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EOSC Initiative in the Czech context

Matej Antol, Ph.D.

26.11.2024

Spolufinancováno Evropskou unií

MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY

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About me

- Principal Project Manager of the IPs EOSC CZ project
  - systemic, strategic project within the Open Science call
  - initiative creating national environment for FAIR research data
  - https://www.eosc.cz/
- CEO @ CERIT-SC, ICS MU
  - one of three partners of the national e-infrastructure e-INFRA CZ
  - www.cerit-sc.cz/
  - https://www.e-infra.cz/
- Research background
  - Analysis of complex, unstructured data
  - Faculty of Informatics, Masaryk university, CZ
  - https://disa.fi.muni.cz/complex-data-analysis

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In this presentation

- On value of research data
- EOSC CZ – two years in the making
- Czech National Data Infrastructure
- Glimpses at the first operational services
- What’s next

On value of research data

Thomas Cole, "Course of Empire: Destruction"

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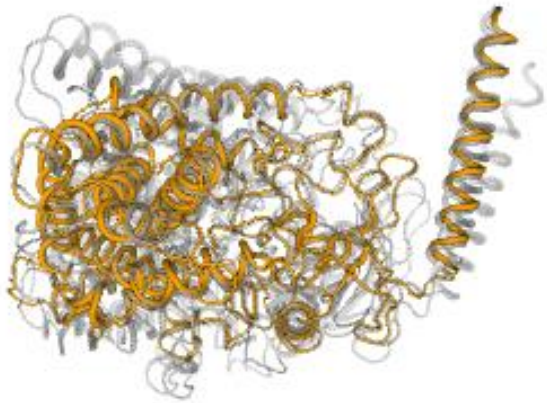
Chemistry, structural biology and life



- PDB (protein data bank) was **established in 1971**
  - **60.000 depositors**
  - **500.000 data entries**: experimentally obtained protein structures
- A couple of weeks ago, the **Nobel Prize for Chemistry** was awarded for computational protein design and protein structure prediction – AlphaFold.
  - We now have **200.000.000+ protein structures** available
- Both PDB and AFDB now **used by millions** for literally endless applications such as decomposing plastics and antibiotic resistance.

Ill. Niklas Elmehed © Nobel Prize Outreach
David Baker
Prize share: 1/2

Ill. Niklas Elmehed © Nobel Prize Outreach
Demis Hassabis
Prize share: 1/4

Ill. Niklas Elmehed © Nobel Prize Outreach
John M. Jumper
Prize share: 1/4

The Nobel Prize in Chemistry 2024 was divided, one half awarded to David Baker "for computational protein design", the other half jointly to Demis Hassabis and John M. Jumper "for protein structure prediction"

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Astronomy, physics and the universe

- **Since 2000**, The Sloan Digital Sky Survey (SDSS) collects data of galaxies
  - **More than 500 contributors** from 13 countries
  - **Millions of data entries**: 2.5 million galaxies and 400.000 quasars
- Its data helped prove the accelerating expansion of the universe, leading to the **Nobel Prize in Physics** in 2011 for the discovery of dark energy.
- Currently, it is a resource for over 10.000 scientific papers, and contributed to the discovery of over **500.000** new galaxies and **20.000** asteroids

© The Nobel Foundation. Photo: U. Montan

Saul Perlmutter

Prize share: 1/2

© The Nobel Foundation. Photo: U. Montan

Brian P. Schmidt

Prize share: 1/4

© The Nobel Foundation. Photo: U. Montan

Adam G. Riess

Prize share: 1/4

The Nobel Prize in Physics 2011 was divided, one half awarded to Saul Perlmutter, the other half jointly to Brian P. Schmidt and Adam G. Riess "for the discovery of the accelerating expansion of the Universe through observations of distant supernovae"

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Art, provenance, culture and history

- Getty Provenance Index (GPI) **exists since 1980**
  - Data from more than **50 institutions** worldwide, including museums, galleries, and auction houses, as well as individual collectors and research scholars.
  - **Over 1.5 million records**: over 300,000 individual works of art, 270,000 owners and 200,000 auction sales.
- **Significant impact on restitution efforts**, particularly for artworks looted during World War II, just as the painting called “The Polish Girl” by Jean-Baptiste Greuze
- Big impact on Art History and Provenance Research, supporting **over 1.000 scholarly publications**, spanning fields like art history, economics of the art market, cultural heritage studies, and legal research on restitution.

https://artuk.org/discover/artists/greuze-jean-baptiste-17251805

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EOSC CZ
two years in the making

People of EOSC CZ

Researchers, librarians, IT professionals, coordinators…

… taking action in designing and building EOSC CZ and the National Data Infrastructure.

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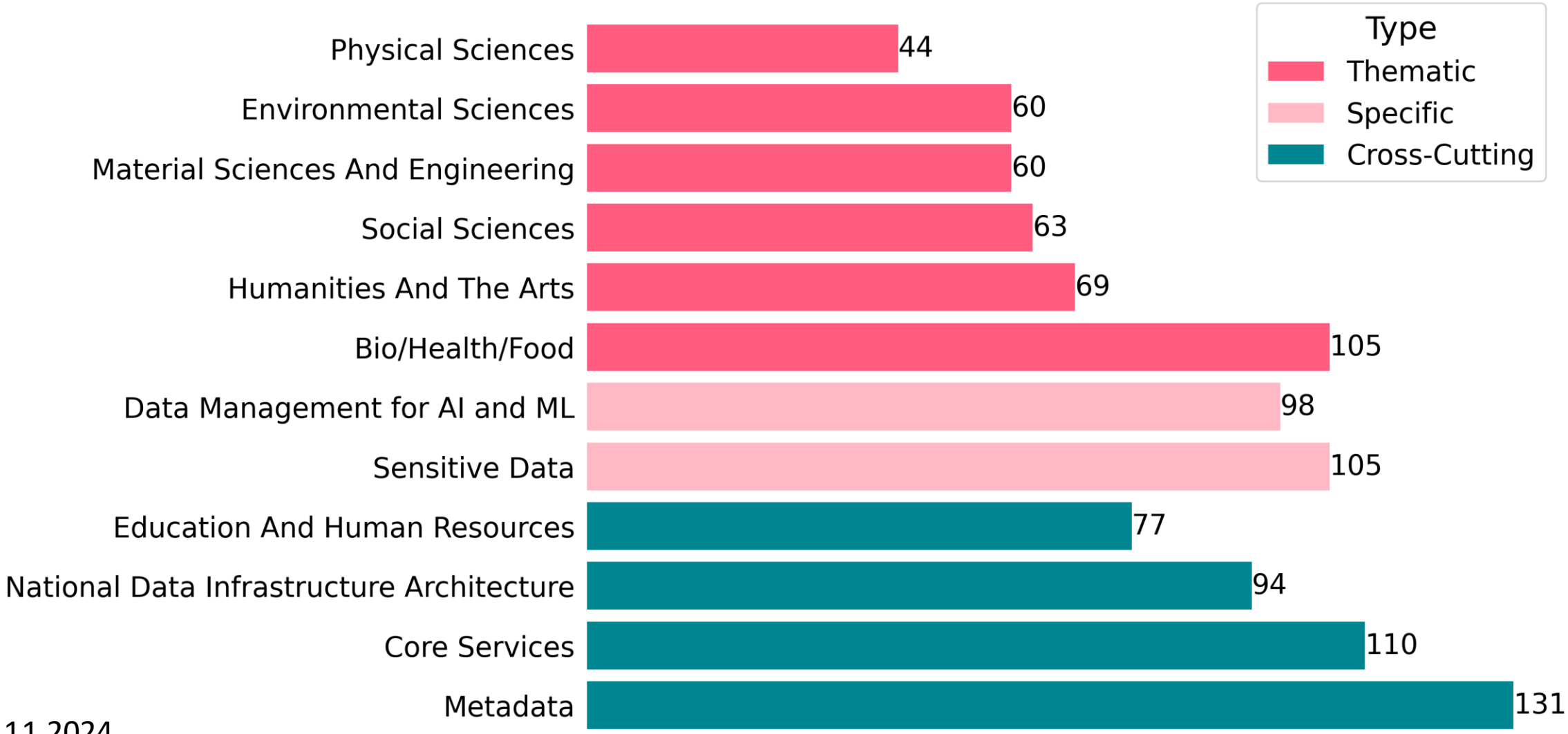
450+ people in EOSC CZ working groups



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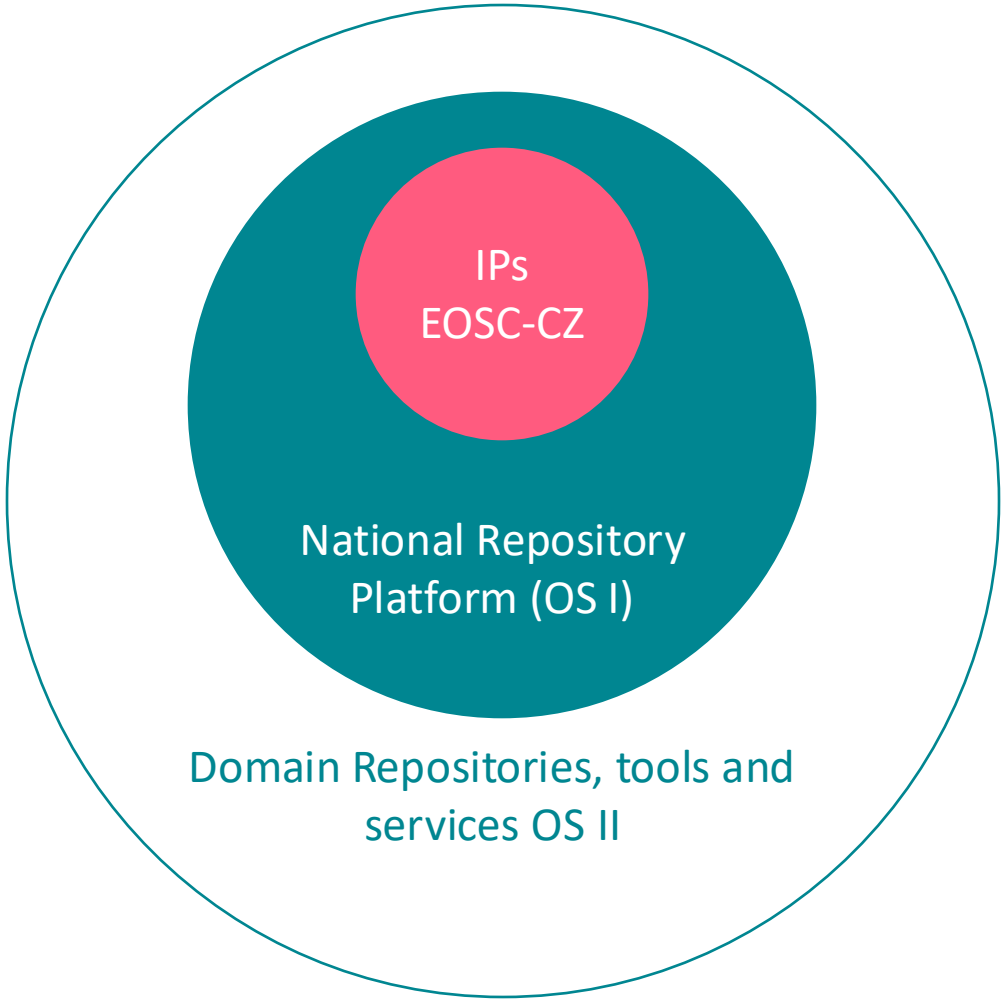

IPs EOSC-CZ (since 2023) – Fundamentals for EOSC implementation in CZ

- Organizational (**Secretariat**) – https://www.eosc.cz/en/secretariat
- Technical (**National Metadata Directory**) -- https://nma.eosc.cz/
- Knowledge and skills (**Training Centre**) -- https://www.eosc.cz/en/training-centre

National repository Platform (OS I, since 2024) – "technical core"

- **Repository platforms** (dspace, cesnet invenio, asep arl) (50+ PB user capacity)
- First **exemplary repositories**
- **Core services** (PIDs, DSW, licenses, …)
- **Compliance** and UX (cybersecurity, ServiceDesk, …)
- **Training** – technical side of things

OS II (since 2025) – "domain specifics"

- Under preparation, content not clear yet
- **Based on expertise of the 8 thematic / discipline workgroups**
    - Bio/Health/Food, Matech, AI & ML, Social Sciences, Physics, Humanities & Arts, Enviro, Sensitive Data
    - see https://www.eosc.cz/en/working-groups

OS III (since 2026?)

