



# GRETE

A quantum leap in  
high-performance data processing

# Challenge:

The Gesellschaft für wissenschaftliche Datenverarbeitung in Göttingen, also referred to as GWDG, is recognized for its leading research role in both practical and applied computer science and involvement in numerous research projects. Furthermore, it is well-known for pushing the boundaries of what is possible and goes far beyond conventional IT standards.

As an integral part of the North German Network for High Performance Computing (HLRN) and as a national high-performance computing center, the GWDG faces the continuous challenge of meeting the rapidly-growing demand for high-performance IT resources in various scientific fields. Specifically, the increasing requirements related to the field of artificial intelligence (AI) have clearly demonstrated the limits of conventional CPU partitions, highlighting the urgent need for optimizing the IT infrastructure.

For energy-intensive systems such as those found in the HPC sector, total cost of ownership is an issue that must be managed. After all, these systems run continuously, 365 days a year, which has a dramatic impact on the overall budget, especially in times of energy crises.



Therefore, the particular challenge was to develop a system that fulfills all of the following criteria:



affordable acquisition costs



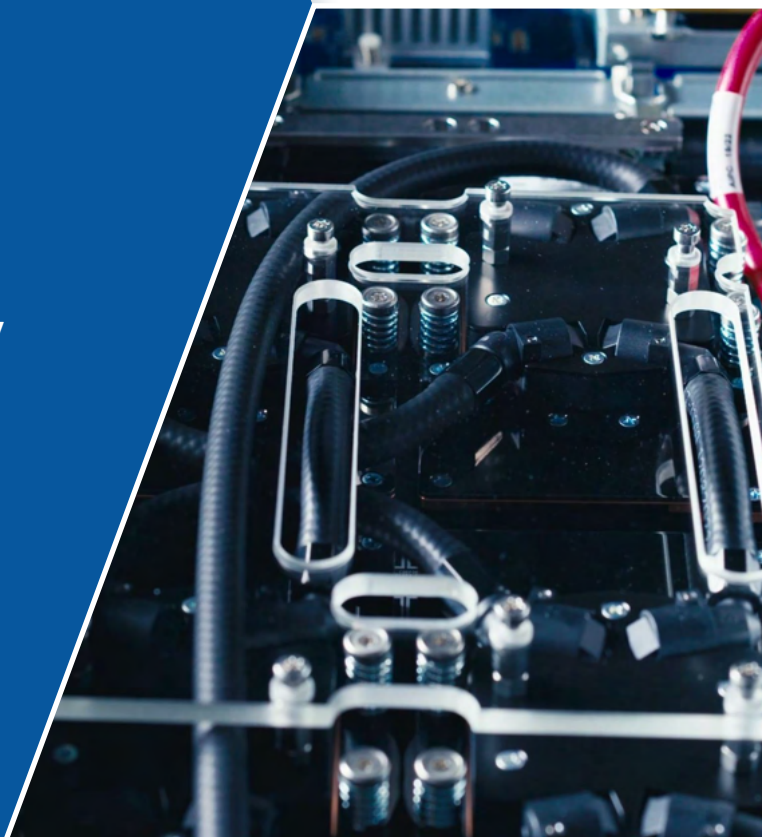
enormously high energy efficiency



sufficient performance resources  
– also for the future



expandability of  
resources and storage



# Top-Class Synergy

Together, MEGWARE and the GWDG are realizing a pioneering project in the field of high-performance computing that is setting new standards. The focus is to increase performance and efficiency, thereby raising the bar for scientific and technical applications to a new level.

## Swipe right! MATCH: MEGWARE

For more than 30 years, MEGWARE has been a respected name in the European HPC landscape, recognized for its outstanding high-performance computing solutions.

**Location:** Chemnitz

**Industry:** Specialist for high-performance computing (HPC) and customized cluster solutions

**Team:** more than 50 highly-qualified experts

**Certifications:** ISO9001, ISO14001

**Website:** [www.megware.com](http://www.megware.com)

**E-mail:** [info@megware.com](mailto:info@megware.com)



## In close contact with the GWDG

The University Computer Center for the Georg-August University of Göttingen and Computing and IT Competence Center for the Max Planck Society.

