



## Interview with the new director, Vít Vondrák

The new director of the IT4Innovations institute, Associate Professor Vít Vondrák, took office on 1 August, 2017. He has been linked to IT4Innovations National Supercomputing Center since its beginning. Vít Vondrák was a member of the team which prepared the Centre of Excellence IT4Innovations project. Being the Head of the Research Programme at IT4Innovations, he later became the IT4Innovations Scientific Director.

[Read more](#)

## Doctoral school for education in mathematical methods and tools in HPC

This new project will integrate doctoral studies in mathematics offered by Charles University in Prague, the Czech Academy of Sciences, and IT4Innovations.

[Read more](#)

## IT4Innovations Educational Training Center

A new educational infrastructure to support research-based study programmes focused on the use of supercomputing technology will be developed.

[Read more](#)

## Looking back at the completed SESAME Net project

This project for supporting small and medium enterprises in using supercomputers was completed in May 2017.

[Read more](#)



## Summer of HPC

It has already been the fifth year where PRACE has enabled 21 students to do an international summer internship with one of the participating European supercomputing centres.

[Read more](#)

## Successful participation of a start-up enterprise in supercomputing: HPC and cranial remodelling helmets

We are currently cooperating with the ING Corporation to develop cranial remodelling orthoses.

[Read more](#)

## A new web user interface and mobile application for increasing the rate of waste separation

The results of our cooperation with OZO Ostrava are software products that will provide a detailed overview about the loading rate of large waste receptacles as well as the process of their loading.

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## The CzeBaCCA project, supporting cooperation between IT4Innovations and Germany

During the project, eight training sessions and scientific workshops were held to support Czech-Bavarian cooperation in the field of supercomputing.

[Read more](#)

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## The next Open Access Grant Competition will be launched at the beginning of October 2017

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At the beginning of October 2017, the 12<sup>th</sup> Open access grant competition will be launched, where you will be able to apply for the computational resources of our supercomputers. Watch the news on our website.

[More info](#)

## INVITATIONS

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### Researchers' Night

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We invite you to the largest pan-European event to support science and technology at IT4Innovations; Researchers' Night, which will be held on **6 October**. We have prepared an educational and entertaining programme for you on **6 October from 5pm to 10pm**. Do not miss out on this unique event this year. Add the date to your diary, **6 October, 2017**, and come to visit us. We look forward to seeing you.

[More info](#)

### The 6<sup>th</sup> Annual Conference of IT4Innovations and the 1<sup>st</sup> Users Conference

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The 6<sup>th</sup> Annual Conference of IT4Innovations will be held on **31 October** in the morning, and we cordially invite all IT4Innovations' employees and employees of the project partners. On the same day, at **12:30**, the two-day 1<sup>st</sup> Users Conference will start. All our users as well as research and project partners from various organisations, research institutions, and industry are welcome to attend the Users Conference. You can register for the conferences until **26 October**.

[More info](#)

## SHORTLY

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Our publication **Supercomputing in Science and Engineering** is also available for ePub and MOBI book readers.

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**Current vacancies**

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**Photos from the IT4Innovations presentation at the NATO Days in Ostrava**



## INTERVIEW WITH ASSOCIATE PROFESSOR VÍT VONDRÁK, THE NEW MANAGING DIRECTOR OF IT4INNOVATIONS NATIONAL SUPERCOMPUTING CENTER

Vít Vondrák was a member of the team which prepared the Centre of Excellence IT4Innovations project, funded from the Operational Programme Research and Development for Innovation (2011-2015), through which the large e-infrastructure IT4Innovations National Supercomputing Center was established.

Being the first Head of the Research Programme at IT4Innovations, he later became the Scientific Director of IT4Innovations. His scientific work primarily focuses on numerical linear algebra, optimization methods, and supercomputing (HPC).

He has participated in several research programmes abroad, namely at Aalborg University in Denmark (1997-2007), the University of Colorado, Boulder, USA (2004), and Stanford University in California, USA (2006). He is a member of the pan-European supercomputing infrastructure PRACE (Partnership for Advanced Computing in Europe) Council, where he represents

the Czech Republic. He was the national coordinator of the relevant PRACE-1IP, PRACE-2IP, and PRACE-3IP projects funded from the European Commission 7th Framework Programme. Moreover, he was a co-investigator for the international HARPA project funded from the same framework programme. At present, he is the coordinator of the fourth and fifth implementation phase of the PRACE project, which currently comes under the subsidy programme Horizon 2020. In addition, he was one of the investigators for the Czech-Bavarian Competence Center for Supercomputing Applications (CzeBaCCA) project.

Furthermore, Vít Vondrák was the principal investigator of the Intel Parallel Computing Center project. Along with Lomonosov Moscow State University, IT4Innovations has been the only institution from Central and Eastern Europe to receive financial support from the Intel Corporation for this project. Vít Vondrák also participated in the preparation of the Urban TEP project funded by the European Space Agency as well as the InnoHPC project within the Interreg programme focused on cooperation with industry. Besides this, he has been an investigator, co-investigator or principal investigator of several national research projects. Last but not least, he was the principal investigator for FLOREON+, a regional project in which a system for crisis management support, such as monitoring and flood prediction, is being developed.

