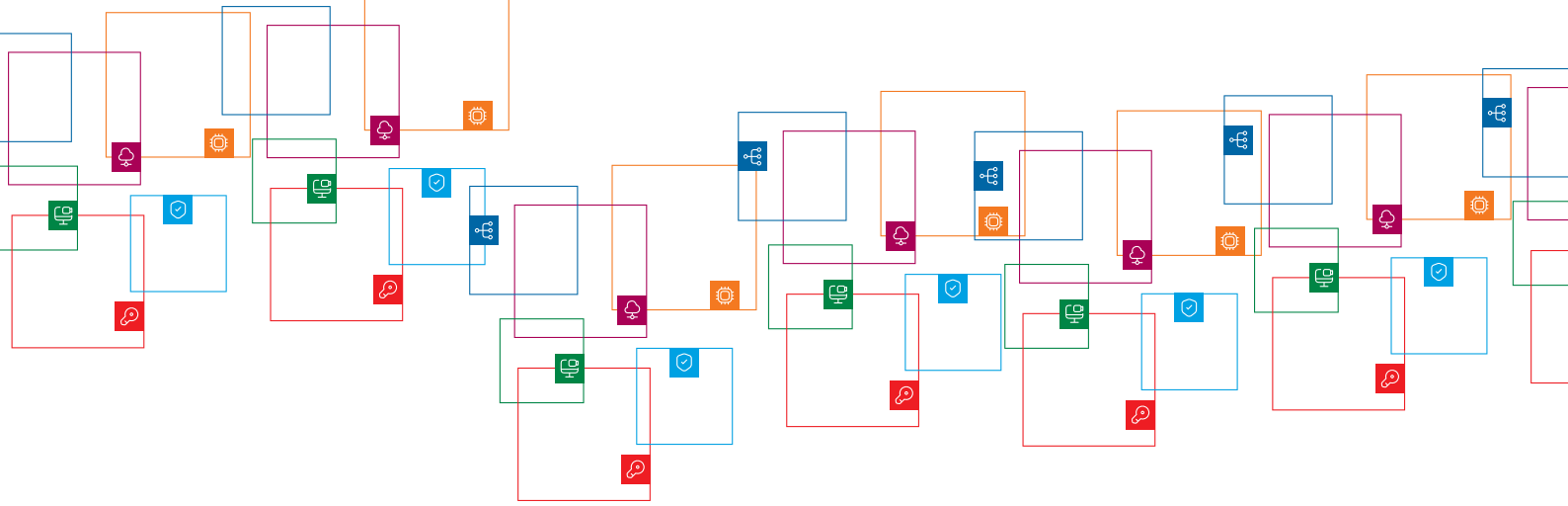
cesnet

Annual Report 2024



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CESNET, an Association of Legal Entities
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Director's Foreword

2024 was a successful year for CESNET. Not only did we maintain a reliable and secure infrastructure, but we also powered ahead with ambitious upgrades and modernization efforts to meet the challenges of tomorrow.

In terms of network infrastructure operations, we significantly increased our connectivity to the pan-European GÉANT network and strengthened cross-border links with partner national research and education networks. In the MetaCentrum computing infrastructure, we deployed new high-performance computing nodes focused on machine learning tasks, updated key software components, and made new data processing tools available to users. We also made significant progress in providing cloud services and container technologies.

One of the outcomes of 2024 was the continued development of components of the National Repository Platform. We launched the operation of the National Metadata Directory and initiated the pilot operation of the National Data Repository. These steps mark an important move forward in how scientific data is preserved and made accessible over the long term in the Czech Republic.

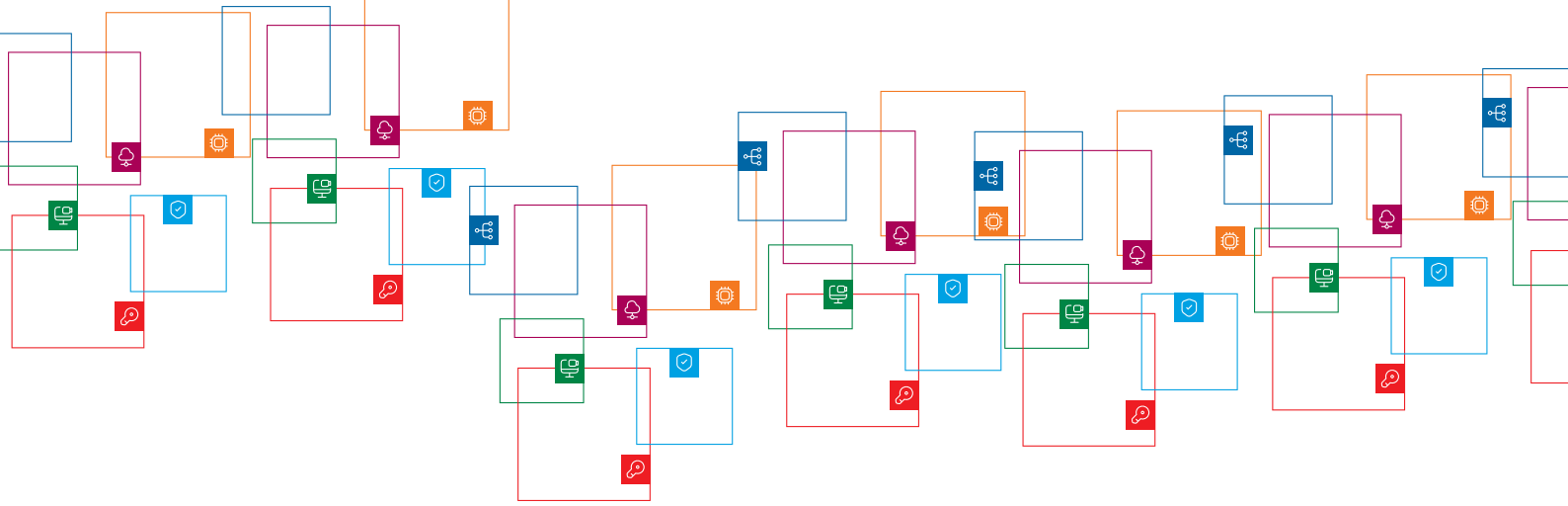
We naturally also focused on activities related to cybersecurity and service management – we successfully passed the ISMS recertification audit, introduced a service lifecycle management process, and implemented new security mechanisms, including so-called step-up authentication. The forensic lab carried out a number of penetration tests and pilot projects focused on vulnerability management in the networks of connected organizations.

The year 2024 was also rich in activities aimed at professional communities and the public. We organized dozens of professional events – including seminars, training sessions, and conferences. These included, for example, the e-INFRA CZ conference, the TF-CSIRT meeting marking the 20th anniversary of the CESNET-CERTS team, the international GÉANT Security Day conference, and the traditional CESNET Day events. We appreciate the interest of the professional community and the active involvement of our partners.

A major milestone for our Association was the admission of the Polytechnic University in Jihlava as the 28th full member of CESNET. This step confirms our stable position within the academic environment and strengthens our role as a key integrator of IT infrastructure services for Czech research and education.

I would like to thank all our staff, partners, and member institutions for their collaboration, professional dedication, and trust. The year 2024 was an especially productive one – and I'm confident we'll be able to build on this momentum to keep improving our services and supporting the scientific and educational community in the Czech Republic.

Ing. Jakub Papírník
ředitel sdružení CESNET



CESNET Association

The history of the Association and its current mission

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

The mission of the CESNET Association is

- to provide the scientific, research, and educational community with unique and comprehensive e-infrastructure services at a level comparable to the global forefront, and to support the concept of Open Science;
- to offer stable, high value-added services that cover the widest possible range of our users' needs;
- to contribute to the advancement of information and communication technologies through our own research activities and to apply the results in practice.

After being established, the Association also operated as a commercial internet provider with the aim of generating additional resources to support its core activities. This activity was discontinued in 2000. CESNET has since focused exclusively on the **development and operation of e-infrastructure for science, research, and education**, along with related activities.

A major milestone in the Association's history came in 2010, when the CESNET e-infrastructure was included in the **Roadmap of Large Research Infrastructures of the Czech Republic**[1]. Subsequently, during the period 2011–2015, the so-called national research and education network was reconstructed into a comprehensive e-infrastructure for research and development in the Czech Republic through CESNET's Large Research Infrastructure project. In connection with the update of the roadmap in 2019, the three e-infrastructures (CESNET, CERIT-SC, and IT4Innovations) merged into a single national e-infrastructure, hereinafter referred to as e-INFRA CZ. e-INFRA CZ, for which CESNET is the host institution, is being developed in cooperation with partner institutions – Masaryk University and the VSB – Technical University of Ostrava.

In 2020, the first **associate members joined the CESNET Association – the National Museum and the Moravian Gallery in Brno**.

In 2021, the CESNET Association, Masaryk University, and the VSB – Technical University of Ostrava were accepted as **members of the EOSC (European Open Science Cloud) Association**.

On January 27, 2022, a measure of a general nature came into effect, designating the CESNET Association as a **critical infrastructure entity** pursuant to Section 2(k) of the Crisis Act, as well as the administrator of a communication system of critical information infrastructure pursuant to Section 3(d) of the Cybersecurity Act.

In 2023, two more institutions joined as associate members – **Extreme Light Infrastructure ERIC (ELI ERIC)** and the **Moravian-Silesian Data Center**.

In December 2024, the General Assembly of the CESNET Association approved the admission of the Polytechnic College in Jihlava as the 28th regular member of the Association, effective from January 1, 2025.

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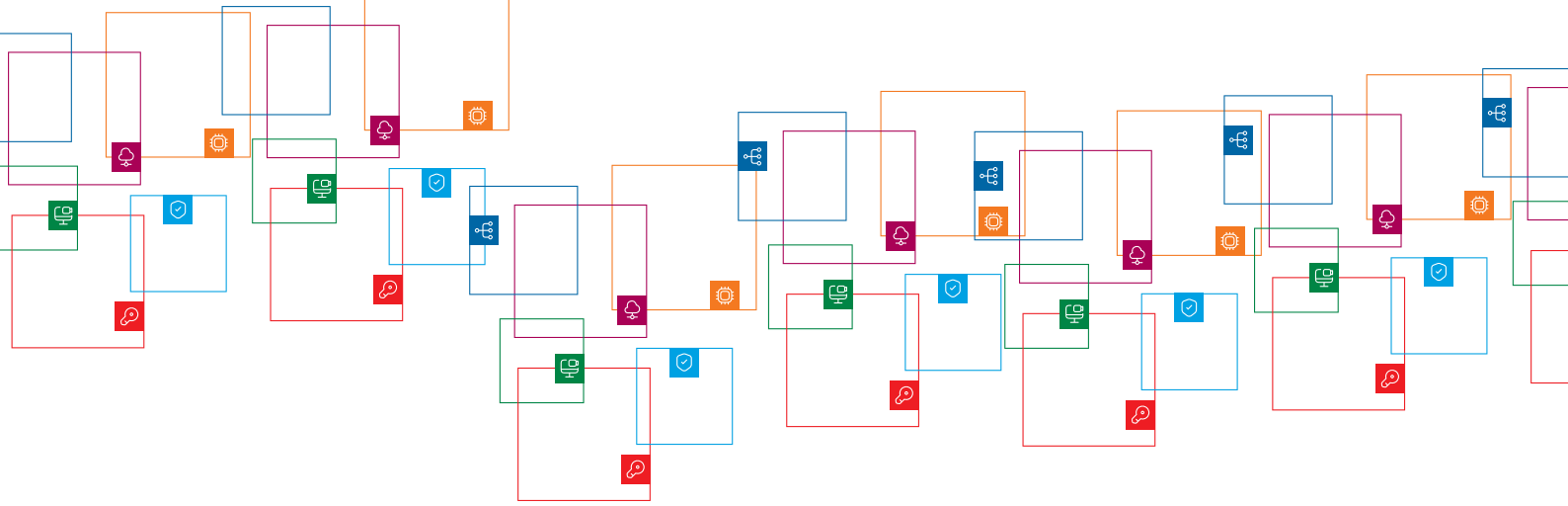
[1] "A large research infrastructure is a research facility essential for comprehensive research and development activities with high financial and technological demands, which is approved by the government and established for use also by other research organizations," according to § 2, Article 2, Paragraph d) of Act No. 130/2002 Coll.

"A research infrastructure means facilities, resources, and related services used by the scientific community to conduct research in relevant fields, including scientific equipment and research materials, knowledge-based resources such as collections, archives, and structured scientific information, information and communication technology infrastructures such as GRID networks, computer hardware and software, communication tools, as well as all other unique elements necessary for conducting research," according to Article 2, point 91 of Commission Regulation (EU) No. 651/2014.



CESNET Association

Scope of Activities

The core activities of the CESNET Association are:

1. to carry out independent research and development activities in the field of information and communication technologies and to provide research services in this area;
2. to promote education in the field of information and communication technologies;
3. to carry out the following activities for the benefit of its members, the organizations established by them, as well as for the benefit of other entities:
4. to carry out the following activities for the benefit of its members, the organizations established by them, as well as for the benefit of other entities:

   - the development and operation of a national communication and information infrastructure that enables the interconnection of member infrastructures, provides access to the CESNET infrastructure, and connects to similar external infrastructures (including Internet access),
   - the development of shared technical, communication, and software tools, as well as information services,
   - the testing of new applications, fostering collaboration and complementarity among members' activities at a level comparable to leading international academic and research infrastructures.

The Association carries out and ensures the scope of its activities within the limits of obtained subsidies and partial reimbursements of the costs associated with these activities. The Association does not carry out these activities in order to make a profit.

In addition to its core activities, the Association also carries out supplementary activities, but solely for the purpose of making more effective use of its assets and in a manner that does not compromise the fulfillment of its objectives. The Services are not provided as publicly available.

Any potential loss arising from supplementary activities shall be settled by the end of the accounting period or the respective supplementary activity shall be terminated before the start of the next accounting period.

The Association uses all profits to support research and development.

CESNET Association

Membership in international and national organizations

In 2024, CESNET was a member of the following prominent organizations:

International Organizations

EOSC AISBL – an international association of institutions involved in developing the concept of the European Open Science Cloud (http://www.eosc.eu).

GÉANT Association – an association of European national research networks focused on the operation and development of the GÉANT European communication infrastructure and the coordination of related activities (http://www.geant.org).

EGI.eu – an organization focused on coordinating European computing grids used for scientific computations and supporting their sustainable development (http://www.egi.eu).

Shibboleth – an international consortium coordinating the development of a service that provides single sign-on solutions, allowing users to access multiple protected network resources with a single login. Shibboleth forms the foundation of academic identity federations (http://www.shibboleth.net).

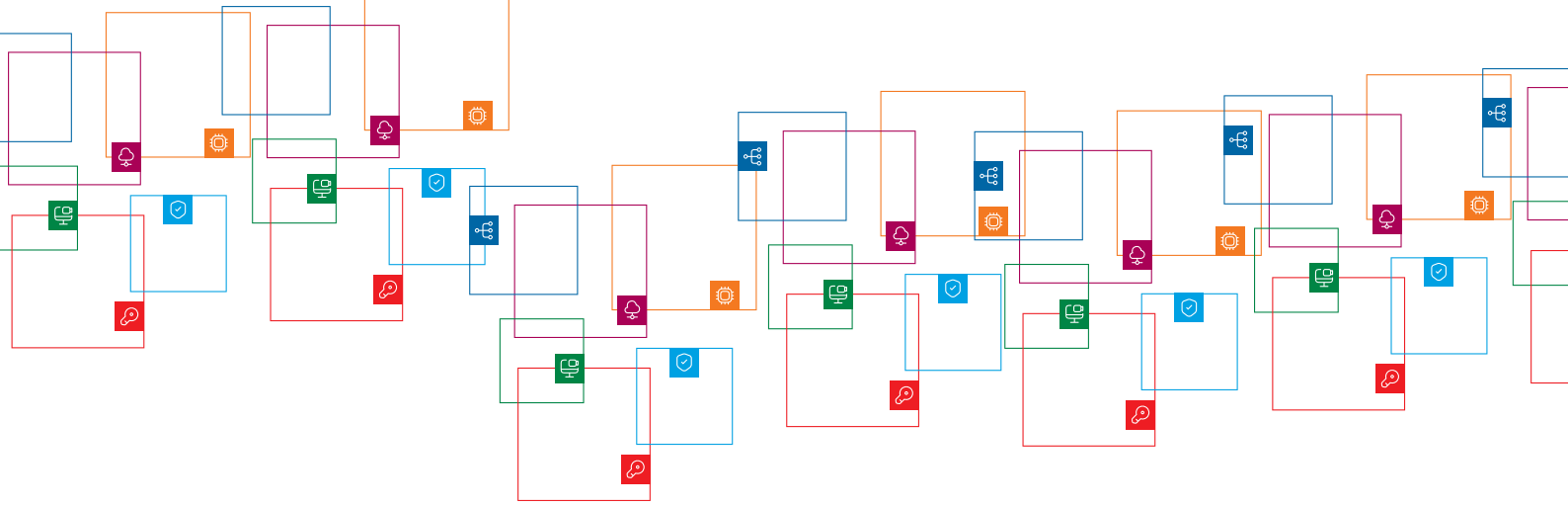
QUAPITAL – a Central European partnership for secure communication with quantum-level security and quantum internet (http://www.quapital.eu).

