MUNI ICS

Institute of Computer Science
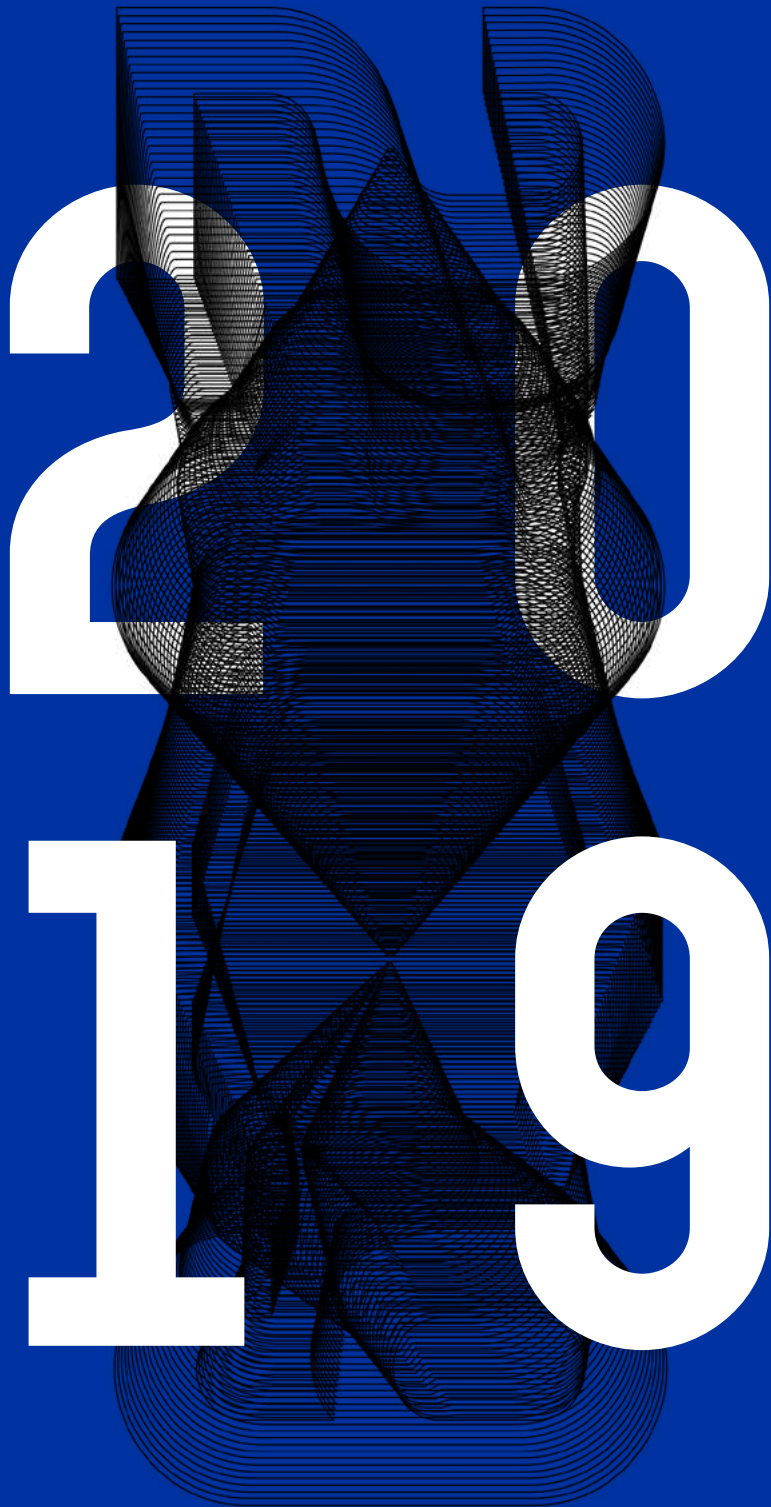
2019

ANNUAL REPORT

INSTITUTE OF COMPUTER SCIENCE MASARYK UNIVERSITY

ANNUAL REPORT 2019

CONTENTS

INTRO-DUCTION

In 2019 the Institute of Computer Science celebrated 40 years of its existence and took part in the centennial celebrations of the university. However, those events only framed an intense professional and research activity the institute spent the year focusing on.

We continued our work on the top C4E cybersecurity project that our institute coordinates. The project's framework is based on cooperation between experts from theoretical and practical informatics, lawyers and social science scholars who work on research question with important social impact. Several other national and international cooperations are connected to the project and C4E centre, which significantly strengthens the institute's position as a unique cybersecurity centre not only within CZ, but also internationally. The institute was active in setting up a new consortium and one of a kind national e-infrastructure e-INFRA CZ. By our involvement of CERIT-SC centre into the e-infrastructure, we became one of the key players strengthened in this field as well. Internationally, we have strengthened our position in the field of authentication and authorization infrastructure (AAI), where we continue to cooperate with our Finnish partners in running and developing ELIXIR AAI. More importantly, by starting the H2020 EOSC project Life, we took over the responsibility of this infrastructure's development in the whole field of life sciences in all Europe. We continued to work on number of other international projects, which make us part of European activities in the European Open Science Cloud (EOSC). Another important milestones were, taking over the Open Science not only at MUNI, but also in the national context; keeping plans regarding science data service for multiple important projects; preparing our participation in OpenAIRE LegalEntity; securing national funding from OP VVV sources; and creating an Open Access manager position at MUNI.

Our unquestionable position as a national centre is being established via our cooperation with CESNET. Our collaboration aims to look for systemic solution to eIDAS regulation on secure digital environment, and launching a robust and large-scale system of qualified digital signature and electronic seals, which is being used by majority of public universities in the Czech Republic.

We maintained our work in digitizing university's environment not only by further development of internal agenda's in INET and other university systems, but also by switching to Microsoft O365 platform for internal cooperation and communication within university with gradual linking to internal cloud environment. We begun market consultations for new university financial and HR system, which should further boost MUNI shared digital platform. We continued in cultivating shared IT community, sharing experience and removing differences between individual faculties and other parts of university by further developing web IT MUNI.

2019 confirmed the institute's quality excellence and high standard, as well as its irreplaceable role in Masaryk University's growth, and strengthened its position in both national and international environment. Since the institution is made by people, it is the institute's employees, who deserve the highest praise for their upstanding work and achieved success.

prof. RNDr. Luděk Matyska, CSc.
director

OUR 10 GREATEST ACHIEVEMENTS AT ICS

1

ONLINE COOPERATION ACROSS THE WHOLE UNIVERSITY

Launching a new generation of Microsoft Office 365 services significantly increased the usage of these technologies at the university. As a result, we experienced a record break-ing increase of 69% in users, who are taking advantage of the offered online tools for their studies and/or work.

2

NEW, USER FRIENDLY LIBRARY SYSTEM

We developed and launched a new user interface for university's library system, which is based on the open-source VuFind tool. It is accessible at katalog.muni.cz and it offers its users a more effective means of information search and detection.

3

OPEN ACCESS AT UNI UNDER OUR DIRECTION

Project HR4MU enabled us to take over the Open Access agenda and create an Open Sci-ence university strategy. The goal is to coordinate all activities within Open Access and MUNI FAIR Data areas and elevate them to a European level.

4

WI-FI ACCESS AVAILABLE EVERYWHERE

We concluded both phases of updating and expanding wireless network in all the build-ings belonging to Accommodation and Catering Services MUNI, making Wi-Fi available not only for students, but also for MUNI guests (special Hotel-SKM network), at all univer-sity locations.

5

NEW GENERATION CLOUD ENVIRONMENT

A new generation of cloud built on Openstack platform was made fully operational. The environment aims to aid research and scientific groups in conducting difficult calcula-tions in HPC regime, as well as in everyday IT infrastructure operations.

6

CYBER COMPASS, ONE OF A KIND CYBERSECURITY COURSE

We created a one of a kind online cybersecurity course — Cyber Compass. The course in-troduces practical advice and serves as a guide to facing traps and behaving securely in the cyberspace. The course is offered not only to university staff and students, but also to wide public at security.muni.cz/cybercompass.

7

SUCCESSFUL COLLABORATION IN THE FIELD OF CYBERSECURITY

We participated in new GA4GH Passport and AAI standard set ups and on creating a refer-ential implementation for ELIXIR research infrastructure that focuses on reliable authenti-cation of researchers digital identities.

8

WE PARTAKE IN IMPORTANT INTERNATIONAL PROJECTS

Together with our partners, we are successfully collaborating on prestigious international projects, e.g. EDIReX and CETOCOEN projects in H2020 or H2020 project series EOSC and many others.

9

UNIQUE E-INFRASTRUCTURE FOR RESEARCH AND DEVELOPMENT IN CZ

In collaboration with CESNET association and IT4Innovations, we received financing for a shared project aiming to create a big modern national research e-infrastructure e-INFRA CZ. This e-infrastructure has also become an integral part of the Czech republic's Travel Map of big research infrastructures for research, experimental development, and innovation.

10

SUCCESSFUL ICS 40TH ANNIVERSARY AND MUNI 100

Alongside university's centennials, ICS celebrated 40th anniversary of its founding. The celebrations culmi-nated in ICS CON 40 conference that took place in University Cinema Scala. The list of speakers included experts from our partners and partner institutions, who introduced the ways of using IT in various research fields -from new drug development to global climate change.

40

THE UNIVERSITY IS 100, THE INSTITUTE 40

The university celebrated its centennial as the institute celebrated a 4th decade in existence. Our anniversaries were commemorated by several events.

OPEN DAY OF ICS

On Saturday morning, June 15th, 2019, there was a special program for our current and former employees and friends of the institute. The Open Day attracted tens of visitors coming to see the way we had grown in the 40 years and the kind of IT services and research projects we work on nowadays.

Apart from presentations by former and current directors, our visitors could tour our computer labs, Cybernetic Proving Ground (KYPO) and peruse a photo exhibition that documented the 40 years of life at the institute.

MUNI 100 FESTIVAL

Masaryk university celebrated its centennial on Saturday afternoon with MUNI 100 Festival, an event packed with music, entertainment, and excellent food at Brno Trade Fairs (BVV). The visitors also had a unique opportunity to see presentations of all MUNI's faculties, departments and university institutes. The ICS booth offered a look into a world of IT that usually remains hidden at first glance.

The main attraction of the booth was an electronic kiosk offering an interactive exploration of 40 varied topics, ranging from how IT helps in research, super-computers and super-net to a historical overview of ICS's firsts in the IT world.