We have asked Associate Professor Vít Vondrák, who took up the position of IT4Innovations Managing Director on 1<sup>st</sup> August 2017, a few questions.

#### Can you remember what exactly led you to an academic career in IT?

To be honest, my academic career did not really start in the field of IT. I graduated in numerical mathematics, the knowledge of which naturally requires accompanying computer science knowledge, more or less. When I joined our university was the exact moment from which I started to focus more and more on the most efficient use of computing resources in solving very complex numerical models, most often in the field of mechanics. Well, and this is exactly how could I characterize my scientific expertise: High performance computing (HPC).

It is, indeed, a multidisciplinary field combining expertise in IT, mathematical modelling, and other domain-related fields of study, which provide computationally demanding problems, be it real world or basic research problems.

#### What is the greatest challenge of the position you have just taken up?

There would probably be more than just one challenge. However, if I were to pick the greatest one of them all, then it would be to establish our centre as one of the most prestigious and respected institutions in the field of supercomputing technologies, services, and applications worldwide in the long run. In order to achieve this, we need to fulfil a number of logically related partial goals such as securing of funding, efficient management system, high quality staffing, generating excellent research results, etc.

#### What are you looking forward to most in your new function, and what is it you would like to focus on?

Well, it is quite closely related to the previous question. For sure, I would like to put stronger focus and emphasis on the consistency of our research activities with our in-house computing infrastructure, which we intend to upgrade regularly. If we manage to operate a top infrastructure then, of course, research that would be able to use it effectively will rank among the European, and possibly even the global elite. In this respect, I would like to define a few flagship policies, which would be able to face very tough global competition as well as successfully promote our centre. It concerns not only international recognition. I will be very happy if our centre also contributes through its competencies to a better social and economic atmosphere in our region. Now, what I am looking forward to most? For sure, I am looking forward to the fact that we will succeed in doing so, and that the employees of our centre will feel proud that they could contribute to it as well! ☺

#### How do you see the current position of IT4Innovations in comparison with other European supercomputing centres?

I think that IT4Innovations is a respected supercomputing centre not only among the centres of comparable size, i.e. Tier-1 in the PRACE nomenclature, but also among the largest European supercomputing centres, i.e. Tier-0. The latest evidence of this is the PTC (PRACE Training Centre) statute award. It is the result of our activities within as well as outside the PRACE infrastructure. Presentation of our infrastructure and research activities at important events, involvement in international projects as well as the results of our research teams, are all factors which contribute to enhancing our strong position as an important



Vít Vondrák presenting his vision when taking up his new post.

European centre. I am very proud that in only five years we have managed to become one of the most prestigious European supercomputing centres. I would like to take this opportunity and express my thanks to all those directly or indirectly contributing to this success. Thank you!

[To date, we are the only supercomputing centre in the Czech Republic. Do you think this will continue to be the case in the future? Or is it possible that such a centre can be established in the private sector as well?](#)

We are the largest, yet not the only supercomputing centre in the Czech Republic. Nowadays, there are also supercomputing centres in the private sector. Probably the largest one would be in Škoda auto, a company with which, incidentally, we have a great partnership. With respect to financial affordability, new centres will naturally emerge as well. That is natural, of course. If we are to maintain our position, we need to secure necessary funding. In order to do so, we must prove that we provide high-quality services, our users are satisfied, and that through our research activities, we are also able to provide added-value services nobody else is.

[Nowadays, researchers have access to enormous computational power compared to a few years ago. How does development of computational resources affect scientific fields?](#)

Certainly very significantly. HPC in research and development will further increase in importance. If the Czech Republic aims to remain competitive in the field of research and development, then use of these technologies is vitally necessary. I remember that at the time of preparing this project, we were subjected to sharp criticism claiming that such large systems would not have users in the Czech Republic. Yet, the opposite is true.

Both Anselm and the several times larger Salomon have been intensively used since the very beginning. Today, we regularly have higher demand for computational capacity than we can offer. The most dominant scientific fields using our systems so far include material science, computational chemistry, and drug design. In my opinion, however, minority scientific disciplines will eventually make use of our computational resources as well. It is only a question of time until the complexity and size of their problems exceed the limits of their available computational capacity.

[How do you personally envision the field of high performance computing in ten years' time \(in the year 2027\)?](#)

This is perhaps the most difficult question to answer. To predict the situation in such a dynamically developing field as HPC requires a huge portion of courage and possibly imagination. If we take a look at what the situation may look like ten years from now, then we will probably be in the exascale era. The most powerful supercomputers will be able to perform  $10^{18}$  operations per second. Due to very fast internet connectivity, high performance computing resources as well as data storage will be available anywhere, including mobile terminals and mobile phones (if they are still being called that). As a consequence thereof, people will have access to the tools of augmented or virtual reality. The results of very complex data analyses and prediction and simulation tools will not be the domain of only a limited group of scientists but will simply be available to larger audiences consisting of professionals as well as the general public, in advanced user interfaces. As a Star Trek fan, however, I'd rather not let my imagination run wild as we could easily go beyond the year 2027.



