HPC-Europa2: Pan-European Research Infrastructure on High Performance Computing for 21st century Science
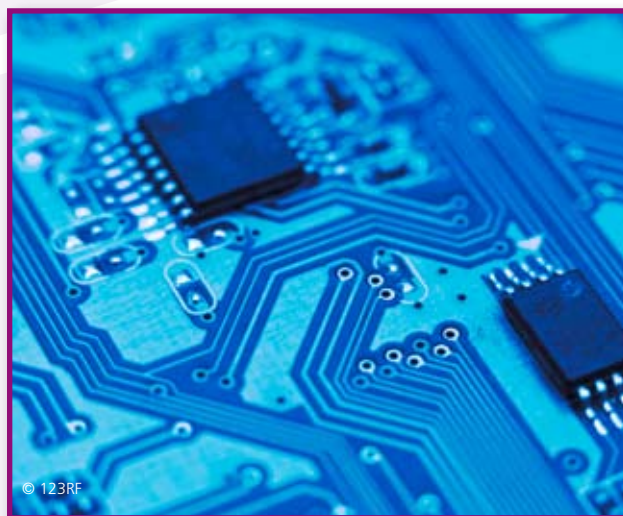
High-performance computing (HPC) is essential to many branches of science and technology, such as climate modelling and aircraft design, but the partners in the HPC-Europa2 project believe it has applications in many non-traditional fields too, from life sciences to knowledge management and discovery. The main function of this project is to give the European research community access to first-class supercomputers and advanced computational services in an integrated way. Anyone whose work would benefit from HPC can apply for an all-expenses-paid visit, lasting up to three months and including training and local support. Through EU funding, HPC-Europa2 – and its predecessors – has hosted hundreds of people in this way.

● NUMBER-CRUNCHING FOR NEWCOMERS

The rise of powerful computers has been good news for scientists and engineers. Since the first supercomputers appeared in the 1970s, researchers have been able to replace some of their experiments with computer-based mathematical simulations of the real world, often saving time and money in the process. For many problems where real experiments remain essential, powerful computers also help to increase the amount of useful data that can be extracted from the results.

The original supercomputers were so-called 'vector' machines with single processors – essentially beefed-up versions of ordinary computers. By the 1990s, the supercomputing had shifted to parallel computing, in which tasks are shared between many processors, often similar to those found in desktop PCs. A further development is the technique known as clustering, in which a large number of separate processors or multi-processors linked by fast interconnection networks co-operate to create a powerful and reliable system scaling up to hundreds of thousands of processors. Grid computing, which links computer systems, supercomputers and instruments through the internet, can also provide a collaborative environment to face complex and computation-intensive problems.

Supercomputers are used for tasks such as weather forecasting, climate research, modelling chemical compounds and biological molecules, simulating the aerodynamics of aircraft and road vehicles, particle physics, astronomy and code breaking.
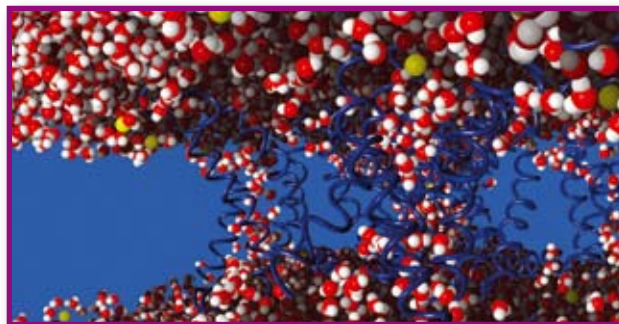
In the current challenging scenario of the HPC ecosystem in Europe, the HPC-Europa2 project is improving Europe's competitiveness in R&D by making the best use of the most advanced supercomputers. HPC-Europa2 gives researchers across Europe access to HPC within a high-quality computational environment, including the necessary technical and scientific support and specialist training, and is also helping to improve HPC facilities generally.

● A COMPUTING GRAND TOUR

The main objective of HPC-Europa2 is to continue providing a high-quality service for transnational access to the advanced HPC systems available in Europe. This activity has been available on an ongoing basis as a highly rated and trusted service for almost two decades. The project is organised around its core activity – the transnational access HPC service provision. Indeed, over its four-year lifetime, transnational access will provide HPC services, specialist support, scientific tutoring and opportunities for collaboration to more than 1 000 European researchers. This very large community of users will be provided with more than 22 million of CPU hours of computing time.

Each visitor is guided by a host researcher, working locally in a related field, who provides office space and a specialised scientific tutoring. The supercomputing centres are CINECA (Italy), EPCC (the UK), BSC (Spain), HLRS (Germany), GENCI-CINES (France), SARA (the Netherlands) and CSC (Finland).

HPC-Europa2's transnational access activity allows any researcher from an eligible country, whose work could benefit from HPC, to visit one of a number of supercomputing centres for up to three months, with all expenses paid. Over the course of the project, hundreds of European researchers, from postgraduates to senior professors, will benefit from this opportunity.

In addition, a number of networking activities will be implemented around the core business of the project; to interact with the HPC ecosystem in Europe; to coordinate the transnational access activities; and to coordinate the activities related to user support, consultancy support and the diffusion and dissemination of the HPC culture.

Three joint research activities are also being undertaken to incorporate results of and contribute to the development of emerging HPC programming models, to develop basic tools for the scientific data service to improve the quality of information extracted from the data and finally, to create a virtual cluster environment which enables researchers to prepare and familiarise themselves with the HPC environment in advance of their visit, thus increasing the effectiveness and productivity of transnational access visits.