ELIXIR – the European bioinformatics infrastructure ELIXIR brings together advanced computing environments, data resources, and unique tools across Europe to support research in the field of bioinformatics (https://elixir-europe.org).

National Organizations

NIX.CZ – CESNET is one of the founding members of NIX.CZ, z. s. p. o. (Neutral Internet Exchange), an association of Internet service providers in the Czech Republic that enables mutual connectivity between the networks of its members (http://www.nix.cz).

CZ.NIC – the Association is also one of the founding members of CZ.NIC, z. s. p. o., which manages the .cz domain, supports public-benefit projects, and engages in activities related to the Internet (http://www.nic.cz).



CESNET Association

Members of the Association

In 2024, the regular members of the Association included the following institutions:

- Academy of Performing Arts in Prague
- Academy of Sciences of the Czech Republic
- Academy of Fine Arts in Prague
- Czech University of Life Sciences in Prague
- Czech Technical University in Prague
- Janáček Academy of Performing Arts
- University of South Bohemia in České Budějovice
- Masaryk University in Brno
- Mendel University in Brno
- University of Ostrava
- Police Academy of the Czech Republic in Prague.
- Silesian University in Opava
- Technical University of Liberec
- The University of Hradec Králové
- Jan Evangelista Purkyne University in Usti nad Labem
- Charles University
- University of Defence
- Palacký University in Olomouc
- University of Pardubice
- Tomas Bata University in Zlín
- University of Veterinary Sciences Brno
- VSB – Technical University of Ostrava
- University of Economics, Prague
- University of Chemistry and Technology, Prague
- Academy of Arts, Architecture and Design in Prague
- Brno University of Technology
- University of West Bohemia

Associate Members:

- Extreme Light Infrastructure ERIC
- Moravian Gallery in Brno
- Moravian-Silesian Data Center
- National Museum

CESNET Association

Internal Organizational Structure

CESNET, as an association of legal entities, has the following bodies:

- General Assembly
- Board of Directors
- Supervisory Board
- Director of the Association

The Board of Directors operated in the following composition in 2024:

Mgr. Michal Bulant, Ph.D.
RNDr. Alexander Černý (until June 27, 2024)
Ing. Jan Gruntorád, CSc.
Ing. Radek Holý, Ph.D.
Mgr. František Potužník
doc. RNDr. Pavel Satrapa, Ph.D.
prof. Ing. Miroslav Tůma, CSc. Ing.
Tomáš Zouhar (from June 28, 2024)

The position of **Chair** was held in 2024 by Prof. Ing. Miroslav Tůma, CSc.

In 2024, the position of **Vice-Chair** was held by Radek Holý, Ph.D., and Mgr. František Potužník.

Rada Fondu rozvoje

The Supervisory Board worked in the following composition in 2024:

Mgr. Kamil Gregorek, MBA
Mgr. Martin Maňásek
prof. JUDr. Radim Polčák, Ph.D.
RNDr. David Skoupil
Ing. Michal Sláma

In 2024, the **Chair** of the Supervisory Board was Ing. Michal Sláma and the position of **Director** of the Association was held by Ing. Jakub Papírník.

Development Fund Council

As of June 2024, the **Development Fund Council** consisted of the following members:

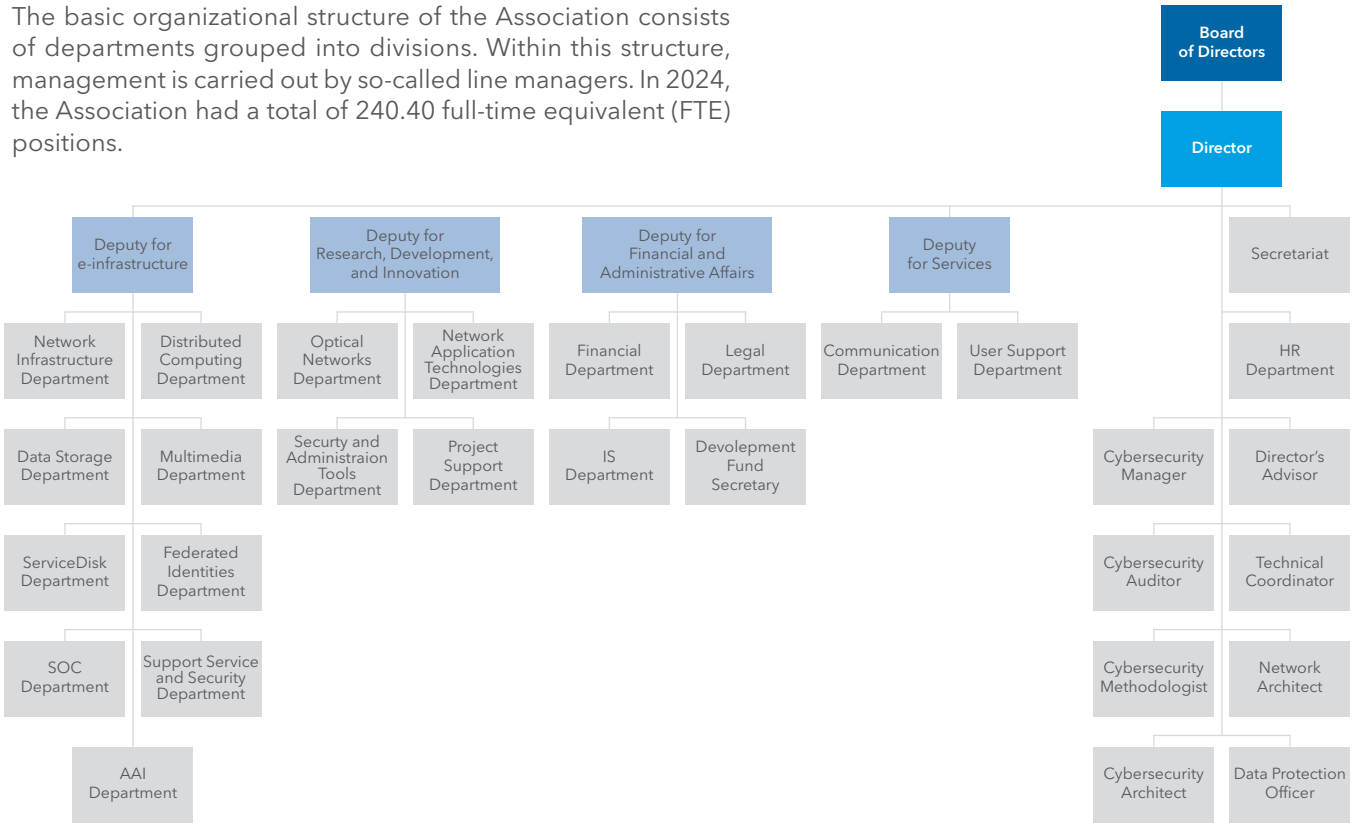
doc. RNDr. Eva Hladká, Ph.D.
Ing. Jaromír Holec
Mgr. Monika Hrabáková
Ing. Marek Kalika, Ph.D.
Ing. Olga Klápšťová
Ing. Tomáš Podermański
prof. Ing. Zbyněk Škvor, CSc.

The position of **Chair** of the Development Fund Council was held by Ing. Olga Klápšťová in 2024.

CESNET Association

CESNET Association's organizational chart for 2024

The basic organizational structure of the Association consists of departments grouped into divisions. Within this structure, management is carried out by so-called line managers. In 2024, the Association had a total of 240.40 full-time equivalent (FTE) positions.



e-Infrastructure CZ

The CESNET Association is the host organization of the large research infrastructure e-INFRA CZ, which is a key component of the Roadmap of Large Research Infrastructures of the Czech Republic for the period 2023 to 2026. It provides a universal, research field – independent environment for the transmission, processing, sharing, and storage of scientific data, as well as for user collaboration – an essential foundation for modern research, development, and innovation across all disciplines today.

e-INFRA CZ is the result of cooperation of three e-infrastructures:

- **CESNET e-infrastructure** operated by CESNET,
- **CERIT Scientific Cloud** operated by Masaryk University and
- **IT4Innovations national supercomputing center** operated by VSB – Technical University of Ostrava.

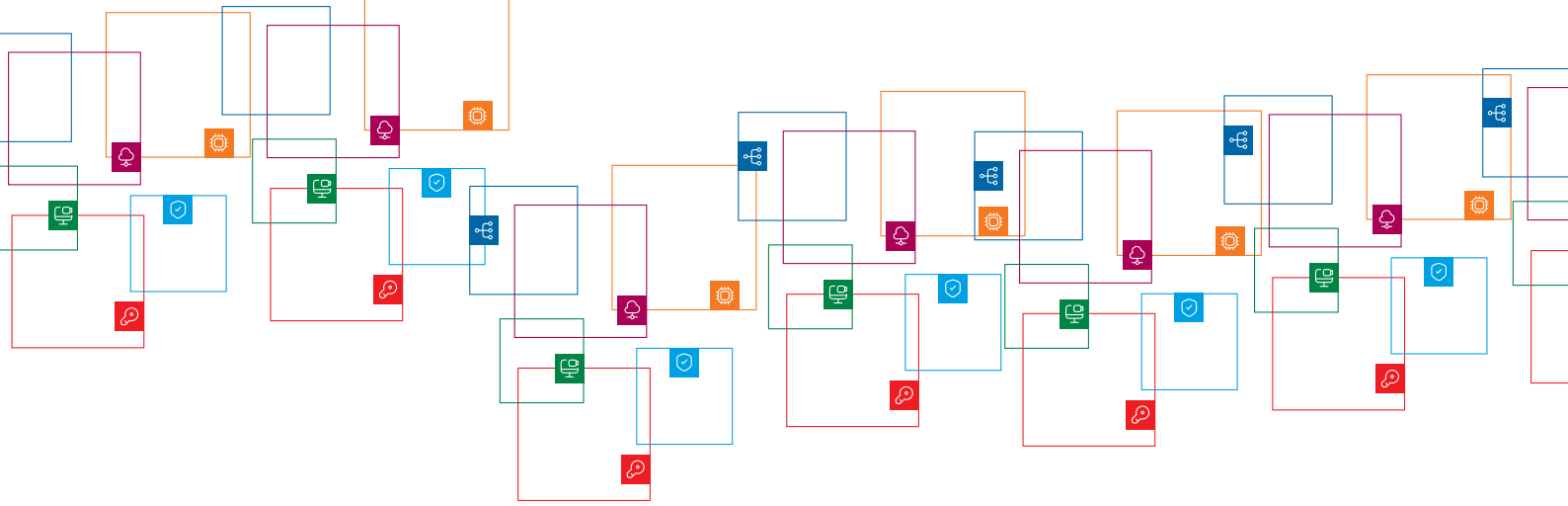
Within the consortium, the CESNET Association serves as the host organization – that is, the organization responsible for the operation of the entire e-INFRA CZ.

CESNET is also the coordinator of two complementary projects for the development and operation of e-INFRA CZ:

- **e-Infrastructure CZ** (LM2018140, 2023–2026), funded under the Large Research Infrastructures Projects program (2010–2026). The targeted support in the form of a subsidy is intended to cover part of the operating costs associated with the operation of the e-infrastructure.
- **Modernization of e-INFRA CZ II** (CZ.02.01.01/00/23_016/0008329), funded under the OP JAK program, which serves as the main source of investment for the qualitative upgrade of the e-infrastructure.

The objective is to modernize the individual components of e-INFRA CZ and ensure their operation. The consortium members thus build on the previous activities of their respective e-infrastructures, while user access to e-infrastructure resources is being consolidated in such a way that users perceive e-INFRA CZ as a unified whole.

Within the CESNET e-infrastructure, **services are provided to support the needs of Czech science, research, development, and education**. The following chapters describe the development of e-infrastructure, the portfolio of services offered, and related research activities. The Association provides these services not only to its members but also to organizations that meet the Conditions of Access to the CESNET e-infrastructure.



Development of the CESNET e-infrastructure

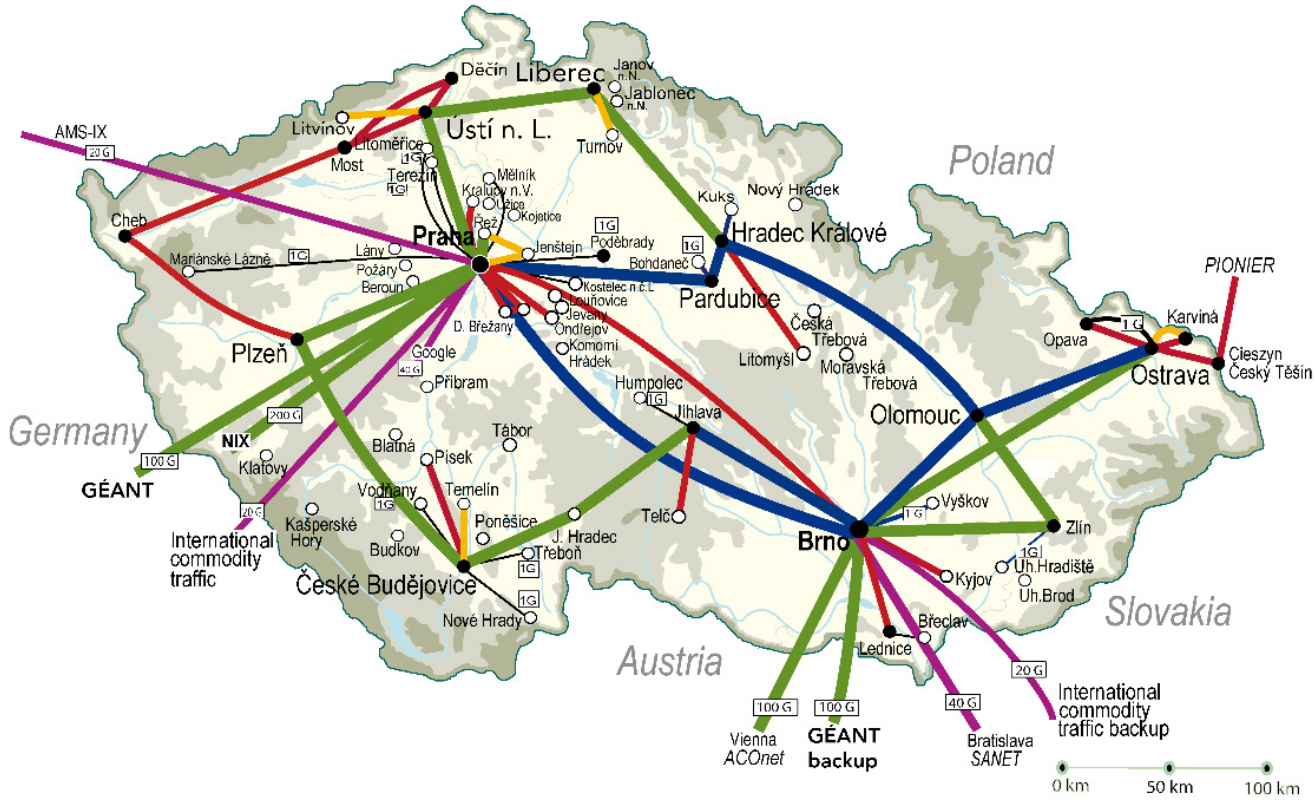
In 2024, alongside maintaining the routine operation of the CESNET e-infrastructure, we focused mainly on upgrading the components of e-INFRA CZ. Some of the most important outcomes from our work on developing and operating the CESNET e-infrastructure include:

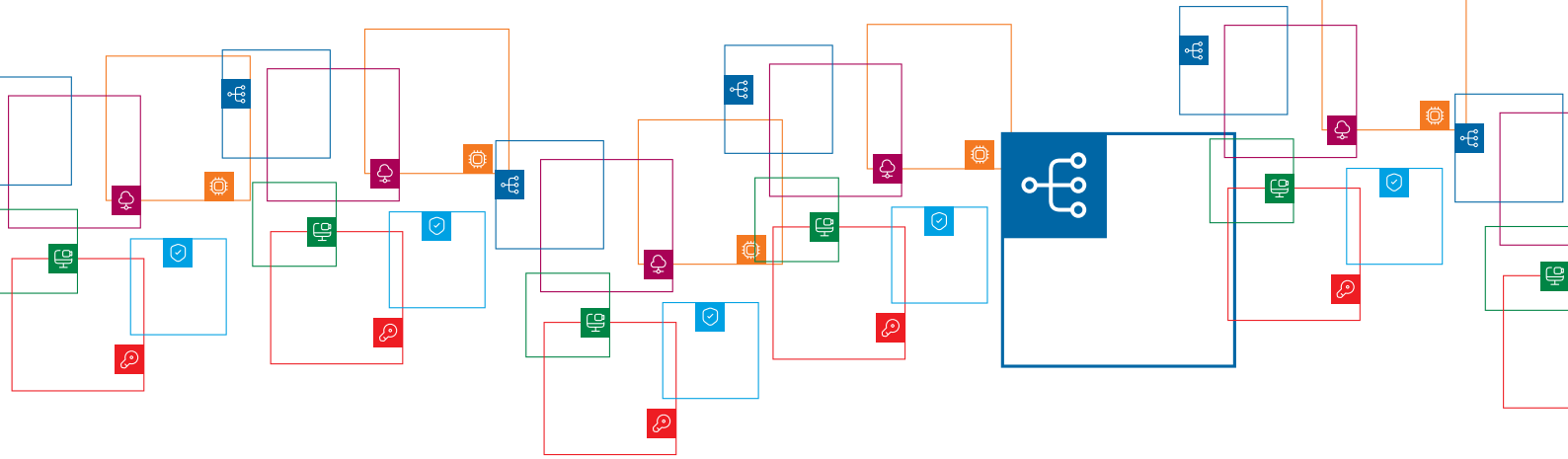
- We upgraded our connectivity to the GÉANT network to 2×200 Gbps and strengthened connections with partner NRENs in Slovakia (SANET, 100 Gbps) and Austria (ACONet, 100 Gbps).
- In the MetaCentrum computing infrastructure, we transitioned to a new scheduler distribution (OpenPBS) and a new operating system (Debian 12).
- We launched the National Data Repository as a catch-all repository developed under the National Repository Platform (NRP) project.
- We launched the National Metadata Directory, which serves as an aggregator of metadata records from repositories within the National Repository Platform and will become the primary search point for scientific datasets stored there.
- Through pilot projects, we tested the possibilities of large-scale and systematic scanning of network infrastructure (as a foundation for so-called vulnerability management) in selected member networks (under the SNER project of the CESNET Forensic Laboratory), as part of a planned service for connected organizations.
- Colleagues from the Laboratory of Advanced Network Technologies (SITOLA) developed a new version of the UltraGrid software for low-latency, high-quality video transmission over IP networks. One of the main new features is technical support for Apple M1 processors. For example, using UltraGrid, we provided a live transmission of procedures from the University Hospital in Hradec Králové and Pardubice Hospital during the 32nd Workshop of the Czech Interventional Cardiology Association in April.
- We activated so-called step-up authentication, which, for security-critical operations, requires the user to verify their identity using a second, independent method – that is, to perform multi-factor authentication (MFA).
- The first version was created outlining how to set up repository instances within the National Repository Platform, including the distribution of roles and responsibilities among the various actors involved in the process.
- We continue to develop user-friendly portal environments (such as the OnDemand portal or Jupyter Notebook). In cooperation with the CERIT-SC center, we are advancing the use of container-based services (Kubernetes), including environments for sensitive data, in collaboration with the FEGA and ELIXIR projects.
- We integrated new machines into the MetaCentrum computing infrastructure, primarily intended for machine learning tasks (20 nodes, 40 NVIDIA H100 GPUs, and 1.2 PB of fast NVMe scratch storage), acquired by the CERIT-SC center as part of the e-INFRA CZ project.
- The MetaCloud cloud infrastructure is actively migrating users to a new environment based on the bescar distribution.

Communication Infrastructure

At the core of the e-infrastructure is a high-quality, high-speed, and low-latency backbone communication network with extensive international connectivity. It offers a wide range of advanced features and capabilities, including dedicated transmission channels and non-IP services such as precise time and stable frequency transfer or quantum key distribution.

Map - CESNET Network Topology





Communication Infrastructure

The CESNET Association develops and operates a modern communication infrastructure with the goal of connecting the resources, services, and users of the e-infrastructure – as well as other large research infrastructures – with one another and with their partners at the international level.

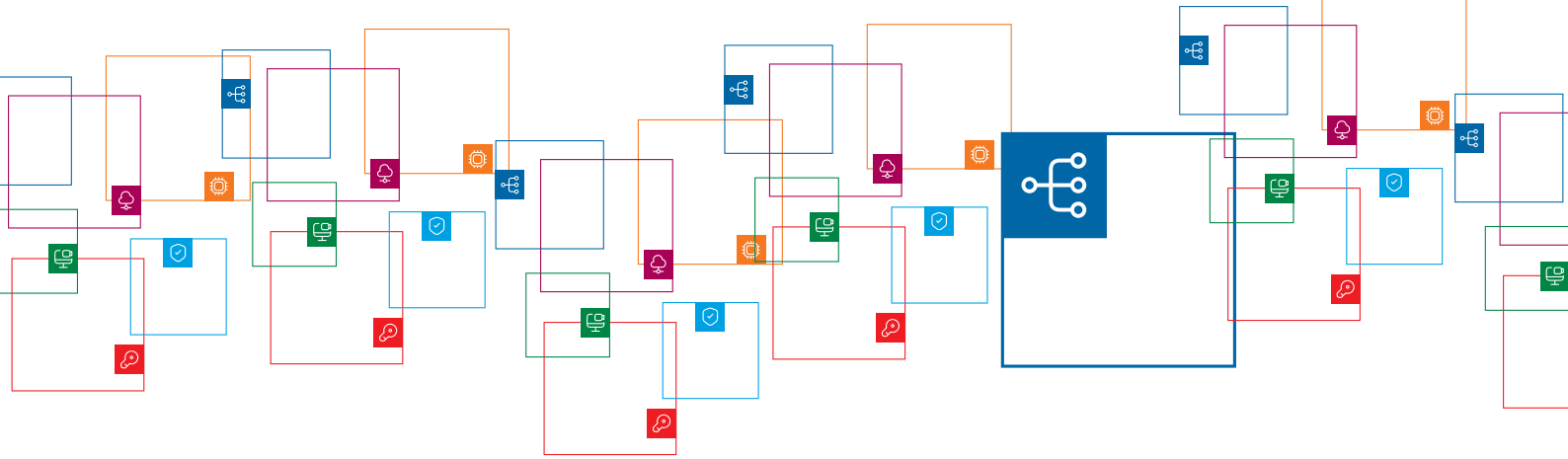
The foundation is a backbone infrastructure designed to provide sufficient capacity for data transfers and to be as resilient as possible to route and technology failures. The infrastructure is connected in various ways, with capacities of up to 400 Gbps. This includes global connectivity (via a Tier 2 operator and interconnection nodes) and links to research networks (GÉANT and several cross-border fibers), providing users not only with sufficient capacity and redundancy but also with specialized connections for specific applications.

Services offered in the area of network access include:

- redundant, high-capacity connection to the CESNET3 backbone network,
- dedicated circuits and networks,
- lambda services with physically dedicated capacity and stable latency,
- photonic services for the most demanding applications, providing a purely optical path between endpoints,
- management of Internet identifiers (CESNET NIC), including the Sponsoring LIR service,
- authoritative and secondary DNS services,
- primary Stratum 1 time servers with their own time source,
- infrastructure monitoring and tracking at multiple levels,
- services of the internationally accredited CESNET-CERTS security CSIRT team,
- continuous network functionality monitoring (NOC),
- 24/7 service desk – a central support contact point (monitoring center and helpdesk).

An integral part of the infrastructure is robust protection against security incidents. The network employs **semi-automated protection against DDoS** attacks at multiple levels to ensure scalable and targeted defense. The detection and mitigation of unwanted traffic are based on the deep expertise of our specialist team, leveraging detailed infrastructure monitoring built on in-house tools (FTAS, G3, ExaFS).

The ExaFS monitoring and service are also available to administrators of institutions connected to the e-infrastructure. Through user-friendly rule-based interfaces, administrators of connected organizations can influence the network traffic belonging to their institution directly at the backbone network routers. For example, the traffic can be dropped or redirected for further analysis to the DDoS Protector (a result of CESNET Association's own research activities), which filters out unwanted traffic. Another layer of protection, which can be applied even before the traffic enters the perimeter of the backbone network, involves the use of global protection against volumetric attacks through a global scrubbing center.



Communication Infrastructure

Following the upgrades to the backbone infrastructure (both the DWDM and IP/MPLS components of the CESNET3 network), 2024 saw the enhancement of connections for universities, Academy of Sciences institutes, research centers, and data and computing resources – particularly storage infrastructure and infrastructure for high-performance computing. The IP/MPLS services also support the integration of large research infrastructures into the European and global research space. At the same time, connectivity to GÉANT was upgraded to 2×100 Gbps, including a 2×100 Gbps backup connection, along with enhanced links to partner NRENs in Slovakia (SANET, 100 Gbps) and Austria (ACONet, 100 Gbps). There was also intensive work on relocating the network node at Masaryk University in Brno, preparing for the migration of the node in Hradec Králové, addressing several potentially risky overlaps in optical fiber routes, and optimizing the fiber infrastructure.

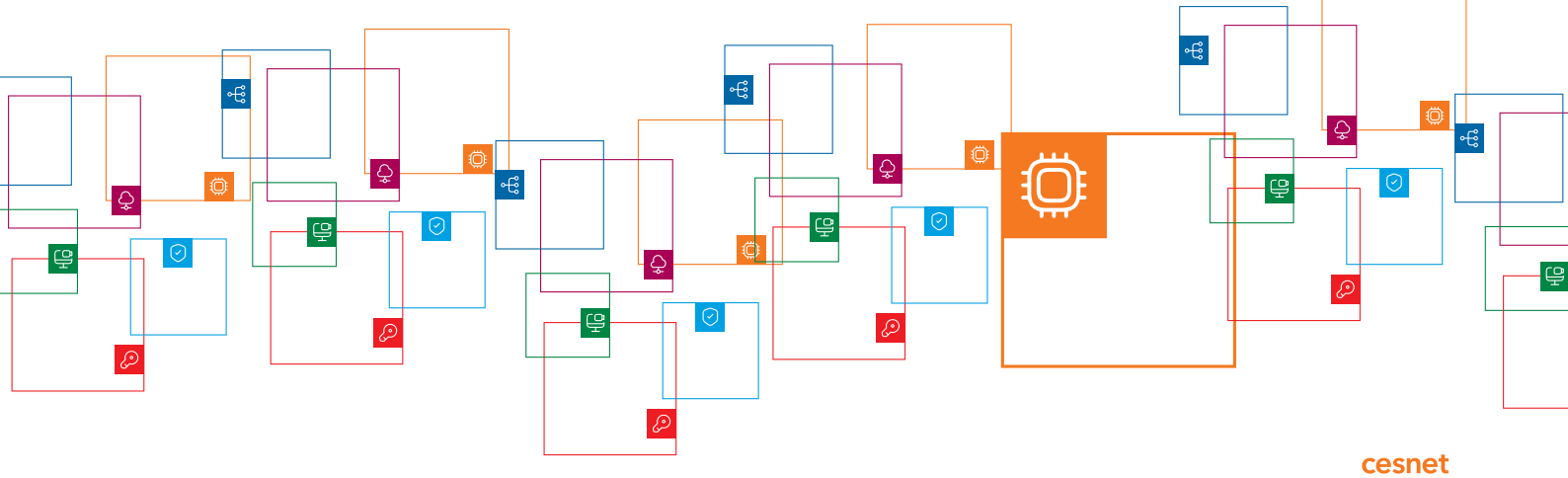
The modernized infrastructure enables data transmission at speeds of up to 400 Gbps, with flexible interconnection of data centers and support for specialized applications such as precise time and stable frequency transfer or quantum key distribution (QKD) within dedicated optical spectrum.

CESNET also successfully tested the deployment of high-speed transmission technology with a capacity of 400 Gbps over a record distance of 846 kilometers. The White Rabbit system was deployed on part of the infrastructure to enable synchronization and precise time transfer. As part of research activities, the feasibility of simultaneously transmitting quantum keys (QKD) and high-speed data at 400 Gbps over a single fiber was successfully tested.

The CESNET Association remains actively involved in the hSOC (Hospital SOC) initiative, which aims to provide better protection for connected hospitals against cyber threats and attacks. It is a dedicated network within the CESNET e-infrastructure, separated from regular traffic, with specific policies and rules, complemented by a range of security tools for monitoring and managing communication among the participating organizations. This separation enables more comprehensive and detailed protection of hospitals. A total of 84 organizations are involved in the hSOC initiative – including healthcare institutions, hospital operators, and other organizations such as: National Cyber and Information Security Agency (NÚKIB), the National Agency for Communication and Information Technologies (NAKIT), the Ministry of the Interior of the Czech Republic (MVČR), etc. A total of 19 hospitals are connected to the dedicated hSOC-VRF network, including University Hospital Brno, Bulovka University Hospital, University Hospital Hradec Králové, University Hospital Olomouc, University Hospital Plzeň, St. Anne's University Hospital Brno, the Institute for Clinical and Experimental Medicine (IKEM), Regional Hospital Liberec, Krajská zdravotní Ústí nad Labem, Jihlava Hospital, Na Homolce Hospital, Nové Město na Moravě Hospital, Pelhřimov Hospital, Tomáš Baťa Regional Hospital in Zlín, Třebíč Hospital, Mladá Boleslav Regional Hospital, the Central Military Hospital in Prague, the Military Hospital Olomouc, and the General University Hospital in Prague.

High-Performance Computing

MetaCentre Map



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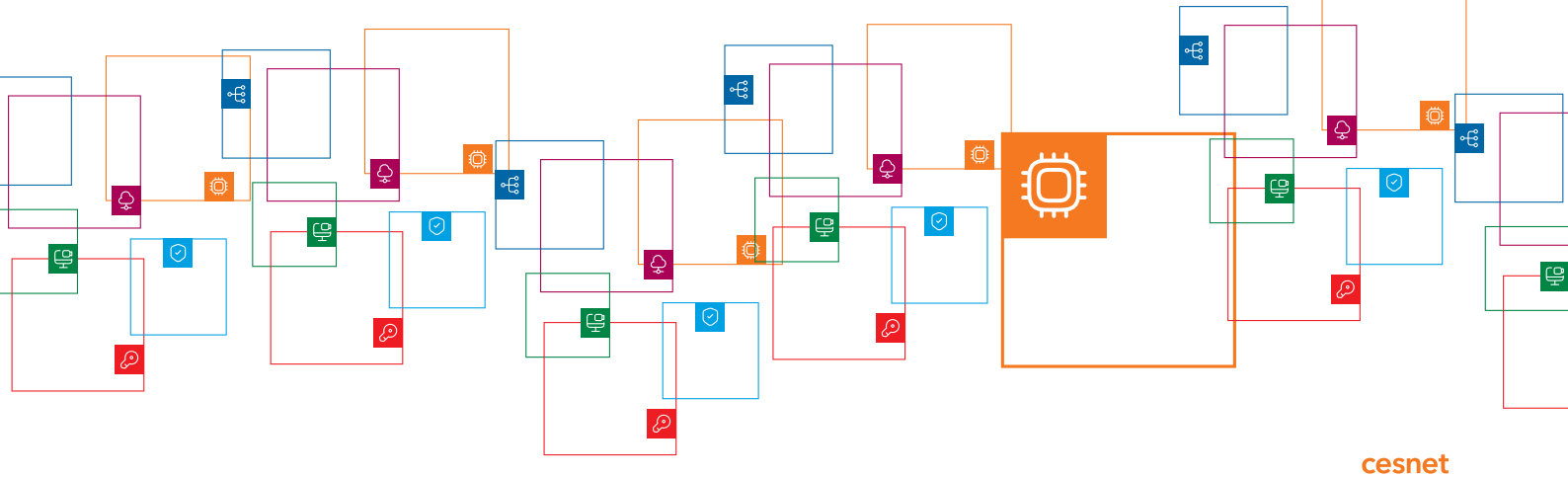
High-Performance Computing

As part of the OP JAK project Modernization of e-INFRA CZ II, procurement procedures were prepared for the first computing clusters – particularly a GPU cluster expected to include servers equipped with at least 80 NVIDIA L40s GP-GPU cards, scheduled for installation in 2025. In cooperation with CERIT-SC, the bee cluster was integrated into the MetaCentrum environment under the same project. It consists of 10 servers equipped with a total of 20 NVIDIA H100 GPU cards. As part of the OP JAK project ELIXIR CZ: Capacity Extension, the first cluster for the ELIXIR research infrastructure was procured, with delivery to sites in Brno, Prague, Olomouc, and České Budějovice taking place at the turn of 2024 and 2025.

