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# Introduction to FAIR Data

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MINISTRY OF EDUCATION, YOUTH AND SPORTS

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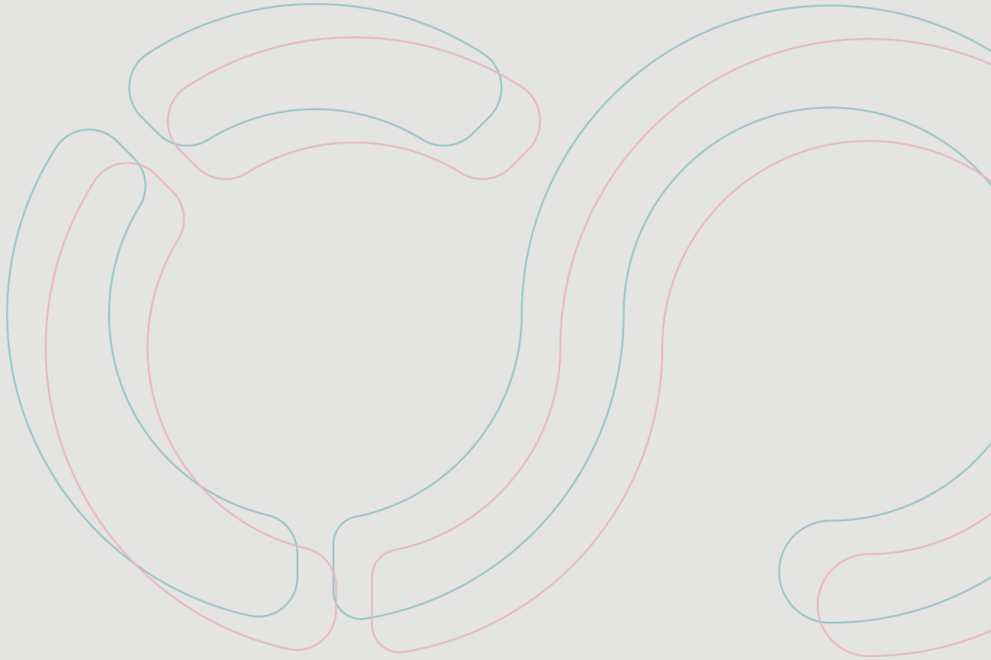
# About Me

- Leader of EOSC CZ open working group Core Services.
  - https://www.eosc.cz/en/working-groups/core-services
- Leader of end-user-services oriented work packages in the NRP project.
  - https://www.eosc.cz/en/projects/national-repository-platform-for-research-data-os-i-nrp/national-repository-platform
- Open Science support team member at CERIT-SC | ICS MU
  - Focus on data management and FAIR data support.
  - Including sensitive data (SensitiveCloud).
- Good coffee and tea lover.

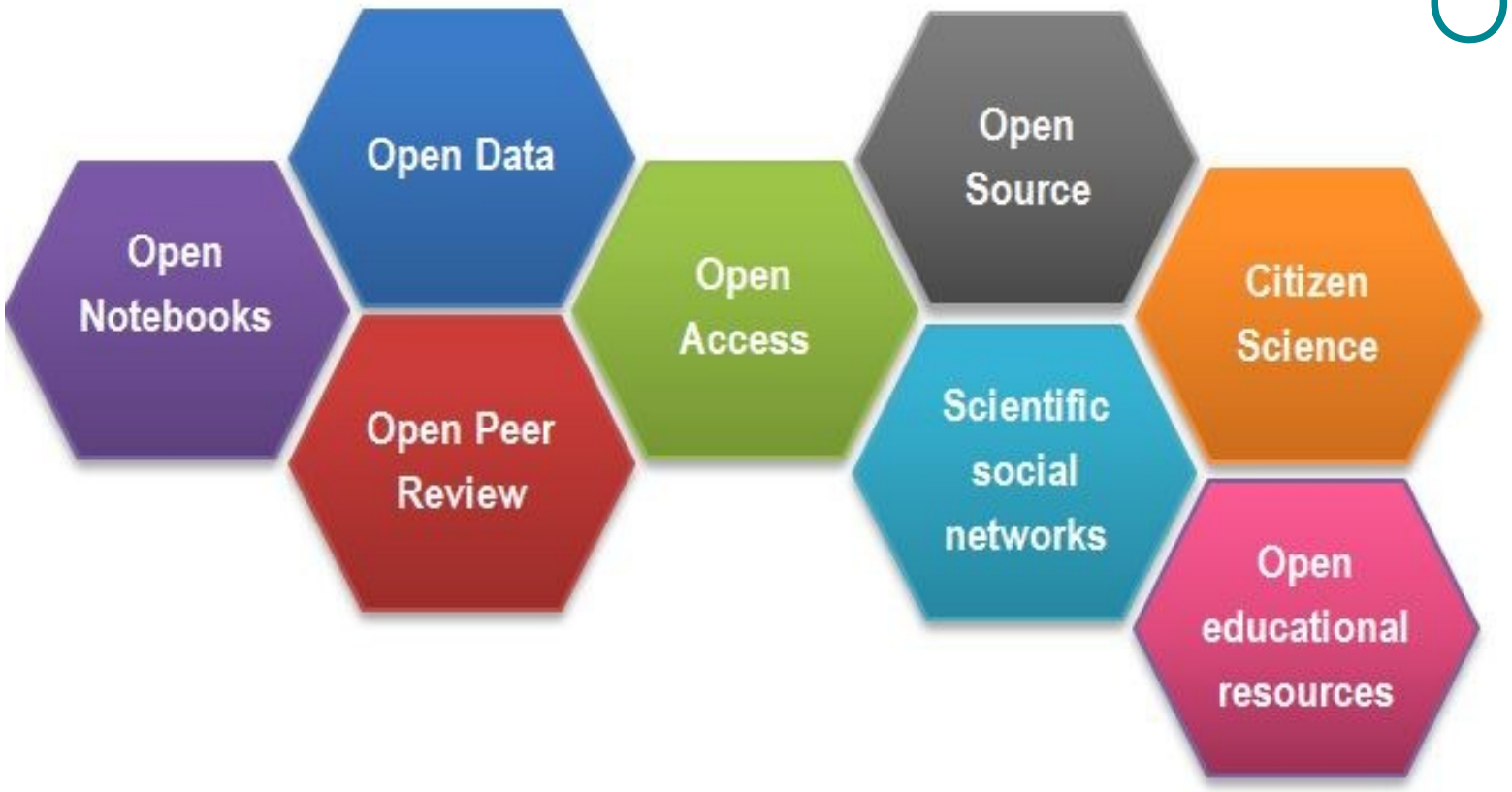
# Outline

1. Context
2. Research Data Life-Cycle
3. Data, Managed Data, FAIR Data, Open Data…
4. Data Management Plan (DMP) in Research Project Calls
5. Where to Store Research Data
   - Practical Examples
6. Tools and Resources to Support FAIR Principles
7. Persistent Identifiers (PIDs)
8. Repositories for Research Data
9. European Open Science Cloud (EOSC)
10. National Repository Platform (NRP) Project
    - Focusing

