
MEGWARE
NVIDIA
CAPELLA
The research game changer –
where innovation meets
computational power

Top performance with responsibility: why Capella is more than just computing power

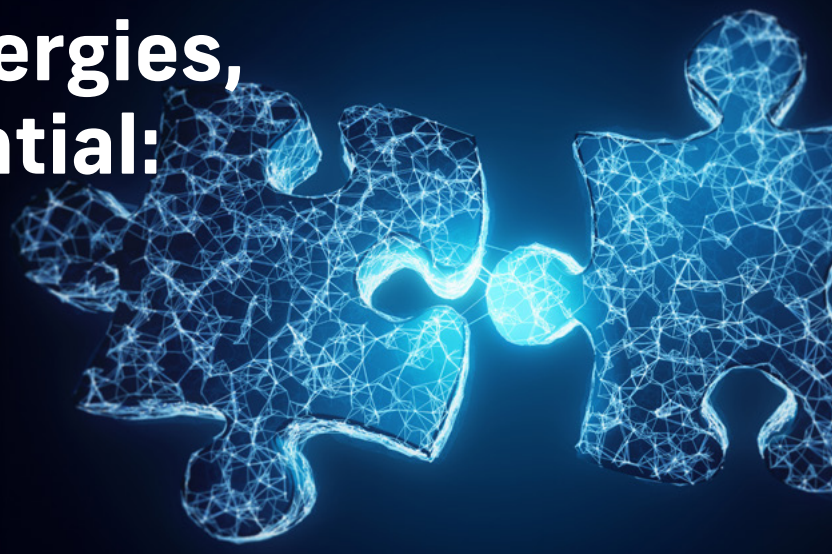
In the world of supercomputers, there are always milestones that redefine the potential of modern technology. Such systems overcome previous technical limitations and offer new possibilities for scientific research, from complex simulations to solving global challenges. Capella was born out of this vision—an ambitious joint project between MEGWARE and the Technical University of Dresden (TUD).

As computational power grows, new challenges arise: Existing systems are reaching their limits, be it due to increasing data volumes, insufficient energy efficiency or the lack of scalability for future scientific requirements. Areas such as artificial intelligence, life sciences, and climate simulations in particular require enormous computing capacities that simply overwhelm conventional infrastructures. Without a new generation of supercomputers that combine computational power, efficiency, and future-proofing, many current research projects would be massively slowed down.

Capella was developed to close this gap. With this system, MEGWARE and TU Dresden have jointly created a supercomputer that not only sets new standards in computational power, but also opens up new horizons in terms of energy efficiency. The aim was to create a balance between extreme computational power and maximum energy efficiency – without compromising on scalability.

The result is a supercomputer that can hold its own worldwide.

Harnessing synergies, unlocking potential: the power of collaboration



TU DRESDEN - CIDS

The Center for Interdisciplinary Digital Sciences (CIDS) is a leader in these fields with its two competence centers for Information Services and High Performance Computing (ZIH) and for Big Data and AI (ScaDS.AI).

Location: Dresden

Category: Research institution

Funding: NHR, ScaDS.AI Dresden/Leipzig, DZA (each BMBF, Free State of Saxony)

Research focus: Data-intensive computing, innovative computer architectures, AI, machine learning, energy and performance efficiency, cloud computing, distributed computing, parallel programming, and algorithm development.

Website: www.tu-dresden.de/zih

TECHNISCHE UNIVERSITÄT DRESDEN

MEGWARE

For over 35 years MEGWARE has been a respected name in the European HPC landscape, known for its outstanding high-performance computing solutions.

