ANNUAL REPORT CESNET 2009

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2009 Annual Report
CESNET

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A MESSAGE FROM THE DIRECTOR

The year 2009 that is to be summarized in this annual report was exceptional for both CESNET and the Czech Republic. In its first half our country had the EU Council presidency function. In relation with the presidency, we have organized a number of international professional meetings where leading network research and development representatives from all over the world participated. The most significant of them was the professional conference *The Future of the Internet: Europe Moving Forward*, which we organized on 11 May in Prague with the European Commission support in cooperation with the Academy of Sciences of the Czech Republic. The exceptional character of this event was underlined by presence of the Viviane Reding, EU Commissioner for Information Society and Media. Positive response of guests and media convinced me that we managed to do a good job when hosting this prestigious event. After the conference, the *Future Internet Assembly* meeting followed, taking place from 12 to 13 May and coordinating the European approach in the future Internet area.

However, in 2009 we succeed also in our principal area, which is the research and development of advanced network technologies and applications. We implement most of our tasks within the research plan *Optical National Research Network and Its New Applications*. In May we successfully tested the 40-Gbps technology in CESNET2, our national research and development network. No other entity has carried out data transfer with such speed in the Czech Republic yet. The main objective of the test was to verify that the connection works flawlessly, which enabled us to deploy the 40-Gbps technology in practice this year (2010). In connection with the above, we have deployed the second Cisco CRS-1/16 router at the end of last year's September in CESNET2 – currently representing the most powerful routing system. The device has been installed in premises of the Technical University in Brno, adding the technology to backbone network nodes in Prague and Brno needed for 40-Gbps connections.

The key position of CESNET in the IT field is further evidenced by the fact that in last year's July the Ministry of Education, Youth and Sports of the Czech Republic appointed CESNET a representative of the National Grid Infrastructure (NGI) in all international structures where the Czech NGI will be active. The Association has also become a coordinator of the key international project in this area – *EGI_DS (European Grid Initiative Design Study)*.

Our care given to students – future network experts – is well illustrated by the last year's September, when a common project of the Intermedia Institute of the Faculty of Electrical Engineering of the Czech Technical University in Prague and CESNET named *Cave to Cave (C2C)* was presented within celebratory opening of a new classroom of the Faculty of Mechanical Engineering of the Czech Technical University in Prague. The presentation involved real-time transfer from a "3D cave" located in hall laboratories of the Faculty of Electrical Engineering to the newly opened classroom, introducing the principle of presentation site remote control. Participation of our experts at the respected CineGrid workshop in California received a significant response. In cooperation of Cinepost we have successfully demonstrated utilization of high-speed networks for increasing productivity within team data processing. This was possible given our own technology for very high resolution (4K) uncompressed real-time video signal transfer across extensive networks. The demonstrated technology allowed for processing of the uncompressed 4K-video in the real time over the distance exceeding 10,000 km.

Results of the research plan *Optical National Research Network and Its New Applications* have also been positively assessed by an opposition board comprising independent experts within their annual opposition procedure. The opposition board appreciated involvement of the implementation team in important European projects, including participation in the management of these projects, successful transfer of research and development results to practice, and also awards of student cooperating on the solutions.

The research plan *Optical National Research Network and Its New Applications* will be completed – and I believe that successfully – in 2010. Even today it is my pleasure to state that we will be able to follow up on this research plan in the coming years by means of a five-year project named *Large Infrastructure CESNET*, the implementation of which was approved by the government of the Czech Republic on 15 March 2010. The main project objective will be CESNET2 reconstruction to a modern comprehensive national e-infrastructure for research, development and innovations.

I am sure that the *Large Infrastructure CESNET* project will successfully connect to outcomes of the *Optical National Research Network and Its New Applications* research plan, the implementation of which would be impossible without substantial support of the Ministry of Education, Youth and Sports of the Czech Republic as well as all members of our Association and great professional approach of all people involved in the plan implementation. I would therefore like to sincerely thank all these institutions and individuals.

Ing. Jan Gruntorád, CSc.
Managing Director and the Member of the Board
of Directors, CESNET, z.s.p.o

CESNET ASSOCIATION

HISTORY

The Association was founded in 1996 by all public universities in the Czech Republic, together with the Academy of Sciences of the Czech Republic ("Akademie věd České republiky" – hereinafter referred to as AV ČR). In 1996, when the Association received a grant for the *TEN-34 CZ Network Deployment* project from the Ministry of Youth, Education and Sport of the Czech Republic, the Association started building the academic backbone network of the Czech Republic at an entirely new level of quality. Along with this process, the academic and commercial traffic was separated and all the members converted to the academic network.

From 1997, the Association operated two independent networks. The first one, *TEN-34 CZ* (later *TEN-155 CZ*), served the needs of science, research and education, to which members of the Association and some other institutions complying with the Acceptable Use Policy were connected. The second network, for historical reasons called *CESNET*, connected commercial customers. After the commercial network was sold in 2000, the Association ceased to act as a commercial Internet provider. Since then, it has been engaged solely in the operation of the science, research and education backbone network (National Research and Education Network – NREN – of the Czech Republic) and other related activities.

For the period of 2004 to 2010, the Association obtained subsidies in the form of an institutional support for its research plan titled *Optical National Research Network and Its New Applications*, the draft of which was submitted in 2003. The year 2009 was the sixth year of works on this research plan.

OBJECTIVES AND THE SCOPE OF ACTIVITIES OF THE ASSOCIATION

The main goals of the Association are the operation and development of the backbone network that interconnects the networks of the Association members, research and development of advanced network technologies and applications and the dissemination of information about them.

The main scope of activities of the Association follows:

1. To perform the research and development in the area of information and communication technologies and their applications.
2. To secure and perform provision of education services within research and development, using the high-speed national research and education network.
3. To secure and perform the following for its members and the organizations 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; testing of new applications; cooperation and complementarity of the members' activities on a level comparable with prestigious education and research networks abroad (including Internet access).
4. To secure and perform, in cooperation with its members, the long-term development, acquisition and use of high quality communication and information technologies based on the Internet and similar modern systems.
5. To support, against the reimbursement of related expenses, propagation of erudition, culture and knowledge, cooperation with members to broaden their experience, expansion of applications of the most modern information technologies, and improvement of the quality of the network by gaining additional participants, information sources and services.

The Association performs and secures its activities within the scope of the subsidies gained and partial compensation of expenses related to these activities. The Association's objective is not to generate any profit.
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 Association does not provide the academic backbone network services only to its members but also to selected entities complying with the *Access Policy of the Next Generation National Research and Education Network ("Zásady pro přístup do sítě národního výzkumu a vzdělávání nové generace")*.
Any loss incurred in connection with the Association's economic/business activities is settled by the end of the fiscal year in question. Otherwise, the Association will abandon the economic/business activities in question before the beginning of the following fiscal year.
After settling the obligatory reserve fund contribution, the Association uses its entire profit to support the research and development.

MEMBERSHIP IN INTERNATIONAL AND NATIONAL ORGANIZATIONS

The CESNET Association is a member of important international and national organizations. The key organization include:

international organizations

TERENA (Trans-European Research and Education Network Association) – established in 1994 through the merger of EARN (European Academic and Research Network) and RARE (Réseaux Associés pour la Recherche Européenne). It is engaged in the development of the telecommunication infrastructure of academic and scientific sites across Europe.

CEENet (Central and Eastern European Networking Association) – organization coordinating international telecommunication activities of countries in Central and Eastern Europe.

GLIF (Global Lambda Integrated Facility) – global experimental network activities, focusing on the development support for most demanding scientific and research applications. The main goal of this project is to construct a network that will service applications with extreme transfer rate requirements.

DANTE (Delivery of Advanced Network Technology to Europe Ltd.) – non-profit organization aimed at the construction and quality improvement of the IP connectivity for academic institutions in European countries.

Internet2 – consortium led by American research and education institutions endeavoring to develop and deploy new types of network technologies, services and applications. The CESNET Association has been an associate member of the consortium since 1999.

PlanetLab – consortium of academic, commercial and governmental organizations from the entire world, collectively operating a global computer network designed for developing and testing new telecommunication applications. There are currently 780 nodes from 31 countries operating in the network.

EGI.eu – organization focusing on coordination of European computing grids used for scientific calculations and their sustainable development support.

national organizations

NIX.CZ – CESNET, z. s. p. o. 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, offering the possibility of mutual interconnection of member networks. At the end of 2009, the association had 72 members.

CZ.NIC – CESNET, z. s. p. o. is also one of the founding members of **CZ.NIC**, z. s. p. o., an organization engaged in the domain registration, support of projects of general benefit and Internet-related activities. At the end of 2009, the association had 63 members.

ASSOCIATION MEMBERS

The following institutions were members of the Association in 2009:

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
Institute of Chemical Technology, Prague
Czech University of Life Sciences 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
Jan Evangelista Purkyně University in Ústí nad Labem
University of West Bohemia in Plzeň
Academy of Sciences of the Czech Republic
Tomáš Baťa University in Zlín
University of Defence

During 2009, the Association accepted no new members.

ASSOCIATION ORGANIZATIONAL STRUCTURE

ASSOCIATION ORGANIZATIONAL STRUCTURE

CESNET, z. s. p. o. has the following **bodies**:

1. General Assembly
2. Board of Directors
3. Supervisory Board

For the electoral term 2008-2010, the 25th General Assembly elected a Board of Directors with the following members within its meeting held on 10 July 2008:

prof. Ing. Jiří BÍLA, DrSc.
RNDr. Alexander ČERNÝ
Ing. Jan GRUNTORÁD, CSc.
Ing. Josef KUBÍČEK
doc. RNDr. Václav RAČANSKÝ, CSc.
doc. RNDr. Pavel SATRAPA, Ph. D.
prof. Ing. Miroslav TŮMA, CSc.

Ing. Josef Kubíček was elected for the post of the Chairman of the Board of Directors, and doc. RNDr. Václav Račanský, CSc., and prof. Ing. Miroslav Tůma, CSc., were elected as Vice-Chairmen.

