

Annual Report

CESNET Association

2015



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Economic Results

A Message from the Director

Ing. Jan Gruntorád, CSc.,
Director and Member of the Board of Directors, CESNET



The CESNET Large Infrastructure project had a major impact on the quality of the country's scientific and research e-infrastructure and its competitiveness.

You have just opened the Annual Report, summarizing CESNET's activities in 2015.

It was a year in which we successfully accomplished the five-year CESNET Large Infrastructure project, entrusted to us by the Ministry of Education, Youth and Sports of the Czech Republic. The following pages will let you know what we managed to implement in the course of the past year.

The CESNET Large Infrastructure project had a major impact on the quality of the country's scientific and research e-infrastructure and its competitiveness. I am convinced that our scientific, research and education network belongs among the most advanced of all on both the European and global

scales, giving professionals in various disciplines first-class connection and associated services. They can thus keep up with their demanding tasks and actively collaborate with the world's leading institutions. As the conclusion of the CESNET Large Infrastructure project was drawing near, we had to think about the future model of funding for our Association. We are glad to see that our work so far has received an adequate response. The follow-up project CESNET E-Infrastructure is now part of the Roadmap of the Czech Republic of Large Infrastructures, formally acknowledged by the Government of the Czech Republic on 30 September 2015. The new project is designed for the years 2016-2019.

The first negotiations about the content and budget of the project took place in March 2015. The framework proposed remained, with the exception of investment expenditures, but the Government made a somewhat surprising decision at the end of the year to reduce the project support by 10% in 2016 and by 20% in 2017-2019. At the same time, we were assured that the Government officials continue to see the Association's work as indispensable. The investment subsidy requested should therefore be provided via a specific call under the Operational Programme Research, Development and Education (OP RDE) for research infrastructures. It is thus more of a process issue, which we will no doubt tackle.

But let us go back to our work in 2015. There is no room in this opening section to provide a complete list of activities, but that is hardly its purpose. I will therefore choose one project that ideally illustrates the several overlaps of our work.

Together with Alcatel-Lucent, we successfully completed the testing of a 400-gigabit transmission system in the CESNET network in June 2015, thus verifying the capabilities of new high-speed and truly broadband services. The testing made use of Alcatel-Lucent's 400G agile optical networking technology along with optical amplifiers developed by our own specialists. These optical amplifiers are part of the family of advanced CzechLight photonic devices, which offer a range of opportunities in fully optical signal processing for new applications and photonic services, and conserve considerable amounts of energy as well. The successful tests proved that optical networks are developing in such a way to satisfy future user requirements without massive investment in infrastructure. Our collaboration with Alcatel-Lucent is a typical example of the necessary interconnection of the academic environment, which CESNET represents, with the world of business. It also documents the uniqueness of solutions resulting from our development activities. The CzechLight family devices are successfully being used in the world, and their uniqueness has been confirmed by the Czech, European and US patent offices. This

brings us to another important dimension of the CESNET Association, which are its international activities. Since the beginning of its existence, the Association has been in contact with the world and tried to be a full-fledged component of international networking development. This still applies to this day.

Our people have successfully presented their achievements at many renowned international forums. A textbook example is the area of high-speed high-definition transmissions, which find applications chiefly in technical and scientific disciplines such as medicine. For example, as part of the eResearch NZ 2015 conference, New Zealand's REANNZ academic network in collaboration with the Czech national CESNET e-infrastructure introduced transmission of surgical interventions in 4K resolution. It was streamed from Prague to Queenstown via the global academic networks GÉANT, Internet2 and Southern Cross. The transmission was carried out using the UltraGrid tool, software for video transmission with low latency and high quality developed by CESNET. However, high-speed transmissions are also useful in culture. In collaboration with HAMU of Prague and the Royal College of Music of London, we organised a distributed music performance in April 2015 as part of the Network Performing Arts Production workshop, held by GÉANT. It was a joint performance of violinist Matouš Pěruška and pianist Alison Rhind while separated by more than 1000 kilometres. The per-

formance was made possible using the 4K Gateway, a device for multi-channel video and audio transmission at high definition and very low latency, also developed by CESNET.

By doing this, we demonstrated the possibilities, unheard-of until recently, that will soon open for people in the advanced world thanks to high-speed infrastructures. It is the task of institutions such as CESNET to ensure that the Czech Republic keeps up the pace with the most advanced countries.

I would like to thank all the Association members, employees and co-workers for the enthusiasm that they have shown in implementing this project, and the Ministry of Education for its indispensable institutional and financial support.

CESNET

ASSOCIATION

01

The task of the Association's key project was to build a so-called large infrastructure necessary for the Czech Republic to connect to the European Research Area.



The Association's History and Current Tasks

The Association was founded in 1996 by public universities and the Academy of Sciences of the Czech Republic.

CESNET main objectives are:

- ▶ **operation** and development of the backbone network that connects its members' networks
- ▶ **research** and development of advanced network technologies and applications and dissemination of knowledge of them
- ▶ **development** of the CESNET e-infrastructure designed for research and education

After its establishment, the Association also operated as a commercial Internet provider, with the aim of gaining sufficient resources from these activities for its main activity. It succeeded in gaining the position of one of the most important entities on the Internet connection market in the Czech Republic. The Associa-

tion discontinued that activity in 2000, chiefly for economic and legislative reasons. Since then, the Association has been engaged exclusively in the development and operation of the science, research and education backbone network (NREN, National Research and Education Network of the Czech Republic) and related activities. The NREN is called CESNET2.

In 2011, the Association received two crucial decisions of the Ministry of Education, Youth and Sports of the Czech Republic on funding for two large projects. One of them was the CESNET Large Infrastructure, a project implemented in 2011–2015.

The purpose of the project was to renovate the CESNET2 national research network into a large infrastructure, which

would include all the information and communications e-infrastructure necessary for connecting the Czech Republic into the European Research Area and enabling, for example, connection to the other e-infrastructures described in the ESFRI Roadmap. Another project, crucial for the Association's work, was the Extension of the National R&D Information Infrastructure in Regions (abbreviated to eIGeR), the main objective of which was to build a regional foundation for a comprehensive national research and development e-infrastructure in the Czech Republic. The project was implemented between May 2011 and October 2013. In accordance with the grant decision, the Association is bound to provide sustainability of the project until at least the end of 2018.

The Association Objectives and Scope of Activities

The main scope of activities of the Association is as follows:

- ▶ **to conduct research and development** in the area of information and communication technologies and their applications;
- ▶ **to provide and arrange** the provision of education services of research and development type, using the high-speed national research and education network;
- ▶ **to ensure** for its members and the allowance organizations that they have established the development and operation of a computer network interconnecting their networks and metropolitan networks; the creation of collectively used technical, communication and software resources and information services; the testing of new applications; the cooperation and complementarity of the members' activities at

a level comparable to leading education and research networks abroad (including Internet access);

- ▶ **to secure and provide**, in cooperation with its members, the long-term development, acquisition and deployment of high quality communication and information technologies based on the Internet and other advanced systems;
- ▶ **to support**, against the reimbursement of related expenses, propagation of erudition, culture and knowledge, cooperation of members with industry, expansion of the latest information technologies deployment, and quality improvement of the network by recruiting additional participants, information sources and services.