Location: Chemnitz

Industry: Specialist for High Performance Computing (HPC) and customized cluster solutions

Team: Over 50 highly qualified experts

Certification: ISO9001, ISO14001

Website: www.megware.com

E-mail: info@megware.com

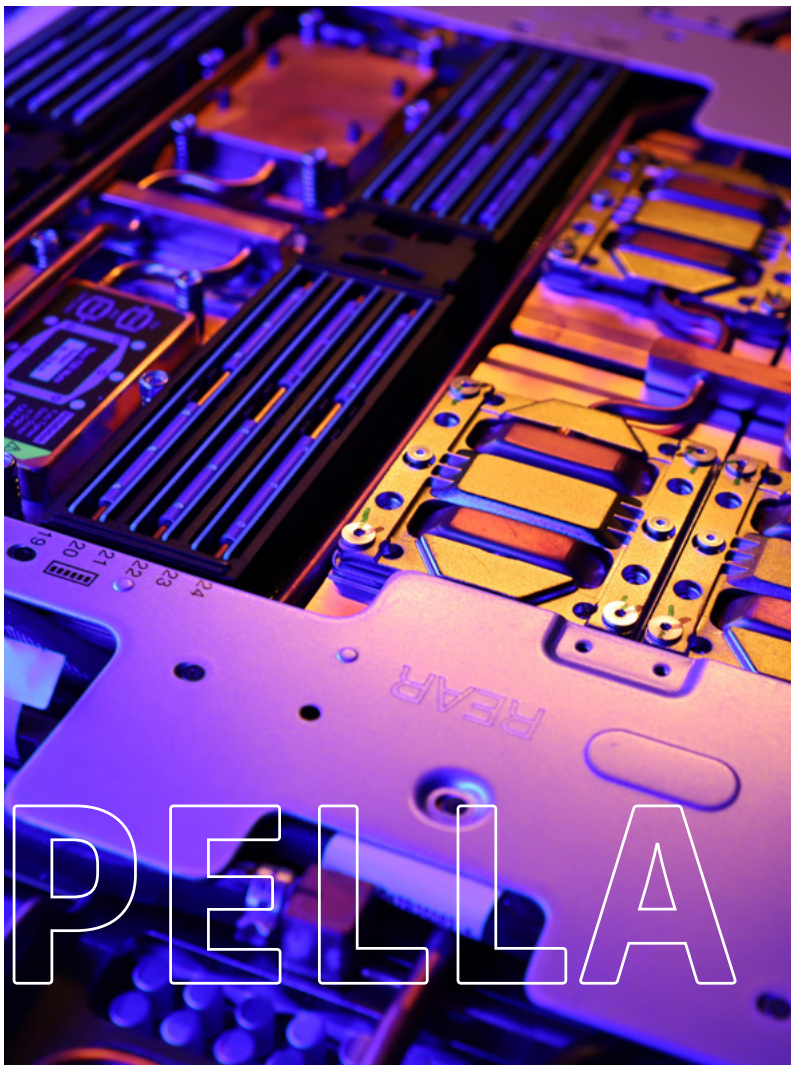
MEGWARE®

Between computational power and sustainability – the new era of supercomputers

Modern research requires extreme computational power, but how do you develop a system that processes immense volumes of data in record time without consuming enormous amounts of energy? MEGWARE and the TUD addressed this challenge and jointly developed a system that does not view performance and efficiency as opposites, but as a symbiotic unit.

Another key factor: Future-readiness. Scientific issues are developing rapidly and the volume of data is growing exponentially. Capella was designed to not only meet today's scientific requirements but also anticipate future challenges.

The perfect collaboration between MEGWARE and TU Dresden was also decisive for the success of the project. Science and industry often speak different languages, but here two worlds had to become one common vision. Through a joint effort, it has been possible to ensure that technical concepts and scientific requirements are seamlessly integrated.



CAPELLA

The customized solution

The answer lay in a unique combination of state-of-the-art hardware, innovative cooling technology, high packing density, and future-proof architecture.

"Capella completely dispenses with fans in the servers and cools each server component directly with 35 °C warm water. This allows more than 95% of the waste heat to be efficiently dissipated via warm water cooling – a decisive factor that makes Capella one of the most energy-efficient supercomputers in the world."
Markus Hilger (HPC Engineer at MEGWARE)

Energy-efficient cooling: Capella relies entirely on direct warm water cooling and does not require any fans. This means that > 95 % of the waste heat is dissipated directly, which enables resource-saving air conditioning for the server rooms.

