INSTITUTE OF COMPUTER SCIENCE

Masaryk University

Annual report

2015

Punctum lacrimale
Plica semilunaris
Caruncula
Punctum lacrimale
Openings of tarsal
glands

Table of Contents

Anterior lingual gland

Lingual nerve

Art. profunda linguæ

Vena com. n. hypoglossi

Longitudinalis inferior

Plica fimbriata

Vena com. n. hypoglossi

Frænulum

Orifice of submax. duct

Plica sublingualis

Introduction

In 2015 the Institute of Computer Science continued to work closely with all of Masaryk University's offices and divisions on the efficient use of information technology for their further development. The Institute administers the University's entire top-level e- infrastructure and offers a very broad portfolio of related services.

We continued to work closely with the academic community. The Institute was involved in planning Research, Development, and Education Operational Programme projects, where in cooperation with the submitters we assessed the potential impact of these projects on the University's e-infrastructure, which will enable the rational planning of its growth in future years.

Through involvement in projects funded by the internal MU Grant Agency we bolstered research collaboration with MU faculties; thanks to projects funded by the Czech Science Foundation and the Technology Agency of the Czech Republic we developed collaborative efforts with other Czech universities and with various institutes of the Czech Academy of Sciences. H2020 projects helped further foster international cooperation within the ELIXIR EXCELERATE project, where we share responsibility for IT services for the biological sciences.

The CERIT-SC center provides the University with a unique knowledge base for using powerful IT systems in research and teaching; this national e-infrastructure has funding until 2019, which, among other things, has fully covered the costs of sustaining outputs of projects funded by the earlier R&D for Innovations Operational Programme.

In 2015 we opened the KYPO Cyber Exercise & Research Platform, which is capable of simulating any e-infrastructure and attacks made against it. In cooperation with the Czech National Security Authority, the Cyber Czech 2015 training event was held, and we continued to work closely with other state security forces. A series of projects focused on cybersecurity were successfully completed, and several new projects that will move research in this field forward and improve its quality were planned or began running. The RemSig system for securely working with personal certificates and digital signatures was launched.

The University system for creating websites that adhere to MU's uniform visual style was further developed. The University acquired a platform through which it is possible to quickly create high-quality websites with little operating costs and its deployment on the University's cloud-based infrastructure guarantees easy access and professional support.

The ICS also oversaw a complete overhaul of the telephone system and in the process opened the way for new communication technologies, including videoconferencing.

All of the ICS's activities in 2015 were aimed at improving the effective introduction and use of information technology at Masaryk University.

prof. RNDr. Luděk Matyska, CSc.
director

Deltoideo-
pectoral
glands

Axillary glands

Supratrochlear
gland
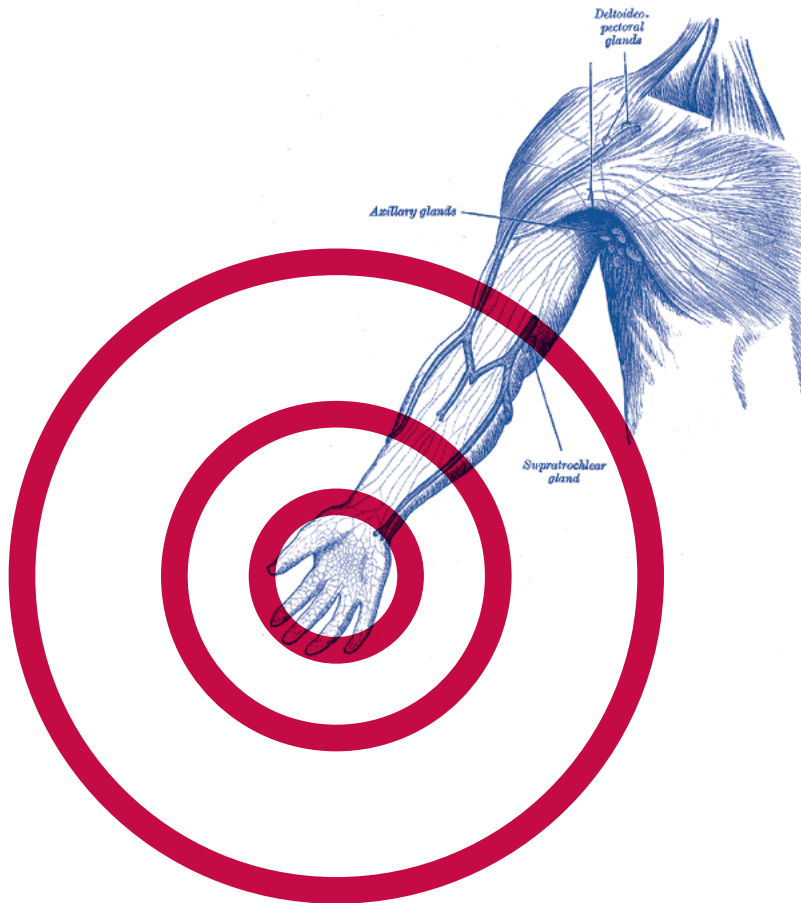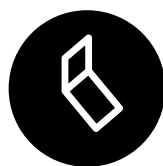
User Support

What we do

- Technical user support
- Specific IT solutions (non-standard use, development, ...)
- IT procurement consultation
- Seminars for academic and non-academic staff

Key events in 2015

- Involvement in preparations for Research and Development for Education Operational Programme projects, focused on their interaction with ICT
- Expansion of the electronic user support system
- Custom IT solutions for various university units

Helpdesk

In 2015 we continued working on the consolidation process we began the previous year. Users may contact a universal user support e-mail address, helpdesk@ics.muni.cz, or a single telephone number, (549 49) 7722; the request is passed to the right team. We also launched a new issue tracking system and introduced internal mechanisms for assessing issue severity in order to determine appropriate response times to each user issue. The most frequent issues are related to the following:

- VPN, Eduroam
- E-mail and calendars   Telephones
- Computer and software settings and configurations

Further, the issues of HR and economic systems are tracked in a dedicated helpdesk application in INET.

In 2015 we handled

750

complex issues, which required cooperation of multiple people at the ICS
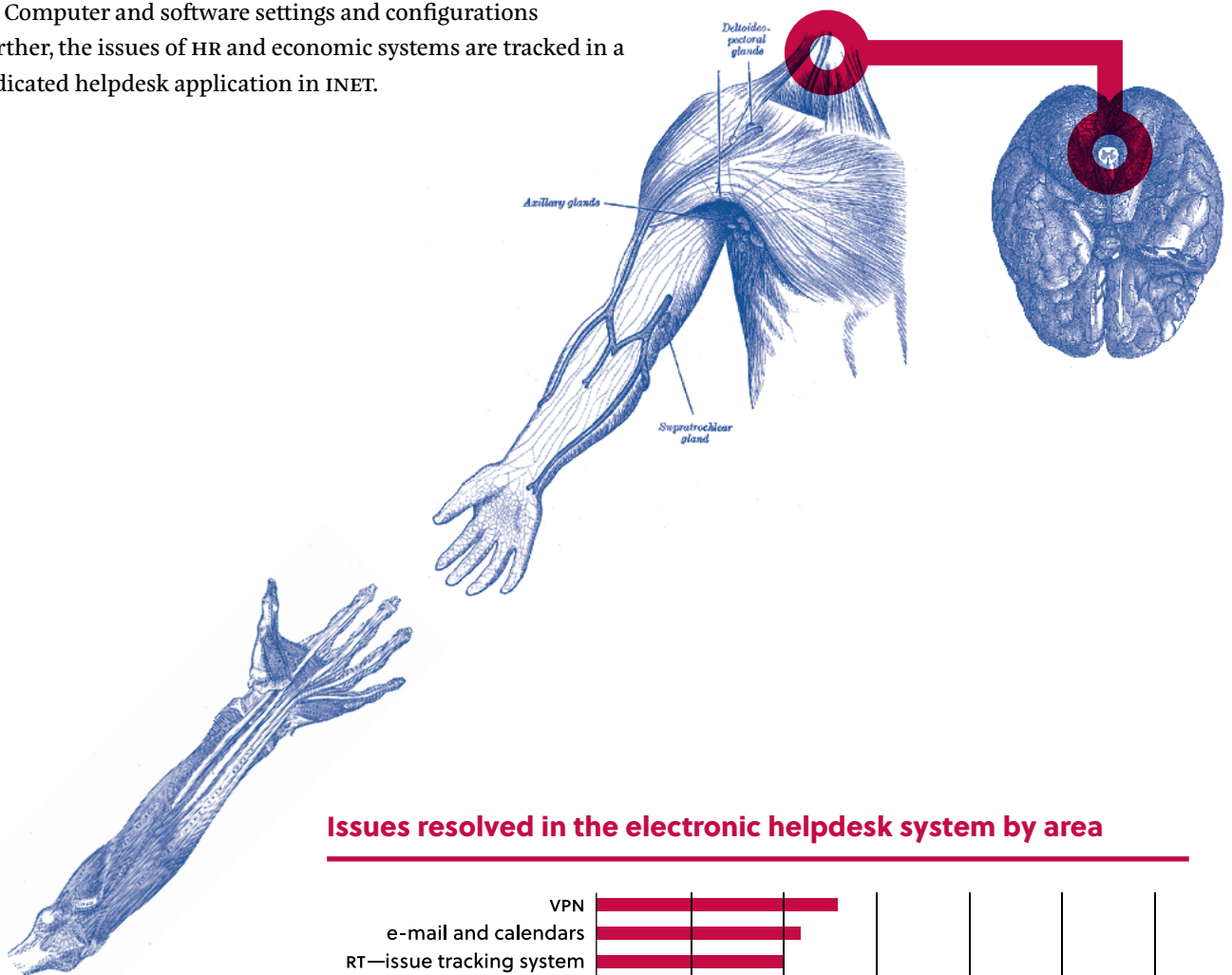
Issues resolved in the electronic helpdesk system by area

Area	Percentage
VPN	~13 %
e-mail and calendars	~11 %
RT—issue tracking system	~10 %
telephones	~8 %
adjusting computer settings	~8 %
computer repair and installation	~6 %
storage	~4 %
printing	~4 %
licenses and software	~3 %
handover of task to other department	~3 %
computer rooms	~1 %
SUPO	~1 %
other issues	~27 %
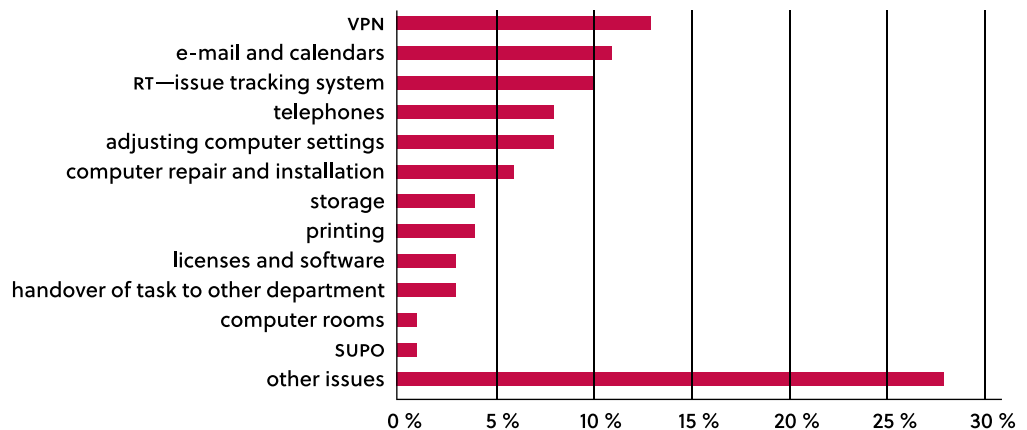
1,389

the number of University employee computers we support. Now with support for the English-version of Windows 7
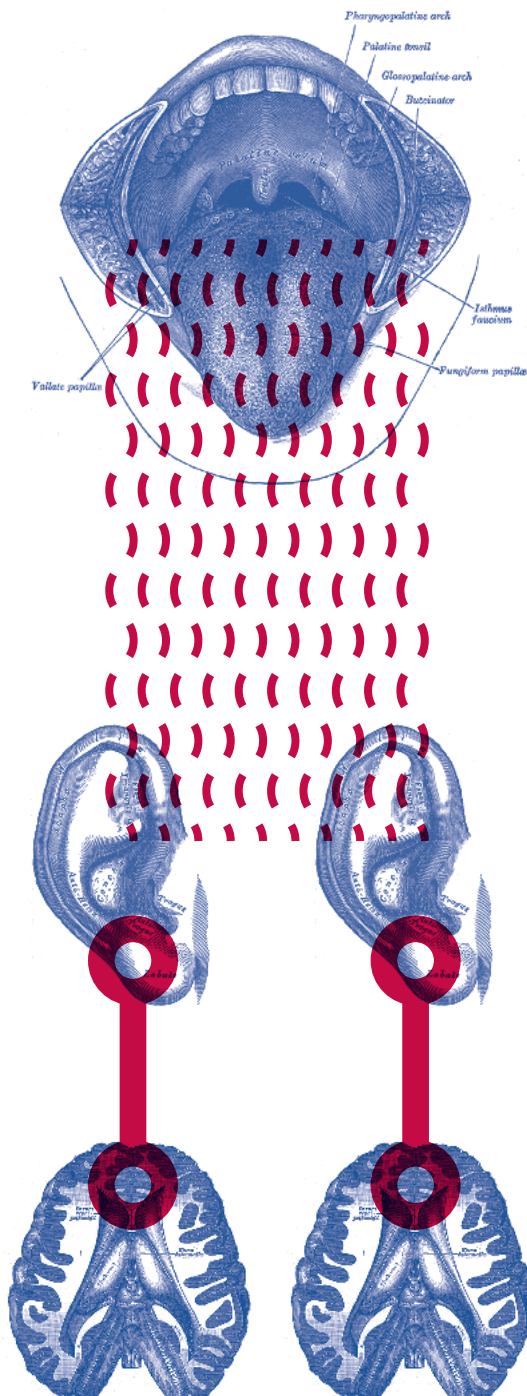
Consultation on MU's e-infrastructure development

According to a decision of the University management, starting from 2015 every large project proposal (especially those funded by the R&D for Education Operational Programme) is discussed with ICS in advance in order to evaluate its potential impact on the University's e-infrastructure. Therefore, the IT needs of the projects are covered appropriately, while we are able to adapt the overall plans of the e-infrastructure development accordingly.