ICS CON 40 CONFERENCE

The celebration of institute's 40th anniversary culminated on Thursday, October 17th, 2019 in ICS CON 40 conference held on the premises of University Cinema Scala. The list of speakers included experts from our partners and partner institutions (CzechGlobe, Czech Academy of Sciences, CEITEC, RECETOX, NÚKIB, CESNET and others) who introduced the use of IT in various research fields. The topics ranged from medicine and new drug development to global climate change, digital pathology, and finally, library digitalization.

The conference was followed by a social evening opened by a ceremony to honor chosen ICS personnel and then continued into an informal gathering with music.

CONCERT OF MUNI'S SYMPHONY ORCHESTRA

To conclude the celebrations, we chose a maybe surprising event — a concert of symphony orchestra in Besední dům. However, surprising only at first, since one of our colleagues is the founder and conductor of MUNI's Symphony Orchestra and the concert introduced his own composition, a Prelude to the opera Zacharatuza.

Almost four hundred spectators present in the auditorium had an opportunity to hear not only his piece, but also the works of Antonin Dvorak, Giuseppe Verdi, and John Williams.
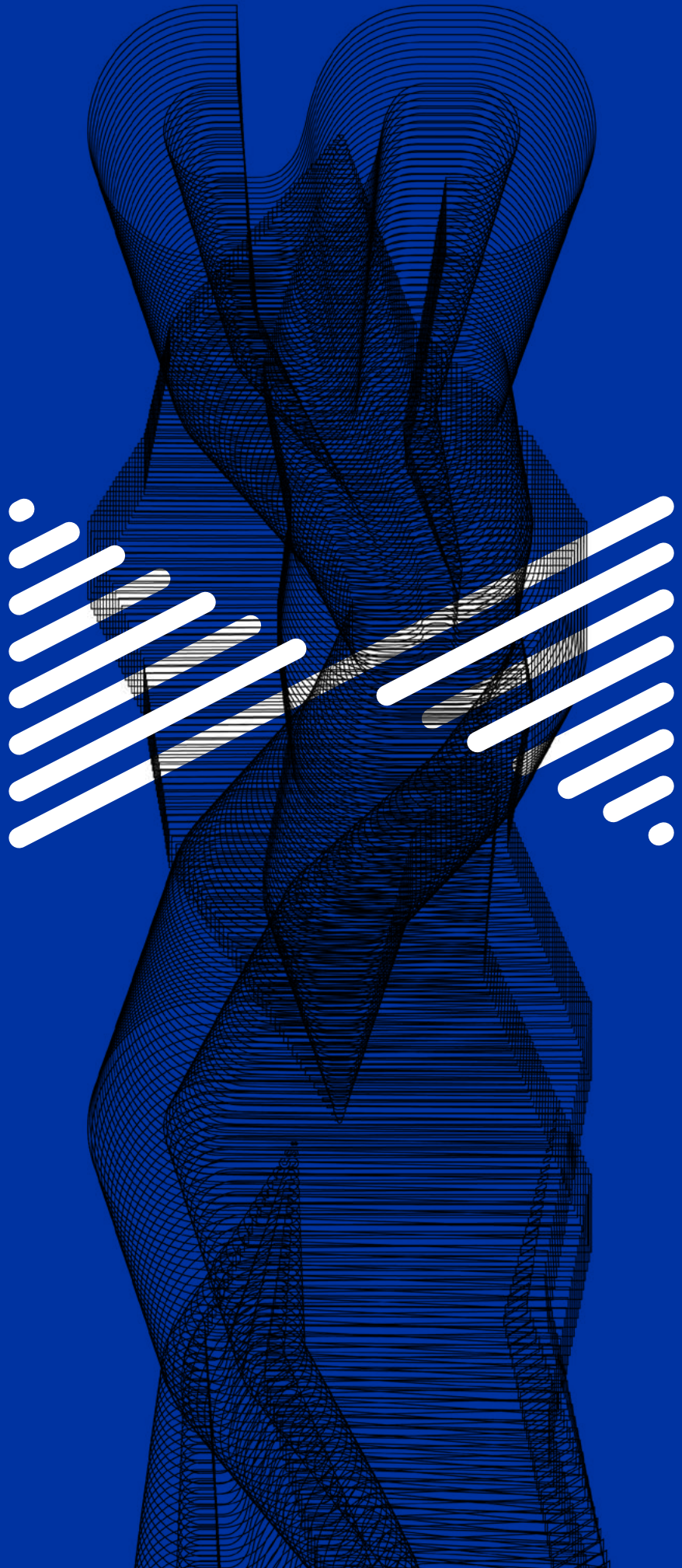
USER SERVICES

We provide the university with an IT services that make it a 21st century institution. Our role is not only to provide technical support, but finding a constant balance between service stability and innovation. We actively seek to create a university-wide community that directly cooperates with employees as well as students beyond research and instruction. Together, we are creating an IT environment, which supports the university to attain its goals.

WHAT WE DO

- Office 365 as university platform for cooperation and communication
- Central administration of computers
- Administration of university computer rooms and the University Computer Centre (UCC)
- Administration of the university's voice and mobile telephone networks
- Printing services for students and employees

- Provision of university software licenses
- Administration and maintenance of MU access and security systems
- University-wide Service desk and call centre
- University IT services catalogue it.muni.cz
- User and technical support
- Taking care of user specific needs
- Training and education of users, conducting seminars

WE ARE IMPROVING AND MAINTAINING USED SERVICES

A significant increase of 69% in Microsoft Office 365 users called for user support through training and further development of these technologies. Additionally, we have supported individual university units in transitions to Office 365, developed a new system for managing identities and new licenses, and developed an architecture for university e-mail service system.
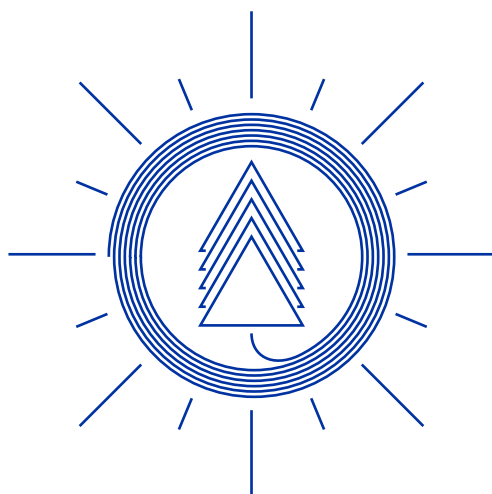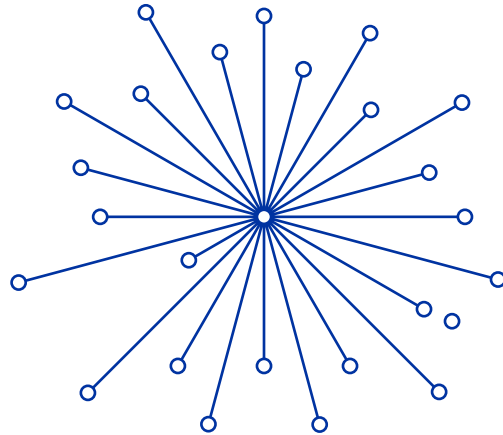
MS OFFICE 365

85,400
unique users that use

51,000 GB
of available OneDrive storage space

52,000
activated Office apps for personal use

OVERVIEW OF PCS ADMINISTERED IN UNIVERSITY COMPUTER ROOMS

University Campus Bohunice	**282**
chemistry classroom	25
classrooms	139
Campus Library	118
Faculty of Science	**152**
Kotlarska 2 — classrooms	57
Kotlarska 2 — study halls	95
Faculty of Law	**124**
Veveri 70 — study halls	64
Veveri 70 — classrooms	60
Faculty of Education	**102**
Porici 31 — classrooms	47
Porici 31 — library	55
Faculty of Social Studies	**109**
Jostova 10 — classrooms	54
Jostova 10 — library	44
Jostova 10 — practice room U3V	11

Faculty of Arts (all locations and departments)	**242**
departments at all locations	90
Arne Novaka 1 — library	73
Veveri 26 — classrooms	31
Gorkeho 7 — classrooms	53
Gorkeho 14 — classrooms	41
Janackovo namesti — classrooms	15
Komenskeho namesti	**173**
CPS	115
Teiresias	58
Vinarska dormitory	**3**
study hall	3
Telc	**76**
classrooms	76
Centre of Scientific Information ESF	**27**
library	27

UPDATED AND SECURE COMPUTERS THANKS TO CENTRAL ADMINISTRATION

We carried on with incorporating further locations into central computer administration. The number of connected computers increased by 37% to a total number of 5,069 devices (including the first wave of laptop computers). The main focus was on data protection and environment performance by e.g. deploying LAPS technology to increase password security, branch and peer cache to optimize network operation.

WE ADMINISTER

5,069
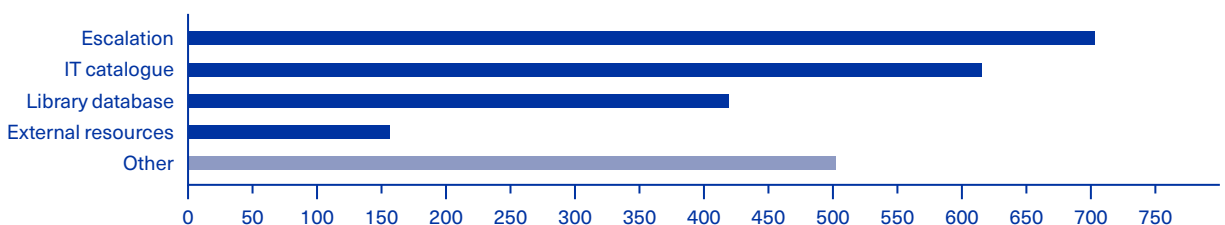computers, 2,138 belong to students and 2,931 to employees
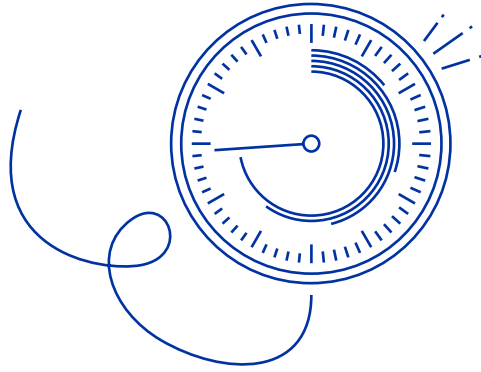
6,530
landlines

1,640
mobile phone numbers

153,000
hours of conversations via landlines

REQUESTS SENT TO SERVICE DESK ACCORDING TO THEIR SOLUTION

Category	Value
Escalation	~705
IT catalogue	~615
Library database	~420
External resources	~160
Other	~500

(scale: 0, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 650, 700, 750)

AUTOMATION SAVES TIME

We expanded the automation technology to servers and integrated it with university virtual infrastructure. The significant increase in speed of the whole process enabled us to effectively upgrade a big portion of the infrastructure (more than 100 servers) from Windows Server 2008 to 2019.