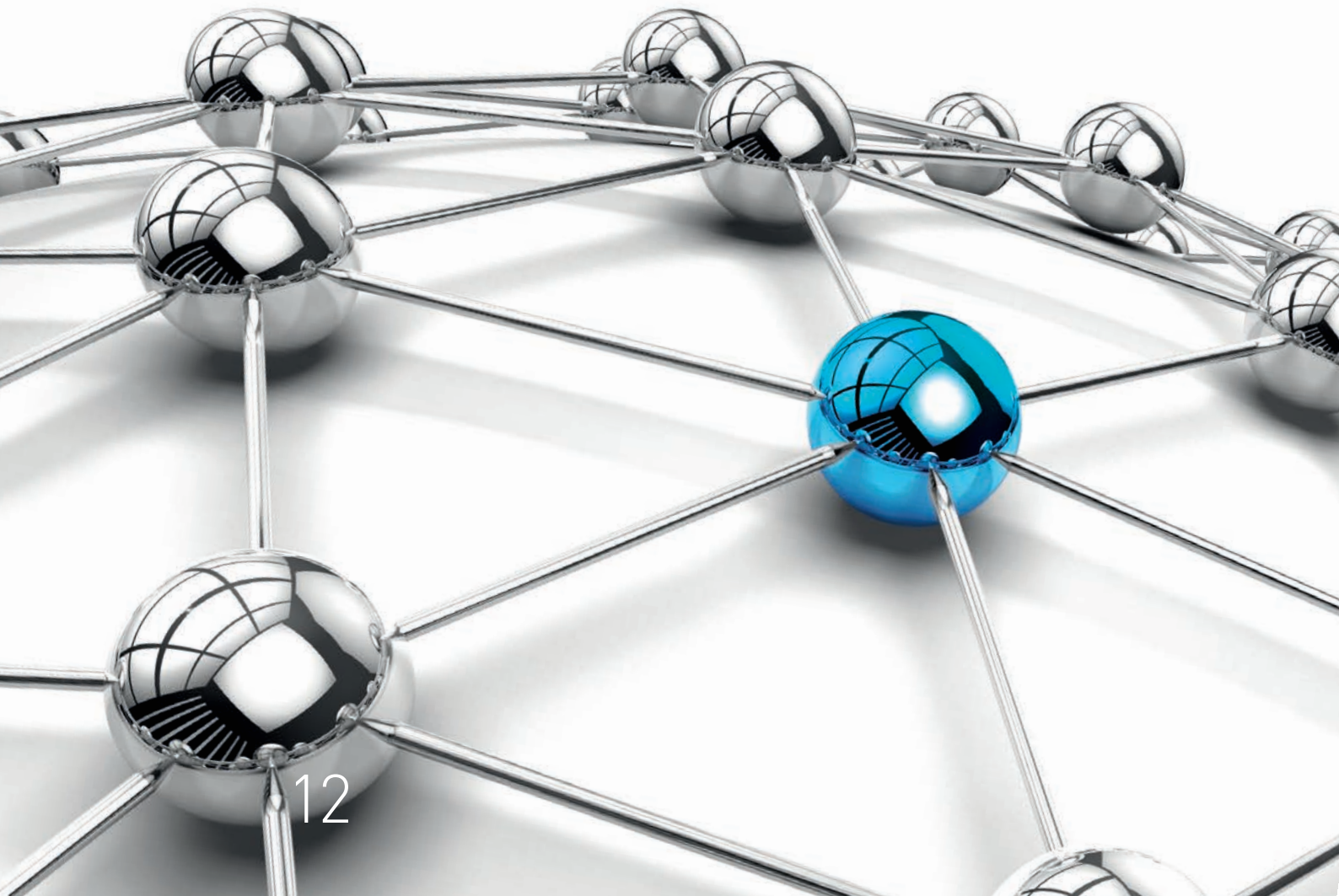
The Association performs and provides its activities within the scope of received subsidies and partial compensation of expenses related to these activities. It is not the Associa-

tion's objective to generate any profit on these activities. In addition to its main activities, the Association also pursues economic/business activities; however, solely with the purpose of making more efficient use of its property and without any negative impact on research activities. The services are not provided on a publicly available basis. The Association provides CESNET e-infrastructure services not only for its members, but also for selected entities that comply with the rules for accessing the e-infrastructure. Any loss incurred in connection with the Association's economic/business activities is settled by the end of each fiscal year; otherwise, the Association will abandon the economic/business activities in question before the beginning of the following fiscal year.

The Association uses all the profits to promote research and development.

Membership in International and National Organizations

The CESNET Association is
a member of important international
and national organizations.



International Organizations

GÉANT Association

An association of European national research networks that deals with operation and advancement of the GÉANT European communications infrastructure and coordination of related activities.

GLIF [Global Lambda Integrated Facility]

Global experimental network activities, focusing on the support for development of the most demanding scientific and research applications; their main objective is to create a network to serve applications with extreme transmission requirements.

Internet2

Consortium led by American research and education institutions endeavouring to develop and deploy new types of network technologies, services and applications; CESNET has been an associate consortium member since 1999.

PlanetLab

Consortium of academic, commercial and governmental organizations all around the world, collectively operating a global computer network designed for developing and testing new telecommunication applications; the network currently encompasses 780 nodes in 31 countries.

EGI.eu

Organisation aimed at coordinating European computing grids used for scientific calculations and at supporting their sustainable development.

Shibboleth

International consortium for the coordination of development of a service providing a solution for unified login, meaning that a user can use multiple protected network resources using a single login; Shibboleth is the foundation for academic federations of identities

National Organizations

NIX.CZ

CESNET is one of the founding members of NIX.CZ, Association of Legal Entities (Neutral Internet Exchange), an association of Internet service providers in the Czech Republic, allowing mutual connectivity among its members' networks; the association had 68 members as of 31 December 2015.

CZ.NIC

The Association is also one of the founding members of CZ.NIC, Association of Legal Entities, which administers the .cz domain, and supports publicly beneficial projects and activities related with the Internet; the association had 115 members as of 31 December 2015.



Association Members

The following institutions were members of the Association in 2015:

- ▶ Charles University in Prague
- ▶ Palacký University in Olomouc
- ▶ Czech Technical University in Prague
- ▶ VŠB – Technical University of Ostrava
- ▶ Academy of Arts, Architecture and Design in Prague
- ▶ Academy of Fine Arts in Prague
- ▶ Brno University of Technology
- ▶ University of Veterinary and Pharmaceutical Sciences in Brno
- ▶ Masaryk University
- ▶ Mendel University in Brno
- ▶ Academy of Performing Arts in Prague
- ▶ Janáček Academy of Music and Performing Arts in Brno
- ▶ University of Pardubice
- ▶ The Institute of Chemical Technology in Prague
- ▶ Czech University of Agriculture in Prague
- ▶ Technical University of Liberec
- ▶ University of Economics, Prague
- ▶ University of Hradec Králové
- ▶ University of South Bohemia in České Budějovice
- ▶ University of Ostrava
- ▶ Silesian University in Opava
- ▶ Jana Evangelista Purkyně University in Ústí nad Labem
- ▶ University of West Bohemia in Pilsen
- ▶ Academy of Sciences of the Czech Republic
- ▶ Tomáš Baťa University in Zlín
- ▶ University of Defence
- ▶ Police Academy of the Czech Republic in Prague

Internal Organisational Structure

CESNET has the following bodies:

- ▶ General Assembly
- ▶ Board of Directors
- ▶ Supervisory Board

BOARD OF DIRECTORS

Based on the elections conducted at the 37th General Assembly on 3 July 2014, the Association's Board of Directors had the following structure in 2015:

- ▶ RNDr. Igor Čermák, CSc.
- ▶ RNDr. Alexander Černý
- ▶ Ing. Jan Gruntorád, CSc.
- ▶ Mgr. František Potužník
- ▶ doc. RNDr. Václav Račanský, CSc.
- ▶ doc. RNDr. Pavel Satrapa, Ph.D.
- ▶ prof. Ing. Miroslav Tůma, CSc.

Prof. Ing. Miroslav Tůma, CSc. held the office of the **Chairman**,

and RNDr. Václav Račanský, CSc., and Mgr. František Potužník, were **Vice-Chairmen**.

SUPERVISORY BOARD

The Supervisory Board consisted of the following members until 9 July 2015:

- ▶ Ing. Jaromír Marušinec, Ph.D., MBA
- ▶ RNDr. Josef Milota
- ▶ Mgr. Eva Šmídová
- ▶ prof. Ing. Ivo Vondrák, CSc.
- ▶ RNDr. František Zedník

Ing. Jaromír Marušinec, Ph.D., MBA, was the Chairman of the **Supervisory Board**.

The General Assembly elected the following Supervisory Board for the term of office 2015–2017 at its 39th session on 9 July 2015:

- ▶ Mgr. Jan Gazda, Ph.D.
- ▶ Ing. Jaromír Marušinec, Ph.D., MBA
- ▶ Ing. Jakub Papírník
- ▶ RNDr. David Skoupil
- ▶ prof. Ing. Ivo Vondrák, CSc.

Ing. Jaromír Marušinec, Ph.D., MBA, was elected the Chairman by the **Supervisory Board**.

Ing. Jan Gruntorád, CSc. was the **Director** of the Association in 2015.

DEVELOPMENT FUND BOARD

The Development Fund Board worked in the following composition until 9 July 2015:

- ▶ Ing. Miroslav Indra, CSc.
- ▶ prof. Ing. Pavel Jura, CSc.
- ▶ Ing. Olga Klápšřová
- ▶ doc. RNDr. Antonín Kučera, CSc.
- ▶ prof. Dr. Ing. Zdeněk Kůs
- ▶ prof. RNDr. Jan Slovák, DrSc.

Ing. Olga Klápšřová held the office of the **Chairwoman of the Development Fund Board**.