Staff seminars and training

- In cooperation with the CESNET association, we held the traditional Grid Computing Seminar for Masaryk University academic workers, this time focused on bioinformatics.
- For staff of the University units, where ICS is involved in maintenance and management of ICT, and for ICS employees as well, we held 18 practical seminars focused mainly on improving the use of common office applications (e-mail, data storage, MS Word, MS Excel). On average, 15 people attended each seminar. The seminars were also recorded for future reference.
- In cooperation with the Czech NSA, we tested the skills of selected government workers at the first national technical cybersecurity training course CyberCzech 2015.
- Twenty representatives of the Police of the Czech Republic (Special Operations Unit, Organized Crime Unit, and the Institute of Criminalistics Prague) took part in a three-day training course on processing and analyzing large volumes of heterogeneous data (using ElasticSearch and Kibana).
- For MetaCenter and CERIT-SC users we held off-site practical training at the Czech Agricultural University in Prague, which was also attended by people from the University of Economics, Prague.

Customized IT solutions

Standard solutions may not always match the specific needs of some user groups. In these cases we look for customized solutions, while still leveraging as many existing components as possible. In 2015, we approached in this way the following collaborations (among others):

- **A database of sensitive data for studies in the Multimodal and Functional Imaging Laboratory (MAFIL)** — we designed a balanced solution ensuring secured access to the database while not raising unacceptable obstacles for its use.
- **The Cancer Genome Archive (TCGA)** — configuration of computing clusters was extended with encrypted storage, allowing the processing of data there while not violating the security-related license terms of the dataset.
- **The CELSPAC-TNG study biobank** — we modified, extended, and deployed the LAS (Laboratory Assistant Suite) system to meet the needs of the study, in particular to follow the specific workflow of the hospital laboratory smoothly.
- **Installing Mascot on a cloud computing platform** — cloud installation, completely transparent to the user, provides better performance by using the most powerful hardware, therefore fully utilizing the expensive software licenses.

Sharing know-how

Foreign IT workers

In April 2015 the second annual Masaryk University Staff Training (MUST) Week was held; this week-long training course was focused on IT. Ten university representatives from seven European countries attended a total of eleven lectures.

University IT employees

We hold regular meetings with the IT employees from each University faculty and office. We provide them with current news and immediate plans, and we discuss their current needs on the university IT together.

10

the number of R&D for Education Operational Programme projects we have provided ICT advice for
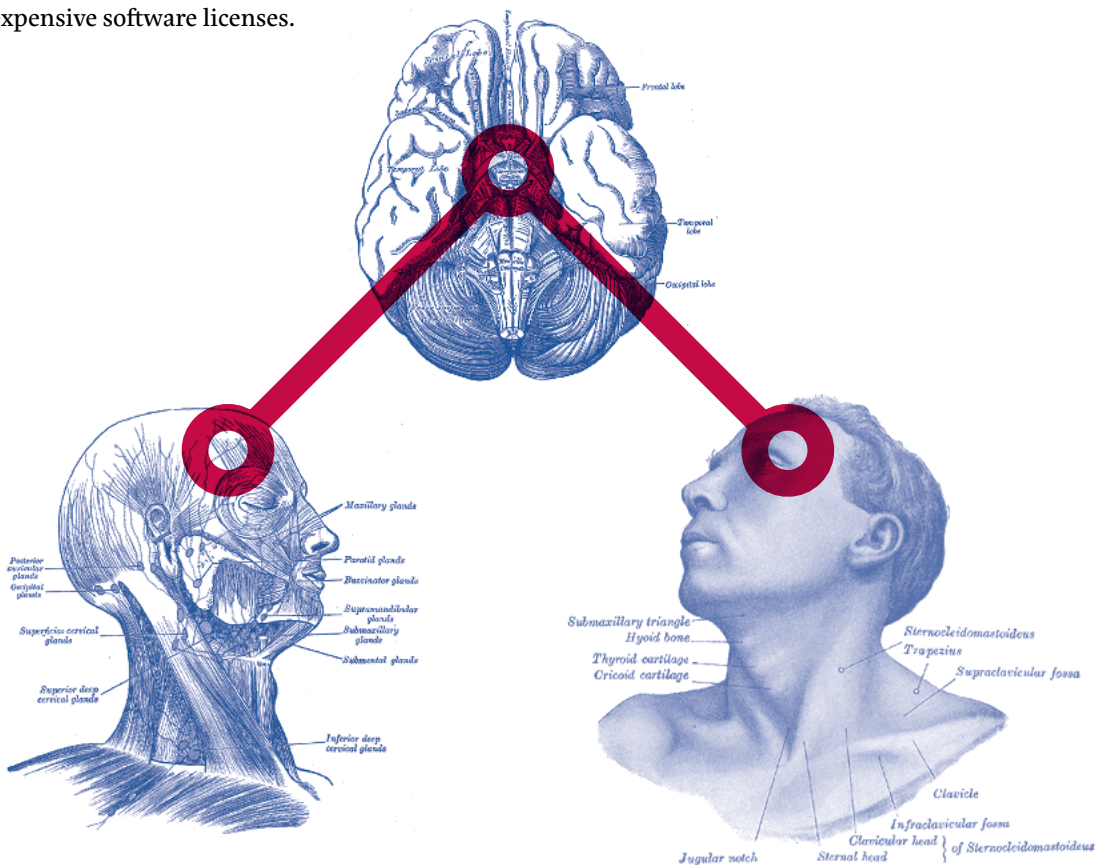
Personal Administration and the Electronic Office

What we work on

- Optimizing and providing electronic access to economic and administrative processes
- Providing Internet access through the Eduroam and Muni Wi-Fi networks
- Access to internal University resources through virtual private network (VPN)
- Administration of the University e-mail gateway
- Photographing and creating student and employee ID cards
- Providing University software licenses
- Access and security system administration in University buildings

Key events in 2015

- Obtaining a blanket license for MS Office on University computers and on employees' and students' private devices
- INET electronic Signature Book for mobile devices
- Ensuring framework contracts for procuring standard computer equipment
- Connecting the CEITEC information system to the university identity
- Operation of new photocenter at the Faculty of Sports Studies

Personal electronic office in INET

We have been working on building personal e-office capabilities in INET since 2000. Its central elements include:

- A directory of personal applications that offers a structured overview of the main "office" applications intended not only for employees.
- A signature book that collects in one place links to various types of documents to be processed and which includes a notification and access management system. Since 2015, the Signature Book has also been available for Android devices.

We are gradually translating the e-office applications into English, so that foreigners working at MU can use it. In 2015, for example, we made the Project Proposal Editor in ISEP available to English-speaking users.

15

comprehensive economic and administrative tasks in the Signature Book

145,385

documents processed in the Signature Book

E-mail

We operate systems for receiving and sending e-mail, which include anti-virus scanning and spam detection. We use our own e-mail system, supplemented by Office 365 cloud services.
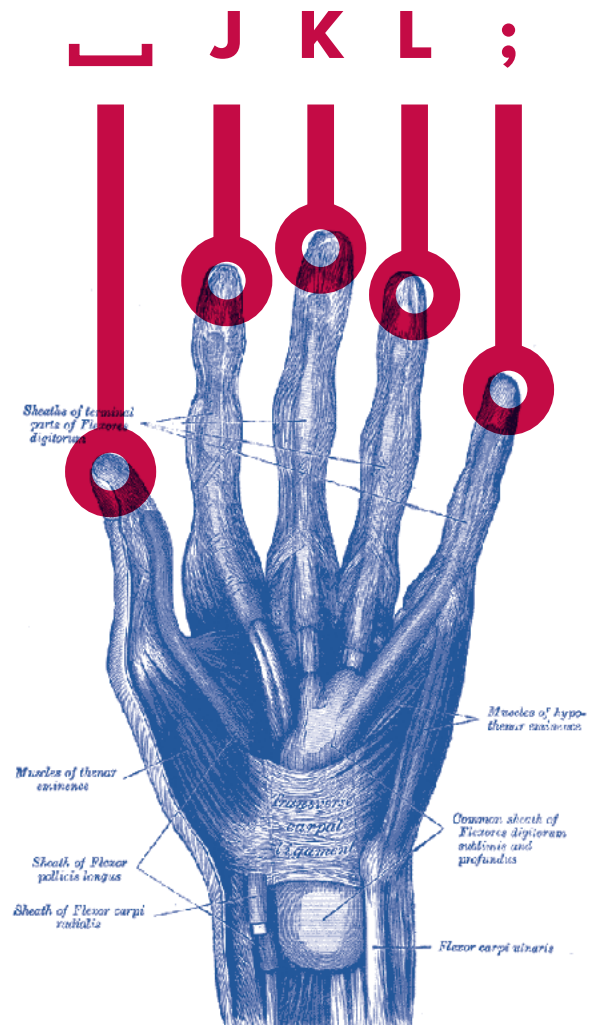
In 2015, we successfully delivered nearly
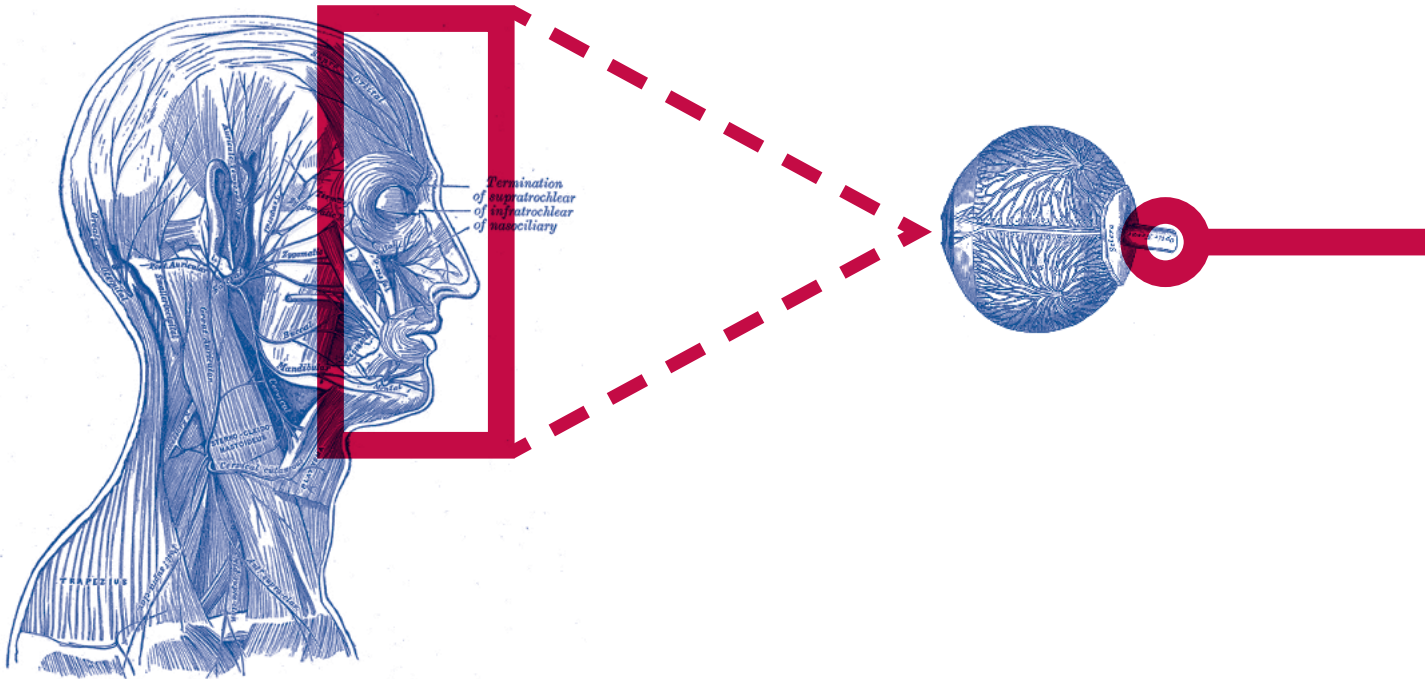
44,000,000

e-mails.

We rejected another

65,000,000

bad, virus-infected, and spam e-mails.

ID Card photographs and printing

We photograph students and employees for their ID cards and for information systems university-wide. During the summer enrollment period, we photographed incoming first-year students for the first time in University Cinema Scala, and we began issuing cards to external university library visitors. In 2015, the photocenter at the Faculty of Sports Studies began regular operations.

In total we photographed
8,680
people,

issued
11,000
ID cards,

and since photography began in 1999 we have acquired a bank of
152,000
photographs.

Eduroam

The eduroam Wi-Fi network was used by a total of
63,000
University employees, students, and visitors

VPN

6,900
Users connected through the Virtual Private Network more than
761,247
times

Licenses

MS Office

We oversaw the signing of an Enrollment for Education Solutions agreement with Microsoft, which permits us to install the latest version of MS Office, as well as older versions, on all computers owned by the University. This agreement also allows for all employees as well as students to use MS Office at home for free on up to five private devices.

Anti-virus programs

Just like every year, based on the needs of each faculty, we acquired licenses for Eset NOD32 Antivirus and Eset Smart Security anti-virus software for University computers. As a first, we also acquired nearly 1,000 licenses for the private home use of employees.

User system for logging in to on-line services (AAI)

We have been making it easier for University employees and students to access various online services—without having to create new accounts. Similarly, we have simplified access for non-University partners to University services. For example, in 2015 we connected the CEITEC information system to the central identity management system, which simplified the administration of internal users from Masaryk University as well as from partner institutions.