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Conferences, workshops and community meetups

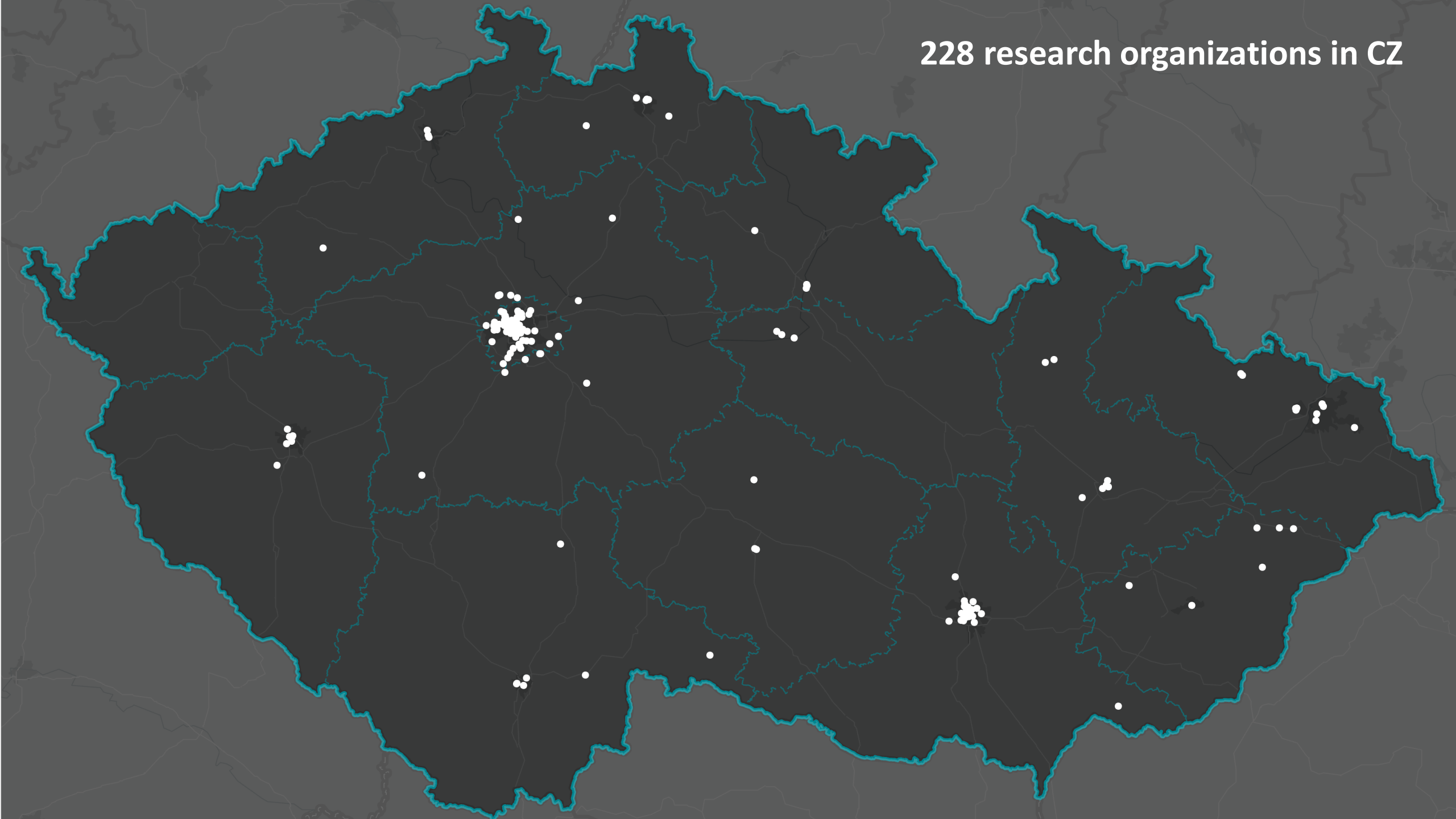
- **21 trainings** and workshops
  - ca **3.000 registrations** from ca 90 research institutions

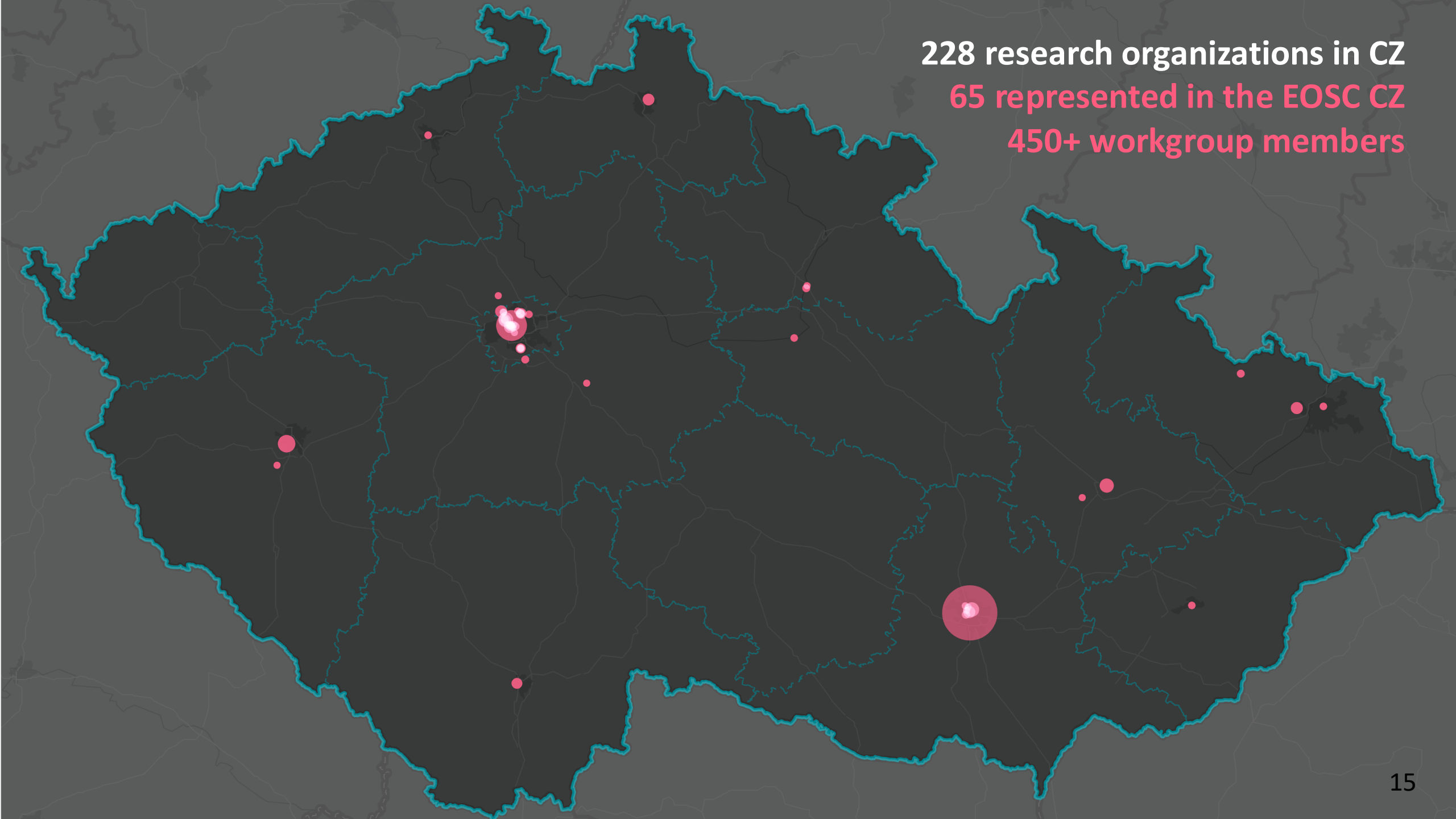
- **3 Conferences** with hundred+ attendees
  - 150 visitors of this conference present + more than 150 online

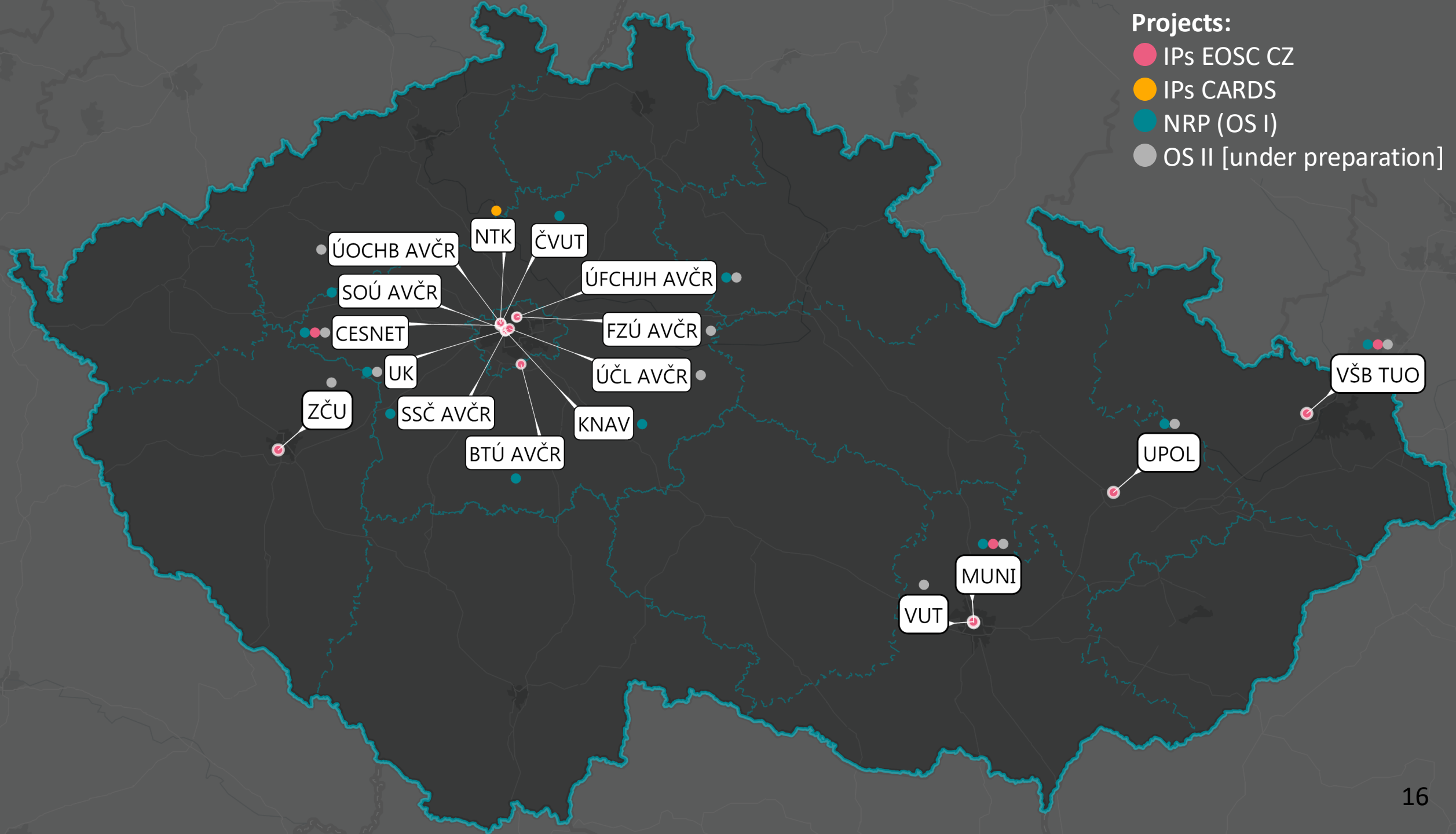
- **31 Physical meetings** of communities and working groups
  - 3 roadshow in Prague, Brno and Ostrava
  - 5 EOSC CZ Networking events – bringing EOSC CZ to the universities in České Budějovice, Liberec, Olomouc, planned trips to Zlín and AV ČR

