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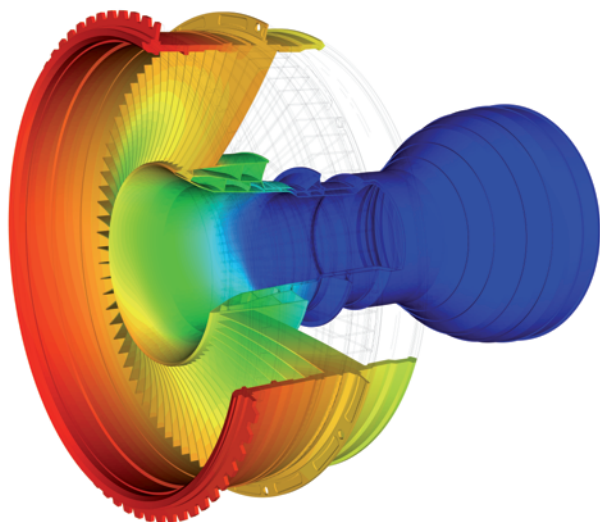
## RESEARCH LABORATORIES AT IT4INNOVATIONS

IT4Innovations National Supercomputing Center is a research institute at VŠB – Technical University of Ostrava. Our main goal is to conduct excellent research and development in High Performance Computing and High Performance Data Analytics with a high impact on science, industry and society. We plan to achieve this goal in collaboration with top Czech and foreign research teams from academia, research institutions and industry.

Since its foundation in 2011, IT4Innovations has been a member of Partnership for Advanced Computing in Europe (PRACE), a prestigious pan-European research infrastructure, where it represents the Czech Republic. In 2016, we became a member of the European Technology Platform for High Performance Computing (ETP4HPC), which focuses on the defining of research priorities for supercomputing.

The core topics of our research are the processing and analysis of large scale data sets, the development of parallel scalable algorithms and libraries, HPC modelling and simulations in engineering and nanotechnology, and the development of supercomputer technologies.

IT4Innovations research is divided into five research laboratories.



### Parallel Algorithms Research Lab

(contact e-mail: [par@it4i.cz](mailto:par@it4i.cz))

The work of this lab is focused on the research and development of parallel scalable algorithms and libraries with applications in CFD, structural mechanics, medical-image processing, and molecular dynamics. In-house libraries and open source products are used for collaborations with both academic and industrial partners. Developed HPC services are offered to users from industry using our web portal [industry.it4i.cz/en](http://industry.it4i.cz/en).

### Infrastructure Research Lab

(contact e-mail: [infra@it4i.cz](mailto:infra@it4i.cz))

In January 2017 we established the Laboratory for Infrastructure Research with the aim of strengthening our own infrastructure research. The main focus of the lab is software and method development related to innovative use, operation and monitoring of supercomputing infrastructure, as well as collaborative research and expert third party research support.



## Advanced Data Analysis and Simulations Lab

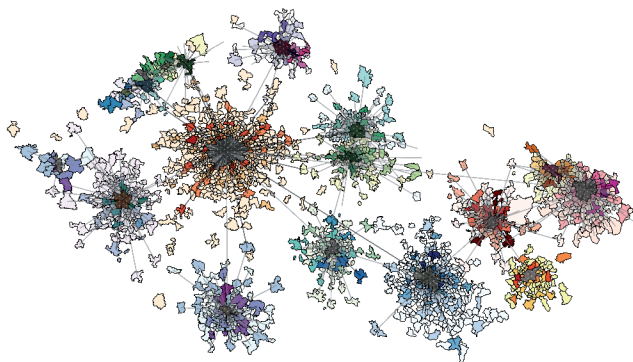
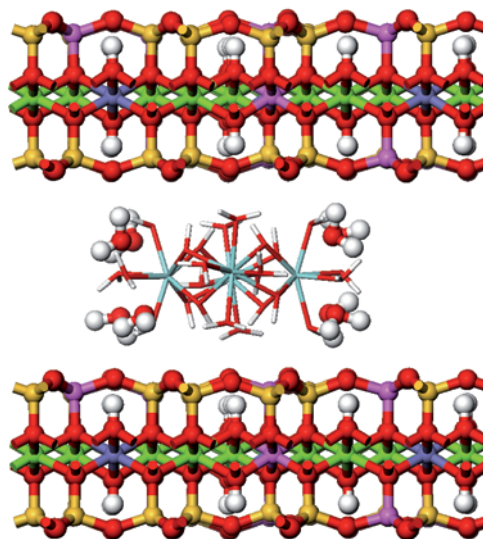
(contact e-mail: [adas@it4i.cz](mailto:adas@it4i.cz))

Research is focused on large scale data processing and analysis as well as on data based simulations with diverse real-life applications. Those applications comprise support for management and decision-making in emergency situations, intelligent navigation and traffic prediction, flood modelling, smart city technology, bioinformatics, and reliability analysis. It also includes research in the area of workflow systems and efficient scheduling. As a part of the lab research agenda tools for HPC as a Service are developed to facilitate access to HPC infrastructure for non-HPC users via a user-friendly interface.

## Modelling for Nanotechnologies Lab

(contact e-mail: [nano@it4i.cz](mailto:nano@it4i.cz))

Research is focused on design of materials based on electronic structure calculations. Activities include research in the fields of magneto-optics, spintronics, ultrafast laser pulses, non-linear optical effects, superhard films, thermoelectric materials for solar cells, low-dimensional magnetic structures for high capacity data recording, new superconductive materials, and high-temperature and entropy stabilized alloys for the aerospace industry.