Vít Vondrák presenting IT4Innovations infrastructure at the NATO days in Ostrava, 16 September 2017



# DOCTORAL SCHOOL FOR EDUCATION IN MATHEMATICAL METHODS AND TOOLS IN HPC

This new project will integrate doctoral studies in mathematics offered by Charles University in Prague, the Czech Academy of Sciences, and IT4Innovations, resulting in the foundation of a new double-degree programme.

The Project “Doctoral school for education in mathematical methods and tools in HPC” is closely related to the project “IT4Innovations Educational Training Center”. Both projects have been approved for funding from the Operational Programme Research, Development and Education.

The main objective of the Doctoral school for education project is to integrate and unify education in mathematical methods and algorithms for High Performance Computing (HPC) in the Czech Republic. In reality, the project plays the role of an edu-

cational counterpart to the Math-In-HPC.CZ project. Within the project, the selected doctoral studies in the following institutions will be integrated and unified: the Faculty of Mathematics and Physics, **Charles University** in Prague, Institute of Mathematics of the **Czech Academy of Sciences**, and **IT4Innovations**, a university institute of VSB – Technical University of Ostrava. The institutions will thus have an opportunity to further develop high-quality research collaboration.

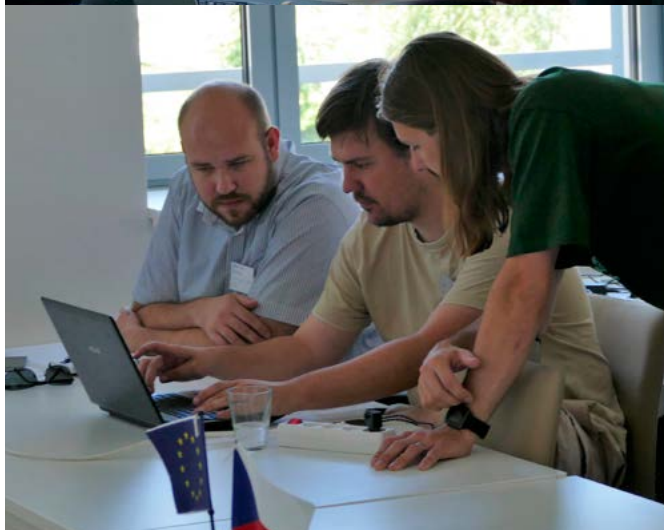
This new doctoral school will closely collaborate with other partners of the Math-In-HPC.CZ project, particularly in the area of theoretical knowledge transfer into computationally oriented applications. It includes, for example, collaboration with the following partners: the Faculty of Electrical Engineering and Computer Science and the Faculty of Mechanical Engineering at VSB – Technical University of Ostrava, the Faculty of Nuclear Sciences and Physical Engineering and the Faculty of Civil Engineering at the Czech Technical University in Prague, the Faculty of Applied Sciences at the University of West Bohemia in Pilsen, and the Institute of Geonics of the Czech Academy of Sciences.

As a consequence of this project, the Computational sciences doctoral study programme at VSB – Technical University of Ostrava, guaranteed by IT4Innovations, will be modernized and internationalized.

Moreover, the **double degree** doctoral study programme focused on mathematical methods in HPC in collaboration with the Swiss Università della Svizzera italiana, as well as one more programme focused on application use in collaboration with the French Université de Toulouse III Paul Sabatier, will be set up. Concerning the non-EU territorial jurisdiction of the Swiss university, the first double degree programme will be set up entirely outside of the scope of the Doctoral school for education project. Only the joint programme with the French university will be set up with a financial contribution from the project.

The additional objective of the project is to increase awareness of the potential use of HPC resources among bachelors and masters students. Promotional activities will include, for example, motivational lectures and, primarily, active involvement of students in research in the field of HPC and its application by means of joint supervision of final theses.

The estimated costs of the project amount to approximately CZK 12 million, and the project itself is to be implemented from September 2017 up to the year 2022.





## IT4INNOVATIONS EDUCATIONAL TRAINING CENTER

The project enabling the educational infrastructure to be developed

Our institution supports the scientific community as well as our users by organizing high-quality courses, tutorials, workshops, and other educational events. The main objective of our educational activities is to increase and diversify the competency of our users in order to maximise efficiency when using the unique computing infrastructure of IT4Innovations. In a broader sense, we also aim to increase awareness and levels of knowledge in the field of HPC nationwide. Last year, we organized 11 educational events with 267 participants in total. Since 2017, we have been acting as a training centre for the PRACE (Partnership for Advanced Computing in Europe) research infrastructure, the objective of which is to make HPC (High Performance Computing) courses geographically more available, thus simultaneously helping to develop educational activities focused on HPC.

With respect to the development of the educational activities of IT4Innovations as well as in connection to the approved project “Doctoral school for education in mathematical methods and tools in HPC”, we have also submitted an application for funding for the project “IT4Innovations Educational Training Center” from the Operational Programme Research, Development and Education.

Thanks to this project, the educational infrastructure to support research-based study programmes focused on the use of supercomputing technology will be developed. In a broader context, the objective of the project is to eliminate a barrier, which prevents a higher level of utilization of supercomputing technologies in the Czech Republic. It primarily concerns the lack of professionals and experts in supercomputing.