The **Supervisory Board** had the following structure to 9 July 2009:
RNDr. Pavel KRBEC, CSc.
Ing. Jaromír MARUŠINEC, Ph. D., MBA
prof. Ing. Ivo VONDRÁK, CSc.
doc. Ing. Zdeněk VOSPĚL, CSc.
RNDr. František ZEDNÍK

Ing. Zdeněk Vospěl, CSc. was the Chairman of the Supervisory Board to 9 July 2009.

For the electoral term 2009–2011, the 27th General Assembly elected a Supervisory Board with the following members within its meeting held on 9 July 2009:
RNDr. Pavel KRBEC, CSc.
Ing. Jaromír MARUŠINEC, Ph. D., MBA
Ing. Petr PĚTIOKÝ, MBA
prof. Ing. Ivo VONDRÁK, CSc.
RNDr. František ZEDNÍK

Ing. Jaromír Marušinec, Ph. D., MBA was elected the Chairman of the Supervisory Board for the aforementioned electoral term.

Ing. Jan Gruntorád, CSc. was the **Managing Director** of the Association also in 2009.

DEVELOPMENT FUND BOARD

The Development Fund Board operated with the following structure to 9 July 2007:
RNDr. Igor ČERMÁK, CSc.
Ing. Miroslav INDRA, CSc.
Ing. Olga KLÁPŠŤOVÁ
doc. RNDr. Antonín KUČERA, CSc.
prof. Dr. Ing. Zdeněk KŮS
prof. RNDr. Jan SLOVÁK, DrSc.
prof. Ing. Pavel TVRDÍK, CSc.

RNDr. Igor Čermák, CSc. was the Chairman of the Development Fund Board.

For the electoral term 2009–2011, the 27th General Assembly elected a Development Fund Board with the following members within its meeting held on 9 July 2009:
RNDr. Igor ČERMÁK, CSc.
Ing. Miroslav INDRA, CSc.
Ing. Olga KLÁPŠŤOVÁ
prof. Dr. Ing. Zdeněk KŮS
Ing. Petr LAMPA
Ing. Vladimír RUDOLF
prof. RNDr. Jan SLOVÁK, DrSc.

RNDr. Igor Čermák, CSc. was elected the Chairman of the Development Fund Board for the aforementioned electoral term.

ORGANIZATIONAL SCHEME

The organization scheme (see Fig. was approved by the Director, following discussions with the Board of Directors, on 12 February 2009. In addition to employees included in the organizational scheme, 182 experts from 28 universities, Academy of Sciences of the Czech Republic and other institutions were cooperating with the Association on the *Optical National Research Network and Its New Applications* research plan in 2009.

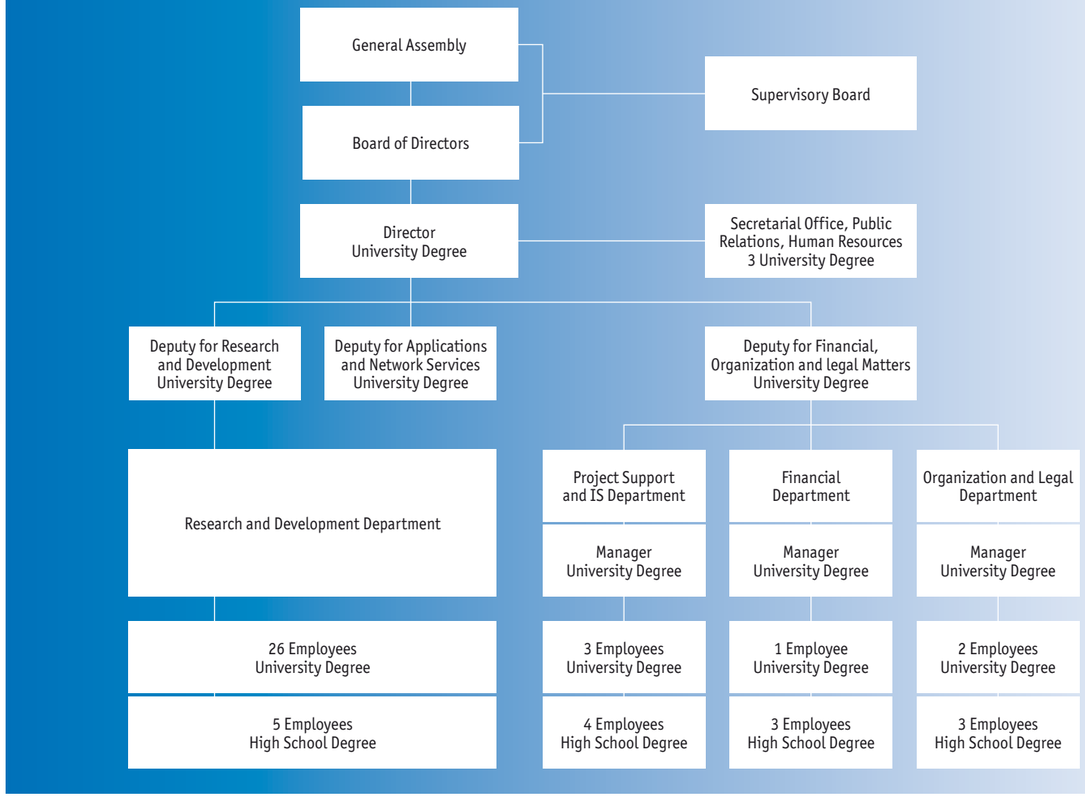

Fig. 1 – Organizational scheme of the Association in 2009

CESNET2 NETWORK

The CESNET Association is building and developing a high-speed computer network for the science, research, development and education purposes – CESNET2. The backbone network interconnects the largest university cities of the Czech Republic with circuits featuring high transfer rates. Users of the network include first of all universities and the Academy of Sciences of the Czech Republic as well as several high schools, hospitals, or libraries.

In addition to the standard Internet connection and high transfer rates for scientific and research purposes, the CESNET2 network offers to its users also some advanced and less common services. These include for example IP telephony, video conferences, or the supercomputing facility MetaCentrum.

In 2004 to 2007 the Association focused on building and developing the optical transfer layer, mainly in the DWDM network area. During 2009 the Association continued developing the entire network infrastructure from the DWDM optical transfer later up to the IP/MPLS network later. Additional nodes in Prague and Brno were integrated to the main core of the DWDM optical transfer network. Using the CL (CzechLight) DWDM technology the Association extended the transfer layer with additional lines, achieving deployment of the DWDM technology across the entire CESNET2 network.

The optical infrastructure topology of the CESNET2 network at the end 2009 is shown in Fig. 2. This topology includes those CESNET2 nodes that are connected using optical fibers and fitted with equipment of the CESNET Association. Lines are fitted with two different technologies, based on their usage character. The first type of the DWDM system contains devices allowing transfers with speeds of up to 10 Gbps in up to 32 channels, at the maximum distance of 1000 km. This system enables software channel configuration, bringing significant flexibility in setting up circuits matching users' needs. The system has been implemented mainly in the core of the CESNET2 backbone. The other system is based on our custom-built CzechLight optical amplifiers, developed by the Association within the research plan works. Unlike the previous system, this system is configured statically, allowing to transfer up to 8 channels with the speed of 1 to 10 Gbps in a single fiber, depending on the device type used. The remaining optical transfer routes currently operate in the "gray optics" mode, meaning that only one transfer channel can be implemented in one fiber.

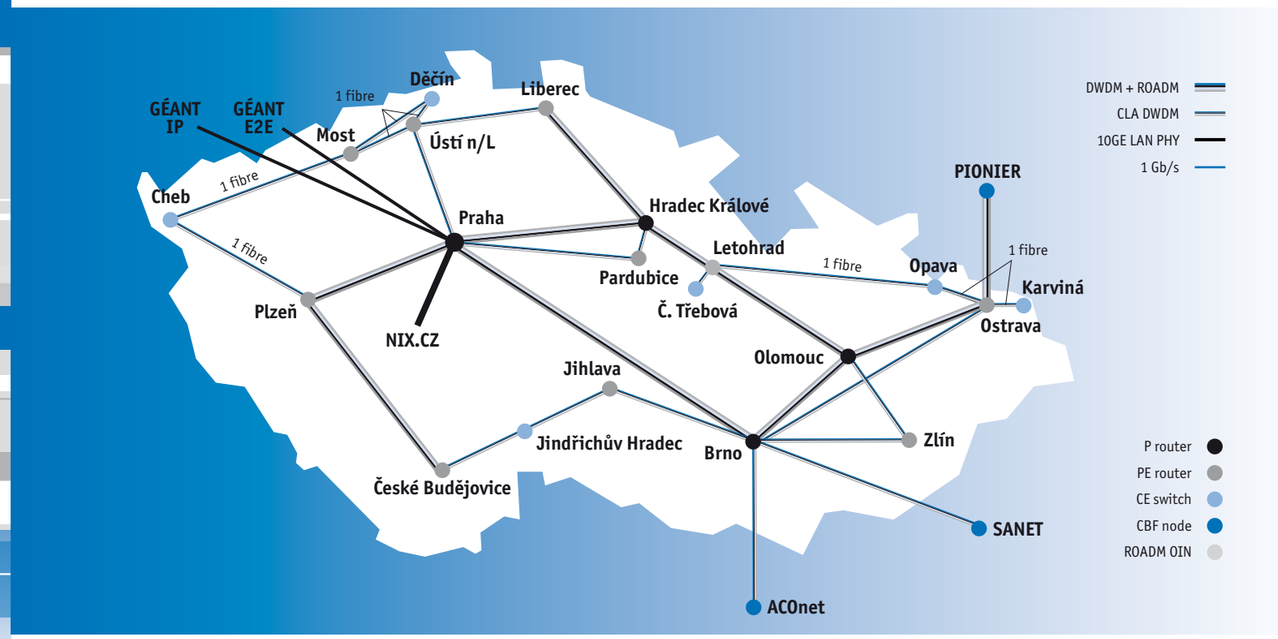

Fig. 2 – Basic optical topology of the CESNET2 backbone network

The IP/MPLS infrastructure topology built above the optical network as of December 2009 is illustrated in Fig. 3. The most significant changes to this infrastructure carried out in 2009 include deployment of the second terabit router in the CESNET2 network in the Brno node and division of this node to increase redundancy by means of two locations.