The General Assembly elected the following Development Fund Board for the term of office 2015–2017 at its 39th session on 9 July 2015:

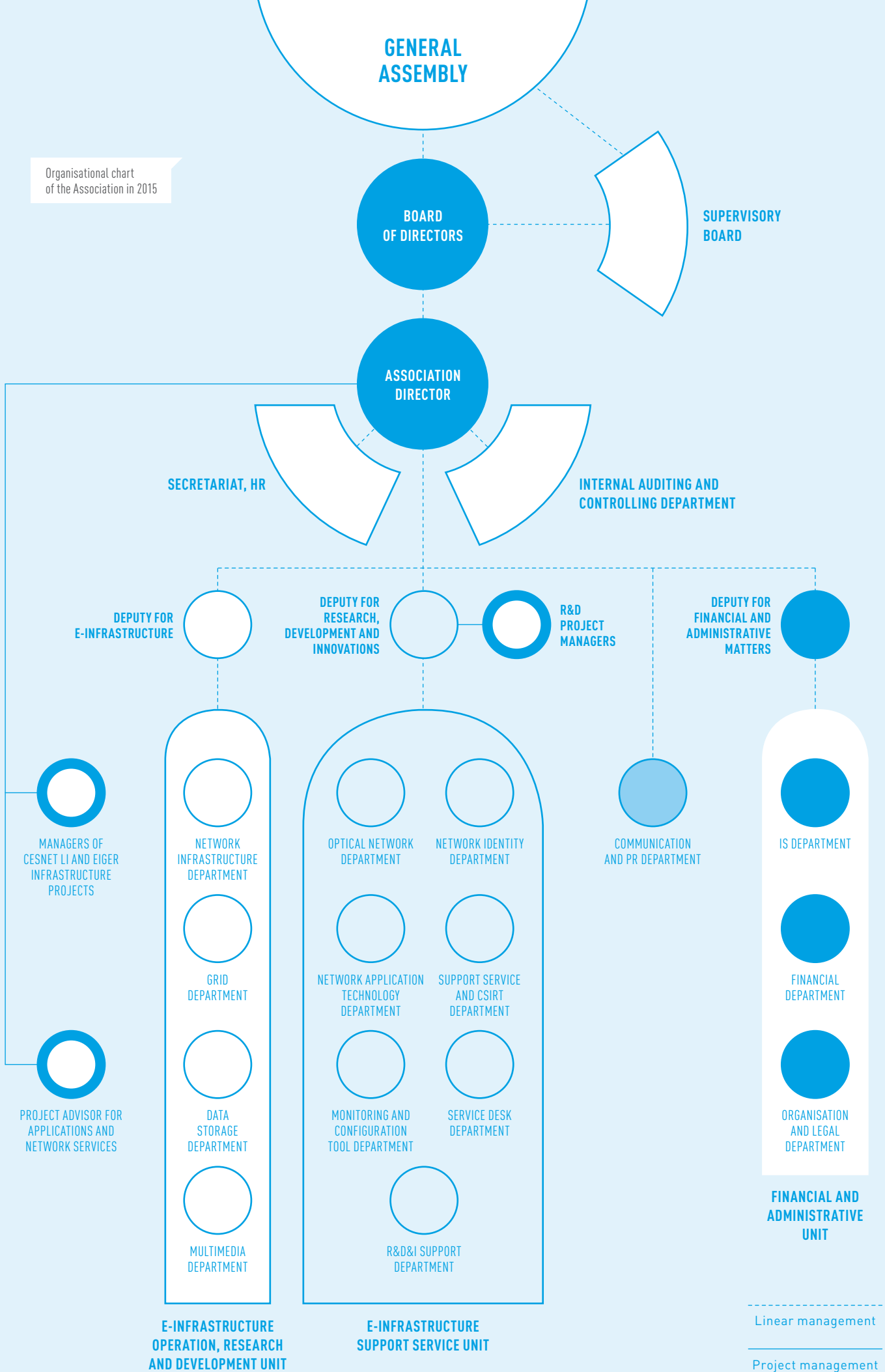
- ▶ doc. Ing. Vojtěch Bartoš, Ph.D.
- ▶ Ing. Miroslav Indra, CSc.
- ▶ Ing. Olga Klápšřová
- ▶ doc. RNDr. Antonín Kučera, CSc.
- ▶ prof. Dr. Ing. Zdeněk Kůs
- ▶ Ing. Michal Sláma
- ▶ Prof. Ing. Zbyněk Škvor, CSc.

Ing. Olga KLÁPŠŘOVÁ was elected the **Chairwoman** by the Development Fund Board.

ORGANISATIONAL CHART

Following discussion with the Board of Directors, the organisational chart was approved by the Association Director on 8 April 2014 and entered into force on 1 May 2014; it was also in force in 2015. The Association had 146.81 converted full-time employees in 2015. The Association's basic organisational structure comprises departments, which may be aggregated into sections. Management within this structure is performed by so-called line managers.

Organisational chart of the Association in 2015



CESNET

E-INFRASTRUCTURE

02

In 2015, the Association focused on assurance of reliable operation, maintenance of adequate performance capacity, and support to other services of the CESNET e-Infrastructure, connected large infrastructures and other network participants.



Introduction

CESNET's fundamental activity is the development, constructing and operation of the CESNET e-infrastructure, which is part of the Roadmap for Large Research, Experimental Development and Innovation Infrastructures in the Czech Republic, approved by Government Resolution No. 208 of 15 March 2010. The role of the CESNET e-infrastructure within the roadmap is to provide a transparent communication environment for the cooperation of entities dealing with research, experimental development and innovation. In 2015, the CESNET e-infrastructure was included in the Roadmap of the Czech Republic of Large Infrastructures for Research, Experimental Development and Innovations for the years 2016 to 2022. Naturally, this e-infrastructure is integrated in relevant international infrastructures. The CESNET e-infrastructure is also used as a testing and development environment for new technologies and applications in the area of information and communication technologies.

Special-purpose Support for Developing and Operating the CESNET e-Infrastructure



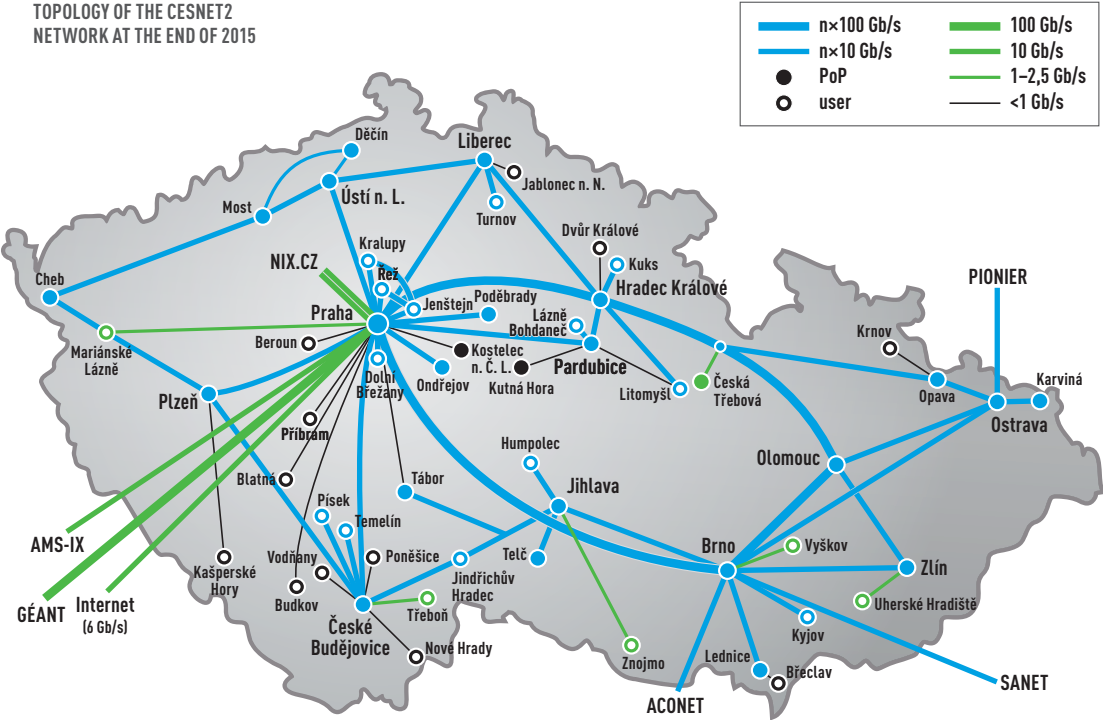
The CESNET Large Infrastructure project defined the basic orientation and goals of the Association's work for the period 2011–2015. The special-purpose support for this project is the most important source of funding for operating and developing the services of this e-infrastructure.

The chief components are a national communications infrastructure with a high throughput, national grid infrastructure (NGI), and data storage infrastructure, enhanced with tools and services for controlling access to e-infrastructure sources, tools for ensuring communication

security and data protection, as well as tools for effective collaboration of distributed users and teams. The year 2015 was the final year of the project implementation, which went along in line with the timetable. **The project goals and indicators were met.**

Communication Infrastructure

In the past period, CESNET focused primarily on assurance of reliable operation, maintenance of adequate performance capacity, and support to other services of the CESNET e-infrastructure, connected large infrastructures and other network participants.





