SELECTED PROJECTS

BioDT (Biodiversity Digital Twin for Advanced Modelling, Simulation and Prediction Capabilities) www.biodt.eu

BioDT aims to push the current boundaries of a predictive understanding of biodiversity dynamics by developing a Digital Twin providing advanced modelling, simulation, and prediction capabilities. By exploiting existing technologies and data available across relevant research infrastructures in new ways, the BioDT project will be able to model the interaction between species and their environment accurately. The consortium brings together a dynamic team of experts in biodiversity, high-performance computing, and artificial intelligence.

EUPEX (European Pilot for Exascale) www.eupex.eu

The EUPEX consortium aims to design, build, and validate the first EU platform for HPC, covering end-to-end the spectrum of required technologies with European assets: from the architecture, processor, system software, and development tools to the applications. Scientifically, EUPEX is a vehicle to prepare HPC, AI, and Big Data processing communities for upcoming European Exascale systems and technologies.

EUROCC2 (National Competence Centres in the Framework of EuroHPC) www.eurocc-czechia.cz

The mission of the National Centre of Competence for HPC (NCK) is to offer a broad portfolio of services. It currently offers courses, webinars or workshops in relevant areas. The services provided also include consulting, design and implementation of pilot HPC solutions, or migration of existing solutions. In addition, it also facilitates partnerships between academia, government and the private sector.

EVEREST (dEsign enVironmEnt foR Extreme-Scale big data analytics on heterogeneous platforms) www.everest-h2020.eu

The project is developing a holistic approach for co-designing computation and communication in the high-tech and especially secure system for HPDA. This will be achieved by simplifying the programmability of heterogeneous and distributed architectures through a "data-driven" design approach, using hardware-accelerated AI, and the efficient monitoring of the execution with a unified hardware-software paradigm.

EXA4MIND (EXtreme Analytics for MINing Data) www.exa4mind.eu

EXA4MIND project will build an Extreme Data platform which brings together data storage systems and powerful computing infrastructures by implementing novel automated data management and effective data staging. The project is driven by four application cases from molecular dynamics, advanced driver assistance systems, smart agri-viticulture and health and social Big Data.

IO-SEA (IO Software for Exascale Architecture) www.iosea-project.eu

IO-SEA aims to provide a novel data management and storage platform for exascale computing based on hierarchical storage management (HSM) and on-demand provisioning of storage services. The platform will efficiently use storage tiers spanning NVMe and NVRAM at the top all the way down to tape-based technologies. Advanced IO instrumentation and monitoring features will be developed within the project, leveraging the latest AI and machine learning advancements to systematically analyse the telemetry records and make smart decisions on data placement.

LIGATE (LIgand Generator and portable drug discovery platform AT Exascale) www.ligateproject.eu

The project aims to integrate and co-design best-in-class European open-source components together with proprietary IPs to keep worldwide leadership on Computer-Aided Drug Design (CADD) solutions exploiting today's high-end supercomputers and tomorrow's Exascale resources, fostering European competitiveness in this field.

MAX (MAterials design at the eXascale) www.max-centre.eu

Materials simulations have become one of the most intensive and fast-growing domains for high-performance computing worldwide. MAX project will target these lighthouse codes to address the challenges and leverage the opportunities arising from future exascale and post-exascale architectures, and to offer powerful paths to discovery and innovation serving both scientific and industrial applications.

OpenWebSearch.EU (Piloting a Cooperative Open Web Search Infrastructure to Support Europe's Digital Sovereignty) www.openwebsearch.eu

The project consortium aims to develop an open European infrastructure for web search. This project will contribute to Europe's digital sovereignty and promote an open human-centred search engine market. Within three years, the researchers will develop the core of a European Open Web Index as a basis for a new Internet Search in Europe. In addition, the project will set the foundation for an open and extensible European open Web Search and Analysis Infrastructure based on Europe's values, principles, legislation, and standards.

SCALABLE (SCAlable LAttice Boltzmann Leaps to Exascale) www.scalable-hpc.eu

The project brings together eminent industrial and academic partners to improve the performance, scalability, and energy efficiency of industrial Lattice Boltzmann methods-based computational fluid dynamics (CFD) software. The Lattice Boltzmann method (LBM) provides a reliable alternative to conventional CFD approaches. LBM is exceptionally well suited to exploit advanced supercomputer architectures as it enables massive parallelisation. The project will directly benefit European industry while contributing to fundamental research.

SPACE (Scalable Parallel and distributed Astrophysical Codes for Exascale) www.space-coe.eu

In Astrophysics and Cosmology, High-Performance Computing-based numerical simulations are outstanding instruments for scientific discovery. The SPACE Centre of Excellence aims to extensively re-engineer target codes to engage with new computational solutions and adopt innovative programming paradigms, software solutions, and HPC libraries.