# Context



# Open Science




Source: https://www.fosteropenscience.eu/node/1420

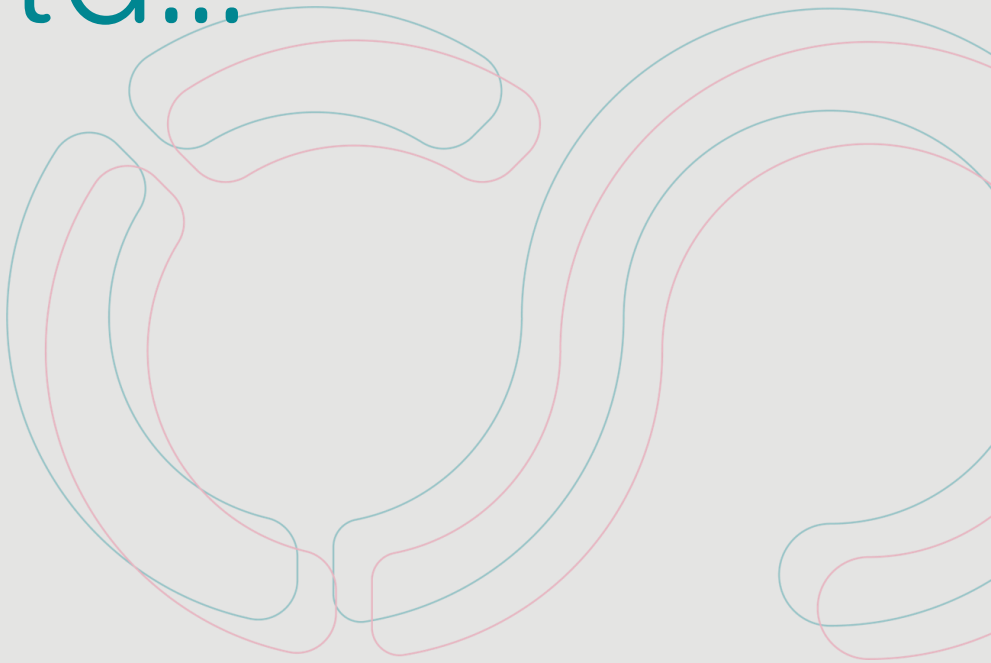
# Research Data Life-Cycle

# Research Data Life-Cycle

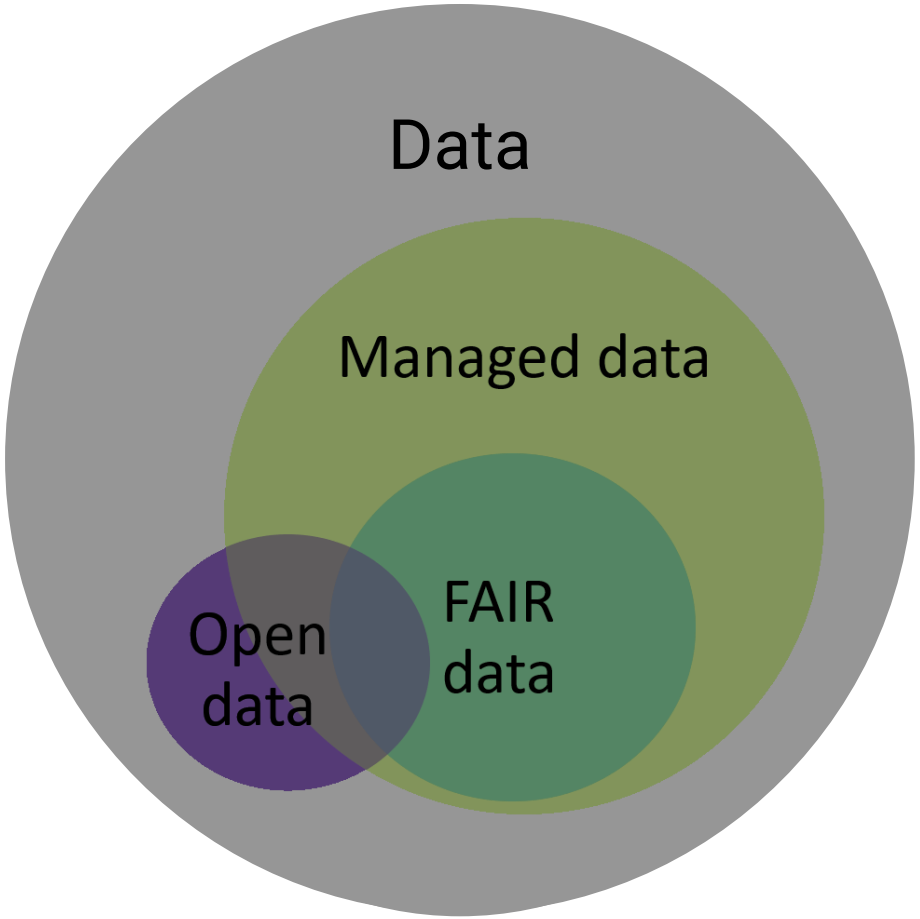

Source: ELIXIR RDMkit, https://rdmkit.elixir-europe.org/

- What data do you (re)use?
  - Including licenses that allow you to do so.
- What data do you generate and how?
- Where do you store, backup, and long-term archive data?
- How do you permanently and uniquely identify it?
- How do you process it?
- How do you analyze it?
- Where do you publish and share it?
- Who pays for all of this?
- What are the data really about?
- What are the data suitable (or unsuitable) for?
- Who can reuse the data?
- What specific data support your results?
- How can they be used to repeat your experiments, etc.?

