Press Release

European Exascale Supercomputer JUPITER Sets New Energy Efficiency Standards with #1 Ranking in GREEN500

Paris, France and Hamburg, Germany – May 13, 2024 – The first module of the exascale supercomputer JUPITER, named JEDI, is ranked first place in the Green500 list of the most energy-efficient supercomputers worldwide, as announced today by Forschungszentrum Jülich and EuroHPC Joint Undertaking, together with the ParTec-Eviden supercomputer consortium at the International Supercomputing Conference (ISC) in Hamburg. The JUPITER Exascale Development Instrument was installed in April by the German–French consortium and has the same hardware as the JUPITER booster module, which is currently being built at Forschungszentrum Jülich.

The rapid pace of digitalisation and the increasing use of artificial intelligence requires an increasing amount of computing power and, in turn, energy. Data centres now account for 4 % of German electricity consumption, and this trend is increasing. As a result, efficient computing has become an increasingly important issue in recent years. Research as well as measures to increase energy efficiency have also been on the rise.

The JUPITER supercomputer procured by the European supercomputing initiative EuroHPC Joint Undertaking is a true pioneer in this field. The first module installed in April, the JUPITER Exascale Development Instrument (JEDI), is capable of 72 billion floating-point operations per second per watt. In contrast, the previous leader achieved around 65 billion.

The decisive factor for the module's outstanding efficiency is its use of graphics processing units (GPUs) and the fact that it is possible to optimise scientific applications for calculations on GPUs. Today, virtually all leading systems on the Green500 ranking rely heavily on GPUs, which are designed to perform calculations with much greater energy efficiency than conventional central processing units (CPUs).

The JEDI development system is one of the first systems in the world to use the latest generation of accelerators from NVIDIA: the NVIDIA GH200 Grace Hopper Superchip, which combines the NVIDIA Hopper GPU and the NVIDIA Grace CPU on a single module. Based on Eviden's latest BullSequana XH3000 architecture, the system includes its highly

efficient hot water cooling system, Direct Liquid Cooling, which requires significantly less energy than conventional air cooling, and allows the heat generated to be reused downstream.

The JUPITER precursor JEDI already has the same equipment as the subsequent JUPITER booster module. Scientists are able to access the hardware at an early stage of development as part of the JUPITER Research and Early Access Program (JUREAP) in order to optimise their codes. In doing so, they are supported by experts from the Jülich Supercomputing Centre.

> *"This momentous milestone with the first modules of the Jupiter exascale supercomputer, JEDI, crowning the GREEN500 list fills us with immense pride. Our partnership in this endeavour underscores our firm dedication to helping our client innovate while giving them the opportunity to meet their sustainability objectives. Achieving exceptional computing power while simultaneously reducing energy consumption is a remarkable accomplishment. Playing a crucial role in this success is our groundbreaking warm water-cooling technology, Direct Liquid Cooling, seamlessly integrated within our BullSequana XH3000 system. Not only does it significantly enhance energy efficiency, but it also resourcefully repurposes waste heat."* **Emmanuel Le Roux, Group SVP, Global Head of HPC, AI & Quantum at Eviden, Atos Group**

JUPITER exascale supercomputer

JUPITER is set to be the first supercomputer in Europe to surpass the threshold of one exaflop, which corresponds to one quintillion ("1" followed by 18 zeros) floating-point operations per second. The final system will be installed in stages in the second half of this year and will initially be made available to scientific users as part of the early access programme before it goes into general user operation at the beginning of 2025.

JUPITER's enormous computing power will help to push the boundaries of scientific simulations and to train large AI models. The modular exascale system uses the dynamic modular system architecture (dMSA) developed by ParTec and the Jülich Supercomputing Centre. The JUPITER booster module, which is currently installed, will have around 125 BullSequana XH3000 racks and around 24,000 NVIDIA GH200 Superchips, interconnected by NVIDIA Quantum-2 InfiniBand networking. For 8-bit calculations, which are common for training AI models, the computing power is set to increase to well over 70 exaflops. As of today, this would make JUPITER the world's fastest computer for AI.