COMPUTER ROOMS

20,140
students took advantage of computer rooms services with 345,000 log-ins

9,480
of them used the UCC during 297,000 entries

1,446,000
pages were printed by students at all locations

WE ARE HERE TO HELP

2,400
resolved service desk tickets

1,640
resolved technical support tickets

142,100
visitors of IT MUNI

3,800
resolved tickets at iHelp

1,200
**resolved tickets at WebCenter**

50
conducted trainings for end users

WE TAKE CARE ABOUT USERS AND IT COMMUNITY

As in previous years, we improved IT services throughout the university. We created a shared IT community with faculty administrators to find optimal solutions to ideas and demands presented by students, employees, and researchers. MS Teams proved to be an invaluable help as much as periodical face to face meetings.

Today, a visitor to it.muni.cz finds not only a list of university wide services provided by the ICS, but also information about local services provided by the most of individual faculties. Along with an enormous number of satisfied users, IT MUNI is being continually improved, and is becoming an effective tool to deal with IT needs and issues. Consequently, our Service Desk has seen some growth too. It can be reached not only by phone on 549 49 7777, but also on new e-mail address it@muni.cz.
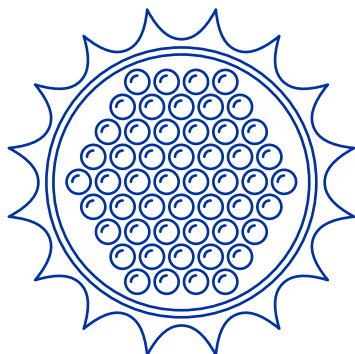
EDUROAM WI-FI NETWORK

85,800

university employees, students, and visitors used the eduroam Wi-Fi network

7,500

users took advantage of virtual private network (VPN) in the total of 907,346 connections

PHOTOS AND ID CARDS

9,878

photos were made

10,912

ID cards were issued

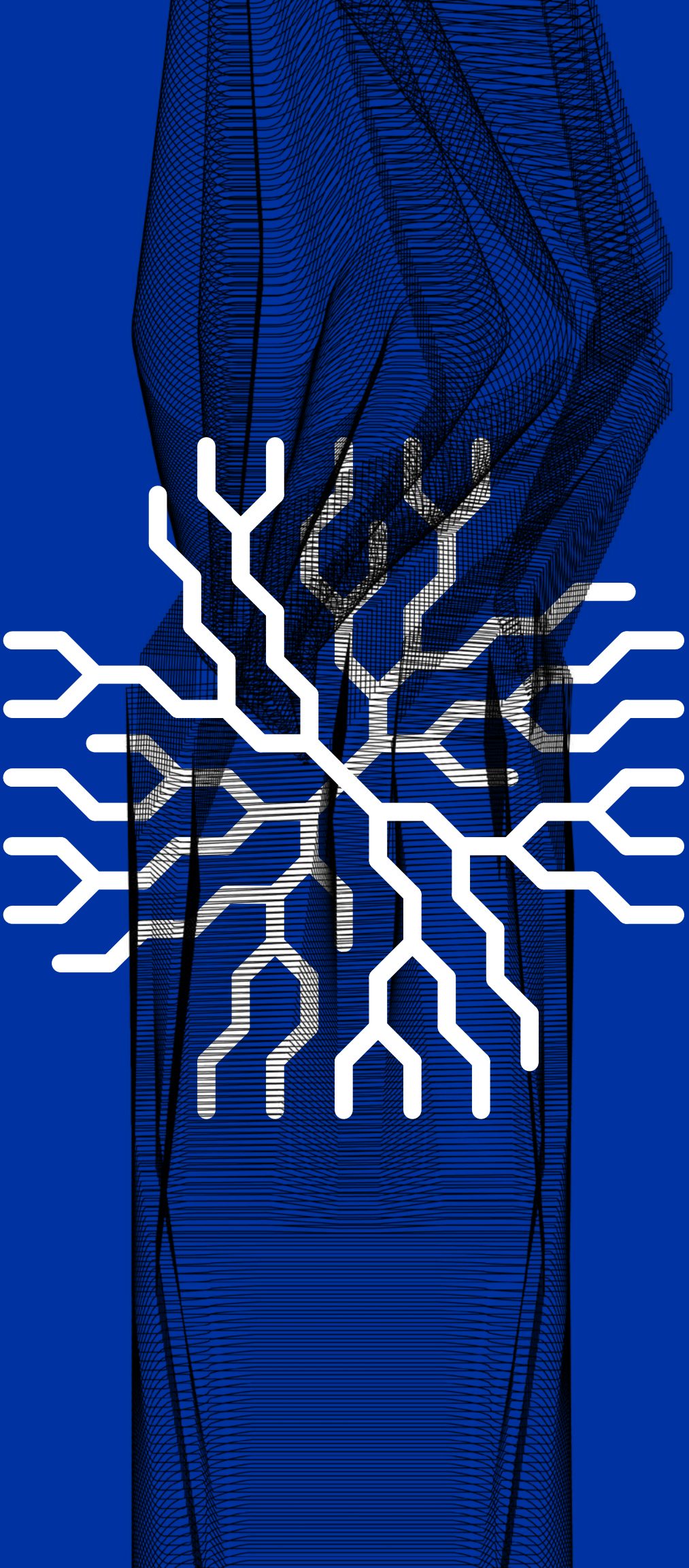## ICT EMPLOYEE INVOLVEMENT IN UNIVERSITY INSTRUCTION AND SUPERVISING MASTER THESES

32
ICT employees taught 86 courses

144
theses were supervised by ICT employees

37
theses were reviewed by them

EXCELLING E-INFRA-STRUCTURE

University e-infrastructure is a complex environment that includes all communication in-frastructure, clouds, computer environment and data storage, all with national and interna-tional structures overlap. It is created with a vision to be the leaders in innovation and au-tomation, especially in regards to fulfilling its basic principle — bring an exclusive additional value to the peak science research and consequently to the society as a whole.

WHAT WE DO

- Comprehensive administration of network backbone and networks in selected locales
- Provide support for computational servers, data storage facilities, and application add-ons
- Maintaining complex cloud environment

- Integration of similar systems owned by other units of university
- Individual adjustment of infrastructure to fit important user groups' needs

WE'VE GONE WIRELESS AT OUR DORMITORIES

In 2019, we successfully extended our wireless network to buildings of Accommodation and Catering Services MUNI. The coverage, which is provided for students and hotel guests, is ensured via 658 access points that are connected to university network by 35 active elements, and was completed in two phases. Furthermore, we have created a new independent wireless network for hotel guests Hotel-SKM.
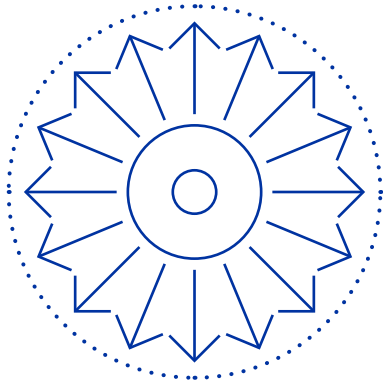
WE INCREASED DATA NETWORK CAPACITY

The computer connections at University Computer Centre and for science groups in Uni-versity Campus Bohunice were upgraded and increased tenfold to 1 Gbps. Buildings in Campus were, furthermore, interconnected at 10 Gbps, the Campus itself then at 40 Gbps. To make sure the increasing volume of transmitted data is processed, we increased the speed of the connection to Support Centre for Students with Special Needs Teiresiás.

WE MAINTAIN

1,900
Wi-Fi access points

26,378
network sockets

16,600 TB
of data was transmitted within the university network

135
kilometres of cable and 12,040 kilometres of optical fiber was laid in optical MUNI network

WE MODERNIZE FACILITIES FOR IMPORTANT UNIVERSITY SYSTEMS

We increased speed and capacity in the part of the university cloud reserved for MUNI im-portant system maintenance. This includes for example HR and finance system EIS Magion, university web presentations, library information system, authentication and au-thorization infrastructure including VPN, and wireless and phone network. Due to growing demands, we increased server capacity by 4.4 TB RAM and 240 processor cores. While we were changing disk storages, we added 100 TB of fast SSD disks to its total capacity. We have also significantly improved data security by unifying the backup process.
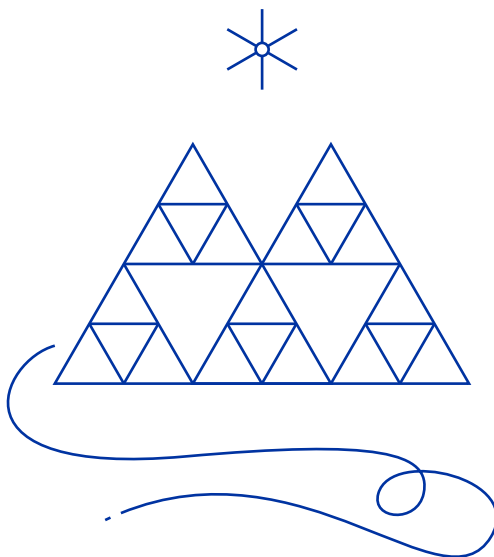
WE PROVIDE

21
physical servers

620
cores

10 TB RAM
in total

747
virtual servers

NEW GENERATION CLOUD ENVIRONMENT

Under the auspices of new research e-infrastructure e-INFRA CZ which we are part of via CERIT-SC centre alongside CESNET assosiation and IT4Innovations, we launched a new generation of cloud environment built above OpenStack system. We have also enabled a unified access within MUNI and e-INFRA CZ, access support via academic identity federa-tion and EGI Checkpoint for accessing cloud to handle international projects and support for commercial identity providers (Google, LinkedIn), to enable cooperation between the private and public sectors. Identities are fully managed by system Perun that is developed in cooperation with CESNET.
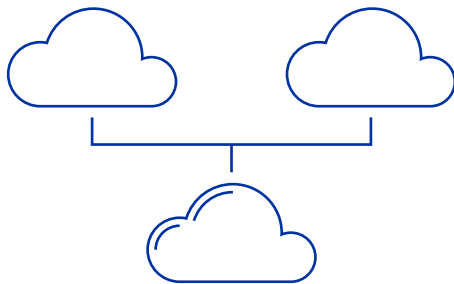
OPENSTACK IN 2019

7,199
virtual servers hosted

UP TO 1,000
virtual servers daily runs at full capacity

492
users connected at least once to cloud infrastructure

PROVIDING

5,344
CPU cores

126,720 GB
of RAM

1.4 PB
of object storage (CEPH)

MODERN INFRASTRUCTURE MAINTENANCE

To automate infrastructure maintenance, we have exploited several mod-ern procedures and tools, e.g. Infrastructure as a Code (IaaC) or container technologies. We use the newly gained knowledge and procedures to maintain and develop university infrastructure and in other projects as well.