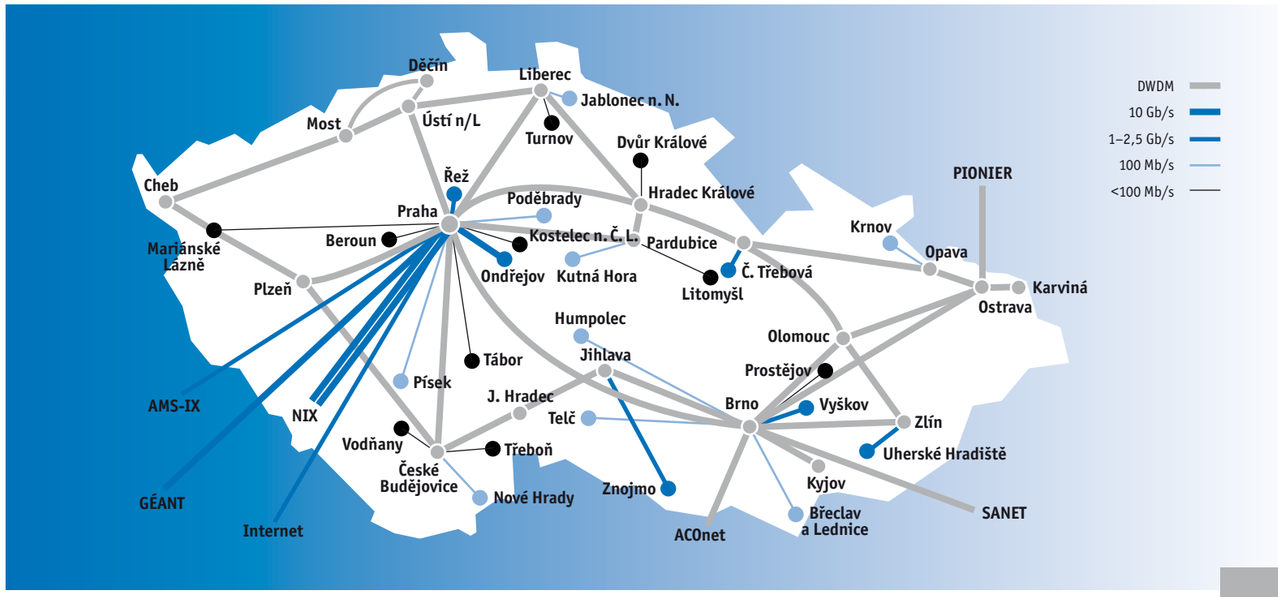

Fig. 3 – CESNET2 IP infrastructure topology in December 2009

When testing options for migrating to technologies allowing 40-Gbps transfers the Association successfully tested within the CESNET2 network capabilities of 40-Gbps data transfers, as the first entity in the Czech Republic. 40-Gbps channel connection was tested using the DWDM optical transfer network between Prague and Brno, both on the direct optical channel Prague-Brno (299 km) and a longer optical channel routed through Hradec Králové and Olomouc (462 km). In both cases the data transfer run flawlessly.

RESEARCH PLAN

OPTICAL NATIONAL RESEARCH NETWORK AND ITS NEW APPLICATIONS RESEARCH PLAN

National Research and Education Networks (NRENs), such as CESNET2 developed by the CESNET Association, have a very specific character. Their advancement requires active participation in the research and development of progressive network technologies and applications both on the national and international level.

Research activities relating to the Czech NREN development are performed mainly within works on the research plan *Optical National Research Network and Its New Applications*. This research plan, scheduled for 2004 to 2010, is to a large degree financed from the institutional support provided by the Ministry of Youth, Education and Sport of the Czech Republic. It involves active cooperation of experts of CESNET, Academy of Sciences of the Czech Republic, and staff and students of universities.

The objective of the research plan is to design a prototype of a transparent integrated communication environment, meeting specific needs of the academic community, and to test its characteristics and viability within practical operation. The need to design a next-generation National Research and Education Network is based on experience with the operation of NREN, indicating that the sufficient bandwidth, considered a priority until recently, is just one of the requirements for NREN. To become a true (virtual) environment enabling cooperation of scientific teams, additional communication services need to be implemented as an extension of the high-speed infrastructure.

With respect to the great extent of the research plan – both from the professional perspective and the financial/HR perspective – the research plan has been divided into ten activities described below in 2009. These activities concentrate on specific areas that are strategic when attempting to complete the comprehensive objective of the research plan.

RESEARCH PLAN ACTIVITIES IN 2009

National Research and Education Network Development

This key research plan activity is focused primarily on the development of the optical transfer infrastructure and its integration with the IP network layer, monitoring and provision of performance characteristics, and support for new functions and properties of this infrastructure, such as IPv6 unicast a multicast, creation of virtual private networks and private optical transfer channels.

An integral part of this activity is the cooperation with the Géant network as well as other European national research networks to ensure interoperability, essential for the provision of advanced services in the international scope. Encompassing more than just the research and implementation of new technologies in the national research environment, this activity includes also all supportive activities needed to provide quality and stable services for other activities and users.

Optical Networks

The Optical Networks activity deals mainly with the research in the CEF (Customer Empowered Fiber Networks) implementation area, particularly with data transfer methods and transfer devices development. Other areas of interest include cooperation on the development of new applications utilizing GLIF (Global Lambda Integrated Facility). Research results are tested both under laboratory conditions and within extensive experimental and subsequently also production networks. For this purpose an optical laboratory is available for this activity in the Association's premises and for needs of experiments on the lowest OSI model layers that could eventually lead to a network functionality loss, there is an experimental distributed laboratory being constructed within this activity (called CzechLight) that is connected to the worldwide experimental infrastructure GLIF. An important component of this activity is also the development of prototypes and functional samples of new optical devices, referred to collectively as the *CzechLight family*. Based on the licenses granted by the CESNET Association, these optical devices are currently offered by two commercial manufacturers.

Programmable Hardware

The objective of this activity is to develop specialized devices utilizing hardware acceleration and applications based on these devices, in particular for the network security area. The COMBO hardware platform allows processing of network traffic on 10-Gbps lines and in close future also 40-Gbps lines. The main network application is currently the FlowMon probe for monitoring IP data flows, exporting flow records in the NetFlow ver. 5 and 9 and IPFIX formats. COMBO cards represent the basis of the 10-Gbps version of the NetFPGA project, on which this activity works together with the Stanford University. The COMBO card and FlowMon probe technologies were successfully commercialized in 2007 and are currently available on the market. One of the first major customers was the GÉANT2 project. And important component of this activity is also systematic work with students that both helps to supply new resources for the development team and represents a great benefit for students, which is documented by their repeatedly gained awards in national and international contests.

Network and Traffic Monitoring

The network infrastructure monitoring focuses on processing and providing information obtained primarily from technical means that constitute the network infrastructure, practically irrespective of the network layer where the given element is dominantly applied. The Association develops tools that would be able to provide both detailed and summary information on specific parameters, capturing at least a certain degree of the network phenomena dynamics, and that could work with different logical structures of network elements as needed on the virtualization level, performing respective aggregation of the trends of desired quantities.

In the network traffic monitoring area the Association performs analysis of what is transferred through the network infrastructure. The focus is on the traffic transferred using the IP protocol (ver. 4 and 6) and processing of traffic logs based on flows describing this traffic in an aggregated form. The traffic information is primarily obtained from the backbone routers of CESNET2 or FlowMon probes developed within the *Programmable Hardware* activity.

Network Communication Performance Monitoring and Optimization

Within this activity, the Association deals with the research the purpose of which is to find mechanisms to ensure the performance characteristics required for transferring data in large high-speed networks. In 2009 the Association continued the development of a modular programmable platform, focusing on monitoring and processing of 40-Gbps network traffic. The platform is capable of analyzing the packets for the purposes of monitoring as well as generating and modifying the packets, such as when processing video transfers.
The Association developed a unique platform on this basis named MVTP-4k (Modular Video Transfer Platform) for very high resolution (4K×2K) video transfer and processing with hardware acceleration. The platform was successfully demonstrated at the CineGrid 2009 workshop that is an important global event in the high-resolution video transfer area. The technology made it possible to process (colour management) uncompressed 4K video in the real time over the distance exceeding 10,000 km. The video signal was transferred from Cinepost at Prague, Barrandov, to the University of California in San Diego. Instructions for real-time video processing were sent in the opposite direction by means of a video conference.

The transfer was carried out via a high-speed GLIF network with data flow exceeding 5 Gbps. The transfer scheme is illustrated in Fig. 4. In addition to this, the Association designed and developed a prototype adaptor for the Virtex-II FPGA evaluation board, using it to successfully test the method of bi-directional time transfer over an optical fibre with the length of 2x50 km in laboratory conditions.