The following fundamental changes and activities took place in 2015:

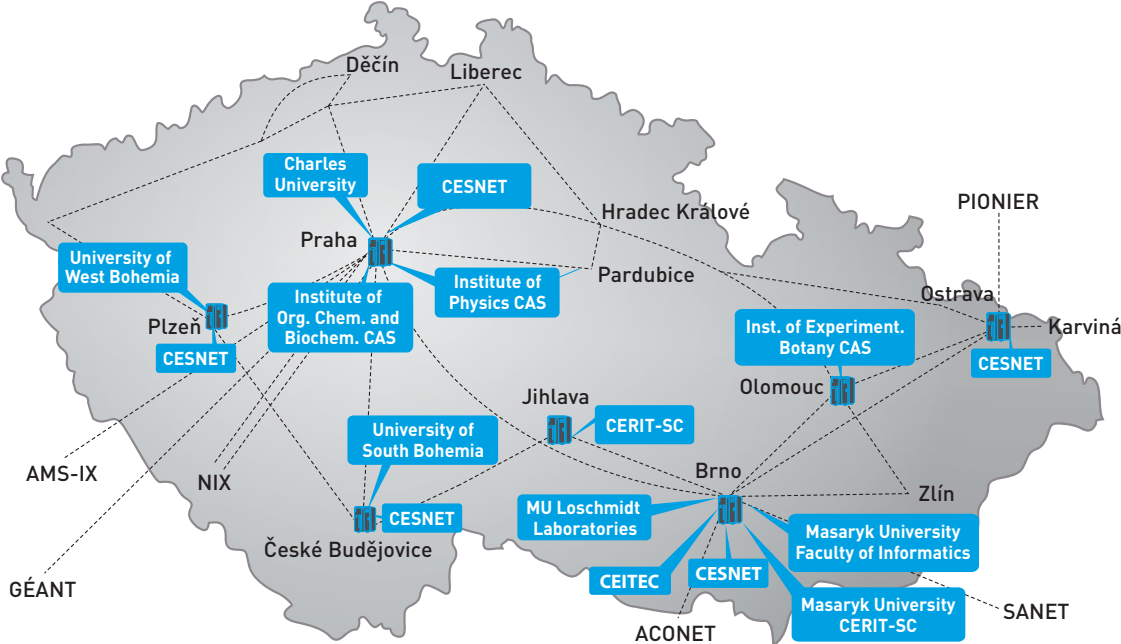
- ▶ Upgrade of the connection to the GÉANT pan-European research infrastructure to 30 Gbps; preparation for an upgrade to 100 Gbps.
- ▶ Upgrade of through connectivity to 10 Gbps.
- ▶ Upgrade of the IT4I connection to 4x10 Gbps; simultaneously, upgrade of the Ostrava node connection with the core of the CESNET2 backbone network to 100 Gbps.
- ▶ Upgrade of router chassis CRS-3/16 to new chassis CRS-X with a permeability of 400 Gbps per slot (support to a new type of multi-port 40GE and 100GE interfaces).
- ▶ Upgrade of chassis of the DWDM transmission system ONS 15454 MSTP at Brno and Ostrava nodes to new chassis NCS2006 (support to 100GE transponders and other new types of interfaces).
- ▶ Migration of some key connections in the Praha node to a new router CRS-X (GÉANT, LHCONE VPN, AMS-IX). The sufficient capacity of this router type will enable further upgrades to these connections, particularly to the GÉANT network.
- ▶ Upgrades of DWDM network nodes, IP/MPLS routers and management of system to newer SW versions with new functionalities.
- ▶ Connection of NIMH Klecany (CL DWDM technology).
- ▶ Upgrade of the CL DWDM route Praha-Ústí nad Labem-Liberec to a newer technology.
- ▶ Connection of Temelín with CL DWDM technology (accurate time transmission from the atomic clock).
- ▶ Addition of a 100GE/40GE interface to the router CRS-X at Brno_2 node (boosting connection to backbone, connecting participants and projects at higher capacities).

With regard to the increasing frequency and intensity of DDoS attacks, CESNET intensely pursued the issues of protection of network communication infrastructure and connected participants. It made RTBH services accessible in a pilot mode in the CESNET2 network environment for their needs. Participants can now effectively block attacks aimed against their infrastructures by themselves across the entire CESNET2 network. In the area of specific network services, the Association continues building the national optical infrastructure for time and frequency transmission – TF infrastructure.

National Grid Infrastructure

The Association's long-term objective in the area of distributed computing is the operation and development of the MetaCentrum national grid infrastructure (NGI) and integration of these activities in corresponding international infrastructures (chiefly the EGI) and projects.

METACENTRUM INFRASTRUCTURE



The NGI includes computing clusters of various types: conventional computing clusters with smaller numbers of more powerful processors, high-capacity SMP servers with larger numbers of processors in a large shared memory (up to 6 TB), clusters with specialised GP-GPU cards, and clusters ready for the MapReduce type of computing with larger storage spaces in each cluster node. Along with these computing servers (approx. 12,500 CPU cores at the end of 2015), the MetaCentrum also operates extensive data capacities (2 PB at the end of 2015), used for temporary storage of data processed. In the international EGI environment, the NGI provides an additional approx. 3200 CPU cores and 3.8 PB of disk space for international projects, particularly in LHC.

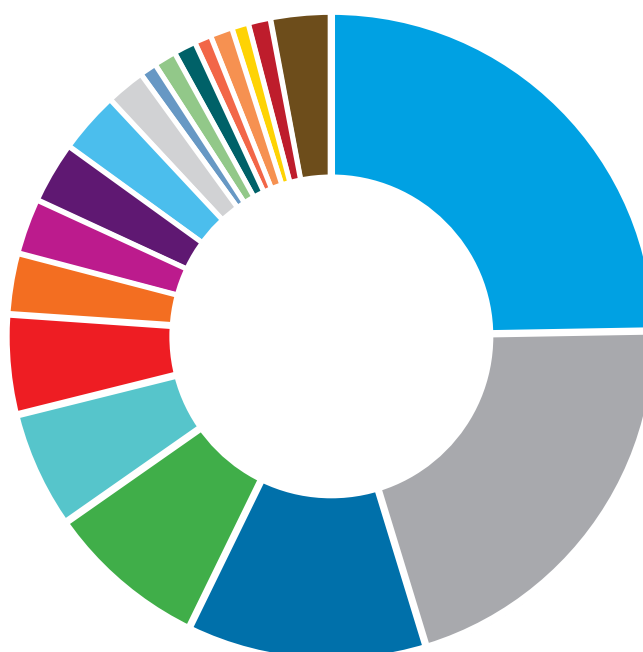
Within the NGI, CESNET plays the role of a national coordinator, linking the clusters acquired by other organisations or projects into a unified national grid and making available its own resources (5000 CPU cores out of the total 12,500) particularly to offset jump demands of different groups and for a faster start-up of application projects that are yet planning acquisition of their own computational resources.

Regarding its international activities, the Association continues supporting projects in LHC, the Pierre Auger Observatory experiment, the Belle project, and more recently, the ELIXIR and CLARIN projects. At the national level, we focus on direct support of user groups in the Czech Republic interested in using the pan-European EGI infrastructure.

A large modification of the international projects under H2020 in which the NGI is involved took place in the course of 2015. The EGI-Engage and INDIGO-DataCloud projects started as a follow-up on previous projects, advancing the European grid infrastructure and developing grid and cloud middleware, and the AARC and MAGIC projects advancing the Association's activities in the area of identity management and support to new security protocols in computing clouds. Besides, CESNET has been developing its collaboration with the ESFRI activities of the ELIXIR project, where the EXCELERATE project started; we are mostly responsible for preparation of cloud services.

SHARES OF DIFFERENT INSTITUTIONS IN THE METACENTRUM COMPUTATIONAL RESOURCES

- ▶ Charles University in Prague [25 %]
- ▶ Masaryk University [21 %]
- ▶ University of Chemistry and Technology Prague [12 %]
- ▶ Czech Technical University in Prague [8 %]
- ▶ Institute of Physics of the CAS, v. v. i. [6 %]
- ▶ University of South Bohemia České Budějovice [5 %]
- ▶ Brno University of Technology [3 %]
- ▶ University of West Bohemia Pilsen [3 %]
- ▶ Institute of Organic Chemistry and Biochemistry AS CR, v. v. i. [3 %]
- ▶ Tomas Bata Univerzity in Zlín [3 %]
- ▶ Institute of Physics of the CAS, v. v. i. [2 %]
- ▶ Institute of Macromolecular Chemistry of the CAS, v. v. i. [1 %]
- ▶ Global Change Research Institute of the CAS, v. v. i. [1 %]
- ▶ Jan Evangelista Purkyně University in Ústí nad Labem [1 %]
- ▶ Faculty hospital Hradec Králové [1 %]
- ▶ Institute of Plasma Physics of the CAS, v. v. i. [1 %]
- ▶ Institute of Geonics of the CAS, v. v. i. [1 %]
- ▶ Institute of Aeronautical Research and Test [1 %]
- ▶ Others [3 %]



Data Storage

Another fundamental component of the e-infrastructure is the distributed data storage, composed of three interconnected high-capacity data centres situated in Plzeň, Jihlava and Brno, with a combined capacity of 21 PB. From a technical point of view, the storage is organized hierarchically (HSM type – Hierarchical Storage Management).