Framework contracts for computer equipment

In cooperation with the Rector's Office we have prepared a call for tenders for another round of framework contracts for desktop computers and accessories, notebooks, printers, and scanners. Thanks to this, standard equipment will be able to be purchased based on the University's current needs.
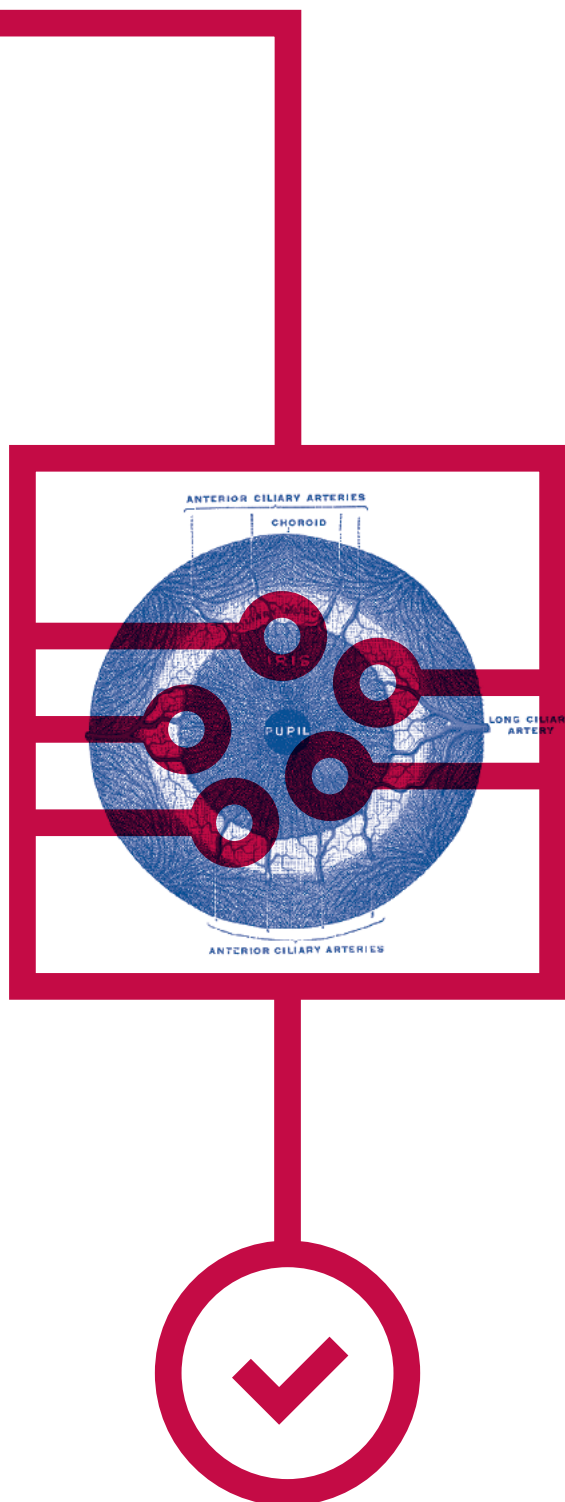
Science and Research / Study and Collaboration

What we work on

- **Science & Research at the ICS**
  - research supporting the development of IT infrastructure
  - interdisciplinary research with research partners
  - cybersecurity research
  - working with sensitive data
- **Study and Collaboration**
  - management of PC labs and related equipment (printers, SUPO)
  - non-stop access to the University Computer Centre (UCC)
  - ensuring access to electronic resources
  - providing lectures, seminars, and training sessions, as well as serving as thesis advisors
  - practical experience for students and their involvement in normal ICS operations

Key events in 2015

- Supporting academic research projects defined in the ESFRI Roadmap and the Roadmap of Large Infrastructures in the Czech Republic
- Direct involvement in national and international projects
- Significant growth in cooperating on interdisciplinary academic research
- Software licenses for supporting studies, including MS Office
- 154 computers replaced at the University Campus Bohunice, the Faculty of Social Studies, and the Faculty of Education

Science & Research at the ICS

Joint interdisciplinary research

We work together with research partners from the Czech Republic as well as from abroad in many scientific disciplines. In 2015, we worked on the following collaborative efforts:

Energy

In collaboration with the Global Change Research Institute of the Czech Academy of Sciences and the companies MycroftMind, a.s and Ness Czech, s.r.o., we proposed and developed a modular platform for providing specialized meteorological forecasts for the energy industry. As a result of the project, electric energy consumption models and generation forecasts for solar and wind power plants will be made more precise.

Climate models

In cooperation with the Global Change Research Institute of the Czech Academy of Sciences we are developing tools for transferring climate data between global models that have been developed in different countries (including the Czech Aladin model).

Biomedicine

- For the European-wide EurOPDX consortium dealing with multidisciplinary cancer research, we provided the IT infrastructure and centralized services.
- In cooperation with eight partner institutes from four countries we are planning the international SyDiMed (Syrian Digital Medical Imaging) project for supporting telemedicine, particularly in the field of medical imaging information.
- We are working on a platform for ensuring secure cooperation between medical facilities, research centers, and educational institutes for processing medical imaging information and related data.

We have contributed to writing

35

publications, of which

11
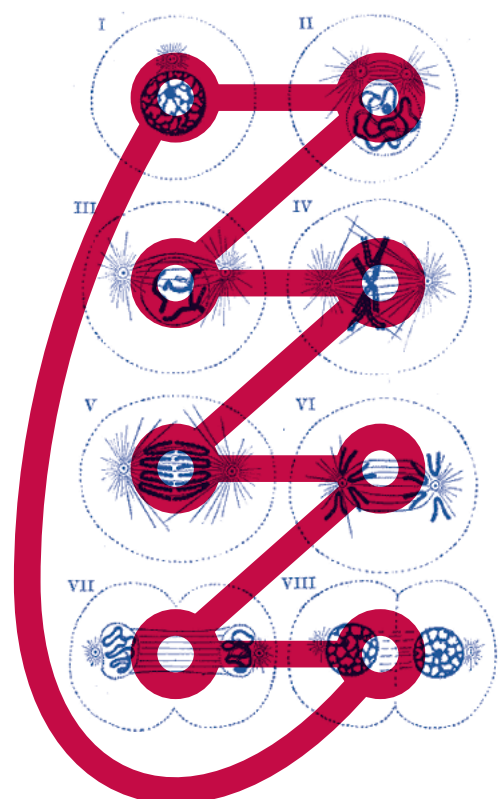
were in conference proceedings

8

were patents

4

were prototypes

3

were articles in academic journals with impact factor

- We have been building and operating secure infrastructure for supporting research activities at the CEITEC Center for Neuroscience. It includes, for example, a process for data acquisition from MRI equipment, reliable, long-term preservation, secure communication between cooperating medical institutes, and processing support for individual research projects.
- We have been working on modeling soft tissue for many years. Findings are applicable in medicine: we are working with the University of Luxembourg to develop methods for modeling the soft tissue of the brain; with French partners (Institut Hospitalo-Universitaire and INRIA Nancy) we are developing tools for soft tissue modeling used in laparoscopy.
- With the Centre for Biomedical Imaging at the Faculty of Informatics of MU we are working on simulating chromatin structures in fluorescent microscopy, in which it is generally difficult to acquire reference data for validating various imaging analysis methods. Our goal is to propose a new procedure that will emulate the actual structure of chromatin within the cell's nucleus as well as its dynamics.
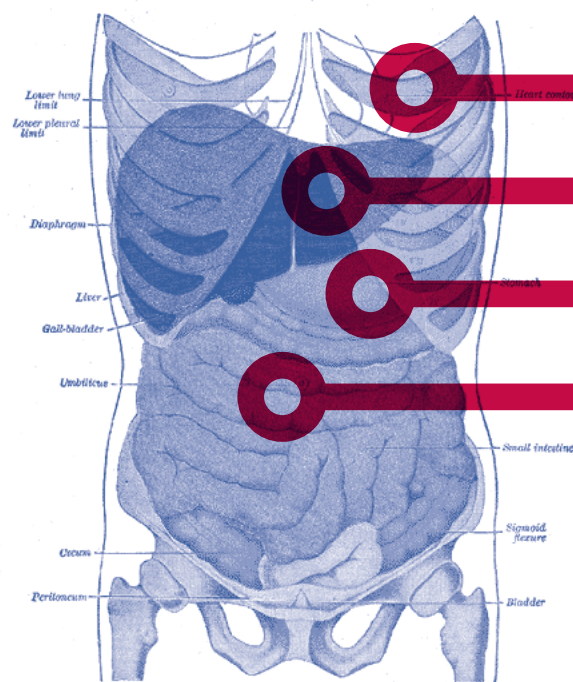
Bioinformatics

- In cooperation with the Research Centre for Toxic Compounds in the Environment (RECETOX) we developed and launched a LAS for keeping track of frozen samples at the University Hospital Brno.
- The international ESFRI project ELIXIR uses the Perun system that we developed and managed for identity management. As the IT partner of the Czech Republic's ELIXIR node, we provide computing, storage capacity, and tools for bioinformatics specialists involved in the ELIXIR project.

Computational chemistry and Structural biology

- In collaboration with the Department of Biochemistry and Microbiology of the University of Chemistry and Technology we are developing a digital metadynamic algorithm as part of the Simulation of complex systems with enhanced sampling project.
- We were involved in the work of an international consortium that planned the H2020 West-life project, which launched in November 2015. At the Institute of Computer Science we are responsible for coordinating and consolidating infrastructure operations. In particular, we are involved in developing tools for processing cryo-electron microscopy data.
- Work continued on an interdisciplinary project supported by MU's Grant Agency in which we are developing advanced methods combining NMR and SAXS experimental data processing in order to more accurately determine biomolecular structures in solution.

134,000,000 Kč

The value of electronic resource subscriptions at Masaryk University in the fields of medicine, healthcare, the natural sciences, and computer science in 2013—2017 that were purchased with funding from the R&D for Innovations Operational Programme.
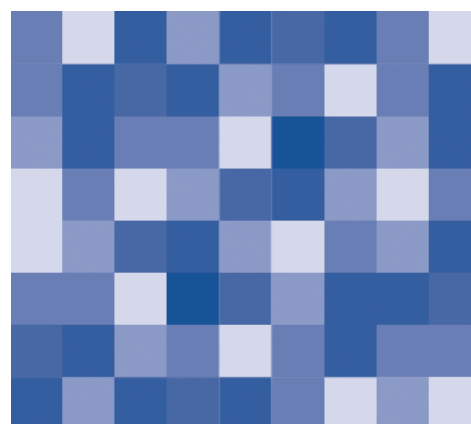
Materials physics

In cooperation with the Institute of Physics of Materials of the Academy of Sciences of the Czech Republic we are developing Elasthor, a tool for comprehensive and effective computation of the elastic reactions of non-textured multiphased polycrystalline materials.

Security — Big Data

- In cooperation with the CESNET association and the company Flowmon Networks we are developing tools for high-speed big network data processing. Tools capable of processing millions of events per second will enable extensive high-speed computer networks to be monitored in real time and will contribute to significantly decreasing reaction time to security incidents.
- For government and criminal justice authorities in 2015 we analyzed and demonstrated the possibilities of processing and interactively analyzing high-volume data (packet, e-mail, and other logs) using modern tools for processing big data, Elasticsearch and Kibana in particular. The outcome was the submission of a four-year research project funded by the Police of the Czech Republic focused on implementing a system for identifying complex connections (e.g., the behavior of identifiable subjects) in heterogeneous, high-volume data.

This year we were involved in

25

projects in total—5 international and 20 national, including work with the Ministry of Culture, the Ministry of the Interior, the Ministry of Defense, and the Czech Science Foundation.
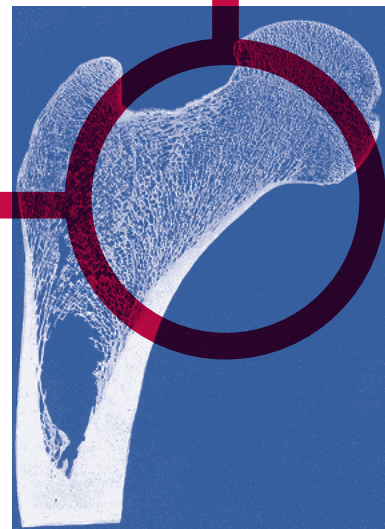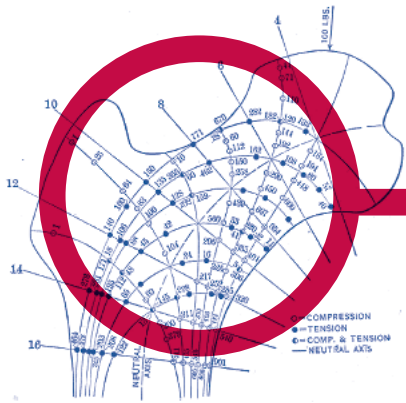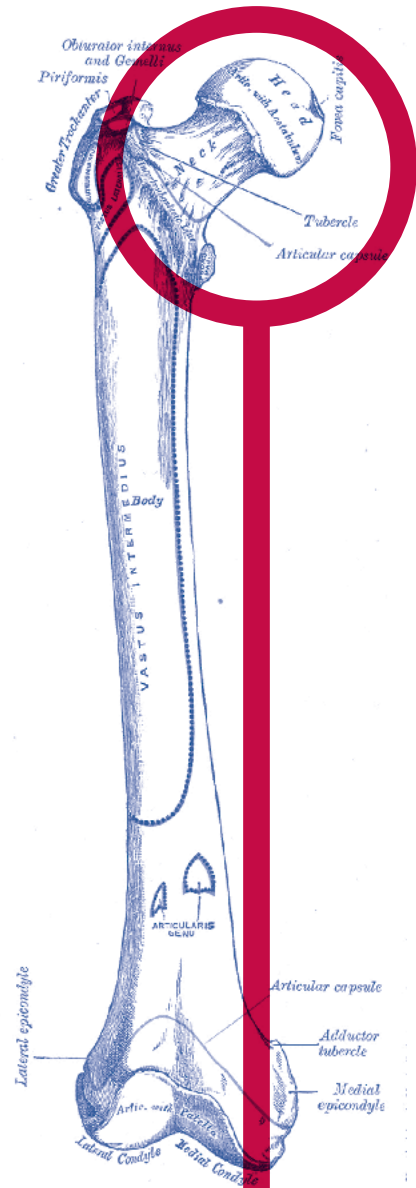
Study and Collaboration

Student support services

In 2015 we continued to provide support services to students. We have provided the following services for many years:

- photographing and printing ID cards
- Internet access via the Eduroam and Muni Wi-Fi networks
- University Computer Centre and other PC rooms
- access to electronic academic resources
- searching for books in University libraries and managing library user accounts
- administering the bydleni.muni.cz site for finding accommodation
- providing University software licenses
- support for ISIC-based payments
- thesis supervision for bachelor's, master's, and doctoral students
- providing opportunities for students to take part in research and become involved in normal ICS operations

University Computer Centre news

- improving Wi-Fi connectivity in all computer rooms
- new air conditioning units installed in the hallway between computer rooms
- test operation of a new version of the SafeQ5 student printing system