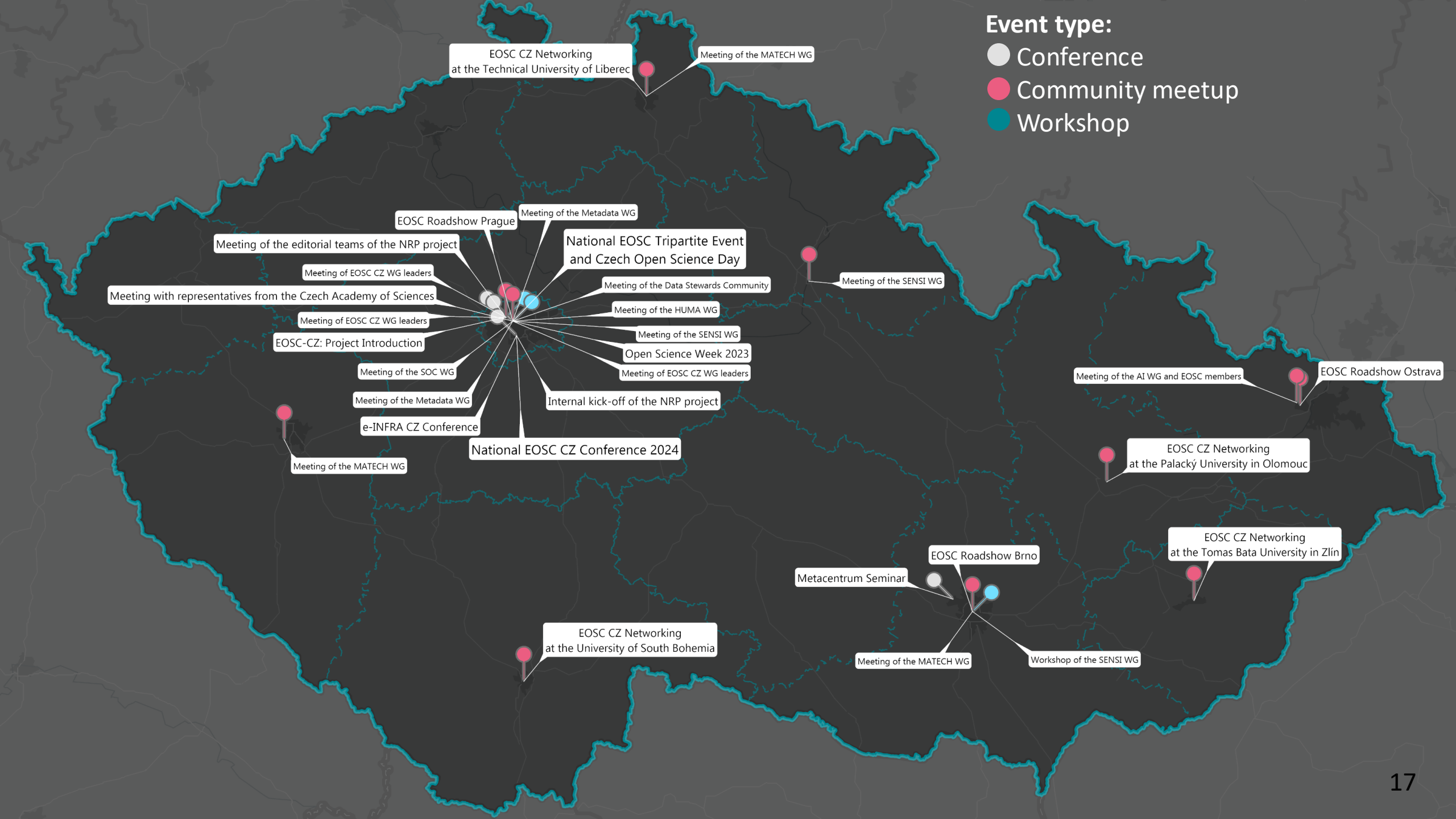
  + over 100 online working group meetings

- **Thousands people continuously in touch**
  - 300+ followers on social networks
  - 300+ EOSC newsletter subscribers
  - 3.000+ views of content on YouTube


228 research organizations in CZ


228 research organizations in CZ
65 represented in the EOSC CZ
450+ workgroup members


Projects:
IPs EOSC CZ
IPs CARDS
NRP (OS I)
OS II [under preparation]
NTK
ČVUT
ÚOCHB AVČR
ÚFCHJH AVČR
SOÚ AVČR
CESNET
FZÚ AVČR
UK
ÚČL AVČR
ZČU
SSČ AVČR
KNAV
BTÚ AVČR
VŠB TUO
UPOL
MUNI
VUT


Event type:
Conference
Community meetup
Workshop
EOSC CZ Networking at the Technical University of Liberec
Meeting of the MATECH WG
EOSC Roadshow Prague
Meeting of the Metadata WG
National EOSC Tripartite Event and Czech Open Science Day
Meeting of the editorial teams of the NRP project
Meeting of EOSC CZ WG leaders
Meeting with representatives from the Czech Academy of Sciences
Meeting of EOSC CZ WG leaders
EOSC-CZ: Project Introduction
Meeting of the SOC WG
Meeting of the Metadata WG
e-INFRA CZ Conference
Meeting of the MATECH WG
National EOSC CZ Conference 2024
Internal kick-off of the NRP project
Meeting of the Data Stewards Community
Meeting of the HUMA WG
Meeting of the SENSI WG
Open Science Week 2023
Meeting of EOSC CZ WG leaders
Meeting of the SENSI WG
Meeting of the AI WG and EOSC members
EOSC Roadshow Ostrava
EOSC CZ Networking at the Palacký University in Olomouc
EOSC CZ Networking at the Tomas Bata University in Zlín
EOSC Roadshow Brno
Metacentrum Seminar
Meeting of the MATECH WG
Workshop of the SENSI WG
EOSC CZ Networking at the University of South Bohemia

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Shaping the European development





- Notable engagement of Czech professionals
  - 14 Czech members in the **EOSC Association Task Forces**
    - 2 Czech Co-Chairs: Jiří Marek and Petr Holub
  - Members in the **Opportunity Area Expert Groups**: Miroslav Ruda, Marek Cebecauer and others
  - **EOSC Executive Board** (2019 – 2020), **EOSC Steering Board** Vice Co-Chair (since 2023) and **Tripartite group:** Jan Hrušák

- Development of the infrastructure
  - CESNET – subcontractor in LOT 1 and LOT 3 **developing EOSC EU Node**
  - Regular contribution and consultations to the **EOSC Association activities**:

    SRIA and MAR, Federation Handbook, EOSC Nodes survey, EOSC Symposium, etc.
  - Participation in the INFRAEOSC projects (Horizon Europe), **OSCARS, BEYOND, ENTRUST, AARC TREE, CRAFT-OA** (**EOSC United** – submitted)

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The Czech National Data Infrastructure

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Infrastructure components

- **Repository platform**
  - Number of platforms -- CESNET Invenio, Clarin-DSpace, ASEP ARL
  - Total of 50+ PB of user data storage capacity
  - Offered to research communities to create and operate specific repositories

- **Services**
  - Support for Data Management Planning
  - Support for persistent identifiers
  - AAI
  - FAIRificator
  - Interfaces to computing environments for analysis
  - Data and objects search and discovery
  - Monitoring
  - Support for metadata