The projected built-up area of the new educational centre is 674 m<sup>2</sup>. The educational centre will include a hall with a capacity of 150 seats, a computer room with 25 seats, and two combined classrooms with a total of 50 seats. The total capacity of the centre will thus be 225 students. The classrooms will be equipped with modern information technology and audio-visual equipment for education processes within the study programmes which focus on utilization of high performance computing resources.

The building will meet the current technical requirements for efficient and safe operation. Moreover, it will be equipped with two heat sources. Due to the proximity of the IT4Innovations research infrastructure, the excess heat produced by the IT4Innovations supercomputer will be used. Thus, environmental friendliness will be achieved as well.

The project “IT4Innovations Educational Training Center” has been recommended for funding, and the funding decision is currently being administered. The estimated costs of the project amount to approximately CZK 114.5 million, and the project itself is to be implemented between 2017 and 2022.



## LOOKING BACK AT THE COMPLETED SESAME NET PROJECT

The SESAME Net project for supporting small and medium enterprises in using supercomputers was launched in June 2015 and completed in May 2017. Enterprises can continue to use the consulting services provided by the network centres and institutions, which have been established within the project.

The project was funded by the EU Horizon 2020 programme of the European Commission for Research and Innovation. The project objective was to establish a pan-European network of both providers of HPC services and small and medium enterprises using these services, including in countries with no supercomputing centres established so far.

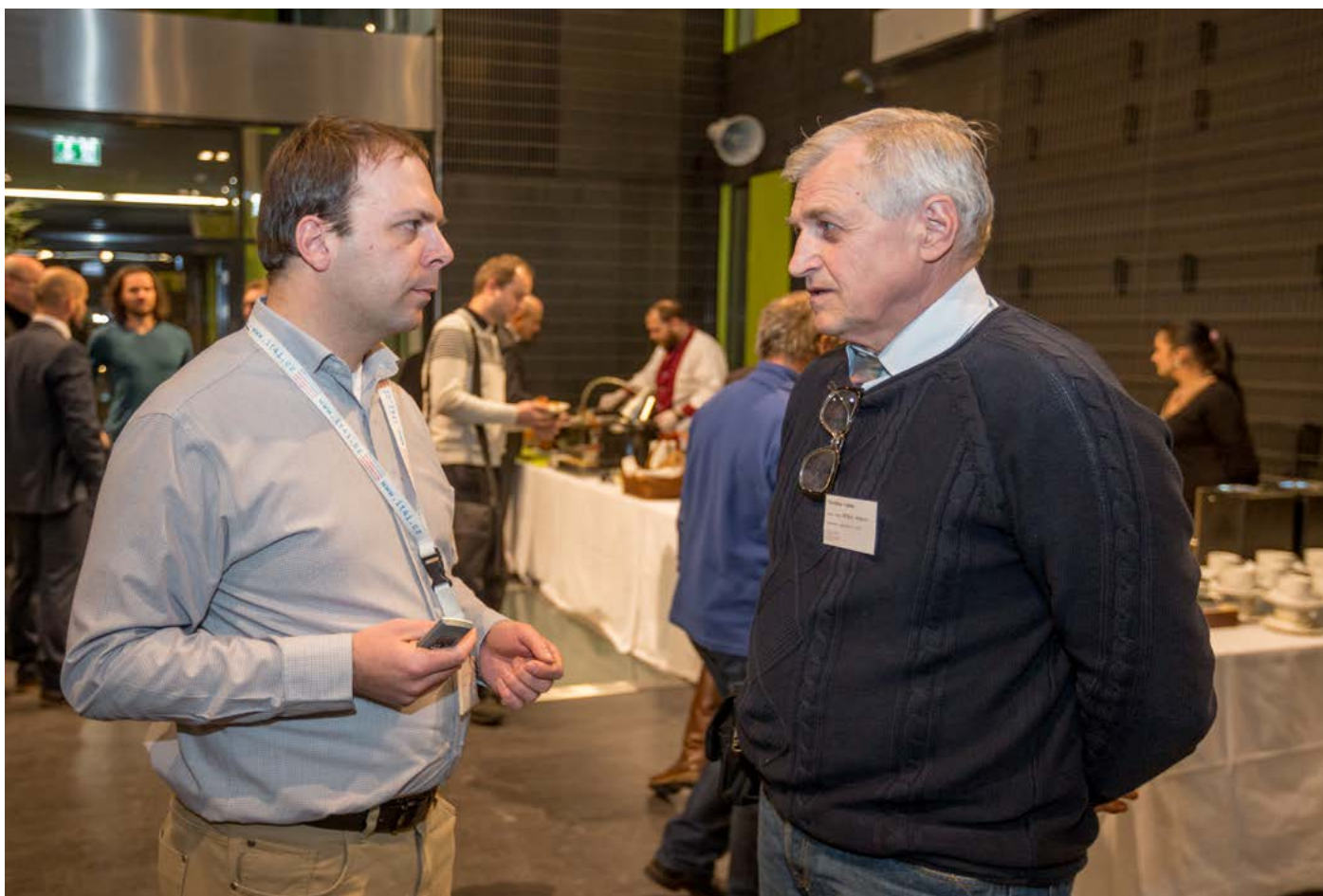
“For small and medium enterprises, it is important to keep up with constant technological development and thus ensure their competitiveness on the market. HPC (High Performance Computing) and availability of supercomputers are more and more necessary for better adaptation to constantly evolving consumer demand, particularly with re-

spect to innovation and fast introduction of new products and services. For small and medium enterprises, however, it is often difficult to get access to even the most elementary HPC knowledge and resources,” Tomáš Karásek, the IT4Innovations Principal investigator of the project, explains the reasons for establishing this network.