Concurrently, we have created a system of central automated maintenance of linux com-puters to cover the needs of CEITEC research groups. The task should be completed in 2020. Research groups involved in this program save a significant amount of time that can be spent more effectively instead.
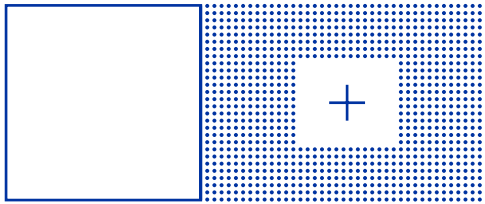
WE INCREASED COMPUTATIONAL AND STORAGE CAPACITY

We continued in increasing storage capacities and computational resources for scientific, administrative and other purposes. We used university investment funds to double storage capacity for study halls, user data, and their backup.

FUNDS FROM OP VVV CERIT SCIENTIFIC CLOUD INVESTMENT PROJECT WAS USED FOR LAUNCH-ING:

- hierarchical data storage with a complete capacity of 10 PB (including 376 TB SSD), which cost 28,400,000 CZK
- massive parallel computing node with large memory that is formed by 504 cores (28x CPU Intel 6154 at 3.1 GHz frequency) and 10 TB RAM

INVESTMENT PROJECT OP VVV ELIXIR CZ PROVIDED US AT THE END OF 2019 WITH:

- 3 PB capacity disk field, partially used for sensitive data
- computing cluster formed by 56 nodes each of 32 CPU cores and 768 GB RAM (total of 1792 CPU cores) which was fully integrated into a cloud

STORAGE CAPACITIES

2.5 PB
user data storage

1.8 PB
storage facility serving study halls, virtual servers, and part of CERIT-SC data

10 PB
CERIT-SC special hierarchical storage facility

1.7 PB
tape backup capacity

CERIT-SC CENTRE AND RESEARCH COLLABORATION

Today, information technologies and research are practically inseparable. As they evolve, it is difficult for the top researchers, experts in their field, to be experts in the field of high performance calculations and e-infrastructures at the same time. To achieve the best results possible, one must, however, fully utilize the possibilities offered by current technologies. That is where we can offer our own research and experience, leading us to collaboration with research teams and making for the best research in several fields.

WHAT WE DO

- Operate and encourage innovative use of the CERIT-SC Centre infrastructure
- Conduct research that supports the development of IT infrastructure
- Conduct interdisciplinary research and development with research partners
- Supervise interdisciplinary student theses
- Take a direct part in national and international research projects

CERIT-SC CENTRE

The CERIT-SC (CERIT Scientific Cloud) Center is a national center that operates computational and storage infrastructure for perfoming extensive "in-silico" experiments, usually in close cooperation with other academic disciplines. It focuses on experimental and innovative use of its resources.

The centre is built on three pillars:

- Providing computational and storage capacity to the academic community — provided a diverse range of computing nodes (5500 CPU cores) from 24-core CPUs with 384 GB of RAM to SGI UV systems with 504 cores and 10 TB of RAM, as well as storage capacity for user data from standard disk systems to hierarchical archive storage with total capacity of 10 PB. Users may use a standard environment with a batch management system and hundreds of installed applications, or run their own virtual machines
- Excellence in research into selected areas of computer science:
  - Big data analysis — processing large volumes of unstructured data, searching for unknown patterns, and application of machine learning techniques.
  - High performance computing — developing and optimizing algorithms, in particular those aimed at parallel and distributed computing and at accelerators (GPU).
  - Custom configuration and optimization of e-infrastructure (cloud) for specific uses
- Long-term collaboration with user groups in many disciplines, where the centre acts as a research partner.

CERIT-SC is on the Czech Roadmap of Large Infrastructure for Research, Experimental Development, and Innovation for the period of 2016—2022 as one of the three national e-infrastructures that signed a consortium agreement and thus, formally created a new national e-infrastructure e-INFRA CZ.

CERIT-SC CENTRE IN 2019

2,160
users

5,000
CPU years of run calculations

2,000,000
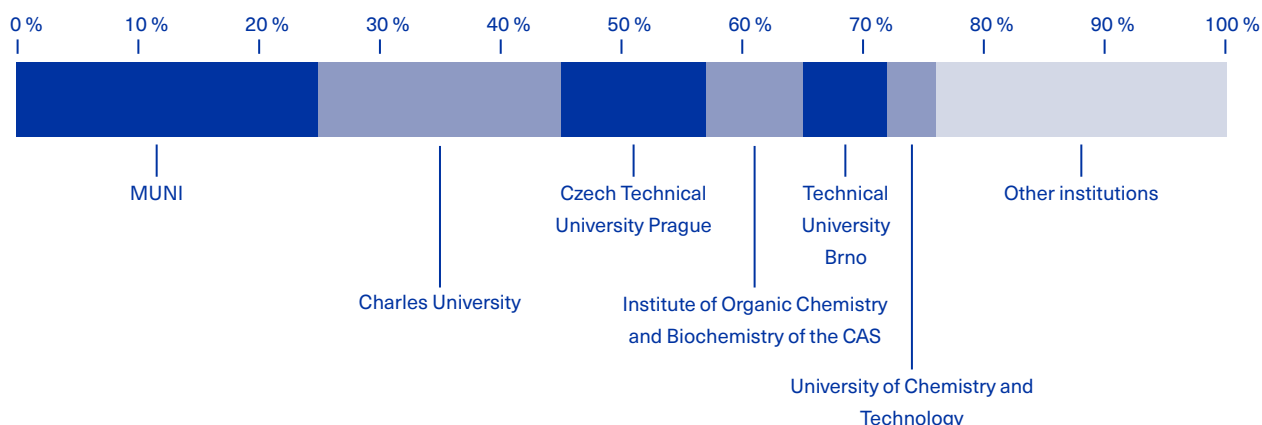tasks

8,000
virtual machines

10 PB
storage capacity

5,500
CPU cores

50
supported organizations

INSTITUTIONS AND THEIR PARTICIPATION ON TIME CALCULATED

0 %   10 %   20 %   30 %   40 %   50 %   60 %   70 %   80 %   90 %   100 %

MUNI

Czech Technical University Prague

Technical University Brno

Other institutions

Charles University

Institute of Organic Chemistry and Biochemistry of the CAS

University of Chemistry and Technology

SHARED INTERDISCIPLINARY RESEARCH

GPU ACCELERATION IN CRYO-ELECTRON MICROSCOPY

Our cooperation with Spanish National Centre for Biotechnology began through H2020 WestLife project. The group in Madrid develops Xmipp tool used for computationally demanding image data reconstruction. We use our GPU to accelerate the computationally most difficult parts of Xmipp, which often means significant changes to the used algorithms. In 2019, we developed and published a new GPU friendly algorithm that effectively accelerates 3D Fourier transformation. We integrated algorithm into Xmipp and reached a significant, almost 30 fold acceleration, compared to previous implementation of parallel process.

WE HELP IN NEW DRUG DEVELOPMENT

In cooperation with ICRC we developed a method for analysis of a small molecule's passing through a protein tunnel. This analysis can be helpful for example in developing new drugs or enzyme engineering. We are advancing a previously developed tool CaverDock that connects advantages of computing chemical energies with easy use and low computational demands. We continued in optimization and finding ways of effective usage within the e-infrastructure.
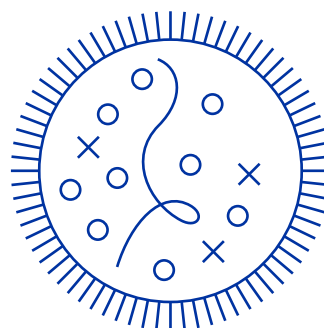
INFRASTRUCTURE FOR BIOLOGICAL DATA ELIXIR CZ

In cooperation with CESNET we run national infrastructure for bioinformatic data en large and we provide services to its European conterpart. In 2019 we focused on:

- RepeatExplorer optimization — service for repetitive DNA analysis where we modify "production prototype" and newly implement algorithms with emphasis on robustness and effectivity
- FireProt — web portal, which analyzes protein heat stability for usage in pharmaceutical industry, was fully converted to cloud environment
- In cooperation with VI ELIXIR CZ we began to create national cloud environment for sensitive data (primarily unanonymized medical data) and began cooperation with national and international 1+M Genomes activities

ANALYSIS OF NATURAL ECOSYSTEM'S METEOROLOGICAL DATA

Along with Global Change Research Institute CAS (CzechGlobe) we began a new cooperation to design an architecture of a data platform supporting complex analyses of meteorological data, which are being collected in various natural ecosystems (forests, wetlands, meadows). The objective is to design a system, which supports interactive user processes in validation and anomaly detection. The longterm future goal is to widen the analytical system with processes of machine learning that enable automated detections, and support of controlled edits of anomalous conditions.

WE PROVIDE SYSTEM SUPPORT FOR CRIMINAL INVESTIGATION

2019 marked a third year of working on the Analysis of Large-scale heterogenous data project that is done in close cooperation with Police of the Czech republic. The main goal of the project is to create an integrated distributed system enabling complex analyses of heterogeneous data of large-scale — large data volumes of digital artifacts obtained under police investigations, whose complex analyses, identification of complex relationships, and behavioral analysis of identified subjects are either impossible, or at least very complicated, were current technologies used.

A continuous support of network flow complex data analysis, secured during investigations, is also performed by CopAs, a tool we are developing. This tool based on Elastic Stack and Docker platforms enables user friendly analysis of complex data flow and consequent securing of needed pieces of evidence.