## Big Data Analysis Lab

(contact e-mail: [bigdata@it4i.cz](mailto:bigdata@it4i.cz))

The Laboratory for Big Data Analysis is engaged in searching for information hidden in large data sets. Such research gives us new insights and knowledge, the elucidation of which requires the application of sophisticated methods to find connections in large volumes of multidimensional data. One specific example of the laboratory's work is the processing of localization and operational data from the mobile phone network. Another topic is the Internet of Things, where data processing from sensors is used to make life easier for people in cities.

## Project supported by the Technology Agency of the Czech Republic

### MOLDIMED

**Centre of Competence for Molecular Diagnostics and Personalized Medicine (2014–2019)**

The primary objective of the project is to achieve a critical mass of experts, institutions, and knowledge in research, development, certification, technology transfer, and commercialization of in vitro diagnostics, in order to create a market oriented flexible national network in the area of diagnostic, prognostic and predictive biomarkers, and to enable further development of personalized medicine.

[www.imtm.cz/moldimed](http://www.imtm.cz/moldimed)

## Projects under the EU Framework Programme for Research and Innovation H2020

### READEX

**Runtime Exploitation of Application Dynamism for Energy-Efficient Exascale Computing (2015–2018)**

The main goal of the project is to develop an autotuning tool which makes computations and simulations more energy efficient by employing new scenarios and techniques which dynamically change software and hardware parameters such as the frequency of computational cores. The task of IT4Innovations is evaluation of dynamism in HPC applications, manual tuning especially of FETI solvers based on domain decomposition combining direct and iterative methods, and evaluation and validation of developed tools taking results of manual tuning as the baseline.

[www.readex.eu](http://www.readex.eu)

### ExCAPE

**Exascale Compound Activity Prediction Engine (2015–2018)**

The objective of the ExCAPE project is to develop an Exascale compound activity prediction engine by producing state of the art scalable algorithms and implementations suitable for running on future Exascale machines. Newly developed methods will enable the processing and analysis of industrial scale complex pharmaceutical analysis workloads.

[www.excape-h2020.eu](http://www.excape-h2020.eu)

### ANTAREX

**Autotuning and Adaptivity Approach for Energy Efficient Exascale HPC Systems (2015–2018)**

The aim of the ANTAREX project is to provide a breakthrough approach; to express by a domain specific language application self-adaptivity, and to runtime manage and autotune applications for green and heterogeneous High Performance Computing systems up to the exascale level.

[www.antarex-project.eu](http://www.antarex-project.eu)

### PRACE-5IP

**Partnership for Advanced Computing in Europe, 5<sup>th</sup> implementation phase (2017–2019)**

The aim of the project is to build on the success of previous PRACE projects by continuing to develop cooperation across the field of supercomputing, to strengthen the competitiveness of European science, research, and industry.

[www.prace-ri.eu/prace-5ip](http://www.prace-ri.eu/prace-5ip)

### EXPERTISE

**Models, Experiments and High Performance Computing for Turbine Mechanical Integrity and Structural Dynamics in Europe (2017–2021)**

The objective of this project is to educate researchers able to participate in interdisciplinary cooperation in the areas of supercomputing and mechanics. The collaboration between industrial partners and research organizations will speed up development of key technologies in turbomachinery and their rapid commissioning in practice.

[www.msca-expertise.eu](http://www.msca-expertise.eu)

## **TETRAMAX**

### **Technology Transfer via Multinational Application Experiments (2017–2021)**

The purpose of this project is to implement the European “Smart Anything Everywhere” initiative in the field of Customized Low Energy Computing for cyberphysical systems and the Internet of Things. The key purpose of this initiative is to accelerate innovations in European industry. The initiative connects technical and application know-how, which helps small and medium-sized enterprises adopt advanced digital technologies more effectively and efficiently.

[www.tetramax.eu](http://www.tetramax.eu)

## **CloudiFacturing**

### **Cloudification of Production Engineering for Predictive Digital Manufacturing (2017–2021)**

The mission of the project is to contribute to the efficient use of high performance computing by European small and medium-sized production companies, thus increasing their competitiveness. This projects aims for optimization of production processes and productivity of companies using HPC-based modelling and simulation, as well as cloud services.

[www.cloudifacturing.eu](http://www.cloudifacturing.eu)

## **Project of the Danube Transnational Programme Interreg (EU funds)**

### **InnoHPC**

#### **High Performance Computing for Effective Innovation in the Danube Region (2017–2019)**

The main objective of InnoHPC is to create a transnational HPC laboratory for co-designing knowledge-intensive innovative products with high value added in transnational value-chains. InnoHPC targets small and medium sized enterprises and clusters, providing the opportunity to increase efficiency of innovations and join transnational value-chains in the Danube region. Higher education and research institutions with HPC will get access to exciting real-life cases and opportunities to exploit their entrepreneurial potential.

[www.interreg-danube.eu/approved-projects/innohpc](http://www.interreg-danube.eu/approved-projects/innohpc)

## **Project of the European Space Agency**

### **Urban TEP**

#### **Urban Thematic Exploitation Platform (2015–2018)**

The main goal of the project is the implementation of an instrument that helps address key research questions and societal challenges arising from the phenomenon of global urbanization. The main role of the IT4Innovations center in the project is to provide state-of-the-art technology and expertise in high performance computing. Thus, the center provides the platform with the processing services and data storage services needed to access, analyse and visualize geospatial data and derived products.

[urban-tep.eo.esa.int](http://urban-tep.eo.esa.int)

## **IT4Innovations**

### **National Supercomputing Center**

VŠB – Technical University of Ostrava  
17. listopadu 15/2172, 70800 Ostrava,  
Czech Republic

[info@it4i.cz](mailto:info@it4i.cz)

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