ICS staff's involvement in MU teaching activity and thesis supervision

68
courses taught by

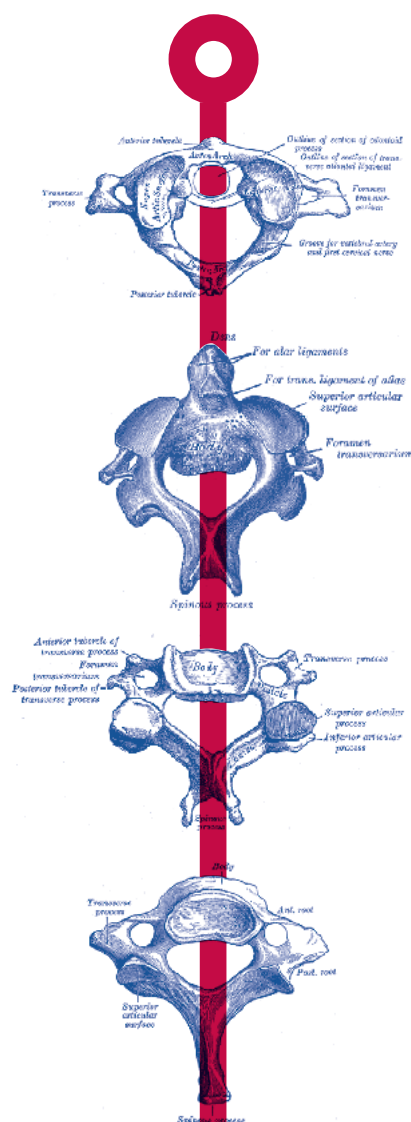**29**
ICS employees

154
theses supervised and

50
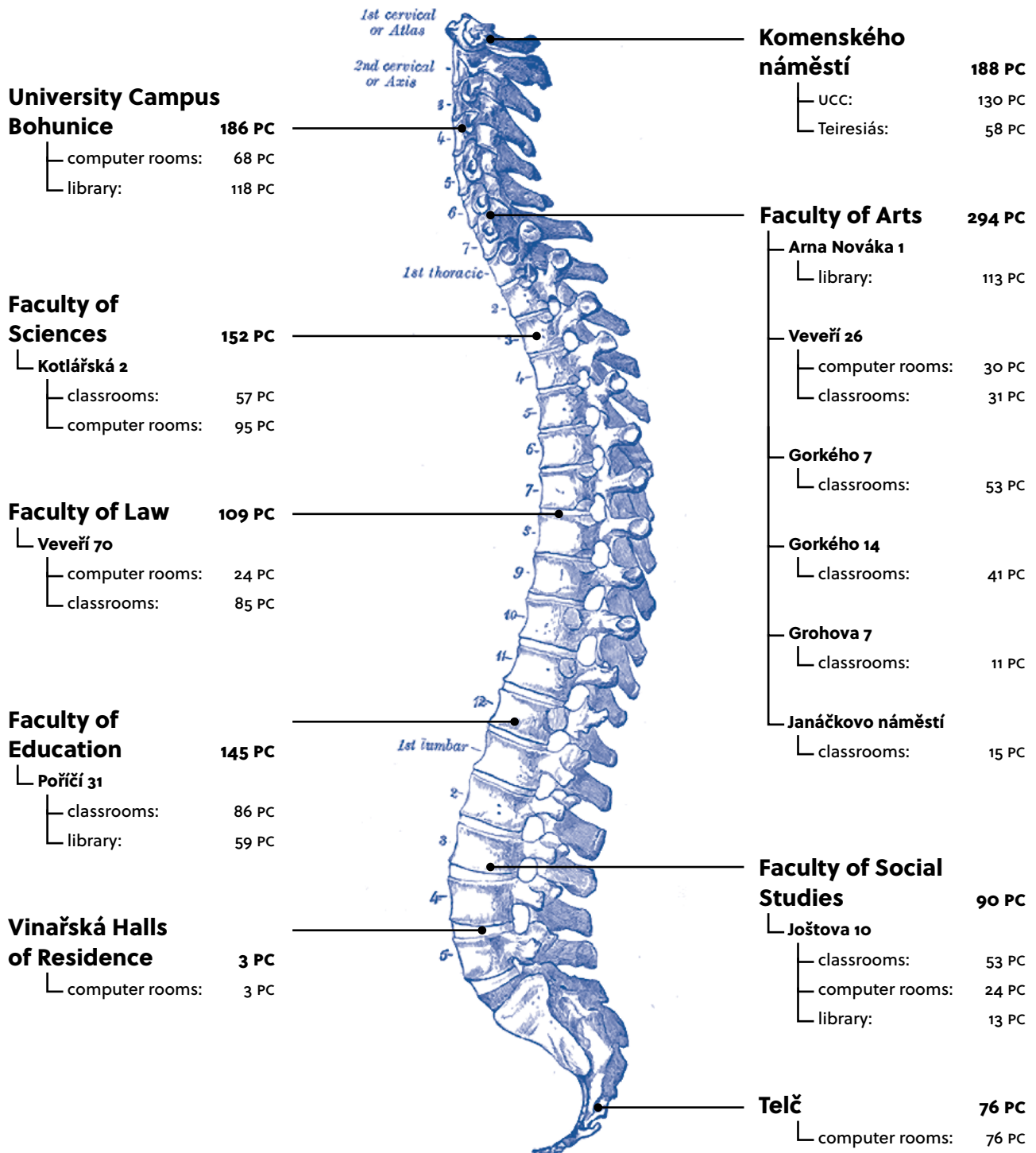thesis opponent reviews by our employees

11,900
students utilized UCC services in 2015 in

267,000
individual sessions. They printed 474,000 pages of the total number of 1,573,000 pages printed at all faculties.

An overview of PCs in MU computer labs managed by the ICS

University Campus Bohunice   **186 PC**
- computer rooms: 68 PC
- library: 118 PC

Faculty of Sciences   **152 PC**
- **Kotlářská 2**
  - classrooms: 57 PC
  - computer rooms: 95 PC

Faculty of Law   **109 PC**
- **Veveří 70**
  - computer rooms: 24 PC
  - classrooms: 85 PC

Faculty of Education   **145 PC**
- **Poříčí 31**
  - classrooms: 86 PC
  - library: 59 PC

Vinařská Halls of Residence   **3 PC**
- computer rooms: 3 PC

Komenského náměstí   **188 PC**
- UCC: 130 PC
- Teiresiás: 58 PC

Faculty of Arts   **294 PC**
- **Arna Nováka 1**
  - library: 113 PC
- **Veveří 26**
  - computer rooms: 30 PC
  - classrooms: 31 PC
- **Gorkého 7**
  - classrooms: 53 PC
- **Gorkého 14**
  - classrooms: 41 PC
- **Grohova 7**
  - classrooms: 11 PC
- **Janáčkovo náměstí**
  - classrooms: 15 PC

Faculty of Social Studies   **90 PC**
- **Joštova 10**
  - classrooms: 53 PC
  - computer rooms: 24 PC
  - library: 13 PC

Telč   **76 PC**
- computer rooms: 76 PC

1,243
computers for students under our management, which is

58 more
than last year––new computers were added at the Teiresiás center. The overall number also includes

154
older PCs we have replaced with newer models: 24 at the Faculty of Social Studies, 118 at the University Campus library, and 12 at the Faculty of Education.

Collaboration with students

In 2015 a total of 35 students collaborated with on research projects. Two examples of successful student involvement:

## Students' programming work has helped in interdisciplinary research

In an interdisciplinary project funded by MU's Grant Agency we developed a new computation method for processing experimental data (NMR and SAXS) in structural biology. But neither its use nor the interpretation of its output are straightforward. Nonetheless, bachelor's and Ph.D. students succeeded in proposing and implementing an intuitive web interface for entering data to be processed and visualizing its output. Thus, this new method can be used by a much wider user community and it can be published more easily. The seemingly mundane programming tasks undertaken by students thus helped capitalize on our interdisciplinary research work.

Thanks to a master's thesis, a tool for modeling air quality was developer

Based on a master's thesis, in collaboration with the Research Centre for Toxic Compounds in the Environment (RECETOX), we developed a tool for the iterative optimization of a system for modeling air quality, which should make already-known data about persistent organic pollutant concentrations in soils more precise. The application, which uses a numerical model for weather forecasting (Weather Research and Forecasting model, WRF) and an experimental version of a tool for modeling air quality and pollution (Community Multiscale Air Quality system, CMAQ), combines several optimization techniques and machine learning methods, whose aim is to make the outputs of the models more accurate and thus hasten the convergence of the entire modeling system's outputs with real measurements.

The result of this intensive cooperation between computer scientists and environmental researchers will contribute to specifying current gross estimates of soil system pollution, which will facilitate increasing the accuracy and reliability of all follow-up prediction processes.
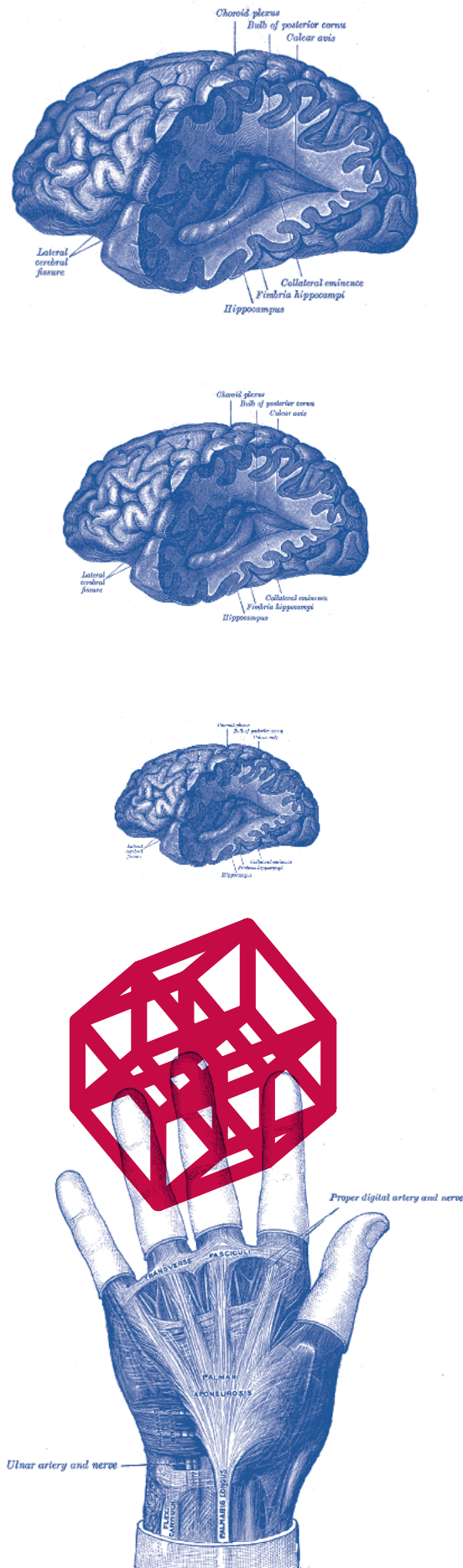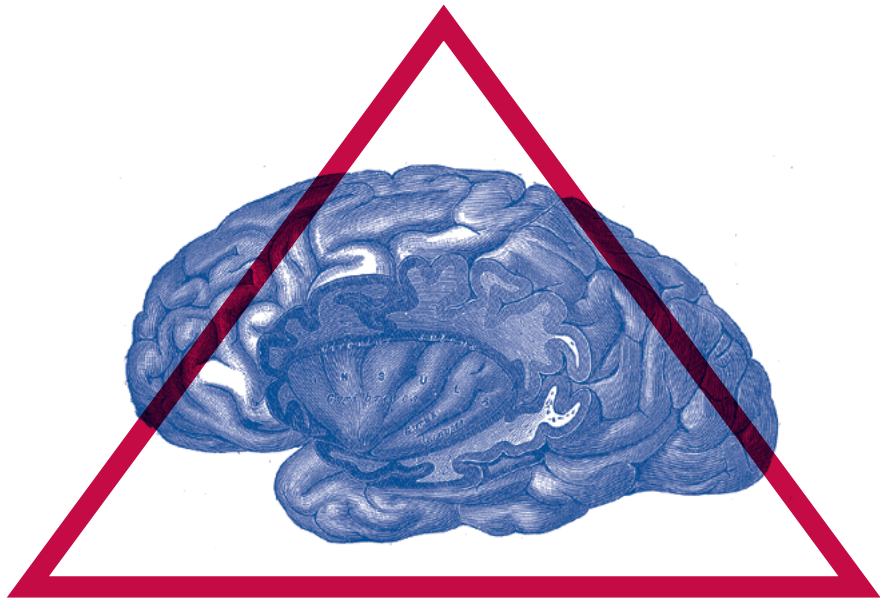
Top-level E-Infrastructure

What we work on

- Managing e-infrastructure and support services
- Optical network and wireless infrastructure
- University computer network administration
- University telephone network administration
- Caring for computational servers, data storage facilities, and application add-ons
- Providing computational servers and data storage capacity
- Custom solutions for users with special demands
- CERIT-SC Centre (research and development of flexible e-infrastructures)

Key events in 2015

- Overhauling and expanding the telephone network
- Boosting central server capacity and central data storage capacity
- Increasing standard storage limits to 100 GB per user
- Migration of research data to midsize storage
- Connecting economic information system servers and storage facilities to shared HW infrastructure by integrated SAN networks
- Migration of the Faculty of Medicine's central e-mail server to the central e-infrastructure
- Creating a platform for secure remote access to laboratory instruments at University Campus Bohunice

Communications Infrastructure

Telephone network

During the first half of 2015 we completed MU telephone network's transition to new technology. Considering the network's size and the limited time available, this was one of the largest telephone system migrations ever in the Czech Republic. Work included, among other things, the following:

The migration of more than

6,500

telephone branches

connecting more than

19,000

metal jacks

Starting

33

new telephone exchanges

all at

22

sites

After overhauling the University phone network, in the second half of the year we expanded it and adapted it to meet the current needs of the University. For this reason, we installed a new phone exchange at the Institute of Physics of the Earth of the Faculty of Science and moved phone lines from part of the Faculty of Arts to the newly reconstructed buildings on Arna Novaka and Joštova streets.
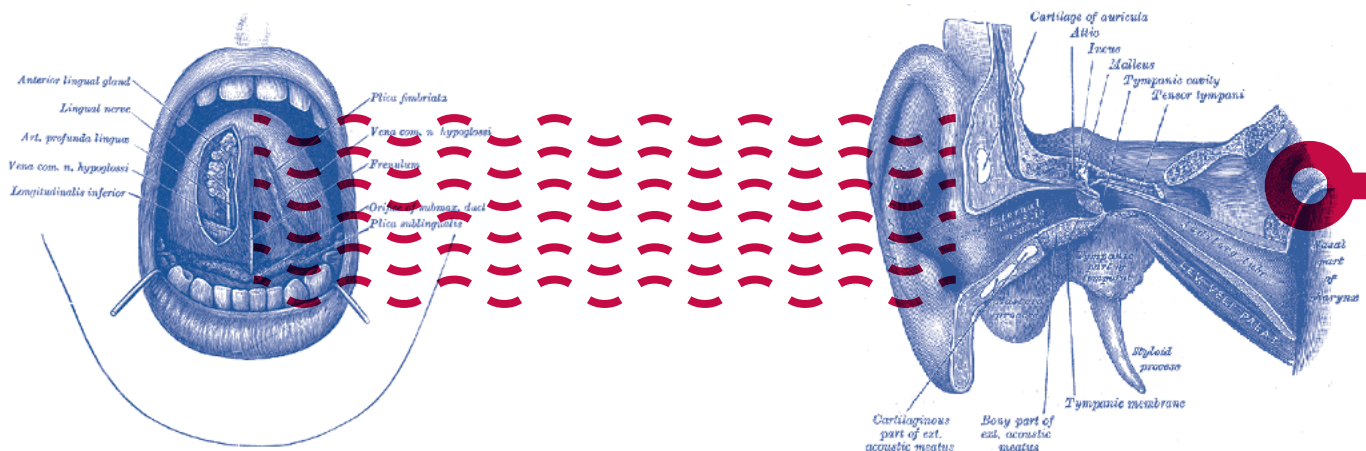
We took care of more than

900

issues concerning telephone extensions in INET

950

the number of mobile phones we switched to a new service provider in September 2015

University network

It is our mission to ensure a top-level network infrastructure that is up to par with the latest trends. That is why in late 2015 a call for tenders was made to procure new high-speed devices for strengthening MU's computer network backbone. These devices will increase data transmission capacity as well as support the deployment of state-of-the-art technology, i.e., software defined networking (SDN) allowing greater network flexibility and adaptability.

