ANNUAL REPORT
CESNET ASSOCIATION

2016

CESNET

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WE CELEBRATED OUR 20TH ANNIVERSARY IN 2016. WE BEGAN TO FULFIL OUR STRATEGIC CESNET E-INFRASTRUCTURE PROJECT, COMPLETED A NUMBER OF IMPORTANT TASKS AND ACHIEVED NOTABLE SUCCESS

The year 2016, at which we are looking back in this Annual Report, was very important for CESNET. We celebrated our 20th anniversary on 6 March 2016. But the jubilee is not the only reason why we will have fond memories of this year. We began to fulfil our strategic CESNET e-Infrastructure project in it. We completed a number of important tasks and achieved notable success.

Symbolically, we organized the ceremonial meeting commemorating our 20th anniversary in the staterooms of the Senate of the Parliament of the Czech Republic. We wanted to emphasize that the Association's main task is to serve Czech science, research and tertiary education. We were elated to have many prominent personalities joining us for the event, which was co-organized by the Senate's Committee for Education, Science, Culture, Human Rights and Petitions. At the end of the gathering, we organized a "remote concert" played from Prague and Copenhagen to demonstrate to our guests one of the paths opened up by the latest advances in technology for a modern information society.

Our activities are closely associated with building it. Shortly after our foundation, we began constructing a high-performance computer network interconnecting universities and individual nodes at the Academy of Sciences, with parameters matching those of similar foreign networks. Today, the CESNET national e-infrastructure is one of the top European infrastructures. This provides the Czech academic community with access to cutting-edge information services, matching the ever-growing needs of today's science and research. Czech experts can thus take part in the most demanding international projects.

Another key event in 2016 was the June TNC16 conference, the most prestigious European event in our industry. Its organizer, GÉANT, an association of European national research networks, chose us as the host, certainly also in consideration of our 20th anniversary. The meeting took place in Prague from 12 to 16 June under the title of Building the Internet of People and was attended by more than 700 managers and experts in networking collaboration and related fields, from both academia and commercial sectors.

Naturally, we continued with our core activities in 2016: building the CESNET national infrastructure as well as carrying out our own

development and research. You can find detailed information on our activities on the next pages, so I will mention just a few.

At the beginning of the year, we provided the country's science and research community with a direct 100Gbps physical connection with today's most powerful infrastructure: the pan-European GÉANT network. The previous speed of 30 Gbps was no longer sufficient for the scientists; high saturation used to occur at peak times. The more than triple speed increase was not the only technological advantage of this step, though. The original link did not allow transferring separate data streams of more than 10 Gbps. This is possible now. The switch to 100Gb technology thus opened the way for developing new, high-demand applications. Unique solutions that our experts help to develop get a great response from the professional public on a long-term basis.

For example, we succeeded in the prestigious Czech Brain competition in 2016. We, together with Netcope Technologies, received the Industrie Prize, awarded by the Ministry of Industry for the most significant innovative technologies, for the development of the first network card for processing 100G Ethernet, that is, for processing data flows on the fastest backbone networks.

The COMBO-CG card can make the Internet faster and safer. Its unique features include the ability to capture network traffic at the full speed of 100 Gbps and transfer it to the host computer's memory for further analysis. This allows using the card to build network traffic monitoring probes. Netcope Technologies have already supplied dozens of these cards to their customers at a unit cost exceeding EUR 10,000. The customers include leading technology companies from Silicon Valley as well as the operators of the largest global networks.

The fortunes of the COMBO-CG card are an illustrative example of how important the results of our activities are for various fields of human activity. And they do not have to be just fields directly linked to communications and networking technologies.

The most famous film festival in Cannes, specifically its Cannes Classics section personally supervised by festival director Thierry Frémaux, featured Ikarie XB 1, a Czech film directed by Jindřich Polák, in May 2016. It was a digitally restored version, which made the film look as fresh again as it did when it was shot back in 1963. Our experts played a major role in the rejuvenation of the film. Ikarie XB 1 was digitally restored by the National Film Archive as part of a project supported by a grant from Iceland, Liechtenstein and Norway and co-funded by the Czech Ministry of Culture. Select significant films from the Czech cinematographic heritage have been restored. As a project partner, CESNET provided the necessary technology and infrastructure and helped develop methods for digital archiving and metadata creation and administration. As you can see, the impact of our work sometimes has unthought-of consequences.

I am sure that people will encounter similar practical uses of our solutions more and more often. Our state-of-the-art infrastructure and related services will continue to help experts across fields to push out the frontiers of human capabilities and knowledge.

In conclusion, please allow me to thank all Association members, employees and collaborators for their excellent work and the Ministry of Education for indispensable institutional and financial aid without which we would never be able to fulfil our ambitious tasks.

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

006 CHAPTER

THE ASSOCIATION BEGAN IMPLEMENTING THE CESNET E-INFRASTRUCTURE PROJECT. THE PROJECT AIMS TO DEVELOP THE NATIONAL E-INFRASTRUCTURE, WHICH WAS BUILT UNDER THE PREVIOUS CESNET LARGE INFRASTRUCTURE PROJECT, IN 2016–2019

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THE ASSOCIATION'S HISTORY AND CURRENT TASKS

The CESNET Association was founded by public universities and colleges and the Academy of Sciences of the Czech Republic (ASCR) in 1996. Its objectives are to:

[1.] Independently conduct fundamental, industrial research and experimental development in information and communications technologies and their application and disseminate the results of such activities by all available means including technology transfer

[2.] Build, develop and operate CESNET research infrastructure on a long-term basis and promote the development, adoption and utilization of state-of-the-art communications and information technologies

[3.] Support, in return for the reimbursement of related expenses, the dissemination of erudition, culture and knowledge, members' cooperation with industry, expansion of applications of the latest information technologies, and improvement of the CESNET research infrastructure by recruiting additional members, information sources and services

When it was founded, the Association also functioned as a commercial Internet service provider to earn additional money from these activities for its main activity. It successfully became one of the top businesses in the Internet connection market in the Czech Republic. The Association 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 a 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 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-infrastructures necessary for the Czech Republic's involvement in the European Research Area and enabling, for example, connection to the other e-infrastructures described in the ESFRI Roadmap.

The other project crucial for the Association's activities was the Extension of the National R&D Information Infrastructure in Regions (abbreviated as 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. According to the grant decision, the Association is obligated to make the project sustainable at least until the end of 2018.

In line with its goals and as part of its main activities (see below), the Association began implementing the CESNET e-Infrastructure project (identification code LM2015042) in 2016. The project aims to develop the national e-infrastructure, which was built under the previous CESNET Large Infrastructure project, during 2016–2019.

The CESNET e-infrastructure is used to provide non-public services to support and serve Czech science, research, development and education. CESNET e-infrastructure services are described in the next sections of the Annual Report. The Association provides these services to not only its members but also other entities that meet CESNET's current e-Infrastructure Access Policy.

SCOPE OF ACTIVITIES

THE SCOPE OF THE ASSOCIATION'S MAIN ACTIVITIES IS AS FOLLOWS:

[1.] Conducting independent research and development activities in information and communication technology and providing research services in this field

[2.] Supporting education in information and communications technology

[3.] Putting the results of in-house research and development into practice through technology transfer of internal nature

[4.] Undertaking the following activities for the benefit of its members, their subsidiary organizations as well as other entities:

- Developing and operating the national communications and information infrastructure enabling the interconnection of their infrastructures, providing access to the CESNET infrastructure and connecting to similar third-party infrastructures (including Internet access)
- Building shared hardware, communications and software and information services
- Verifying new applications, collaboration and complementarity of member activities at a level comparable to that of leading academic and research infrastructures abroad

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 Association's objective to generate any profit on these activities.

In addition to its main activities, the Association also pursues economic/business activities, but only 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.