In 2015, we acquired disk fields with solid-state disks for storage of file system meta-data for storage in Jihlava and Brno. This contributed to their increased permeability. The data storage infrastructure stored over 6000 TB of data at the end of 2015. The storage was used via standard file-oriented interfaces by 158 user groups (virtual organisations), which translates into 3000 individual user accounts (persons and service identities). Combined, they occupied over 12,000 TB of available media. However, the total impact of the storage on the community

is greater, as an individual user with an account in the storage often represents a group for which it does backup or archiving operations.

The data storage service also includes the very popular **FileSender** service for exchanging large data files among users. The service has gained popularity quickly: by the end of 2015, it had handled more than 43,000 files totaling about 60 TB of data.

The **ownCloud** cloud storage for data sharing and synchronisation is directly accessible

to members of the **eduID.cz** national federation of identities. The number of users of this service at the end of 2015 was almost 4650; they stored 35 TB of data in approximately 35 million files.

Infrastructure for Cooperation and User Support



IP telephony, video and web conferencing and multimedia streaming

The IP telephony network

pinterconnects several dozen gateways linked to institution exchanges, and several IP telephone exchanges of various brands. In 2015, it served 550,000 calls with a total length of 27,000 hours.

The video conferencing infrastructure offers primarily client registration, use of virtual rooms, recording and airing of programmes. Our multi-conferencing units (MCU) provided 5750 hours of meetings in dozens of virtual rooms. Over 120 hardware units were registered, and other users used the software client provided by

the Association. The Association runs a web-conferencing system built on the Adobe Connect platform, where users held more than 5860 hours of meetings, which is an increase of more than twenty percent compared to the previous year. The collaboration infrastructure includes resources for live transmissions (streaming) and recorded transmission. The infrastructure is used by over ten institutions, storing over 15 TB of multimedia data for VoD (video on demand) and 48 TB of Mediasite data in the storage. The Association also develops its own systems for high-quality

video and audio transmission with low latency. We organised transmission for about ten mostly medical congresses and events organised by institutions connected to the CESNET infrastructure. The Association demonstrated its technologies for high-quality low-latency transmission at six events abroad.

In 2015, the Association continued its role of national partner to the Czech-Norwegian project Digital Restoration of Czech Film Heritage, co-funded under the scheme CZ 06 Cultural Heritage and Contemporary Art.

Network Identity

A system for user management and access control for services provided under the e-infrastructure is an integral component of the comprehensive e-infrastructure. The user management is based on the **eduID.cz** distributed federation of identities, where the initial user registration and authentication services are provided by the home organizations while the authorization information is managed at the level of the services and their administrative domains. By the end of 2015, the federation included 68 identity providers (IdP) and dozens of service providers (SP), including services of the **eduGAIN** international federation of services, which are also accessible to **eduID** users.

The service of the special **eduID.cz IdP Hostel** is still available for minority user groups without their own IdP. Registered users may use the large infrastructure services at least to a limited extent. In 2015, we also started the process of harmonising rules for a clear identification of users and their parent organisations. The solution chosen is compatible with identity and service providers abroad.

eduroam.cz is the federated service still most accepted by users; it enables users of all the participating institutions to connect to the (typically wireless) network of any collaborating institution, thus gaining access to the Internet, as well as other services provided by the host network. Users are always authenticated by the home institution. This academic roaming

system was established as a European initiative under the TERENA Association (GÉANT Association nowadays) and has since spread all over the world. To ensure safe and trustworthy communication, the Association operates a public key infrastructure, based on the CESNET CA certification authority, issuing various types of certificates: for individuals, servers and other types. This category also includes provision of the TCS (Trusted Certificate Service), which was shifted to a new provider – DigiCert – in 2015.

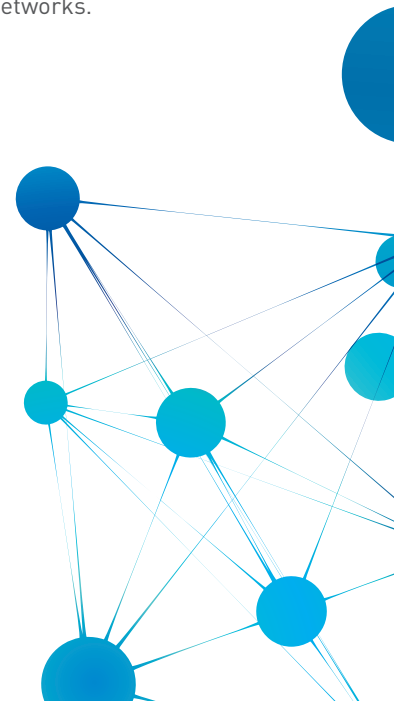
In the area of identity and access management, we continue developing the Perun system along with the Masaryk University. The **Perun** system instance manages identities and access to services for more than 150 user communities (national and international) with more than 4000 users. The authentication of the Perun system was initiated as a pilot project for identity management in the local environment of the AAAD in the latter half of 2015.

Security of the e-Infrastructure

The CESNET-CERTS security team is the basic element ensuring the e-infrastructure security. The core of its activity is incident handling – the receipt of security incident notifications occurring in the CESNET2 network, its solving and related coordination.

The team closely cooperates with other security teams and relevant organisations at the

national and international levels, is a member of the CSIRT. CS Working Group, organised by the Czech Republic's National CSIRT Team, and is also involved in the TF-CSIRT platform run by GÉANT. Network monitoring and detection of security events and anomalies play an important role in the area of security; in the CESNET e-infrastructure, they are provided by the systems and services FTAS, G3 and the Warden system, operated at a very high quality level, thus enabling both CESNET administrators and those in connected institutions to improve the quality of network, service and user security. Since 2013, the Association has run the FLAB forensic laboratory, which provides services such as analysis of security incidents or penetration and loading tests for preventive verification of integrity, credibility and availability of systems run. The laboratory services are available not only to CESNET e-infrastructure members but to other clients as well. The Association pays great attention to awareness raising among users and administrators of the connected computer networks.



Cooperation with National Research and Development Infrastructures

CESNET continuously deals with representatives of other large infrastructures, listed in the Roadmap for Large Research, Experimental Development and Innovation Infrastructures in the Czech Republic and other infrastructure projects. It identifies their needs from the point of view of the services provided by the Association and tries to start cooperation in the area. Examples of this cooperation in 2015 are as follows:

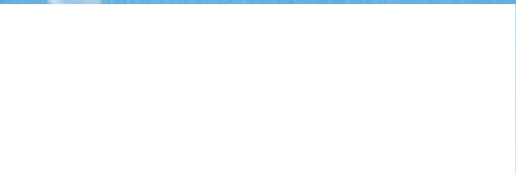
- ▶ active participation in building the **ELIXIR CZ** infrastructure, the national node of the European **ELIXIR** bio-information infrastructure; in this case, the Association is in fact a member of the consortium that applied for the project under Large Infrastructure Projects for Support of Research Infrastructures for **R&D&I**
- ▶ upgrade of the IT4I connection to 4x10 Gbps; penetration tests carried out
- ▶ preparation for connecting BIOCEV to the CESNET e-infrastructure
- ▶ consultation of design for ELI local network

At present, CESNET e-infrastructure services are used by 55 out of the 57 (apart from CESNET) large infrastructures included in the roadmap. Negotiations of connection with the other two are underway.

INTERNATIONAL INFRASTRUCTURAL PROJECTS

03

CESNET is involved in numerous major international projects: GÉANT, EGI, ELIXIR, GLIF, PlanetLab...



International Infrastructural Projects

GÉANT

The European GÉANT communication infrastructure makes available network services to about 40 million users from over 3500 institutions in 38 countries of Europe, and provides connection of the European national research and education networks with other similar networks, such as Internet2 and ESnet networks in the USA, CANARIE in Canada, and networks on other continents. The funding for this infrastructure and the related activities at the European level was assured in 2015 by support for two follow-up projects: GN3plus+ (until May 2015) and GÉANT2020 (after May 2015). In both the projects, CESNET was involved in solving tasks connected with network operation, development of new services, security, network identity, end-user networks and provision of cloud services. Simultaneously, the Association led a task force focused on building and management of physical infrastructure for testing of network technologies on a European

scale: the GÉANT Testbed Service (GTS). The GÉANT2020 project is scheduled for 68 months and divided into three phases. The end of the first, 12-month phase was scheduled for April 2016, which is why intensive work on preparation of phase two was underway in the latter half of 2015. The Association is involved in this 32-month-long phase to a greater extent than in phase one; CESNET also has more influence over the project implementation. In addition to the GTS, the Association leads another activity, focused on development of fibre infrastructure for the GÉANT network. The preparation of this project phase was entrusted to a seven-headed advisory body, the GÉANT Programme Planning Committee – GPPC, including the CESNET Director Ing. Jan Gruntorád, CSc.