MELASA — ESTIMATIONS OF ANISOTROPIC ELASTIC PROPERTIES OF NANOCOMPOSITES

In cooperation with the Institute of Physics of Materials CAS, we developed MELASA (Multi-phase ELAStic Aggregates) tool which computes anisotropic elastic properties of coherent nanocomposites using matrices of elastic stiffnesses of co-existing phases as input. Elastic properties are visualized in the form of directional dependencies of selected elastic characteristics. The tool can also process multiple-phase composites of user selected materials and makes possible an inclusion of internal rotation of co-existing phases. By offering a more effective and detailed analysis of elastic properties of nanocomposites, the tool's features make it a unique solution for the community of material physicists and a significant move forward compared to other tools potential.

RESEARCH COLLABORATION IN THE FIELD OF TOXIC SUBSTANCES IN THE ENVIRONMENT

In 2019 we focused on expanding our cooperation with RECETOX research infrastructure significantly. We set up a shared team where we gradually took over the maintenance and development of e-infrastructure. That includes purchase and installation of hardware and software solution design, research data management and collaboration in developing used computation methods. We devised a solution for prepared ESFRI infrastructure EIRENE, specifically, we focused on preparing biobank's sample database migration from unsuitable LAS system to more supported Open Specimen, and on designing a computing environment for mass spectrometry data processing, including implementation of innovative computing methods.

BRAIN AND HUMAN MIND RESEARCH

In cooperation with MAFIL CEITEC laboratories and Faculty of Medicine MUNI, we have significantly progressed in creating and verifying a 3D cortical layers imaging reconstruction method from data collected by noninvasive low resolution MRI scans. This method is of high importance when it comes to timely diagnostics of severe mental illnesses. We submitted a GA MU project proposal, to be able to continue our work on this research. Furthermore, we are developing a system for storing experimental MRI examination records.

PUBLICATIONS

3 7
publications with contribution of our authors, including

1 9
conference proceedings
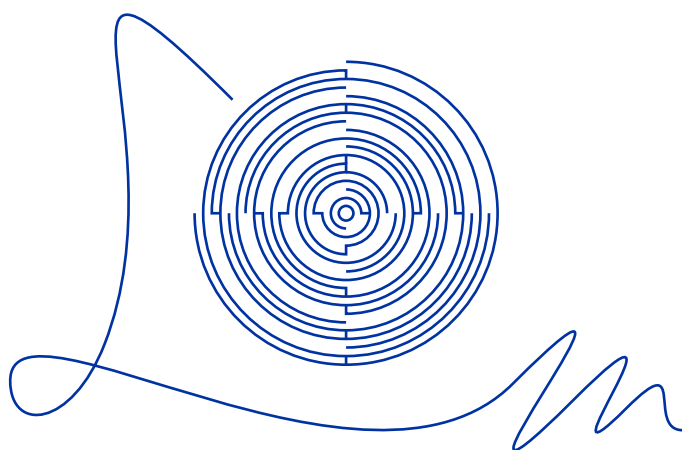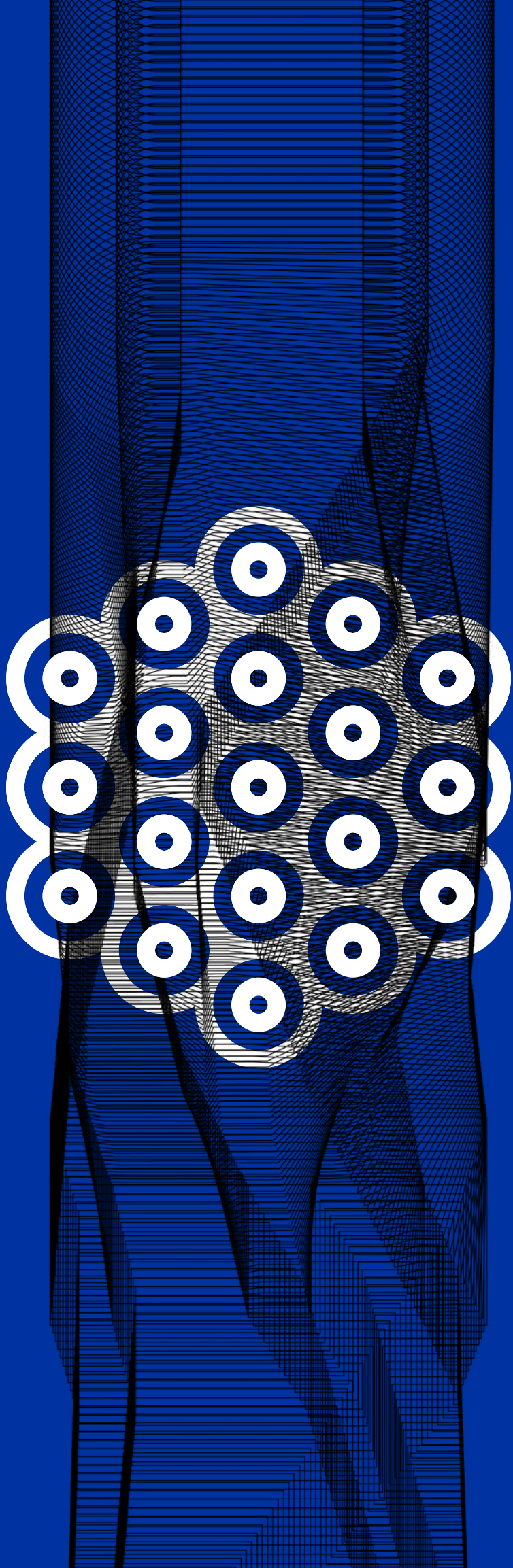
7
softwares

6
journal articles

5
other outcomes

C4E CENTRE OF EXCEL- LENCE AND CYBERSECU- RITY

Safe cyberspace, which we provide, is for Masaryk university an absolute necessity. We protect Masaryk University's students and employees, while continuously working on improving our services. We process security incidents, monitor upcoming security risks, look for and patch up weak spots, train specialist and common users, and are always ready to help.

WHAT WE DO

- Coordinate steps and address security incidents
- Security training and education of users and administrators
- Detection and containment of cyber attacks
- Share threat information and alert users
- Penetration testing of university systems
- Users digital identities security and service access management
- Secure certificate saving and electronic signing of documents
- Cybersecurity research and development of threat containment tools
- National and international collaboration in cybersecurity

C4E CENTRE OF EXCELLENCE

The Czech CyberCrime Centre of Excellence (C4e) is an academic expert centre focused on research, development, and education in cybercrime, cybersecurity, and the protection of critical information infrastructure. The Centre is formed by expert departments at the Institute of Computer Science, Faculty of Informatics, and Faculty of Law, and cooperates with research partners in Europe, Asia, and United States.
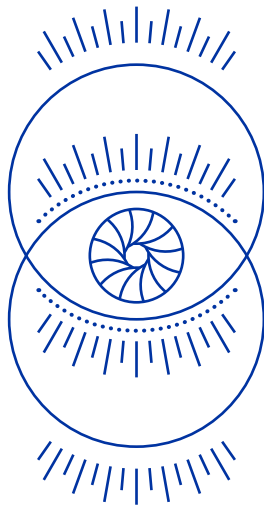
SECURITY INCIDENTS

111,317
cyber attacks were detected

99.51 %
of them were resolved automatically, only 546 incidents must have been resolved manually. 397 incidents originated in MUNI network.

CSIRT-MU CYBERSECURITY TEAM

CSIRT-MU team aims to create safe cyberspace for university. To do so, we research current threats, new ways of their containment, and train and educate users and IT experts. In 2019, we successfully initiated the process of Trusted Introducer recertification and put us among the best security teams in Europe. Our primary operational target is to secure solutions and coordination of cybersecurity incidents at Masaryk University.

WE EDUCATE USERS AND TRAIN IT PROFESSIONALS

In 2019, we organized several professional trainings for students and employees of Masaryk University. The most popular was an online course offering practical information and directions on safe behavior in cyberspace. It was launched under the name Cyber Compass at the security portal security.muni.cz, where we also post current threat warnings and information.

We further continued to train IT professionals through a series of practical sessions Cyber Czech that are unparalleled in the Czech republic. A combination of technical and non-technical devices creates a complex realistic situation to practice cyberattack defense. The training was organized in cooperation with National Cyber and Information Security Agency (NÚKIB) in KYPO Cyber Range Platform.
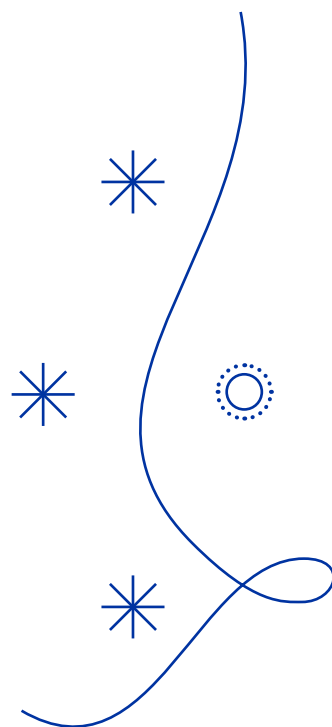
DIGITAL IDENTITIES SECURITY

We updated unified MUNI login in compliance to university's visual style and strengthen its security. For service administrators, we developed an SPreg service, which enables simple integration of services into unified MUNI login for internal and external providers. We cooperate with CESNET association in the field of identity management to further develop the Perun system. The cooperation is managed by a work group of the same name, which has a large overreach into important national and international projects. Developed technologies are, therefore, used not only at Masaryk University, but also at large research infrastructures in the Czech republic and abroad.

CENTRAL SYSTEM FOR USER ADMINISTRATION AND ACCESS MANAGEMENT PERUN ADMINISTERED

108,824
user accounts

3,062
groups

NEW METHODS AND MORE SECURE CYBERSPACE

The aim of the concluded projects of security research for Ministry of Interior CZ was to improve security team skills in national cyberspace through sharing information (SABU project) and threat simulation in critical information infrastructure (KYPO II project). In the ITOA project, we examined new analytical methods for monitoring security and performance problems in infrastructure. Furthermore, we licensed a software for timeline analysis and complex events processing for the Flowmon company.
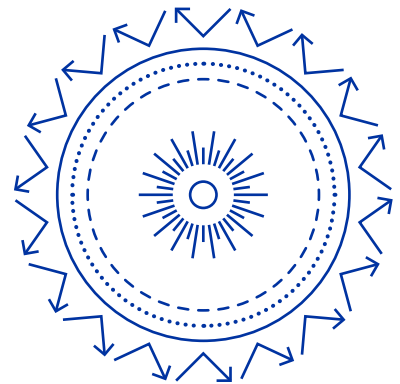
RESEARCH AREAS WITH INTERNATIONAL OVERLAP

We are involved in a new MACE project for Technology Agency CZ that focuses on network traffic in cloud environment. SAPPAN project in H2020 program explores data sharing with focus on preserving user privacy. We are also contributing to CONCORDIA project, which creates shared cybersecurity ecosystem in Europe. All these projects give us an opportunity to collaborate with more than 50 academic and industrial partners and expand our Pan-European cooperation.