**Location:** Göttingen

**Category:** research institution

**Organisation:** Max Planck Society & University of Göttingen

**Main research areas:** high-performance computing, cloud infrastructures, data analytics, data infrastructures, research data management, scheduling & resource management

**Team:** more than 200 employees, 8 working groups, including 110 scientists.

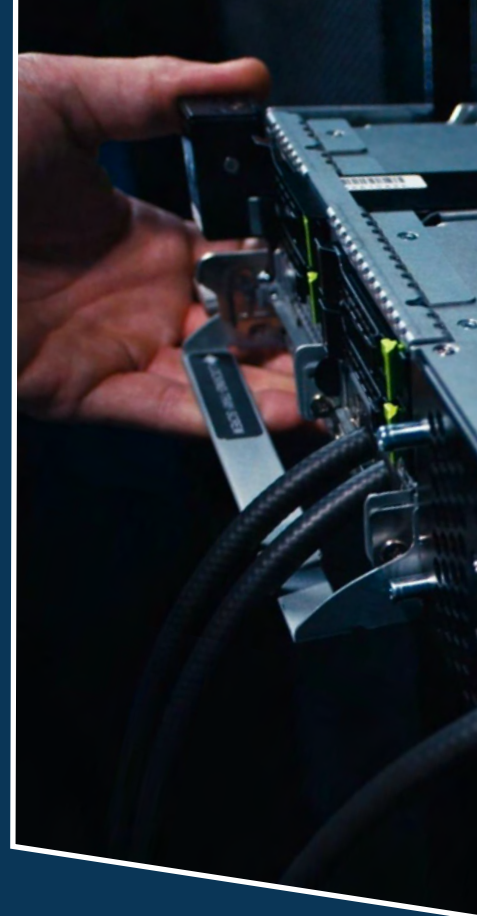
**Website:** [www.gwdg.de](http://www.gwdg.de)

**E-mail:** [gwdg@gwdg.de](mailto:gwdg@gwdg.de)

# The Vital Role of Energy Efficiency and Total Cost of Ownership

MEGWARE was already involved as a sparring partner in the conception phase of the project. It made a valuable contribution to the system planning by benchmarking, analyzing and calculating various configuration variants. The planning was carried out on a manufacturer-neutral manner in order to carefully ensure compliance with the requirements of the EU-wide tender.

**In direct comparison with international providers, MEGWARE was ultimately able to assert itself as a partner for the implementation.**



**With more than three decades of experience, MEGWARE is an established company in the development and installation of High Performance Computing (HPC) systems and Linux clusters designed to deliver both high performance and energy efficiency.**

With this wealth of experience and an outstanding reputation in the field of HPC, MEGWARE primarily serves the public sector. In particular the company supports research institutes and universities, where it focuses on offering customized total solutions that use the available resources sustainably and economically, in addition to significantly reducing energy consumption, cutting emissions and, as a result, reducing costs, thereby actively contributing to environmental protection.

This flexible approach is firmly anchored in the corporate culture and goes far beyond mere marketing statements. Much rather, it is a promise that is actually put into practice, and which is centered on understanding individual needs.



# The Solution:

In response, the GRETE project was created. It is a high performance GPU system that not only provides impressive computing power, but also ensures remarkable energy efficiency. One of the project's outstanding innovations is the integration of hot water cooling technology, a specialty of MEGWARE, which has contributed significantly to the system's performance and increased energy efficiency.



# GRETE

Named after Grete Hermann, a pioneer in computer algebra, GRETE represents a significant extension of the existing "Emmy" HPC system, which has been operated by the GWDG for the University of Göttingen since 2018. Not only is this innovation a milestone for the GWDG; it also marks a significant step forward for the entire German scientific and HPC community.

*"Many users will benefit from the new system. In addition to applications in the field of **machine learning, life sciences** and **digital humanities** projects will also be supported.*

*During the tendering process, it was very important for us to find a solution that prioritized **energy efficiency, the procurement price** and the **entire life cycle**. Within the scope of this context, **MEGWARE's solution** proved to be superior, which is why we clearly opted for it."*

Prof. Dr. Julian Kunkel

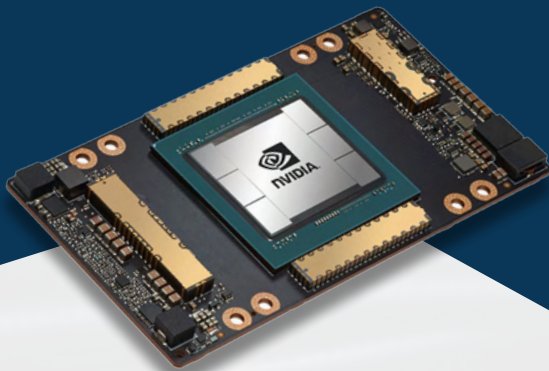


# Meet GRETE

**GRETE** is a supercomputer capable of processing enormous amounts of data at lightning speed. Originally designed with 36 powerful compute nodes, GRETE has been expanded to a total of **101 nodes**, each equipped with 2 AMD EPYC „Milan“ processors and **64 super-fast „Zen 3“ cores**.