Any loss incurred in connection with the Association's supplementary activities will always be settled by the end of the fiscal period in question or the supplementary activity in question will be discontinued before the beginning of the following fiscal period.

The Association uses all of its profits to promote research and development.

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MEMBERSHIP IN INTERNATIONAL AND NATIONAL ORGANIZATIONS

CESNET WAS A MEMBER OF RENOWNED INTERNATIONAL AND NATIONAL ORGANIZATIONS IN 2016.

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 support for the development of the most demanding scientific and research applications; their main objective is to create a network to serve applications with extreme bandwidth requirements

Internet2 – a consortium led by US research and education institutions endeavouring to develop and deploy new types of networking technologies, services and applications; CESNET has been an associate consortium member since 1999

PlanetLab – a consortium of academic, commercial and governmental organizations from all around the world, collectively operating a global computer network designed for developing and testing new telecommunications applications; the network currently encompasses 780 nodes in 31 countries

EGI.eu – an organization aimed at coordinating European computing grids used for scientific computations and at supporting their sustainable development

Shibboleth – an international consortium for the coordination of the development of a service providing a single sign-on solution, meaning that a user can use multiple secured network resources using a single login; Shibboleth is the foundation for academic identity federations

NATIONAL ORGANIZATIONS

NIX.CZ – CESNET is one of the founders of NIX.CZ, z. s. p. o. (Neutral Internet Exchange), an association of Internet service providers in the Czech Republic, allowing mutual connectivity among its members' networks; the association had 71 members as of 31 December 2016

CZ.NIC – the Association is also one of the founding members of CZ.NIC, z. s. p. o., which administers the .cz domain and supports publicly beneficial projects and activities relating to the Internet; the association had 112 members as of 31 December 2016

ASSOCIATION MEMBERS

THE FOLLOWING INSTITUTIONS WERE MEMBERS OF THE ASSOCIATION IN 2016:

- 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 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
- University of Chemistry and Technology Prague
- Czech University of Life Sciences 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
- Jan 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

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INTERNAL ORGANIZATIONAL STRUCTURE

CESNET HAS THE FOLLOWING BODIES:

— GENERAL ASSEMBLY
— BOARD OF DIRECTORS
— SUPERVISORY BOARD

GENERAL ASSEMBLY

The Association's Board of Directors consisted of the following members until 30 June 2016:

— 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.

The **Chairman** was Prof. Ing. Miroslav Tůma, CSc. and the **Vice-Chairmen** were doc. RNDr. Václav Račanský, CSc. and Mgr. František Potužník.

For the term of 2016–2018, the 41st General Assembly elected the following members of the Board of Directors at its meeting held on 30 June 2016:

— Mgr. Michal BULANT, Ph.D.
— RNDr. Igor ČERMÁK, CSc.
— RNDr. Alexander ČERNÝ
— Ing. Jan GRUNTORÁD, CSc.
— Mgr. František POTUŽNÍK
— Doc. RNDr. Pavel SATRAPA, Ph.D.
— Prof. Ing. Miroslav TŮMA, CSc.

Prof. Ing. Miroslav TŮMA, CSc., was elected as **Chairman**; RNDr. Igor ČERMÁK, CSc., and Mgr. František POTUŽNÍK were elected as **Vice-Chairmen**.

BOARD OF DIRECTORS

Based on the elections held at the 39th General Assembly on 9 July 2015, the Supervisory Board consisted of the following members in 2016:

— Mgr. Jan GAZDA, Ph.D.
— Ing. Jaromír MARUŠINEC, Ph.D., MBA
— Ing. Jakub PAPÍRNÍK
— RNDr. David SKOUPIL
— Prof. Ing. Ivo VONDRÁK, CSc.

The **Chairman** was Ing. Jaromír Marušinec, Ph.D., MBA.

Prof. Ing. Ivo Vondrák, CSc. resigned from the Supervisory Board on 11 November 2016. Based on the Articles of Association, the Supervisory Board co-opted Ing. Michal Sláma as a new member on 1 December 2016. The co-option was confirmed by the 42nd General Assembly on 22 December 2016.

Ing. Jan Gruntorád, CSc. was the **Director** of the Association in 2016.

DEVELOPMENT FUND BOARD

Based on the elections held at the 39th General Assembly on 9 July 2015, the Development Fund Board consisted of the following members in 2016:

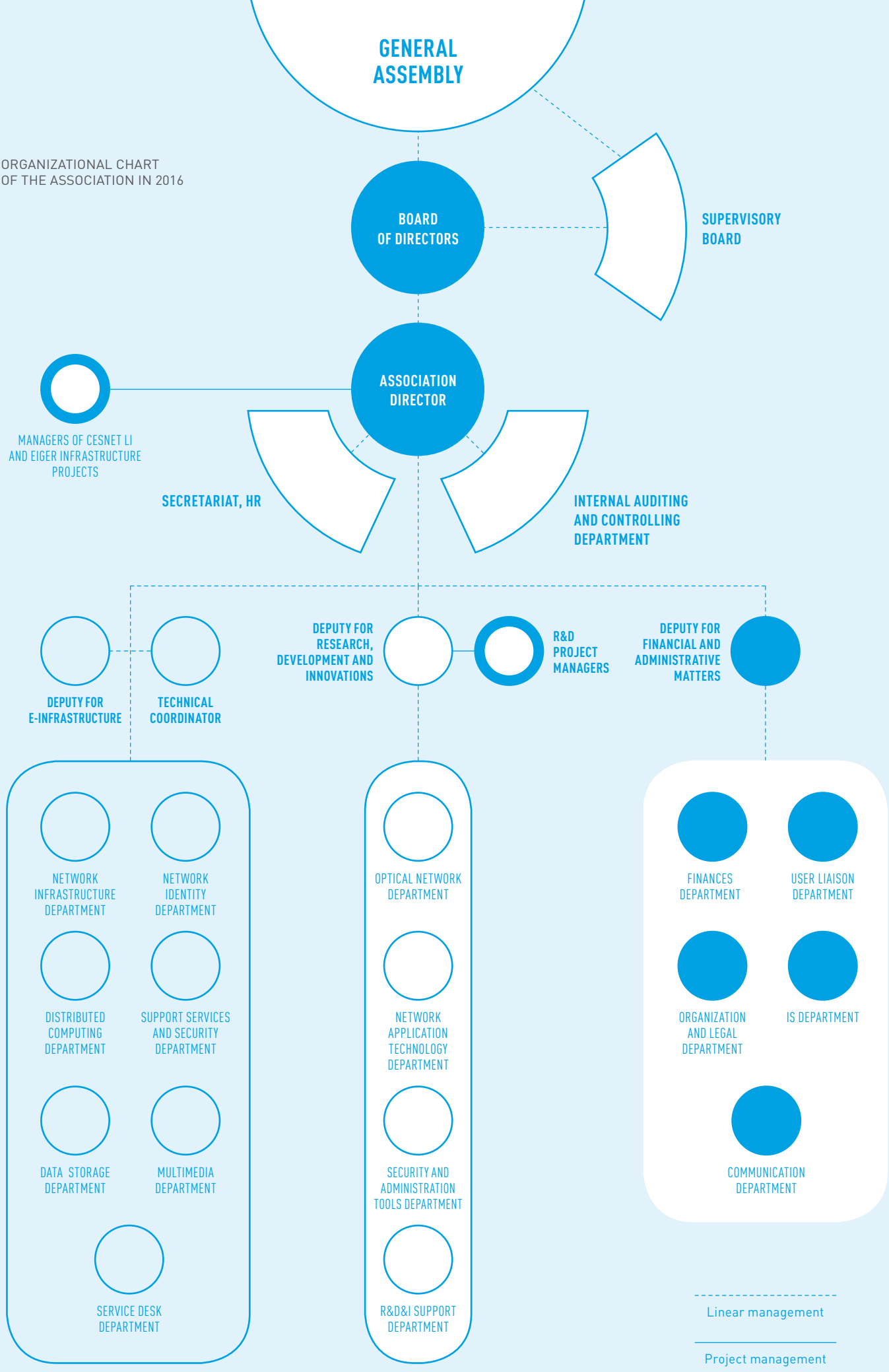
— Doc. Ing. Vojtěch BARTOŠ, Ph.D.
— Ing. Miroslav INDRA, CSc.
— Ing. Olga KLÁPŠŤOVÁ
— Doc. RNDr. Antonín KUČERA, CSc.
— Prof. Dr. Ing. Zdeněk KŮS
— Ing. Michal SLÁMA
— Prof. Ing. Zbyněk ŠKVOR, CSc.