Sustainable use of waste heat: The heated water transports the waste heat to the district heating network, where it is utilized through the use of heat pump systems.

The hardware in the supercomputer has been specially optimized for maximum performance and efficiency. Capella's computing nodes are based on state-of-the-art Lenovo servers, which have been specially designed for maximum efficiency and performance in the HPC sector. Each of the more than 140 nodes is equipped with four NVIDIA H100 accelerators and two AMD processors with 32 cores each. This combination enables an impressive peak computing performance of over 38 petaflops. Each graphics processor has 94 gigabytes of high bandwidth memory – enough to provide gigantic amounts of data in fractions of a second. A storage system of over 2 petabytes acts as a "burst buffer" and provides data at over 1,500 gigabytes per second for the AI accelerators, which is particularly advantageous for training large AI models. **Whether it's increasingly complex AI models or data-intensive simulations, Capella is ready for the task.**

NVIDIA Elite Partner

At 38 petaflops, we are talking about FP64 (double precision) flops. This corresponds to a performance of 38 quadrillion calculations per second. Capella is therefore around 38 million times more powerful than the best gaming notebooks on the open market. To support this performance, the supercomputer has a storage capacity of 2 petabytes – enough to store over 1.1 million hours of YouTube videos in 1080p, which equates to around 125 years of uninterrupted video consumption.

From idea to reality

In November 2024, Capella achieved **51st place** in the prestigious TOP500 ranking of the **world's most powerful supercomputers**. Even more impressive is the ranking on the Green500 list: Capella took 5th place here, making it one of the **most energy-efficient supercomputers in the world**. Capella will be used at the TU Dresden for a variety of demanding scientific projects.

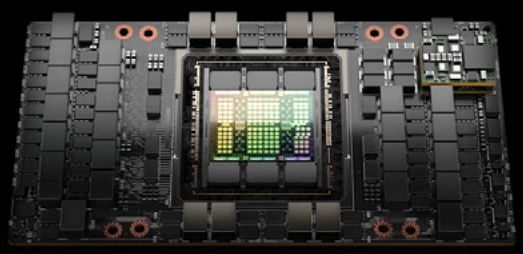
Most powerful supercomputer
Worldwide: 51st Place

Most energy-efficient supercomputer
Worldwide: 5th Place

In addition to its scientific relevance, Capella also sets new standards in terms of cooperation between industry and science. The close collaboration between MEGWARE, TU Dresden, and other technology partners has shown how different competencies can be bundled to enable innovation. Prof. Dr. Wolfgang E. Nagel, Director of the Center for Information Services and High Performance Computing (ZIH) at TU Dresden, emphasizes the importance of Capella:

"With Capella, we are strengthening TU Dresden's leading position as an attractive research location. Thanks to the National High Performance Computing Initiative (NHR), Germany remains on a par with international competitors, and even achieves leading positions, as our system proves. These investments are essential for the future of research."
Prof. Dr. Wolfgang E. Nagel

NVIDIA H100 SXM is one of the most powerful GPUs for artificial intelligence and scientific computing.
It is based on the latest Hopper architecture from NVIDIA and has been specially developed for high-end AI applications and high-performance computing.



DID YOU KNOW?
Many modern AI models, including large language models such as ChatGPT, are trained and run on NVIDIA H100 GPUs or similar high-performance GPUs.

The NHR Network (National High Performance Computing) pools the resources and expertise of university high-performance computing, makes them available for science and research (NHR Association) and serves as a federal government funding instrument for the national HPC.

A look into the future

Today, Capella is among Europe's most powerful and energy-efficient supercomputers – but its true impact will unfold over the coming years: in groundbreaking research projects, faster scientific breakthroughs, and a new generation of researchers equipped with the best tools to develop solutions to the pressing issues of our time. From AI to climate research, from simulations to quantum physics: The course has been set. With Capella, MEGWARE is not only setting new standards in energy efficiency, but also paving the way for the next generation of scientific breakthroughs.

Want to find out more? Contact us for further information:

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