What did we work on in 2015?

- Completing the transition to a new distribution layer in the University network backbone by connecting nodes at the following Faculties: Education, Economics and Administration, Social Studies, Arts, and Sciences. All University facilities are now connected at a rate of 10 Gbit/s.
- Introducing IPv6: We have expanded the network connected through IPv6 to include the Faculty of Economics and Administration. We focused in particular on server rooms.
- Deploying a next-generation firewall for economic information systems and the University Computer Centre.
- Expanding the network to include sites at the Faculties of Law, Arts, and Education.
- Increasing network access at the Faculty of Arts through the dual connection of the main Faculty router to two backbone sites.
- Wi-Fi: Expanding Wi-Fi coverage (80 new access points) at nearly all University sites, in 2015, for example, at the Faculties of Science and Art and at the University Centre Šlapanice.
- Replacement of network monitors and consolidating them at backbone devices, which will lead to more effective network monitoring.
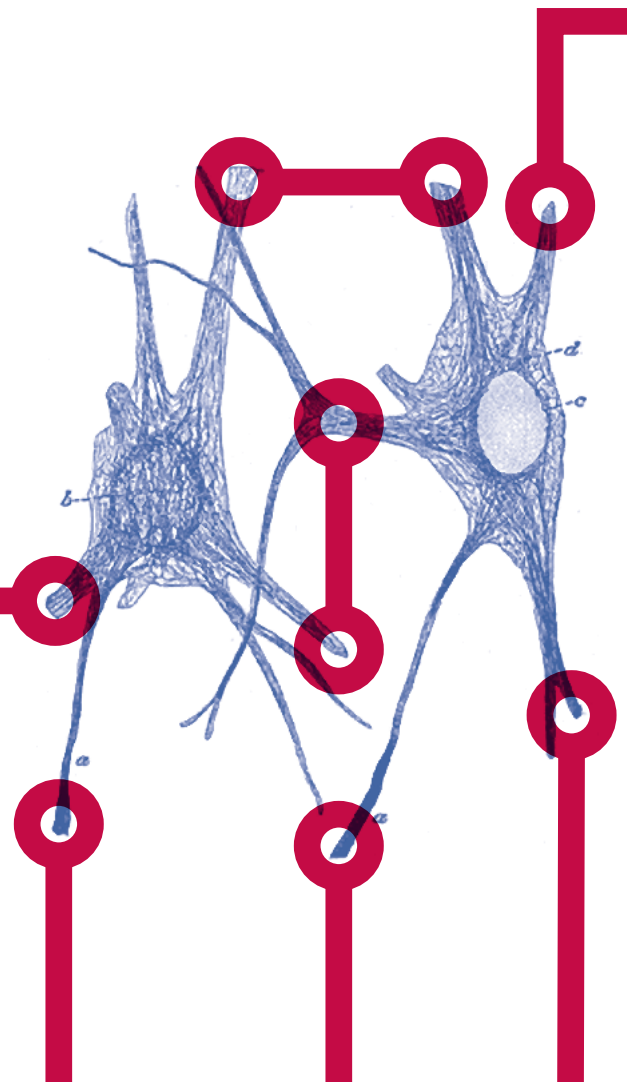
420

routers and switches under our management

21,000

network ports under our management, of which 9,000 with a speed of 1 Gbit/s

910

wireless access points under our management

Optical network

In 2015 we continued work on building the University optical network, which benefits users with its faster and more stable Internet connectivity. To make the University sites connection more robust, we have introduced redundant connections at the following sites:

- The Faculty of Economics and Administration, Lipová
- Vinařská Halls of Residence
- The Faculty of Education, Poříčí
- Connection point for the Institute of Biostatistics and Analyses on Poštovská Street (part of MU)

In the future we also plan redundant connections for the Faculty of Social Studies on Joštová Street and the Faculty of Law on Veveří Street.
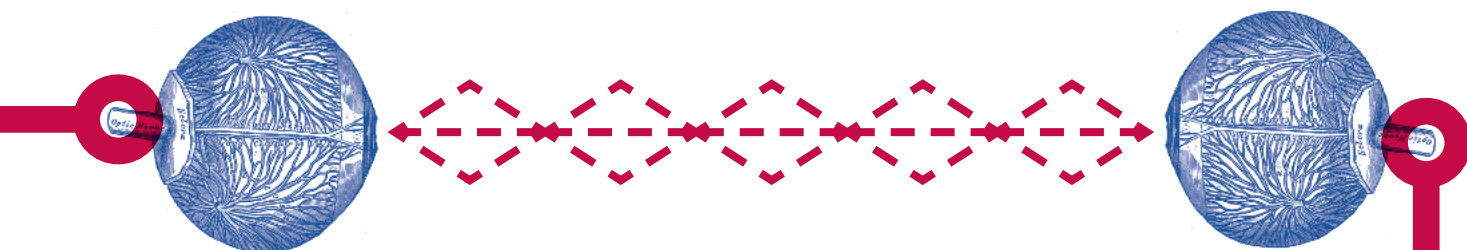
The MU Computer Network

185

connected sites

On average

22,722

communicating devices (PCs, laptops, mobile phones) were connected to the network

MU's fiber-optic backbone network

70 km

of underground optical lines

10 km

of above-ground optical lines

120 km

cabels

13.5 km

cabels

Computational Infrastructure

- In 2015 we boosted central server and storage capacity. Thanks to this we could increase the standard storage limit to 100 GB per user.
- Alongside increasing performance and capacity of the University's e-infrastructure we also continued to integrate University economic information systems into a shared cloud-based infrastructure.
- Specifically, information system servers and storage centers were connected to shared HW infrastructure through a storage area network.
- We also oversaw the migration of important servers to the central e-infrastructure; for example, we migrated the Faculty of Medicine's central e-mail server and the servers monitoring the optical infrastructure, part of which involved connecting a secondary GSM modem to send outage reports via text message, which increased the entire system's robustness.

468
the number of virtual servers we have hosted

of which
126
at the request of various faculties

Expansion of infrastructure in 2015 to include
19
servers
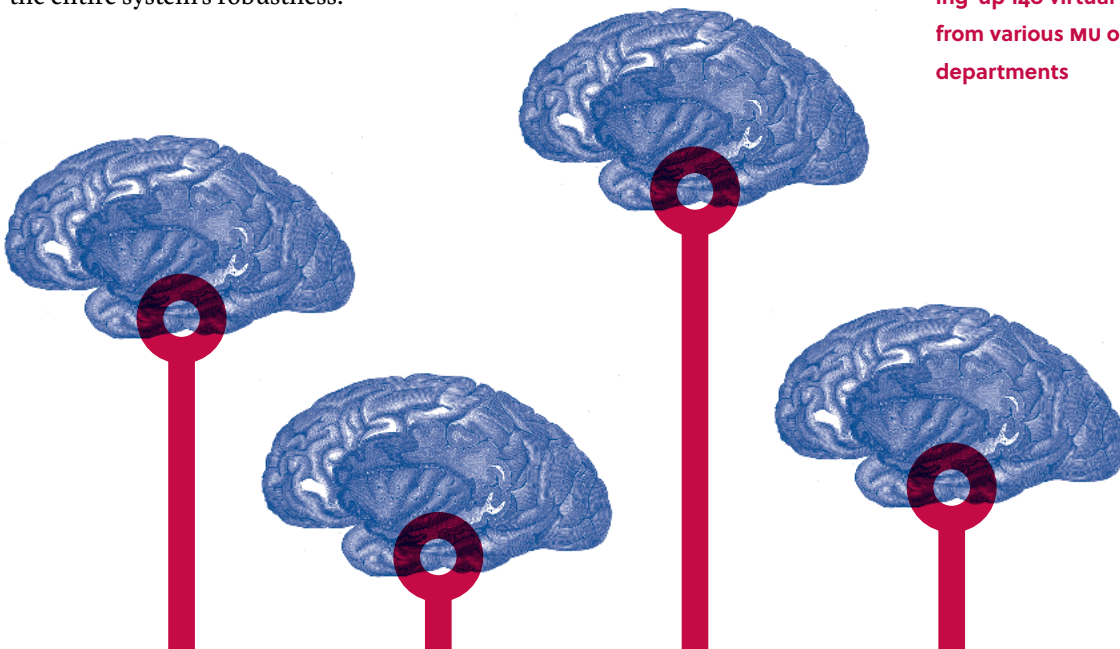
352
CPU cores

5.9 TB
of memory

830 TB
of shared storage space

450 TB
in the tape library for backing-up 140 virtual servers from various MU offices and departments

Experimental research in the scientific cloud

CERIT-Scientific Cloud is a center and important part of the national e-infrastructure, which provides flexible storage and computational capacity. Moreover it supports a platform for difficult computations and ensures linkages country-wide. The center engages in research and development in the area of flexible e-infrastructures and collaborates on the research activities of its users.

At the center, more than 4,800 CPU cores, including the unique SGI UV2 system with 6 TB of RAM and 4 PB of storage space are available. It has the second largest processing capacity in the Czech Republic behind IT4Innovations. In 2015 CERIT-SC acted as a partner to the CESNET Large Infrastructure project.

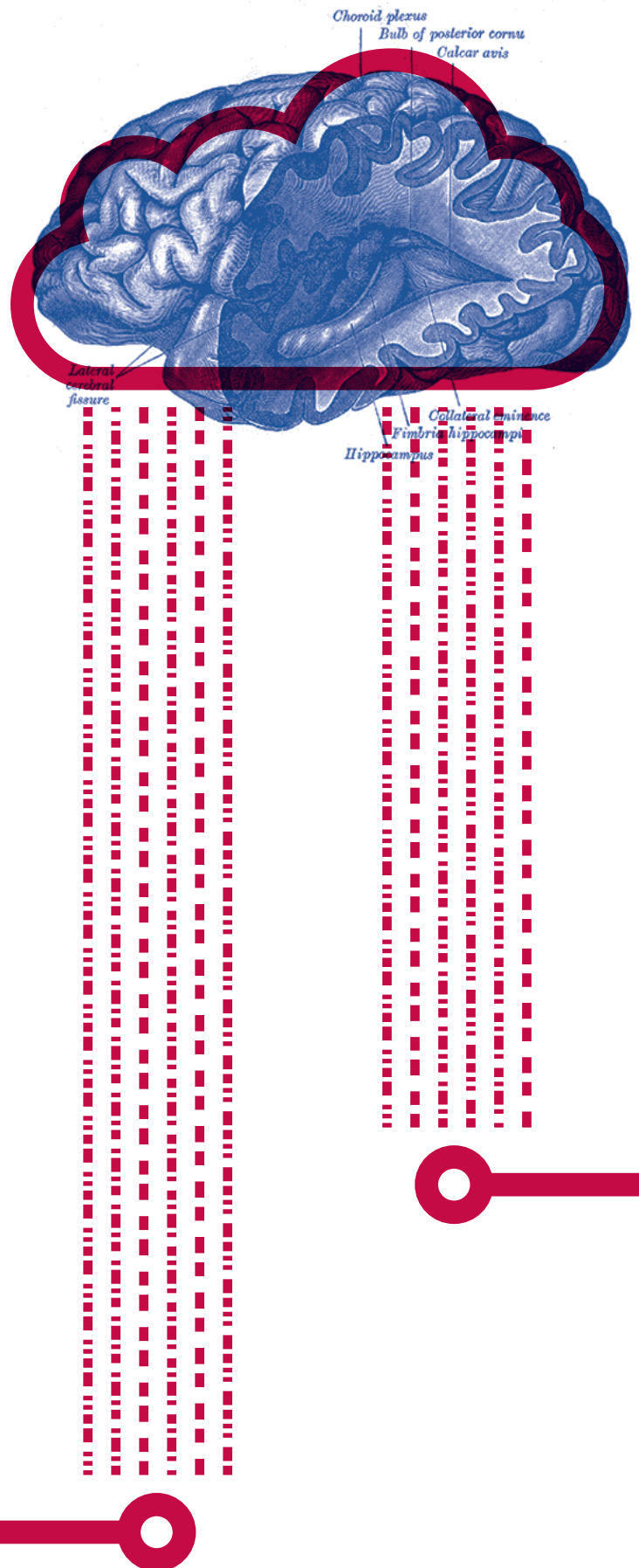## CERIT-Scientific Cloud includes

4,896
CPU cores

630 TB
of shared storage space

3.5 PB
in high-capacity data storage HSM

Storage Infrastructure

The Institute of Computer Science offers and arranges various possibilities for data storage. Standard, midsize, and large-scale storage is available, with a total capacity of over 1 PB. We provide storage solutions with various available capacity, speed, reliability, data access possibilities, and management modes. Thus, users are offered a wide scale of storage solutions suitable for daily work with common data (documents, spreadsheets) as well as for storing extremely large volumes of data (e.g., video or data acquired through instrumental measurements with volumes of up to several dozen TB).

Storage makes researchers' work with storing, transferring, and sharing data markedly easier. In 2015, at CEITEC MU we helped migrate dozens of TB of research data from old systems to a reliable central storage system.