The **Chairwoman** of the Development Fund Board was Ing. Olga KLÁPŠŤOVÁ.

ORGANIZATIONAL CHART

Following discussion with the Board of Directors, the organizational chart was approved by the Association Director on 4 January 2016 and entered into force on 4 January 2016. The Association had 155.2 full-time equivalents in 2016. The Association's basic organizational structure comprises departments, which may be aggregated into sections. Management within this structure is performed by line managers.

ORGANIZATIONAL CHART
OF THE ASSOCIATION IN 2016



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CESNET E-INFRASTRUCTURE

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THE PURPOSE IS TO PROVIDE AND DEVELOP A COMPLEX OF HIGH-QUALITY INFORMATION AND COMMUNICATIONS SERVICES WITH ADEQUATE CAPACITY FOR USERS IN THE FIELD OF RESEARCH, DEVELOPMENT AND INNOVATION

016 INTRODUCTION

CESNET'S FUNDAMENTAL ACTIVITY
IS DEVELOPING, BUILDING AND OPERATING THE CESNET E-INFRASTRUCTURE, WHICH IS A COMPLEX ENVIRONMENT COMPRISING A HIGH-THROUGHPUT NATIONAL COMMUNICATIONS INFRASTRUCTURE, A NATIONAL GRID INFRASTRUCTURE (NGI) AND A DATA STORAGE INFRASTRUCTURE, COMPLEMENTED WITH TOOLS AND SERVICES FOR MANAGING ACCESS TO RESOURCES, COMMUNICATION SECURITY AND DATA PROTECTION TOOLS AND TOOLS FOR EFFICIENT COLLABORATION BETWEEN DISTRIBUTED USERS AND TEAMS.
THE CESNET E-INFRASTRUCTURE IS PART OF THE ROADMAP FOR LARGE RESEARCH, EXPERIMENTAL DEVELOPMENT AND INNOVATION INFRASTRUCTURES IN THE CZECH REPUBLIC FOR 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 INFORMATION AND COMMUNICATIONS TECHNOLOGY.

SPECIAL-PURPOSE SUPPORT FOR DEVELOPING AND OPERATING THE CESNET E-INFRASTRUCTURE

The development and operation of the CESNET e-infrastructure in 2016 to 2019 is supported from public funds as part of special-purpose support for the CESNET e-Infrastructure project (LM2015042) under the R&D&I Large Infrastructure Projects programme. The support was granted based on an assessment of research infrastructures carried out in 2014. The purpose of the project is to provide and systematically develop a complex of high-quality information and communications services with adequate capacity, purposefully built to cater for the needs of users in the field of research, development and innovation. An integral part of the project is interconnecting Czech research and development with European and global research infrastructures.

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COMMUNICATIONS INFRASTRUCTURE

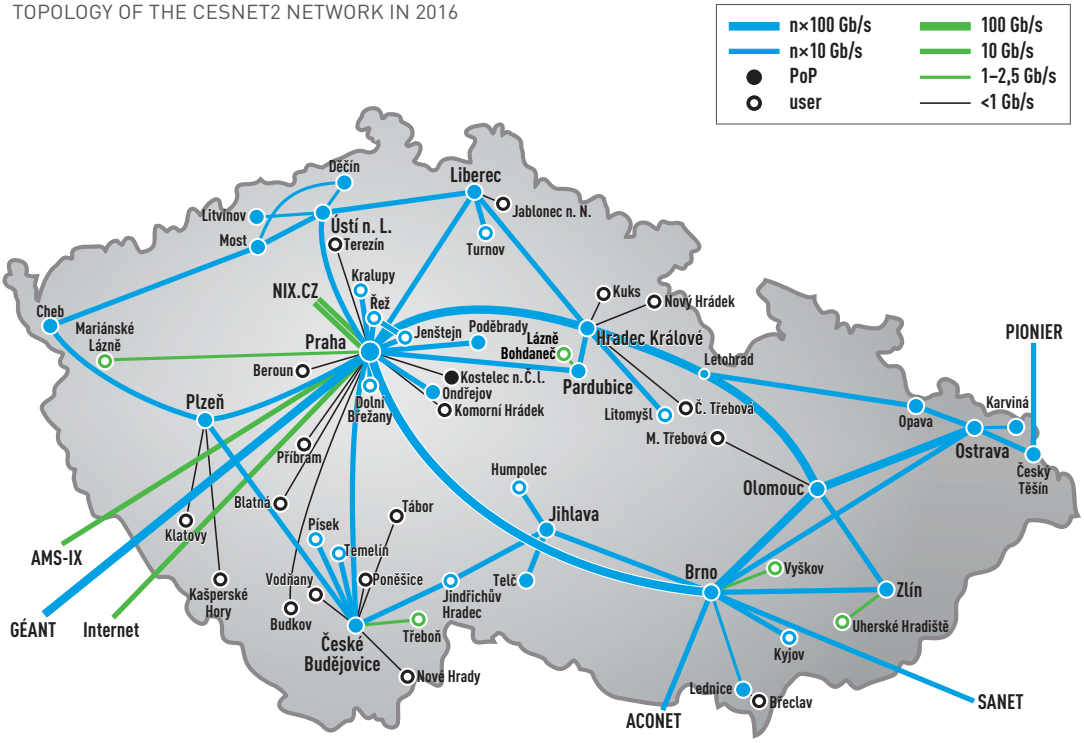
IN THE PAST PERIOD, CESNET FOCUSED PRIMARILY ON ASSURING RELIABLE OPERATION, MAINTAINING ADEQUATE PERFORMANCE AND SUPPORTING OTHER SERVICES OF THE CESNET E-INFRASTRUCTURE, AND CONNECTED LARGE INFRASTRUCTURES AND OTHER NETWORK MEMBERS.

The following fundamental changes and activities took place in 2016:

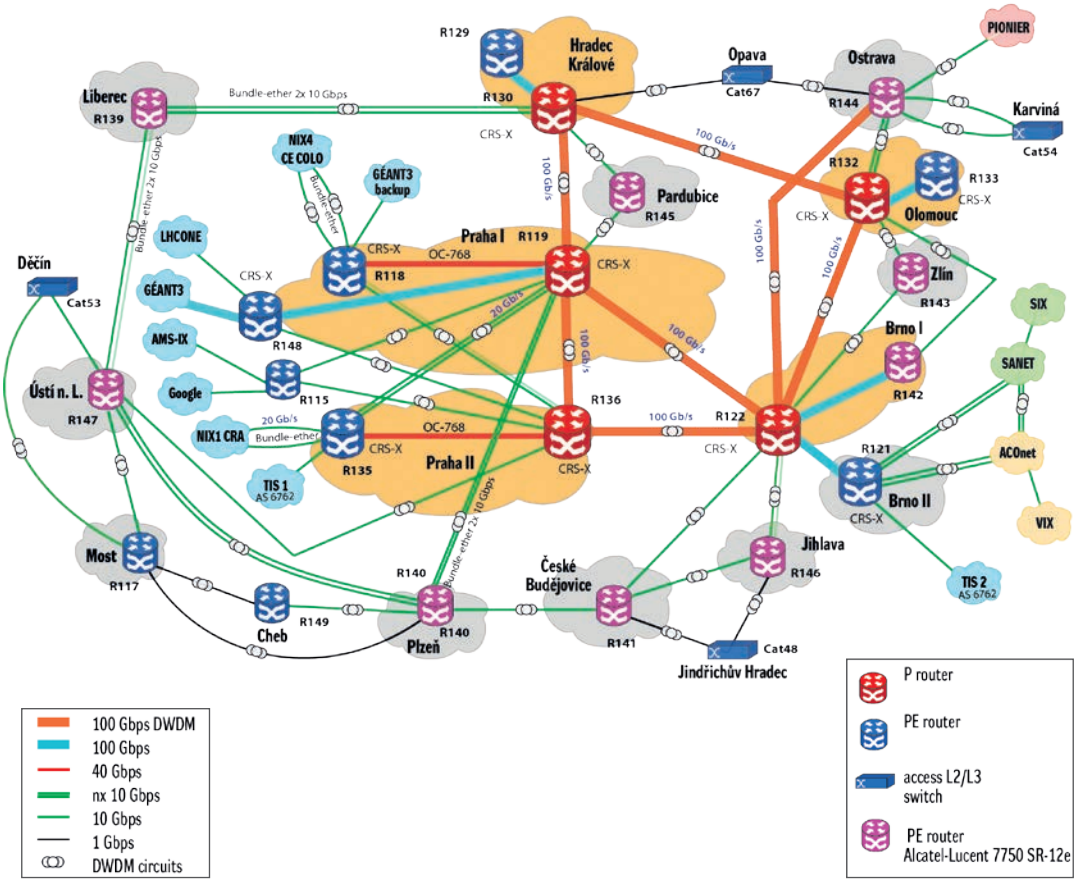
- Upgrading the connection to the GÉANT pan-European research infrastructure to 100 Gbps
- Completing the migration of the Praha_2 node to a new housing centre (ČRA, Mahlerovy sady 1)
- Upgrading the chassis of the DWDM ONS 15454 MSTP transmission system at the Praha_1 and Praha_2 nodes to new NCS2006 chassis (support for 100GE transponders and other new interface types)
- Completing a tendering procedure for manufacturer service and support for all Cisco technology; over time, the new contract will replace existing contracts, which will expire by the end of 2018 (the first service contract ended in December 2016); approximately 20% service cost savings are expected
- Upgrading DWDM network nodes, IP/MPLS routers and management systems to newer SW versions with new functionalities
- Proceeding with the migration of subscribers at the Praha_1 node from OSR7609 to CRS-X, freeing up another OSR7609 router (R84)
- Interconnecting virtualization platforms at the Praha_1 and Brno_1 nodes
- Upgrading the LHCONE connection for the Institute of Physics to 20 Gbps
- Continuing the technical and economic optimization of fibre-optic backbones
- Connecting the Institute for Clinical and Experimental Medicine to the CESNET2 network
- Adding a 100GE interface to an Alcatel-Lucent router at the Brno_1 node (upgrading the connection to the backbone to 100 Gbps)

Due to an increasing frequency and intensity of DDoS attacks, CESNET worked intensely on the protection of network communication infrastructures and connected members. It made RTBH services available in a pilot mode in the CESNET2 network environment for their needs. Members themselves can now effectively block attacks aimed against their infrastructures across the entire CESNET2 network. The Association also worked on verifying the promising BGP Flowspec technology on Cisco and Alcatel-Lucent/Nokia routers, which provides more advanced functionalities for attack blocking than RTBH. In the area of specific network services, the Association continues building the national optical infrastructure for time and frequency transmission – TF infrastructure.

TOPOLOGY OF THE CESNET2 NETWORK IN 2016



IP/MPLS TOPOLOGY OF THE CESNET2 NETWORK IN 2016



020

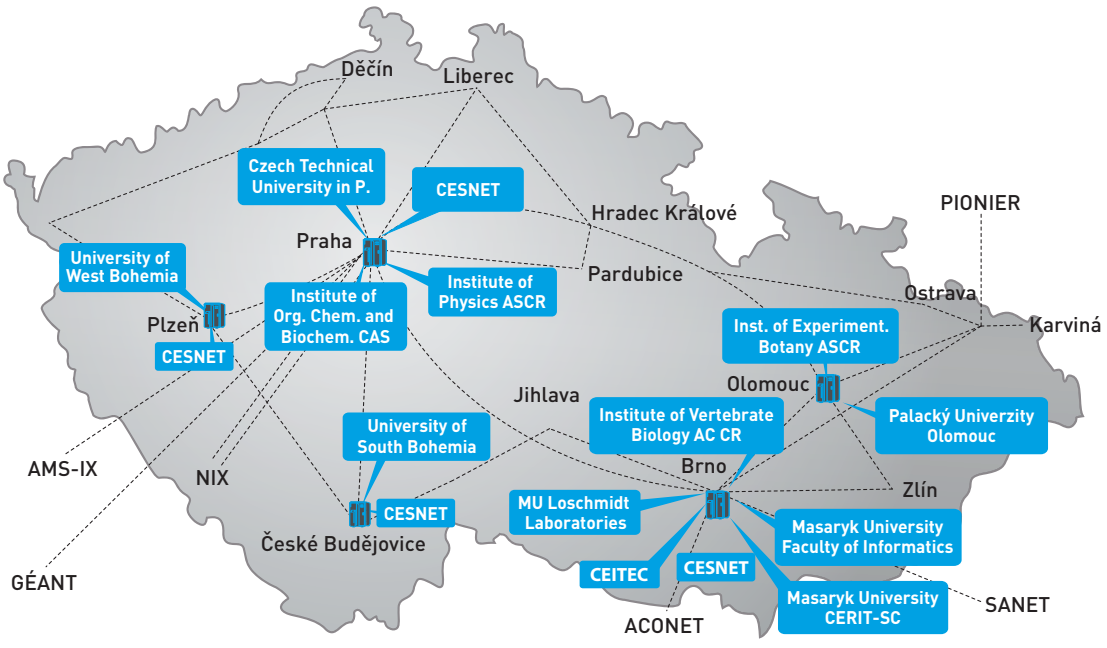
NATIONAL GRID INFRASTRUCTURE

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 (ESPECIALLY EGI AND ELIXIR) AND PROJECTS.

The NGI includes computing clusters of various types: conventional computing clusters with smaller numbers of more powerful processors, high-performance SMP servers with larger numbers of processors in a large shared memory, specialized SGI UV machines with up to 6 TB of memory, clusters with specialized GP-GPU cards as well as clusters prepared for MapReduce computations (Hadoop or Spark) with larger storage in each cluster node. Along with these computing servers (approximately 13,500 CPU cores at the end of 2016), the MetaCentrum also operates extensive data capacities (3 PB at the end of 2016) used for temporary storage of processed data.