Alongside the renewal and expansion of computing capacities, storage capacities for processed data are also being strengthened. In addition to expanding home storage space in Prague at the Biocev and IOCB sites, a distributed BeeGFS filesystem was also installed to serve as shared scratch storage for clusters located in Brno. In Brno, a cluster was also relocated from the partially renovated building of the Faculty of Informatics at Masaryk University to newly utilized facilities at Mendel University in Brno. Another parallel filesystem based on Ceph is being used – in collaboration with the Data Storage Department – for storing larger project datasets. Development in the area of modern parallel filesystems is planned to continue in 2025, with a new scratch storage space for clusters in the Plzeň location to be deployed based on these experiences.

In the area of cloud computing, migration is underway to the new OpenStack distribution Bescar Cloud, which is being developed by CESNET in collaboration with CERIT-SC. Following initial experience with deploying this version of OpenStack at IT4Innovations, the installation was also carried out in Brno in 2024, where the production MetaCentrum cloud is operated. In addition to the installation, the first wave of migration of all major cloud projects to the new deployment took place during 2024. The migration will be completed in 2025, with the remaining personal projects scheduled to be migrated in the first half of the year.

Job management tools were significantly enhanced in the grid environment, where a major reconfiguration and upgrade of the PBS scheduling system took place. The new version made it possible to unify all batch system installations into a single deployment and, to improve scheduling efficiency, allows the use of parallel scheduling components, including native support for Singularity containers. The environment also supports further development in scheduling efficiency and energy efficiency, which we are working on as part of the GreenDigit project. In the same year, a full upgrade of the Debian operating system to version 12 was carried out across all computing clusters, and on this occasion, the application software packages managed by MetaCentrum were also updated.



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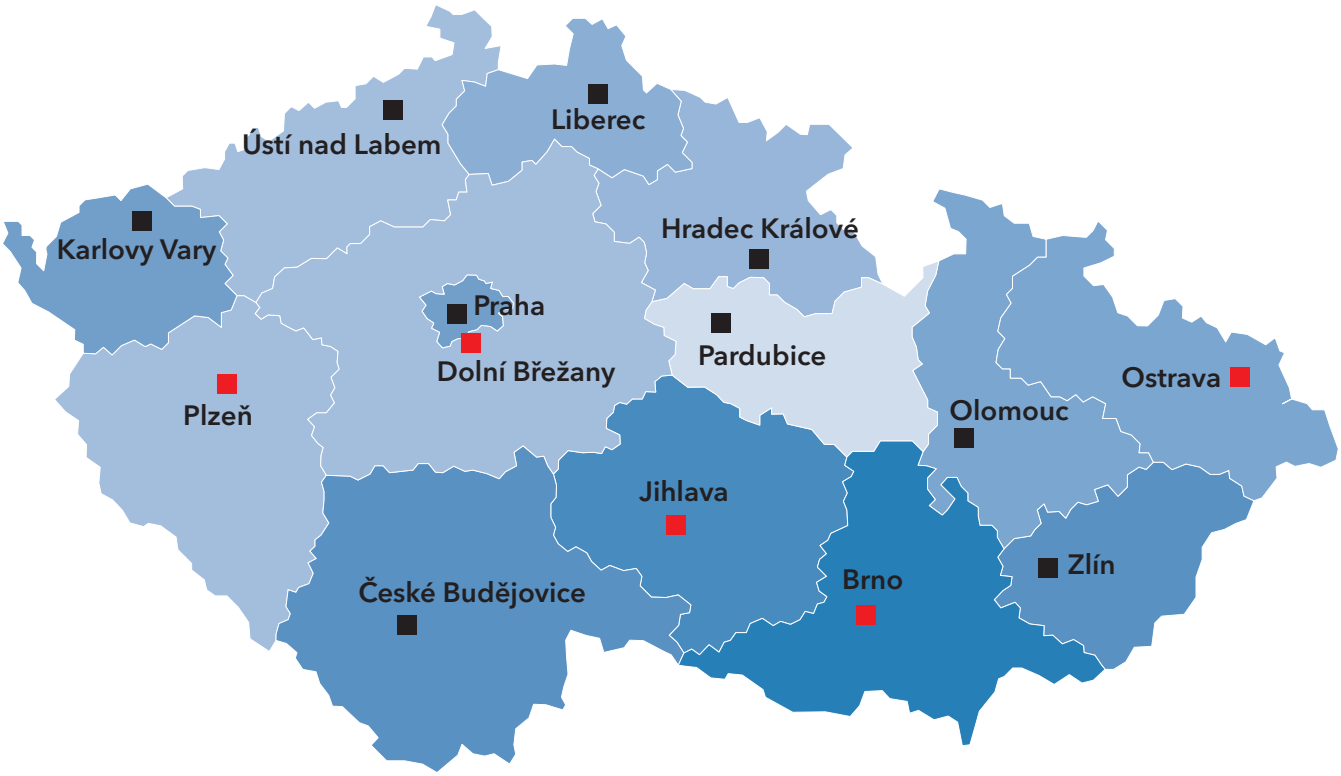
High-Performance Computing

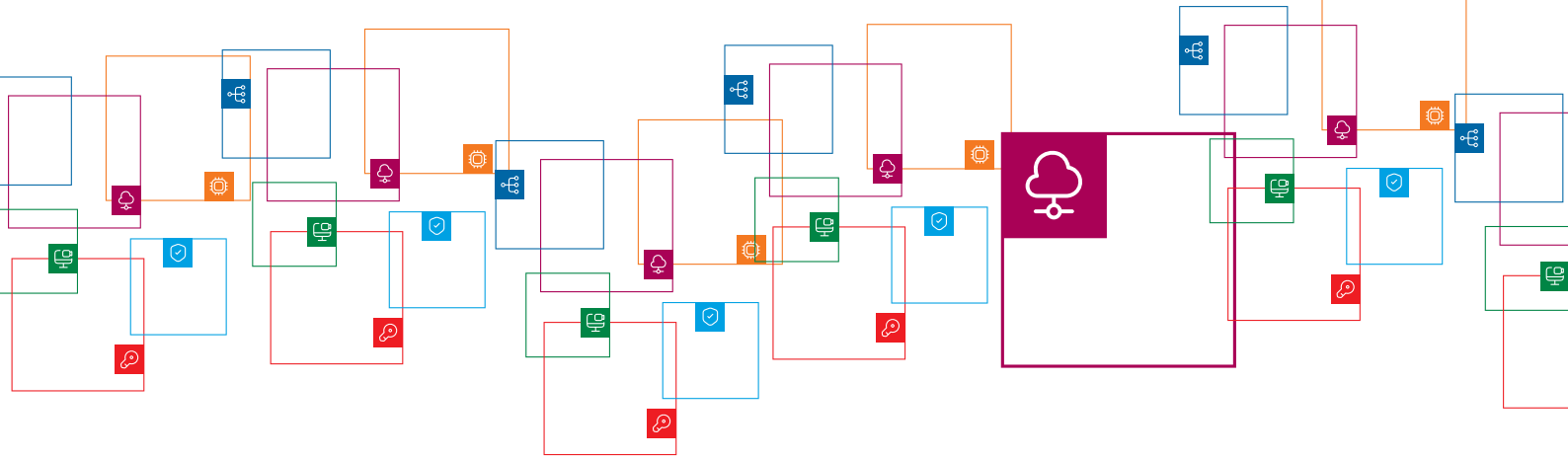
MetaCentrum continues to develop user portals and graphical interfaces for accessing the services it provides. Basic application tools such as Matlab, ANSYS, and R were made available within the Open OnDemand graphical interface, including support for using AI tools like PyTorch and TensorFlow. The Galaxy graphical interface is designed to support scientific workflows. Through the usegalaxy.cz installation, we offer it both to the national user community and, as part of the European project EuroScience Gateway, to users across the European Union.

MetaCentrum is also significantly strengthening its support for Jupyter Notebook environments. In addition to a standalone JupyterHub installation, Jupyter Notebooks are also available within the Open OnDemand environment. CESNET is responsible for operating the Interactive Jupyter Notebooks service within the EOSC EU Node, where we run an installation that is now also offered for the EGI and ENVRI-Hub Next projects. The same team is also involved in developing computing services for the national EOSC node and, as part of the EOSC Beyond project, is preparing a pilot installation of a complete national node. In addition to computing services, this node will include the initial services from the European Open Science Cloud Czech Republic (EOSC CZ) project and the National Repository Platform for Research Data (NRP) project.

Data Storage

Data storage map





Data Storage

cesnet datacare

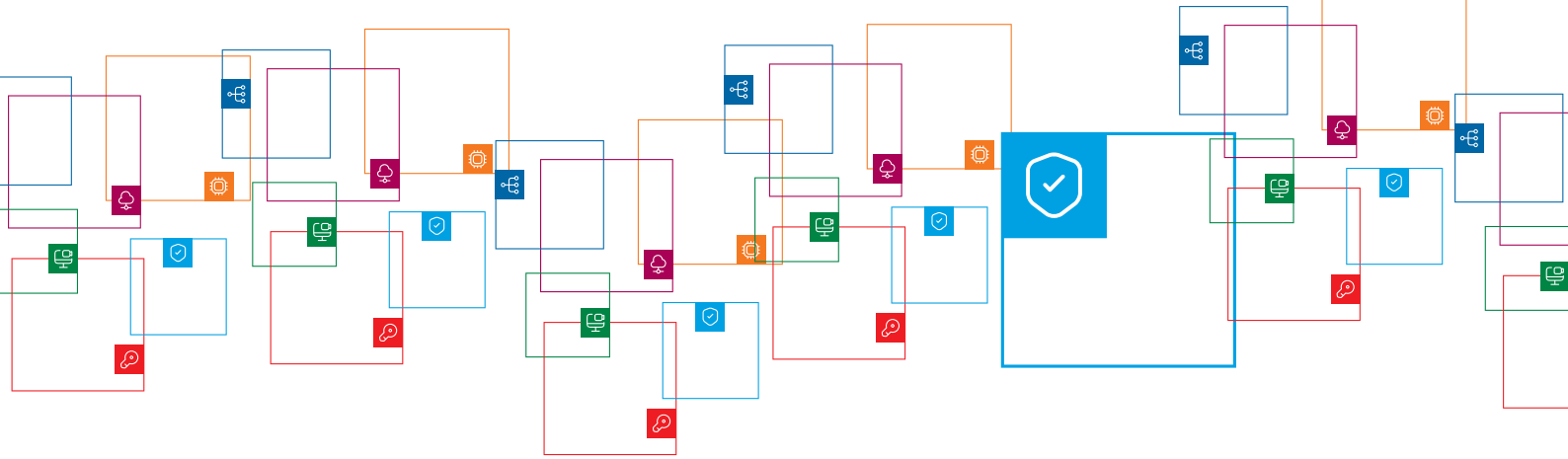
The data storage infrastructure focused on maintaining operations, developing services and international collaborations, and supporting application communities. All storage services are in operation, including access to file systems and object storage, as well as tools for data transfer, synchronization, and sharing.

Staff from the department were involved in the international HPLT (High Performance Language Technologies) project, providing direct technical support for the development of large language models (LLMs).

This is a prime example of the evolving role of data storage systems for unstructured data, shifting toward high-volume storage solutions for computing – where standard disk arrays directly attached to computing clusters are no longer sufficient. The role of archival storage will increasingly be taken over by data repositories.

Data storage systems were heavily involved in the implementation of EOSC in the Czech Republic. Work was underway on the overall architecture of the data repository system, which directly feeds into the upcoming National Repository Platform project. This project will support the creation of a high-capacity data repository environment with rich metadata, designed for storing data from the broader scientific community in line with FAIR principles. Although repositories are currently viewed primarily as storage for archiving scientific data, the repository infrastructure will not function solely as an archive – it will also be designed to support active data use.

The consortium project National Repository Platform (NRP) was launched with the goal of developing a system for instantiating repository systems based on the needs of user groups. It builds on the six-year project IPs EOSC-CZ. Within its framework, components of the National Data Infrastructure were developed to serve as the foundation of the National Repository Platform. Most of these systems form the technical backbone of the infrastructure and will largely remain hidden from end users. The National Metadata Directory was launched to aggregate metadata from repositories within the National Repository Platform as well as from its broader ecosystem, serving as a central search point for scientific datasets in the Czech Republic. As part of the NRP project, a catch-all repository for scientific data and several pilot repositories are available. Preparations for building the platform itself were underway, encompassing everything from the repository systems and software layers of storage to application runtime environments and the specification of the necessary hardware.



Security of the CESNET e-Infrastructure

Since 2018, the CESNET Association has held an internationally recognized certification of its Information Security Management System (ISMS) in accordance with the ČSN EN ISO/IEC 27001:2014 standard. This standard defines the requirements for managing information security within the organization's operations and services, with the aim of minimizing risks to the availability, confidentiality, and integrity of data.

In the area of security incident prevention and effective incident response, a key component of the technological framework is the set of tools used for **backbone network monitoring, detection of security events and incidents, and information sharing – specifically the services FTAS, G3, Warden, and Mentat**. All of these systems underwent continuous development, taking into account the needs of the Association as the operator of the e-infrastructure, as well as the requirements of users (members and participants). All systems have continued to prove stable and valuable, with the potential to serve – among other things – as tools for meeting the requirements of the Cybersecurity Act (ZKB), both for CESNET and for connected institutions that are designated obligated entities under the ZKB.

In 2024, security services – particularly those of the **Security Operations Centre** – continued to develop, and several meetings of the CSIRT working group were held to address topics related to the operation and security of services.

In 2024, the CESNET Forensic Laboratory (FLAB) carried out **six penetration testing assignments** and conducted several training sessions in forensic analysis. The deployment of the Phishingator service – used for conducting simulated preventive phishing campaigns – is also a growing area of activity.

The traditional **Seminar on Network and Service Security** also took place, focusing on the operation and security of networks, services, and Internet applications.

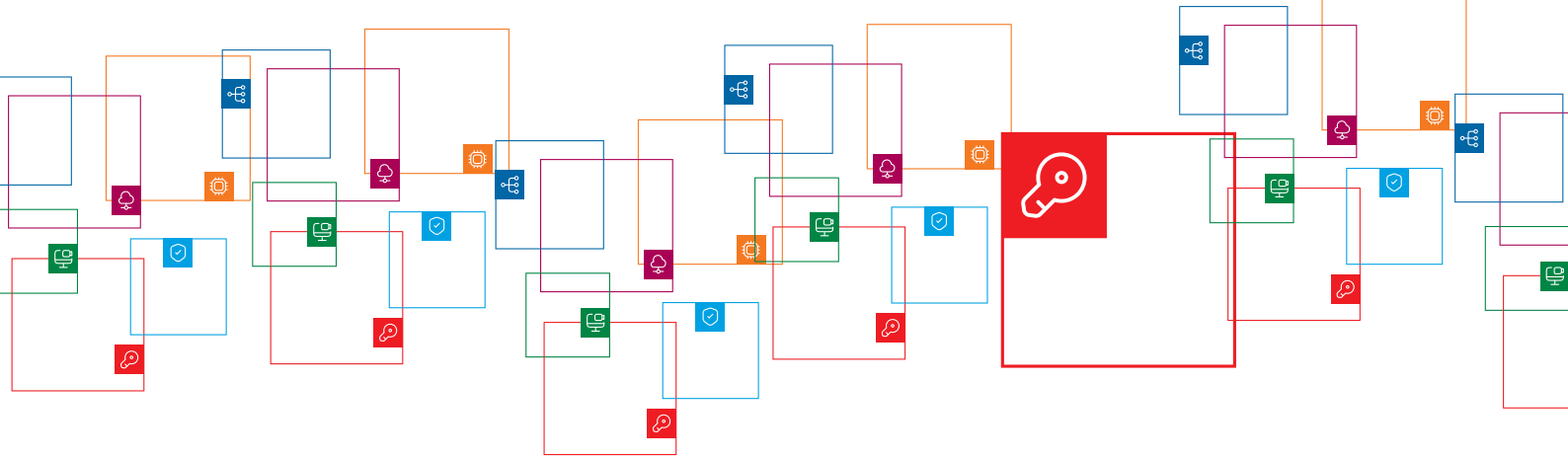
As in previous years, the FLAB team organized the educational **competition "The Catch"** in October to mark Cybersecurity Month. A total of 528 participants took part in the event.

528

participants took part in the event

cesnet

cesnet-certs



Network identities

cesnet eduid.cz

The purpose of the authentication infrastructure services is to ensure a trusted electronic identity and easy access to e-infrastructure services.

At the core of this infrastructure is the Czech academic identity federation eduID.cz, which brings together members who share user identity information with one another, thereby simplifying access to various network services. Each full member of the federation may act in one or both of the following roles:

- An Identity Provider (IdP) manages usernames, passwords, and other user information, and makes selected data available to service providers.
- A Service Provider (SP) operates a web application or network service and uses information about the identity and, where applicable, other attributes of users to control access to it.