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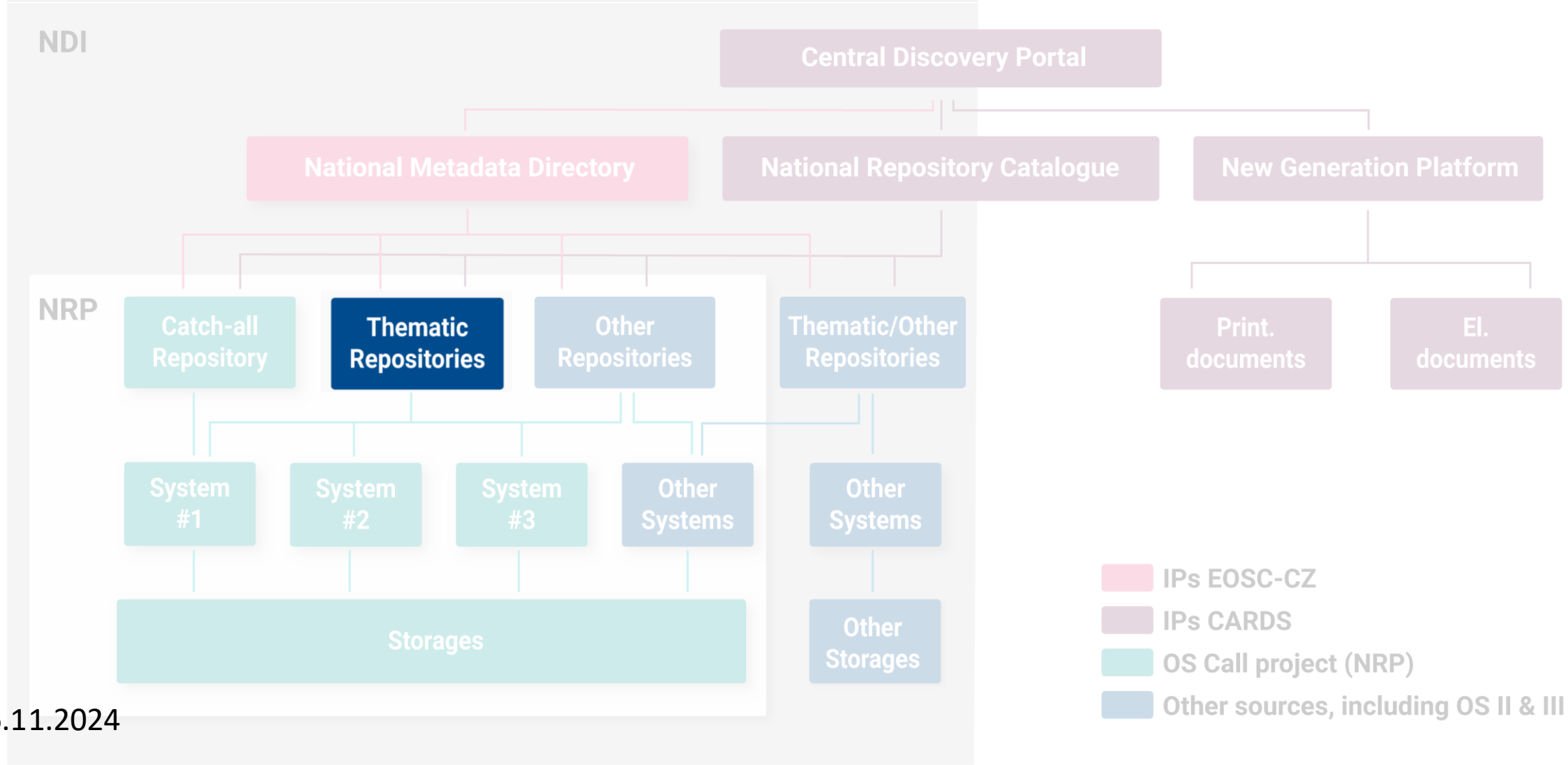
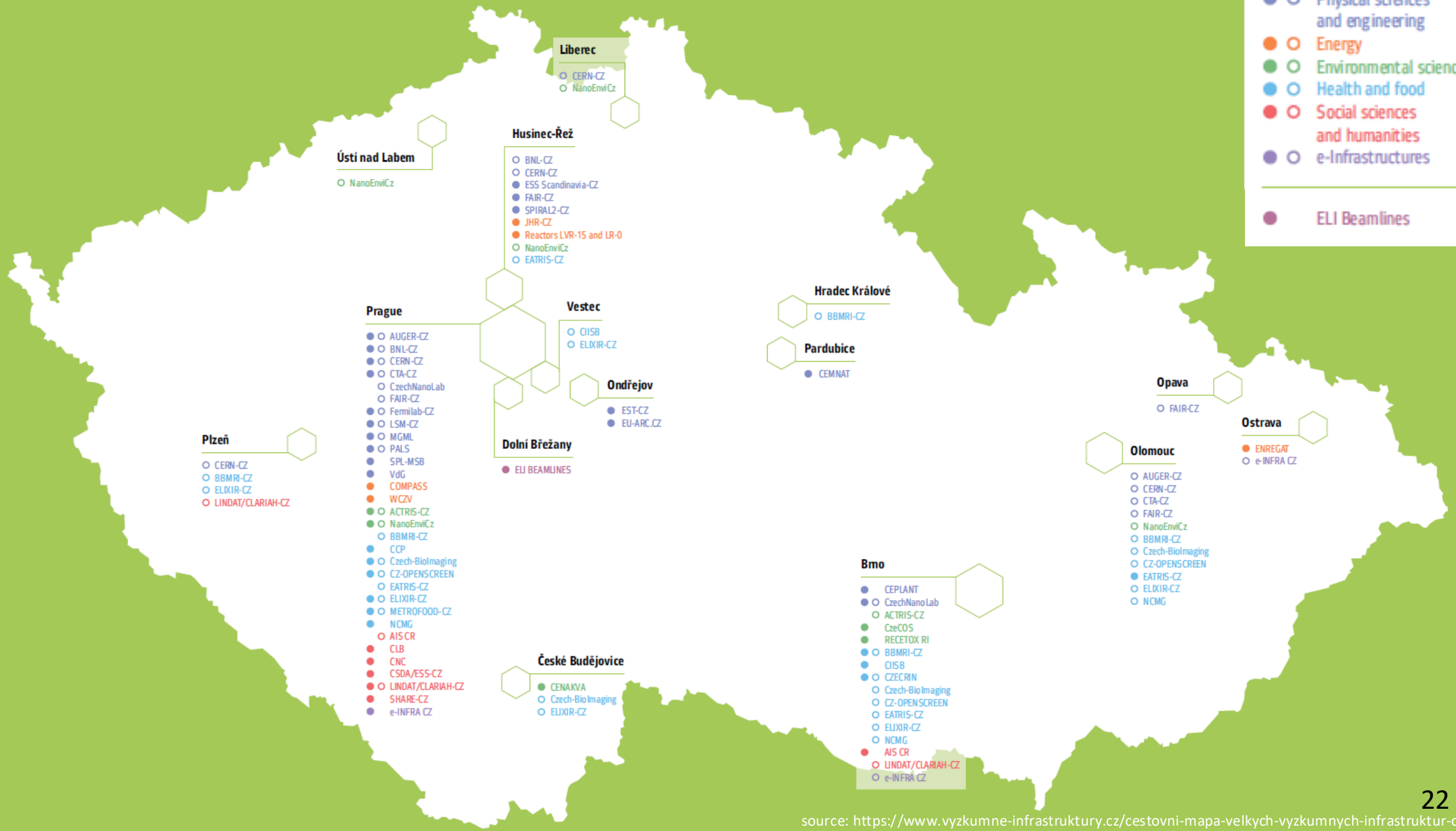
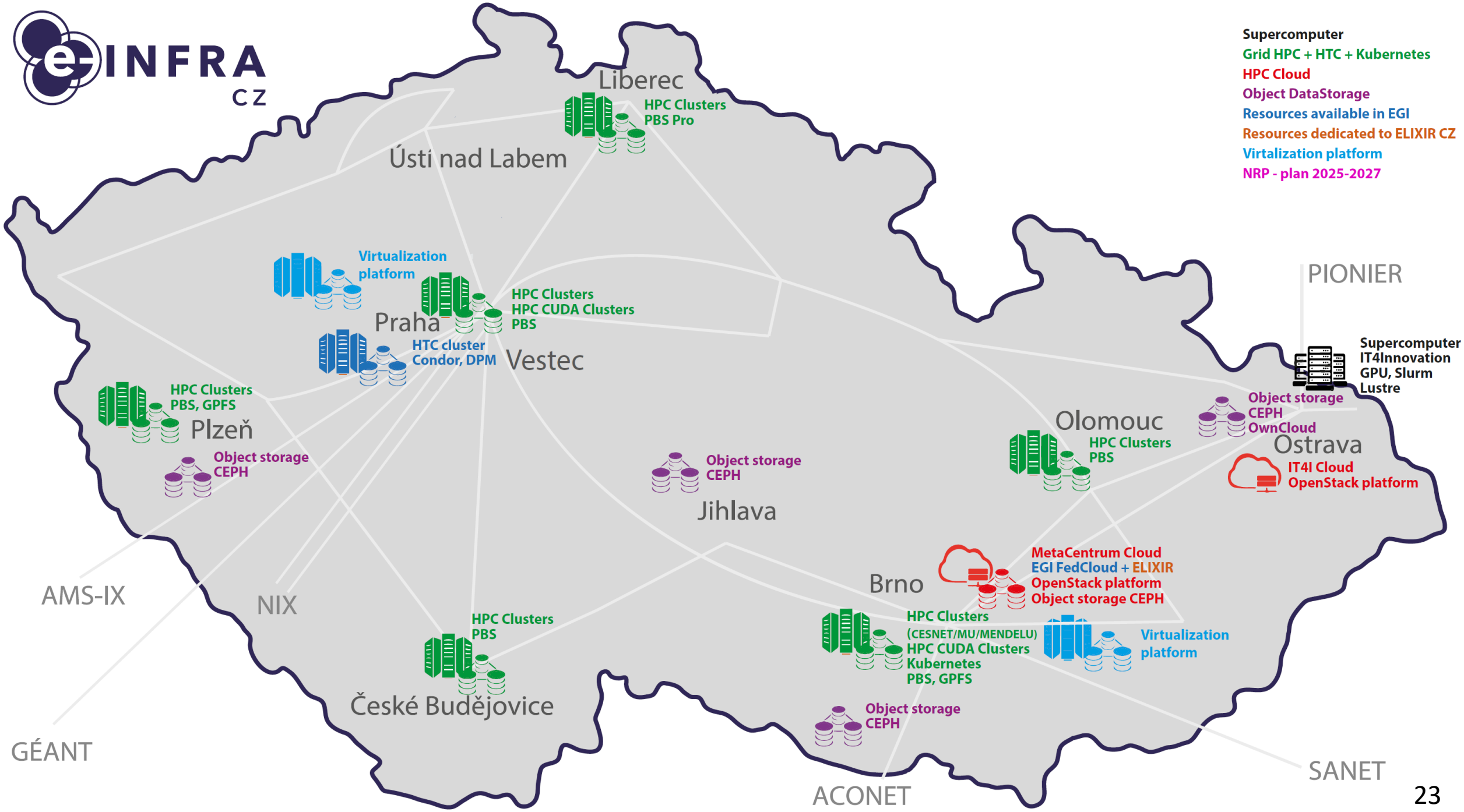
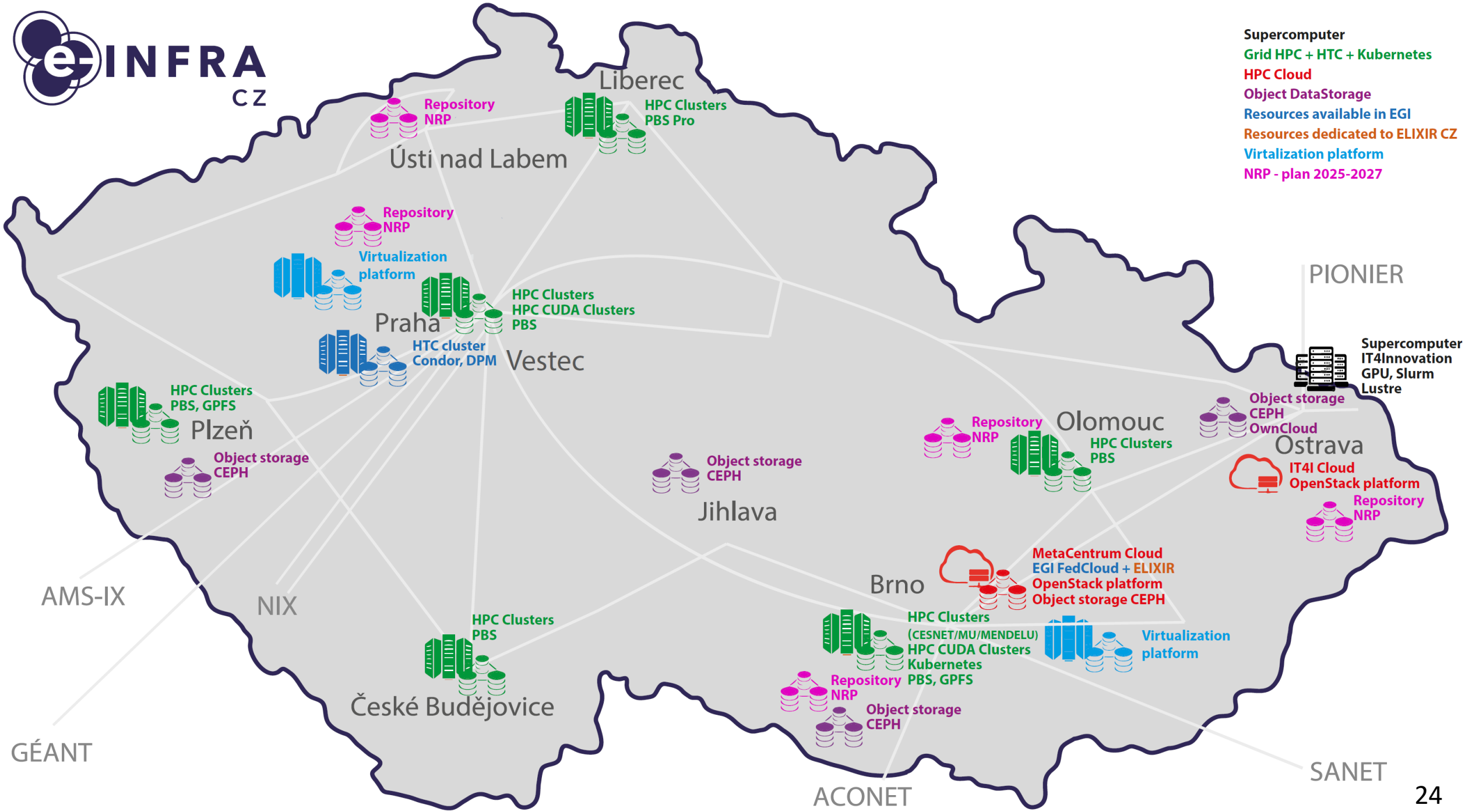
National Data Infrastructure (NDI)





source: https://www.vyzkumne-infrastruktury.cz/cestovni-mapa-velkych-vyzkumnych-infrastruktur-cr/