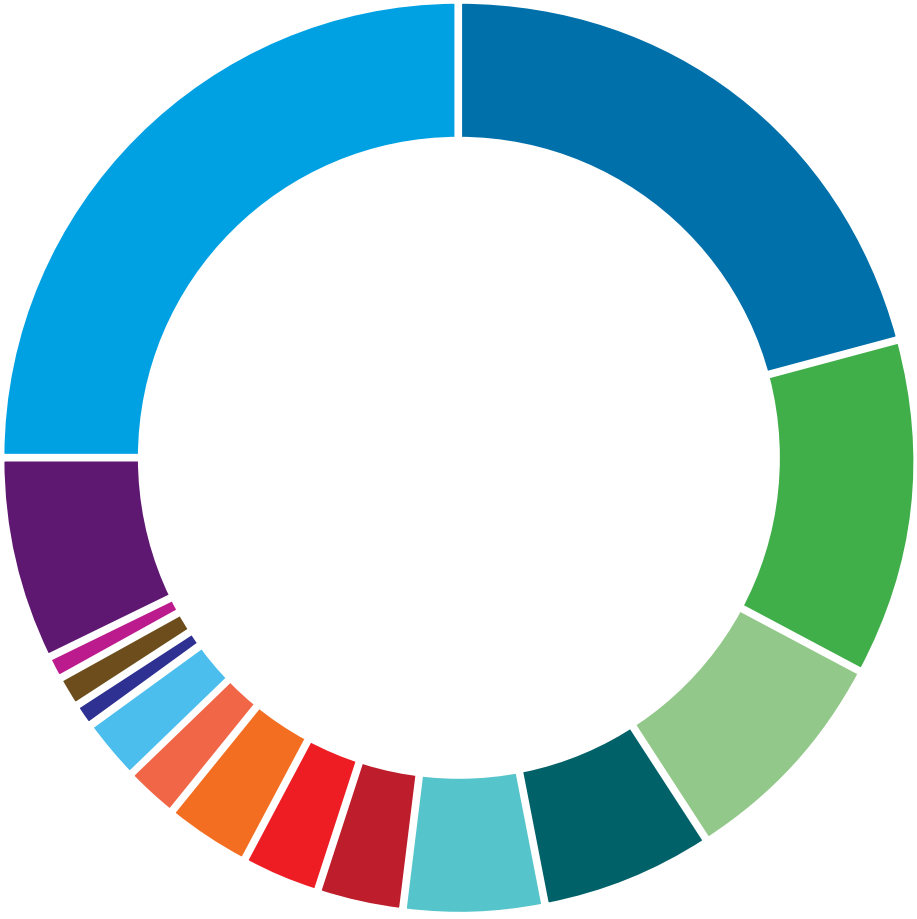
In the international EGI environment, the NGI provides an additional approximately 3,200 CPU cores and 3.8 PB of disk space for international projects, particularly in LHC. The Prague cluster and disk array were renovated and the first portion of older SMP servers were replaced in 2016.
CESNET functions as the national coordinator for the NGI, interconnecting individual clusters purchased by other organizations or projects into a single national grid. Our integration activities include the development and management of grid and cloud middleware, coordination of application software purchases, and user support.

METACENTRUM INFRASTRUCTURE



ORGANIZATION ACCORDING TO REAL COMPUTED CPU TIME – 2016

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 **[2 %]**
Institute of Physics AS CR, v. v. i. **[2 %]**
Institute of Macromolecular Chemistry AS CR, v. v. i. **[1 %]**
CzechGlobe AS CR, v. v. i. **[1 %]**
Jan Evangelista Purkyně University in Ústí nad Labem **[1 %]**
Others **[7 %]**



As part of its international activities, the Association continues to support international LHC projects, the Pierre Auger Observatory experiment, the Belle project, and more recently, ELIXIR and CLARIN projects. At the national level, we focus on direct support of Czech user groups interested in using the pan-European EGI infrastructure. A specific example is our involvement in the European ELIXIR project, in its EXCELERATE development project and in the construction of the ELIXIR research infrastructure in the Czech Republic. During 2016, CESNET continued working on H2020 international projects that the NGI participates in: EGI-Engage, INDIGO-DataCloud or AARC.

At the national level, we took part in the initiation of the VI ELIXIR infrastructure and in the preparation of an ELIXIR project under the Research, Development and Education Operational Programme. We also managed to get involved in the EOSCpilot project.

DATA STORAGE

ANOTHER FUNDAMENTAL COMPONENT OF THE E-INFRASTRUCTURE IS A DISTRIBUTED DATA STORAGE, COMPOSED OF THREE INTERCONNECTED HIGH-CAPACITY DATA CENTRES SITUATED IN PLZEŇ, JIHLAVA AND BRNO, WITH A COMBINED GROSS CAPACITY OF 21,000 TB ON INSTALLED MEDIA.

From a technical point of view, the storage is organized hierarchically (HSM type – Hierarchical Storage Management). Its basic principle is that less frequently utilized data is shifted to cheaper and slower-access high-capacity media, typically tapes, which considerably reduces the operating costs. A portion of the media thus serves as a cache for stored and read data – this applies especially to conventional disk arrays in the systems – while some of the media serve as actual archives (especially MAID arrays and tape libraries). The only significant user limitation of this system is that the query will take somewhat longer to process when accessing long-unused data, before the data is moved from the slower storage layer. Since the infrastructure hardware will need to be replaced, we have prepared a tendering procedure for a new hierarchical storage, which should be purchased in late 2017. We have also prepared extensive tests of object storage technologies, which should allow shifting the data storage paradigm towards a community-built shared infrastructure. This activity is becoming one of the main pillars of storage infrastructure development.
More than 7,000 TB of user data was stored in the data storage infrastructure at the end of 2016, with different requirements for necessary storage redundancy within the systems. Generally, data goes to disk arrays in the systems (so their own capacity cannot serve as an archive) and is migrated over time to MAID arrays and lastly to tapes. Data in the archival layers of the storage is treated (depending on the type of the system) as multiple copies or incremental backups. To minimize the risk of data loss, data is usually stored in a form resilient to the failure of at least one medium, namely on a MAID and a backup tape or on a pair of tapes. Because multiple copies of user data are kept and certain capacity needs to be reserved for HSM system overhead, free user data capacity is diminishing. If the current trends continue, it will be necessary to introduce restrictions on capacity allocation to new users in the first half of 2017. If the storage system becomes completely full, its stability, functionality and data availability would be at critical risk.
The storage was used via standard file-oriented interfaces by 196 user groups (virtual organizations), which translates to 4,000 individual user accounts (persons and service identities). However, the total impact of data storage on the community is greater, as an individual user with an account in the storage often represents a group for which they perform backup or archiving operations, without all group members necessarily having physical access to the repository. A service for creating checksums of stored files was implemented, allowing users to check the binary consistency of their data. A system for data storage and transmission accounting was made available to users.

Data storage services include a very popular FileSender service for exchanging large files among users. The service was used to exchange more than 60,000 files by the end of 2016, which represents approximately 130 TB of data.
The ownCloud cloud storage for data sharing and synchronization is directly accessible to members of the eduID.cz national identity federation. The service had 7,200 users at the end of 2016, who stored 78 TB of data in 64 million files.

INFRASTRUCTURE FOR COLLABORATION AND USER SUPPORT

IP TELEPHONY, VIDEO AND WEB CONFERENCING AND MULTIMEDIA STREAMING

The IP telephony network interconnects several dozen gateways linked to institution exchanges, and several IP telephone exchanges of various brands. In 2016, it served 415,000 calls with a total length of 21,000 hours.
The video conferencing infrastructure offers client registration, use of virtual rooms and session recording and broadcast. Our multi-conferencing units (MCUs) provided 6,174 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 operates a web conferencing system based on Adobe Connect where users had more than 5,949 hours of meetings.
The collaboration infrastructure includes resources for live broadcasts (streaming) and recorded broadcasts. The infrastructure is used by about a dozen institutions, keeping over 19 TB of multimedia data for VoD (video on demand) and 15 TB of Mediasite data in the storage.
UltraGrid, a high-quality, low-latency transmission solution developed by the Association has been used for a number of live broadcasts of surgeries during medical events. The solution is also used for cultural events and teaching.