At the heart of these nodes are four **NVIDIA A100 SXM GPUs**. Each has nearly **7000 CUDA cores** and special tensor cores to perform even the most complex calculations at record speeds.

These GPUs are interconnected via **NVLINK** on a special GPU baseboard. This enables ultra-fast communication between them. And to ensure that all compute nodes have access to all the data they need at all times, they are connected by a high-speed **NVIDIA InfiniBand** network, which provides an impressive data transfer rate.



In a nutshell:  
**In addition to the optics, the inner values are strong, too.**

## GRETE - MEGWARE GPU SERVER SYSTEM, AMD EPYC 7513 32C 2.6GHZ, NVIDIA A100 SXM4 80 GB, INFINIBAND HDR

Cores:	50,096 (CPU and GPU-SM cores)
Processor:	AMD EPYC 7513 32C 2.6GHZ
GPU:	NVIDIA A100 SMX4 40/80 GB
Interconnect:	InfiniBand HDR
Installation Year:	2022

### Performance

Linpack Performance (Rmax):	5.46 PFlop/s
Theoretical Peak (Rpeak):	7.90 PFlop/s

### Power Consumption

Power:	205.62 kW (Green500: 128.18 kW)
Power Measurement Level:	2

To safely store all this processed data, GRETE provides an **enormous storage capacity of 130 TiB**, which is further expanded by the already existing 8.5 PiB "Emmy" storage system.

All in all, GRETE is not just another **step towards the future of high-performance computing** – it is a giant leap that will completely revolutionize the way in which we solve complex problems.

# Empowering AI Evolution

At a time when we are witnessing the increasing presence of artificial intelligence not only in professional contexts, but also in everyday life - we only need to mention the use of advanced chatbots such as ChatGPT, which can carry out complex human-like conversations – the demands on the underlying infrastructure are increasing exponentially. These developments require not only graphics accelerator/GPU resources, but also innovative thinking to meet the growing challenges.

**Within this tension, GRETE was able to meet the expectations of the GWDG and its leading scientists, Prof. Dr. Ramin Yahyapour and Prof. Dr. Julian Kunkel, in many ways.**

*"We are continuously committed to provide the **best possible service** to our users.*

**GRETE complements the existing CPU partition with an energy-efficient GPU system, allowing us to explore new application areas and realize deep learning applications, for example."**

**Prof. Dr. Julian Kunkel**



*"The **GRETE expansion** is an important milestone that enables us to support this emerging field. With the **National High Performance Computing Initiative**, the federal and state governments have made a significant contribution to **improving the research infrastructure** in Germany, for which we are of course very grateful"*

**Prof. Dr. Ramin Yahyapour**

# The Rise of GRETE

In the November 2023 edition of the TOP500 list of the world's fastest supercomputers, GRETE secured **142nd place** in the Linpack benchmark, with an impressive computing power (Rpeak) of **5.46 PFlop/s** (quadrillions of computing operations per second).

The basis for this was a goal-orientated, trust-based cooperation between the **GWDG** and **MEGWARE**, which ensured that technical excellence and innovative spirit were combined in **GRETE**.

## Computing power & hot-water cooling technology, for peak energy efficiency.

In addition to its impressive GPU performance, which replaces many conventional compute nodes, GRETE is a prime example of ecological responsibility and technological innovation, thanks to its **hot-water cooling system**, which supports temperatures of up to 40 degrees Celsius. When it went into operation, this **avant-garde cooling technology**, combined with the high computing power achieved by the high parallelism of the many computing cores, has enormously increased energy efficiency and set a new standard in Germany, as **the country's most energy-efficient supercomputer**.

Fastest  
supercomputer

**Worldwide:  
Place 142**

Most energy-efficient  
supercomputer

**Germany:  
1st place**



**In global comparison, GRETE achieved 12th place in this category on the Green500 list in November 2022!**

[www.top500.org/lists/green500/list/2022/11/](http://www.top500.org/lists/green500/list/2022/11/)

*"The demand for energy-efficient systems is enormous, especially in Germany, where energy prices are quite high. Therefore, we are all the more delighted that we have once again been able to set standards in this respect."*

**André Singer**

Member of MEGWARE's management board





# Science 2.0: at the cutting edge of research with GRETE

**Prepare for science that opens new horizons:** With GRETE, the GWDG is enabling groundbreaking advances in its research and computing. More than just a supercomputer, GRETE is a powerful tool that solves complex scientific challenges faster and more efficiently than ever before, opening up new possibilities in areas such as machine learning, life sciences, computation and digital humanities.



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