e-INFRA CZ
Supercomputer
Grid HPC + HTC + Kubernetes
HPC Cloud
Object DataStorage
Resources available in EGI
Resources dedicated to ELIXIR CZ
Virtalization platform
NRP - plan 2025-2027
Liberec
HPC Clusters
PBS Pro
Ústi nad Labem
Virtualization platform
HPC Clusters
HPC CUDA Clusters
PBS
Praha
HTC cluster
Condor, DPM
Vestec
PIONIER
Supercomputer
IT4Innovation
GPU, Slurm
Lustre
HPC Clusters
PBS, GPFS
Plzeň
Object storage
CEPH
Object storage
CEPH
OwnCloud
Olomouc
HPC Clusters
PBS
Ostrava
IT4I Cloud
OpenStack platform
Object storage
CEPH
Jihlava
MetaCentrum Cloud
EGI FedCloud + ELIXIR
OpenStack platform
Object storage CEPH
Brno
HPC Clusters
(CESNET/MU/MENDELU)
HPC CUDA Clusters
Kubernetes
PBS, GPFS
Virtualization platform
AMS-IX
NIX
HPC Clusters
PBS
České Budějovice
Object storage
CEPH
GÉANT
SANET
ACONET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Supercomputer
Grid HPC + HTC + Kubernetes
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Liberec
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Repository
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Virtualization
platform
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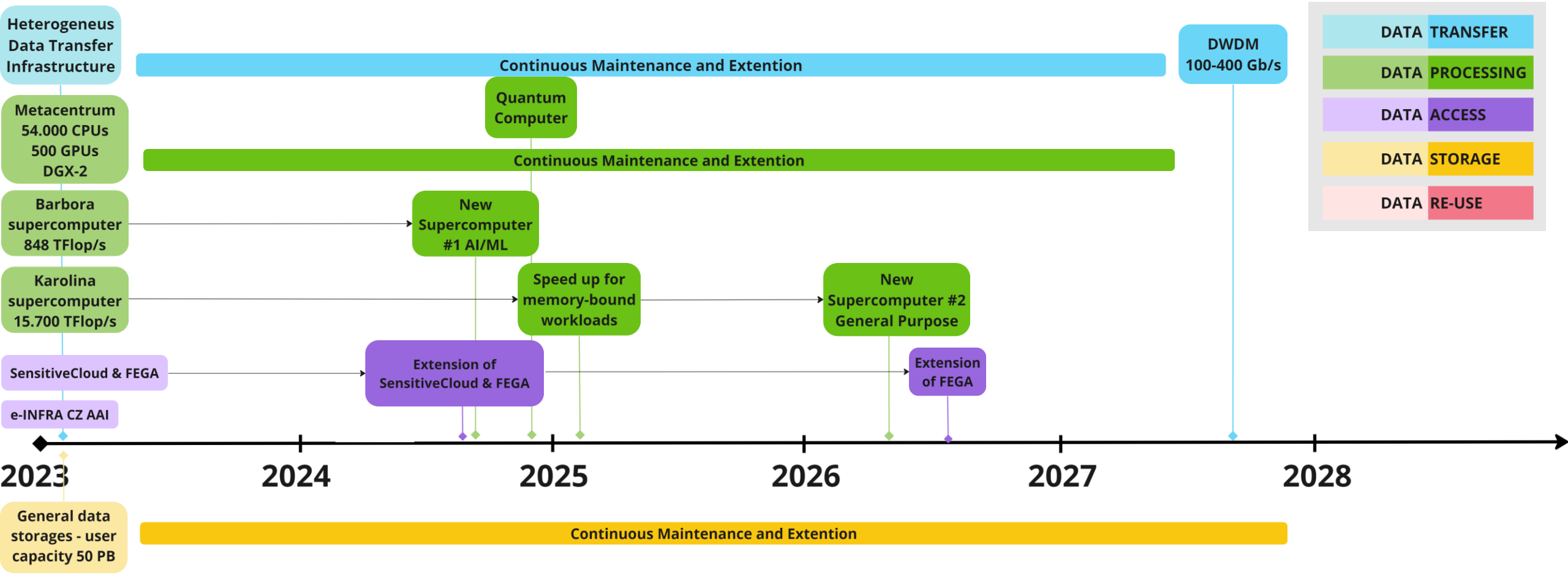
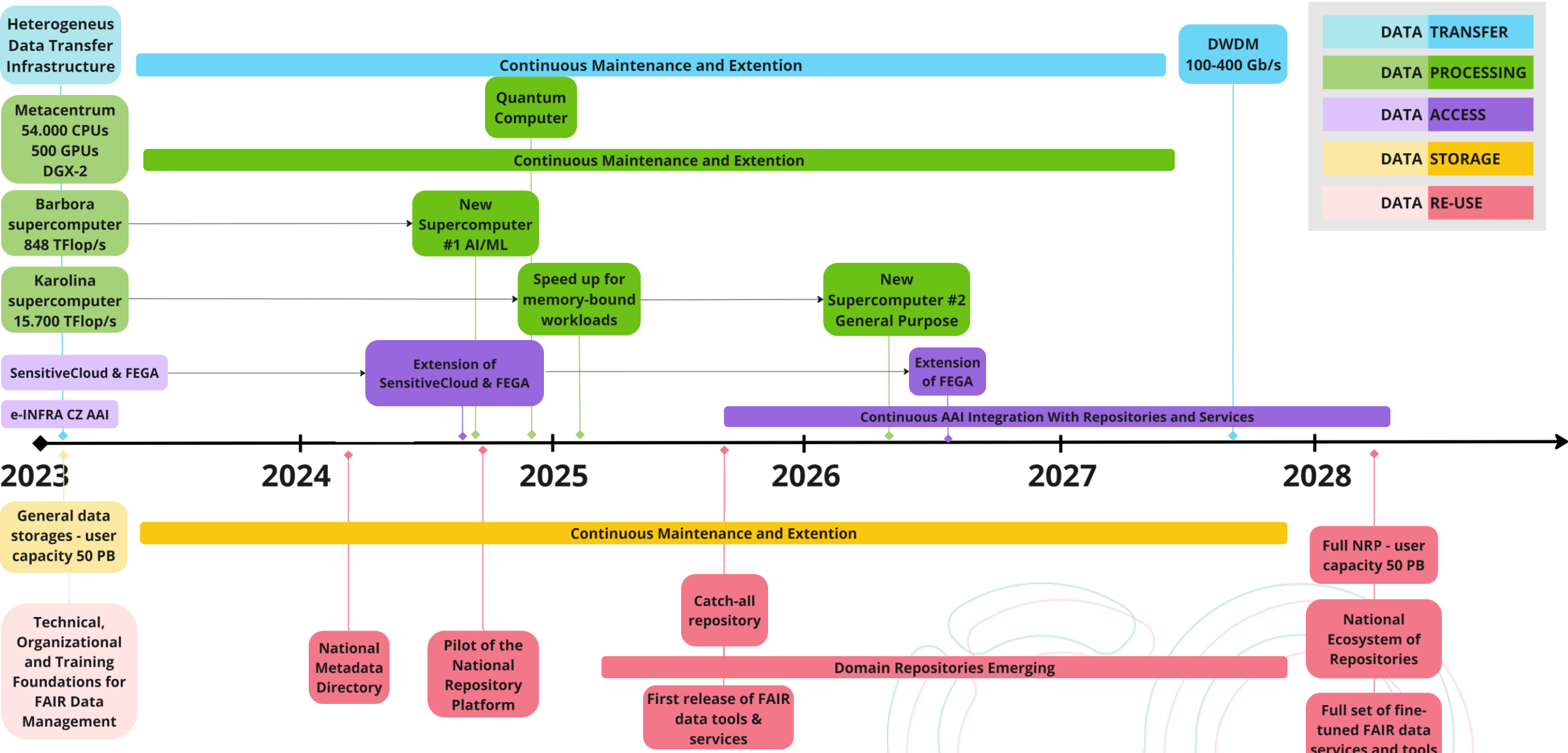
HPC CUDA Clusters
PBS
Praha
HTC cluster
Condor, DPM
Vestec
PIONIER
Supercomputer
IT4Innovation
GPU, Slurm
Lustre
HPC Clusters
PBS, GPFS
Plzeň
Object storage
CEPH
Object storage
CEPH
Jihlava
Repository
NRP
Olomouc
HPC Clusters
PBS
Object storage
CEPH
OwnCloud
Ostrava
IT4I Cloud
OpenStack platform
Repository
NRP
AMS-IX
NIX
MetaCentrum Cloud
EGI FedCloud + ELIXIR
OpenStack platform
Object storage CEPH
Brno
HPC Clusters
(CESNET/MU/MENDELU)
HPC CUDA Clusters
Kubernetes
PBS, GPFS
Virtualization
platform
Repository
NRP
Object storage
CEPH
HPC Clusters
PBS
České Budějovice
GÉANT
ACONET
SANET


Heterogeneus Data Transfer Infrastructure
Continuous Maintenance and Extention
DWDM 100-400 Gb/s
Quantum Computer
Metacentrum 54.000 CPUs 500 GPUs DGX-2
Continuous Maintenance and Extention
Barbora supercomputer 848 TFlop/s
New Supercomputer #1 AI/ML
Karolina supercomputer 15.700 TFlop/s
Speed up for memory-bound workloads
New Supercomputer #2 General Purpose
SensitiveCloud & FEGA
Extension of SensitiveCloud & FEGA
Extension of FEGA
e-INFRA CZ AAI
2023
2024
2025
2026
2027
2028
General data storages - user capacity 50 PB
Continuous Maintenance and Extention
DATA TRANSFER
DATA PROCESSING
DATA ACCESS
DATA STORAGE
DATA RE-USE


DATA TRANSFER
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Extension of FEGA
e-INFRA CZ AAI
Continuous AAI Integration With Repositories and Services
2023
2024
2025
2026
2027
2028
General data storages - user capacity 50 PB
Continuous Maintenance and Extention
Full NRP - user capacity 50 PB
Technical, Organizational and Training Foundations for FAIR Data Management
National Metadata Directory
Pilot of the National Repository Platform
Catch-all repository
National Ecosystem of Repositories
Domain Repositories Emerging
First release of FAIR data tools & services
Full set of fine-tuned FAIR data services and tools

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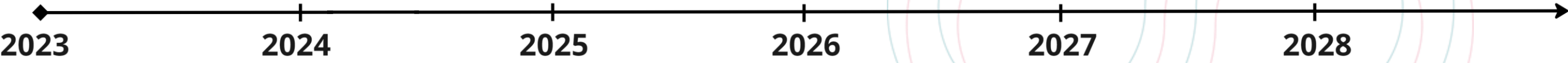
Nearing the end of the first phase

Phase 1

- **Engage Czech researchers** and professionals
- **Organize** the work groups and communities
- **Kick-off 3 major projects**
- **Design** the core infrastructure and services
- **Release first** services
- **Increase awareness**



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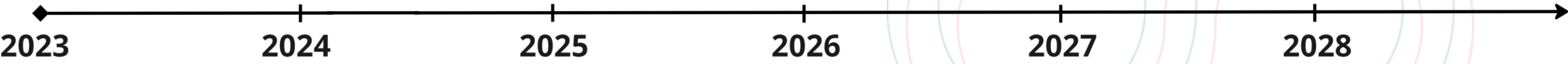
Beginning the second phase

Phase 1

- **Engage Czech researchers** and professionals
- **Organize** the work groups and communities
- **Kick-off 3 major projects**
- **Design** the core infrastructure and services
- **Release first** services
- **Increase awareness**

Phase 2

- **Deploy the infrastructure**
- **Deploy all the core services**
- Integrate and deploy **first repositories**
- Support the uptake of data management **skills and know-how**
- **Integrate** the national and international ecosystem
- Propose the **sustainability** model



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Glimpses at the first operational services for FAIR research data management

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National “catch-all pilot” Repository

Měření průměrné teploty v Praze: vzorový detailní záznam

Licence:

Soubory:

research_data_sample_test.xlsx
Tabulka

Identifikátor objektu:

DOI 10.48700/datst.7n287-zc761

Stav záznamu:
Veřejný

V komunitě:
General community

Překlad názvu: angličtina Average temperature measurement in Prague: example of detailed record

Tvůrci: Vyčítalová, Hana || Černohlávková, Petra (manažer dat)

Datum zveřejnění: 2022-01-03

Datum vytvoření datové sady: 2018-07-01/2018-07-25

Datum sběru dat: 2018-04-01/2018-06-30

Jazyk: čeština, angličtina

Vydavatel: Národní technická knihovna

Klíčová slova: cs teplota | cs klima | cs Praha | cs Česká republika

Oborové kategorie: Přírodní vědy || Vědy o Zemi a související environmentální vědy || Meteorologie, vědy o atmosféře || Výzkum klimatu

Abstrakt: čeština | angličtina

> Měření průměrné teploty v Praze (hlavní město České republiky) během dubna, května a června 2018.

Metodologie: čeština

> Teplota byla měřena každou hodinu a z hodnot byla vypočítána průměrná denní teplota.