NETWORK IDENTITY

An integral component of the comprehensive e-infrastructure is a system for user management and control of access to services. User management is based on the **eduID.cz** distributed identity federation, where initial user registration and authentication services are provided by the home organizations while authorization information is managed at the level of services and their administrative domains. At the end of 2016, the federation included 83 identity providers (IdPs) and more than 150 service providers (SPs), including additional 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. We completed the process of harmonizing rules for clear differentiation of users and their parent organizations in 2016.
One highly used federated service is **eduroam.cz**, which provides users with wireless connectivity at their home institution or any other cooperating institution. Secure user authentication is always provided by the home institution. This academic roaming system was created as a European initiative under the TERENA Association (now GÉANT Association) and has since spread all over the world. The Czech federation had a total of 82 member organizations in 2016, providing connectivity in more than 700 locations. Up to 38,000 users utilize connectivity at an organization other than their home institution on a daily basis.
To ensure secure and trustworthy communication, the Association operates a public key infrastructure based on the CESNET CA certification authority, which issues various types of certificates for specifically defined application areas to selected groups. This also includes providing a trusted certificate service (TCS). The service is used by 97 organizations.
For identity and access management, we continue developing the **Perun** system together with Masaryk University. The main instance of the system manages identities and access to services for almost 300 user communities (national and international) with more than 20,000 users.
A separate local instance of **Perun** was deployed at the Academy of Arts, Architecture and Design in Prague in September 2016.

E-INFRASTRUCTURE SECURITY

The internationally accredited CESNET-CERTS security team is the basic element ensuring e-infrastructure security. Its core activity is incident handling – receiving reports of security incidents occurring in the CESNET2 network and responding and coordinating response to such incidents.

The team closely cooperates with other security teams and relevant organizations at the national and international levels, is a member of the CSIRT.CZ Working Group, organized by the Czech Republic's National CSIRT Team, and is also involved in the TF-CSIRT platform coordinated 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 such systems and services as FTAS, G3 and Warden, which are operated to very high standards, thus enabling both CESNET administrators and administrators in connected institutions to improve the level of network, service and user security. CESNET achieved 2 million security events detected and handled by Warden in a single day in 2016.

Since 2013, the Association has run FLAB, a forensic laboratory that provides services such as analysis of security incidents and penetration and stress tests for preventive checks of the integrity, credibility and availability of operated systems. The laboratory's services are available to CESNET e-infrastructure members as well as other clients. The Association is committed to raising awareness among users and administrators of connected computer networks. Association personnel took part in several international exercises in 2016, such as the prestigious Locked Shields 2016 exercise where they were members of the Czech team which was placed fifth.

COLLABORATION WITH NATIONAL RESEARCH AND DEVELOPMENT INFRASTRUCTURES

CESNET holds continuous discussions with representatives of other large infrastructures included in the Roadmap for Large Research, Experimental Development and Innovation Infrastructures in the Czech Republic and other infrastructure projects. We endeavour to identify their needs from the point of view of the services provided by our Association and establish collaboration in this area. CESNET e-infrastructure services are currently used by 55 out of the total of 57 (apart from CESNET) large infrastructures included in the Czech Republic's Roadmap for 2016 to 2022. In terms of collaboration with CESNET, an exceptional position is held by the national node of the European ELIXIR bioinformatics infrastructure – the ELIXIR CZ research infrastructure.

026 CHAPTER

INTERNATIONAL INFRASTRUCTURE PROJECTS

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CESNET INTERCONNECTS THE SERVICES IT PROVIDES AT NATIONAL LEVEL WITH THE SERVICES OF EUROPEAN E-INFRASTRUCTURES THROUGH MAJOR INTERNATIONAL PROJECTS

INTERNATIONAL INFRASTRUCTURE PROJECTS

AN IMPORTANT TASK OF THE CESNET E-INFRASTRUCTURE IS INTERCONNECTING THE SERVICES IT PROVIDES AT NATIONAL LEVEL WITH THE SERVICES OF EUROPEAN E-INFRASTRUCTURES TO JOINTLY ESTABLISH AN INFORMATICS FOUNDATION FOR THE EUROPEAN RESEARCH AREA.

GÉANT

The interconnection of European National Research and Education Networks (NRENs) and creation of a pan-European infrastructure for data transmissions is coordinated by GÉANT. It provides access to network services for approximately 40 million users from more than 3,500 institutions in 38 European countries and ensures interconnection with similar networks such as Internet2 and ESnet in the USA, CANARIE in Canada as well as networks on other continents. The operation of the GÉANT e-infrastructure and development of its services has been supported by the European Union since 2015 under a seven-year project named GÉANT2020, jointly implemented by most European NRENs including CESNET. The project is divided into three stages, with the second project stage of 32 months starting in 2016.

CESNET's involvement in this stage included, in particular:

- Leading a task focusing on developing a fibre infrastructure for the GÉANT network
- Coordinating the construction of the GTS (GÉANT Testbed Service) testing environment for networking technologies and applications
- Taking part in negotiating favourable terms with major commercial providers of cloud services
- Developing the AAI and guaranteeing security
- Communicating with large European research infrastructures

Preparations for the third project stage started in 2016, led by the GÉANT Programme Planning Committee (GPPC) whose seven members include CESNET Director Ing. Jan Gruntorád, CSc.

EGI

Another linchpin of the CESNET e-infrastructure is MetaCentrum, a distributed computing infrastructure that plays the role of the Czech National Grid Infrastructure (NGI), an officially recognized part of the European Grid Infrastructure (EGI). The objective of the EGI is coordinating national activities in the implementation of grid technologies as an important part of the European-level e-infrastructure. The operation and further development of the EGI is supported by the European Union under a project named EGI-Engage (Engaging the EGI Community towards an Open Science Commons), elaborating the concept of a multidisciplinary pan-European grid infrastructure. CESNET is involved in all the primary operational activities within the project, takes care of the operation of the national EGI grid node and provides computational resources. Another of the Association's tasks is to provide support for the Auger and VOCE virtual organizations as well as direct support for Czech user groups interested in using the pan-European grid.

ELIXIR

Since 2012, CESNET has been actively involved in building the national node of the European ELIXIR bioinformatics infrastructure, which provides an advanced computing environment, data resources and unique tools for the bioinformatics scientific community in the Czech Republic and Europe. Support provided to this user community includes a dedicated computing node for bioinformatics computations. The Association participates in the development of the European infrastructure by its involvement in the European ELIXIR-EXCELERATE project under the Technical Services activity focusing on the establishment of a common framework for the provision of computational services and services related to data storage.

GLIF

The role of a national research and education network such as CESNET is not only operating the infrastructure but also research and development in information and communications technology. It is advisable to build a parallel testing infrastructure – a testbed – for demonstrations and experiments that could adversely affect routine infrastructure operations. Organizations involved in networking research and application in Europe, North and South America, Asia and Australia that have separate testing infrastructures have created the Global Lambda Integrated Facility (GLIF) to carry out joint experiments. It is 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 Exchange), set up by this organization. Such an environment also enables experiments and demonstrations that pose a risk of interference and destruction.

PLANETLAB AND RELATED PROJECTS

Planet-lab.org and Planet-lab.eu are research networks involved in global activities in the field of the Next-Generation Internet. The networks are used for testing new network applications, protocols, in simulation processes, etc. as well as for teaching in master's programmes in computer and information technology departments. CESNET permanently maintains four serves in the infrastructure and is responsible for the operation of a local infrastructure. We have created and operate 20 active virtual networks with various configurations as specified by the users themselves. In total, all the virtual networks used by CESNET users contain about 400 nodes abroad. This gives users an unusual opportunity to test their applications in a global context.

030 CHAPTER

THE ASSOCIATION'S RESEARCH ACTIVITIES

CESNET'S KEY ACTIVITIES INCLUDE RESEARCH AND DEVELOPMENT IN INFORMATION AND COMMUNICATIONS TECHNOLOGY

THE ASSOCIATION'S RESEARCH ACTIVITIES

E-INFRASTRUCTURE SECURITY

CESNET has long been committed to network security.