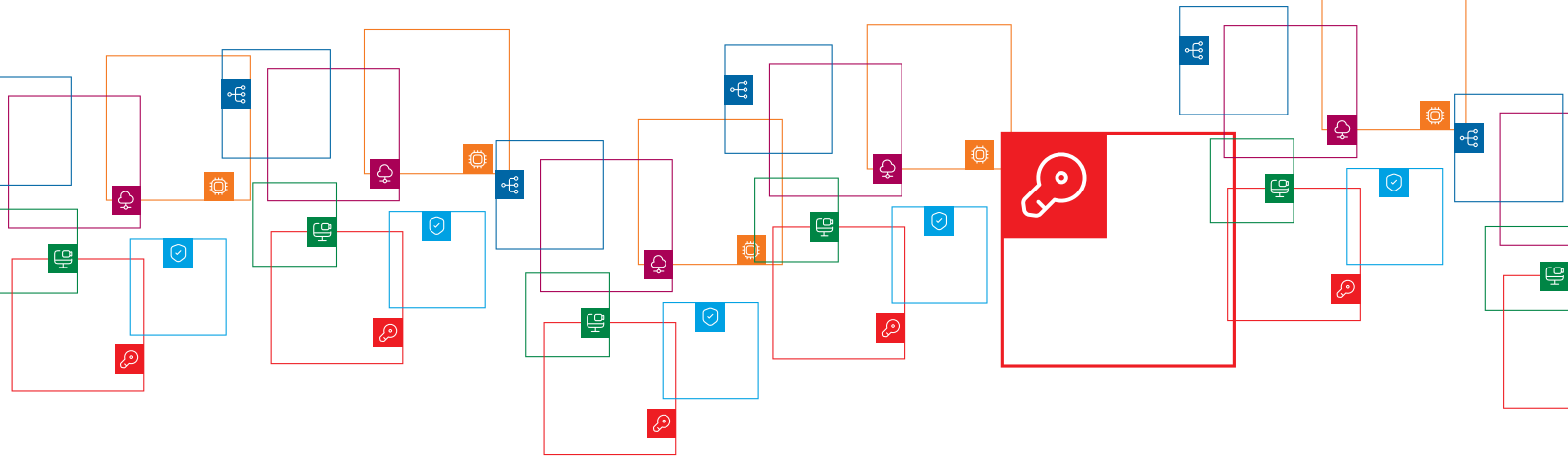
The eduID.cz federation currently includes 275 identity providers – 45 affiliated with universities, 50 with institutes of the Czech Academy of Sciences, 14 with hospitals, 116 with libraries, and 37 with other institutions such as international research groups, museums, archives, and regional authorities.

CESNET activated federated authentication for the SciFinder service for members of the eduID.cz federation. By the end of 2026, the European Digital Wallet using Verifiable Credentials is expected to be available in the EU. In 2024, the pilot operation of the eduGAIN OpenID inter-federation was launched. OpenID will be used in digital wallets; following REFEDS recommendations, we participated in preparatory discussions on supporting OpenID within national federations and on planning academic identities in the context of digital wallets at both the European and global levels. A number of services for eduID.cz members who will gradually start using digital wallets also operate outside the EU, typically in the USA. The specifications for digital wallets therefore need to be harmonized at the global level.

Ansible scripts were created for the eIDAS document validator to enable easy server recovery in case of failure. A new certification authority was established for CESNET's internal servers. The reason was the need for a less restrictive policy than that required by CAs accredited by the EUGridPMA. CESNET's timestamp servers have dropped support for the ESSCertID (Enhanced Security Services Certificate Identification) identifier in timestamps and now support only the newer ESSCertIDv2 identifier as specified in RFC 5816. One of the changes is the support for a more secure hash algorithm in timestamps.

275

identity providers are currently in the eduID.cz federation



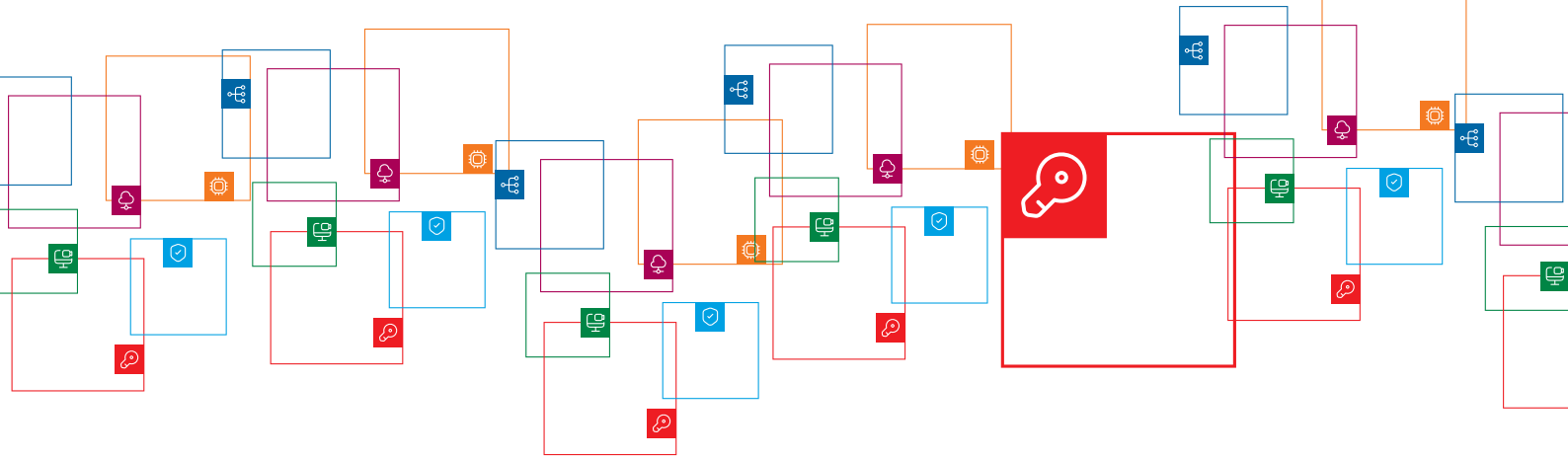
Network identities

The TCS portal was updated to simplify registration for new organizations and administrator updates for existing ones. They can now add and remove their own representatives, reducing the administrative burden of these changes for both CESNET and the organizations involved. The process is now fully digitalized; paper documents are no longer accepted, and all communication is handled exclusively via the data mailbox system. The manual removal of unnecessary personal data of inactive users – whose sensitive data we are no longer allowed to retain under GDPR – has been automated. The TCS portal was also enhanced with the option to request server certificates programmatically using the ACME standard, allowing both certificate owners and organization administrators to manage issued authorization keys. Unfortunately, shortly after the changes were introduced and the system went live, GÉANT's contract with the certificate provider Sectigo was unlawfully terminated, resulting in a temporary service outage.

In the eduroam project, the first year was dedicated to testing and fine-tuning the new infrastructure. The final placement of all national RADIUS servers was completed, followed by the launch of parallel operation of the new and old infrastructure. In the second half of the year, connected organizations were migrated, which required increased and more frequent support for those organizations. During the migration, additional features were added, and the existing solution was adjusted based on the demands that arose throughout the process. For some organizations, the migration to the new infrastructure was a challenging process that required them to reconsider their continued participation in the federation. Especially in cases where their connection had been established to meet grant requirements and the project's sustainability period had already ended. Nevertheless, most organizations completed the migration successfully, and the old infrastructure will be decommissioned after eight years of operation. In 2024, 44 new organizations joined the eduroam project, bringing the total number of realms to 584. This year also marked the 20th anniversary of the Czech eduroam federation. The eIDAS service continued in production mode, with additional information systems gradually connecting to it – 10 new ones, bringing the total to 36 – from 18 participating organizations, including 2 newly connected ones. In 2024, nearly 635,000 documents were signed or sealed (an increase of 405,000), and 510,000 qualified timestamps were issued (an increase of 337,000). In 2024, a total of 1,016 valid qualified certificates (an increase of 200) and 23 qualified seals were managed. The service is continuously being developed based on user feedback.

44

new organizations joined the eduroam project in 2024



Authentication and Authorization Infrastructure (AAI)

The proprietary software system Perun, which complies with the international AARC Blueprint standard (Authentication and Authorization for Research and Collaboration), is deployed and operated in production mode (24/7 with 99.9% availability) for several international and national research infrastructures and two universities.

In order of number of users, these are:

- project for student mobility MyAcademicID, including Erasmus+ (myacademic-id.eu)
- Masaryk University (muni.cz)
- e-INFRA CZ / EOSC CZ (e-infra.cz)
- LifeScience Login for ELIXIR, GDI, BBMRI and EJP RD infrastructures (lifescience-ri.eu)
- pan-European organization Géant linking national research and education networks (geant.org)
- Academy of Arts, Architecture and Design in Prague (umprum.cz)
- the Dutch national research and education network SURF (surf.nl)
- MyAccessID – the central authentication service for the EOSC AAI Federation
- EOSC EU Node – the EOSC node operated by the European Commission (eosc-federation.eu)
- EGI – European Grid Infrastructure (egi.eu)
- UmbrellaID – the digital identity for photons and neutrons (umbrellaid.org)
- FENIX Research Infrastructure – an association of supercomputing centers (fenix-ri.eu)
- European Consortium for the Development of Fusion Energy (euro-fusion.org)
- eduTEAMS Service (eduteams.org)
- eLTER – the European Long-Term Ecosystem, critical zone and socio-ecological Research Infrastructure (elter-ri.eu)

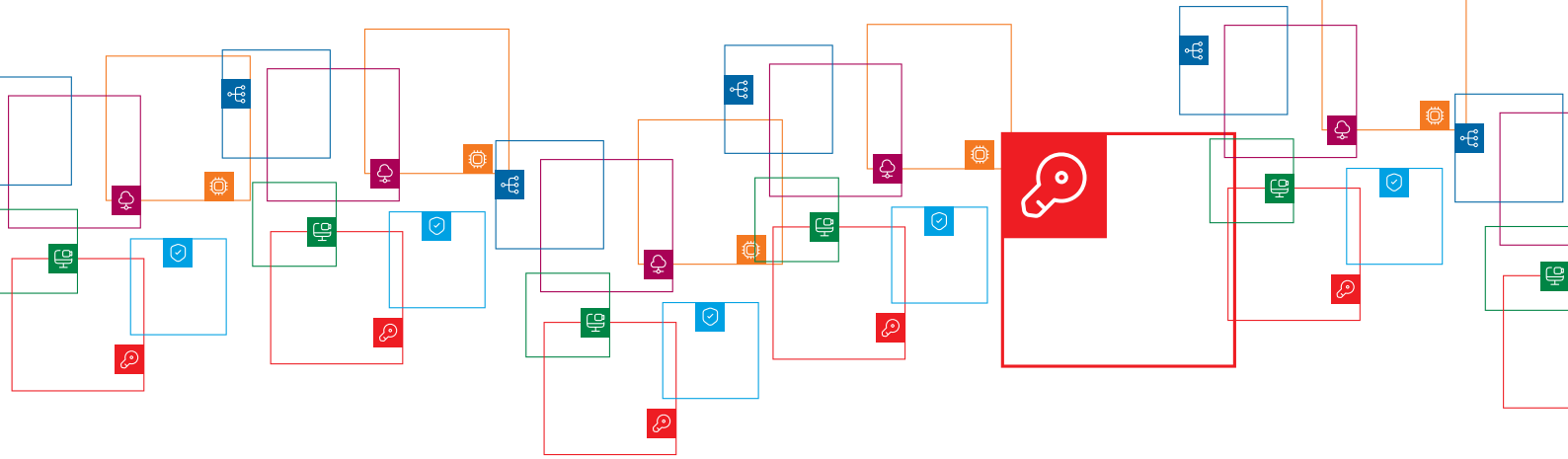
The Perun AAI system consists of two components:

- IdM – Identity Management system providing application management, user account administration, user data records, group creation, and authorization data configuration on managed machines
- Proxy IdP – a component that connects user authentication from identity providers in the Czech academic federation eduID.cz, the global eduGAIN inter-federation of research and education organizations, and selected social accounts (Google, Microsoft, Apple, ORCID, GitHub) to services with a web interface

In 2024, the number of registered users of the AAI instance for MyAcademicID increased significantly – by 47% – from 332,052 users in January 2024 to 488,258 users in January 2025. The number of registered users also grew significantly for the LifeScience Login instance – by 33% to 23,483 users – and for the e-INFRA CZ instance – by 9% to 112,244 users.

In 2024, key activities took place as part of building the EOSC (European Open Science Cloud) for processing FAIR data (Findable, Accessible, Interoperable, Reusable).

At the international level, the first pilot EOSC Federation node, known as the EOSC EU Node, was launched. The Perun software system plays a key role in this development in two distinct ways. One instance of the Perun IdM system has been used for several years as part of the MyAccessID service operated by GÉANT, serving as the central authentication service for the EOSC AAI Federation. The second instance of Perun IdM, newly created in 2024, is used for user registration and group management within the EOSC EU Node.



Authentication and Authorization Infrastructure (AAI)

Within the EOSC Beyond project, activities were carried out to connect additional nodes to the EOSC Federation. The Perun system instance for the national computing infrastructure e-INFRA CZ and the Perun instance known as LifeScience Login, serving the life sciences community, represent the AAI for two additional planned nodes. The first represents a national node and the second a community node, with their integration into the EOSC Federation planned for the coming years.

At the Czech national level, activities were carried out as part of building the NRP (National Repository Platform for Research Data), where the Perun system instance operated for the national computing infrastructure e-INFRA CZ is also used to connect NRP repositories. A significant number of repositories are scheduled to be connected in 2025.

Notable changes were also made in 2024 to the implementation of the Perun system for the national computing infrastructure e-INFRA CZ. Since 2022, it has also been used to manage access in the Sensitive Cloud environment for processing sensitive data.

In 2024, so-called Step-Up authentication was deployed, requiring users to verify their identity with a second factor before performing security-critical operations. The introduction of Step-Up authentication builds on the implementation of Multi-Factor Authentication (MFA) in 2022 and further enhances the security of access control to sensitive data.

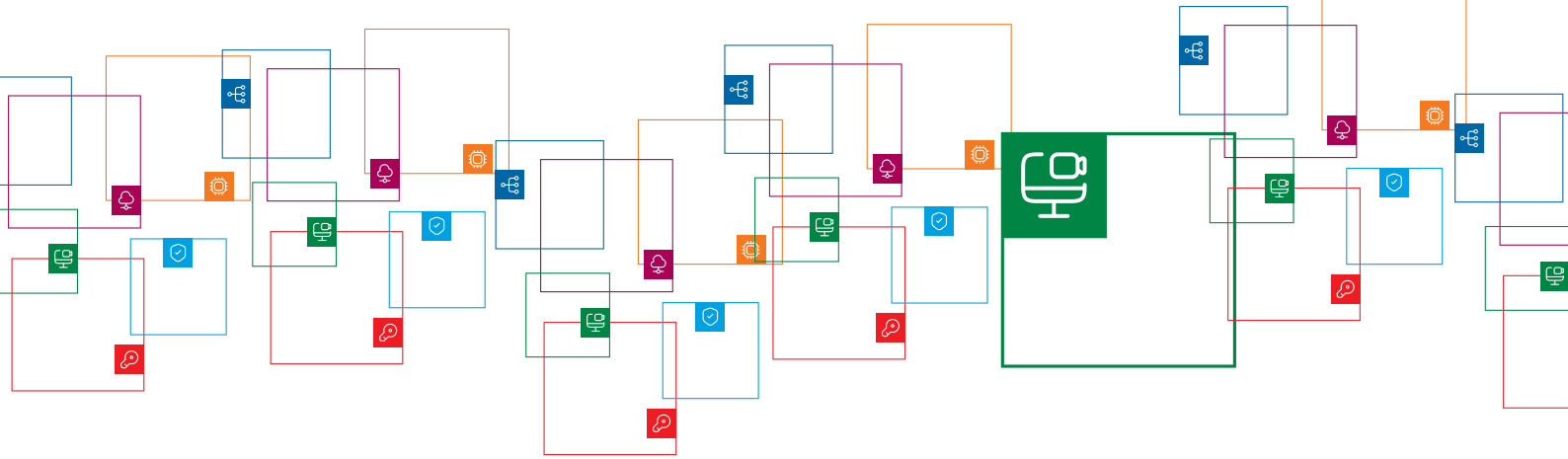
Additionally, the same instance of the Perun AAI system for e-INFRA CZ deployed so-called hierarchical virtual organizations, where a user's membership in one virtual organization can depend on their membership in another. This adjustment was necessary to better model the membership lifecycle rules across the entire e-INFRA CZ infrastructure as well as its subcomponents – such as IT4Innovations, CERIT-SC, MetaCentrum, and the Data Storage facilities – which each have their own membership lifecycles.