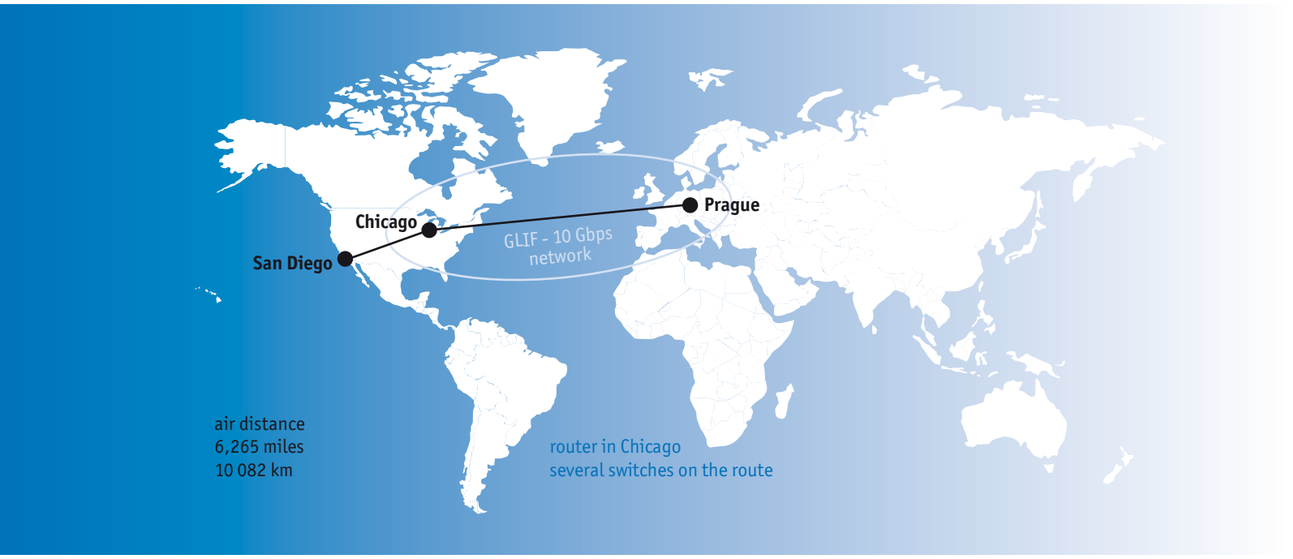

Fig. 4 – Scheme of 4K video transfer within the CineGrid workshop

AAI and Mobility

The goal of the activity is the development and implementation of an "inter-domain" distributed infrastructure, providing authentication and authorization services to support cooperation of users registered in various home institutions. The basic requirement for the constructed infrastructure is its compatibility with similar solutions developed in European NRENs (TERENA, GN3) and on the worldwide level (Internet2, in particular). The activity includes implementation of computer network roaming within the international *eduroam* initiative. In 2009 the Association participated in selection of a new supplier of accredited server certificates for *Server Certificate Service* provided by the TERENA association, intermediating generally accredited server certificates for servers of organizations incorporated in the CESNET2 national research network. When negotiating with the new supplier, the provided services were extended with grid server certificates, personal certificates for common users (S/MIME and authentication) and personal certificates for grid users. The TERENA association provides and CESNET intermediates this comprehensive service under the name TERENA *Certificate Service (TCS)*. In cooperation with the universities involved, the Association has prepared a certification authority – *CESNET Personal Signing CA*. The authority will issue personal certificates intended mainly for electronic signing of documents and authentication of users in university agendas.

MetaCentrum

The long-term objective of the activity is construction, development and operation of a distributed computing infrastructure – grid – within the Czech Republic and its connection to the international infrastructure by means of participation in corresponding projects. The grid infrastructure in operation includes necessary storage capacity, serving mainly for storing primary data, intermediate results and final results of computations. In 2009, construction of a customizable grid environment based on consistent virtualization of entire MetaCentrum computing environment continued. This orientation makes MetaCentrum fully compatible with current trends of the so-called Cloud Computing, i.e. providing of elastic computing and storage capacity that can be customized by users to meet their needs. During the year there was a significant increase of the level of utilization of computing resources incorporated in MetaCentrum. For eleven months of 2009 user performed computations for 4.5 million CPU hours within almost half a million jobs. By adjusting the management of queues and politics that were restricting the number of simultaneous jobs run by individual users allowed to virtually triple the machine time used for computations and double the number of jobs in the second half of the year. In 2009 users registered about 30 scientific works published in international magazines or prestigious international conferences with credits going to MetaCentrum.

Multimedia Transmissions and Collaborative Environments

The objective of this activity is the research and development of communication technologies covering signaling protocols and relating infrastructures, transfer protocols for multimedia data, and sharing, storing and application utilization of this data. One of the areas dealt with by the Association within this activity is the development of rich communication services (including voice, video, text and presentations) using signaling protocols (SIP, H.323, SS7) and services (MCU, ENUM) and their link with the surrounding environment. The objective is both geographic and technological integration. A specific purpose of this activity is the support for implementation of communication systems at Association members and other institutions with emphasis put on security. Another area of interest is the research in the field of user-controlled elements to support multi-point synchronous communication. Concerning the video transfer, the Association deals with multi-point transfers of uncompressed HD and 4K video over long distances, using an infrastructure of active elements and possibly (in future) the optical multicast. Own research is done in the multimedia search engine area, planned to be extended to all European countries. The Association will also extend availability of HD streaming for distance learning needs. The Association has been cooperating with the media industry on further streaming applications and use of online transfers for production and post-production of content with HD or better quality.

CESNET CSIRT

The objective of the activity is to achieve a better internal organization level in the area of the security of the CESNET2 network and services running this network. Our goal is to have the users and administrators of the CESNET2 network prepared for potential network security violations, furnished with functional procedures, rules and technical means to remove the problems that occurred as fast as possible and minimize the damage. This kind of background is best to create in the environment of CSIRT (Computer Security Incident Response Team), which is why one of the main tasks here is to run our own security team *CESNET-CERTS*. The primary objective of this team is to handle or coordinate security incident handling in the CESNET2 network, regardless whether CESNET2 is a victim or cause of the incident. Another task with equal importance is cooperation with global security platforms such as TF-CSIRT, FIRST, ENISA. An important part of the activity is the educational work for administrators and users of data networks. One of the specific outputs is a service designed for universities – custom training (primarily) for students of first grades in the area of copyrights, SW licenses, personal data protection and cybernetic crime.

Application Support

The objective of this activity is to search for and support applications requiring above-standard communication with high demands for data transfer parameters (such as unusual volume, transfer rate, response time or reliability) and/or requiring special transfer modes that cannot be achieved in a shared IP network. For these applications end-to-end routes and private and virtual networks on various levels are created, ensuring the required parameters and the transfer quality needed. The main component of the activity is implementation of selected model applications from various branches that will take advantage of the potential and capacity of the network created by other activities in both the national and international context. To provide an example, there are medical applications dealing with graphic data collected with modern scanning devices in hospitals (X-ray, MRI, CT) and applications from the field of physics processing data created in unique devices (electron microscopes, radiation detectors etc.). Data transfers connected with real-time 3D image modeling, virtual reality and high-resolution video are becoming more and more frequent in network applications.

EVALUATION OF RESEARCH PLAN RESULTS ACHIEVED IN 2009

The assessment of results of the *Optical National Research Network and its New Applications* research plan achieved in 2009 was carried out within a regular opposition procedure, prescribed by the Ministry of Youth, Education and Sport of the Czech Republic as the institutional support provider, on 5 February 2010.

The board of opponents comprising independent experts appreciated the high professional level of the Association's work and evaluated the results achieved as excellent with international meaning. According to the board of opponents, the high professional level of the research plan is further evidenced by participation of the implementing team to important EU projects, including participating in their management, successful transfer of research and development results to practice as well as awards gained by students cooperating on the research plan implementation from national and international contests. In their reports, members of the board of opponents emphasized active participation of the implementing team in many professional conferences, the number of professional publications released, organization of own seminars and workshops, and mainly acquisition of several patents and prototypes.

INTERNATIONAL COOPERATION

GN2 and GN3 Project

The CESNET Association has been actively participating in the construction of a European infrastructure interconnecting research and education networks (NREN) of individual European countries with high-speed links since 1996. From September 2004, this construction took place within the Multi-Gigabit European Academic Network project (GN2). 32 organizations engaged in the area of high-speed research and education networks was involved in the project. The goal of the project was to provide European research and education institutions with a communication environment, capable of meeting their requirements from ensuring mobility in the European Research Area (ERA) to providing reserved high-capacity connections between specific terminal devices.

When the project was finalized in June 2009, the GÉANT2 network provided its services to about 40 million users from over 3,500 institutions in 38 European countries. In addition to the basic IP communication, this hybrid network supported also (for needs of specific projects) guaranteed service quality transfers, creation of temporary special-purpose infrastructures (grids) or point-to-point connections, based both on virtual private networks (VPN) and reserved wavelengths (so-called λ-services). Other services available within GÉANT2 included the *eduroam* roaming system, federalized *PERT (Performance Enhancement Response Team)* providing services in the network performance characteristics performance, identity management services, coordination of security incident handling as well as interconnection of European NRENs by means of GÉANT2 with similar networks on other continents.

Continuation of the operation of this infrastructure (including the services provided) and its further development is the subject of the *Multi-Gigabit European Research and Education Network and Associated Services (GN3)* project. Unlike the GN2 project focusing on the hybrid network construction that is now used as the basis of GÉANT (see Fig. 5), GN3 is focused on provision of advanced communication services for NREN users. The Association has been actively participating in all project components, working both on coordination activities and activities relating to the research and development of services and applications in the area of advanced information and communication technologies as well as those that relate to implementation of these results in practice.

