JUPITER: Europe’s First Exascale Supercomputer

JUPITER, the first European exascale supercomputer, is set to be launched at Forschungszentrum Jülich. “Joint Undertaking Pioneer for Innovative and Transformative Exascale Research”, or JUPITER for short, is the first system in Europe with a computing power of more than one exaflop/s. This corresponds to one quintillion floating-point operations per second or the computing power of roughly one million modern smartphones. As one of the world’s most powerful AI supercomputers, JUPITER will enable a whole new level of breakthroughs in the use of artificial intelligence and scientific simulations – serving as a major driver of progress for Germany and Europe and ensuring technological and digital sovereignty.

Simulations and AI

JUPITER is designed for simulations and AI applications in science and industry that require a maximum level of computing power. Potential areas of application include training large-scale neural networks such as AI language models, simulations for developing functional materials, creating digital twins of the human heart or brain for medical purposes, validating quantum computers, and high-resolution climate simulations encompassing the entire Earth system.

Over 70 exaflop/s for AI

JUPITER is set to be the first European supercomputer to achieve the performance of more than one quintillion floating point operations per second – or one exaflop/s – with double the precision (64 bits) typically required for scientific simulations. The computer performance is equivalent to that of around one million modern smartphones. There are currently only two other computers of this performance class, both of which are located in the US. For the training of AI models, JUPITER is expected to achieve over 70 exaflop/s for calculations with lower accuracy (8 bits). This would make JUPITER one of the fastest computers for AI in the world.

High energy efficiency

JUPITER is equipped with particularly energy-efficient processors and will be powered by green electricity. Its estimated energy requirements will average around 11 megawatts, which is roughly equivalent to the requirements of several thousand typical households. JUPITER will be operated with a highly efficient warm-water cooling system. The heat that is generated will be used to heat buildings, which will cover a substantial proportion of the heating requirements on the Jülich campus in the medium term. JUPITER's development system JEDI, installed in April 2024, is also a real pioneer in terms of energy efficiency. It has the same hardware as JUPITER and took first place on the Green500 list of the most energy-efficient supercomputers in 2024.

Modular data centre

JUPITER is being installed in a high-performance modular data centre (MDC), which consists of around 50 container modules and covers more than 2,300 square metres – roughly the equivalent of half a football pitch. This concept has numerous benefits, including the fact that planning and assembly times are significantly shorter, and construction and operating costs are lower. It can also be flexibly adapted for new generations of computers and new power supply and cooling infrastructure, as well as offering improved opportunities for recycling.

Costs

The costs for JUPITER and its operation over an estimated period of six years amount to € 500 million, half of which is being provided by the European supercomputing initiative EuroHPC JU. The other half is being provided in equal parts by the German Federal Ministry of Education and Research (BMBF) and the Ministry of Culture and Science of the State of North Rhine-Westphalia (MKW NRW).

Partners

JUPITER is owned by the European supercomputing initiative EuroHPC JU.

The supplier is the German–French consortium ParTec-Eviden, which is led by Eviden. Both parties signed a contract for the construction of the exascale supercomputer in October 2023. Europe's first exascale supercomputer will be located at Forschungszentrum Jülich in North Rhine-Westphalia.

Timeline

Installation of the JUPITER Booster module began in stages in the second half of 2024. The system will initially be made available to scientific users as part of an early access programme before it goes into general user operation in 2025.

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