Storage capacity not including the large-scale storage of CERIT-SC:

830 TB

reserved for data from various MU units, employees, and research teams, broken down as follows:

50 TB

for standard storage

300 TB

for midsize storage

480 TB

for laboratories and virtual servers
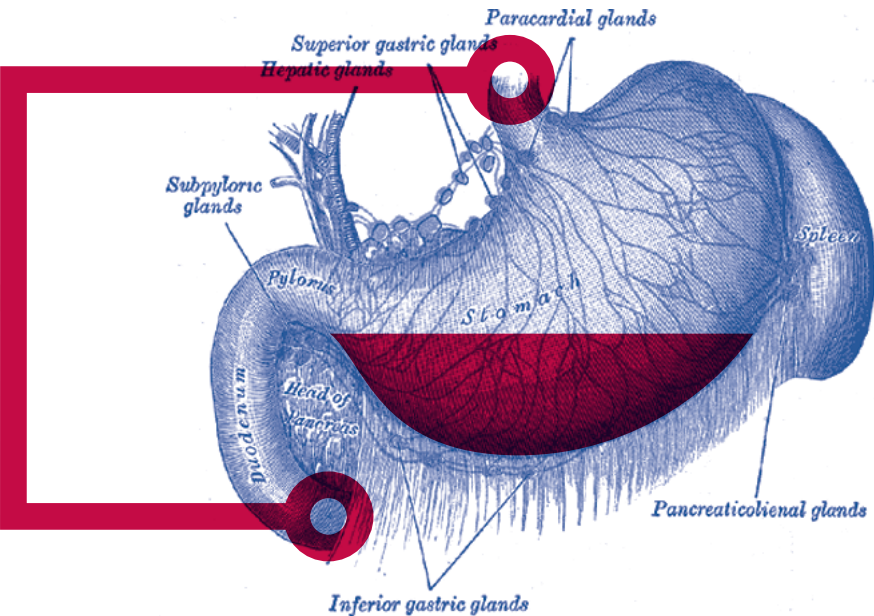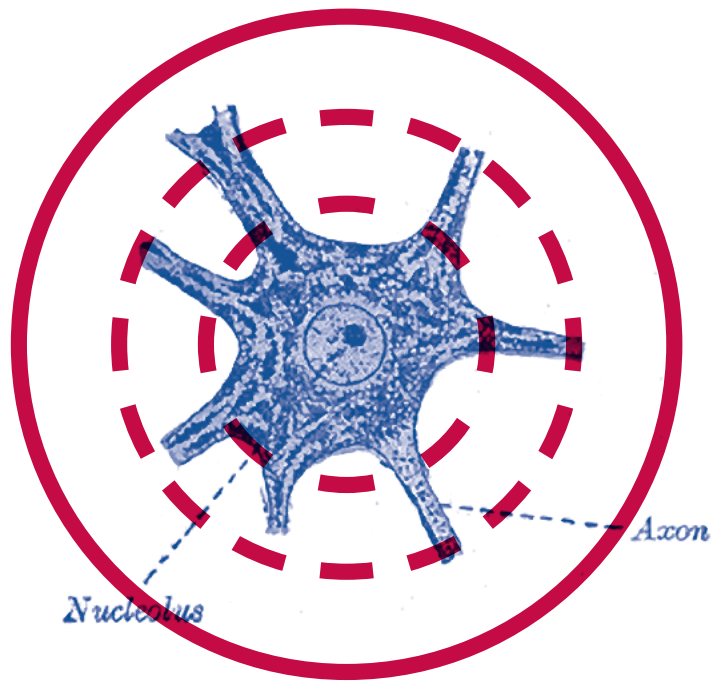
Cybersecurity

What we work on

- Protecting the computer network and University services by the CSIRT-MU security team
- Security research and development for the government and commercial sectors
- Research and development of the KYPO Cyber Exercise and Research Platform

Key events in 2015

- Organization of the Cyber Czech 2015 national cybersecurity training event
- The opening of the KYPO Cyber Exercise and Research Platform laboratory
- Collaboration with criminal justice agencies on investigating security incidents
- Development and production deployment of the RemSig electronic signature system for University documents
- Development and prototype deployment of methods for penetration testing of University infrastructure devices
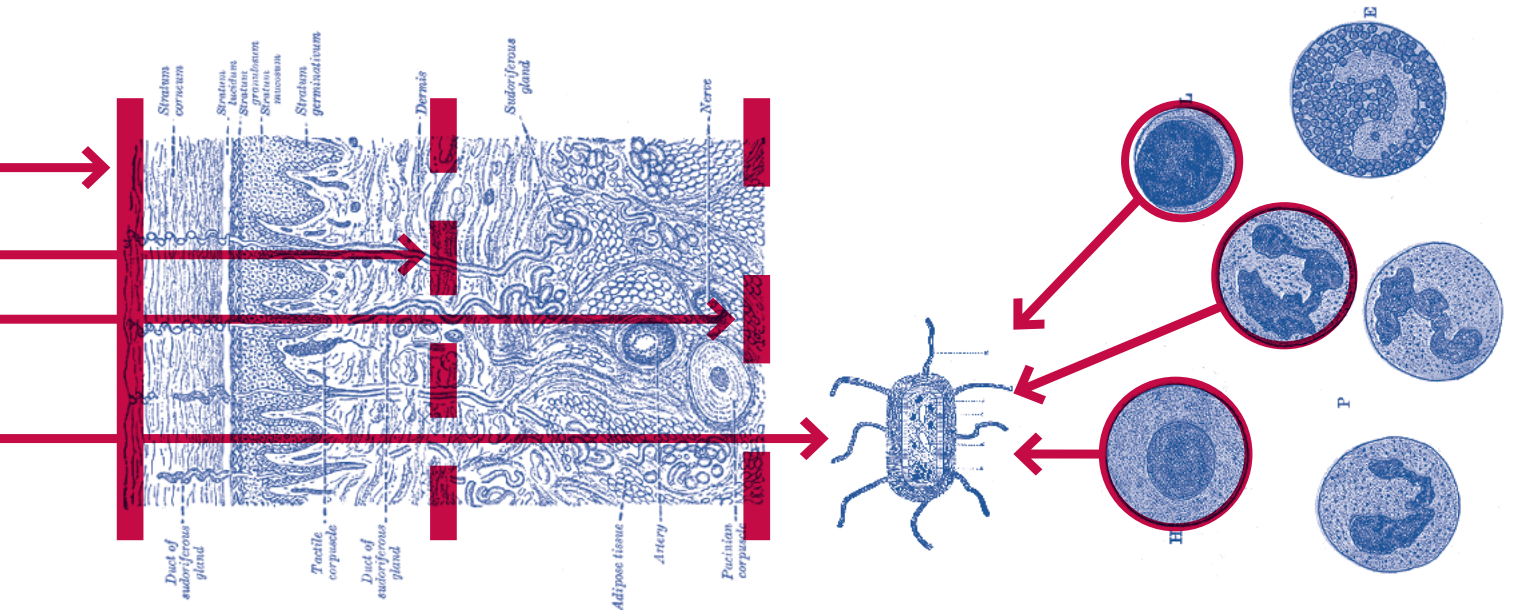
Events in 2015

Boosting detection methods for finding security gaps in University systems

Besides improving automatic detection methods in 2015 we developed, and in some systems deployed, methods for semi-automatic and automatic penetration testing. The goal of our experiments was to find possible security vulnerabilities in the University's systems' security mechanisms. Besides fine-tuning detection methods in our internal systems, we also conducted approximately twenty pilot penetration tests on various external university systems.

The ceremonial opening of the KYPO Cyber Exercise and Research Platform laboratory

On Wednesday 29 April 2015, with representatives from the National Security Authority, the Minister of the Interior, and the Police of the Czech Republic in attendance, the KYPO Cyber Exercise and Research Platform laboratory was ceremonially opened. This platform enables the creation of computer network simulation in a secure, closed environment, and in doing so attacks on real infrastructure can be tested without risk of any direct threat. This system uses tools developed here at the ICS as part of a project of the same name funded by the Ministry of the Interior. Besides IT specialists from companies, KYPO can be used by employees of the NSA and other state security forces.

Czech security experts were trained using the platform

In cooperation with the NSA on 6–7 October 2015 we successfully conducted the first national technical cybersecurity training event, Cyber Czech 2015. The goal was to practice technical abilities and share information between teams from various government agencies. Czech security experts practiced defending a fictive nuclear power plant against cyberattacks in order to test the technical capabilities of defense mechanisms against an extensive security attack, as well as the ability to coordinate work and cooperate.

82,000

the number of attempts at disrupting University infrastructure security we discovered and actively repelled in 2015.

99 %

of these attempts were suppressed by fully automated procedures; only 250 incidents had to be treated manually by local administrators. We subjected 3 incidents to detailed forensic examination.

In 2015 we also successfully completed

4

security projects and prepared

1

new security research project, which has been running since 1 January 2016

Open Digital Science

What we work on

- Coordinating growth of the University library network and the Aleph library system
- Digitization and creation of digital libraries
- Coordinating library projects and consortiums
- Acquiring electronic resources for research, teaching, and education at the University
- Technology for accessing and utilizing electronic resources

Key events in 2015

- Sustainability of electronic resources acquired from Research and Development for Innovations Operational Programme–funded projects
- Modernizing university library processes
- Transition to new Resource Description and Access (RDA) cataloging rules
- Organizing the Erasmus MUST Week on libraries
- LTP-pilot and VISK-9 projects

Computerizing the libraries

In 2015 university library processes underwent an extensive upgrade. We introduced an electronic user registration system and chip cards for external users. With assistance from the legal division of the University rector's office, we launched a central system for collecting outstanding fines and introduced a system for remote payments from borrowers. We also created a method for keeping records of e-books. More over MU libraries also adopted the new RDA (Resource Description and Access) international cataloging rules. Borrowing rules at faculty libraries were also made uniform.

VISK-9 Project: Harmonizing and creating authority files

This project, funded by the Ministry of Culture as part of the Public Information Library Services (VISK), aims to consolidate author descriptions in library systems throughout the entire Czech Republic. This means that librarians modify author records in the University catalog to meet a predefined standard. These records are then transferred to the Authoritative Base of the National Library of the Czech Republic, from where other libraries can adopt them for their catalogs.

The University library network

The system is coordinated by the Library Information Centre of the Institute of Computer Science of Masaryk University. It includes

15 libraries

↙ ↓ ↘

8 central faculty libraries **2 special libraries** **5 departmental libraries**

1,900,000
physical items in the University's library collections

+41,774
new items in 2015

MUST week for librarians

MUST Week, or Masaryk University Staff Training Week, is an annual event organized by Masaryk University for foreign participants. It offers practical experience from our University's libraries. Besides the MUST Week for librarians, others are held as well, such as the IT MUST Week.

Every year a different MU library organizes the MUST Week for librarians; in 2015 this duty fell upon our Library Information Centre. This June event included lectures on the organization and services of University libraries, trips to select libraries, and a panel discussion on the mutual exchange of experience between Masaryk University and foreign participants. Six librarians from five different countries attended.

The Aleph Library System

1,258,000
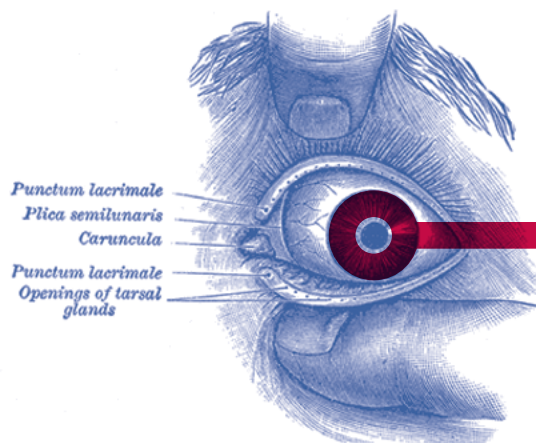**Catalog items**
Growth of 47,000 items since 2014

50,000
registered users with more than half a million registered borrowed items

Punctum lacrimale
Plica semilunaris
Caruncula
Punctum lacrimale
Openings of tarsal glands

Expanding electronic resources

In 2015 we had to handle for the first year the post-project sustainability of electronic resources purchased in previous years from R&D for Innovations Operational Programme–funded projects, which included eight projects and 27 packets of electronic resources.

The University Library Information Centre was involved in preparing the new system for ensuring key electronic resources for research, development, and education within Czech academia and the educational sector. The CzechELib national licensing center should be established, which will centrally ensure the procurement of necessary electronic resources. It will also provide support for making these resources accessible and using them. For creating this center and test running it a systems project will be undertaken as part of the Education for the Research, Development, and Education Operational Programme.

In 2015 we also perfected the discovery.muni.cz search service, a central spot for searching for all types of academic information at the University. We also implemented a new link resolver, Full Text Finder, for directing users to available full versions of e-documents.

Work on integrating the services of the Aleph library system into the search service continued, with the eventual aim of transitioning to a single system for searching and acquiring academic information at the University.

Electronic resources

116

licensed electronic resource packages, subscriptions, and permanent access agreements

23,000

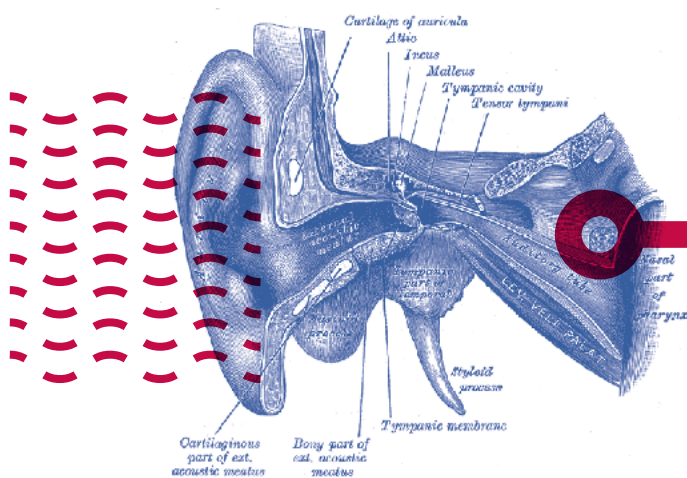e-journal titles, and

142,000

e-book titles

The discovery.muni search service

500,000

unique searches and more than

230,000

sessions

45-6c-65-6b-74-72-6f-6e-69-7a-61
63-65-20-6b-6e-69-68-6f-76-65-6e

How to preserve digital information?