# Data, Managed Data, FAIR Data, Open Data...



# Research Data Levels




Source: FAIR příručka pro data steward komunitu v ČR, https://doi.org/10.71495/hxfc-6f57

- FAIR principles:
  - Findable
  - Accessible
  - Interoperable
  - Reusable

# 5-Stars Deployment Scheme for Open Data

★ Make your stuff available on the Web (whatever format) under an open license.

★★ Make it available as structured data (e.g., Excel instead of image scan of a table).

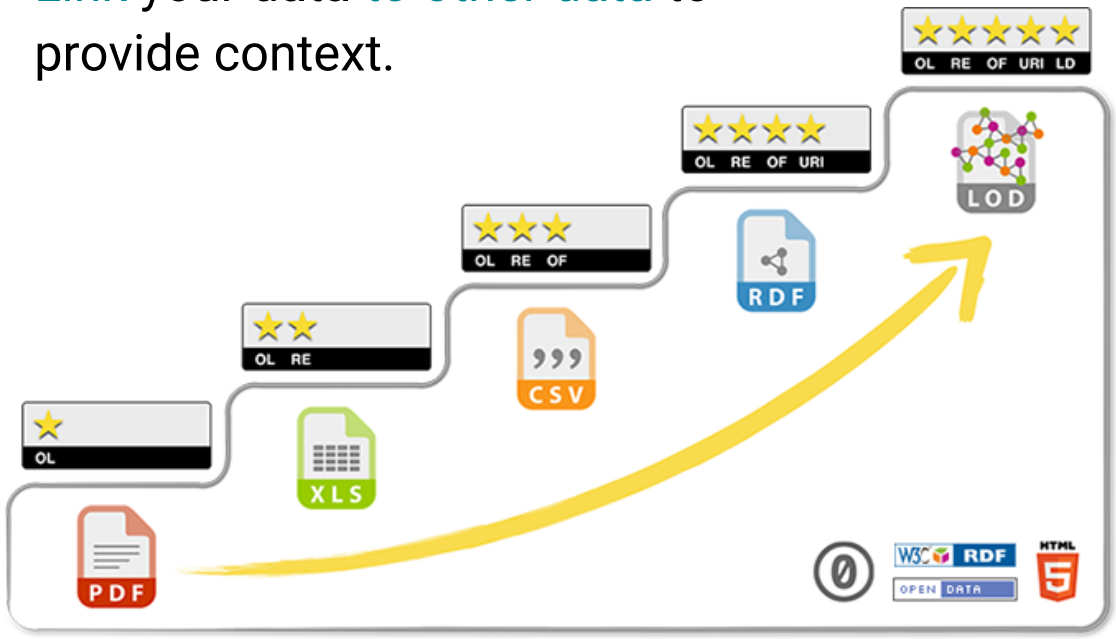
The dataset is provided in a machine-readable format that allows automated machine processing.

★★★ Make it available in a non-proprietary open format (e.g., CSV instead of Excel).

★★★★ Use URIs to denote things, so that people can point at your stuff.

★★★★★ Link your data to other data to provide context.

In 2010, Tim Berners-Lee published a system for assessing the openness of linked data, the so-called 5-Star Linked Open Data.




Source: FAIR příručka pro data steward komunitu v ČR, https://doi.org/10.71495/hxfc-6f57

# FAIR Principles

https://www.go-fair.org/fair-principles/

- FAIR is an abbreviation of the four English adjectives denoting these principles.
- Findable
  - For people and machines.
  - We need (machine-readable) metadata that is available to search engines/users.
  - We need unique persistent identifiers (PIDs).
- Accessible
  - Technical solution for access to data and metadata – use standard open protocols (e.g. https://) common in the field.
  - The data does not have to be freely accessible – then the authentication mechanisms should be common and standard (e.g. OpenID Connect) in the field.
  - If the data itself is inaccessible (not public or has been deleted), at least the metadata should be freely available (for Findable and audit-record of the deleted data).
- Interoperable
  - Similar to Accessible, but not about access protocols, but about the data itself.
  - Data and metadata in machine-readable open formats common in the field.
  - Other data/metadata should be referenced using standard persistent identifiers.
- Reusable
  - Rather the goal we are aiming at in the previous points, rather than a separate principle.
  - Clear declaration of license, use of open licenses (e.g. CC0, CC-BY).
  - Data and metadata in industry-standard and usable formats.
  - Provenance metadata – a relatively new area dealing with the metadata record of all operations with data from their inception to the present.

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# FIP Mini-Questionnaire

https://www.go-fair.org/how-to-go-fair/fair-implementation-profile/

## Building your FAIR implementation profile.

| Community description | |
|---|---|
| Name of Community | *e.g. ENVRI* |
| Description of Community | |
| Supporting Links | |
| Research Domain | *e.g. Environmental Sciences* |
| Data Steward | *e.g. ORCID #* |
| Date of FIP creation | |

| FAIR principle | Question | FAIR enabling resource types | Your answers |
|---|---|---|---|
| F1 | What globally unique, persistent, resolvable identifiers do you use for metadata records? | Identifier type | *e.g. PURL, DOI* |
| F1 | What globally unique, persistent, resolvable identifiers do you use for datasets? | Identifier type | |
| F2 | Which metadata schemas do you use for findability? | Metadata schema | |
| F3 | What is the technology that links the persistent identifiers of your data to the metadata description? | Metadata-Data linking mechanism | |
| F4 | In which search engines are your metadata records indexed? | Search engines | |
| F4 | In which search engines are your datasets indexed? | Search engines | |
| A1.1 | Which standardized communication protocol do you use for metadata records? | Communication protocol | |
| A1.1 | Which standardized communication protocol do you use for datasets? | Communication protocol | |
| A1.2 | Which authentication & authorisation technique do you use for metadata records? | Authentication & authorisation technique | |
| A1.2 | Which authentication & authorisation technique do you use for datasets? | Authentication & authorisation technique | |
| A2 | Which metadata longevity plan do you use? | Metadata longevity | |
| I1 | Which knowledge representation languages (allowing machine interoperation) do you use for metadata records? | Knowledge representation language | |
| I1 | Which knowledge representation languages (allowing machine interoperation) do you use for datasets? | Knowledge representation language | |
| I2 | Which structured vocabularies do you use to annotate your metadata records? | Structured vocabularies | |
| I2 | Which structured vocabularies do you use to encode your datasets? | Structured vocabularies | |
| I3 | Which models, schema(s) do you use for your metadata records? | Metadata schema | |
| I3 | Which models, schema(s) do you use for your datasets? | Data schema | |
| R1.1 | Which usage license do you use for your metadata records? | Data usage license | |
| R1.1 | Which usage license do you use for your datasets? | Data usage license | |
| R1.2 | Which metadata schemas do you use for describing the provenance of your metadata records? | Provenance model | |
| R1.2 | Which metadata schemas do you use for describing the provenance of your datasets? | Provenance model | |