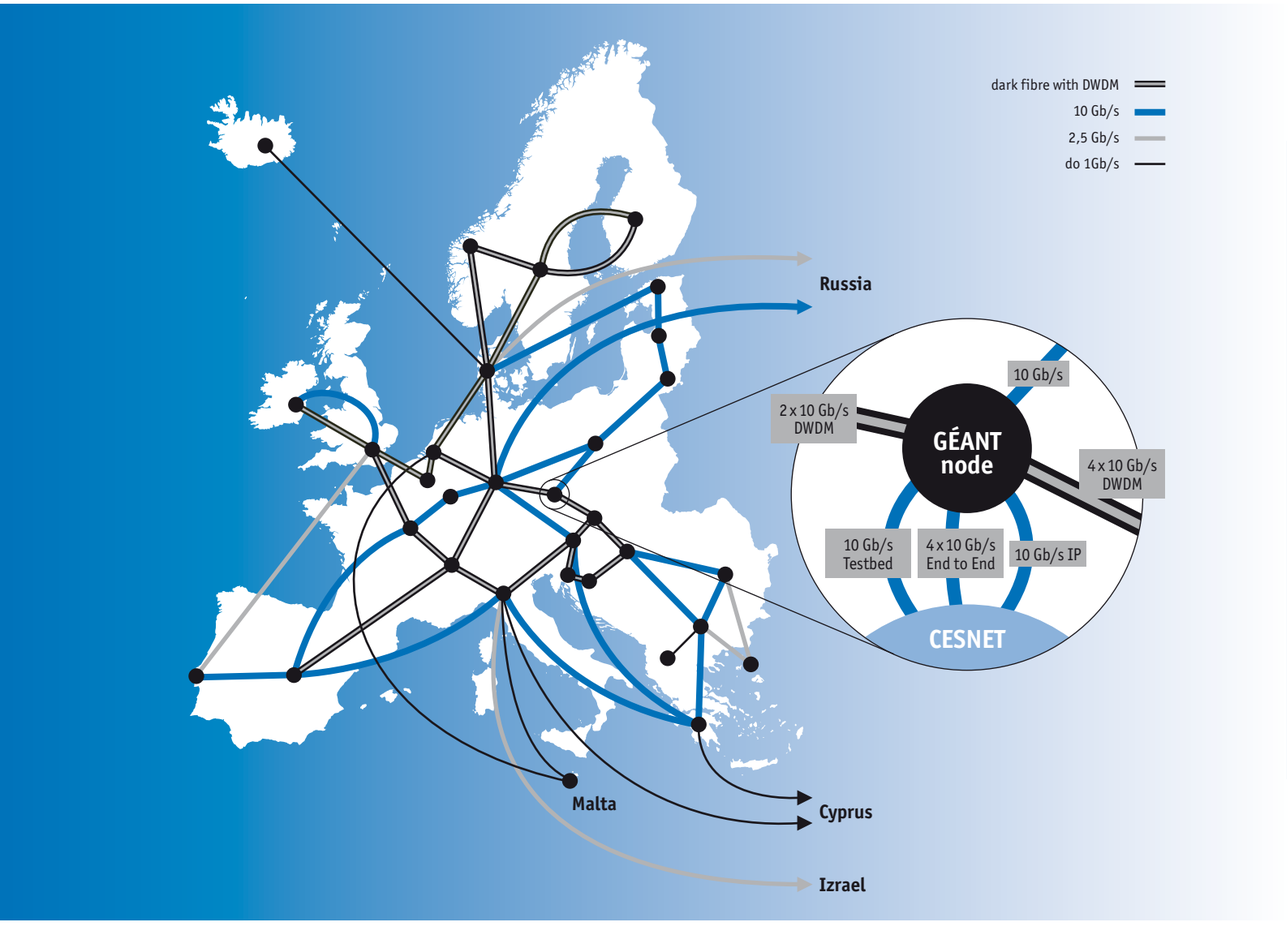

Fig. 5 – GÉANT network topology at the end of 2009

The Association has a major role within this project, which is, in addition to strong involvement of its experts, further evidenced by the fact that the Association director Ing. Jan Gruntorád, CSc., is one of the five project Executive Committee members.

More information: www.geant.net.

ORIENT

A project for implementing a connection of the GN2 network with Chinese research and education networks (CERNET and CSTNET) named ORIENT was launched in October 2005. Besides CERNET, there were six more European NRENs involved in the project plus DANTE. The CESNET Association invested its experience in the project, gained within monitoring of extensive networks. The project was successfully closed in 2009.

More information: www.dante.net.

Phosphorus

Since October 2006 the Association has been actively participating in development of a global testbed (Europe-USA-Canada, see Fig. 6) for testing provision of on-demand network services in an extensive and heterogeneous (from the perspective of technologies in use and key element producers) network environment within an extensive international project named *Phosphorus*. The project included development of middleware needed for smart allocation of network resources.

The third (final) project year was evaluated in September 2009 in Poznan, Poland, where demanding test were demonstrated with presence of EC representatives. All project objectives were accomplished and the project was successfully closed.

More information: www.ist-phosphorus.eu.

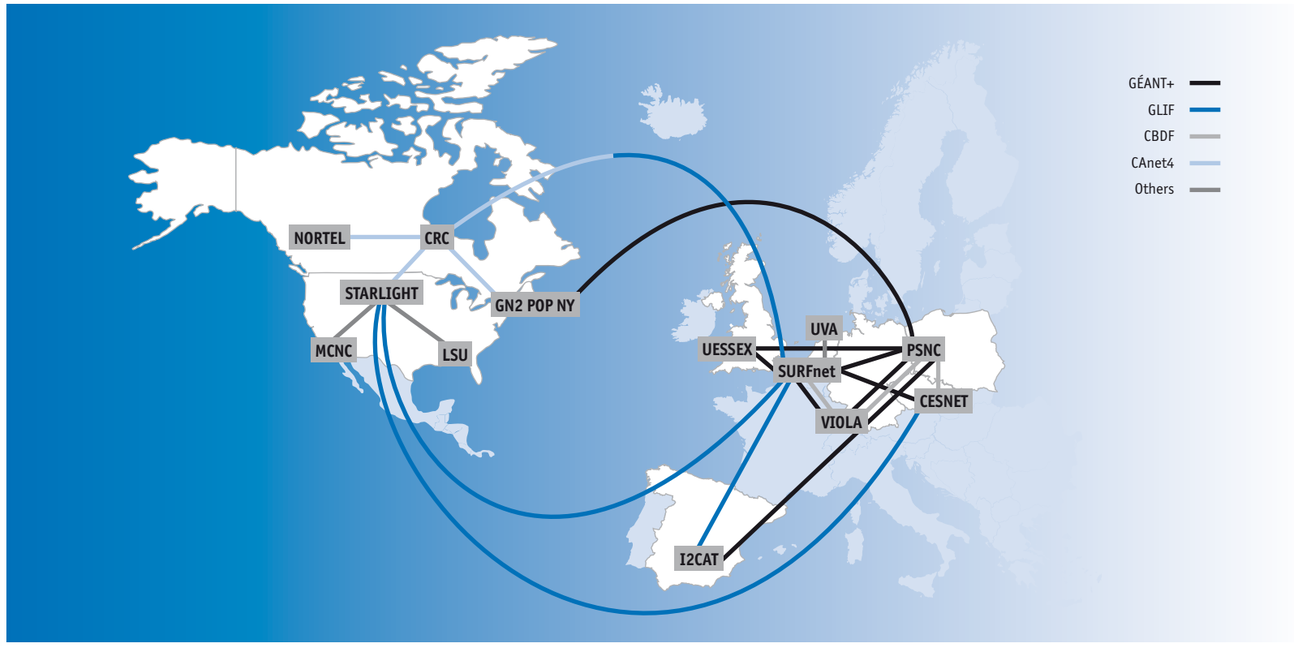

Fig. 6 – Global testbed of the Phosphorus project

GLIF

Global Lambda Integrated Facility (GLIF) is an international research activity with participation of the most advanced institutions and consortia engaged in the network development and application in Europe, North and South America, Asia and Australia. Individual *GLIF* participants enable other participants to use certain resources so that collective experiments could be carried out. This environment differs from common infrastructures in that the resources of participants are used for constructing testbeds and performing experiments and demonstrations, which are not possible in the standard network, for example due to the risk of network destruction. This helps to determine in which direction the research and commercial networks, their services and applications should be concentrated.

More information: http://www.glif.is/.

FEDERICA and Other Related Projects

The most important one from the new generation Internet projects is *FEDERICA (Federated E-infrastructure Dedicated to European Researchers Innovating in Computing Network Architectures*). This EU project with 23 partners was launched in January 2008 and despite being relatively limited in terms of finance, its importance has grown significantly. The project is currently included in the project group named *FIRE (Future Internet Research and Experimentation)* that represent a European analogy of the American *GENI (Global Environment for Network Innovations)* project.

The *FEDERICA* project responds to the current tendencies to virtualize information technologies. The objective of the project is to develop an experimental network (see Fig. 7) with several levels, based on virtual principles. This network should be based on the GÉANT physical infrastructure, existing national research and education networks and their newly created links. The FEDERICA environment has been operational from the November 2008 and is designed for European researchers who need to test new computer network architectures, experiment with new drafts of communication protocols in these networks including the option to verify destructive behavior of some of their elements, and study means to avoid these situations. The CESNET Association is responsible within the project for creation of a monitoring system that will provide information to all users and administrators for the physical layer and all virtual layers. CESNET is one of the founders of the project and has an important role in it, participating in the design of the general network concept and development of resources for monitoring virtual infrastructures.

More information: www.fp7-federica.eu.