We successfully completed the Long-Term Preservation Pilot (LTP-pilot) project, financed by the CESNET Development Fund. It served for verifying low-cost opportunities for long-term digital preservation using the Archivematica open-source system. During our extensive user and system testing of Archivematica we discovered the strengths and weaknesses of this storage tool. We presented our project findings at the national LTP workshop attended by 60 people.

In cooperation with other partners (The Library of the Academy of Sciences of the Czech Republic, the National Library, the Moravian Library), we prepared the ARCLib project for developing functional LTP solutions. It is based on open-source tools and methods for the long-term preservation of digital data for libraries in the Czech Republic, as well for other archival institutes. The project was approved for a five-year period as part of the Programme for Supporting Applied Research and Experimental Development of National and Cultural Identity in 2016 to 2022 (the NAKI II programme), which is funded by the Ministry of Culture.

Digitization and managing University journals

We have begun collaborating with MU Press particularly on digitalization, introducing DOI/CrossRef data, supporting editorial work for University journals published and accessible through the Open Journal System, and on making MU Press products accessible in the library system and through the discovery.muni.cz search portal.

5

digital library systems:
- **e-prezenčka**
- **Digital Photography Library**
- **Czech Digital Mathematics Library**
- **Digital Library of the MU Faculty of Arts**
- **Digital Library of the MU Faculty of Arts**

11,500

digitized books in the e-prezenčka system

50,000

photographs in the 31 collections of the Digital Photography Library

nearly

37,000

articles by 15,000 authors in the Czech Digital Mathematics Library

more than

28,000

documents by 6,000 authors in the Faculty of Art's Digital Library

Did you know…?

DOI stands for Digital Object Identifier, which is the international standard for unambiguously identifying electronic publications and other types of digital objects. DOIs are used within the Crossref service primarily for persistent identification and interlinking academic articles online.
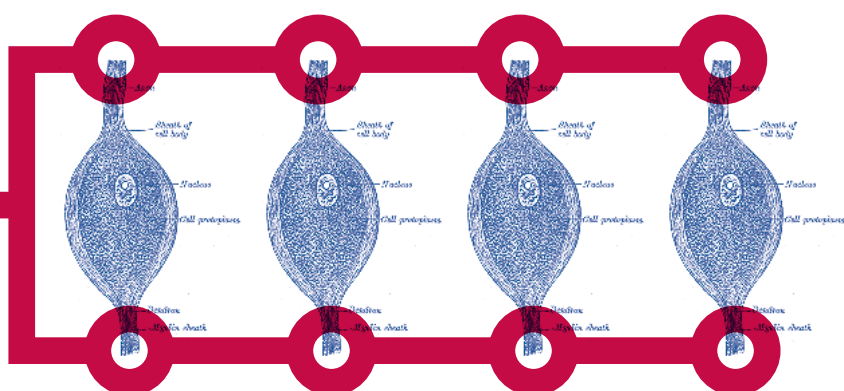
Information Systems

What we work on

- Magion economic information system
- The INET economic and administrative intranet
- Map applications and the web-based Kompas GIS
- Union Register of University Students and other Ministry of Education, Youth and Sports systems

Key events in 2015

- EIS Magion and iFIS user cooperation network
- Development of Magion system in reaction to changes in legislation
- Electronic disposal of assets and e-approval of project proposals in INET
- The first mobile INET application
- E-application to Jobs.MU in WebCentrum
- Technology documentation system in Kompas
- Newly supported Ministry of Education, Youth and Sports systems

# The Economic and Administrative Information System

This system provides comprehensive support for economic, HR, and operating activities throughout the entire University. At its core there are two closely connected sub-systems: EIS Magion externally provided by Magion System, a.s., and INET MU, developed in-house at the Institute of Computer Science.

EIS Magion is used by several hundred users from the University's economic and HR offices. In contrast, the INET system is intended for use by the entire University community and has almost 30,000 users. It is built on Magion, significantly supplementing and expanding its functions (in economic matters, asset management, HR, and wages). INET also covers science, research, and operating services. For asset management, in addition to these two systems, a third one—the web-based Kompas GIS—is also used, primarily by operations and facility management employees.

EIS Magion

Seven universities in the MagNet network, which is coordinated by Masaryk University, collaborate on developing Magion. In 2015, this network began systematically cooperating with another twelve universities operating the iFIS economic system and coordinated by the Czech Technical University in Prague.

In 2015 new HR and economic functions were added to Magion. These additions primarily involve comprehensive support for settling VAT on assets with the automation of related accounting processes, systems support for selling electronic services abroad, and VAT inspection reports. For the latter two activities a crucial integrated interface was developed for the MU IS Shopping Center. Another important interface was created on INET, specifically for sending off documents created in Magion via INET and the MU IS Document Office, and for automatically transferring HR and wage data from Magion to the ExIS executive system.
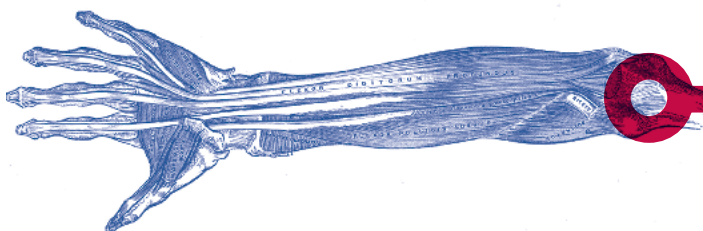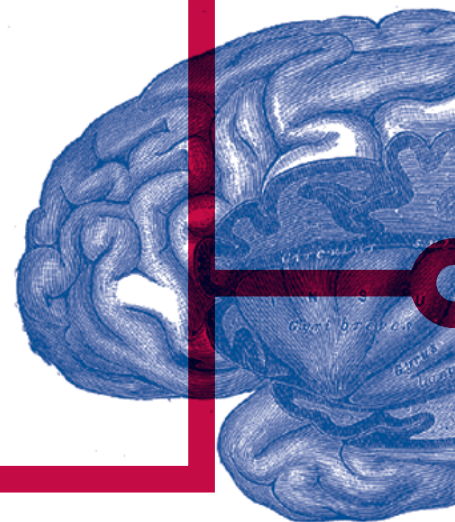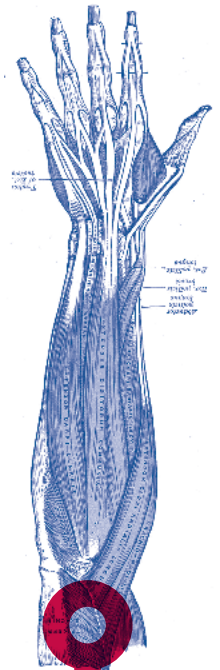
INET

In 2015 several system changes were made in INET—mainly a systems upgrade to Java 8 and WebLogic 12.1.3. and the creation of a control panel as the basis of changing usage ergonomics in relation to the transition to the new MU uniform visual style.

Applications development focused on e-Documents, or a paperless office, and brought the following innovations:

- electronic financial control of other types of economic documents
- approval of annual leave schedules
- comprehensive workflow of asset disposal
- approval of project proposals
- approval of library rules and regulations
- management of personal digital certificates and electronic signatures for PDF files
- work with documents for academic qualification procedures
- Jobs.MU system for managing competitive hiring procedures with e-job applications

Secure access for external persons involved in academic qualification procedures, just like access for applicants to Jobs.MU, is made through the WebCentrum webhosting system, which was also developed at our Institute. The first mobile application was developed for the INET paperless office: the mobile version of the Signature Book for Android devices.

Internal and external participants in academic qualification procedures can now be granted access to non-public information as well as permission to work with documents. We also implemented electronic voting, which we plan on making public in the future in conformity with University regulations.

In support of operating activities, application development focused on landline and mobile telephone services as a follow-up to the change of telephone exchanges and mobile operator. Also, new algorithms were applied to the calculation of work-related and private call charges, the latter utilizing cashless payment via SUPO.

In 2015 we had

782

active EIS Magion users

27,000
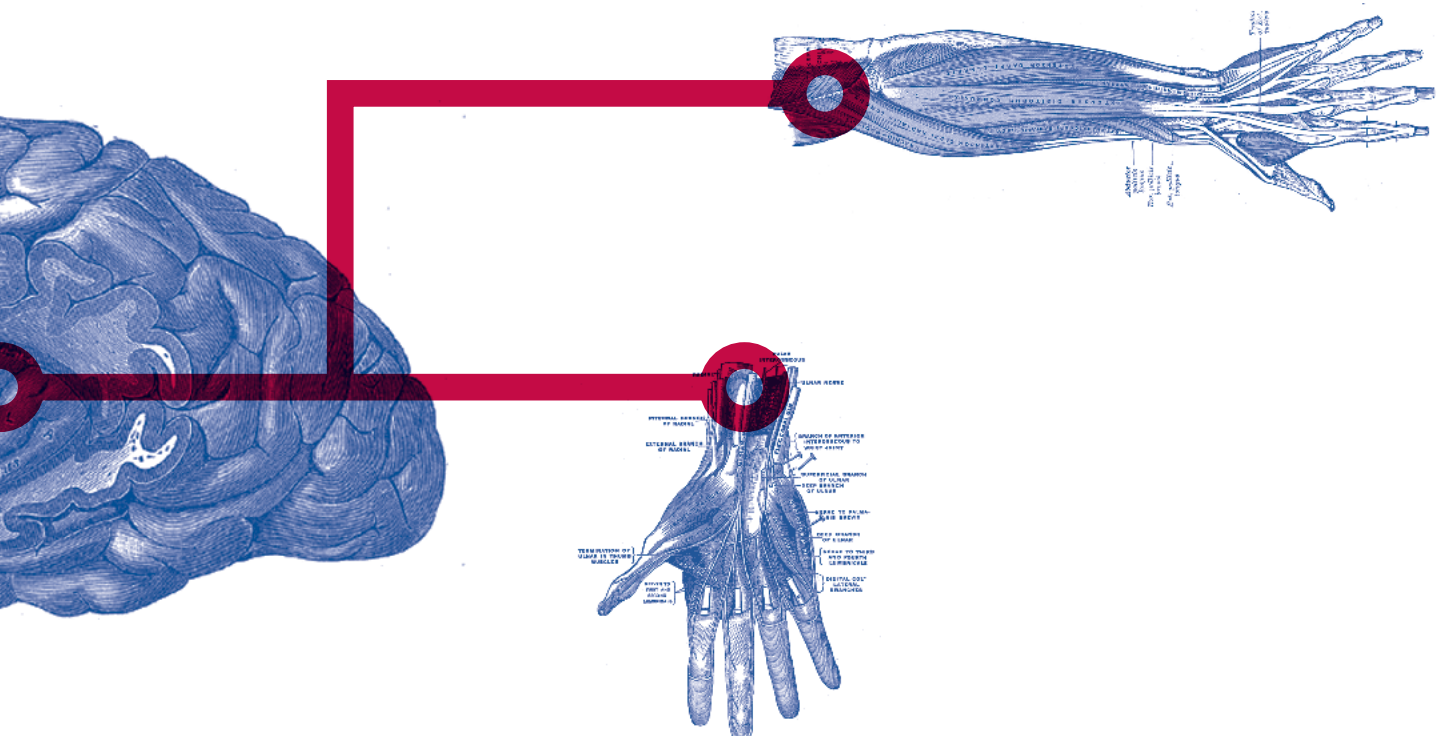
active INET users

721

active Kompas users

The electronic office in INET

625,000

electronic documents, of which

60 %

of documents that can be processed electronically are done so

Asset management and GIS

- Under asset management in INET a register of instrumentation for R&D was created with potential applications for planning and reserving instrument time.
- In asset management the Magion and INET systems are supplemented by the web-based Kompas GIS, built on the ESRI platform. It is intended particularly for employees in operations and facility management.
- In 2015 a new Kompas module was created—the Technology Documentation System for searching and visualizing the University's technology assets. Data from the Building Documentation System are presented in map form in INET, MU IS, and on www.muni.cz for the entire University community as well as the public.
- The BAPS GIS keeps records of and manages data and telephone network devices.
- Other map applications and geospatial data are accessible from the combined MU Geoportál directory. It covers asset management and technical records for the whole University. It also includes special map applications.
- In 2015 we successfully completed the GISTraLiK project, the output of which is a public web-based GIS of traditional folk culture, also accessible from the MU Geoportál.

ISEP project register

1,251
new project proposals

1,077
running projects

Assets:

266,000
inventoried items

60,000
software licenses
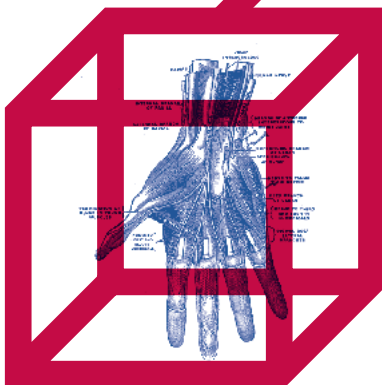
Other news

- In INET information about blocked funds in dynamic purchasing systems and framework contracts was added to budget statements of economic orders.
- We added support for automatic scanning HW to the EviSoft software licence record system.
- A register of websites and web applications operated at the University was created.
- Comprehensive wage overviews broken down into details were added to the ExIS executive system. We added an interface for personnel and wage statements in the Magion system, which facilitates fully automatic data transfer.

SUPO cashless payment system

turnover
130,000,000 Kč
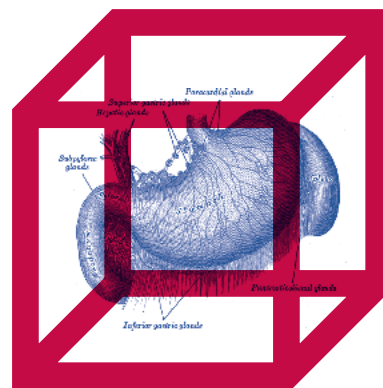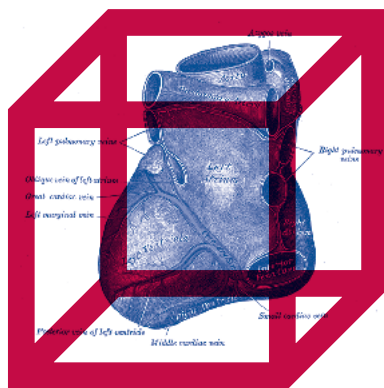
Registered issues in the electronic helpdesk system by area

User issues related to HR, economic, and operating issues are taken care of using a special helpdesk application in INET and via the e-mail address ihelp@ics.muni.cz. In 2015 we registered a total of 2,919 issues.