The founding members, including important European supercomputing centres and institutions, have created a platform for sharing their experience from cooperating with small and medium enterprises. Based on this experience, various strategies to improve services provided to such companies were then developed throughout the project. Emphasis was put on increasing the awareness of the benefits and potential of HPC technologies.

The initial SESAME Net network comprised 13 partner organizations, including companies, research institutions, and universities from 12 countries, namely Belgium (Flemish Supercomputing Centre), Bulgaria (Bulgarian Academy of Science), Croatia (Yotta Advanced Computing, Ruder Bošković Institute), the Czech Republic (IT4Innovations), Germany (Fraunhofer Institute for Algorithms and Scientific Computing), Greece (Greek Research and Technology Network S.A.), Ireland (Irish Centre for High-End Computing), Lithuania (Vilnius University), Poland (Poznań Supercomputing and Networking Center), Romania (West University of Timisoara), and Spain (Supercomputing Centre in Galicia, CESGA). Leadership and coordination was taken up by the Arctur company from Slovenia.





During the project implementation period, the SESAME Net network grew to a total of 51 members. They include supercomputing competency centres, providers of supercomputing services, suppliers of hardware and in-house developed software, research and training institutions, corporate users of supercomputing services, and public sector organizations from 19 different European countries. For more information about the successfully established cooperation of the supercomputing centres with the corporate sector so far, see the project website. You can also learn more about our cooperation with Czech companies there, for example, the simulation of passenger seat crash tests as well as simulations of the quenching process, and about the development of highly parallel software tools for 3D models of prosthetic and orthotic devices.

Nevertheless, the completion of the project does not cease the process of cooperation within the SESAME Net network. Small and medium enterprises still have the opportunity to contact the consulting centres, which provide consulting services in many languages. These services include individual consultations and help companies to find out if using HPC can be beneficial for them. The consulting centres can share their vast experience in the field of model-

ling, simulations, and data analysis in various areas. They assist in developing and using HPC for solving various real world problems.

As part of the project, an on-line tool helping companies to assess their potential to use supercomputing technologies has been developed. Thanks to this tool, every company is able to verify, in a few steps, if using supercomputing (HPC) technologies can be beneficial for them. The only requirement is to fill in a questionnaire. Based on the given answers, a valuable message is automatically generated, including the position of the company, its strengths and weaknesses as well as several recommendations for increasing the company's potential to use HPC. During the evaluation process and after its completion, the companies gain access to a portfolio of support services including personal consultation, a technical on-line forum, teaching materials as well as consultations about co-funding opportunities within the currently held open access competitions.