EGI

The EGI.eu initiative coordinates, at the European level, national activities in the area of implementation of grid technologies

as an important component of the e-infrastructure. Cooperation in EGI.eu is supported by the project EGI-Engage (Engaging the EGI Community towards an Open Science Commons), which further develops the concept of multi-disciplinary pan-European grid infrastructure. Under the project, CESNET is involved in all the basic operating activities, assures the running of the national EGI grid node, and provides computing resources comprising both the Association's own computing capacities and those of the Institute of Physics of the Czech Academy of Sciences. We also continue supporting the virtual organisations Auger and VOCE, as well as directly supporting user groups in the Czech Republic interested in using the pan-European grid. A focus on specific needs of domestic professional groups and their international projects is a priority. Another project associated with advancement of international grid infrastructures in which the Association staff was involved in 2015 is the CHAIN-REDS



(Coordination and Harmonisation of Advanced e-Infrastructures for Research and Education Data Sharing), dealing with coordination of cooperation of European grid infrastructures with similar infrastructures in other regions.

ELIXIR

CESNET is actively involved in building a national node of the European ELIXIR bio-informatics infrastructure, which will provide an advanced computing environment, data resources and unique tools for the bio-informatics scientific community in the Czech Republic and in Europe. The support to this user community includes the provision of a pilot computing node for bio-informatics calculations for the national node ELIXIR CZ. The Association contributes to the development of the European infrastructure by its involvement in the European project ELIXIR-EXCELERATE, launched in September 2015, namely as part of the activity Technical services, focused on

the creation of a common framework for provision of computing services and services connected with data storage.

GLIF

Global Lambda Integrated Facility (GLIF) is a global research activity involving the most advanced institutions and consortia engaged in network research and application in Europe, North and South America, Asia and Australia. Individual GLIF participants enable other participants to use part of their resources so that collective experiments can be carried out. GLIF refers to a virtual organization composed of involved institutions as well as a research environment (facility), consisting of lambdas and nodes known as GOLE (GLIF Open Lightpath Exchanges), set up by this organization. Such an environment also enables experiments and demonstrations that pose a risk of interference and destruction. CESNET hosted the annual conference of this initiative in late September 2015.

PlanetLab and Related Projects

Since 2006, CESNET has been a member of the PlanetLab consortia and maintains four machines permanently in the PlanetLab networks (.org and .eu). The popularity of PlanetLab among university users has maintained a stable level. The Association is in charge of operating the local infrastructure. It registers about thirty permanent users from several universities, but their numbers increase substantially temporarily during semestral teaching. For these users, the Association has established and operates twenty active virtual networks with various configurations as specified by the users themselves. In total, all the virtual networks used by the CESNET users contain about 400 foreign nodes. This gives the users an unusual opportunity to test their applications in a global context.

THE ASSOCIATION'S RESEARCH ACTIVITIES

04

Besides building and operating e-infrastructure, CESNET also does research and development in the area of information and communication technologies.



The Association's Research Activities

E-Infrastructure Security

CESNET has long paid extremely close attention to the network security area. We were involved in the following projects in 2015:

- ▶ **Distributed system for comprehensive monitoring of high-speed networks (DMON100)** was a project under ALFA3 scheme of the TACR, in which the Association collaborated with INVEA-TECH, a. s. The project objective was to develop a monitoring system for networks with lines of up to 100 Gbps capacity. The project won second place in the contest Best Collaboration of 2015.
- ▶ **Technology for large-scale network processing and analysis (SecurityCloud)** is a project under the ALFA4 scheme of the TACR. The objective of the project is to develop an innovative technological solution that will enable both providers and users of network infrastructures and centralised services to reveal security problems.
- ▶ **Technology for high-speed network protection (DCPro).** Part of the EPSILON scheme of the TACR, the project aims at producing equipment with a permeability of 400 Gbps for processing and filtering of high-speed computer network traffic.
- ▶ **BEhavior-BAsed forwarding (BEBA)** is an international project under H2020, aimed at further advancing the OpenFlow technology in order to increase its flexibility and expand its capabilities (e.g., monitoring).
- ▶ **Detection of infrastructural security threats (DOBI).** The project is part of the scheme Security Research for the Czech Republic 2015–2020 of the Ministry of the Interior of the CR. The objective is to develop and verify methods for preventive protection of fibre infrastructure, which is frequently threatened during various construction works as well as by line theft.
- ▶ **Security event sharing and analysis in the national cyberspace (SABU).** The project was applied for under the same call as the DOBI, but its implementation only started in January 2016. The main objective is to create a pilot system for timely submission and analysis of events related to the national cyberspace.

Network Identity

The Association is continuously developing and implementing infrastructure for federalised sharing of services and resources. In 2015, we were involved in two international H2020 projects:

► **Authentication and Authorisation for Research and Collaboration (AARC).**

The objective is to design a general authentication and authorisation infrastructure for the broad user base of research infrastructures.

- The project **Middleware for collaborative Applications and Global Virtual Communities (MAGIC)** focuses on authorisation and authentication mechanisms in grid and cloud environments.

Grid Middleware, Clouds

Within the activities related to the running of the grid environment, the Association is intensely involved, particularly as part of the EGI.eu activities, in developing grid middleware related to task scheduling, as well as some components related to grid infrastructure operational security. We also deal with issues of computing clouds, including in the international H2020 project **INtegrating Distributed data Infrastructures for Global ExpLOitation (INDIGO-DataCloud)**, focused on developing and implementing an integrated, secure and permanent on-demand cloud service.

Optical Transmission Systems

CESNET develops numerous original fully optical CzechLight transmission systems, the greatest advantage of which is their open nature: software modifications can be made by the device owner or administrator themselves. The CzechLight series components have found practical application: specialist companies manufacture and market them under a CESNET licence. CESNET was involved in the following projects in 2015:

- **Set of components for photonic communication (EPCOM II)** is a project under EPSILON scheme of the TACR. Its objective is to make a set of optical and electronic components that will enable the operation of a photonic service on fibre and wireless communication links with a high degree of compensation for traffic delays in information transmitted.
- **COMMunication PLatform for tenders of novel Transport nEtworks (COMPLETE)** is an international H2020 project, with the expected outcome of more efficient tendering regarding construction of communication infrastructure for research and education.
- **eXperimental Infrastructures for the Future Internet (XIFI)** is an international project under the EU Public-Private-Partnership on Future Internet. Its objective is to build and run a unified European-scale platform for large experiments in the areas of Future Internet and Smart Cities. The project was concluded with a successful review in 2015.

- **NEAT-FT** was a project under the EMRP (European Metrology Research Programme) focused on the capabilities for transmission of accurate time (deviation up to 100 ps) and frequency (accuracy of 10⁻¹⁷) in optical networks. The project ran from 2012 to mid 2015, and CESNET was the only project partner representing national research and education networks.

Research and Development Outcomes

Three patents were registered in 2015:

- Ubik Sven, Halák Jiří, Žejdl Petr: Device For Receiving Of High-Definition Video Signal With Low-Latency Transmission Over An Asynchronous Packet Network, No. EP2553936, issued by EPO_1 – European Patent Office (EPO), 27 November 2015
- Vojtěch Josef, Hůla Milošlav, Karásek Miroslav, Šíma Stanislav, Radil Jan: Modular kit of devices for variable distribution, mixing and monitoring of optical signals in the internet and other networks, No. US 8948590, issued by US001 – United States Department of Commerce – United States Patent and Trademark Office (USPTO), 3 February 2015
- Slovák Petr, Holub Petr, Troubil Pavel: Videoconferencing environment for communication of remote groups and method for communication of remote groups in the videoconferencing environment system,

No. 305294, issued by CZ001 – Industrial Property Office, 22 July 2015

Among other outputs, the Association's research work in 2015 resulted in the publication of one book chapter, 6 articles in professional journals, and 35 articles in conference proceedings.

CESNET Development Fund

In early 2015, projects submitted for the second round of the tender for 2014 were evaluated. A total of 23 project applications were made. Seventeen projects were accepted for co-financing, including five after rework. The contributions requested by three projects were reduced compared to the amounts requested.

The table no. 1 shows an overview of the accepted projects.