Area	
HR	
DPS and framework contracts	
Magion	
accounting	
research and development (ISEP)	
contacts	
SUPO	
other issues	

0 %   5 %   10 %   15 %   20 %   25 %
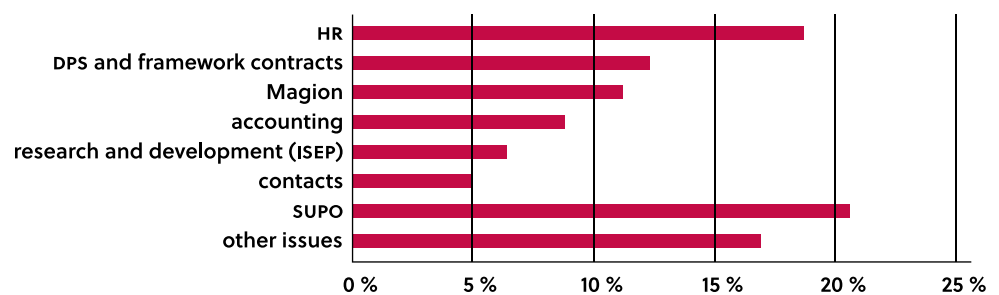
Ministry of Education, Youth and Sports Information Systems

In 2015 we submitted the best tender to the Ministry, thanks to which we were awarded a one-year contract from June 2015 to May 2016 to operate and develop five information systems for the Higher Education Division of the Ministry:

- SIMS (Union Register of University Students)
- REDOP (Register of Professors and Associate Professors)
- PPSVS (assessment of foreign study programs at the tertiary level)
- ISACC (Accreditation Committee IS)
- NVS (register of requests for recognizing foreign university degrees—
- nostrification)

These systems are used by more than

600

active users and

72

institutes of higher education

Managed data volumes are:

1,400,000
students along with

2,500,000
studies

3,400,000
study stages (SIMS)

9,700
associate professors and professors included in the REDOP system

31,300
applications in the PPSVS system

18,400
accreditation requests in the ISACC system
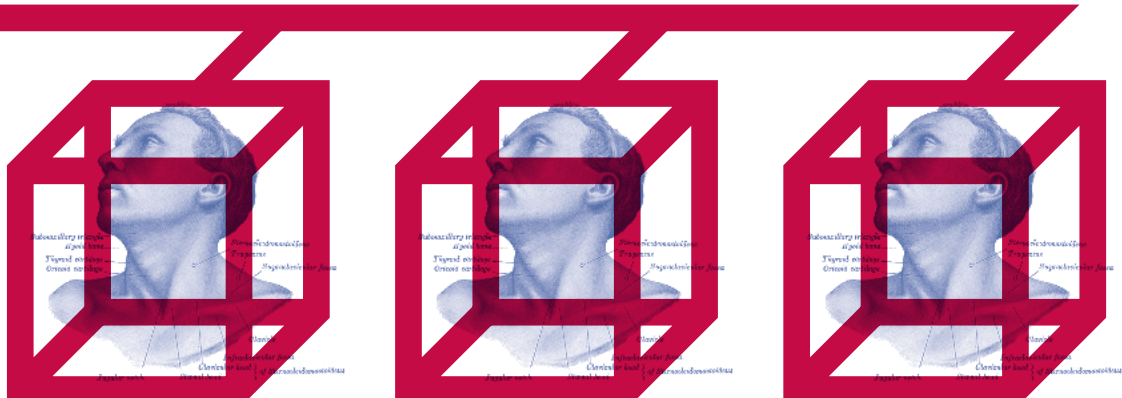
University Websites

What we work on

- Creating and administering University websites (for the entire University, individual faculties, departments, and other units, conferences, projects)
- Web solutions for the University's corporate identity
- Development and operation of MU's webhosting system
- Custom websites and functions

Key events in 2015

- Creation of a University website system with responsive graphics
- New version of the content management system
- Leading and implementing the new Faculty of Social Studies website project
- Expanding services provided
- Improving support for conference websites

Website solutions

In 2015 we worked on perfecting the content management system and expanding its functionality. We created the first version of a unified web system and conducted preparation for running a new muni.cz website, particularly deploying a new database cluster with servers in remote sites.

We created and launched

30

new websites, of which

3

for international conferences

1

faculty website

Expanding website functionality

We have expanded functions to include, in particular, web building kits, that is, an elaborate system of components that can be inserted into web pages. Thanks to the expansion of the overall functional base we can quickly and cheaply make websites with more complicated functionalities as well as custom-built websites.

- Now on conference websites we can facilitate working more easily with participants, uploading abstracts, and collecting information about participants.
- Thanks to a new reservation function, a registration application for events with limited capacity or with different possible times can easily be added to websites.
- Within various projects (particularly on the Faculty of Social Science's website) we have begun working on graphic design, the implementation of graphic styles, website architecture planning, use testing, and website content management.
- On the existing www.muni.cz website we have added mobile-optimized pages, linked career opportunities with jobs.mu, an electronic register of job applications, and upgraded its appearance in keeping with Masaryk University's new visual style guide.
- For the needs of all University websites, we created a general cookie consent panel for complying with statutory regulations for informing users about cookies; this panel can be used regardless of hosting or technology.

A mere

1 day

the amount of time we need to make a standard website

In 2015 we had already

97

created websites

223

active users and content managers

38

configurable web system components

WEBSITE www.muni.cz

3,184,000

visitors

Economics, HR, and Projects

Employee structure of the ICS

	Elementary education	Secondary school	Bachelor's degree	Master's degree	Ph.D.
Manual workers	3				
Specialized workers		19	3	56	7
Professional workers				7	12
Administrative workers		5	2	19	1
Assoc. Prof.					4
Professors					1

ICS MU income

Non-investment activity	2011	2012	2013	2014	2015
Educational activity 1111/2112	103,726,000	93,350,000	96,197,000	96,197,000	96,997,000
Educational activity CF 1112[1]	24,715,000	16,257,000	31,791,000	35,833,000	41,093,000
R&D institutional funding	200,000	457,000	1,241,000	1,506,000	2,670,000
Total	128,641,000	110,064,000	129,229,000	133,536,000	140,760,000
Total non-investment budget of ICS[2]	214,793,000	229,083,000	251,192,000	289,838,000	294,285,000
Total ICS employees[3]	133	144	132	142	130
Of which paid from 1111	108	96	93	95	102

Non-investment income	2011	2012	2013	2014	2015
Projects and instrumental funds, including FISP	62,600,000	78,400,000	124,500,000	61,400,000	42,453,000
Economic activity	29,500,000	27,680,000	27,415,000	26,970,000	23,737,000
Total	92,100,000	106,080,000	151,915,000	88,370,000	66,190,000

investments: from funding, IDP and FRFA	2011	2012	2013	2014	2015
Buildings, networks, easements	11,600,000	7,300,000	5,000,000	5,000,000	5,318,000
software, licenses, machines, equipment	28,000,000	16,500,000	29,170,000	46,170,000	39,064,000
total	39,600,000	23,800,000	34,170,000	51,170,000	44,382,000
ICS net income	2,365,000	2,786,000	3,822,000	4,513,000	2,994,000

1 CF does not include payroll expenses

2 Including write-offs

3 On average

Public contracts – ICS MU 2015

Type of contract		in CZK
Open call, above-threshold	1	10,000,000
Open call, sub-threshold	1	2,385,000
Sub-threshold, SSP	5	13,869,000
Sub-threshold, NPWP	0	0
Small-scale public contracts	16	18,006,000
Total	23	44,260,000

ICS MU grants in 2015

National grants	MEYS: ECOP	MEYS: VI	MEYS: EUREKA	CSF	TACR	MC	MI	MD	Various	Total	Amount awarded
Number	3	1	3	1	3	2	3	1	3	20	30,143,000

Foreign grants	EU: CIP		EU: 7.RP		EU: H2020		EU: other				
Number	1		1		2		1			5	9,965,000

Total										25	40,108,000

Ministry of Education, Youth, and Sports

MEYS development project
- Development of information systems for supporting internal quality of public universities
- ICS —IP contribution 2015

Education for Competitiveness Operational Programme
- Platform for Sharing E-learning Resources and Knowledge for Schools in the South Moravian Region
- Standardization of IT Literacy at Masaryk University
- Teaching Pathology with Hypertext Teaching Materials

VI
- CESNET Large Infrastructure

EUREKA
- Buildings as a Service
- Orientation and Positioning System for Mobile Data Communication Equipment
- Advanced Onboard Data Recording

Czech Science Foundation
- Simulation of Complex Systems with Enhanced Sampling

Technology Agency of the Czech Republic
- Research and Development of Integrated Camera Systems in Medical Environments
- Platform for Providing Specialized Meteorological Forecasting for the Energy Sector
- Technology for Processing and Analyzing High-Volume Network Data

Ministry of Culture

- Geographic Information System of Traditional Folk Culture
- Revision and Harmonization of Local Titles – 2015 Phase

Ministry of the Interior

- Cybernetic Proving Ground
- Security of Optical Components in Data and Communication Networks

Ministry of Defense

- CIRC — Mobile Dedicated Devices

EU: CIP — Competiveness and Innovation

- SDI4Apps (Uptake of Open Geographic Information Through Innovative Services Based on Linked Data)

EU: Seventh Framework Programme

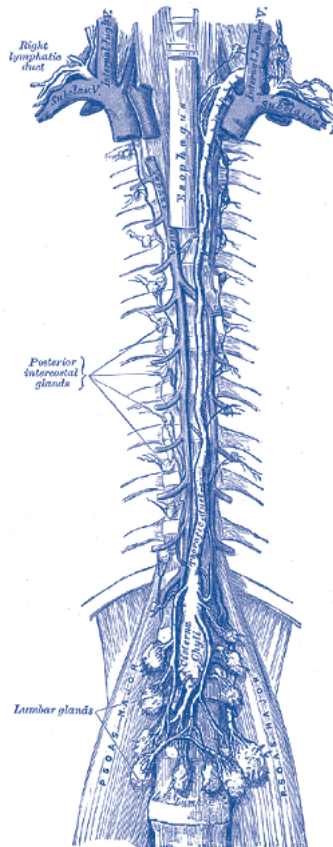- Thalamoss

EU: Other Community Programmes

- C4E — Czech CyberCrime Centre of Excellence

EU: Horizon 2020 — RIA

- ELIXIR-EXCELERATE
- West-Life

Organizational Structure

Management

- prof. RNDr. Luděk Matyska, CSc., *director*
- doc. Ing. Otto Dostál, CSc., *vice-director for research and development*
- JUDr. Dana Šrubařová, *bursar*
- RNDr. Jana Kohoutková, Ph.D., *division head, Information Systems Division*
- Mgr. Aleš Křenek, Ph.D., *division head, User Support Division*
- Mgr. Kamil Malinka, Ph.D., *division head, Computational and Storage Infrastructure Division*
- RNDr. Tomáš Rebok, Ph.D., *division head, Communication Infrastructure Division*

Director's Council

- prof. RNDr. Luděk Matyska, CSc., doc. Ing. Otto Dostál, CSc., JUDr. Dana Šrubařová, RNDr. Miroslav Bartošek, CSc., RNDr. Jana Kohoutková, Ph.D., Mgr. Aleš Křenek, Ph.D., Mgr. Kamil Malinka, Ph.D., doc. RNDr. Václav Račanský, CSc. (*until 30 April 2015*), RNDr. Tomáš Rebok, Ph.D., Mgr. Břetislav Regner, Mgr. Michal Vičar (*from 1 October 2015*)

Scientific Board

Chairman
- prof. RNDr. Luděk Matyska, CSc.

Internal members
- prof. Mgr. Jiří Damborský, Dr.
- doc. Ing. Otto Dostál, CSc.
- doc. RNDr. Ladislav Dušek, Ph.D.
- doc. RNDr. Petr Holub, Ph.D.
- prof. RNDr. Michal Kozubek, Ph.D.

External members
- prof. Ing. Václav Hlaváč, CSc. (FEL ČVUT v Praze)
- Ing. Martin Svoboda (National Technical Library)
- prof. Ing. Ivo Vondrák, CSc. (VŠB-TU Ostrava)

Organizational structure

ICS management, secretariat
- CERIT SC
- Project department

User support division
- University Computer Centre
- Technical Support Department
- Proactive Support Department
- Public Relations Department

Communication Infrastructure Division
- Security Department
  - Incident Analysis Group
  - Network Traffic Analysis Group
  - CSIRT-MU Group
- Collaborative Systems Department
- Network Infrastructure Department

Computational and Storage Infrastructure Division
- Server and Data Storage Administration Department
- Systems Administration Department
- Software Development Department

Information Systems Division
- MU Library and Information Centre
- Information Systems Administration
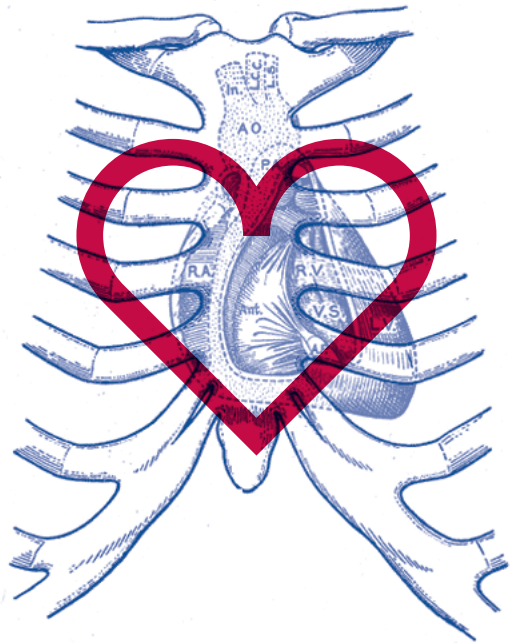- Information Systems Development

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

Cooperation between ICS and Partners

Besides cooperation with units throughout Masaryk University and universities in the Czech Republic, in 2015 we worked with the following partners:

Ministries and state institutes

- Ministry of Education, Youth and Sports
- Ministry of Culture
- Ministry of Defense
- National Security Authority
- National Cyber Security Centre
- Police of the Czech Republic

Professional institutions and organizations

- CESNET
- CEITEC
- EUNIS CZ National Association
- Various institutes of the Academy of Sciences of the Czech Republic

Commercial and industrial partners

- Microsoft
- Y Soft
- Magion System, a. s.
- Invea-Tech
- Mycroft Mind
- SVS FEM
- Comprimato Systems

Libraries

- National Library of the Czech Republic
- National Technical Library
- Library of the Academy of Sciences of the Czech Republic
- Moravian Library