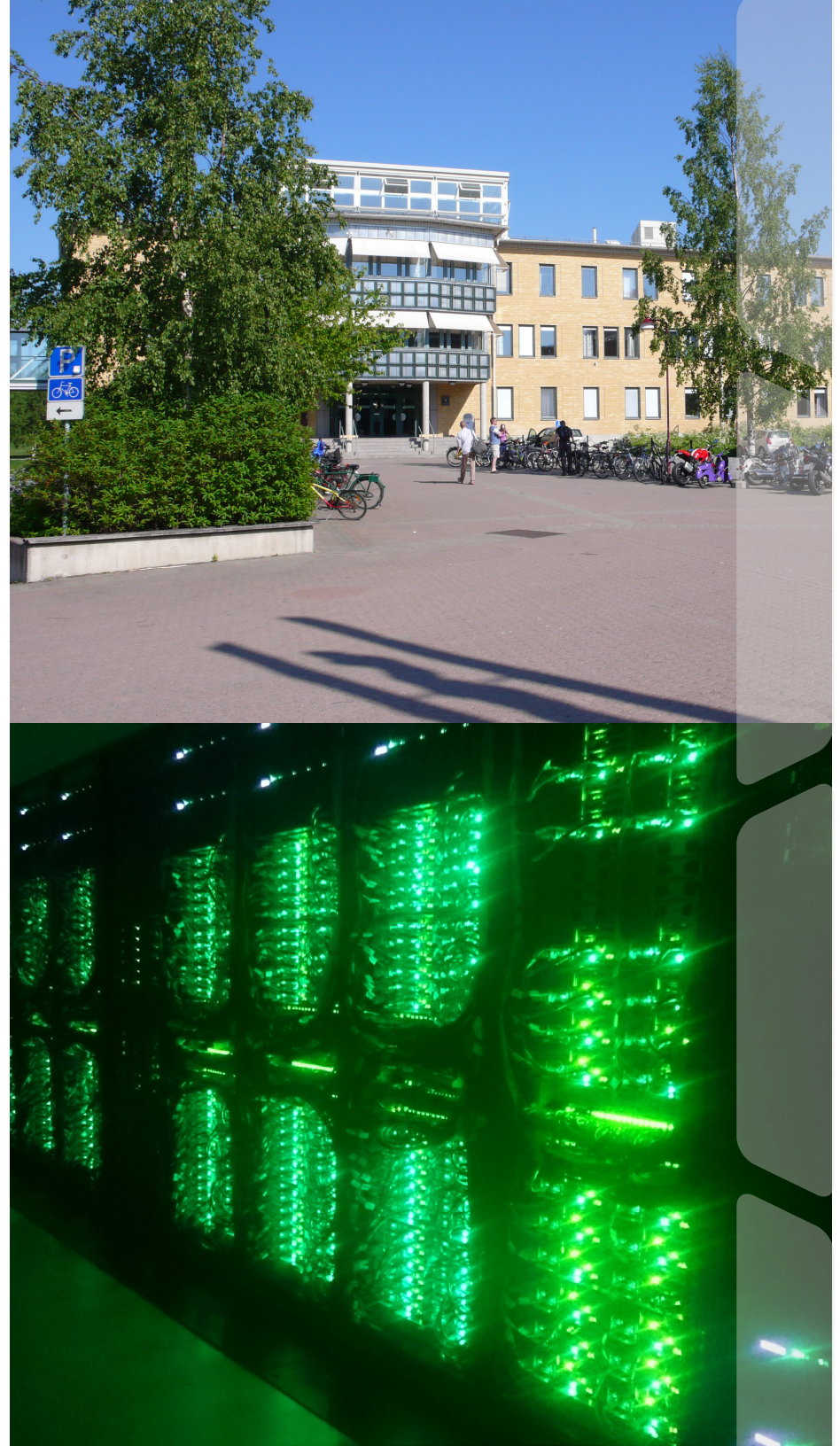
This is where a Lenovo NeXtScale System supercomputer entered the picture, equipped with high-performance Intel® Xeon® processors. The first Mellanox EDR-based system in the Nordic region, the Lenovo supercomputer delivers significant bandwidth and latency improvements over HPC2N's previous system.