For the on-line tool, see  
<https://www.network.sesamenet.eu/>

The project website: <https://sesamenet.eu/>

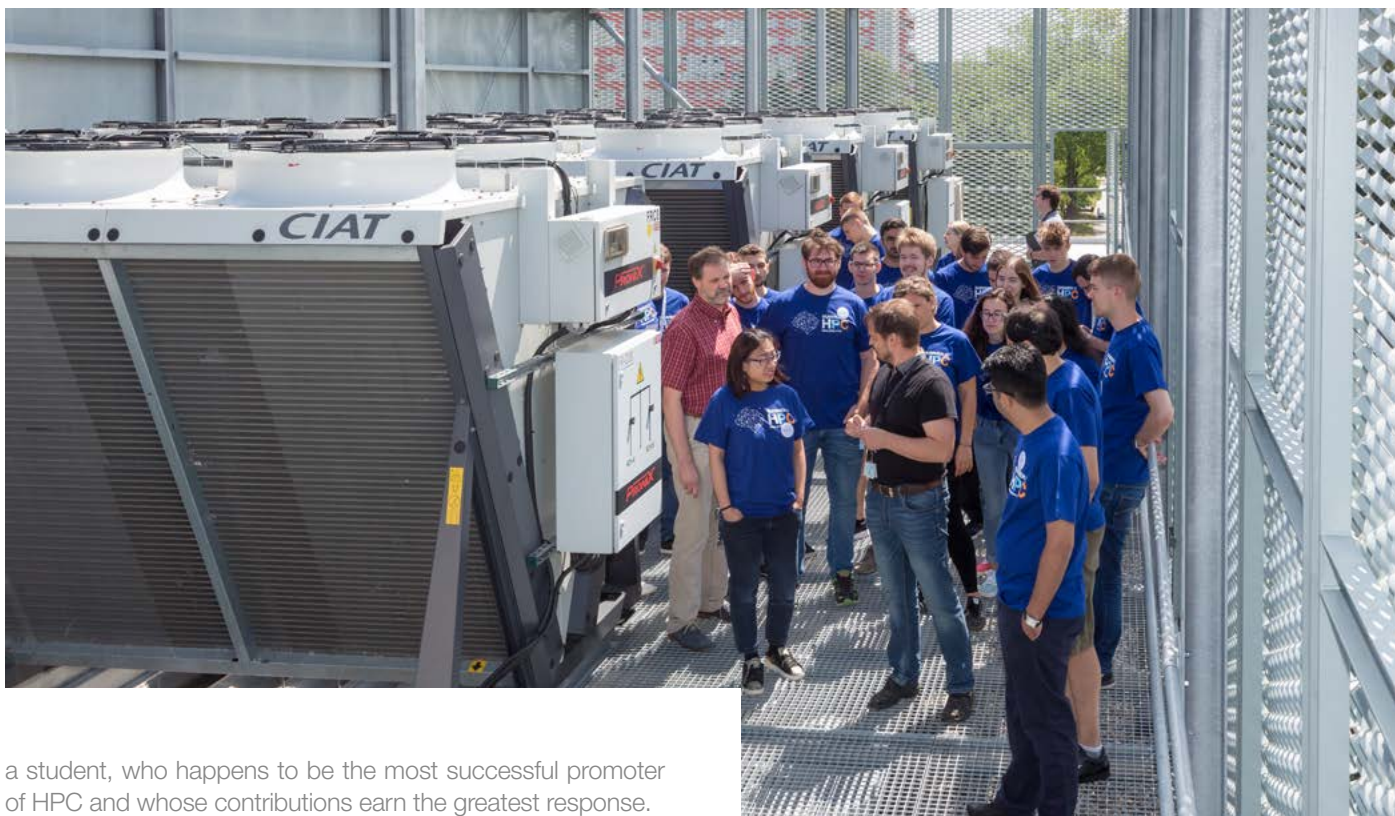


# SUMMER OF HPC

Students nowadays have many opportunities to travel abroad and thus broaden their knowledge. This is now the fifth consecutive year that the Partnership for Advanced Computing in Europe (PRACE) has enabled 21 students to do an international summer internship with one of the participating supercomputing centres throughout Europe.

The programme has two objectives: provide talented students from various fields of study with an opportunity to test out high performance computing (HPC) resources for solution of problems in their specialization, and increasing awareness of the younger generation of future HPC scientists. This is to be achieved through projects that the selected students are assigned to and work on during the two month-long summer holiday, resulting in blog contributions and video presentations, which are further used for promoting HPC. The most essential source of motivation includes two Best Student prizes, which are awarded by PRACE. The Best Project Prize is awarded to a student with the most interesting scientific outcome and best visualization. The HPC Ambassador Award is awarded to





a student, who happens to be the most successful promoter of HPC and whose contributions earn the greatest response.

Annually, the programme starts with a joint kick-off HPC basics training week. Held this year in Ostrava, the Czech Republic, the training course was led by lecturers from IT4Innovations and one lecturer from the partner centre of SurfSARA from the Netherlands. During that week, the students were introduced to the programme objectives as well as HPC basics. They also had an opportunity to visit interesting local sites. In Ostrava, in particular, they went on an excursion to the Vítkovice Lower Area. Upon completing the training week, the students spread to their host countries including Italy, Spain, Ireland, The United Kingdom, Slovakia, Slovenia, Greece, Denmark, Germany, and two of the students stayed at IT4Innovations in the Czech Republic.

Those two students were Shukai Wang, a Chinese student, who studies chemistry at Imperial College London, and David Bourke from the Irish Trinity College in Dublin. Shukai worked on the Performance visualisation for bioinformatics pipelines project. David, on the other hand, was involved in the Visualization of real motion of the human body based on motion capture technology project.

The prospective Summer of HPC 2018 candidates are recommended to follow the SoHPC facebook profile, where all the essential information about the application process will be published at the turn of the year.  
<https://www.facebook.com/SummerOfHPC>

More information about the programme and the results of all the past years are available on the following website:  
<https://summerofhpc.prace-ri.eu>





## SUCCESSFUL PARTICIPATION OF A START-UP ENTERPRISE IN SUPERCOMPUTING: HPC AND CRANIAL REMODELLING HELMETS

We are currently cooperating with the ING Corporation in developing cranial remodelling orthoses (helmets), which are used to correct asymmetric growth of the heads of children. Several types of deformations of the head can occur in new-borns and infants, for example because of a preference to lie on one side only.

### What does such a helmet look like, and how is it made?

The helmet consists of an internal sponge clad and external solid plastic hard shell. During the therapeutic process, the internal clad is adjusted depending on the growth and development of the skull. The size of the external plastic part remains the same. It is designed so as to provide the space necessary for the desired growth of the skull. Since each child's head has a unique shape and the deformations can be different, it is important to customize each helmet design. Nowadays, orthoses are adjusted manually. Based on a computer model, production data are prepared and, employing CNC machining, a model, which is an accurate copy of a particular child's head, is produced. Then, a symmetric shape of the head is modelled. The resulting model serves in production of the first remodelling helmet.