In 2024, the transition to fully automated management of all AAI instances using the Ansible tool was completed. All AAI instances managed by CESNET are now administered according to Infrastructure-as-Code principles–their state is described in a machine-readable format, and all changes are executed and tracked in a version control system (git). This makes it possible to trace any change back to when and by whom it was made.

In 2024, the system transitioned to a new implementation of the Perun web user interface, which is responsive (adapts to the screen size of the display device), supports new security roles, and includes support for both MFA and Step-Up authentication.

In March 2024, so-called distributed authorization between two IdM systems was also put into operation. Its first deployment is between the Perun IdM of Masaryk University and the Perun IdM of e-INFRA CZ, which jointly manage user access to a shared OpenStack cloud system. Distributed authorization is implemented so that user groups from MUNI who are also users of e-INFRA CZ are synchronized from Perun IdM MUNI to Perun IdM e-INFRA CZ after each change. The latter then passes user and group information to the OpenStack system. This solution enables a division of user management, where user groups from MUNI are managed in the Perun IdM operated by MUNI, while other e-INFRA CZ user groups are managed in the Perun IdM for e-INFRA CZ.

Due to the use of the Perun LifeScience Login instance in the GDI (European Genomic Data Infrastructure) and EOSC-ENTRUST projects – focused on building a European federation of Trusted Research Environments for processing sensitive data – and our participation in the EOSC AAI Workgroup and the GA4GH (Global Alliance for Genomics and Health) Data Security Work Stream, we contributed to developing standards for authentication and authorization in handling sensitive, especially genomic, data.



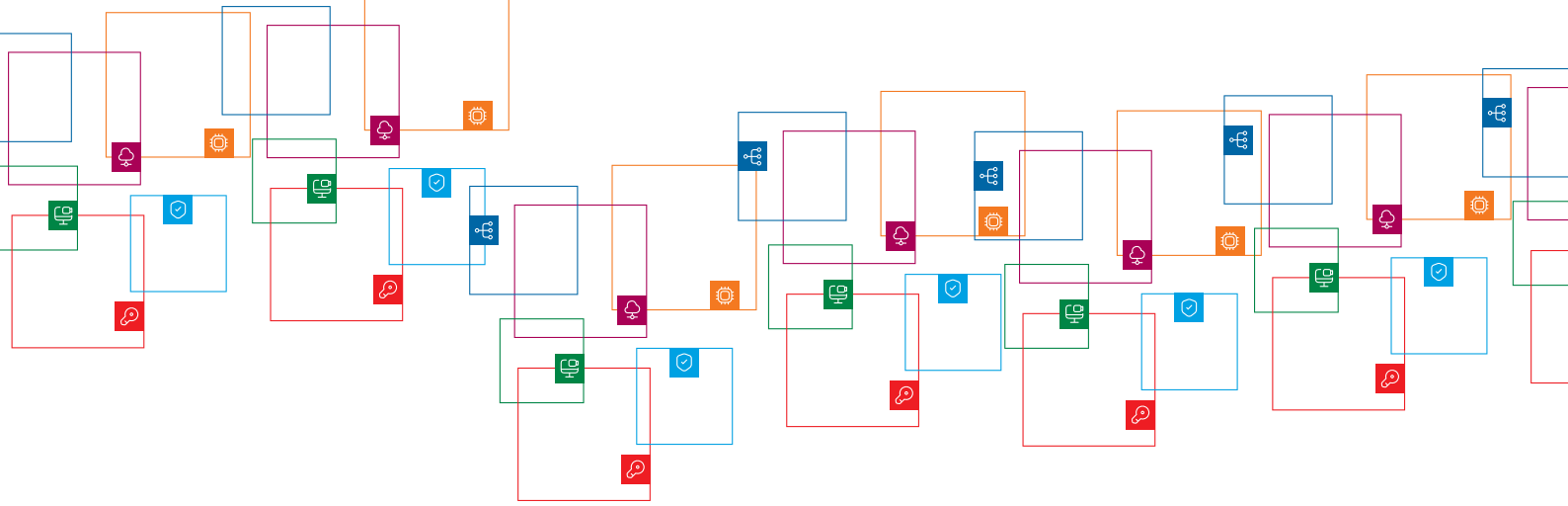
User Collaboration and Multimedia

CESNET Association's services in the area of remote collaboration and multimedia support are used by nearly all members, including 50 out of 55 institutes of the Czech Academy of Sciences, as well as other connected organizations.

cesnet meetings

In 2024, our video conferencing infrastructure once again hosted over 100,000 meetings for more than 600,000 users. Compared to the previous year, we have once again seen a slight increase in interest in remote and hybrid forms of work. CESNET Streaming shows a steady increase in user interest. In 2024, the volume of streamed video grew to 1.25 PB. The volume of recorded video on our infrastructure increased year-over-year by nearly 40%. We successfully tested the deployment of AI to automate captioning of recordings stored on our infrastructure within the MetaCentrum environment. Interest in our IP telephony service – which connects traditional phone exchanges of affiliated members and organizations – has remained virtually unchanged compared to previous years. Last year, our infrastructure handled 360,000 phone calls between CESNET Association members and other connected organizations.

We continue to develop the UltraGrid software tool for low-latency transmission of high-quality audio and video. The development reflects current trends in graphics and video libraries used across MS Windows, macOS, and Linux platforms. We have newly implemented a compatibility mode in UltraGrid with the SMPTE 2110 standard for transmitting video, audio, and data signals over IP networks in high-quality production environments. In collaboration with VŠB-TUO, we successfully tested low-latency video transmission with up to 8K resolution using UltraGrid in a campus 5G network environment with millimeter wave support in the 26.5–27.3 GHz frequency range.



Collaboration with Large Research Infrastructures

The CESNET e-infrastructure is part of the relevant European e-infrastructures, forming a communication and information environment for national large-scale infrastructures in other scientific disciplines. It facilitates their collaboration with international partners.

GÉANT – The European backbone communication infrastructure – that interconnects national research and education networks across Europe and links them to similar infrastructures on other continents. CESNET serves as the national node of this infrastructure – the national research and education network. By the end of 2024, collaboration within GÉANT was funded through the GN5-1 project, in which CESNET is primarily involved in activities related to building specialized network environments (such as for precise time and stable frequency transmission or QKD) and issues concerning AAI.

EGI.eu – The European infrastructure for distributed computing – coordinating national activities at the European level in the implementation of grid technologies. Collaboration among members of this infrastructure mainly takes place within the framework of the EOSC-Future project and the EGI-ACE program under Horizon 2020. Within this collaboration, CESNET participates in all core operational activities, manages the national node of the EGI grid, and provides computing resources composed of both the association's own capacities and those of the Institute of Physics of the Czech Academy of Sciences. The connected capacities are also part of MetaCentrum and utilize its virtualized infrastructure. We continue to support the virtual organizations ELIXIR (bioinformatics), Auger (cosmic rays), Belle (particle physics), and CTA (gamma astronomy), as well as directly supporting user groups from the Czech Republic interested in using the pan-European grid. The priority is to focus on the specific needs of these groups and their international projects.

ELIXIR is a European infrastructure for bioinformatics that brings together advanced computing environments, data resources, and unique tools across Europe to support research in the field of bioinformatics. CESNET supports the development of the European infrastructure through the Technical Services workstream of the ELIXIR Compute Platform. This effort focuses on creating a shared framework for providing computing and data storage services, along with building the Life Science AAI. CESNET is also directly involved in national activities in this area, being one of the founding members of the ELIXIR CZ infrastructure, which provides advanced computing environments, data resources, and unique tools to the bioinformatics research community in the Czech Republic and across Europe. CESNET is a direct participant in the Czech National Infrastructure for Biological Data project, part of the Large Research Infrastructure Projects program that ensures the operation of this infrastructure.

QUAPITAL represents a partnership for secure communication with quantum-level security in Central Europe, as well as for the quantum internet. The goal of this initiative is to build a quantum-compatible infrastructure that connects quantum experiments across various research facilities throughout Central Europe.

EOSC AISBL - is an international association of institutions involved in implementing the European Open Science Cloud concept. CESNET, as the "mandated organization," represents the Czech Republic within this association. CESNET representatives are also involved in specific working groups, namely "AAI Architecture," "Long-Term Data Preservation," and "Financial Sustainability."

Collaboration with Large Research Infrastructures

National Large Research Infrastructures

Besides its close cooperation with international e-infrastructures and ELIXIR CZ, CESNET regularly collaborates with other major infrastructures from the Czech Republic's 2023–2026 research infrastructure roadmap, addressing their ICT needs and offering support. Examples include:

- Collaboration on service provision and cybersecurity for the European Open Science Cloud – EU Node
- Collaboration between e-INFRA CZ, ELIXIR CZ, and EATRIS to provide high-performance computing for the Institute of Molecular and Translational Medicine at the Faculty of Medicine, Palacký University Olomouc.

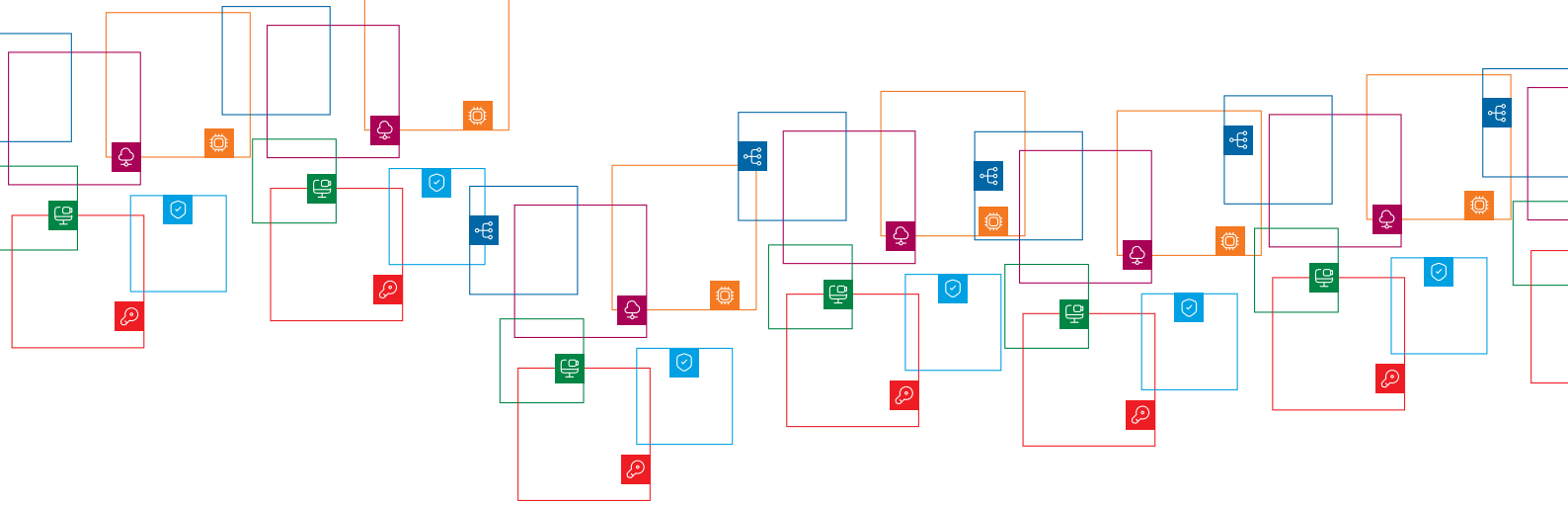
EUROPEAN OPEN SCIENCE CLOUD

EOSC

As part of e-INFRA CZ, CESNET is helping to implement Open Science in the Czech Republic by building a national data infrastructure for storing, sharing, and working with FAIR (Findable, Accessible, Interoperable, Reusable) data.

The national data infrastructure includes the national repository platform, metadata repository, discipline-specific repositories, and the national EOSC secretariat. CESNET and e-INFRA CZ are expected to be involved in this concept by creating the national repository platform and supporting the national EOSC secretariat. The development of the national data infrastructure is planned to be funded through the OP JAK program.

At the beginning of the year, the e-INFRA CZ consortium launched the first project titled European Open Science Cloud Czech Republic, aiming to establish a comprehensive shared infrastructure – including a secretariat, national metadata directory, and training center – by the end of 2028. Following the OP JAK Open Science I program call, we also began preparing the National Repository Platform project, which will simultaneously with the EOSC-CZ project build the foundation of the data repository infrastructure for FAIR data.



Research, Development, and Innovation

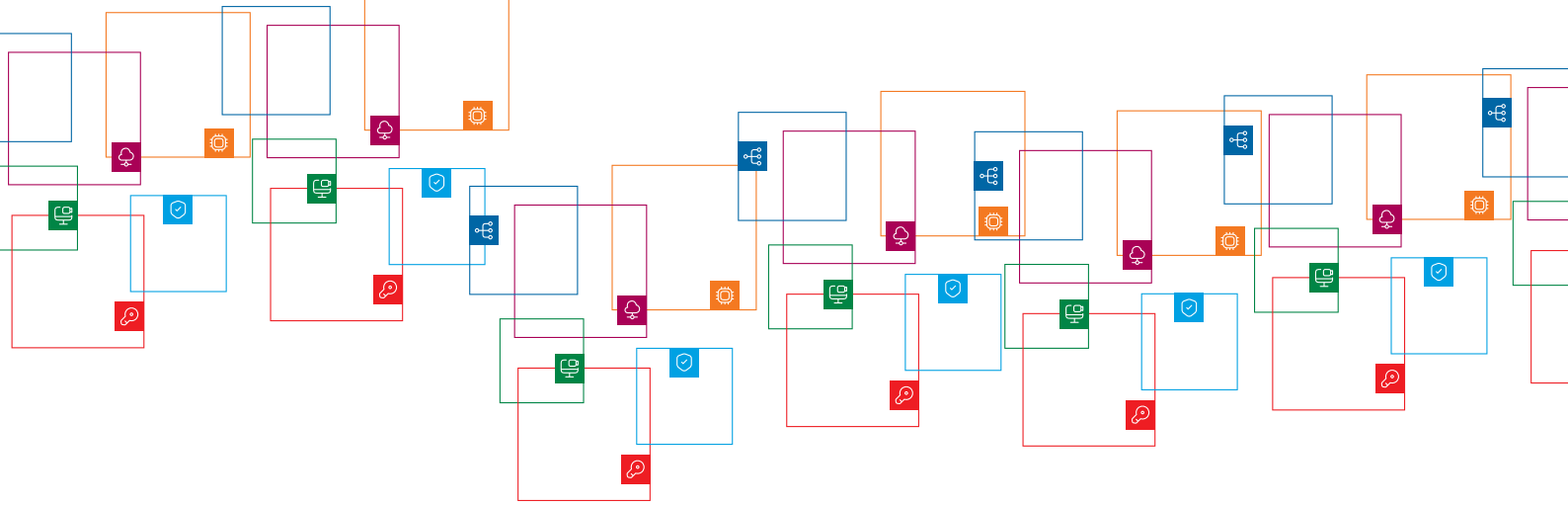
An innovative approach is essential for the development of the CESNET e-infrastructure. Therefore, alongside building and operating its e-infrastructure, the association also engages in research and development in information and communication technologies, focusing especially on the areas listed below.

Optical Transmission Systems
CESNET has long been involved in software control of optical networks, precise time and stable frequency transmission, quantum key distribution, and using optical networks as sensors for physical quantities.

Security of the CESNET e-Infrastructure
CESNET has long devoted significant attention to the security of its e-infrastructure. Alongside creating tools to protect user privacy and data security and to share information about security incidents, CESNET also focuses on developing tools for network monitoring and spotting unusual traffic that could indicate attacks. The association continues to develop its own system against DDoS attacks (**DDoS Protector**).

Network identity
In the field of identity management and access control, CESNET, together with Masaryk University, develops the **Perun system**, which allows organizing users into virtual organizations and groups, assigning them resources, and managing their access.

New Applications
CESNET continually explores ways to apply its e-infrastructure in new fields such as medicine, culture, architecture, and more. Research in this area includes developing two platforms: the hardware platform called **MVTP** and the software platform **UltraGrid** (in collaboration with Masaryk University), designed for working with high-resolution video (up to 8K) while maintaining low latency. The Association also focuses heavily on digitization and presentation of cultural heritage objects, as well as on Internet of Things (IoT) technologies.