“We invited vendors to join a ‘competitive dialogue’ procurement process, which was challenging but worked really well”, recalls Björn Torkelsson, Technical Coordinator at HPC2N. “It allowed us to communicate our requirements and emerge with an optimal solution: the offering from Lenovo.”

He continues: “To make the system the best it could be took lots of planning, and Lenovo was right alongside us throughout that process. Once the solution was ready, we had support from Lenovo Lab Services in installing it and carrying out the initial testing – and our new system, Kebnekaise, was born.”

“Together with ongoing upgrades of the system, Kebnekaise will have close to 1 petaflop performance, with over 125 terabytes of memory – increasing performance fivefold,” explains Bo Kågström. “Because users can achieve more in less time, they can translate their research into real-world impact sooner.”

With a high-density Lenovo NeXtScale System equipped with high-performance Intel® Xeon® processors and NVIDIA GPUs, Kebnekaise delivers massive parallelism and vectorization, enabling it to support the most demanding HPC applications.



“Since Kebnekaise is a national resource, we attract users from all the largest research institutions and universities in Sweden,” says Bo Kågström. “Already, more than 150 research projects have been awarded HPC resources on Kebnekaise during its first year in production.”

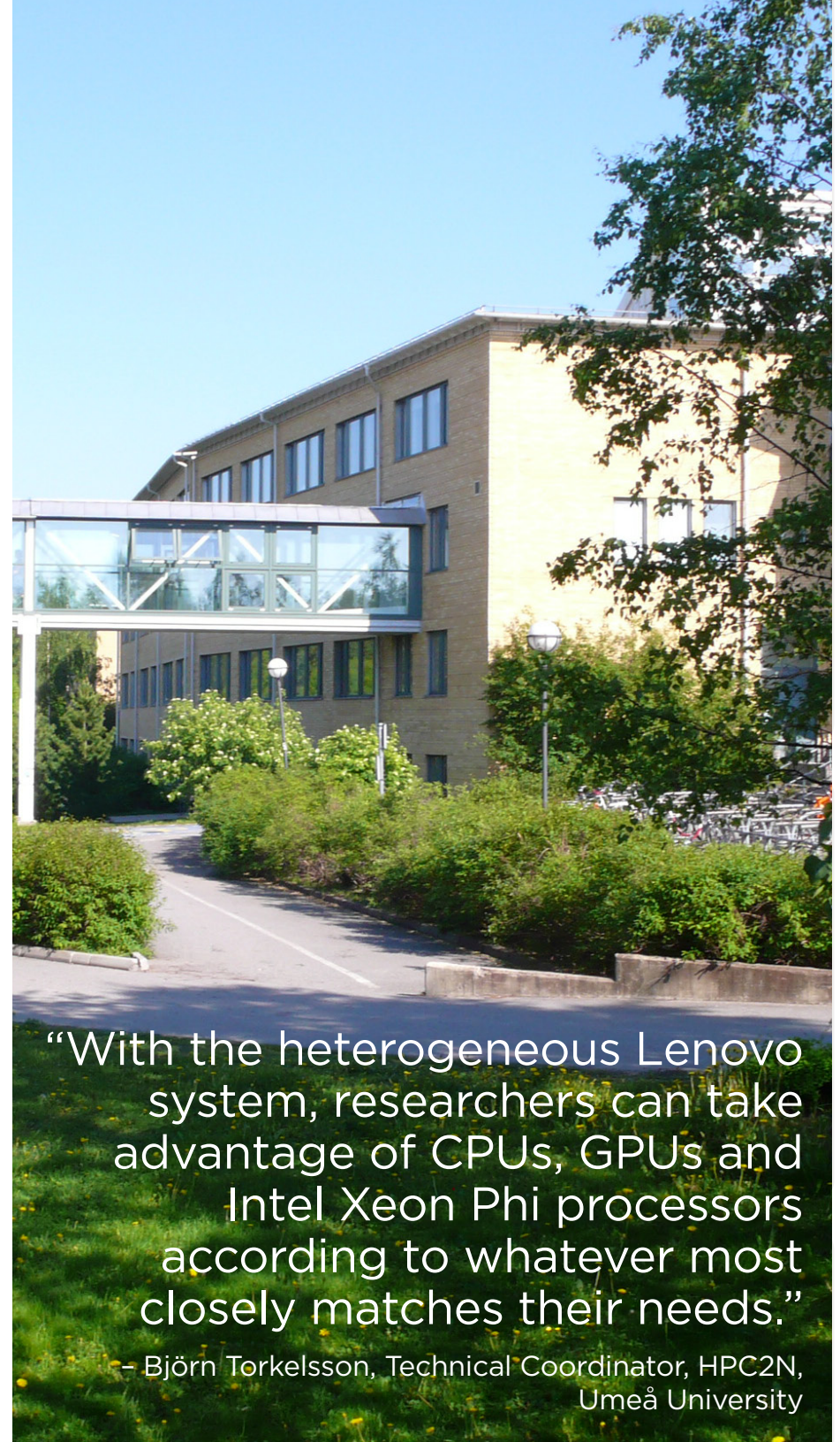
Powering pioneering research projects

Today, users can access a diverse range of resources within Kebnekaise, supporting varied research activities. Björn Torkelsson comments: “With the heterogeneous Lenovo system, researchers can take advantage of CPUs [central processing units], GPUs and Intel Xeon Phi processors according to whatever most closely matches their needs.

The HPC2N project portfolio encompasses a wide range of research areas, including biosciences, medicine, chemistry, computing science, economics, engineering, materials science, mathematics, statistics, as well as physics and astronomy.

Academics are using Kebnekaise to support life-saving research, encompassing everything from developing new materials to gaining a better understanding of the universe.