In mid 2015, the Development Fund Board in cooperation with the Association selected topics and opened a new project tender.

The following topic areas were announced for the first round in 2015:

- ▶ Utilisation and advancement of CESNET2 network services and modern information and communication technologies in teaching and education processes, creative and scientific research work, and management of public universities and the Academy of Sciences of the CR
- ▶ Advanced applications utilizing the high-speed backbone network
- ▶ Support to utilisation of CESNET data storage
- ▶ Support of training for Association members' employees aiming to acquire a globally recognised IS/IT certificate

Out of the 25 project applications submitted in that round, 19 were admitted for co-funding, including three after reworking. The contributions requested by three projects were reduced compared to the amounts requested.

The table no. 2 shows an overview of the accepted projects.

Two rounds of review procedures for completed projects took place in 2015: 21 projects were successfully completed, one project was terminated upon the project manager's request. Completion of final documentation was requested for several projects. Final project reports within the CESNET Development Fund are available on the Association's website.



PROJECT NO.	PROJECT CARRIER	PROJECT NAME
532R1/2014	Charles University	Integration of CESNET data storage services into the data backup and archiving process at scientific offices of the CU Faculty of Science
534/2014	University of West Bohemia	Acquisition of Oracle Database 12c Administrator Certified Associate certificate
535/2014	University of West Bohemia	Utilisation of minicomputers in the UWB authentication infrastructure
536/2014	University of West Bohemia	Acquisition of Oracle Database 12c Administrator Certified Professional certificate
537/2014	Silesian University	Improving professional qualifications of the employee in charge of IT system administration at the SU of Opava
538/2014	ASCR	Improving professional qualifications of the IT network and security specialist of the Institute of Molecular Genetics of the ASCR – CCNP re-certification
540/2014	University of Economics Prague	Pilot application for distributed analysis of large data using computing capacities of CESNET MetaCentrum
542/2014	Czech Technical University	Integration of WebRTC technology with existing video and audio conferencing systems
544/2014	ASCR	Implementation of unified authentication of users accessing the internal wired and wireless network of Centre of Administration and Operations of the ASCR using an end station and user authentication system
545/2014	ASCR	Improving qualifications by taking the Cisco Academy with the purpose of acquiring an international Cisco CCNP certificate
546R1/2014	University of Technology	System for testing security of IPv6 networks and processing of incidents in private address spaces
548R1/2014	Masaryk University	Video conferencing environment for remote interpretation into the sign language based on the CoUniverse and UltraGrid technologies (acronym CoUnSiL)
549/2014	Charles University	Establishment of a CSIRT security team (CSIRT-CUNI office), building of monitoring systems for supporting handling of security incidents and detection of anomalies in data networks of Charles University in Prague, integrated of Charles University into the Warden, a system for sharing information on detected security events (http://warden.cesnet.cz)
550R1/2014	University of Pardubice	Creation of conditions for IP telephony and shift to unified university communication
551/2014	Charles University	Interactive identification in clouds – expansion of outcomes of project 431/2011
552R1/2014	Academy of Performing Arts in Prague	Addition of presentation and teaching features to the environment for development of perception tests
553/2014	UJEP	Improving qualifications of Cisco Networking Academy staff at the Department of Informatics of the Faculty of Science Jan Evangelista Purkyně University in Ústí nad Labem

THE TABLE NO. 1

PROJECT NO.	PROJECT CARRIER	PROJECT NAME
554/2015	ASCR	Improvement of professional qualifications of the IT system administrator of the Institute of Molecular Genetics of the ASCR – RHCE re-certification
555R1/2015	AAAD	Installation and implementation of the Perun identity and access management system, including connection to other systems and the EduID federation of identities
556/2015	UTB	Creation of unique identifiers of scientific paper authors using the ORCID and Shibboleth services
557/2015	University of Hradec Králové	Professional training and certification of virtualisation technology administrators
558/2015	University of Hradec Králové	Improving qualifications of staff of the UHK Information Technology Centre in planning, design, implementation and configuration of SQL server databases
559/2015	Czech Technical University	System for management, display and storage of large data from medical examinations in a data storage
561/2015	ASCR	Improving qualifications by taking the Cisco Academy with the purpose of acquiring an international Cisco CCNP certificate
562R1/2015	Technical University Ostrava	Backup of virtual infrastructures
563/2015	Masaryk University	Improving qualifications of the employee in charge of IT administration by taking the course VMware vSphere: Fast Track (V6) aiming at acquisition of the international certificate VMware Certified Professional 6 – Data Center Virtualization
564/2015	Masaryk University	Improving qualifications of the employee in charge of IT administration by taking three courses aiming at acquisition of the international certificate Solutions Associate Windows Server 2012
565/2015	University of Pardubice	Improving qualification of an security employee by means of Firewall F5
566/2015	Silesian University	Improving professional qualifications of the employee in charge of IT system administration at the SU of Opava
567/2015	Czech Technical University	Traffic analyses in the CESNET network infrastructure
569/2015	Czech Technical University	System for multisensory recording of historical buildings using unmanned helicopters
570/2015	Czech Technical University	Implementation and testing of methods for detection of phishing attacks in the CESNET network
571R1/2015	University of West Bohemia	Optimisation of management and security of virtual machines
572/2015	UJEP	Further improving qualifications of Cisco Networking Academy staff at the Department of Informatics of the Faculty of Science Jan Evangelista Purkyně University in Ústí nad Labem
575/2015	University of West Bohemia	Acquisition of the certificates Oracle Certified Expert, Java Platform, Enterprise Edition 6 Enterprise JavaBeans Developer and Oracle Certified Expert, Java EE 6 Web Services Developer
578/2015	TUL	Data caching in data storage for visualisation server

THE TABLE NO. 2



PUBLIC RELATIONS

05

The Prague session of the international GLIF consortium promoting lambda services was the most important event of the year. Experts from all over the world convened at the event.



Public Relations

In 2015, the Association continued its activities highlighting its unique role for science and research infrastructure in the Czech Republic. It also worked on activities aimed at passing on experience to the Internet community.

The Association organised seminars, conferences and workshops for both the academic and expert public, each one dealing with a specific topic. We organised 17 events, including 11 national and 6 international, in 2015.

The most important event of 2015 was the GLIF (The 15th Annual Global LambdaGrid Workshop) – a meeting of an international consortium promoting lambda services. The conference took place at the International Hotel on 28-30 September, being the second session in Prague and a great success. It welcomed 108 experts from all over the world (the USA, Canada, Brazil, Singapore, Japan, South Korea, etc.). Several demonstrations were shown during the conference. Among other things,

the Association's experts demonstrated the technology for low-latency transmission of high-quality video in the 4K and 3D HD formats along with information from sensors of a remotely controlled mobile robot, designed for jobs such as examination of dangerous areas (see Figure 1).

The Association also hosted other international meetings, primarily working groups under the GÉANT project (GN4 NA3 T2 Best Campus Practices Kickoff Meeting – see Figure 2, GN4 SA7 Support to clouds, GN4 SA8 Educonf). Prague was also the venue of the final meeting of the project FI-PPF XIFI (Future Internet – Public Private Partnership, eXperimental Infrastructures for Future Internet). It welcomed

over 70 participants from more than 35 organisations. The Association was given a silver prize for the quality of its services at the meeting. Besides, the OpenTech Nebula Day workshop took place in 2015.

The domestic events followed up on the traditional CESNET Day – an informal meeting between the Association's experts and representatives of member organisations. Each organisation chose a focus depending on its own requirements. These meetings are very popular and boost communication among the Association members. The CESNET Day took place at the Tomáš Baťa University in Zlín (see Figure 3), Czech University of Life Sciences in Prague, and the University of Defence in Brno.



Figure 1

GLIF 2015 example of demonstrations: remotely controlled mobile robot



Figure 2

GN4 NA3 T2 Best Campus Practices Kickoff Meeting



Figure 3

CESNET Day at Tomáš Baťa University in Zlín

Figure 4

CESNET
Community
Forum



Figure 5

Network
and Service
Security
Seminar



Figure 6

Shooting
the show
Mystery
Hunters



In 2015, the Association organised another year of the CESNET Community Forum – Multimedia (see Figure 4). The meeting dealt with multimedia and resources for remote collaboration. The Association's experts presented new features and trends in the area of environmental services for collaboration (video and web conferencing) as well as advanced transmission and visualisation technologies developed or co-developed by the Association (Ultragrid, MVTP-4K). Two highly successful Network and Service Security Seminars (see Figure 5) took place, focusing on the expert public. Another security seminar, the !Security FEST! was intended for a more general public. A seminar on grid and cloud computation focused on bio-information was held towards the end of the year. The Association organises or co-organises numerous other training courses.