We were involved in the following projects in 2016:

- Technology for Large-Scale Network Data Processing and Analysis (SecurityCloud) is a project under TACR's ALFA4 programme. The objective of the project is to develop an innovative technological solution that will enable both providers and users of network infrastructures and centralized services to detect operational and security issues.
- Technology for High-Speed Network Protection (DCPro). Part of TACR's EPSILON programme, the project aims to build equipment with a throughput of 400 Gbps for processing and filtering high-speed traffic in computer networks.
- BEhaviour-BAsed forwarding (BEBA) is an international project under the H2020 programme, aimed at further advancing the OpenFlow technology in order to increase its flexibility and expand its capabilities (for example, monitoring).
- Detection of Infrastructure Security Threats (DOBI). The project is part of the Security Research for the Czech Republic in 2015–2020 programme of the Ministry of the Interior of the Czech Republic. 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.
- National Cyberspace Security Event Sharing and Analysis (SABU). The project was submitted to the same call as 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.
- Proactive Risk Management through Situation Awareness (PROTECTIVE). Starting in September 2016, the PROTECTIVE project intends to establish a platform for sharing information about cyber threats among many interest groups, such as risk analysis specialists or security team members, with the aim of efficiently assessing and prioritizing detected threats and response to them.

Another project that needs to be mentioned because of its result is the Distributed System for Comprehensive Monitoring of High-Speed Networks (DMON100) under TACR's ALFA3 programme, which CESNET worked on in collaboration with Netcope Technologies, a. s. The objective of the project, successfully completed in 2015, was to develop a monitoring system for networks with up to 100Gbps lines. Both the project itself and its key outcome, a prototype of the COMBO-CG network card, whose unique features include the ability to capture network traffic at the full speed of 100 Gbps and transfer it to the host computer's memory for further analysis, received several awards in 2016: the project was placed second in the Best Collaboration

of 2016 competition, the COMBO card received the Industrie award for the most significant innovative technology and the card prototype was ranked by an expert panel as an excellent result of research and development under Pillar II of the Research Organization Assessment in 2016.

NETWORK IDENTITY

The Association continuously develops and implements an infrastructure for federalized sharing of services and resources.

In 2016, 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 authorization infrastructure for the broad user base of research infrastructures.
- The Middleware for collaborative Applications and Global vIrtual Communities (MAGIC) project focuses on authorization and authentication mechanisms in grid and cloud environments.

GRID MIDDLEWARE, CLOUDS

As part of its activities associated with the operation of a grid environment, the Association participates intensely, mainly through EGI.eu, in the development of grid middleware relating to task scheduling as well as some components relating to the security of grid infrastructure operation. We also work on computational clouds, including the international H2020 project INtegrating Distributed data Infrastructures for Global ExplOitation (INDIGO-DataCloud), which focuses on developing and implementing an integrated, secure and permanent on-demand cloud service.

OPTICAL TRANSMISSION SYSTEMS

CESNET develops a range of original, fully optical transmission systems, CzechLight, whose greatest advantage is openness: software modifications can be made by device owners or administrators themselves. CzechLight units have found practical application – they are manufactured and marketed by specialist companies under the Association's licence.

CESNET was involved in the following projects in 2016:

- Set of Elements for Photonic Communication (EPCOM II) is a project under TACR's EPSILON programme. Its objective is to create a set of optical and electronic elements 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 transmitted information.
- COMmunication PLatform for tenders of novel Transport nEtworks (COMPLETE) is an international H2020 project that is expected to bring the benefit of more efficient tendering processes concerning the construction of communications infrastructures for research and education.

NEW APPLICATIONS

Today, innovative network applications usually require combining many technologies. The benefit of such network applications is better e-infrastructure utilization in new areas and new possible ways of collaboration in research, development and education in various fields such as medicine, culture or architecture.

CESNET was involved in the following projects in 2016:

- Digital Restoration of the Czech Film Heritage is a project co-financed from EEA funds (Norway Grants) under the CZ06 programme. The foreign partner of the project is the National Library of Norway; the beneficiary is the National Film Archive.
- Laterna Magika. History and the Present, Documentation, Preservation and Accessibility. The goal of this project under the NAKI II programme – Support for Applied Research and Experimental Development for the National and Cultural Identity in 2016–2022 – supported by the Ministry of Culture of the Czech Republic is to restore the archives of Laterna Magika films, create a storage methodology, build a pilot storage and present the films.
- 8K Studio over IP Bridge (8KSVIP) is a project under the European EUROSTARS2 programme, whose goal is to design, implement and experimentally verify an architecture and components for scalable image transmission devices.

RESEARCH AND DEVELOPMENT OUTCOMES

CESNET's research activities resulted in seven articles in peer-reviewed scientific journals, 28 articles in conference proceedings, two utility models and five functional specimens in 2016.

Two patents were granted:

- UBIK Sven, HALÁK Jiří, ŽEJDL Petr: Device for receiving video signals transmitted over a packet computer network, US 9,491,333 B2, granted by the United States Department of Commerce – United States Patent and Trademark Office (USPTO), 8 November 2016
- SLAVÍK Radan, VOJTĚCH Josef, SMOTLACHA Vladimír, RADIL Jan: Modular kit for the construction of a device monitoring the spectral separation of channels in optical wavelength multiplexer networks, No. 306141, granted by the Industrial Property Office, 17 August 2016

CESNET DEVELOPMENT FUND

The Development Fund Board in cooperation with the Association selected topics and opened a new project tendering process in early 2016. Out of the 15 project applications submitted in the first round, 12 projects were admitted for co-funding, including two projects admitted after rewriting. The contributions requested by three projects were reduced compared to the amounts requested. The table below shows an overview of the accepted projects.

In late 2016, the Development Fund Board prepared and announced a new tendering process. Its topics were chosen in cooperation with CESNET. Two rounds of review procedures for completed projects took place – a total of 28 projects were successfully completed. Amendments to the final documents of several projects were requested. Final reports for projects carried out under the CESNET Development Fund are available on the Association's website.

PROJECT NUMBER	PROJECT HOLDER	PROJECT TITLE
579R1/2016	Czech Technical University	Increasing the Effectiveness of the Public miXGENE System for Integrative Analysis of Molecular Data
580/2016	University of West Bohemia	New Generation of Identity Management and Access Control Systems in a Large Academic Computing Environment
581/2016	University of West Bohemia	Penetration Testing of the UWB Network and Services
582/2016	University of West Bohemia	Improving the Professional Qualifications of UWB Networking Experts in Security and Wireless Technology
583/2016	University of Technology	Monitoring Wireless Internet-of-Things Networks for Enhanced Security
584/2016	University of Pardubice	Selection and Deployment of a Digital Content Management System
587/2016	VŠB – Technical University of Ostrava	Developing a VoIP Honeypot Usable in the CESNET Network
588/2016	University of Hradec Králové	Enhancing Computer Network Security at the University of Hradec Králové Using CESNET Forensic Laboratory Services
589R1/2016	Janáček Academy of Music and Performing Arts	Improving the Professional Qualifications of JAMPA's Networking Expert in CISCO Technologies
590/2016	Charles University	Creating a Multidisciplinary Superportal for Protected Video Streaming and Developing Its Services and Mobile Applications
591/2016	Academy of Performing Arts	Enhancing the Security of the Network Infrastructure, Operated Services and Users at the Academy of Performing Arts in Prague
592/2016	Academy of Performing Arts	APA Instructional Material Storage and Access Using the CESNET Streaming System

036 CHAPTER

IN THE YEAR OF ITS 20TH ANNIVERSARY, CESNET HOSTED THE LARGEST AND MOST PRESTIGIOUS EUROPEAN CONFERENCE IN THE FIELD, TNC16. IT WAS ATTENDED BY MORE THAN 700 GUESTS FROM ALL OVER THE WORLD.