Some major projects that place very large demands on HPC resources include: Capturing Evolution with Computers (Uppsala University), Quantum Modelling of Electron Structure for Materials Properties (Luleå University of Technology), Understanding the Mechanism of Nerve Agent Antidotes (Umeå University), and How the Solar Wind Interacts with the Moon, Mars, Comets, Ceres, Ganymede, Callisto and Exoplanets (Swedish Institute of Space Physics, Kiruna).



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– Björn Torkelsson, Technical Coordinator, HPC2N,
Umeå University

One high-profile research project being conducted by chemists from Umeå University involves developing an antidote to nerve gases such as sarin, a highly toxic, colorless, odorless liquid. Exposure to sarin is fatal even at very low concentrations.

By combining 3D structural depictions of how different drugs react to the nerve agent with advanced calculations and biochemical experiments, researchers hope to discover how certain molecules can be used to counteract the deadly effects of nerve gases.

“Researchers have enthusiastically embraced our new supercomputer, with a new job started in the system every 10 seconds – from small jobs to very large ones,” says Björn Torkelsson. “Many users have stated that Kebnekaise, built on Lenovo technology, helps them carry out research that wasn’t possible before. For example, they can utilize the built-in GPUs to explore new areas such as machine learning. Undoubtedly, it is helping us to attract new users to our facility – reinforcing that HPC2N and Umeå University provide the resources to help researchers break the boundaries of current knowledge.”

HPC2N and SNIC

High Performance Computing Center North provides state-of-the-art HPC resources and expertise for Swedish eScience, and is a prominent part of the Swedish National Infrastructure for Computing (SNIC), a distributed metacenter under the [Swedish Research Council](#).

HPC2N is organized as a consortium between universities in Northern Sweden that form a competence network for scalable high performance and parallel computing, grid and cloud computing, and effective large-scale storage solutions as well as eScience applications.

“With Kebnekaise, users can achieve more in less time and translate their research into real-world impact sooner.”