Projects carried out in 2024

International Projects

Acronym	Project name	Program	Provider
	Large infrastructures		
GN5-1	Research and Education Networking - GÉANT	Horizon Europe	EU
	EOSC		
EOSC-FUTURE	EOSC-FUTURE	Horizon Europe	EU
EuroScienceGateway	leveraging the European compute infrastructures for data-intensive research guided by FAIR principles	Horizon Europe	EU
GraspOS	GraspOS: next Generation Research Assessment to Promote Open Science	Horizon Europe	EU
EOSC Beyond	Advancing Innovation and collaboration for research	Horizon Europe	EU
ENVRI-Hub NEXT	ENVironmental Research Infrastructures delivering an open access Hub and NEXT-level interdisciplinary research framework providing services for advancing science and society	Horizon Europe	EU
	Cybersecurity		
SEQRET	Secure and Industrialized Quantum Key Distribution for European Telecom Networks	Digital Europe	EU
SOCCER	Developing and deploying SOC capabilities for the academic sector - a teamwork of Universities and RTOs in the CEE region	DIGITAL JU SIMPLE	EU
	Advanced technologies and applications		
GreenDIGIT	Greener Future Digital Research Infrastructures	Horizon Europe	EU
GREAT	The Green Deal Data Space Foundation and its Community of Practice	Digital Europe	EU
HPLT	High Performance Language Technologies	Horizon Europe	EU
interTwin	An interdisciplinary Digital Twin Engine for science	Horizon Europe	EU
SUBMERSE	SUBMarine cablEs for ReSearch and Exploration	Horizon Europe	EU

Projects carried out in 2024

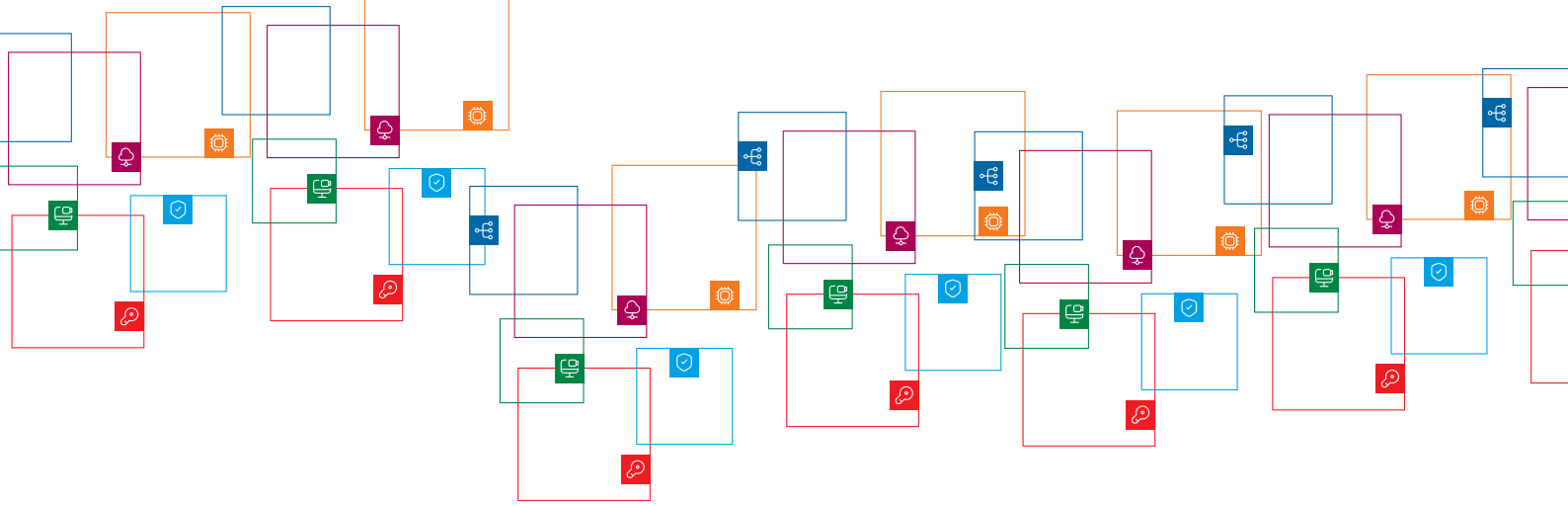
Other National Projects

Acronym	Project name	Program	Provider
	Large infrastructures		
e-INFRA CZ	e-infrastructure CZ	Large Research Infrastructure Projects	Ministry of Education, Youth and Sports (MŠMT)
e-INFRA CZ	Modernization of e-INFRA CZ II	OP JAK	MŠMT
ELIXIR-CZ	Czech National Biological Data Infrastructure	Large Research Infrastructure Projects	MŠMT
ELIXIR-CZ: Capacity Extension	ELIXIR-CZ: Capacity Extension	OP JAK	MŠMT
	EOSC		
EOSC-CZ	European Open Science Cloud Czech Republic	OP JAK	MŠMT
National Repository Platform for Research Data (NRP)	National Research Data Repository	OP JAK	MŠMT
	Cybersecurity		
CYBYRTHREATS	CYBERTHREATS - Using Artificial Intelligence for Defense Against Cyber Attacks	Ambition	MO
CZQCI	Czech National Quantum Communication Infrastructure	Digital Europe	EU
FETA	Analysis of Encrypted Traffic Using Network Flows	IMPAKT 1	Ministry of the Interior of the Czech Republic (MV ČR)
HALOGEN	Hardware Acceleration of High-Speed DPDK SmartNIC	TREND	Technology Agency of the Czech Republic (TA CR)
NeSPoQ	Cybersecurity of networks in the post-quantum era	IMPAKT 1	MV ČR
NU-CRYPT	Quantum-Encrypted Communication with Enhanced Physical Layer Security	OPSEC	MV ČR
HSPF	High-speed network traffic filtration	SECTECH	MVČR
HUGO Honeynet	Cross-sectoral cooperation to build a honeypot network	Digital Europe	NÚKIB
PANDDA	Passive device discovery and analysis on the network	Digital Europe	NÚKIB
	Advanced technologies and applications		
HFT	Acceleration platform for ow-latency stock trading	TREND	TA ČR
DigiOrloj	Digitalization of the Old Town Astronomical Clock	SIGMA	TA ČR
QUEENTEC	Quantum Engineering and Nanotechnology	OP JAK	MŠMT

We would like to thank all grant providers for their support in funding the implementation of the projects.

R & D Results

The research activities in 2024 resulted in 7 articles published in peer-reviewed scientific journals (including one in the journal Nature), 20 conference proceedings papers, 1 prototype, and 1 software outcome.



CESNET Association Development Fund

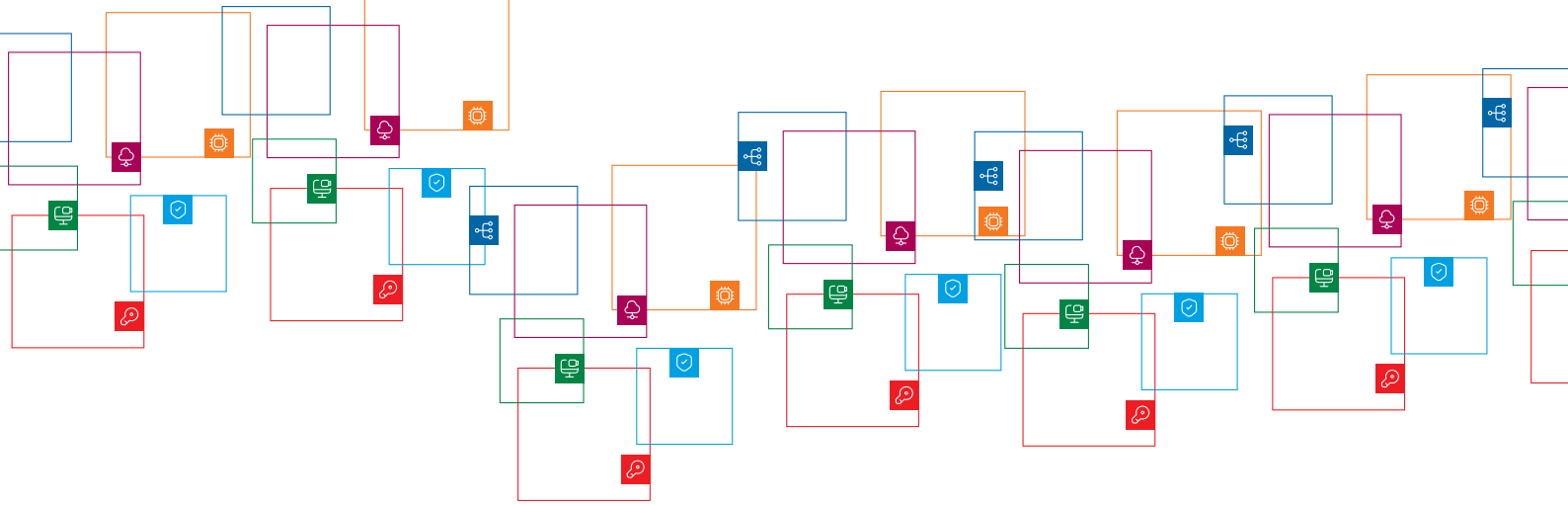
At the end of 2023, the Fund Council prepared and announced the first round of the tender for projects for 2024. Besides the regular members of the Association, the tender was also open to associate members.

In cooperation with the Association, the following thematic areas were selected:

- Use and development of CESNET e-infrastructure services and modern information and communication technologies in teaching and learning, creative and research work, and managing public universities and the Czech Academy of Sciences.
- Advanced applications utilizing the CESNET e-infrastructure

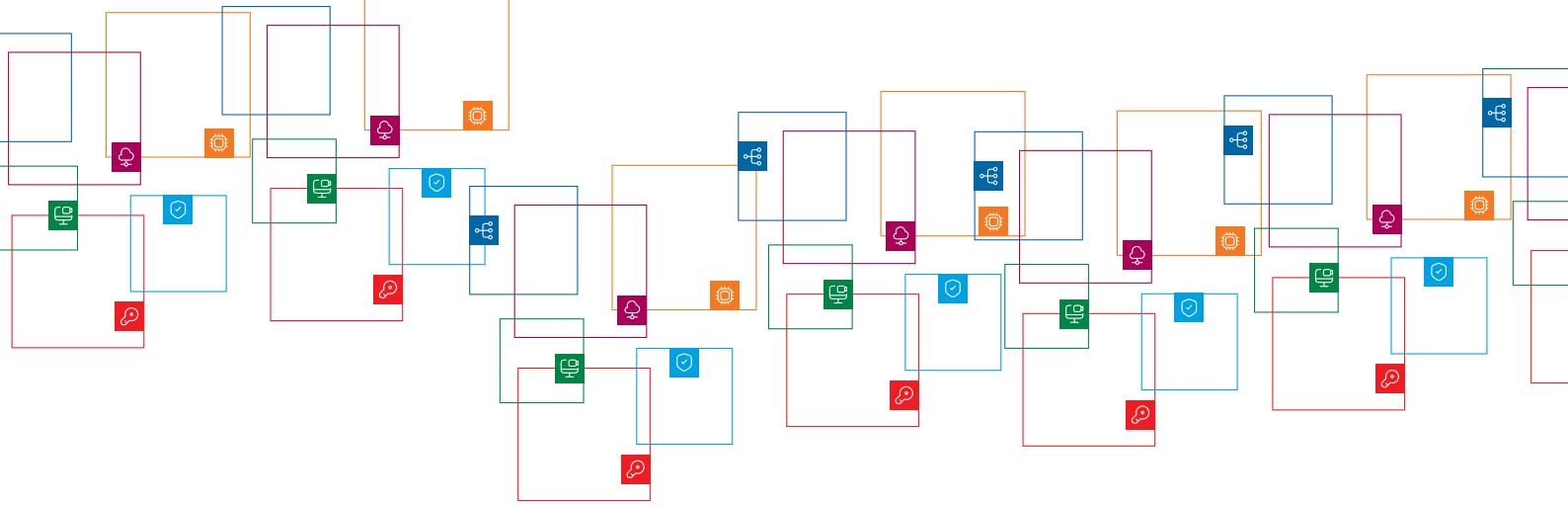
A more detailed specification of the objectives and focus was provided in the announcement text. Based on the tender, 22 projects were submitted. Sixteen projects were accepted for co-financing, three of which after revision. The overview of projects approved for implementation is presented in the following table.

Project number	Project leader	Project name
745/2024	JAMU	Low-latency artistic and educational collaboration between JAMU and AMU
746/2024	UHK	Support for the digitization of public university processes
747/2024	MENDELU	Adaptive IT infrastructure management based on environmental monitoring using IoT
748/2024	VSB – Technical University of Ostrava	Coordinated cybersecurity in the CESNET II network
749R1/2024	UWB – University of West Bohemia in Pilsen	Possibilities for the digitization of physical NFC identification cards in the university environment
750/2024	MU – Masaryk University	Onedata system client application for Windows
752/2024	MU – Masaryk University	Tool for automatic annotation and searching of large protein datasets based on the similarity of their structures
753R1/2024	MU – Masaryk University	Methodological support for log management in the organization
756/2024	MU – Masaryk University	DSW templates for Data Management Plans tailored to key RFOs for Czech academic institutions
757/2024	VUT – Brno University of Technology	Atmospheric anisotropy and its impact on quantum wireless links of the CESNET infrastructure
758/2024	AV ČR – Czech Academy of Sciences	Distribution node for the transmission of ultra-stable optical frequencies
759/2024	MU – Masaryk University	Molecular dynamics as an open science
761/2024	ČVUT – Czech Technical University in Prague	Connection and development of the Security Laboratory to the CESNET network
764/2024	AV ČR – Czech Academy of Sciences	Storage for scientific research data in the field of life sciences
765/2024	AV ČR – Czech Academy of Sciences	Vegetation indices as a suitable tool for analyzing growth processes of forest ecosystems in the territory of the Czech Republic
766R1/2024	MU – Masaryk University	Support for Microsoft 365 environment security at universities



CESNET Association Development Fund

During 2024, final peer review procedures for completed projects also took place. In total, 14 projects were successfully completed. For some projects, the Fund Council recommended presenting the findings and conclusions from the project at an appropriate conference. At the same time, for some projects, the Council gave recommendations to supplement the project outputs so that they can also be used by other members of the Association. Final reports of projects carried out within the CESNET Development Fund are available on the website https://fondrozvoje.cesnet.cz/ .



External Relations

In 2024, the CESNET Association continued to develop activities that confirm the key role of e-infrastructure in supporting science and research in the Czech Republic. At the same time, it focused on sharing experience and knowledge with both the user community and the professional as well as the broader public. During the year, CESNET hosted thematically focused seminars, conferences, and workshops intended for both the academic and professional sectors.

In 2024, we held 15 events that brought together nearly three and a half thousand participants. Over the course of 207 hours, our colleagues delivered 203 engaging presentations at six different locations across the Czech Republic.

We kicked off 2024 with our staple and most popular event, the Seminar on Network and Service Security. In April, we organized the e-INFRA CZ conference, where in cooperation with CERIT SC and IT4Innovations, we presented the services and research activities of the e-INFRA CZ consortium.

In June, the ninth annual IPv6 seminar was held. At the end of the year, the National EOSC 2024 Conference took place, focusing on the latest trends in data management and storage. Training sessions and workshops such as Forensic Training, several CESNET Days events, as well as international workshops and conferences, continued throughout the year. We co-organized and partnered in many events – CSNOG 2024, RIPE, Digital Science Week, and Linux Days – where, together with colleagues from the e-INFRA CZ consortium, we prepared an engaging booth and met with many participants to discuss expert topics.

The traditional Cybersecurity Competition Month also took place, during which we once again organized the CTF competition called The Catch. It was participated in by 528 players from around the world – including Japan, Brazil, Singapore, and other countries.

One of the highlights of the year was one of our technical achievements – enabling low-latency transmission between musicians in Prague and Vienna, streamed live to a music festival in Hong Kong. Also this year, the SAGELab laboratory celebrated its 10th anniversary since its founding.

A major recognition this year was the awarding of a state honor to the emeritus director Ing. Jan Gruntorád, CSc., who received the Medal of Merit in the field of technology from the President of the Republic, Petr Pavel.

We continue to regularly prepare updates, showcase the activities and achievements of our employees, and publish information about events and other happenings through our website, social media, and the e-News newsletter.

We also manage the websites of the Large Research Infrastructures of the Czech Republic as well as the website of the e-INFRA CZ consortium.

For 2024, we issued 5 press releases and recorded a total of 268 media outputs. Colleagues also regularly appeared in mass media, providing expert commentary on specialized topics on television and radio.