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VSB TECHNICAL UNIVERSITY OF OSTRAVA | IT4INNOVATIONS NATIONAL SUPERCOMPUTING CENTER

e-INFRA CZ

RESEARCH AT IT4INNOVATIONS

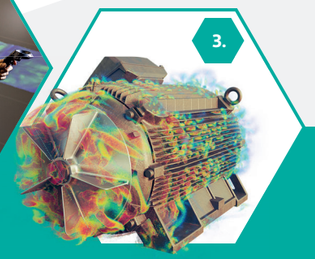
Our supercomputers support European science, industry, and society

IT4Innovations National Supercomputing Center (IT4Innovations) is a university institute of VSB – Technical University of Ostrava, Czech Republic. It is a leading research, development, and innovation centre active in the fields of High-Performance Computing (HPC), Data Analysis (HPDA), Quantum Computing (QC), and Artificial Intelligence (AI) and their applications in other scientific fields, industry, and society. It operates the most powerful supercomputing systems in the Czech Republic. Together with the CESNET and CERIT-SC e-infrastructures, 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.

Czech research communities also have access to the LUMI supercomputer, thanks to IT4Innovations' membership in the eponymous consortium. Located in the Finnish town of Kajaani, LUMI is the most powerful European supercomputer with a theoretical peak performance of 580+PFlop/s. IT4Innovations also participates in its operation.

The key research areas of IT4Innovations include big data processing and analysis, machine learning, quantum computing, the development of parallel scalable algorithms, solving computationally demanding engineering problems, advanced visualisation, virtual reality, modelling for nanotechnologies, and material design.



RESEARCH LABS

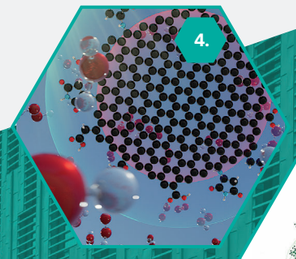
1. The Advanced Data Analysis and Simulations Lab specialises in advanced data analysis, research and development in HPC co-design, data analysis and cloud technologies to enhance industry and society, programming models for HPDA, artificial intelligence, quantum computing, modelling, simulation, and application of dynamical systems.

2. The Infrastructure Research Lab focuses on developing and accelerating parallel applications, code analysis, performance and scalability optimisation, as well as HPC application energy-efficiency optimisation, development of services provided to the infrastructure users, medical data processing, scientific data visualisation, and virtual and augmented reality.

3. The Parallel Algorithms Research Lab is primarily targeted on providing support for industry. The research team conducts applied research in developing scalable algorithms and HPC libraries, numerical modelling and simulations, and the deployment of artificial intelligence in engineering.

4. Modelling for Nanotechnologies Lab is engaged in design, computer modelling, and preparation and experimental characterisation in the field of advanced nanomaterials and nanotechnology. It is also dedicated to developing special surfaces for nano-optics and has state-of-theart experimental equipment for studying nanosystems.

5. Big Data Analysis Lab is focused on network security, the Internet of Things, big data analysis, speech processing, and artificial intelligence applications in complex systems. It also aims to develop efficient knowledge acquisition and processing methods.



CERTIFICATION

- ISO 9001 Quality Managment System
- ISO 27001 Information Security Managment System

THE NATIONAL COMPETENCE CENTRE IN HPC

The reference and the single point of contact and coordination in Czechia for high-performance computing (HPC) and data analysis (HPDA).
www.eurocc-czechia.cz/en

EUROPEAN DIGITAL INNOVATION HUB OSTRAVA

Supports the deployment and use of digital technologies primarily in small and medium-sized companies.
www.edihostrava.cz

SUPERCOMPUTERS

	NVIDIA DGX-2	Barbora	Karolina	LUMI
Put into operation	Spring 2019	Autumn 2019	Summer 2021	Autumn 2022
Theoretical peak performance	130 TFlop/s	849 TFlop/s	15,7 PFlop/s	580+ PFlop/s
Compute nodes	1	201	831	5,042
Accelerators in total	16x NVIDIA Tesla V100	32x NVIDIA Tesla V100	576x NVIDIA Tesla A100	11,912x AMD Instinct MI250X
			2x NVIDIA RTX 6000	8x NVIDIA A40 GPU
CPU cores in total	48	7,232	106,880	454,784

IT4INNOVATIONS IS A PROUD MEMBER OF:

- BDVA (Big Data Value Association)
- EUDAT CDI (EUDAT Collaborative Data Infrastructure)
- EuroHPC Joint Undertaking
- ETP4HPC (European Technology Platform in the area of High-Performance Computing)
- PRACE (Partnership for Research and Advanced Computing in Europe)
- EOSC (European Open Science Cloud)
- LUMI (Large Unified Modern Infrastructure)

EDUCATION AND TRAINING ACTIVITIES

- 20 courses, workshops, conferences a year
- Doctoral School MathinHPC
- EUMaster4HPC
- NVIDIA Deep Learning Institute Ambassador

www.it4i.eu