According to estimates, JUPITER's energy requirements will average around 11 megawatts. Further measures will help to use energy even more sustainably. The modular data centre in which JUPITER will be housed is designed to extract the heat generated during cooling and to then use it to heat the buildings on the Forschungszentrum Jülich campus.

All hardware and software components of JUPITER will be installed and managed by the unique JUPITER Management Stack. This is a combination of ParaStation Modulo (ParTec), SMC xScale (Eviden), and software components from JSC.

JUPITER development system JEDI

The JUPITER development system JEDI is much smaller than the final exascale computer. It consists of a single rack from the latest BullSequana XH3000 series, which currently contains 24 individual computers, known as compute nodes. These are connected to each other via four NVIDIA Quantum-2 InfiniBand switches and will be complemented with 24 additional computing nodes over the course of May.

During measurements for the Green500 ranking of the most energy-efficient supercomputers, the JEDI system achieved a computing power of 4.5 quadrillion floating-point operations per second, or 4.5 petaflops, with an average power consumption of 66 kilowatts. During optimised operation, the power consumption was reduced to 52 kilowatts.

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About Eviden[1]

Eviden is a next-gen technology leader in data-driven, trusted and sustainable digital transformation with a strong portfolio of patented technologies. With worldwide leading positions in advanced computing, security, AI, cloud and digital platforms, it provides deep expertise for all industries in more than 47 countries. Bringing together 47,000 world-class talents, Eviden expands the possibilities of data and technology across the digital continuum, now and for generations to come. Eviden is an Atos Group company with an annual revenue of c. € 5 billion.

About EuroHPC

The EuroHPC Joint Undertaking (EuroHPC JU) is a legal and funding entity created in 2018 to enable the European Union and EuroHPC participating countries to coordinate their efforts and pool their resources with the objective of making Europe a world leader in supercomputing. The mission of the EuroHPC JU is:

- to develop, deploy, extend and maintain in the EU a federated, secure hyperconnected supercomputing, quantum computing, service and data infrastructure ecosystem;
- to support the development and uptake of demand-oriented and user-driven innovative and competitive supercomputing and quantum computing systems based on a supply chain that will ensure the availability of components, technologies and knowledge;
- and, to widen the use of that supercomputing and quantum computing infrastructure to a large number of public and private users.

In order to equip Europe with a world-leading supercomputing infrastructure, the EuroHPC JU has already procured nine supercomputers, located across Europe, with more coming soon.

No matter where in Europe they are located, European scientists and users from the public sector and industry can benefit from these EuroHPC supercomputers, which rank among the world's most powerful.

About Forschungszentrum Jülich

Shaping change: This is what drives us at Forschungszentrum Jülich. As a member of the Helmholtz Association with more than 7,200 employees, we conduct research into the possibilities of a digitized society, a climate-friendly energy system, and a resource-efficient economy. We combine natural, life and engineering sciences in the fields of information, energy, and the bioeconomy with specialist expertise in high-performance computing and we also use unique scientific infrastructure.

Jülich scientists focusing on the research priority of information investigate how information is processed in biological and technical systems. To this end, research at Jülich combines three areas:

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[1] *Eviden business is operated through the following brands: AppCentrica, ATHEA, Cloudamize, Cloudreach, Cryptovision, DataSentics, Edifixio, Energy4U, Engage ESM, Evidian, Forensik, IDEAL GRP, In Fidem, Ipsotek, Maven Wave, Profit4SF, SEC Consult, Visual BI, Worldgrid, X-Perion. Eviden is a registered trademark.*

simulation and data science using high-performance computing (HPC), brain research, and research into bioelectronics- and nanoelectronics-based information technologies of the future.

https://www.fz-juelich.de/en

About ParTec AG

ParTec AG specializes in the development and manufacture of modular supercomputers and quantum computers as well as accompanying system software. Its offering includes the sale of pioneering High-Performance Computers (HPC) and Quantum Computers (QC) as well as consulting and support services in all areas of the development, construction, and operation of these advanced systems. The dynamic Modular System Architecture (dMSA) approach is a unique and successful feature of ParTec AG, which has proven particularly successful for the complex requirements of massive computing power in AI. Further information on the company and ParTec AG's innovative solutions in the field of high-performance computing and quantum computing can be found at www.par-tec.com.

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