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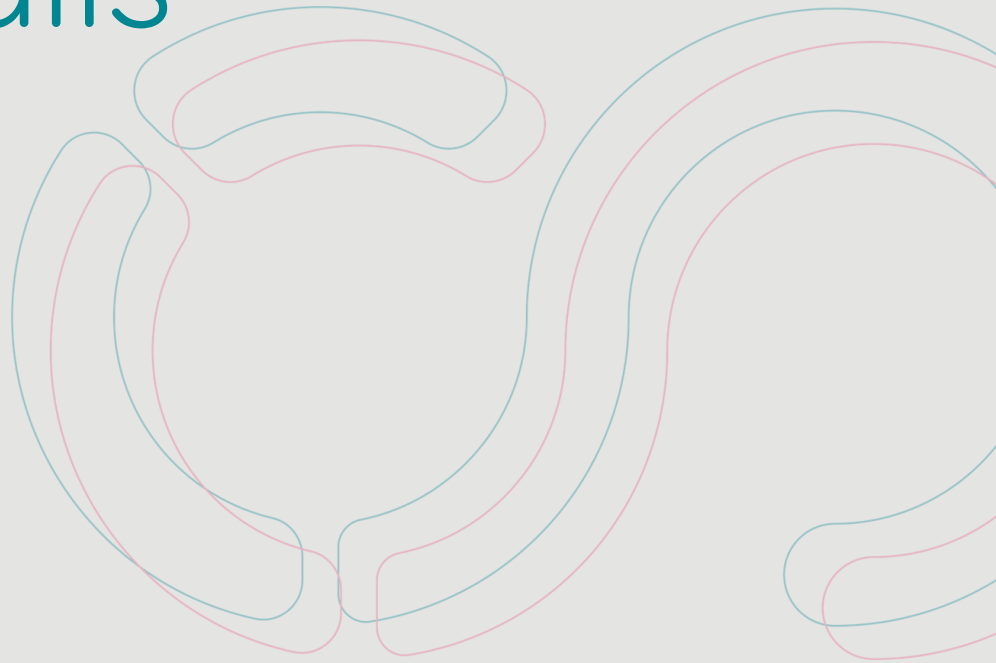
# Data Management Plan (DMP) in Research Project Calls



# Open Science and Projects

- Requirements for compliance with Open Science principles have already been established as a standard part of research project calls.
- Often mandatory and optional principles:
  - Mandatory: Open Access, Data Management (DMP)
  - Optional: Citizen Science, Open Source, Preprints, …
- DMP is a living document: Regular updates are expected.

# DMP and Horizon Europe

- DMP is mandatory.
- DMP is a living document with regular updates:
  - Initial DMP.
  - Updates during the project.
  - Final DMP at the end of the project.

- *Horizon Europe Open Science Requirements in Practice*
  - OpenAIRE webinar, 2023-03-13
  - Slides available at: https://doi.org/10.5281/zenodo.7324363

# DMP and GAČR

- DMP is mandatory according to this year's project agreements.
  - Beware, including projects already started from 2024-01-01.
  - The requirement is included in all GAČR project calls announced for following years.

- GAČR, *STANDARD PROJECTS – 2025, Terms and Conditions for the Public Tender and Grant Projects in Research, Experimental Development, and Innovation*, available at: https://gacr.cz/wp-content/uploads/2024/02/TD_STD_2025.pdf.

Page 64:

*[…] The Beneficiary agrees to submit a Data Management Plan (DMP) on or before the date of the submission of the first Interim Report and to update the DMP regularly, as needed, and to submit it regularly as part of the Interim and Final Reports, including information on the availability and dissemination of the research results and research data. The updated research data management plan shall be included in the Interim and Final Reports. The research data management plan shall include, as a minimum, information on: (i) what kind of research data will be generated, processed or collected by the Beneficiary within the project; (ii) what methods and principles of data management will be used; (iii) whether and how the data will be shared, published and/or disclosed, and, where appropriate, an explanation of why the research data cannot be disseminated or disclosed (the Beneficiary shall not disclose information on research data the disclosure of which would unduly interfere with the intellectual property rights, trade secrets, national security and/or legitimate commercial interests of the Beneficiary or those of a third party); (iv) and how the data will be stored during the project and preserved after the project. […]*

# DMP and GAČR

- Research data management has to be described in the scientific research project proposal.
- DMP is a life document with regular updates.
  - Each Interim Report.
  - With Final Report.

- GAČR, *STANDARD PROJECTS – 2025, Terms and Conditions for the Public Tender and Grant Projects in Research, Experimental Development, and Innovation*, available at: https://gacr.cz/wp-content/uploads/2024/02/TD_STD_2025.pdf.

Page 19:

*[…] a brief description of the research data to be generated, used, and stored in the course of the Project, and how these data will be handled; in particular, information on the availability and dissemination of the research results and research data, in accordance with the principle that research results and research data are not made public only where justified (an update shall be provided with each Interim Report and Final Report); the Beneficiary agrees to submit a Data Management Plan (DMP) no later than the date of delivery of the first Interim Report, and to update the DMP periodically as needed; […]*

# DMP and Applied Health Research Projects by the Ministry of Health of the Czech Republic

- DMP is mandatory for projects started from 2025-05-01.
  - Continuous maintenance and regular updates are required.
- Compliance with FAIR principles is expected.
- Ministry of Health of the Czech Republic, *Tender Documentation for Public Tender no. 2 in Experimental Development and Innovation in the Applied Health Research Support program for the Years 2024–2030*, available at: https://mzd.gov.cz/wp-content/uploads/2024/05/ZD-VES-2025-EN-1.pdf.

