

# KAROLINA SUPERCOMPUTER

OUR SUPERCOMPUTERS  
SUPPORT EUROPEAN SCIENCE,  
INDUSTRY, AND SOCIETY



IT4Innovations National Supercomputing Center at VSB – Technical University of Ostrava is a leading research, development, and innovation centre active in the fields of High-Performance Computing (HPC), Data Analysis (HPDA), and Artificial Intelligence (AI) and their application to other scientific fields, industry, and society. IT4Innovations operates the most powerful supercomputing systems in the Czech Republic, which are provided to Czech and foreign research teams from both academia and industry. Together with the CESNET and CERIT-SC institutions, IT4Innovations constitutes e-INFRA CZ, a strategic research infrastructure of the Czech Republic.

IT4Innovations currently operates three supercomputers — Barbora, NVIDIA DGX-2, a specialized system for AI calculations, and a petascale system called Karolina with a theoretical peak performance of about 15.7 PFlop/s.

The key research areas include big data processing and analysis, machine learning, development of parallel scalable algorithms, solution of computationally demanding engineering problems, advanced visualization, virtual reality, modelling for nanotechnologies, and material design.

## KAROLINA SUPERCOMPUTER

The petascale system Karolina, acquired as part of the EuroHPC Joint Undertaking, was installed in 2021.

The Karolina supercomputer is designed to coherently respond to the needs of its user communities, addressing complex scientific and industrial challenges, including standard numerical simulations, demanding data analysis, and artificial intelligence applications.

The Karolina supercomputer reaches a theoretical peak performance of **15.7 PFlop/s**, which corresponds to 15.7 quadrillion floating-point operations per second.

The Karolina supercomputer is the most powerful supercomputer in the Czech Republic.

In the TOP500 list (June 2021), which evaluates supercomputers in terms of their performance, it ranked 69<sup>th</sup> worldwide, 19<sup>th</sup> in Europe. In the Green500 list of the most energy-efficient supercomputers, it even ranked 15<sup>th</sup> and in HPCG benchmark ranked 38<sup>th</sup>.

## TECHNICAL SPECIFICATION

The supercomputer consists of 6 main parts:

- a universal part for standard numerical simulations, which consists of approximately 720 computer servers with a theoretical peak performance of 3.8 PFlop/s,
- an accelerated part with 72 servers and each of them being equipped with 8 GPU accelerators providing a performance of 11.6 PFlop/s for standard HPC simulations and up to 360 PFlop/s for artificial intelligence computations,
- a part designated for large dataset processing that provides a shared memory of as high as 24 TB, and a performance of 74 TFlop/s,
- 36 servers with a performance of 192 TFlop/s are dedicated for providing cloud services,
- a high-speed network to connect all parts as well as individual servers at a speed of up to 200 Gb/s,
- data storages that provide space for more than 1.4 PB of user data processing and also include high-speed data storage with a speed of 1 TB/s for simulations as well as computations in the fields of advanced data analysis and artificial intelligence.