Technické informace: čeština

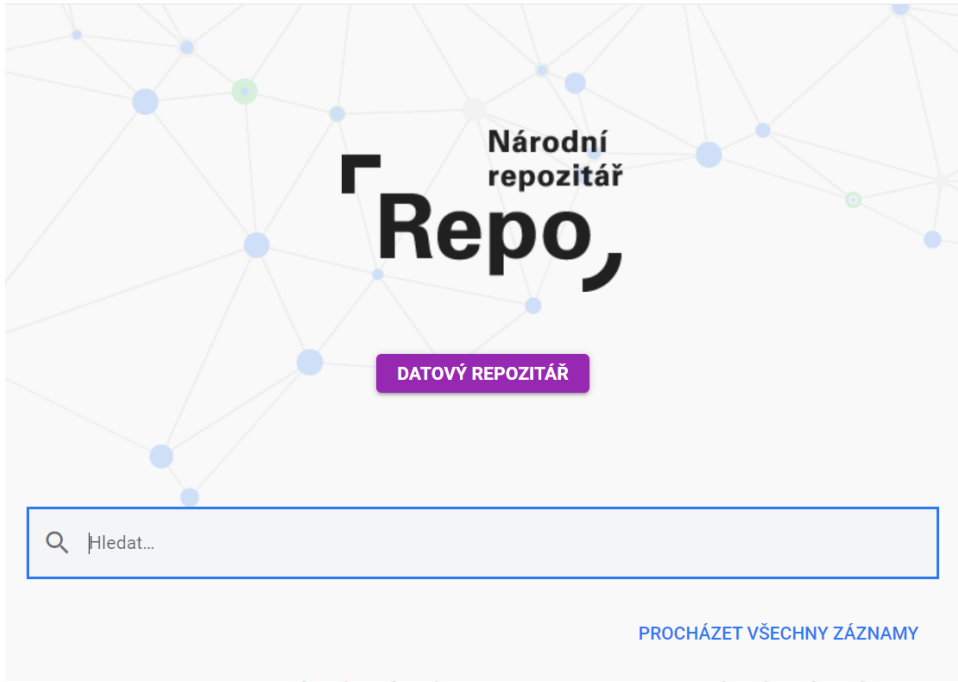
> K zaznamenání byl použit měřicí přístroj, hodnoty byly zaznamenány ve stupních Celsia. Hodnoty byly zpracovány pomocí excelové tabulky. Zobrazení dat nevyžaduje speciální software.

Poznámky:

Vazby na/z dalších zdrojů:
Název: Collecting Grey Literature – Institutional Repository versus National Aggregator | **Autoři:** Černohlávková, Petra; Vyčítalová, Hana | **Rok:** 2018 | **DOI:** 10.26069/greynet-2018-000.009-gg

Projekt: ID34F57 | Evropská agentura pro životní prostředí

Práva: Creative Commons Uveďte původ 4.0 Mezinárodní licence



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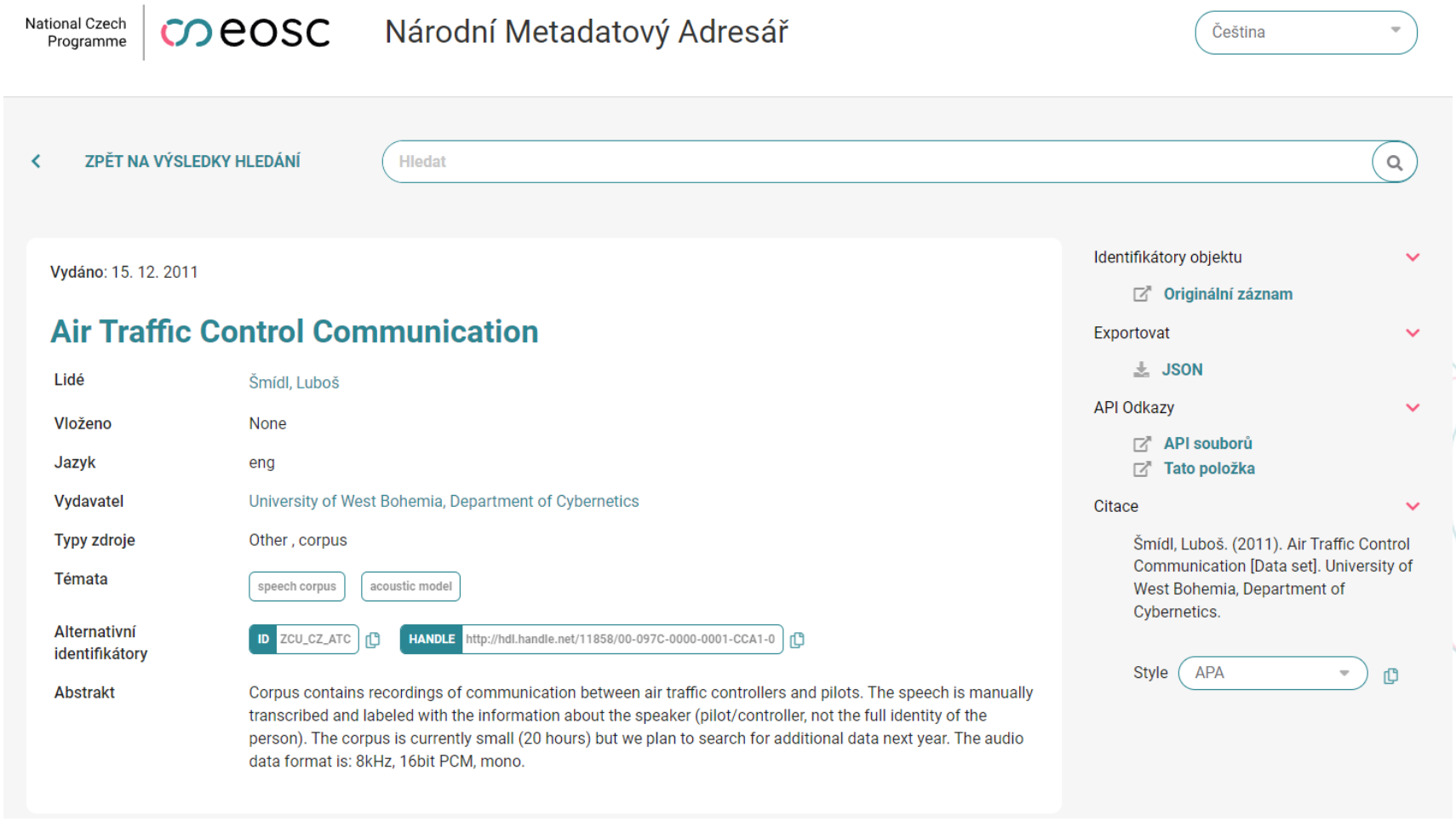
National Metadata Directory

- **Single point of contact** for research data – uniform format and metadata



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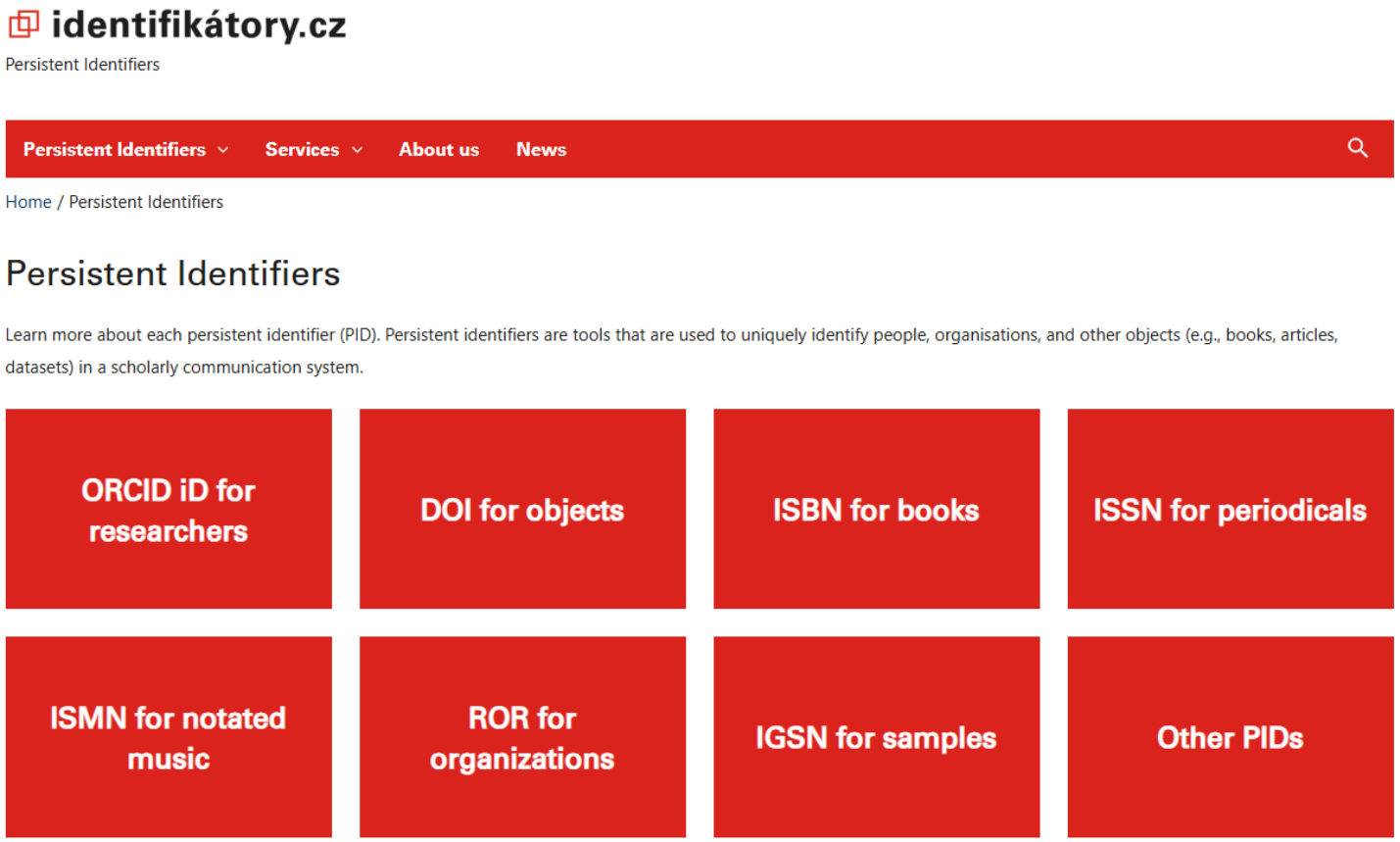
Identifikátory CZ – Portal for Persistent Identifiers



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SensitiveCloud

Environment for processing sensitive data

- Virtual desktop
- Computing resources
- Secure applications
- Storing, sharing and cooperation
- VPN, Kubernetes

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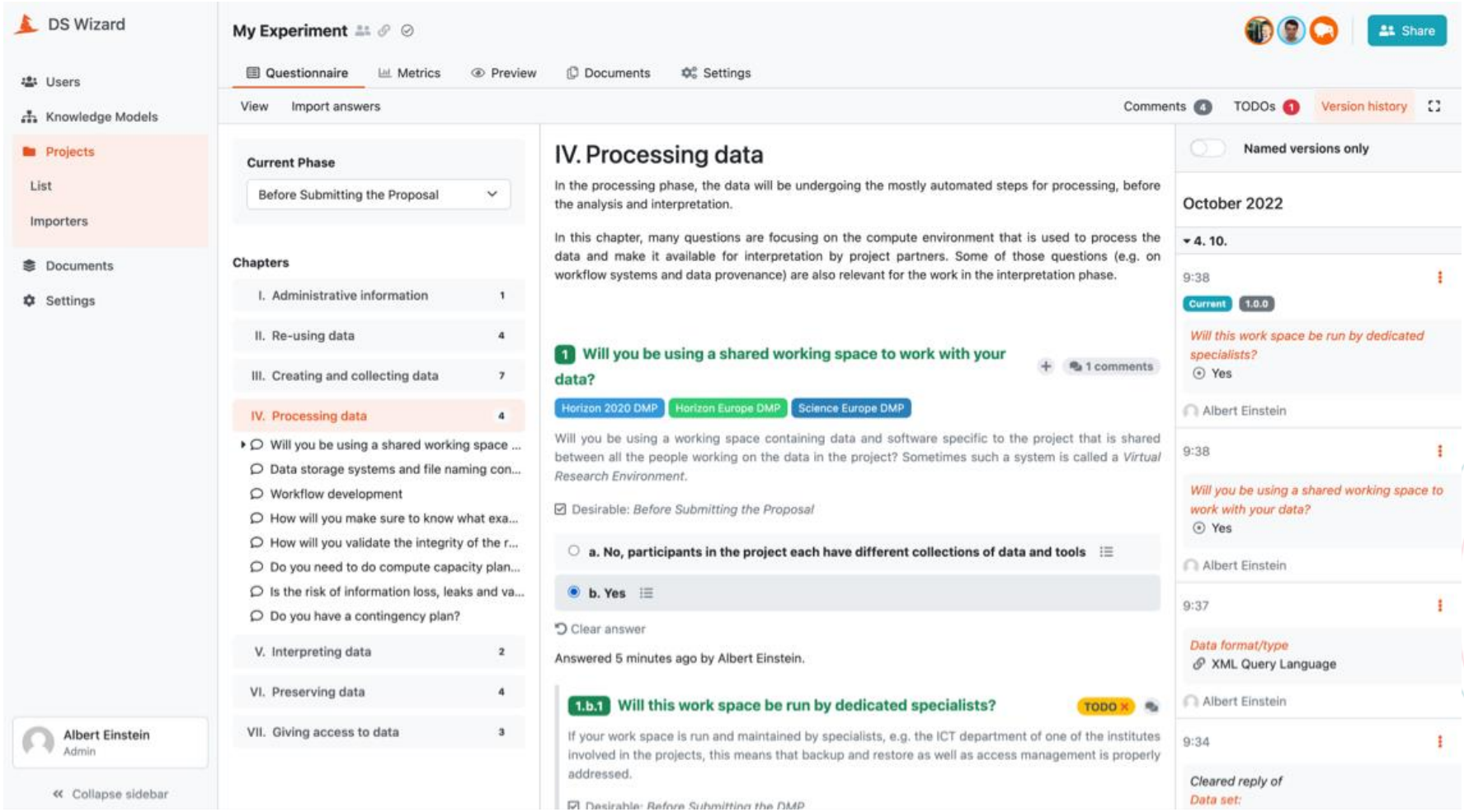
Data Stewardship Wizard