Page 24:

*[…] A brief description of the **research data** that will be used, collected or generated during the Project and how it will be handled; the Beneficiary is required to have a Data Management Plan (DMP) in place at the latest at the time of submission of the first sub-report and to update the DMP on a regular basis if necessary and to submit it on request; the DMP should include, among others, information on what methods and principles of data management will be used with respect to the FAIR principles (findability, accessibility, interoperability and reusability); […]*

# DMP and INTER-EXCELENCE II by the Ministry of Education, Youth and Sports of the Czech Republic

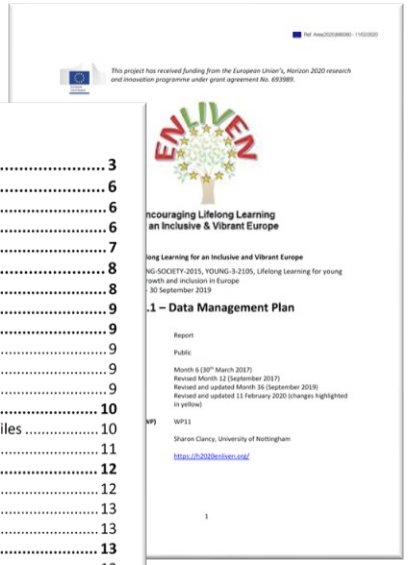
- DMP is mandatory.
  - Continuous maintenance and regular updates are required.
- Ministry of Education, Youth and Sports, *Model contract for granting support, INTER-ACTION sub-programme, INTER-EXCELLENCE II programme*, available at: https://www.msmt.cz/file/62614_1_1/.

Page 6:

*[…] develop and submit a Data Management Plan to the Provider in the Interim Project Report; furthermore, update it regularly during the course of the Project and submit an updated version as part of each subsequent Project Report. […]*

# ENLIVEN ('Encouraging Lifelong Learning for an Inclusive and Vibrant Europe') Data Management Plan

- https://hdl.handle.net/11353/10.1139743
- DMP from the area of Social Sciences.
  - Audio and video data, transcription of interviews.
  - Restricted access to the data.
- Use of existing data + collection of own data.
- Continuous updating of the DMP.
  - Changes are summarized in a table.
  - Migration of some of the data to the UK.
  - Data saved encrypted in MS O365 Teams.
- Ethic aspects are described in a standalone document referenced from the DMP.
- Joined project of multiple institutions → explicit definition of responsibilities.
- Nice description of data protection.
  - Information on anonymization procedures in the DMP appendix.
- Documentation and produced publications (including project website) are covered in the DMP.
- Description of the used hardware and software could be more detailed.
  - Nevertheless, the backup process and strategy are described.
- Described intellectual properties and QA process.



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# Where to Store Research Data

## Practical Examples

# Example: Storages at MU and Recommendations for their Use

- Centrally managed by Institute of Computer Science
  - https://it.muni.cz/en/categories/data-storage
- Recommendations their use:
  - Data type categorization.
  - Storage technology categorization.
  - Matrix of suitability of different storages for different types of data.

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# Example: Storages at MU – Suitability of storage for different types of data

| STORAGE TYPE | USAGE | | | |
|---|---|---|---|---|
| | GREEN: PUBLIC DATA | BLUE: INTERNAL DATA | ORANGE: DISCRETE DATA | RED: SENSITIVE DATA |
| PORTABLE MEDIA (FLASH DRIVES, EXTERNAL HDD, CD, DVD, ...) | Appropriate | Possible<br>Encryption recommended | Inappropriate<br>Possible when using encryption | Inappropriate |
| LOCAL STORAGE | | | | |
| IN COMPUTERS (DESKTOP, LAPTOPS) | Appropriate | Appropriate | Appropriate<br>Encryption recommended | Inappropriate<br>possible in well-justified cases, when performing an individual analysis, using encryption and applying other security measures resulting from the analysis |
| IN MOBILE DEVICES (MOBILE PHONES, TABLETS, ...) | Appropriate | Appropriate<br>Screen lock required (pattern, fingerprint reader, PIN, password) | Possible<br>Encryption required<br>Strong screen lock required (fingerprint reader, PIN, password) | Inappropriate<br>possible in well-justified cases, when performing an individual analysis, using encryption and applying other security measures resulting from the analysis |
| ICS NETWORK AND CLOUD STORAGE (SO-CALLED STANDARD AND MEDIUM NETWORK STORAGE, SEE IT CATALOGUE, CERIT-SC STORAGE) | Appropriate | Appropriate | Appropriate | Appropriate<br>It is recommended to perform an individual analysis, use encryption and apply other security measures that result from the analysis |

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# Example: Storages at MU – Suitability of storage for different types of data

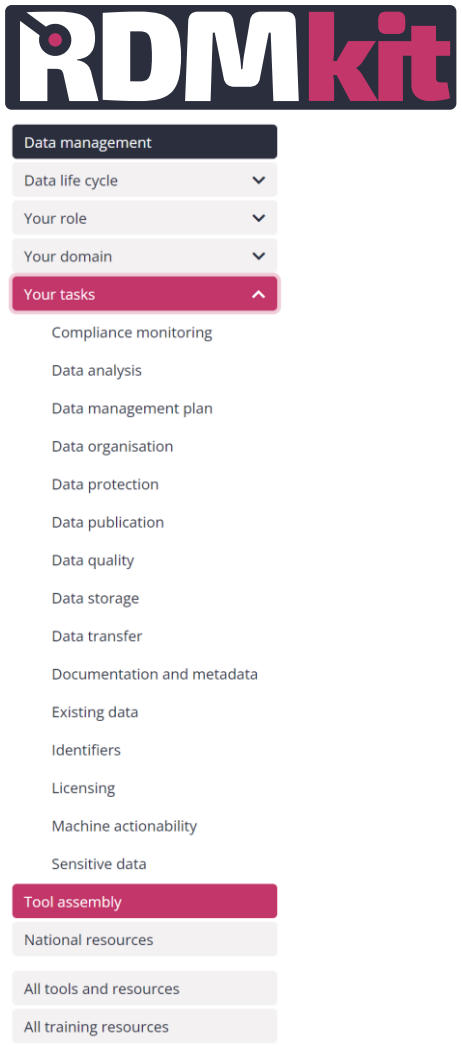
| STORAGE TYPE | USAGE | | | |
|---|---|---|---|---|
| | GREEN: PUBLIC DATA | BLUE: INTERNAL DATA | ORANGE: DISCRETE DATA | RED: SENSITIVE DATA |
| IS MUNI REPOSITORY (E.G. DOCUMENT SERVER, FILE DEPOSITORY, ETC.) | Appropriate | Appropriate | Appropriate | Appropriate<br>It is recommended to perform an individual analysis, use encryption and apply other security measures that result from the analysis |
| CESNET STORAGE (E.G. CESNET ARCHIVE STORAGE, OWNCLOUD, FILESENDER, ..., SEE CESNET DATA STORAGE DEPARTMENT) | Appropriate | Appropriate | Appropriate | Appropriate<br>It is recommended to perform an individual analysis, use encryption and apply other security measures that result from the analysis |
| EXTERNAL STORAGE | | | | |
| WITH A CONTRACT WITH MUNI | | | | |
| MUNI MICROSOFT O365 (MUNI O365 ONEDRIVE, SHAREPOINT, ..., VIZ MUNI O365) | Appropriate | Appropriate | Appropriate<br>Encryption recommended | Possible<br>only with adequate procedural coverage of the situation based on an individual analysis and the application of security measures that result from the analysis |
| MUNI GOOGLE G SUITE FOR EDUCATION (SEE MUNI GOOGLE APPS) | Appropriate | Appropriate | Inappropriate<br>Possible when using encryption | Inappropriate |
| GRAMMARLY | Appropriate | Appropriate | Inappropriate | Inappropriate |
| WITHOUT A CONTRACT WITH MUNI | | | | |
| PUBLIC GOOGLE, MICROSOFT, DROPBOX, ... STORAGES | Appropriate | Inappropriate | Inappropriate | Inappropriate |