SUCCESSFUL RESEARCH AND EXPLORATION

Our research is internationally renown and its results are being presented at prominent conferences and published in prestigious scientific journals. One of our greatest achievements is publication in IEEE Communication Surveys & Tutorials journal (IF 20,23) and an award for the best paper at ARES conference. We have also contribute to new standard preparations (GA4GH Passport and AAI) and reference architecture (NATO IST-152). In future, we plan to make software results from the KYPO project available under free license.

SECURITY RESEARCH

In 2019 we worked on:

4

projects of Ministry of Interior CZ

2

projects of Ministry of Education, Youth, and Sports

2

projects of Technology Agency CZ

3

international H2020 projects
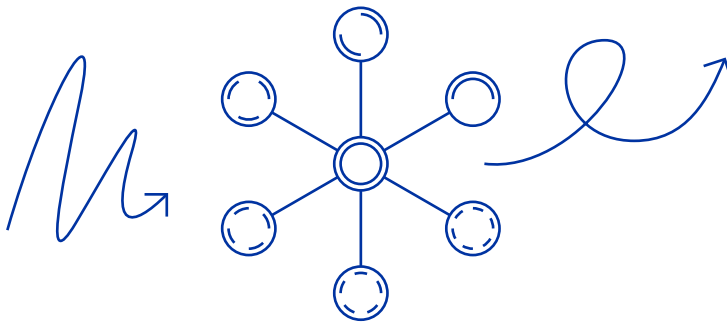
COLLABORATION OUTSIDE OF THE UNIVERSITY

We collaborate with security teams in our region and share with them our know-how. We cultivate our cooperations with National Cyber and Information Security Agency (NÚKIB) and CESNET association. We play a key role in the CESNET coordinated eIDAS activity, where we design and deliver solutions for qualified certificate management and remote signing for public universities. We began a cooperation with Open cities group, providing secure authentication and authorization for public sector.

INFORMATION AND PRESENTATION SYSTEMS

We create modern information and presentation systems for the university to make data management and communication between users secure and comfortable. We administer wide spectrum of financial and administrative agendas and take care of university's online presence. We ensure that the individual parts of the system are secure and user friendly. We cooperate with other universities and partners on national and international level.

WHAT WE DO

- The MUNI Portal for employees
- Digitizing and optimizing the MU financial and administrative agenda
  - Coordinating the operation and development of the Magion information system
  - Operating and developing INET, the financial and administrative intranet
- The university-wide editing system for creating websites
  - Operation and development of the Umbraco editing system and the website and newsletter modules in MU's unified visual style that it supports
  - The creation and administration of modular websites (for the university, faculties, departments, workplaces, conferences, projects, and others)
  - Development of custom websites and website components
- Map applications and the GIS Kompas website
- Information systems and registries for ministries (of education and health)

THE MUNI PORTAL — EVERYTHING IN ONE PLACE

In 2019, for university's centennial, we launched a first version of the MUNI Portal and started a pilot run. The Portal serves as a central access point for all of the university's important information sources and communication systems. It also facilitates information delivery, sharing, and search. We continued to map out and transfer information from faculty web to the Portal structure and develop its applications.
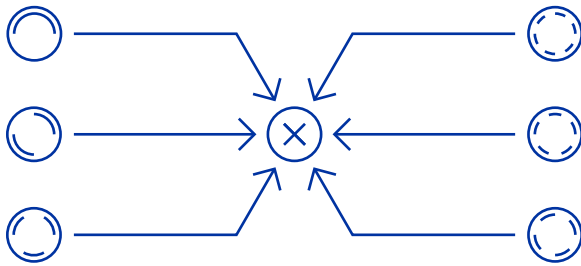
IN 2019 WE HAD

891
active EIS Magion users

15
new items in EIS Magion catalogue of functionalities

27,000
active INET users

990
active Kompas users

656
active WebCentrum Users

### 1,400,000
visitors to www.muni.cz

525
active users of university student registry

EIS MAGION AND INTER-UNIVERSITY COOPERATION

We coordinate a MagNet network of 7 universities that cooperate on developing the Magion system. The network also closely works on shared projects with another 18 universities that run the iFIS and SAP finance systems. In 2019, we focused on e-Sick Leave, mandatory record keeping, and finally, on covering schools' administrative needs as user access management, linking employee training records with eLearning system, and project statement processing. The cooperation among universities in the area of information systems is shielded by the EUNIS-CZ association, where we have a representative on the executive committee.

WE ARE LOOKING FOR A NEW FINANCIAL SYSTEM

Aiming to specify requirements for a new financial system for the university, we have conducted several technological market consultations. We focused on providers with open API systems, to ensure the users will be able to access the system functions via the INET interface. We processed technological profiles of 3 key EIS and the next consultation round will be focused on resolving concrete case studies.
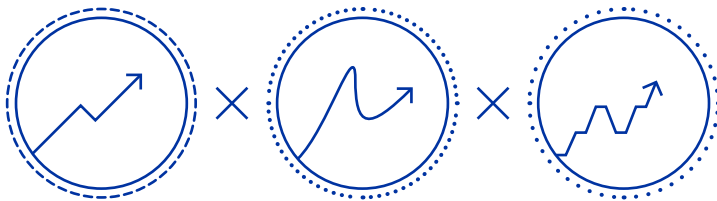
INET MU AND E-OFFICE

We develop the Czech-English system INET that focuses on digitizing financial and administrative university agenda using data and functions from EIS Magion and other systems. In 2019, we added to INET a complex support of e-Sick Leave, and newly a system for submitting and approving of creative leave requests. We have also significantly changed the process of stock-taking of real property with barcode readers and the Inspection System. We launched a pilot version of a system for submitting and approval of changes to labor relations. Additionally, the creation, approving and signing of financial contracts, the monthly attendance records registry in HR, and the drafting and approving of remuneration in wage management were all switched into routine operation. We have received a 2nd place award in category TREND of prestigious Fair Sourcing Awards for our Central Purchases application.

INET

1,300,000
saved documents

74 %
of documents from digitalized agendas was handled electronically

142,000,000
annual turnover in the SUPO cashless payment system

3,478
electronic job applications accepted

GEOGRAPHIC SYSTEMS FOR MUNI

We administer and develop map library Munimap, web GIS Kompas, and Portal for ArcGIS designed to search and visualize real property and technical facilities at MUNI. All these applications are accessible through Geoportal MU navigation site. In 2019 we launched a new Fire Protection module in Kompas, new points of interest were added to Munimap and virtual tours to Geoportal. Furthermore, Portal for ArcGIS was made available to allow students and employees to create their own maps and map applications, display prepared outputs in mobile devices, and add information in the field.
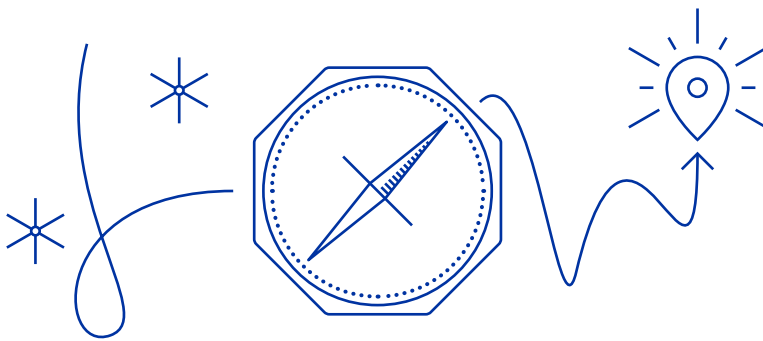
MAPS AND GIS

2,100
maps are daily created in Munimap

WEBCENTRUM WEB KIT

The WebCentrum was built using the Umbraco editing system and it uses data from the university's internal systems. It offers a wide range of constructional components for web and newsletter creation. In 2019, we focused on constructional component accessibility and methodology of web design and creation. Several new webs came into existence, especially for MUNI100 anniversary, web for faculty of education, medicine, natural sciences, social studies, as well as, for other units of university. We also began a wide migration of faculty webs from individual departments and institutes into the WebCentrum.