- Comprehensive Tool for Data Management Planning

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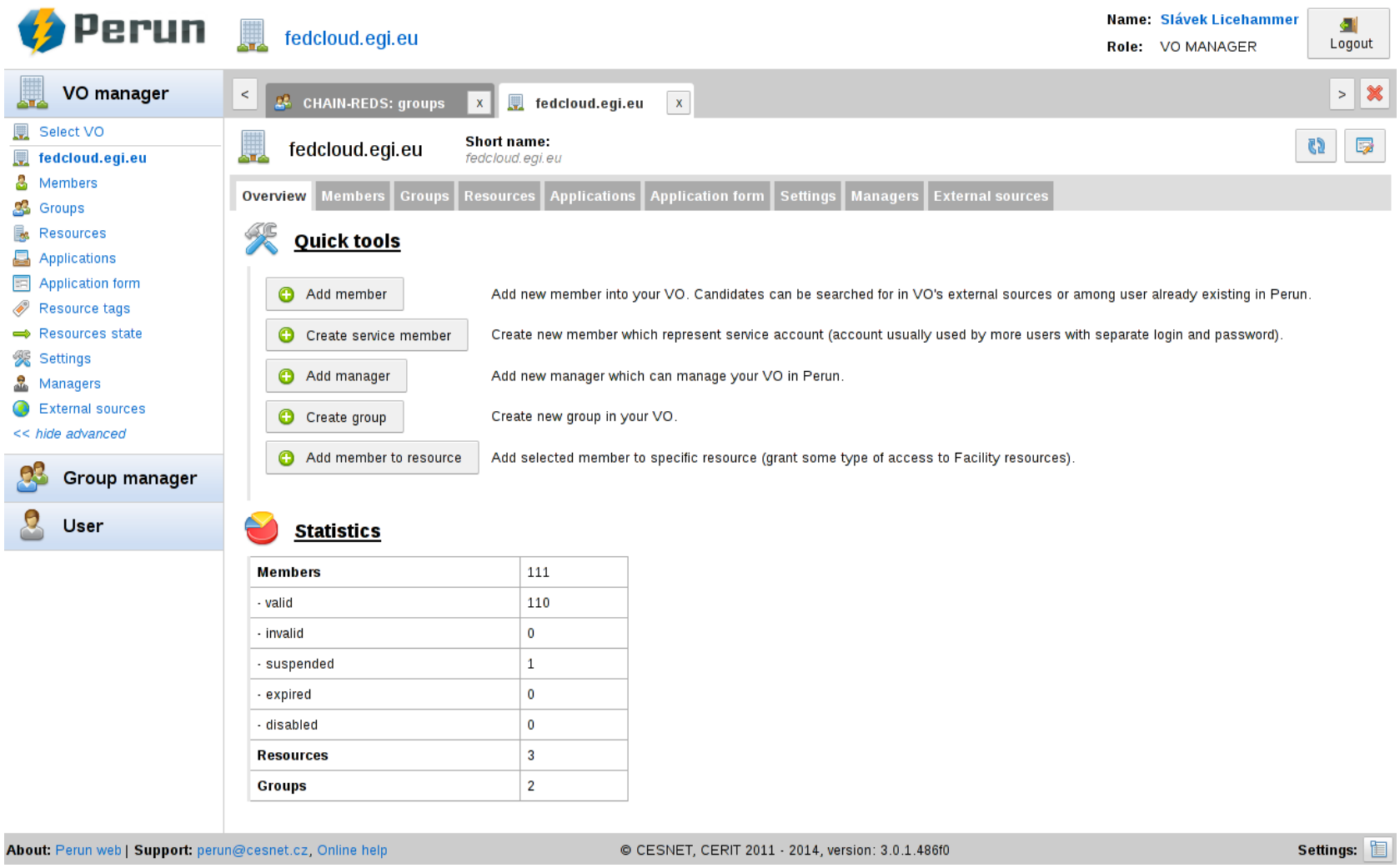
Authentication and authorization infrastructure (AAI)



To allow users from different institutions easy access to data and services.

- Access and identity management
- Management of groups and roles
- Rights' delegation
- System integration

What’s next

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In 2025...

Infrastructure

- Installation of **first hardware for repositories**
- Emergence of **first and pilot repositories**
- National Repository Catalogue

Services

- First versions of all major core services, including
  - Repository platforms
  - FAIR Implementation Profile Wizard
  - Data Stewardship Wizard
  - License management
  - AAI for repositories

  … and more

Events

- National Tripartite Event
- Data Steward Summer School

  … trainings, workshops, seminars, conferences, …

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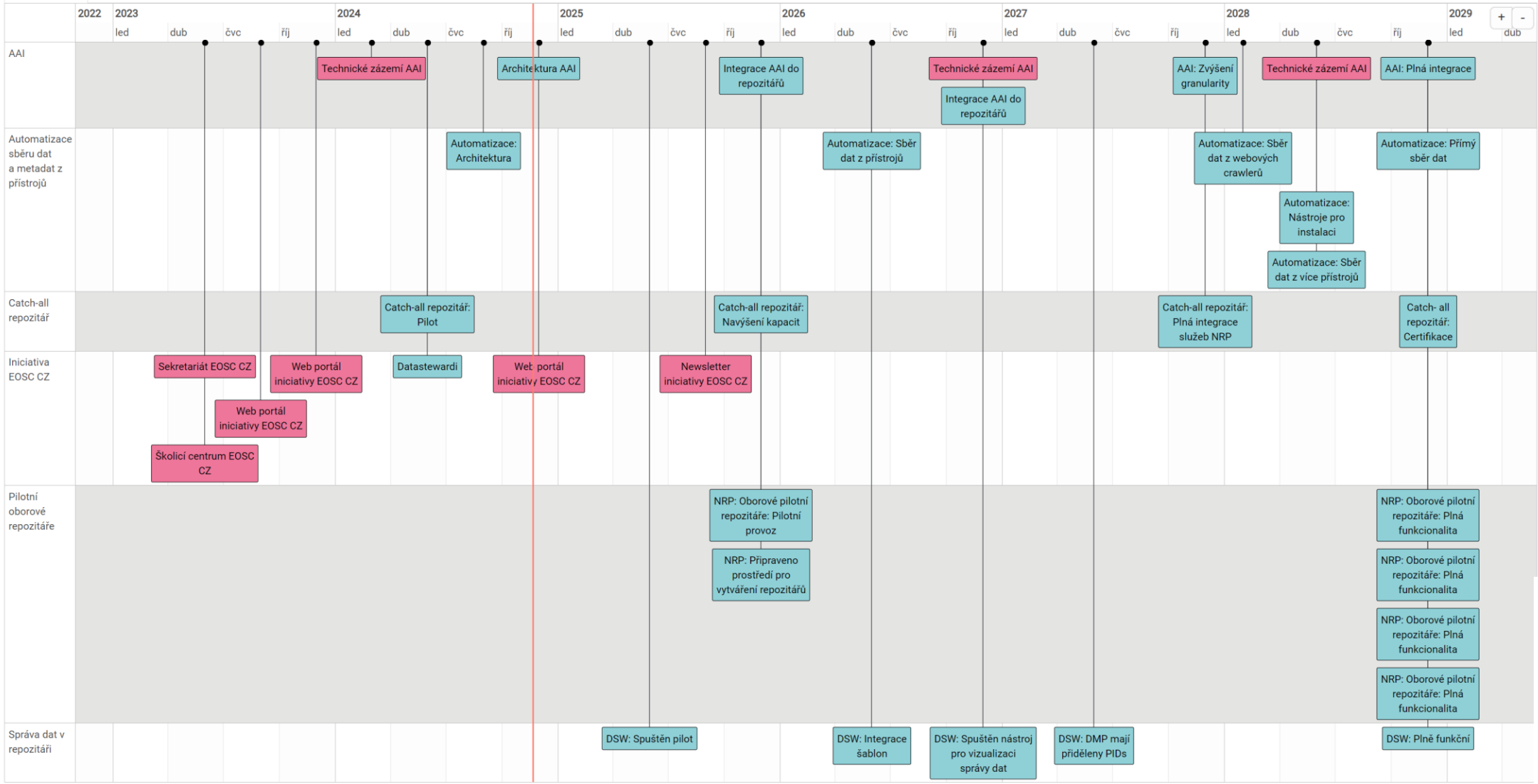
Časová osa | Tabulka



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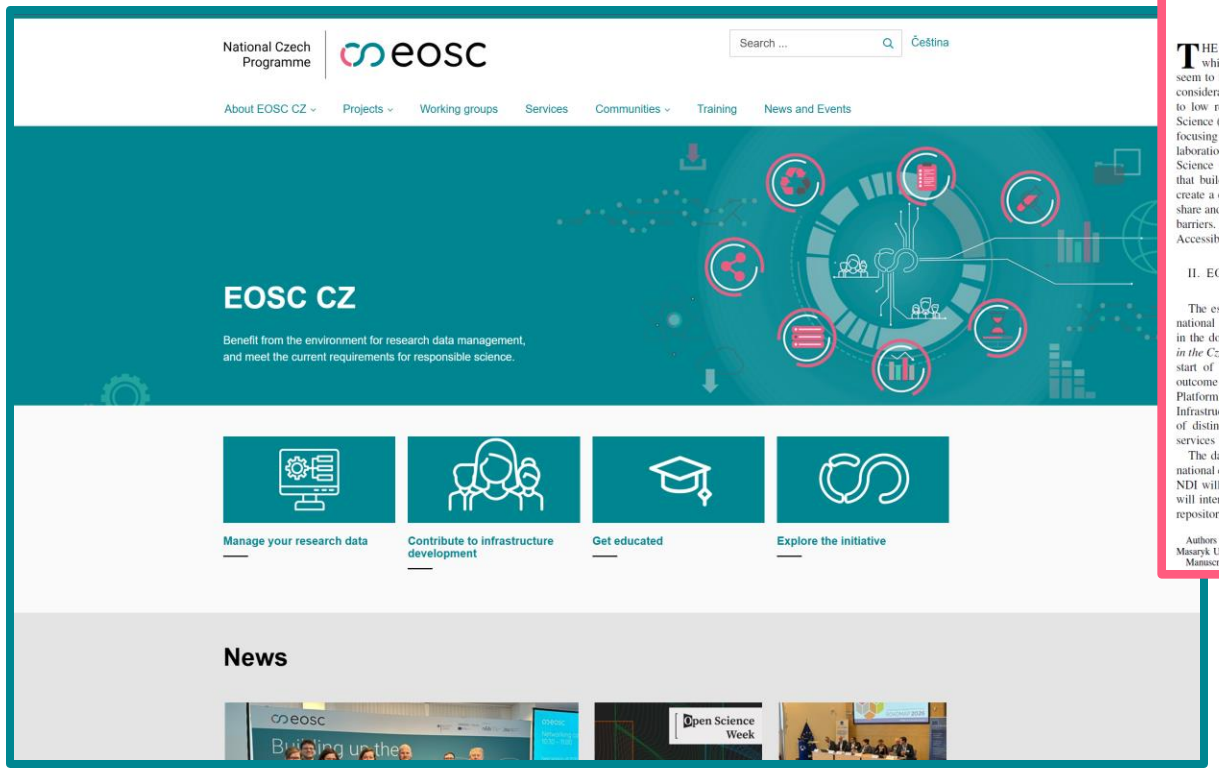