# Tools and Resources to Support FAIR Principles

# Tools and Resources to Support FAIR Principles

## The ELIXIR Research Data Management Kit (RDMkit)

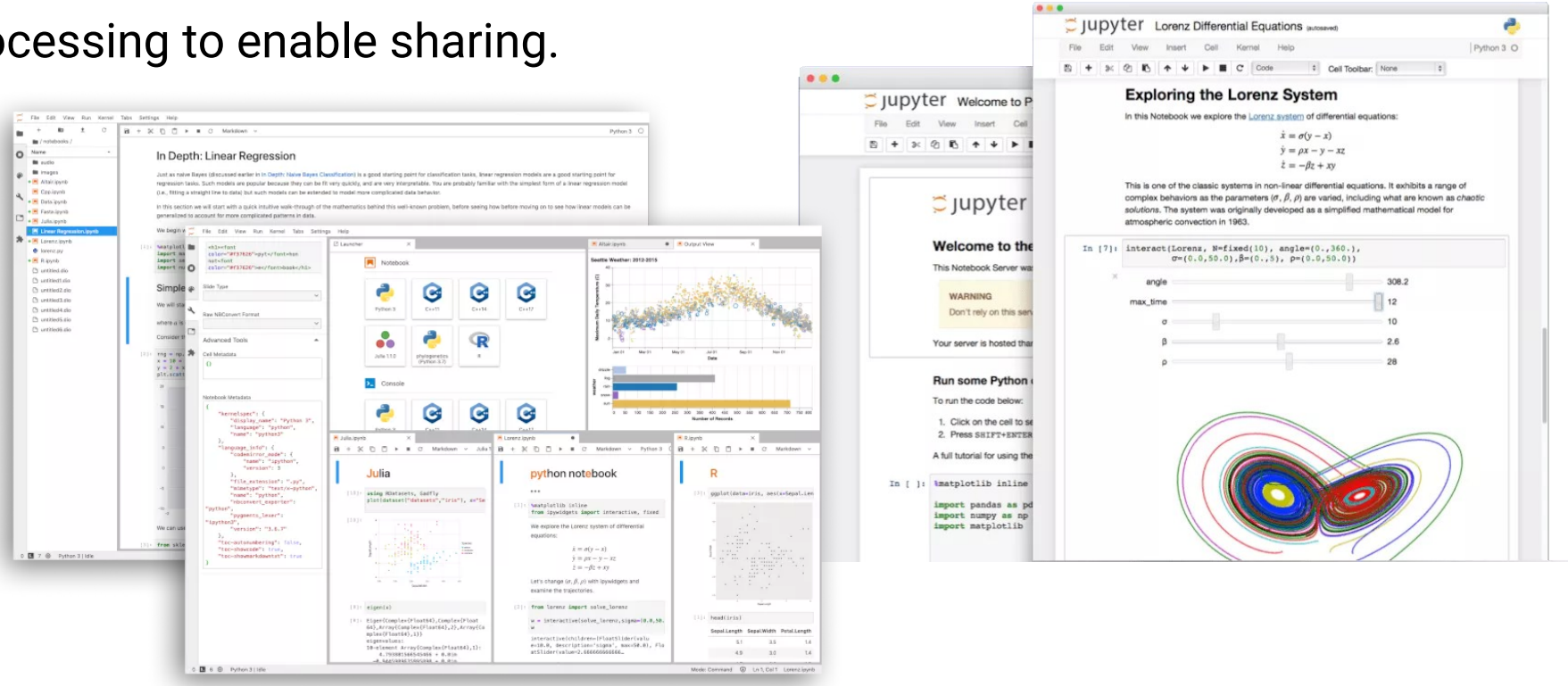
- https://rdmkit.elixir-europe.org/
- Online guide to data management in the life sciences.
- Links to several external sources.



