

PRACE for Society



THE PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

How HPC Helps You

Over the past two decades, High Performance Computing (HPC) has developed into a key scientific tool alongside theory-based and experimental research methods. The Partnership for Advanced Computing in Europe (PRACE) ensures that all European research and development institutions have access to high-performance computer systems to help them tackle the diverse range of challenges facing humanity. Computer simulations speed up the process of acquiring knowledge enormously by shortening or even completely replacing complex, time-consuming laboratory experiments.

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A wide-range of scientific domains and industrial sectors benefit from access to the HPC resources provided by PRACE. Such domains and sectors include climate and earth sciences, energy, construction, materials science, biology, chemistry, automotive, aeronautics, astrophysics, and many more. Below examples from three important domains are highlighted.

PRACE Supports Medicine

Virtually all medical research can benefit from HPC. One of the largest and well-known computer-aided research projects and an EU Flagship initiative, the Human Brain Project (HBP), benefits from the results of research supported by PRACE. Driven by the goal of simulating the human brain right down to the processes which take place at the cellular level, the HBP hopes to gain a better understanding of the brain and the mechanisms that control behaviour and cognition. The aim is to achieve a fundamental understanding of the brain that would help in the treatment of medical conditions such as dementia or Alzheimer's disease. The findings from this research can also be used to stimulate technological advances. For example, the working principle of the human brain could serve as a basis for building computers capable of achieving a similar degree of efficiency – high-performance machines with a low level of power consumption.

Computer simulations carried out within the PRACE project framework are also used to study heart and cardiovascular diseases, and develop treatments. Heart disease is the leading cause of death worldwide. Based on simulations, researchers formulate new medicines and develop tiny vehicles for delivering them. These transporters consist of nano-molecules from DNA with the ability to deliver medicine directly to the cell when triggered.

PRACE supports risk assessment and mitigation

Extreme weather conditions caused by climate change present new challenges both for researchers investigating adaptation strategies and for insurance companies and government organisations that must deal with the ramifications. Effective adaptation programmes rely on substantiated forecasts based on computer simulations. Researchers involved in PRACE projects have created simulations for predicting the development of watercourses that pose potential flood risks and devised technologies that allow insurance providers to more accurately assess risks associated with changing environmental conditions.

PRACE Supports Engineering

Engineering simulations are used to develop safer, faster and more efficient vehicles and aircraft. Automotive and aeronautical engineers use materials science simulations to find new materials that have the potential to improve the efficiency of solar or hydrogen cells, or materials that are extremely lightweight and robust. Graphene – being studied as part of the EU's Graphene Flagship project – is one example of a light but sturdy material, and PRACE infrastructure is being used extensively to support graphene-based nanomaterial research.