The Association also presented itself as a partner at several events. As traditionally, this was the Science and Technology Week, where we provided Internet broadcasting of selected lectures, as well as the Linux-Days, Install Fest, the Internet and Technologies meeting and the OpenSource Network Solutions conference. All the events featured presentations delivered by the Association's experts.

The year 2015 was also a success regarding our television appearances. CESNET contributed to the making of two episodes of Mystery Hunters on Czech Television (see Figure 6). The first episode, called „Networking“, included shots from several CESNET offices, followed by another episode, „Following the Digital Trail“. In the show Prima hodinka of Prima TV, the Association Director Ing. Jan Gruntorád, CSc., spoke about the 20th anniversary of commercial Internet in the Czech Republic. The Association Director appeared again in a news report of TV Barrandov commemorating the 23rd anniversary of Internet connection in the Czech Republic.

The Association also presented its activities on its web site, which it kept updated throughout the year. A blog was launched towards the end of the year, publishing posts by the Association's experts with information on interesting technologies and events, and musings relating to information and communication technologies. The Association also used social networks for presenting itself, where it shared its latest news, its employee's achievements, and information on conferences and other events.

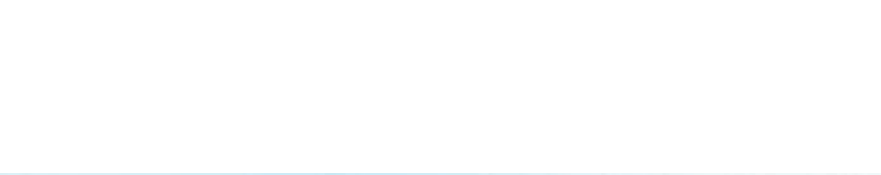
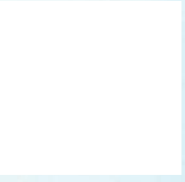
As in previous years, our collaboration on the international scale continued. There were meetings of the TF-CPR and GLOBAL PR working groups, where communication and PR specialists shared their experience.

The Association continued to use feedback in the form of periodic media monitoring and monthly analyses of these outcomes. In 2015, the Association made twenty-four press releases, adopted and published by various media.

ECONOMIC RESULTS

06

The Association managed the funds entrusted to it properly in 2015. The financial statement was verified by the auditor without any remarks.



2015

Economic Results

Activities of the CESNET Association are divided into two categories in accordance with its statutes: Principal Activity and Economic Activity.

Principal Activity

The year 2015 was the last of the five-year project CESNET Large Infrastructure.

As part of its principal activity, the Association continued building an e-infrastructure of a new quality providing Association members and other entities eligible for connection to the CESNET2 network with a comprehensive set of services. In addition, the Association was involved in executing international research projects under the EU's 7th Framework Programme, grants from the Technology Agency of the Czech Republic, the Ministry of the Interior of the CR, Norway Grants, and projects of the Development Fund Board. The Association's principal activity in 2015 was concluded with an accounting loss of CZK 5025 thousand. Revenues from the Association's principal activity amounted to CZK 545,007 thousand; the expenditures were CZK 550,032 thousand. The income tax base from

the yields of the Association's principal activity in 2015 was positive, amounting to CZK 1032 thousand.

Economic activity

The Association's economic activity in 2015 mainly involved management of the largely bond-based portfolio of the Development Fund comprising financial resources obtained by sale of the commercial part of the CESNET network in 2000 and management of financial resources in other funds. The Association's economic activity ended 2015 with a book profit of CZK 6745 thousand. Revenues from the Association's economic activity in 2015 amounted to CZK 54,055 thousand; expenditures on the economic activity were CZK 47,310 thousand. The income tax base from the yields of the Association's economic activity in 2015 was positive, amounting to CZK 7490 thousand.

Total Book and Tax Economic Result

The total book economic result of the CESNET Association prior to taxation reported in 2015 was a profit amounting to CZK 1720 thousand.

The total income tax base after deducting tax base-reducing items was CZK 7522 thousand. The Association paid income tax of CZK 1490 thousand for the year 2015, resulting in profit after taxation of CZK 230 thousand.

Conclusion

The Association properly managed the entrusted resources in 2015, meeting all its obligations resulting from the legislation, decisions of the Ministry of Youth, Education and Sport of the Czech Republic and concluded contracts. The financial statement for 2015 was verified by the auditor without any remarks.

BALANCE SHEET IN THOUSANDS OF CZK

	2015	2014	2013	2012
Assets total	664,518	834,034	1,020,221	1,145,473
Fixed Assets	509,375	648,300	814,654	676,126
Intangible fixed assets	6,149	9,277	10,044	7,800
Tangible fixed assets	199,004	304,242	475,675	345,263
Financial Investments	304,222	334,781	328,935	323,063
Current assets	155,143	185,734	205,567	469,347
Supplies	92	92	92	1,406
Receivables	31,565	38,628	46,879	52,862
Current liquid assets	99,849	130,761	135,918	397,617
Other assets	23,637	16,253	22,678	17,462
Liabilities total	664,518	834,034	1,020,221	1,145,473
Own resources	601,646	717,133	907,022	985,784
Funds	481,132	589,923	768,320	839,660
Economic result	230	418	16	21,686
Undivided profit from last years	120,284	126,792	138,686	124,438
External resources	62,872	116,901	113,199	159,689
Obligations	60,813	112,014	109,676	157,015
Loans	0	0	0	0
Other liabilities	2,059	4,887	3,523	2,674

PROFIT AND LOSS STATEMENT IN THOUSANDS OF CZK				
INDICATOR	2015	2014	2013	2012
Earnings for the sale of goods	3	5	193	748
Earnings of own product and services	106,582	101,565	99,276	98,697
Current liquid assets revenues	9,037	54,746	151,325	89,755
Other revenues	231,827	279,950	229,200	187,818
Received membership fees	0	0	0	0
Operation subsidies	251,613	237,135	237,810	248,233
Revenue total	599,062	673,401	717,804	625,251
Purchase price of sold goods	1	2	4	263
Material and energy consumption	24,350	17,475	22,473	19,656
Purchased services	199,501	198,033	222,073	230,517
Personnel costs	149,066	134,699	137,480	133,844
Depreciation and amortization of intangible and tangible fixed assets	177,362	256,126	181,783	132,057
Other costs	47,062	62,926	153,135	82,550
Income tax – assesment for the current year	1,490	3,722	840	4,678
Costs total	598,832	672,983	717,788	603,565
Economic result (Revenue – Costs)	230	418	16	21,686

R – audit, s. r. o.

140 00 Praha 4, Olbrachtova 1980/5, Krč

tel.: 731 692 459; e-mail: info@r-audit.cz

zapsána v obchodním rejstříku MS Praha oddíl C, vložka 20496, od 31. května 1993, číslo auditorského oprávnění 124

INDEPENDENT AUDITOR'S REPORT

Auditor's report for the members of the association of CESNET, Association of Legal Entities with its registered office at: Praha 6 – Dejvice, Zikova 4, Company Registration Number: 63839172

Financial Statement's Report

We have audited the accompanying financial statements of association CESNET, Association of Legal Entities which comprise the balance sheet as at 31 December 2015, a profit and loss statement and the appendix to these financial statements, including a description of the significant accounting policies used. Information about CESNET, Association of Legal Entities is specified in point 1 of the appendix to these financial statements.

Statutory Body's Responsibility for the Financial Statements

The statutory body of CESNET, Association of Legal Entities is responsible for the preparation of financial statements that give a true and fair view in accordance with Czech accounting regulations and for such internal control as statutory body determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with Act No. 93/2009 Coll., the Act on Auditors and International Standards on Auditing and the related application guidelines issued by the Chamber of Auditors of the Czech Republic. Those laws and regulations require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation of the financial statements that give a true and fair view in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion, the financial statements give a true and fair view of the financial position of CESNET, Association of Legal Entities as of 31 December 2015, and of its financial performance for the year then ended in accordance with Czech accounting regulations.

Other Information

The other information comprises the information included in the annual report, but does not include the financial statements and our auditor's report thereon. The Statutory Body is responsible for the other information.

Our opinion on the financial statements does not cover the other information and we do not express any form of opinion thereon. However, in connection with our audit of the financial statements, our responsibility is to read the other information and consider whether the other information is not materially inconsistent with the financial statements or our knowledge obtained in the audit, the annual report has been prepared in accordance with the applicable legal requirements, or the other information does not otherwise appear to be materially misstated. If, based on the work we have performed, we conclude that the above is not true, we are required to report such facts.

Based on the work we have performed, we have nothing to report in this regard.

Date of issue of report:
In Prague on 13 June 2016

Auditing company: R – audit, s. r. o.
Chamber of Auditors of the Czech Republic certificate number 124
Company head office: Praha 4, Olbrachtova 1980/5

Responsible auditor: Ing. Tomáš Valder
Chamber of Auditors of the Czech Republic certificate number 1326