# Tools and Resources to Support FAIR Principles

## JupyterLab

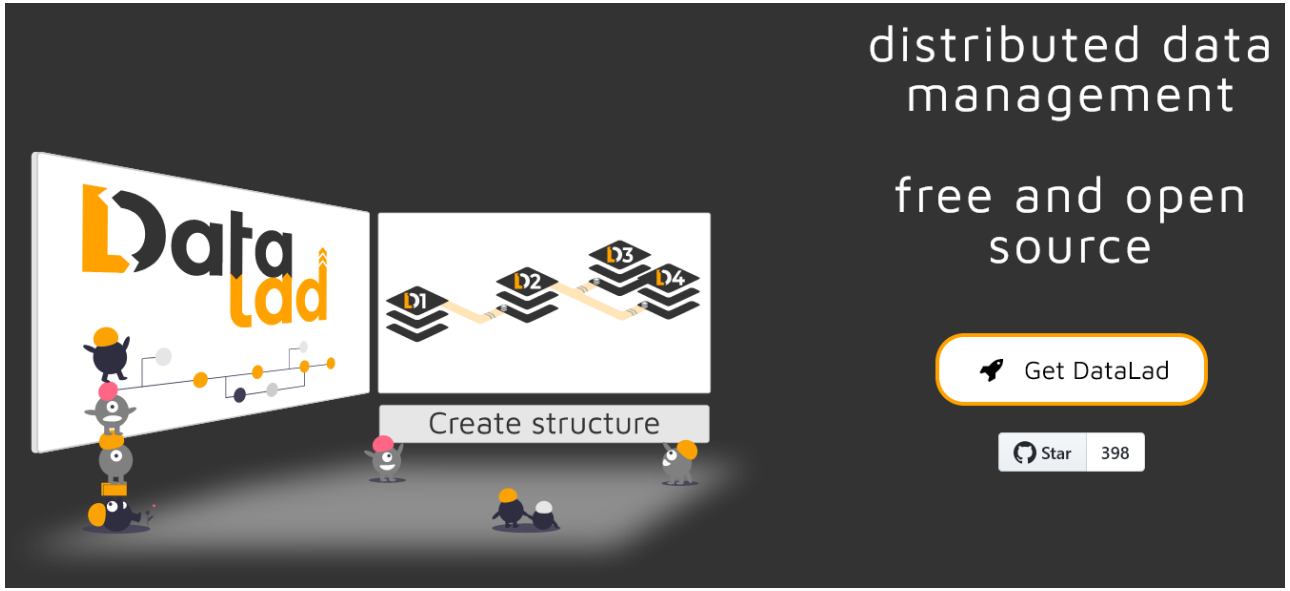
- https://jupyter.org/
- Documented data processing to enable sharing.



# Tools and Resources to Support FAIR Principles

## DataLad

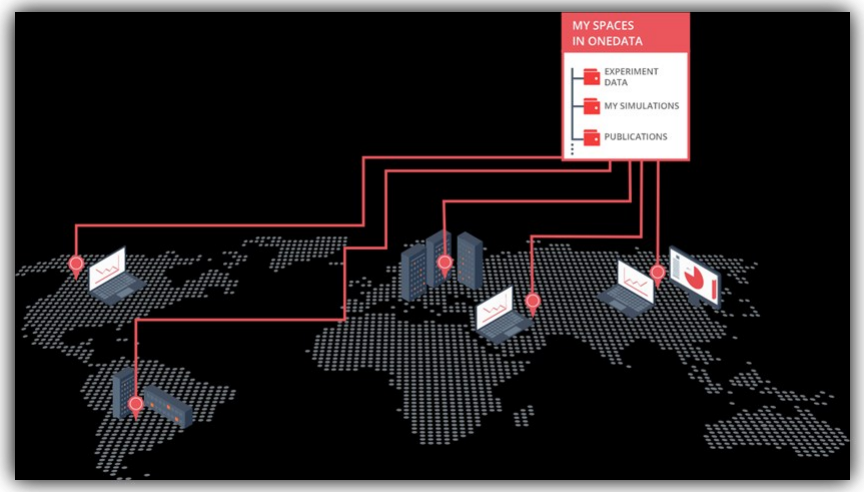
- https://www.datalad.org/
- *DataLad is a free and open-source distributed data management system that keeps track of your data, creates structure, ensures reproducibility, supports collaboration, and integrates with widely used data infrastructure.*



# Tools and Resources to Support FAIR Principles

## OneData

- https://onedata.org/
- *Perform heavy computations on huge datasets. Access your data in a dropbox-like fashion regardless of its location. Publish and share your results with public or closed communities.*



# Persistent Identifiers (PIDs)

# Persistent Identifiers (PIDs)

- They are supposed to ensure the separation of the identification of the object as such,
  - person,
  - institution,
  - publication,
  - dataset,
- from its current physical location.

- Example – dataset *https-set*
  - Dataset identifier: https://doi.org/10.48791/4mxp-r725
  - Current physical location: https://ucnmuni.sharepoint.com/teams/mu-UVT-https-set/Shared%20Documents/Forms/AllItems.aspx?id=%2Fteams%2Fmu%2DUVT%2Dhttps%2Dset%2FShared%20Documents%2Fhttps%2Dset%2Dv1%2E0%2E0&p=true&ga=1
  - The physical location is likely to change in the future – a move to the National catch-all data repository, is being considered.
  - Changes don't matter – users are *always* presented with a link to the data being DOI 10.48791/4mxp-r725, which always takes them to the current location.

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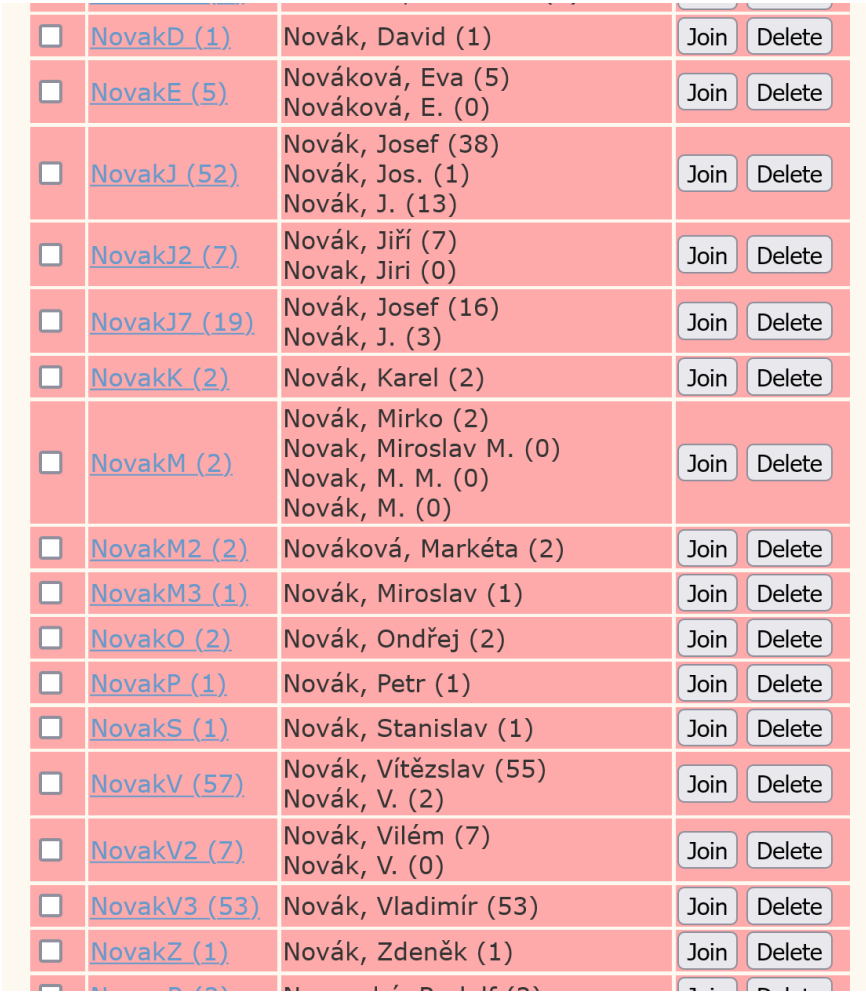
# Persistent Identifiers (PIDs)