– Professor Bo Kågström, Director, HPC2N, Umeå University



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Solution components

Hardware

Lenovo NeXtScale System M5 technology with Intel® Xeon® E5 processor family, and Intel Xeon Phi™ processors
Lenovo System x3850 X6 with Intel Xeon E7 processor family
Lenovo System x3550 M5 with Intel Xeon E5 processor family
Lenovo RackSwitch G8052
Lenovo RackSwitch G8272
Mellanox EDR

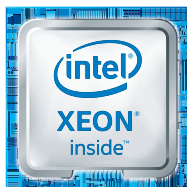
Sample software

Amber
COMSOL Multiphysics
Gaussian
Gromacs
NAMD
VASP

Besides the examples above, currently over 250 software products are installed.

Services

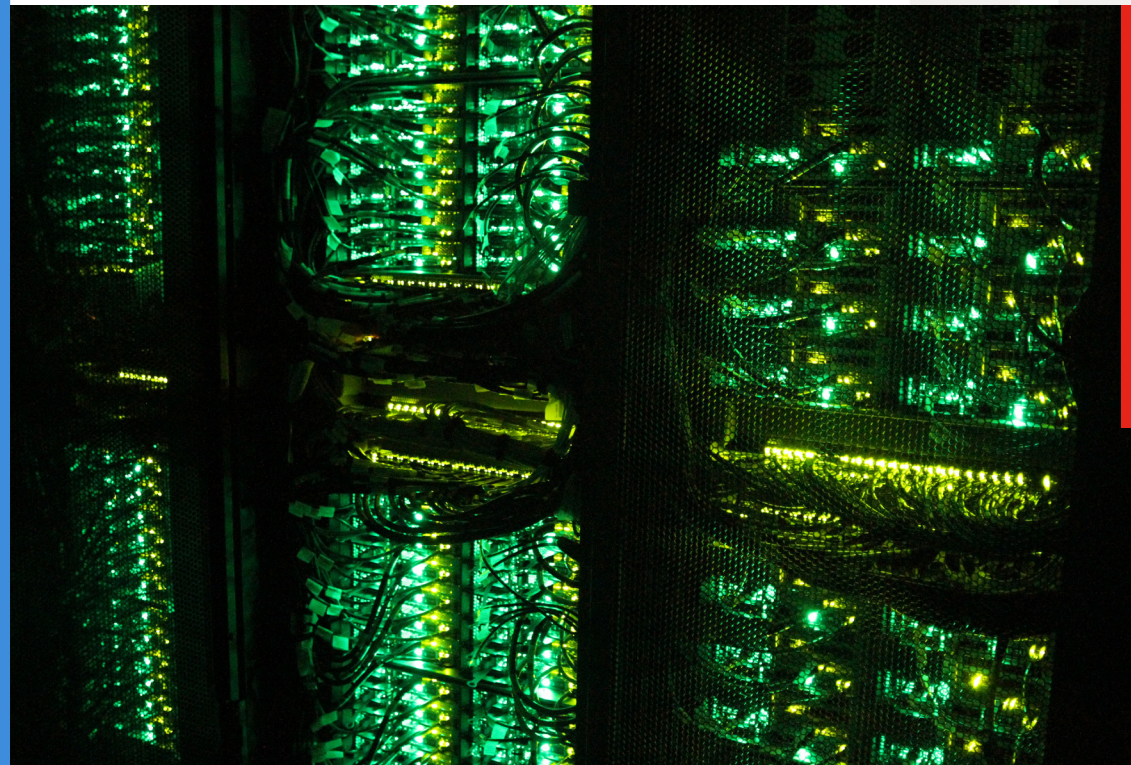
Lenovo HPC Deployment Services
Lenovo On-Site Services
Lenovo Health Checks



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—Professor Bo Kågström, Director, HPC2N, Umeå University

High Performance Computing Center North (HPC2N) at Umeå University is driving forward research innovation with a high-density Lenovo supercomputer. Equipped with powerful Intel® Xeon® processors and NVIDIA GPUs, the solution delivers five times the performance and offers new capabilities, helping users push the limits of existing knowledge for world-changing impact.



Lenovo™