External Relations

Seminar on Network and Service Security ▶

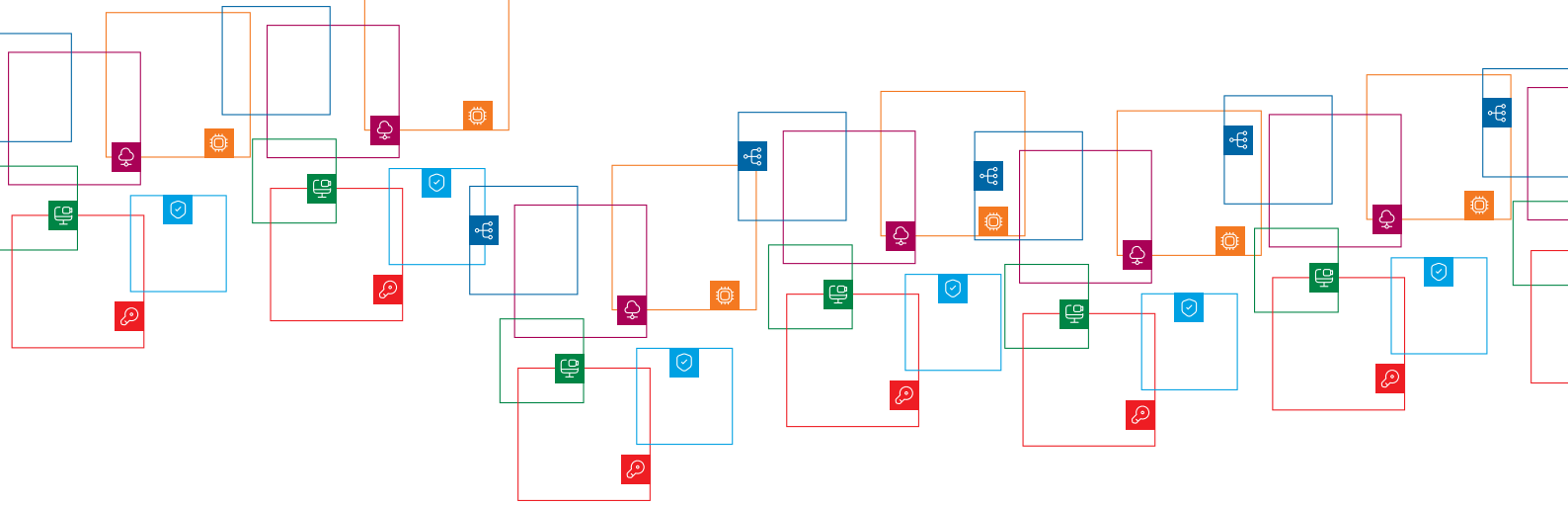
◀ CESNET Day at the Czech University of Life Sciences

CESNET booth at the international RIPES conference ▼

▲ Emeritus director of CESNET, Jan Gruntorád, receives an award from the President of the Republic, Petr Pavel

▲ Meeting on the occasion of the 10th anniversary of SAGELab

◀ A reunion of the top contestants of The Catch 2024 competition



Economic Results in 2024

CESNET, an association of legal entities, maintains accounting records and prepares financial statements in accordance with Act No. 563/1991 Coll., on Accounting, as amended, Decree No. 504/2002 Coll., and the Czech Accounting Standards for accounting units that account according to Decree No. 504/2002 Coll. As of December 31, 2024. The accounting period is the calendar year.

The accounting complies with the general accounting principles established by the Accounting Act. The Association has not deviated from standard accounting methods.

Accounting is processed using computer technology with the ABRA Gen information system from ABRA Software a.s. Accounting documents are archived at the Association's headquarters.

Long-term tangible and intangible assets are valued at acquisition cost, which usually includes customs duties, transportation, and costs of installation and commissioning.

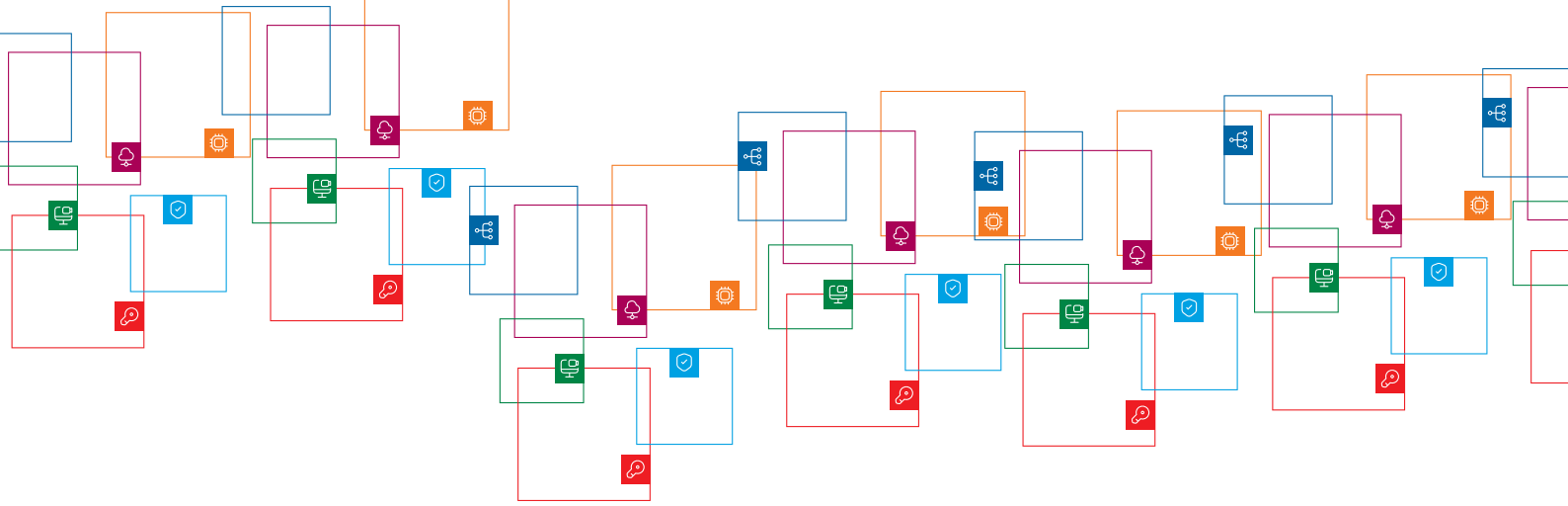
Securities are valued at acquisition cost, including acquisition fees. Securities are revalued to their fair value annually on December 31 of the current accounting period.

Receivables and liabilities denominated in currencies other than CZK are revalued annually on December 31 of the current accounting period using the Czech National Bank exchange rate.

For the revaluation of foreign currency cash registers, foreign currency accounts, receivables, and liabilities, the following Czech National Bank exchange rates valid on the balance sheet date were used: 24.237 CZK/USD, 25.185 CZK/EUR, 30.378 CZK/GBP, 2.135 CZK/NOK, 26.768 CZK/CHF.

Long-term tangible and intangible assets are depreciated on a straight-line basis monthly, with depreciation starting in the month the asset is put into use. For tax purposes, long-term assets are depreciated using an accelerated method, except for long-term intangible assets, which are depreciated on a straight-line basis. The depreciation period is determined by the asset's classification into a depreciation group according to the Income Tax Act. An exception is made for assets for which extraordinary straight-line depreciation was chosen over a period of one year. Assets for which this method of depreciation is more advantageous were selected.

The Association owns long-term financial assets in the form of bonds, shares, and holdings in mutual funds. As of the balance sheet date, securities were revalued to fair value using the current market value applicable on that date.



Economic Results in 2024

Items of long-term assets

	Opening balance	Increase	Decrease	Closing balance
Software	46,354	2,656	657	48,353
Unfinished intangible assets	74	2,441	2,270	245
Buildings	13,835	386	0	14,221
Tangible movable assets	1,769,734	30,998	194,442	1,606,290
Unfinished tangible assets	0	0	0	0
Long-term financial assets	9,554	634	734	9,454

Corrections

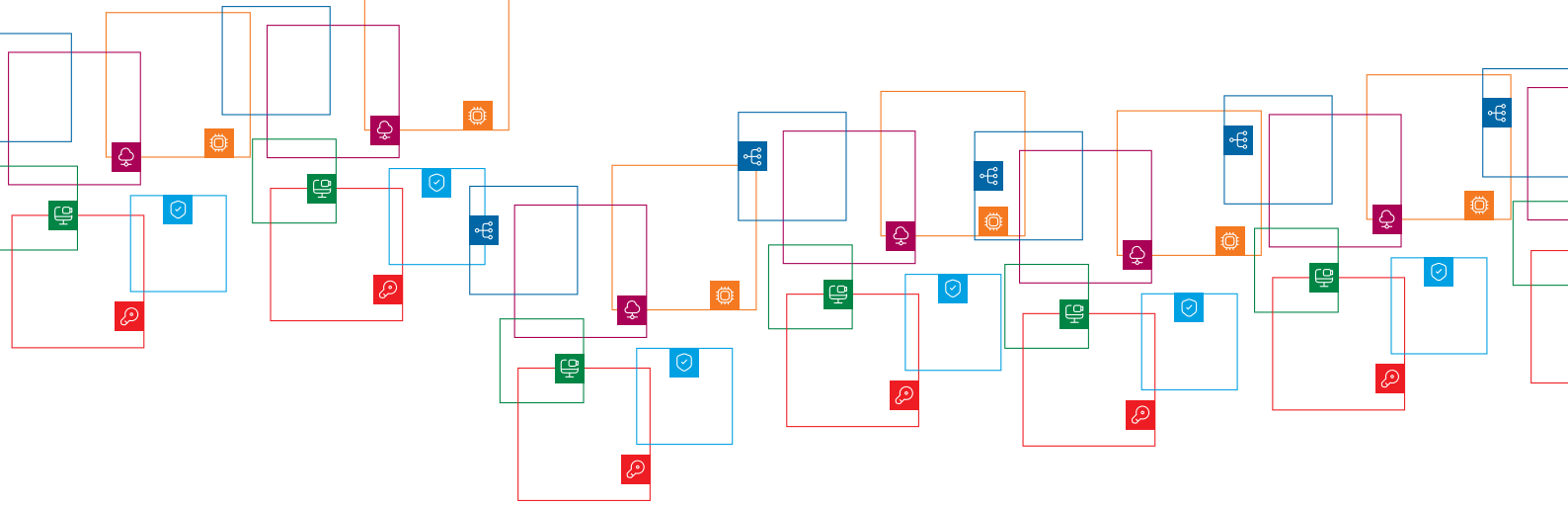
	Opening balance	Increase	Decrease	Closing balance
Software	36,915	7,728	658	43,985
Buildings	6,243	453	0	6,696
Tangible movable assets	1,318,785	234,637	194,442	1,358,980

Holdings in funds as of December 31, 2024 (amounts are stated in whole CZK)

ISIN code	Number of units	Valuation as of December 31, 2024, in CZK
CZ0008474509	14,485,943	CZK 26,856,938
770000001116	24,048,363	CZK 30,688,116
CZ0008044856	13,157,895	CZK 22,763,158
MT000006987	73,348	CZK 10,819,561

The total investment portfolio held by the Association has a value of CZK 343,089 thousand as of the financial statement date. thousand.

The activities of the CESNET Association are divided in accordance with the Statutes into two groups – Main and supplementary (economic) activities.



Economic Results in 2024

Core activities
Within the core activities, the Association continued building a qualitatively new CESNET e-infrastructure, which provides members of the Association and other entities meeting the terms of access to the CESNET network with a comprehensive set of services. In 2024, a subsidy of CZK 336,838 thousand was received for the operation of the e-infrastructure. An additional CZK 7,113 thousand of eligible project costs is recorded as an accrued item and will be settled against the project subsidy in 2025 (project identification code: LM2023054, provider: Ministry of Education, Youth and Sports).

Furthermore, the Association participated in international research projects under the Horizon 2020 and Horizon Europe programs, national projects supported by the Ministry of Education, Youth and Sports, the Technology Agency of the Czech Republic, the Ministry of the Interior, the Ministry of Culture, and projects of the CESNET Development Fund Council, as already mentioned in the previous section of the annual report.

The Association's core activities in 2024 ended with an accounting loss before tax of CZK 19,937 thousand. Revenues from the Association's core activities amounted to CZK 824,392 thousand, while expenses reached CZK 844,329 thousand.

Economic activities
The Association's economic activities in 2024 primarily consisted of holding a mostly bond portfolio of the Development Fund Council, formed from financial resources obtained from the sale of the commercial part of the CESNET network in 2000, and managing financial resources of other funds.

The Association's economic activities in 2024 ended with an accounting profit of CZK 24,907 thousand. Revenues from the Association's economic activities amounted to CZK 97,950 thousand, and expenses of the Association's economic activities amounted to CZK 73,043 thousand.

Total accounting and taxable economic result
The total accounting profit of the CESNET Association for 2024 before tax was CZK 4,970 thousand.

The tax base for income tax is determined from the accounting result adjusted for deductible and addable items in accordance with the Income Tax Act. The income tax base is reduced pursuant to Section 20, Paragraph 7 of the Income Tax Act. Funds obtained from tax reliefs are used to finance the core (non-economic) activities in accordance with the Association's statutes.

The total income tax base of the Association was CZK 11,897 thousand. The total corporate income tax for the Association for 2024 amounts to CZK 2,831 thousand, Resulting in a profit after tax of CZK 2,139 thousand.

In 2024, the profit or loss for the previous accounting period was settled. From the 2023 profit of CZK 5,881 thousand, CZK 2,715 thousand was allocated to funds and CZK 3,166 thousand was transferred to retained earnings from previous years.

Economic Results in 2024

Employees and personnel expenses
The average recalculated number of employees as of the balance sheet date was 240.4.

Of which:
Employees with an indefinite-term employment contract: 123.2
Employees with a fixed-term employment contract: 100.1
Employees under an agreement to perform work (DPČ): 17.1

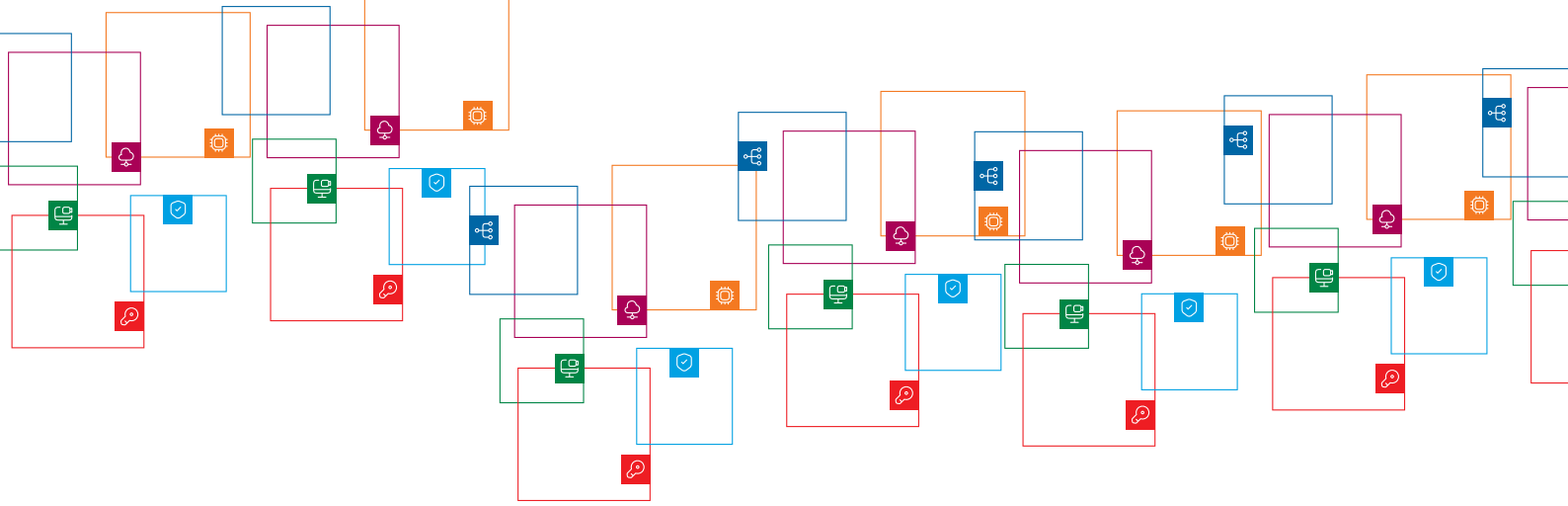
Breakdown of personnel expenses:
Wages..... CZK 268,824 thousand
Statutory social insurance.....CZK 89,557 thousand
Statutory social costs..... CZK 7,063 thousand
Other social costs.....CZK 2,878 thousand

Remuneration of members of the Association's bodies:
Board of Directors: ..... CZK 5,058 thousand
Supervisory Board: ..... CZK 1,109 thousand
CESNET Development Fund Council:.....CZK 843 thousand

Conclusion
In the past year, the CESNET Association responsibly and properly managed entrusted funds and fulfilled all its obligations arising from legislation, decisions of the Ministry of Education, Youth and Sports of the Czech Republic, and concluded contracts.

The auditing company BDO Audit s.r.o., located at V Parku 2316/12, Prague 4, Chodov, with authorization number KA ČR no. 018, conducted the audit verification of the annual financial statements.

All our accounting and financial practices are conducted transparently and in full compliance with the laws of the Czech Republic. We ensure that our financial management adheres to the principles of accountability and openness.



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