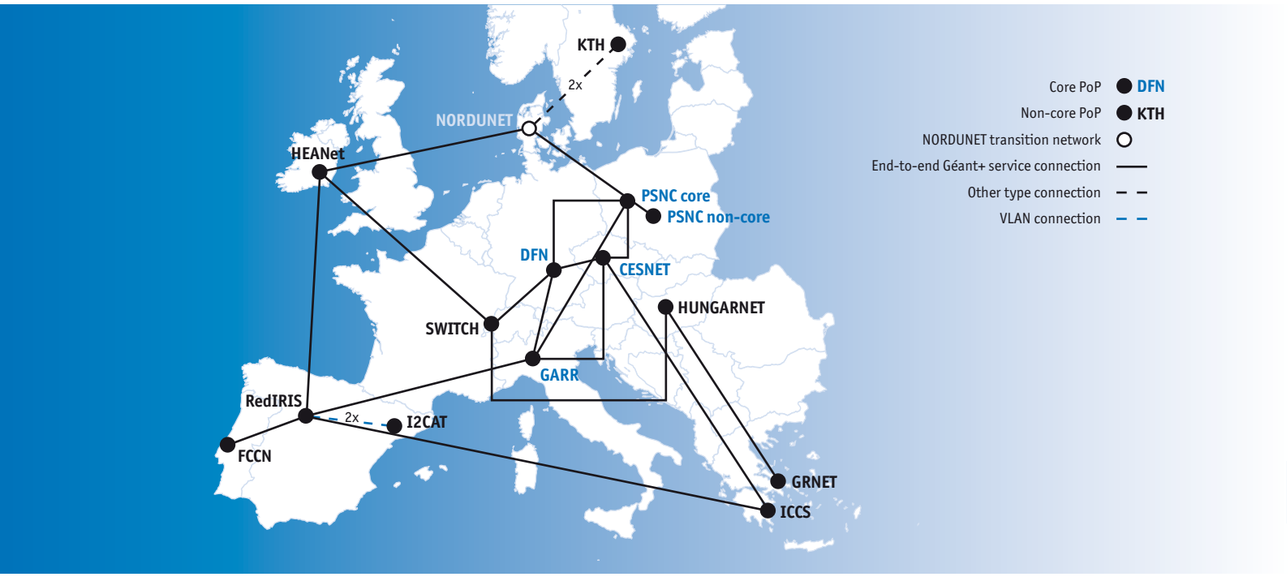

Fig. 7 – Scheme of the FEDERICA experimental network

Other project that are linked with the *FEDERICA* to some extent, have developed in 2009 only as required by users. The *PlanetLab* project has been active for three years now. Computers of CESNET incorporated in this project are fully used within the global user community. There are three workplaces of universities (Association members) actively participating in the project but the number of home users has not increased much during the year. This is considered by the Association to be related with a relatively low pedagogic activity of expert workplaces of our universities in this area.

Another project with similar type was *VINI (Virtual Network Infrastructure)*, launched several years ago by the Department of Computer Science z Princeton University in cooperation with Internet2 and the NLR network. The Association joined this project in 2008. Currently the Association is attempting to create its own control system based on PLE-PLC with the objective to set up a federation between VINI-CZECH and the original VINI, running on Internet2 nodes. There are now works in progress on implementation of the *IIAS (Internet in the Slice)* project in the VINI network and basic interconnection of nodes of PlanetLab and VINI is performed. The purpose of these efforts is to create an experimental network allowing to test principles of federalization of independent networks with distributed administration.

The third related project is *ONElab*, an important project of the 7th Framework Programme that belongs to the FIRE group. Since September 2009 CESNET has been a member of the PlanetLab.eu consortium, representing the European structure of this worldwide network.

More information: www.planet-lab.org/, www.planet-lab.eu, www.onelab.eu/ and www.vini-veritas.net/.

INTERNATIONAL GRID PROJECTS

EGEE III

The international cooperation in the grid area is represented particularly by the Association's participation in the *EGEE III* project. The objective of this project is to further extend the existing grid infrastructure, simplifying it from the users' perspective. A vital goal is also to connect scientists from other branches (i.e. areas different from the high-energy physics, for which this environment was primarily constructed in connection with the LHC project preparation in CERN) to its use. There is a crucial change in the management of this infrastructure, the migration from the grid administration model based on specific research projects to a federation infrastructure comprising national grid initiatives.

More information: www.eu-egee.org.
Specific information on the participation of CESNET: egee.cesnet.cz.

EGI_DS Design Study

The most important project in the grid area in Europe was *EGI_DS (European Grid Initiative Design Study)*. The objective here was to analyze options for creating a sustainable infrastructure on the European level, outlining a concept of mutual cooperation of grid initiatives from individual countries (both on the organizational and technological level), develop means for its implementation, and test these means in operation. The primary contribution of the study and the activity of the European grid initiative as such should be a maximally effective use of considerable resources invested in grid systems on the European and national level. In the course of 2008 the Association took over the role of project coordinator from the University in Linz, leading the project to successful completion in 2009. Setting up of the European grid initiative *EGI.eu* uniting grid activities of European countries is considered as the most significant outcome of this project. Prof. RNDr. Luděk Matyska, CSc., from CESNET became the vice-chairman of the EGI.eu Council.

More information: http://www.eu-egi.org/.

EUAsiaGrid

The interconnection of European and Asian grid infrastructures is the subject of the *EUAsiaGrid (Interconnection and Interoperability of Grids between Europe and Asia)* project. The asian partners are represented by the grid workplace of Academia Sinica and includes also sites from Thailand, Malaysia, Singapore, Vietnam, and other countries. European part of consortium consíst of University of Manchester (Great Britain), HealthGrid (France), INFN (Instituto Nazionale di Fizica Nucleare, Italy) and CESNET. CESNET is responsible for the Applications area.

More information: www.euasiagrid.org

TERENA TASK FORCES

In addition to international projects supported by EU, experts from the CESNET Association are also actively involved in Task Forces, made up of groups of experts who undertake joint work in their common areas of interest organized by TERENA. The following groups are concerned:

TF-CSIRT – coordination of network security incident handling

TF-EMC² – promotion of development and deployment of open and interoperable middleware infrastructures among national and regional research and education networking organizations and academic and research institutions.

TF-mobility and Network Middleware – development and deployment mobile technologies and utilize network middleware for supporting interoperable roaming services within academic networks

TF-PR – exchange of information relating to NREN presentation

TF-Media – collection and exchange of ideas, knowledge and experience on technical, administrative and legal aspects of the Internet multimedia content creation, its management and distribution of relating work procedures in the European space

TF-Storage – new workgroup dealing with the topic of data repository implementation in the environment of academic networks

TF-NOC – newly created workgroup that will deal with the topic of network operation centres at national research and education networks

NATIONAL RESEARCH PROJECTS

In addition to the research plan and international projects, the CESNET Association takes part also on research tasks within the national support. We are currently cooperating on two projects, the first of which is supported by the Grant Agency of the Academy of Sciences of the Czech Republic within the Information Society program and the other by the Ministry of Interior of the Czech Republic.

The objective of the *MediGrid – Methods and Tools for Utilizing Grid Networks in the Biomedicine* project, submitted collectively by the University Hospital in Motol, Masaryk Hospital in Ústí nad Labem and CESNET, is to design, develop and implement a pilot of MediGrid – an environment and modular system of applications for distributed processing of data and computing tasks in the healthcare area.

In the middle of 2007 works were initiated on the project named *Cybernetic Threat Issues from the Perspective of Czech Security Interests*. One of the project objectives is to develop a model national CSIRT (Computer Security Incident Response Team) of the Czech Republic. To accomplish this objective, the Association is making their knowledge and experience gained when developing and running CESNET-CERTS available. Other partners of this project are the Faculty of Mathematics and Physics of the Charles University, Faculty of Philosophy of the Charles University and Faculty of Science of the Charles University in Prague, Faculty of Electrical Engineering of the Czech Technical University, Institute of Sociology of the Academy of Sciences of the Czech Republic and NESS Czech, s. r. o.

CESNET AS THE NATIONAL GRID INFRASTRUCTURE OF THE CZECH REPUBLIC

The Ministry of Youth, Education and Sport appointed CESNET the representative of the national grid infrastructure (NGI) in all international structures where the Czech NGI will be active. The key international project in this area is *European Grid Initiative – Design Study (EGI_DS)*, the objective of which is define conditions for establishing a long-term sustainable pan-European grid infrastructure EGI.eu and to initiate implementation of this setup. The NGI role assigned to CESNET will involve provision of basic computing and storage grid services, incorporation of substantial computing and storage capacities of other subjects to these grid, and coordination of sharing and use of these capacities.

CESNET A PART OF THE *RESEARCH AND DEVELOPMENT INFRASTRUCTURE ROADMAP*

According to that a new legislation governing the framework of financing the research and development in the Czech Republic (law 130/2002 of the Collection of Laws) came to force, on 1 July 2009, the Association took part in works aiming to define a *Research and Development Infrastructure Roadmap*, initiated by the Ministry of Youth, Education and Sport. This strategic document has been prepared in response to the European roadmap (ESFRI Roadmap) and reflects involvement of Czech large research infrastructures in the European Research Area.

In connection with completion of the *Optical National Research Network and Its New Applications* and in line with *Research and Development Infrastructure Roadmap*, the Association launched drafting a project named *Large Infrastructure CESNET* with the objective to rebuild the existing CESNET2 e-infrastructure into a modern complex national e-infrastructure for research, experimental development, and innovations. The infrastructure will include all general e-infrastructure components needed for integrating the Czech Republic to the European Research Area,. The main components will be a national communication infrastructure with high throughput level and national grid infrastructure, extended with tools and services for controlling e-infrastructure resource access, tools for securing communication and protecting data, and tools for efficient cooperation of distributed users and teams.

The *CESNET Large Infrastructure* project scheduled for five years (2011 to 2015), was approved on 15 March 2010 by the government of the Czech Republic within approval of the text of the Czech Republic Roadmap of Large Infrastructures for Research, Development, and Innovations. Currently the negotiations regarding the final project version and subsidies are under way.

DEVELOPMENT FUND

In 2009, the Fund Development Council announced two calls for new projects. For the first one, the following thematic groups were specified:

- Utilization of services of the CESNET2 network and modern information and communication technologies within the tuition and education process, creative and scientific/research activities and management of public universities and the Academy of Sciences of the Czech Republic
- Advanced applications utilizing the high-speed backbone network
- Network services and applications research support
- Education support for Association member employees with the objective to obtain a globally recognized certificate in the IS/IT area

The Association accepted 21 of 30 projects submitted in this round, 10 projects of which were accepted after revision: For three projects the allocated financial resources were lower than the required amount.