PUBLIC RELATIONS

THE YEAR 2016 WAS CHARACTERIZED BY CELEBRATIONS FOR CESNET. IN MARCH IT WAS EXACTLY 20 YEARS SINCE IT WAS FOUNDED. THE WHOLE YEAR WAS ABOUT THE NUMBER TWENTY. A SPECIAL LOGO WAS CREATED FOR THIS SPECIAL OCCASION AND USED THROUGHOUT THE YEAR. A CONCISE BROCHURE WAS PUBLISHED, MAPPING THE ASSOCIATION'S PAST 20 YEARS.

A ceremonial meeting was held on the occasion of the 20th anniversary in the Main Hall of the Wallenstein Palace on 10 March 2016 (Fig. 1). The ceremony was opened by Senator Prof. MUDr. Eva Syková, DrSc., Ing. Robert Plaga, Ph.D., from the Ministry of Education and Prof. Ing. Miroslav Tůma, CSc., Chairman of the Board of Directors of CESNET. Technical presentations were given at the meeting by representatives of CESNET and collaborating organizations (Institute of Physics of the Academy of Sciences of the Czech Republic, ELIXIR and CZ.NIC). A "remote" concert organized in the conclusion of the meeting was jointly performed by artists from Prague and Copenhagen (Fig. 2). The event was attended by more than 100 guests. A series of interviews with CESNET's director was published on the occasion of the Association's 20th anniversary – for example, in Euro, Computerworld and Telekomunikace magazines and on expert server Root.cz. There was also an article about the anniversary in GÉANT's international Connect magazine.

Like in previous years, there were seminars, training courses and workshops held in 2016. The Association organized 19 events – 13 national and 6 international – during the year.
CESNET was provided with a great opportunity when it hosted the largest and most prestigious European conference in the field – The TNC16 Networking Conference – again after five years (Fig. 3 and 4). The conference on research into computer networks and communications took place in early June and lasted for four days. It attracted over 700 participants from more than 60 countries. At the end of the conference, the Association's director was awarded a medal of honour of the Vietsch Foundation. It is awarded to people who have made a contribution of lasting value to the research and development of advanced Internet technology aimed to support science, research and higher education. Another award, the Community Award, was given posthumously to Stanislav Šíma, a former head of CESNET's team researching optical transmission technologies. This award is given annually by GÉANT to outstanding personalities from among its expert community. CESNET received a certificate of honour in recognition of the professional organization of the entire conference. A "remote" organ concert played from Brno and Trondheim took place during TNC16, streamed by CESNET experts using 4K Gateway equipment that uses technology patented by the Association. The concert was streamed to Czech Radio.

Like every year, there were several seminars entitled CESNET Day. This time, our experts went to the University of Hradec Králové, Palacký University in Olomouc, Charles University in Prague and, last but not least, to the Academy of Sciences of the Czech Republic (Fig. 5).

A seminar on network and services security took place, traditionally, in early February and met with a great response. An IPv6 Seminar on the current status of and experience with using Internet Protocol version 6 was held in June.


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CESNET

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1 Meeting on the premises of the Parliament of the Czech Republic marking the 20th anniversary of CESNET

2 "Remote" concert at the meeting marking the Association's 20th anniversary

3 CESNET's booth at the TNC16 conference

4 Director's introductory speech at the TNC16 conference

5 CESNET Day in Villa Lanna for AS CR

6 Celebration meeting marking the Association's 20th anniversary, attended by former and current employees

6

As the administrator of eduID.cz, the Czech academic identity federation, CESNET organized a University Identities 2016 seminar in the second half of the year. The seminar informed, in particular, about identity management systems and related technologies. It presented interesting AAI solutions usable in large academic networks. Other seminars in the autumn focused on security: Security FEST 2016, or How to Survive on the Internet and Proactive Security. Several workshops and training courses led by CESNET experts took place during the year.

The Association hosted several international working meetings in the first half of 2016. There was an international meeting of the EGI security working group and kick-off meetings of the JRA1 T1 and GN4-2 JRA1 Task working groups. A two-day Campus Network Monitoring and Security Workshop took place in April and included a practical course on Tools for Security Analysis of Traffic on L7.

The Association was once again a partner for several national and international events in 2016: Science and Technology Week, Linux Days, Install Fest, HiPEAC and TSP2016.

International collaboration with SIG-Marcomms in communication, PR and marketing took place throughout the year. All information about current events was published on the Association's website as well as in social media. The official blog continued to be published, with eight posts written by the Association's employees in 2016.

In terms of a wider media impact, it should be mentioned that the Association's director appeared in Czech Television's @online programme, giving an interview concerning 25 years of the Internet in the Czech Republic. Czech Radio broadcast an interview with CESNET's Aleš Padrta about Internet downsides. There was also certain media coverage of the meeting of current and former employees celebrating the Association's 20th anniversary. The celebration was mentioned in four newspapers and magazines. The Association issued a total of 19 press releases in the past year, which were subsequently published in the media. CESNET makes use of feedback in the form of regular media monitoring and its monthly analyses of these outputs confirm a steady increase in activities presenting the Association's work in a positive light.

042 CHAPTER

THE ASSOCIATION MANAGED THE FUNDS ENTRUSTED TO IT PROPERLY IN 2016. ITS FINANCIAL STATEMENTS WERE REVIEWED BY AN AUDITOR AND GIVEN AN UNQUALIFIED OPINION.

ECONOMIC RESULTS

ECONOMIC RESULTS IN 2016

CESNET's activities are divided into two categories in accordance with its statutes: principal and economic activities.

PRINCIPAL ACTIVITY

A four-year project entitled CESNET e-Infrastructure was started in 2016.
As part of its principal activity, the Association continued building an e-infrastructure of a new quality to provide Association members and other entities eligible for connection to the CESNET2 network with a comprehensive set of services. The Association was also involved in the execution of international research projects under the EU Horizon 2020 programme, grants from the Technology Agency of the Czech Republic, Ministry of the Interior of the Czech Republic and Norway Grants and projects of the Development Fund Board, as already mentioned in the previous section of the Annual Report. The Association's principal activity in 2016 was concluded with an accounting loss of CZK 995 thousand.
Revenues from the Association's principal activity amounted to CZK 504,709 thousand; expenditures were CZK 507,248 thousand.
The income tax base for the Association's principal activity in 2016 was positive, amounting to CZK 8,606 thousand.

ECONOMIC ACTIVITY

The Association's economic activity in 2016 consisted primarily in holding a prevailingly bond-based portfolio of the Development Fund, comprising financial resources obtained by sale of the commercial part of the CESNET network in 2000, and in managing financial resources in other funds.
The Association's economic activity in 2016 generated an accounting profit of CZK 6,327 thousand. Revenues from the Association's economic activity in 2016 amounted to CZK 47,342 thousand; expenditures on the economic activity were CZK 42,285 thousand.
The income tax base for the Association's economic activity in 2016 was positive, amounting to CZK 7,100 thousand.

TOTAL ACCOUNTING AND TAX ECONOMIC RESULTS

CESNET had a total accounting profit of CZK 5,332 thousand before tax in 2016.
Its total income tax base after deducting tax base-reducing items was CZK 14,706 thousand.
The Association paid income tax of CZK 2,814 thousand for the year 2016, resulting in a profit after tax of CZK 2,518 thousand.

CONCLUSION

The Association managed the entrusted funds properly in 2016, meeting all of its obligations resulting from legislation, decisions of the Ministry of Youth, Education and Sport of the Czech Republic and concluded contracts. Its financial statements for 2016 were reviewed by an auditor and given an unqualified opinion.

THANK YOU FOR READING

1996–2016
CESNET