HORIZON 2020

An open architecture to equip next generation HPC applications with exascale capabilities

Results in Brief

Software solutions for energy-efficient supercomputing

The EuroHPC JU-funded REGALE project developed tools to cut the energy demand of exascale computing. These could benefit European industry and make supercomputing more accessible to researchers.

DIGITAL ECONOMY

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Powerful exascale supercomputers are expected to prove crucial for next-level scientific research. They are also expected to require a substantial amount of energy.

“Power consumption could be in the order of tens of megawatts,” notes REGALE project coordinator Georgios Goumas, from the Institute of Communication and Computer Systems at the National Technical University of Athens in Greece. “Moreover, systems of this scale are quite hard to program, especially when one targets scalability in the order of thousands, even millions of compute nodes.” While most supercomputers take power from the central grid, increasing demand could lead to the need for on-site power generation.

Tackling energy efficiency is therefore an essential step to ensuring the feasibility, and widespread adoption, of exascale computing. To address this, the REGALE

project brought together supercomputing experts and academics, as well as end users from critical target sectors including renewable energy, enterprise risk assessment and the automotive industry.

Software for supercomputing systems

“We focused on the effective utilisation of computational resources in order to improve application performance, system throughput and energy efficiency,” says Goumas. “We also looked at how to ensure the easy and flexible use of supercomputing services by application developers and users.”

To accomplish this, the project built several prototype supercomputer systems. In particular, the project identified and implemented software, designed to ensure smooth coordination across processes, nodes and systems.

This software included enhancements and coordination of several open-source tools such as OAR, EAR, DCDB, EXAMON, COUNTDOWN, MELISSA, RYAX and others. These are needed for effective resource utilisation and the execution of complex applications.

“These different tools work in concert to support energy-efficient operations at different levels of the architecture,” explains Goumas. “They also help to implement a core infrastructure that supports modularity and interoperability, and can integrate any component with minimal modification.”

Energy-efficient, sustainable and green solutions

The REGALE solution was successfully pilot-tested with industry partners in order to demonstrate that the tools work smoothly together across a range of different use cases. REGALE supercomputing architecture was used in the design of a car bumper made of carbon-reinforced polymers, as well as the design of hydraulic turbines.

“Several of these tools are now finding their way to industrial or academic supercomputing facilities,” adds Goumas. “Project partners have also expressed strong interest in further developing the overall architecture and framework of this solution.”

The ultimate aim here is to ensure that the advances made through the REGALE project go on to contribute towards more energy-efficient, sustainable and green supercomputing in Europe. The project was carried out with support from the European High Performance Computing Joint Undertaking (EuroHPC JU), an initiative set up to develop a world-class supercomputing ecosystem in Europe.

“REGALE started with ambitious goals, a diverse and outstanding consortium of European partners, and a vision to pave the way for greater energy efficiency in the new exascale generation of supercomputers,” says Goumas. “Thanks to the commitment and excellent collaboration between all partners, we are now able to present the REGALE toolchain, an open and scalable foundation for sustainable supercomputing.”

Energy efficiency at the exascale

This increase in computational capacity has the potential to bring benefits to a range of complex applications including weather prediction, natural disaster prevention and climate modelling. Other possible end uses include personalised medicine and artificial intelligence.

“Beyond these applications though, exascale computing also has the potential to democratise access to supercomputing resources,” adds Goumas. “Researchers, academics and SMEs could have easier and cheaper access to advanced computing services.”

Keywords

REGALE | EuroHPC JU | software | computing | exascale | supercomputing | energy | efficiency | tools | HPC

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Project Information

REGALE

Grant agreement ID: 956560

Project website

DOI
10.3030/956560

Project closed

Funded under
INDUSTRIAL LEADERSHIP - Leadership in enabling and industrial technologies - Information and Communication Technologies (ICT)

Total cost
€ 7 595 308,75

EU contribution
€ 3 309 292,32

Coordinated by

EC signature date
16 February 2021

Start date
1 April 2021

End date
31 March 2024

EREVNITIKO PANEPISTIMIAKO INSTITOUTO SYSTIMATON EPIKOINONION KAI YPOLOGISTON
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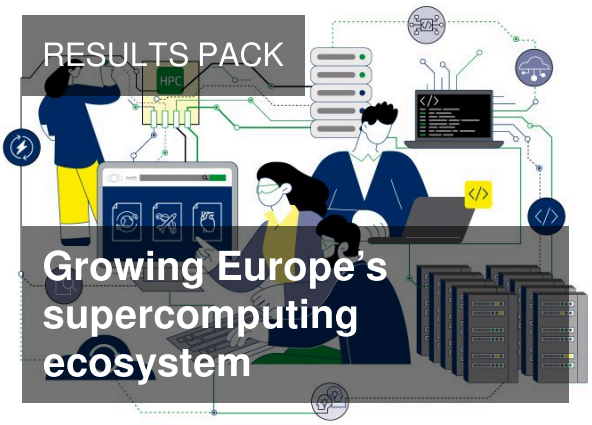

23 July 2024

Last update: 18 July 2024

Permalink: https://cordis.europa.eu/article/id/452283-software-solutions-for-energy-efficient-supercomputing