The ING Corporation plans to transfer the whole process of helmet design and production to the digital realm. They plan to use 3D printing to produce Helmets. Such technology, requires work with high-definition computer models, the processing of which is highly time demanding when using average personal computers. Therefore, the company has decided to establish a cooperative partnership with IT4Innovations with the aim of speeding up the whole process of helmet design and production.

The IT4Innovations research team is currently working on making the whole helmet modelling procedure semiautomatic in order to speed it up. Using 3D scanning (by means of optical 3D scanners), the team obtains exact dimensions of a child's head along with the dimensions of the desired shape. This entry data is used for adjusting the helmet to the desired shape using a morphing algorithm.

The digitalization of production not only allows the helmet production to be faster, easier, and cheaper but also allows the helmet motive to be custom made.

**We asked Dr. Jiří Rosický, CEO at ING corporation, two questions.**

**How did you come up with the idea of using the infrastructure of IT4Innovations National Supercomputing Center in the helmet development?**

In order to produce helmets using 3D printing, it is necessary to prepare a computer-aided engineering 3D model. Since each helmet for an individual child is unique in shape and dimensions, we started to consider CAD using a computational algorithm to make models. We have used the opportunity of finding great and enthusiastic experts in the research group of Dr. Tomáš Karásek, who have developed a software application for us within a joint project. This application enables the helmet models to be constructed automatically. The advantage of using the supercomputer for us is the opportunity to obtain a relatively complex CAD model for 3D printing in a few seconds in comparison with a manual CAD model generation taking several hours.

**Why is it important to speed up the process of helmet design and production?**

At the age of 4 to 6 months when we start to apply the cranial remodelling helmet, the child's head grows rapidly. Therefore, it is necessary to minimize the time between obtaining the initial shape of the head using 3D scanner and the moment of finalization and application of the helmet. We can thus ensure that the subsequent orthotic treatment will run smoothly and comfortably. This unique solution developed in cooperation with IT4Innovations will help us increase the quality of our products and services.



# A NEW WEB USER INTERFACE AND MOBILE APPLICATION FOR INCREASING THE RATE OF WASTE SEPARATION

Concerning the successfully completed project titled “Increasing the rate of waste separation and decreasing the costs of its collection”

The objective of the “Increasing the rate of waste separation and decreasing the costs of its collection” project was to map the behaviour of citizen's waste generation, and based on the gathered information, to propose a way to decrease the total costs of municipal waste collection as well as increase overall knowledge about the volume of individual waste categories classified according to the category and place of collection.

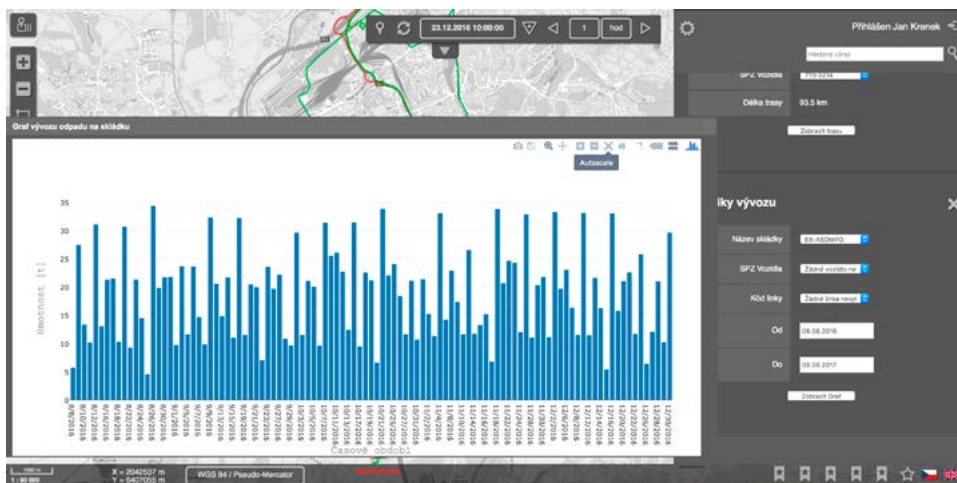
The project was implemented by a research team from the Advanced Data Analysis and Simulations Lab along with experts from the OZO Ostrava company. The outcome of the project is a sufficiently universal application, which can be used to increase the rate of waste separation in any region. The higher the increase in waste separation, the greater the decrease in the total volume of generated waste, which leads to a considerable reduction of costs.

Within the project, two software products were developed. The first is the GAIA web user interface, and the second is the GAIA Mobile application.