WEBCENTRUM

77
new webs created

656
editors

369
webs administered

19,500
web pages in total

WE MAINTAIN INFORMATION SYSTEMS FOR MINISTRY OF EDUCATION

Contractually, we maintain and develop 7 information systems for Ministry of Education. These include, among others, University Students Registry, Associate Professors and Professors registry, and Artistic Outputs Registry. In 2019, we made several changes and expansions to the systems according to relevant grant requirements, and various one-off special outputs per request.
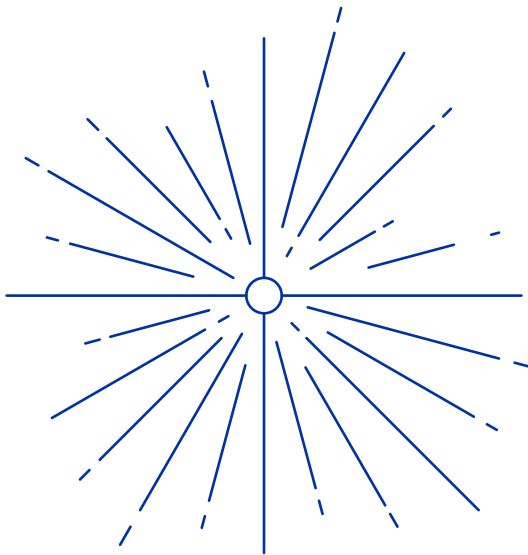
MEYS SYSTEMS
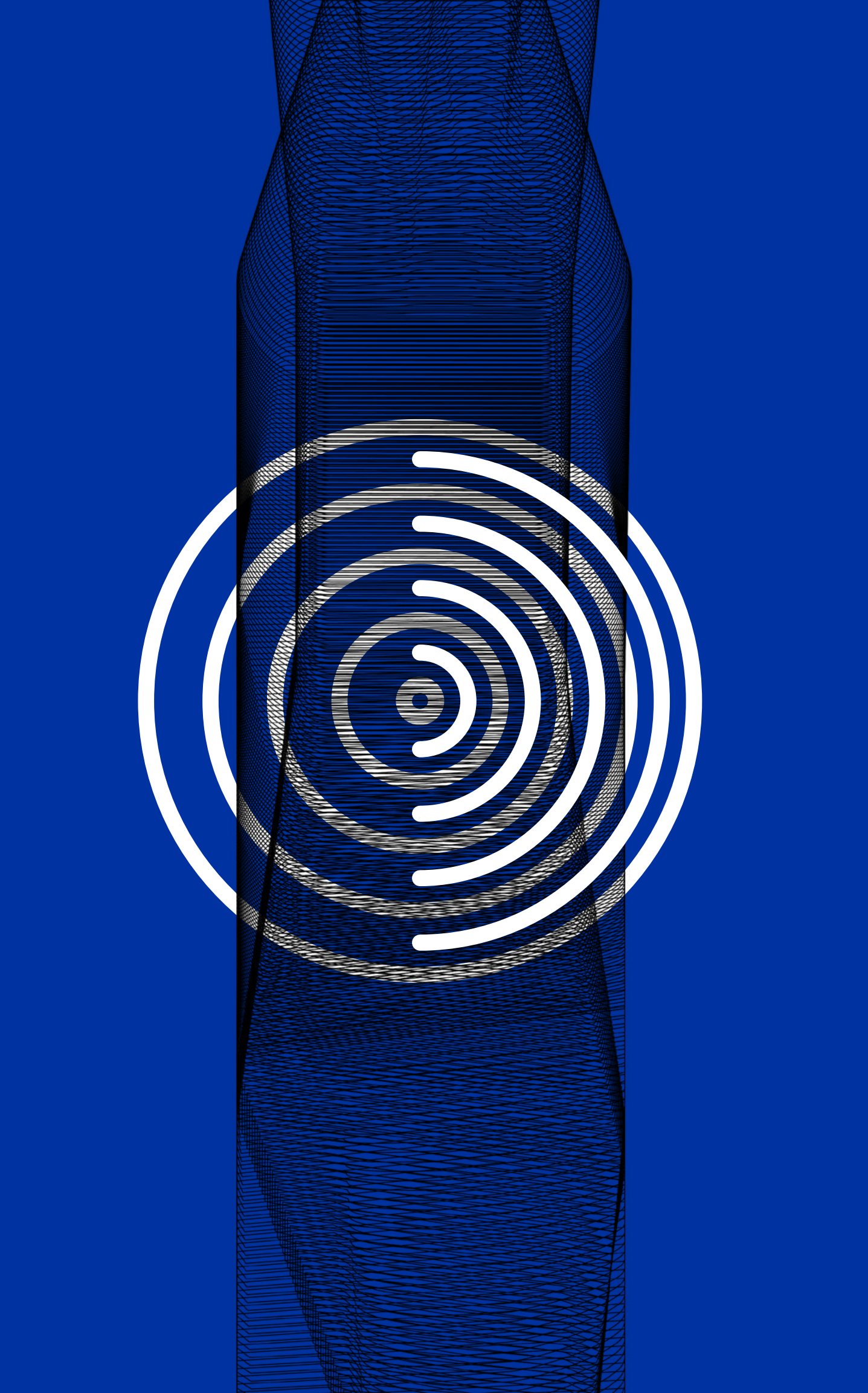
We maintain databases for

82

universities

The databases contain

3,100,000

studies in total

OPEN DIGITAL SCIENCE

Alongside the MUNI libraries, we provide the finest information background and services to support science, research, and education at the university. We cooperate on international, national, and university levels to implement open digital science, focusing on open access to scientific publications and research data.

WHAT WE DO

- Manage university's involvement in Open Science (open scientific publications and FAIR research data)
- Data management and security support for research teams
- Coordinate development of the university library network using the MU Library Information Centre (KIC MU)
- Operation, management, and development of university-wide library technologies
- Provide librarians with methodological leading and training
- Procure electronic information resources (EIR) for research, instruction, and education at the university
- Implement technologies for effective accessing and using of DIS
- Digitizing and creating digital libraries
- Coordination of library projects and consortiums

REVAMPED LIBRARY SYSTEM AND E-RESOURCES PORTAL

We have developed and put into operation a new user interface for MUNI library system. The interface is based on VuFind, an open-source tool, and is accessible at katalog.muni.cz. It offers a more effective search options and information detection.

Simultaneously, we have improved portal ezdroje.muni.cz, which contains detailed data about all electronic information resources available to MUNI users. We have especially simplified remote access to licensed e-resources from devices out of the university computer network.

COOPERATION LEADS TO FURTHER COOPERATION

Together with the National Library of Technology, the institute initiated a creation of a working group of academic libraries that aims to prepare a new generation of library platform project within OP JAK. This new library platform should replace outdated library systems and enable integration of print, electronic and digitized information resources, as well as insure a more effective interlibrary cooperation.

CZECHELIB COOPERATION EXPANSION

We coordinate MUNI's involvement in National Centre for Electronic Information Resources CzechELib. Last year, we have negotiated MUNI's affiliation to several new information consortiums. Currently, we are providing 67 packages of e-resources via CzechELib, for which we received a financial support of 18 million CZK in 2019.

THE MUNI COORDINATED LIBRARY SYSTEM

15
main libraries at MU (8 central faculty libraries, 2 special libraries, 5 branch libraries)

1,733 824
physical library units in the stocks of MU libraries

30 743
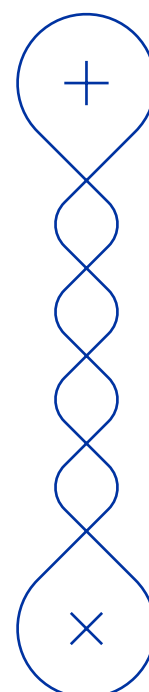new physical library units in 2019

27 550
registered users borrowed

585 391
books in 2019

WE HAVE ACCEPTED THE MUNI OPEN ACCESS CHALLENGE

Thanks to project OP VVV HR4MUII, we have prepared a concept to revitalize Open Access at MUNI and prepare for a new university strategy in Open Science. Among other, the project asks for staff increase and casting the Open Access manager position.
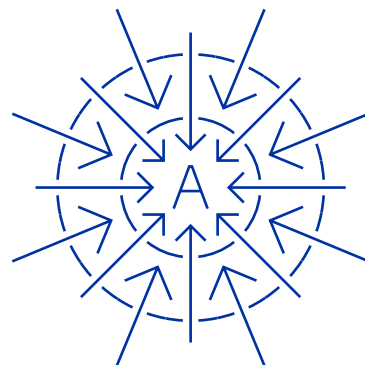
SUPPORTING RESEARCHERS IN THE FIELD OF RESEARCH DATA

We have established an active cooperation with several research groups at MUNI (e.g. RECETOX, CEITEC, FSS, FI) to prepare and implement plans for data management. Especially their saving, storing, and sharing according to FAIR principles.

NATIONAL AND INTERNATIONAL COOPERATION IN OPEN SCIENCE

As a national coordinator, we took part in the OpenAIRE project (among others, as members of the Research Data Management Taskforce) and prepared MUNI's involvement in the newly formed OpenAIRE Legal Entity. We participated in the meetings with working group for implementation of Action Plan for National Open Access Strategy in the Czech Republic and prepared a questionnaire for the Czech Repository Survey.

ELECTRONIC INFORMATION RESOURCES
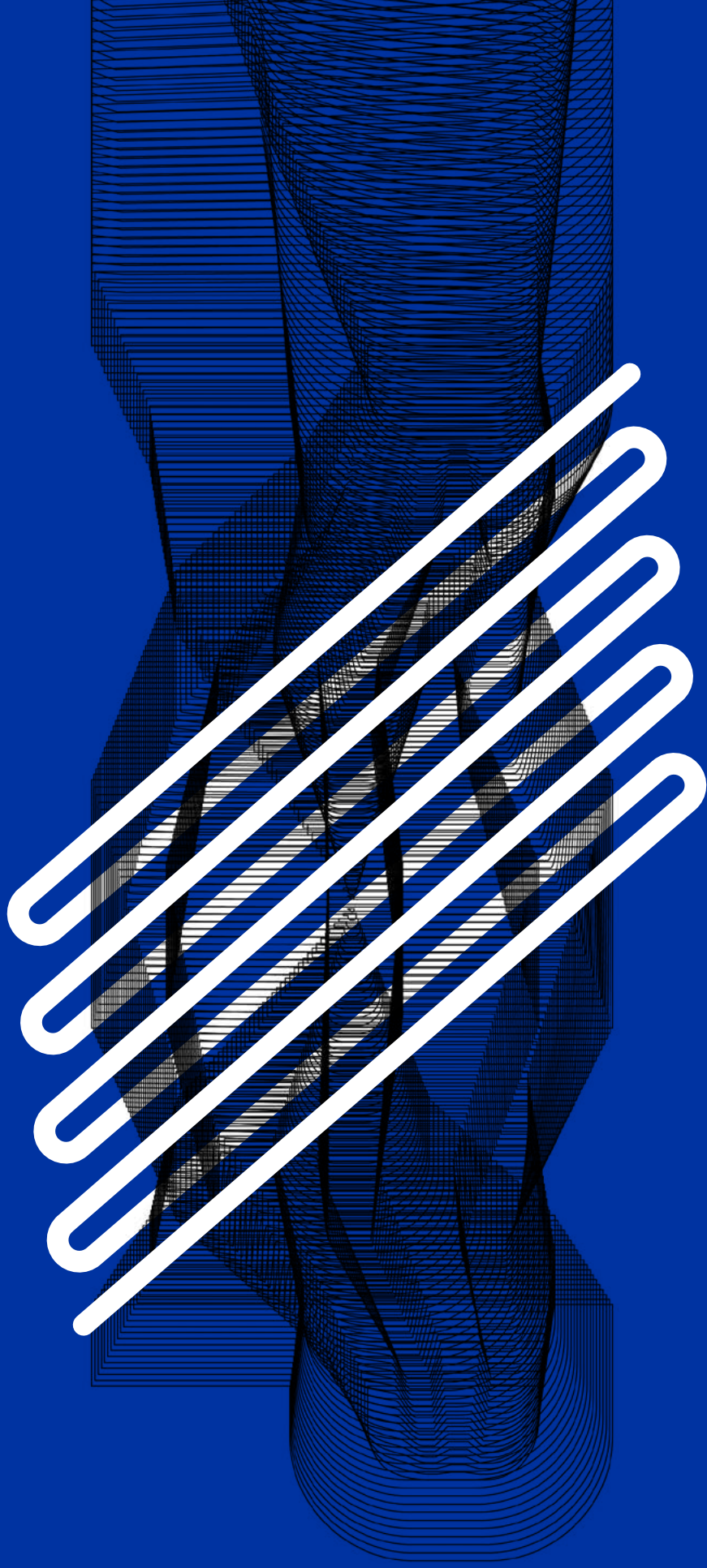
144
packages of licensed EIR accessible to MUNI users