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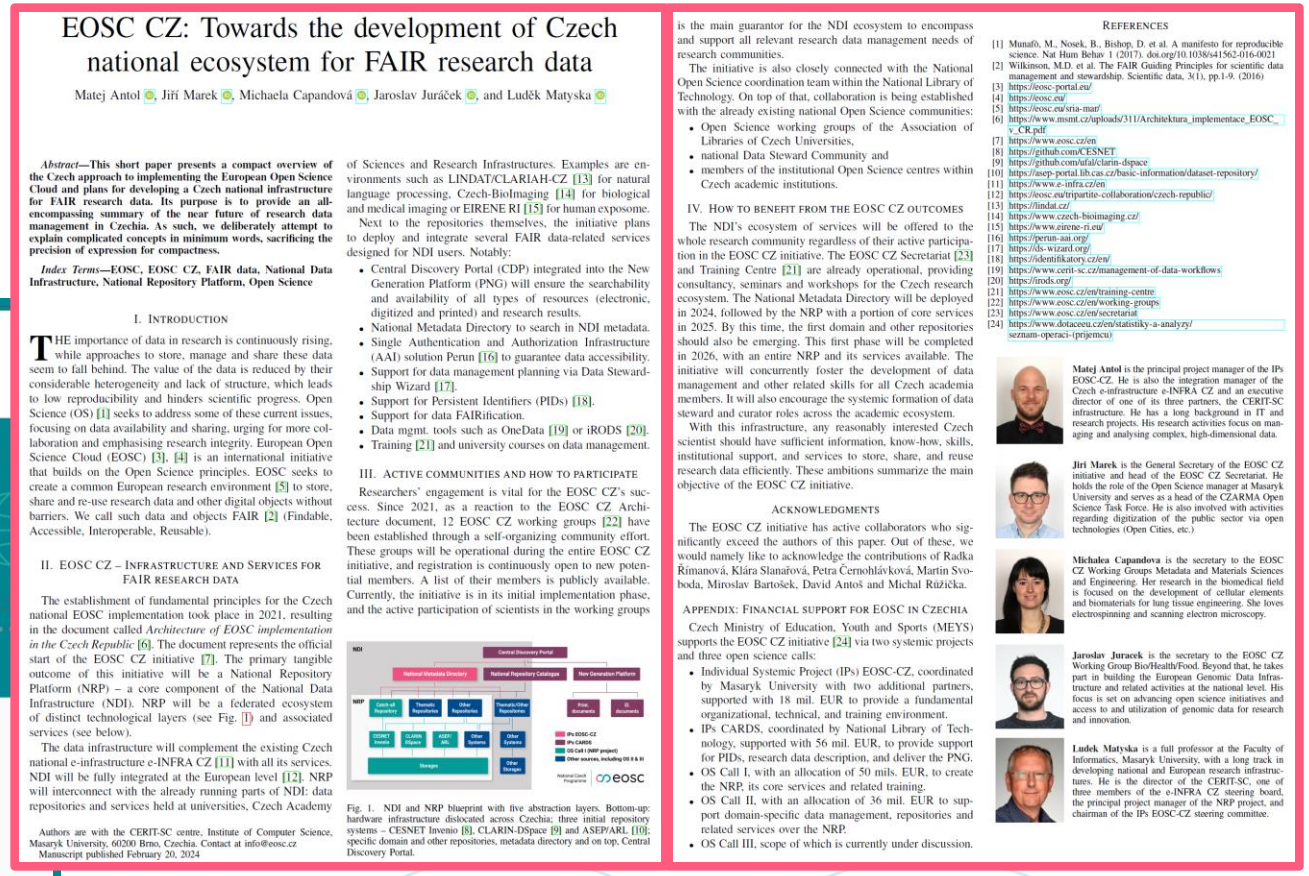

EOSC CZ: Towards the development of Czech national ecosystem for FAIR research data

Matej Antol, Jiří Marek, Michaela Capandová, Jaroslav Juráček, and Luděk Matyska

Abstract—**This short paper presents a compact overview of the Czech approach to implementing the European Open Science Cloud and plans for developing a Czech national infrastructure for FAIR research data. Its purpose is to provide an all-encompassing summary of the near future of research data management in Czechia. As such, we deliberately attempt to explain complicated concepts in minimum words, sacrificing the precision of expression for compactness.**

Index Terms—**EOSC, EOSC CZ, FAIR data, National Data Infrastructure, National Repository Platform, Open Science**

I. Introduction

THE importance of data in research is continuously rising, while approaches to store, manage and share these data seem to fall behind. The value of the data is reduced by their considerable heterogeneity and lack of structure, which leads to low reproducibility and hinders scientific progress. Open Science (OS) [1] seeks to address some of these current issues, focusing on data availability and sharing, urging for more collaboration and emphasising research integrity. European Open Science Cloud (EOSC) [3], [4] is an international initiative that builds on the Open Science principles. EOSC seeks to create a common European research environment [5] to store, share and re-use research data and other digital objects without barriers. We call such data and objects FAIR [2] (Findable, Accessible, Interoperable, Reusable).

II. EOSC CZ – Infrastructure and Services for FAIR Research Data

The establishment of fundamental principles for the Czech national EOSC implementation took place in 2021, resulting in the document called *Architecture of EOSC implementation in the Czech Republic* [6]. The document represents the official start of the EOSC CZ initiative [7]. The primary tangible outcome of this initiative will be a National Repository Platform (NRP) – a core component of the National Data Infrastructure (NDI). NRP will be a federated ecosystem of distinct technological layers (see Fig. 1) and associated services (see below).

The data infrastructure will complement the existing Czech national e-infrastructure e-INFRA CZ [11] with all its services. NDI will be fully integrated at the European level [12]. NRP will interconnect with the already running parts of NDI: data repositories and services held at universities, Czech Academy of Sciences and Research Infrastructures. Examples are environments such as LINDAT/CLARIAH-CZ [13] for natural language processing, Czech-BioImaging [14] for biological and medical imaging or EIRENE RI [15] for human exposome.

Next to the repositories themselves, the initiative plans to deploy and integrate several FAIR data-related services designed for NDI users. Notably:

- Central Discovery Portal (CDP) integrated into the New Generation Platform (PNG) will ensure the searchability and availability of all types of resources (electronic, digitized and printed) and research results.
- National Metadata Directory to search in NDI metadata.
- Single Authentication and Authorization Infrastructure (AAI) solution Perun [16] to guarantee data accessibility.
- Support for data management planning via Data Stewardship Wizard [17].
- Support for Persistent Identifiers (PIDs) [18].
- Support for data FAIRification.
- Data mgmt. tools such as OneData [19] or iRODS [20].
- Training [21] and university courses on data management.

III. Active Communities and How to Participate

Researchers' engagement is vital for the EOSC CZ's success. Since 2021, as a reaction to the EOSC CZ Architecture document, 12 EOSC CZ working groups [22] have been established through a self-organizing community effort. These groups will be operational during the entire EOSC CZ initiative, and registration is continuously open to new potential members. A list of their members is publicly available. Currently, the initiative is in its initial implementation phase, and the active participation of scientists in the working groups is the main guarantor for the NDI ecosystem to encompass and support all relevant research data management needs of research communities.

The initiative is also closely connected with the National Open Science coordination team within the National Library of Technology. On top of that, collaboration is being established with the already existing national Open Science communities:

- Open Science working groups of the Association of Libraries of Czech Universities,
- national Data Steward Community and
- members of the institutional Open Science centres within Czech academic institutions.

IV. How to Benefit from the EOSC CZ Outcomes

The NDI's ecosystem of services will be offered to the whole research community regardless of their active participation in the EOSC CZ initiative. The EOSC CZ Secretariat [23] and Training Centre [21] are already operational, providing consultancy, seminars and workshops for the Czech research ecosystem. The National Metadata Directory will be deployed in 2024, followed by the NRP with a portion of core services in 2025. By this time, the first domain and other repositories should also be emerging. This first phase will be completed in 2026, with an entire NRP and its services available. The initiative will concurrently foster the development of data management and other related skills for all Czech academia members. It will also encourage the systemic formation of data steward and curator roles across the academic ecosystem.

With this infrastructure, any reasonably interested Czech scientist should have sufficient information, know-how, skills, institutional support, and services to store, share, and reuse research data efficiently. These ambitions summarize the main objective of the EOSC CZ initiative.

Acknowledgments

The EOSC CZ initiative has active collaborators who significantly exceed the authors of this paper. Out of these, we would namely like to acknowledge the contributions of Radka Římanová, Klára Slanařová, Petra Černohlávková, Martin Svoboda, Miroslav Bartošek, David Antoš and Michal Růžička.

Appendix: Financial Support for EOSC in Czechia

Czech Ministry of Education, Youth and Sports (MEYS) supports the EOSC CZ initiative [24] via two systemic projects and three open science calls:

- Individual Systemic Project (IPs) EOSC-CZ, coordinated by Masaryk University with two additional partners, supported with 18 mil. EUR to provide a fundamental organizational, technical, and training environment.
- IPs CARDS, coordinated by National Library of Technology, supported with 56 mil. EUR, to provide support for PIDs, research data description, and deliver the PNG.
- OS Call I, with an allocation of 50 mils. EUR, to create the NRP, its core services and related training.
- OS Call II, with an allocation of 36 mil. EUR to support domain-specific data management, repositories and related services over the NRP.
- OS Call III, scope of which is currently under discussion.

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Michalea Capandova is the secretary to the EOSC CZ Working Groups Metadata and Materials Sciences and Engineering. Her research in the biomedical field is focused on the development of cellular elements and biomaterials for lung tissue engineering. She loves electrospinning and scanning electron microscopy.

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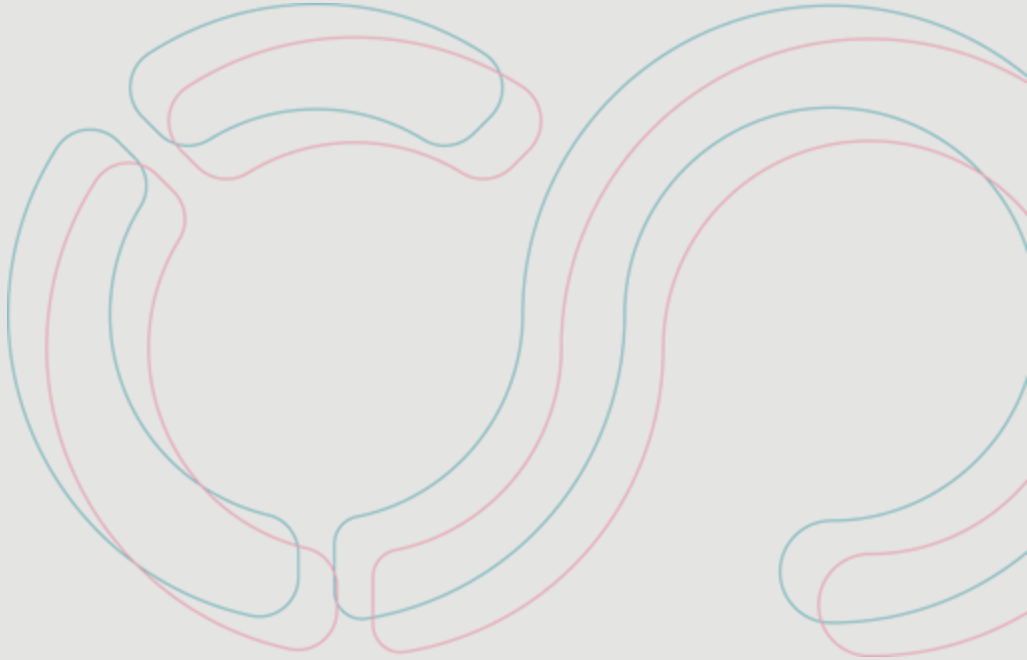
Thank you for your attention



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