

European Fusion Computer Comes to Jülich

ParTec provides Cluster Management and Operation System to JuRoPA II as well as to additional Fusion Supercomputer HPC-FF

"We are proud that the European Fusion Development Agreement EFDA has chosen to make use of Jülich's know-how," says Prof. Achim Bachem, Chairman of the Board of Forschungszentrum Jülich. "Jülich will show what Europe can do as a supercomputing site for energy research." The concept for the supercomputer Bull HPC-FF was drawn up by the team headed by Dr. Thomas Lippert, director of the Jülich Supercomputing Centre, optimized and implemented together with the partner companies Bull, Intel, Mellanox and ParTec. "HPC-FF will be closely coupled to the Jülich 200-teraflop system, JuRoPA, already purchased in 2008. So, if required fusion researchers can access computing power totalling 300 teraflop/s," says Lippert, the leading scientist.

The main aim of the EU Fusion project is to speed up research into nuclear fusion - a high-potential way of generating energy which should, in the long-term, enable us to meet the challenges both of sustainable development and the disappearance of fossil fuels.

From the moment it is deployed, the HPC-FF supercomputer will be used to validate the very latest nuclear fusion computer simulation models. It will enable research in the area of plasma turbulence, one of the major challenges confronting physicists today. The new supercomputer will also be used in the areas of fast particle physics, which dominates plasmas in thermonuclear combustion and materials physics.

The new additional cluster is being built through an innovative alliance between Mellanox, Bull, Intel, Sun Microsystems, ParTec, and the Jülich Supercomputing Centre; the first such collaboration in the world. The new best-of-breed system, one of Europe's most powerful, will support advanced research in many areas such as health, information, environment, and energy. It consists of two closely coupled clusters, JuRoPA, a general purpose cluster with more than 200 Teraflop/s performance, and HPC-FF, with more than 100 Teraflop/s. The latter will be dedicated for the European fusion research community.

Fusion researchers intend to use HPC-FF's computing capacity to better understand the complex mechanisms in the fusion matter, the plasma, that reaches a temperature of 100 million degrees Celsius inside ITER. They will develop computer simulations that can reproduce important physical effects more realistically than is yet possible. Supercomputing is indispensable for understanding the turbulent processes which determine the extraction of energy from the plasma at the material surfaces of the first wall of the burn chamber.

The HPC-FF (High Performance Computing – for Fusion) supercomputer is a best-of-breed system. It will consist of 1,080 computing nodes each equipped with two Nehalem EP Quad Core processors from Intel. The grand total of 8,640 processors will have a clock rate of 2.93 GHz each, they will be able to access 24 gigabytes of total main memory and will be water-cooled. Their total computing power of 101 teraflop/s corresponds at the present moment to

30th place in the list of the world's fastest supercomputers. The combined cluster will achieve 300 teraflops/s computing power and would be among the top 10 supercomputers in the world.

Infiniband ConnectX QDR from the Israeli company Mellanox will be used as node interconnect. The administrative infrastructure is based on servers of the type NovaScale R422-E2 from the French supercomputer manufacturer Bull, who will supply the compute hardware and on a SUN ZFS/Lustre Filesystem. The cluster operating system "Parastation" will be supplied by the Munich software company ParTec. ParTec's ParaStationV5 cluster operating system combined with Quad Data Rate (40 Gb/s) InfiniBand-based high-performance systems delivers an integrated, easy to use and reliable compute cluster environment," says Hugo Falter, COO of ParTec GmbH. "This cluster will provide the foundation for the next generation cluster computers to the worldwide community of users and scientists."

HPC-FF is being funded by the European Commission (EURATOM), the member institutes of EFDA and Forschungszentrum Jülich.

ITER (International Thermonuclear Experimental Reactor) will go into operation in 2018 and will be the first fusion reactor to generate at least 500 megawatts of excess power. It will thus pave the way for future fusion power plants and will make a decisive contribution to creating a carbon-dioxide-free energy supply. ITER – Latin for "the way" – will be constructed in Cadarache, in the south of France, by a consortium consisting of the European Union, Japan, the USA, China, Russia, India and South Korea.

EFDA (European Fusion Development Agreement) is an agreement between European fusion research institutions. As the link to the European Commission, EFDA coordinates research and technological development in Europe as well as EU contributions to international projects. EFDA also very successfully operates the European fusion experiment JET in the UK, which has been existence since the mid-eighties and in which Jülich plays a major role. All EFDA member institutes will have access to the new Jülich supercomputer.

About the Fusion community

The Fusion community brings together the largest European research laboratories working in the areas of nuclear fusion and high-energy physics. Its members include, most notably, the Max-Planck-Institut für Plasmaphysik (Max Planck Institute for Plasma Physics) and the Forschungszentrum Jülich (Jülich Research Center), in Germany, the Institut de Recherche sur la Fusion par confinement Magnétique (Institute for Research into Magnetic Confinement Fusion) part of the French Atomic Energy Authority (the CEA), the Laboratorio Nacional de Fusión del CIEMAT (National Fusion Laboratory) in Spain, the Centro Ricerche ENEA Frascati (Frascati Research Center of the National Agency for New Technologies, Energy and the Environment) in Italy and UKAEA-Culham in the UK. One element of the research is being co-ordinated as part of the European Fusion Development Agreement (EFDA).

About Forschungszentrum Jülich

Forschungszentrum Jülich pursues cutting-edge interdisciplinary research on solving the grand challenges facing society in the fields of health, energy and the environment, and also information technologies. In combination with its two key competencies - physics and

supercomputing - work at Jülich focuses on both long-term, fundamental and multidisciplinary contributions to science and technology as well as on specific technological applications. With a staff of about 4400, Jülich - a member of the Helmholtz Association - is one of the largest research centres in Europe.

HPC-FF: High-Performance Computing For Fusion
JuRoPA: Jülich Research on Petaflop Architectures
EFDA (European Fusion Development Agreement
ITER (International Thermonuclear Experimental Reactor

About ParTec

ParTec Cluster Competence Center GmbH is specialized in development of comprehensive cluster software and support of productive supercomputers. ParaStation, an own developed cluster software stack that creates a parallel environment for Linux clusters in a reliable, stable and highly efficient way is one of the most world class operating and management platforms. ParTec provides vendor-independent consultancy for a sophisticated choice of products and support for professional operation of Linux compute clusters. Our approach ensures rapid deployment cycles and seamless interoperability of software components.

ParTec is member of major European and worldwide research consortia (e.g. PROSPECT, PRACE, D-GRID, Unicore etc.) to contribute to the development of Juropa-II, the next Petaflop architecture of supercomputers. The headquarter of ParTec is located in Munich, Germany.

Logos:



ParaStationV5

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