Project Number	Beneficiary	Project Name
290R1/2009	Brno University of Technology	Processing of statistic data on data flows in the environment of a 10-Gb metropolitan computer network
291R1/2009	Masaryk University	Intelligent logging server
292R1/2009	University of West Bohemia in Plzeň	Employee training for computer networks
293/2009	University of West Bohemia in Plzeň	Validation of OSD model for AFS
294/2009	University of West Bohemia in Plzeň	IBM WebSphere Portal Server upgrade and management
295/2009	University of West Bohemia in Plzeň	System for collection and display of traffic data on the user level
296/2009	University of West Bohemia in Plzeň	Integration of applications to the Czech National Academic Federation eduID.cz
297/2009	VŠB - Technical University of Ostrava	Additional training for RCNA Ostrava in the area of reliable converging computer network design
298/2009	University of Pardubice	Extension of education of academic workers in the operating system administration area
299R1/2009	Mendel University in Brno	Increase in qualification of workers responsible for the wireless network administration
301R1/2009	VŠB - Technical University of Ostrava	Implementing of computer network monitoring tools
302/2009	University of Pardubice	Centralized management of access points and extended coverage of the *eduroam* wireless network
303/2009	Janáček Academy of Musical and Performing Arts in Brno	Increase in qualification of the network specialist in the area of CISCO technologies
304/2009	Janáček Academy of Musical and Performing Arts in Brno	Innovation of the existing IP telephony system and SIP protocol deployment in the regular academy operation
307/2009	Czech Technical University in Prague	Obtaining of SGI certificate for the administration of Altix Linux servers of the Computing and Information Centre
309R1/2009	Mendel University in Brno	Virtuální perimeter
311R1/2009	Masaryk University	Use of single-board computers for securing medical data transfers
313R1/2009	Masaryk University	Reference knowledge system for medical image databases to increase the medical diagnostics process efficiency
315R1/2009	Czech Technical University in Prague	Research and use of mechanisms for preventing attacks in the area of IP telephony and voice services
317/2009	Charles University in Prague	Increase in qualification of workers of the CIT network
318R1/2009	Academy of Sciences of the Czech Rep.	Increase in qualification through participation in the Cisco Networking Academy program, with the objective to obtain the CCNP international certificate

For the second call for projects, the following thematic groups were specified:

- Utilization of services of the CESNET2 network and modern information and communication technologies within the tuition and education process, creative and scientific/research activities and management of public universities and the Academy of Sciences of the Czech Republic
- Advanced applications utilizing the high-speed backbone network
- Network services and applications research support

45 projects were submitted based on this announcement. The Association accepted 35 of the projects submitted in this round for financing. 10 projects were accepted after revision and for 6 projects the allocated financial resources were lower than the required amount.

In 2009 there were two rounds of opposition procedures for completed projects. 23 projects were successfully completed in total; one was presented by its beneficiary within an opposition procedure. For several projects, additions to the final documents were required. Final reports for projects implemented within the CESNET Development Fund are available at the Association's website. To streamline activities relating to the assessment of projects, a system for electronic processing of opponent reports was implemented. The system was deployed for assessing project drafts and assessing final project documents. Participants of seminars for the team implementing the research plan of the CESNET Association as well as participants of meetings of the VIC Directors Club ("Klub ředitelů VIC") are regularly informed on activities of the Development Fund and projects implemented within the Development Fund. Results of some projects were presented within the seminars of entities working on the CESNET's research plan, at professional seminars for CESNET members as well as at international conferences. Results of projects were presented also by means of publishing activities in specialized magazines.

Project Number	Beneficiary	Project Name
321/2009	Academy of Sciences of the Czech Rep.	Completion of the *eduroam* network at the Plant Molecular Biology department of the Biology Centre of the Academy of Sciences of the Czech Republic
322/2009	Jan Evangelista Purkyně University in Ústí nad Labem	Extension of the University wireless network – 2009
323/2009	University of West Bohemia in Plzeň	Collection and processing of traffic data to locate system anomalies
324/2009	University of West Bohemia in Plzeň	Secure access to the ALEPH library system
325R1/2009	University of West Bohemia in Plzeň	Software equipment deployment of the Czech National Registry of Bone Marrow Donors to the academic network and its further development
326R1/2009	University of West Bohemia in Plzeň	Innovation of IS COURSEWARE – electronic study guide
330R1/2009	University of West Bohemia in Plzeň	Free implementation of a groupware service
331R1/2009	University of West Bohemia in Plzeň	Secure electronic document in the University environment
332/2009	Brno University of Technology	Completion of the eduroam.cz network in the premises of the Faculty of Chemistry of the Technical University in Brno
333/2009	Masaryk University	API for accessing identity federations
337/2009	VŠB - Technical University of Ostrava	Implementation of passive optical network to the communication technologies education
338/2009	VŠB - Technical University of Ostrava	Distributed experimental and educational environment for network technologies
339R1/2009	Academy of Sciences of the Czech Rep.	SIP development and VoIP unification in the Common Activity Centre of the Academy of Sciences of the Czech Republic
340/2009	Academy of Sciences of the Czech Rep.	Pilot IPv6 implementation in the network of the Common Activity Centre of the Academy of Sciences of the Czech Republic
341/2009	VŠB - Technical University of Ostrava	Operation of mobile devices in wireless networks
342R1/2009	VŠB - Technical University of Ostrava	Connection of service providers (SP) of the Technical University of Ostrava to the Czech Academic Identity Federation eduID.cz
343R1/2009	Brno University of Technology	Support for creating podcast education materials
344/2009	Brno University of Technology	Transfer of the Ipv6 network from experimental to routine operation
345/2009	University of Hradec Králové	Development of wireless networks in connection with the *eduroam* project in the University of Hradec Králové
347/2009	Czech Technical University in Prague	Extension of the *eduroam* network to the premises of the Faculty of Information Technologies
348/2009	Masaryk University	GColl2A: Gcoll environment deployment in the academic environment
350R1/2009	University of Pardubice	Integration of network and system monitoring services for supporting users of information systems
351/2009	Tomáš Bata University in Zlín	Measurement workplace with safe remote access for research and development of applications and WLAN 802.11 protocols
352R1/2009	Tomáš Bata University in Zlín	Extension of the wireless network coverage at the Faculty of Applied Informatics building
353/2009	Academy of Performing Arts in Prague	Another stage of the *eduroam* network development
354/2009	Charles University in Prague	Streaming and distribution of protected multimedia of medical faculties of the Charles University using the infrastructure technology of CESNET
355/2009	Academy of Fine Arts in Prague	Completion of the wireless network of the Academy in connection with the *eduroam* project
357/2009	University of Economics, Prague	Access to HD technology for multimedia production
358/2009	Academy of Sciences of the Czech Rep.	Deployment of tools for supervising and monitoring the computer network
359/2009	Charles University in Prague	Deployment of authentication using the Shibboleth system for selected applications at the Charles University and extension of databases of accessible information resources for users from the academic community with audiovisual documents
360/2009	Academy of Sciences of the Czech Rep.	Application of a high-speed network for transferring high-volume image data
361R1/2009	Charles University in Prague	Efficient identification of physiologic systems at the computing grid
362/2009	Czech University of Life Sciences in Prague	Implementation of the IPv6 protocol at the network of the Czech University of Agriculture in Prague
363/2009	Mendel University in Brno	Digital backbone network infrastructure model
364/2009	Mendel University in Brno	Extension of the *eduroam* wireless network in the University II

CESNET and Czech Republic EU Presidency

EU2009.CZ

The first half of 2009 was marked by the Czech Republic EU presidency. In connection with the presidency, the Association organized several international events.

As the most prestigious, the international conference *The Future of the Internet* organized by the Association on 11 May with the support of the European Commission, where over 400 Internet research and development representatives from the entire world took part , was considered. The event was opened by celebratory band cutting performed by Viviane Reding, EU Commissioner for Information Society and Media, and Vlastimil Růžička, Deputy Minister of Education, Youth and Sport of the Czech Republic (see Photo 1). The purpose of the conference was to assess strategic orientation and trends marking the future social and economic development of Internet and mobile societies and present useful ideas and projects in the field. The event included a press conference where over thirty Czech and foreign journalists participated (see Photo 2). Speech recordings were made accessible at the conference website: http://www.fi-prague.eu/.

After the conference, the *Future Internet Assembly* meeting followed, taking place from 12 to 13 May and attempting to establish coordinated European approach in the future Internet area. On 12 May there was held the *Future Internet Forum* of EU member states (see Photo 3). This meeting was the first step on the way to mapping European initiatives in the further Internet development area. The forum represents an informal group enabling member states to share knowledge, experience and best practices, determining key national players, activities and institutions with the objective to find common approach to individual areas. The forum unifies member states where a national initiative focused on the future of the Internet is in progress or is planned.

In connection with the *The Future of the Internet* conference, the *Millennium* programme broadcast a day later, on 13 May, at the ČT24 news TV channel was dedicated to the future of the Internet. The programme included performances of the Association's director Jan Gruntorád and a Department Director with the European Commission General Directorate for the Information Society and Media Mario Campolargo (see Photo 4).

Photo 1 - Viviane Reding a Vlastimil Růžička at The Future of the Internet conference

Photo 2 – Press conference within The Future of the Internet

On 14 and 15 May the Association organized the *e-Infrastructure Reflection Group (e-IRG) Workshop* (see Photo 5). This workshop is organized regularly (twice per year) under the auspices of the EU presidency. The *e-Infrastructure Reflection Group* has been formed in order to specify and recommend optimal utilization of the pan-European electronic infrastructure. The *Reflection Group* comprises official government representatives of all EU countries. Recommendations and analyses of the group are critical when building the European knowledge society. Special attention is given to the grid computing, data repositories, and networks. The Prague meeting dealt for example with issues of the data management, e-infrastructure federalization or e-infrastructure legal aspects (see Photo 6).