27 600
e-journals

266 000
e-book titles

55,400 000
CZK cost of EIR for MUNI in 2019

FINANCE, HR, AND PROJECTS

EMPLOYEE STRUCTURE

	Elementary education	Secondary education	Bachelor degree	Master degree	Ph.D.	CSc.
Manual workers	3	—	—	—	—	—
Specialists	—	12	7	75	12	1
Proffesionals	—	—	—	8	11	—
PostDoc	—	—	—	—	1	—
Administrative workers	—	1	3	15	—	1
Technical workers	—	10	—	4	—	—
Associate proffesors	—	—	—	—	2	1
Proffesors	—	—	—	—	—	1

INCOME AND EXPENSES (IN CZK)

Non-investment activity	2015	2016	2017	2018	2019
Educational activity 1111/2112	96,997,000	96,500,000	96,197,000	105,817,000	110,050,000
Educational activity CF 1112 [1]	41,093,000	42,715,000	39,170,000	29,700,000	53,946,000
Institutional support R&D	1,977,000	2,612,000	3,094,000	4,985,000	5,272,000
Total	140,067,000	141,827,000	138,461,000	140,502,000	169,268,000
Total non-investment budget of ICS [2]	294,285,000	271,225,000	262,706,000	266,002,000	297,459,000

	2015	2016	2017	2018	2019
Total ICS employees [3]	130	126	128	144	149
Number paid from 1111	102	102	99	102	103

Non-investment income	2015	2016	2017	2018	2019
Projects & instrumental funds, including FISP	42,453,000	38,135,000	49,121,000	92,406,000	92,932,000
Economic activity	23,737,000	26,859,000	32,885,000	27,109,000	25,748,000
Total	66,190,000	64,994,000	82,006,000	119,515,000	118,680,000

Investments: from funding, IDP and FRFA	2015	2016	2017	2018	2019
Buildings, networks, easements	5,318,000	4,852,000	4,080,000	6,863,000	1,304,000
Software, licenses, machines, equipment	39,064,000	28,225,000	43,621,000	58,465,000	115,027,000
Total	44,382,000	33,077,000	47,701,000	65,328,000	116,331,000

	2015	2016	2017	2018	2019
ICS net income	2,994,000	4,963,000	2,841,000	3,662,000	3,896,000

[1]   CF does not include payroll expenses

[2]   including write-offs

[3]   on average

PUBLIC CONTRACTS

	Number	Won (in CZK)
Above-threshold, open-call	5	42,443,000
Above-threshold, without prior publication	—	—
Sub-threshold, open-call	—	—
Sub-threshold, SSP	8	31,209,000
Sub-threshold, without prior publication	—	—
Small-scale public contracts	7	9,677,000
Total	20	83,329,000

PROJECT OVERVIEW

Domestic Projects

Project name	Type of project	Income ICS
Harmonizace EIS s požadavky legislativy 2019 v síti vysokých škol	MEYS development project	765,000
Digitalizace MU 2019	MEYS other funded project	1,000,000
ÚVT — Příspěvek na IP 2019	MEYS development project	474,196
Zvýšení kyberbezpečnostního povědomí na MU	MEYS development project	545,000
MUNI4students	MEYS OP RDE	765,493
Revize a harmonizace lokál. záhlaví — fáze 2018	VISK Ministry of Culture	399,000
CERIT-SC VI	MEYS Large Infrastructures	10,150,000
ELIXIR-CZ OP VVV	MEYS OP RDE	2,767,730
CERIT-SC OP VVV	MEYS OP RDE	7,353,695
C4e OP VVV	MEYS OP RDE	6,789,543
HR4MU	MEYS OP RDE	289,079
Vícečásticové kvantové provázání a bezpečnost (MULTIQUEST)	GA CR LA projects	975,000
NAKI ARCLib	NAKI Ministry of Culture	950,000
Simulace, detekce a potlačení kyber.hrozeb (KYPO2)	Ministry of Interior	7,233,828
Sdílení a analýza bezpečnostích událostí v ČR	Ministry of Interior	1,298,202
Výzkum nástrojů pro hodnocení kybernetické situace — CRUSOE	Ministry of Interior	3,059,519
Komplexní analýza a vizualizace heterogenních dat	Ministry of Interior	1,758,014
Detekce narušení obranného perimetru pomocí změny polarizace optického signálu	Ministry of Interior	1,831,546
ELIXIR-CZ VI	MEYS Large Infrastructures	2,882,000
Integrovaný aktivní monitorovací systém pro pacienty s externími kardiostimulátory	TA CR Epsilon	1,116,000
Výzkum a vývoj pokročilých analytických nástrojů (ITOA)	TA CR Epsilon	1,014,000
IoT senzor koncentrace CO2	TA CR Epsilon	1,296,000
Inteligentní senzory pro měření a analýzu cloudového prostředí	TA CR Epsilon	1,008,000
Zpřesnění molekulárně mechanických potenciálů léčivům podobných molekul MPM	GA CR	686,000
Wearable IoT	MEYS EUREKA CZ	250,000
Zvýšení odborné kvalifikace kyberbezpečnostního týmu MU	FR Cesnet	51,000
Total		56,707,845

Foreign Projects

Project name	Type of project	Income ICS
Senter	EU-Ostatní komunitár. progr.	1,573
LIVE_FOR	EU-Ostatní komunitár. progr.	14,614
ELIXIR-EXCELERATE	H2020-RIA	1,207,522
West-Life	H2020-RIA	−47,337
EOSC Hub	H2020-RI	496,019
OpenAire	H2020-RI	507,954
Edirex	H2020-RI	3,928,805
CONCORDIA	H2020-RIA	5,361,375
SAPPAN	H2020-IA	6,975,751
EOSC-Life	H2020-RIA	15,420,677
EJP RD	H2020-RIA	157,460
CINECA	H2020-RIA	2,008,975
ConcePTION	H2020-RIA	190,794
Total		36,224,182

ORGANIZATIONAL STRUCTURE

MANAGEMENT

prof. RNDr. Luděk Matyska, CSc.   Director
Ing. Martin Veselý   Deputy Director for Strategy
  and Service
doc. Ing. Otto Dostál, CSc.   Vice-Director for Research
  and Development
JUDr. Dana Šrubařová   Bursar

RNDr. Miroslav Bartošek, CSc.   Head of
  Cybersecurity and Data Management Division
RNDr. Jana Kohoutková, Ph.D.   Head of Information
  Systems Division
Bc. Tomáš Zeman   Head of IT Infrastructure Division
Mgr. Kamil Malinka, Ph.D.   Head of IT Services Division

DIRECTOR'S COUNCIL

prof. RNDr. Luděk Matyska, CSc.
Ing. Martin Veselý
doc. Ing. Otto Dostál, CSc.
JUDr. Dana Šrubařová
RNDr. Miroslav Bartošek, CSc.

RNDr. Jana Kohoutková, Ph.D.
Bc. Tomáš Zeman
doc. RNDr. Petr Holub, Ph.D.
Mgr. Kamil Malinka, Ph.D.
RNDr. Tomáš Rebok, Ph.D.

Mgr. Břetislav Regner
Mgr. Michal Vičar
Ing. Filip Janovič, Ph.D.

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doc. Ing. Otto Dostál, CSc.
prof. RNDr. Ladislav Dušek, Ph.D.
doc. RNDr. Petr Holub, Ph.D.

EXTERNAL MEMBERS
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prof. RNDr. Ing. Michal V. Marek, DrSc., dr. h. c.
  CzechGlobe AV ČR
Mgr. Vladimír Rohel   NAKIT, s. p.

ICS management, Secretariat
- CERIT-SC
- C4e
- Project Department

IT Services Division
- University Computer Centre
- IT Service Desk
- Support and Service Department
- Public Relations Department

IT Infrastructure Division
- Analysis and Cooperation
- Automated Infrastructure Systems
- Data and Technical Networks

Information Systems Division
- Project and communication coordination
- Information Systems Administration
- Information Systems Development

Cybersecurity and Data Administration Division
- Data security and management
- Security team — CSIRT-MU
  - Secure Digital Identities Group
  - Proactive Security Group
  - Incident Response Group
- Library-Information Centre

Operational and Economic Division
- Financial and Administrative Office
- Technical and Operational Office
- Investment and Public Tender Office
- Personnel and Wage Department

COLLABORATION BETWEEN ICS AND PARTNERS

MINISTRY AND STATE INSTITUTES

- Academy of Sciences CZ Library
- Ministry of Education, Youth and Sports
- Ministry of Defence
- Ministry of the Interior
- National Agency for Communication and Information Technologies
- National Cyber Security Centre
- National Cyber and Information Security Agency
- National Library of the Czech Republic
- National Library of Technology
- Police of the Czech Republic
- Institute of Health Information and Statistics of the CR

PROFESSIONAL INSTITUTIONS AND ORGANIZATIONS

- CEITEC
- CESNET
- EUNIS-CZ National Association
- ELIXIR-CZ
- GÉANT — TF-CSIRT
- EGI
- Institutes of the Academy of Sciences of the Czech Republic
- Masaryk Memorial Cancer Institute
- Moravian Library

COMMERCIAL AND INDUSTRIAL PARTNERS

- ArcData Praha, s. r. o.
- ČEPS, a. s.
- Flowmon Networks a. s.
- Magion System, a. s.
- PragoData, s. r. o.
- Y Soft Corporation, a. s.
- Mycroft Mind
- SVS FEM s. r. o.
- Comprimato Systems s. r. o.
- SWC InTech s. r. o.

INTERNATIONAL PROJECTS PARTNERS

- University of Utrecht (NL)
- Science and Technology Facility Council (UK)
- Centro Nacional de Biotecnología (ES)
- Instituto Nationale di Fisica Nucleare (IT)
- University of Torino (IT)
- EurOPDX (international consortium)