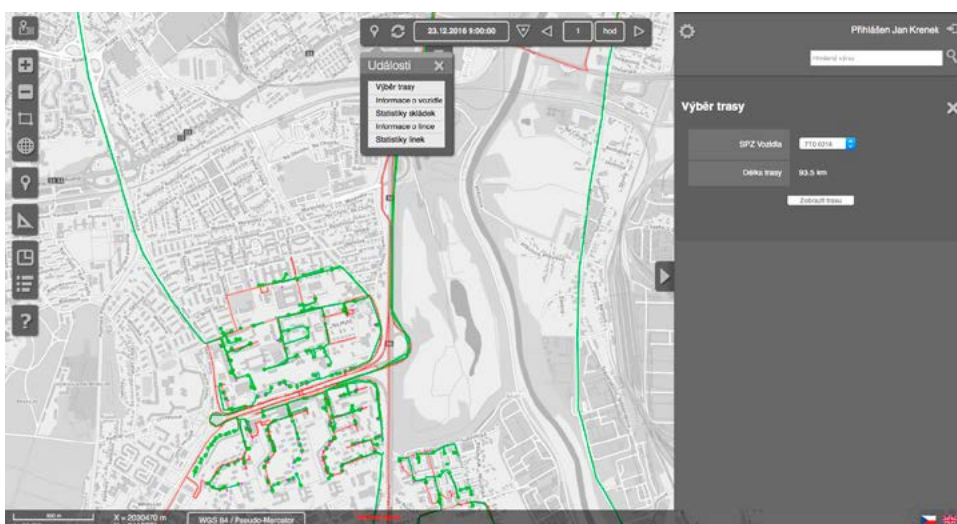
Using sensors attached to the large waste receptacles, the **GAIA web user interface** enables us to monitor, in real time, the level to which the receptacles are loaded. The web interface of the system is user-friendly when working with maps. To illustrate this point, it provides a function for displaying map data as well as calculations on a map. In addition, GAIA allows various custom-made functions integrated according to the current role of the user. The user can display real-time traffic information, location of large waste receptacles, information about a particular receptacle as well as updated information about the receptacles equipped with sensors such as the load



GAIA Mobile application



GAIA web user interface:  
Export of waste to a particular landfill  
collected by one waste collection vehicle



GAIA web user interface:  
The route of a specific waste collection  
vehicle (red collection route proposed  
by the optimization algorithm and green  
current collection route)

level. Furthermore, the user can display information about particular waste collection routes, waste collection vehicles as well as information about waste dumping sites, such as their locations and relevant statistics.

For the needs of data collection related to the current status of large waste receptacles, the **GAIA Mobile application** was developed. In the case of every waste receptacle, the user can manually enter the level of waste load or take and send photos to substantiate in case of damage or any other unusual event. The developed software products will provide not only a detailed overview of the large waste receptacles load level but also information about the loading rate as well as the process of their loading. The data obtained from monitoring the status of waste receptacles can be used for planning the waste collection routes in order to reduce the total waste collection operating costs.

To design and optimize the waste collection routes, our experts have adopted the metaheuristic algorithm, which can solve the Vehicle Routing Problem. By connecting the application to “HPC as a service”, the developers enabled the regular users to remotely run computationally demanding computations. Development and adaptation of the above-mentioned algorithm is supported by the Ministry of Education, Youth, and Sports from the National Programme of Sustainability II programme “IT4Innovations Excellence in Science”.

The project “Increasing the rate of waste separation and decreasing the costs of its collection” was supported by the Technology Agency of the Czech Republic, PRE SEED Fund of VSB - Technical University of Ostrava/TG01010137.



## THE CZEBACCA PROJECT, SUPPORTING COOPERATION BETWEEN IT4INNOVATIONS AND GERMANY

In the middle of this year, the IT4Innovations National Supercomputing Center along with two Bavarian institutions, namely the Leibniz Supercomputing Centre (LRZ) and the Technical University Munich (TUM), have completed the Czech-Bavarian Competence Team for Supercomputing Applications project, also known as CzeBaCCA.

This project commenced on 1<sup>st</sup> of January 2016 and, funded by the German Federal Ministry of Education and Research, addressed the increasing complexity of state-of-the-art supercomputers and the essential need for efficient support of experts in using supercomputers in various areas of application. It was based on exceptional cooperation among the above-mentioned institutions as well as on their geographical proximity. The project was primarily focused on the following objectives:

- development of knowledge and skills of scientists and researchers in efficient use of state-of-the-art supercomputers,
- upgrade of the simulation software and codes for mathematical modelling,
- support of Czech-German cooperation in the field of supercomputing.

As far as the educational activities are concerned, the most noticeable output of the CzeBaCCA project was a series of eight training and scientific workshops with a total duration of 16 days, which were held alternately on the grounds of IT4Innovations and LRZ. The training workshops focused on the various technical aspects of programming and use of accelerators

as the state-of-the-art means of increasing the performance of supercomputers. The main focus was on the Intel MIC architecture-based accelerators. The scientific workshops targeted advanced modelling and simulations of complex natural phenomena such as seismic threats, water-related disasters (floods, tsunami, etc.), and various atmospheric and climatic phenomena. The events have received wide international attention. For instance, the SeisMIC - Seismic Simulation on Current and Future Supercomputers workshop, held in February 2016 at IT4Innovations, was attended by about thirty experts in the field, from six European countries.

Although the CzeBaCCA project has already finished, cooperation in the sense of the last above-mentioned objective continues in various forms. In the educational area, for example, IT4Innovations, along with the German partners, are planning a week-long VI-HPS Tuning Workshop, a significant event dedicated to practical optimization of user codes, in April next year.

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Project webpage <https://www.lrz.de/forschung/projekte/forschung-hpc/CzeBaCCA/CzeBaCCA/>