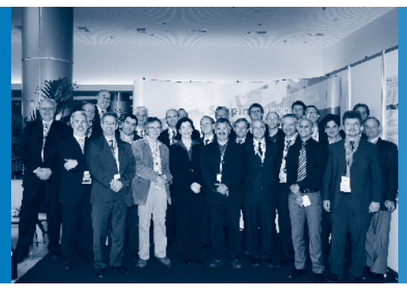

Photo 3 – Future Internet Forum

Photo 4 – Mario Campolargo

The Association also became a partner for another important event taking place within the Czech EU Presidency, which attracted almost 600 experts from 41 countries of 5 continents to Prague. This event was a top meeting of scientists from the sector of nuclear physics and elementary particle physics within the *CHEP 2009 – Computing in High Energy and Nuclear Physics* conference taking place from 21 to 25 March. The Association did not provide connectivity for the entire event only but it also enabled online streaming of selected lectures. The plenary conference meeting was opened by leading representatives of its organizers: Jan Gruntorád, Association Director, Václav Hampl, Rector of the Charles University in Prague, Jiří Drahoš, Chairman of the Academy of Sciences of the Czech

Photo 5 – e-Infrastructure Reflection Group (e-IRG) Workshop

Photo 6 – Naděžda Witzanyova and Jan Gruntorád at the e-IRG meeting

Republic, and Václav Havlíček, Rector of the Czech Technical University in Prague (see Photo 7). The Association issued a popularization publication titled CESNET: *Meeting Point*, mapping professional national and international events organized by the Association from 2000 to the first half of 2009 when the Association participated in the Czech EU presidency events.

Other Activities for Experts and General Public

In 2009 the Association organized several other national and international events. In January there was the *EGI Policy Board Meeting* – meeting of representatives of all countries participating in the EGI_DS (European Grid Initiative-Design Study) EU project, the aim of which is to define the long-term development and operation of the European grid infrastructure. The Association is representing the Czech Republic in this project, working also as the project coordinator. In February the Association became a partner of a meeting discussing use of top communication technologies in the digital film post-production named *Film and Technology: End of Hard Drives, Coming of Optical Networks* (see Photo 8). This was the fifth time when representatives of research networks from the entire world met in Prague at the *CEF (Customer Empowered Fibre) Networks Workshop* to exchange experience with CEF design and operation. In May there were two national seminars focusing on network security. The seminar *Background for CERT/CSIRT Teams*, intended mainly for members of security teams, provided up-to-date information from the area of preventing and handling of security incidents (see Photo 9). The seminar *Secure Network and Services Operation* was dedicated to basic rules for securing computer networks and services, procedures for handling security incidents, and damage minimization. In November there were two events organized by the Association: a preparatory meeting of the international workgroup TERENA *TF – Media (Task Force Media)* in Prague and a grid computing seminar in Brno, dedicated to the Czech national grid environment *MetaCentrum*. The Association was a partner of the 19th year of the *International Conference on Field-Programmable Logic and Applications (FPL)* that took place from 31 August to 2 September in Prague. The Association presented mainly results of the activity *Programmable Hardware* and *Performance Characteristics Monitoring and Optimization* (see Photo 10).

The year 2009, rich with important events, was closed by the December seminar *IP Telephony and Videoconferences*, traditionally attracting high level of interest among the Czech professional public. On 20 April the Czech TV broadcast the Millennium programme on the ČT24 TV channel, dedicated to the CRS-1 router located in the CESNET2 network. Jan Gruntorád, director of the Association, and Václav Novák, CESNET2 network administrator appeared in this programme.

Photo 7 – CHEP 2009 conference opening

Photo 8 – Film and Technology: End of Hard Drives, Coming of Optical Networks

There is another important presentation form of the Association, the provision of direct transfers of significant professional and popular educational events. In January the Association took part in technical aspects of the unique ophthalmology video conference *Live and Video Surgery 2009*. In November the Association became of the co-organizers of the ninth year of the *Science and Technology Week* again, providing direct streaming and archiving of selected professional lectures. Results of the research activities of the Association were published in classic and electronic versions of specialized magazines as well as internal university bulletins. Three internal newsletter Datagram issues were published during the year. One special issue was dedicated to announce the request to submit projects for the Development Fund of the

Photo 9 – Background for CERT/CSIRT Teams seminar

Photo 10 – CESNET stall at the FPL 2009 conference

CESNET Association. There was also a third version of our collection of selected technical reports *Networking Studies 2009*. Datagram as well as the collection were distributed in printing; however, both materials are available also as PDF at the Association's website. In the international area, the Association continued in active participation in the TF-PR group of the TERENA organization and GÉANT2 PR Network group of the DANTE organization. The Association takes advantage of feedback in the form of regular media monitoring. Monthly analyses focusing mainly on articles in the public press confirm stable richness of media outputs, including the biggest mass media – such as TV and radio – in 2009 again.

ECONOMIC RESULTS

2009 ECONOMIC RESULTS

Activities of the CESNET Association are divided into two categories in accordance with its statutes: main activities and economic activities.

Main Activities

The most important share of the Main Activities in 2009 was the implementation of the seven-year *Optical National Research Network and Its New Applications* research plan, launched on 1 January 2004. The Ministry of Youth, Education and Sport of the Czech Republic provided its institutional support (operation subsidies) for this research plan. This support amounted to 51 % of all yields from the Main Activities and was fully utilized.Within its Main Activities, the Association continued in developing the CESNET2 national research and education network, providing services to the Association members utilizing the CESNET2 networkas well as to other entities meeting conditions required to be connected to this network. In addition the Association cooperated on implementation of international research projects of the 7th EU Framework Program, grants of the Academy of Sciences of the Czech Republic, Ministry of Interior, and projects of the Development Fund framework. The Main Activities of the Association ended in 2009 with the book loss of 7,656,000 CZK. Yields from the Main Activities of the Association in 2007 amounted to 336,801,000 CZK; costs amounted to 344,457,000 CZK. The basis of the income tax from the yields of Main Activities of the Association in 2009 was positive, amounting to 2,207,000 CZK.

Economic Activities

The Economic Activities of the Association in 2009 involved mainly 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 Economic Activities of the Association ended in 2009 with the book profit of 14,881,000 CZK. Yields from the Economic Activities of the Association in 2009 amounted to 29,455,000 CZK; costs for the Economic Activities reached 14,574,000 CZK. The basis of the income tax from the yields of Economic Activities of the Association in 2009 was positive, amounting to 15,342,000 CZK.

Total Book and Tax Economic Result

The total book economic result of the CESNET Association prior to taxation reported in 2009 was the profit amounting to 7,225,000 CZK. The total basis of the income tax after subtracting deductible items reached 16,549,000 CZK. The Association will pay in 2009 the income tax of 3,310,000 CZK, resulting in the net profit of 3,915,000 CZK.

Conclusion

The Association properly managed the entrusted resources in 2009, 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 2009 was verified by the auditor without any remarks.

BALANCE SHEET in Thousands of CZK	2009	2008	2007	2006
Assets total	754,621	753,947	734,438	741,539
Fixed Assets	524,013	525,680	535,043	410,531
Intangible fixed assets	3,064	4,369	3,949	4,952
Tangible fixed assets	206,780	208,788	220,715	217,591
Financial Investments	314,169	312,523	310,379	187,988
Current assets	230,608	228,267	199,395	331,008
Supplies	0	0	504	0
Receivables	25,879	36,086	35,139	32,115
Current liquid assets	160,692	158,078	128,070	264,249
Othed assets	44,037	34,103	35,682	34,644
Liabilities total	754,621	753,947	734,438	741,539
Own recources	681,001	679,806	686,467	699,578
Funds	538,976	529,987	524,413	660,115
Economic result	3,915	707	343	-25,704
Undivided profit from last years	138,110	149,112	161,711	65,167
External resources	73,620	74,141	47,971	41,961
Obligations	70,980	70,923	46,315	38,884
Loans	0	0	0	0
Other liabilities	2,640	3,218	1,656	3,077

PROFIT AND LOSS STATEMENT in Thousands of CZK	2009	2008	2007	2006
Earnings for the sale of goods	23	44	23	730
Earnings of own product and services	105,437	100,946	99,567	101,611
Current liquid assets revenues	19,603	18,691	16,988	16,915
Other revenues	54,505	115,270	319,955	54,125
Received membership fees	0	0	0	0
Operation subsides	186,688	193,720	182,828	195,963
Revenue total	366,256	428,671	619,361	369,344
Purchase price of sold goods	19	41	19	711
Material and energy consumption	17,416	23,006	15,244	23,545
Purchased services	191,555	178,318	171,417	184,016
Personnel costs	104,878	103,807	93,038	89,016
Depreciation and amortization of intangible and tagible fixed assets	30,902	40,262	46,065	54,297
Other costs	14,261	80,474	293,235	43,463
Income tax – assesment for the current year	3,310	2,056	0	0
Costs total	362,341	427,964	619,018	395,048
Economic result (revenue – costs)	3,915	707	343	-25,704

R – audit, s. r. o.

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entered in the Commercial Register kept at the Municipal Court in Prague under Section C, Entry 20496 from 31 May 1993, auditor's certificate number 124

REPORT OF THE INDEPENDENT AUDITOR

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: 63 83 91 72

We have audited the accompanying financial statements of association CESNET, Association of Legal Entities which comprise the balance sheet as at 31 December 2009, 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.

The statutory body of CESNET, Association of Legal Entities is responsible for the presentation and the fair presentation of the financial statements in accordance with Czech accounting regulations. This responsibility includes: designing, implementing and maintaining internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error; selecting and applying appropriate accounting policies; and making accounting estimates that are reasonable in the circumstances.

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 standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance that the financial statements are free from material misstatement. An audit involves performing accounting procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The accounting 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 preparation and fair presentation of the financial statements 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 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.

In our opinion, the financial statements give a true and fair view, in all material respects, of the assets, liabilities and financial position of CESNET, Association of Legal Entities as at 31 December 2009 and of its expenses, revenues, and income from operation for the accounting year then ended in accordance with Czech accounting regulations.

We therefore verify the annual financial statements without reservation.

Date of issue of report:
In Prague on 31 May 2010

Auditing company: R – audit, s. r. o.
Chamber of Auditors of the Czech Republic certificate number 124
Company head office: Praha 5, Ostrovského 253/3

Responsible auditor: Ing. Radmila Špišková
Chamber of Auditors of the Czech Republic certificate number 1326

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