History & Mission

The HLRS was founded in 1996 as the first German national HPC center, setting an important milestone in the 50 year old history of HPC at the University of Stuttgart.

From the start, HLRS has given support to local industry leaders like Daimler and Porsche, provided expertise in simulation – since 2008 through the Automotive Simulation Center Stuttgart (ASCS) – and access to HPC systems; a service extended to other industries as well.

Since 2007, the HLRS is a partner of the Gauss Centre for Supercomputing (GCS), working together with its fellow centers to support European researchers.

Nowadays, the HLRS carries the mission of acting as a center of competence in the field of HPC, supporting users and conducting research. The focus is on applications targeting health, mobility, energy and the environment.

Cray XE6 “Hermit”

Large scale computing systems such as Hermit must be carefully designed to meet the requirements of the targeted user community. The Hermit computing system, based on the Cray XE6 technology and its Gemini interconnect, has been especially balanced to meet the demands of highly scalable applications, spanning the complete system for one single job.

Particular attention has been given to specific requirements of applications in engineering, such as turbine design for highly efficient power plants, electric and CO₂ footprint optimized cars, etc.

The Hermit computing system is enabling progress in a wide range of application domains ranging from energy and environment to mobility, from methods of medical treatment to a personalized approach in research and industry.

Hermit
Petaflop/s Performance for Engineering Applications

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Energy

Simulation is the most valuable tool to enable a turnaround in energy supply from conventional, fossil fuel based to sustainable technologies. It can help to optimize existing technologies, as well as to develop new ones, avoid costly experiments, test new methods and the virtual power plant is only a fingertip away, once the full potential of simulation can be released in the Petaflops era.

At HLRS optimization of key energy production technologies is a long term activity. The foundation of the simulation of bones, which helps to analyze the behavior of different bone implants inserted in the fractured bone in different positions. The simulation of bone structures and implants enables the development support of new implants and endoprostheses, designing their shape and functionality physiologically to ensure an optimized healing process.

Health

In an aging society, simulation plays a key role in helping to shape the future of medical care by testing new methods and approaches in development. The HLRS and its users apply medical simulation in a wide variety of fields. Computational fluid mechanics is used in simulations of the blood flow in the arteries, or the flow of air in the respiratory system; applications such as the investigation of aneurysms can help to improve the quality of life of a patient. Another important application is computational structural mechanics: the foundation of the simulation of bones, which helps to analyze the behavior of different bone implants inserted in the fractured bone in different positions. The simulation of bone structures and implants enables the development support of new implants and endoprostheses, designing their shape and functionality physiologically to ensure an optimized healing process.

Mobility

Mobility is a key for the quality of life; yet, it is still connected to a series of energy and environmental problems. Such problems can be overcome through simulations that optimize the traditional combustion based concepts by improving the design of cars, as well as their inner processes. Simulation is one of the key factors in speeding up the transition from fossil fuel based mobility to electric mobility. Design and layout of batteries, as well as global design of a new type of cars, are at the forefront of simulation research. The HLRS is working together with ASCS, the Automotive Simulation Center Stuttgart, to employ simulation, that aims to reduce emissions and develop entirely new concepts of mobility for the future.

Climate

Climate-related extreme events, such as tropical cyclones and high-latitude storms, and their associated risks are a major concern for society. Climate scientists currently have limited understanding of extreme event behaviour and how the nature of extreme weather may respond to climate change. Currently, the largest project on Hermit is the UPSCALE project addressing these concerns through computer-intensive simulations of weather and climate. High-resolution simulations of the global climate system will be used to improve understanding of weather and climate risk, and explore possible future weather and the risks around it.

"With the access to Hermit, the results can be achieved within 12 months rather than within 33 years with the resources we had available so far" says Pier Luigi Vidale, Willis Chair of Climate System Science and Climate Hazards at the University of Reading’s Meteorology Department.