- They are intended to ensure clarity.
- Example – names of natural persons:
  - Multiple forms of writing the name of one physical person.
  - Multiple different individuals with the same name.
- They are intended to ensure persistence.
  - Metadata physically located with a third party, independent of the physical location of the referenced entity.
- The identifier's owner takes care of updating the metadata and updating the route to the current location.
- The third party is responsible for preserving the latest version and history of the metadata and the existence of the identifier itself, even if the owner of the identifier stops caring for it. And even if the identified entity is not retained as such.

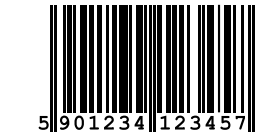


| | | | |
|---|---|---|---|
| ☐ | NovakD (1) | Novák, David (1) | Join Delete |
| ☐ | NovakE (5) | Nováková, Eva (5)<br>Nováková, E. (0) | Join Delete |
| ☐ | NovakJ (52) | Novák, Josef (38)<br>Novák, Jos. (1)<br>Novák, J. (13) | Join Delete |
| ☐ | NovakJ2 (7) | Novák, Jiří (7)<br>Novak, Jiri (0) | Join Delete |
| ☐ | NovakJ7 (19) | Novák, Josef (16)<br>Novák, J. (3) | Join Delete |
| ☐ | NovakK (2) | Novák, Karel (2) | Join Delete |
| ☐ | NovakM (2) | Novák, Mirko (2)<br>Novak, Miroslav M. (0)<br>Novak, M. M. (0)<br>Novák, M. (0) | Join Delete |
| ☐ | NovakM2 (2) | Nováková, Markéta (2) | Join Delete |
| ☐ | NovakM3 (1) | Novák, Miroslav (1) | Join Delete |
| ☐ | NovakO (2) | Novák, Ondřej (2) | Join Delete |
| ☐ | NovakP (1) | Novák, Petr (1) | Join Delete |
| ☐ | NovakS (1) | Novák, Stanislav (1) | Join Delete |
| ☐ | NovakV (57) | Novák, Vítězslav (55)<br>Novák, V. (2) | Join Delete |
| ☐ | NovakV2 (7) | Novák, Vilém (7)<br>Novák, V. (0) | Join Delete |
| ☐ | NovakV3 (53) | Novák, Vladimír (53) | Join Delete |
| ☐ | NovakZ (1) | Novák, Zdeněk (1) | Join Delete |

Source: Authors' database of the project DML-CZ

# Popular PIDs

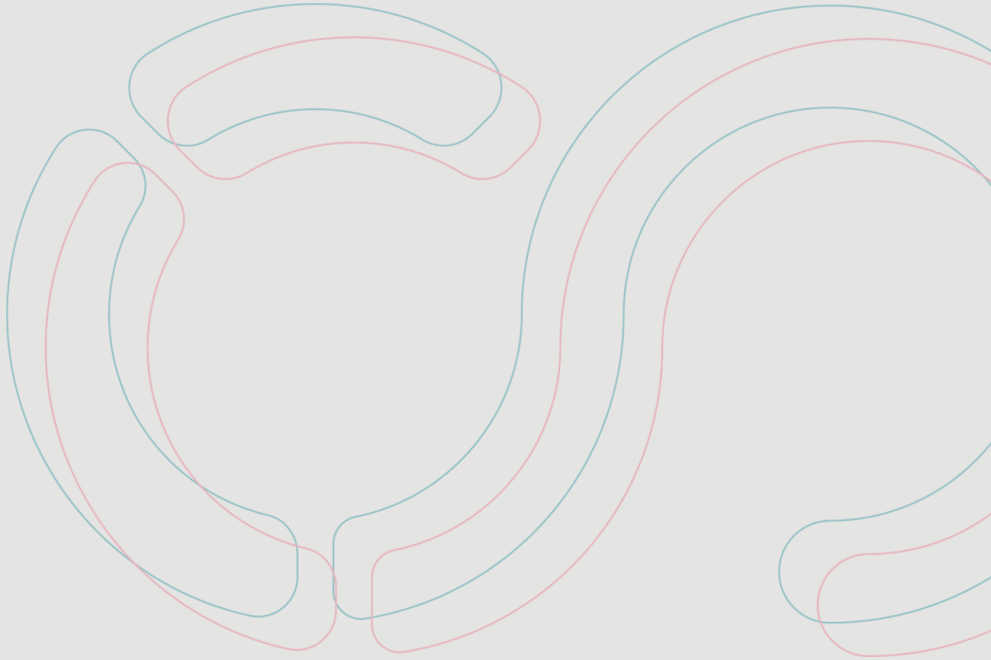
- People
  - **ORCID**: https://orcid.org/
    - Example: **0000-0001-6399-5453**
- Institutions
  - **ROR**: https://ror.org/
    - Example: **02j46qs45**
- Publications
  - **DOI**: https://www.crossref.org/
    - Example: **10.5817/CP2022-3-1**
- Datasets
  - **DOI**: https://datacite.org/
    - Example: **10.48791/4mxp-r725**
  - **Handle**: https://handle.net/
    - Example: **11222.digilib/130328**
- Books
  - **ISBN**: https://www.isbn-international.org/
    - Example: **978-3-16-148410-0**
- Journals
  - **ISSN**: http://portal.issn.org/
    - Example: **0378-5955**
- Business articles
  - **EAN13**: https://www.gs1.org/standards/barcodes/ean-upc
    - Example: **5901234123457**





- Inhabitants of the Czech Republic
  - **Birth Number** (~Social Security Number): https://www.zakonyprolidi.cz/cs/2004-302/
    - Example: **736028/5163**

# Repositories for Research Data

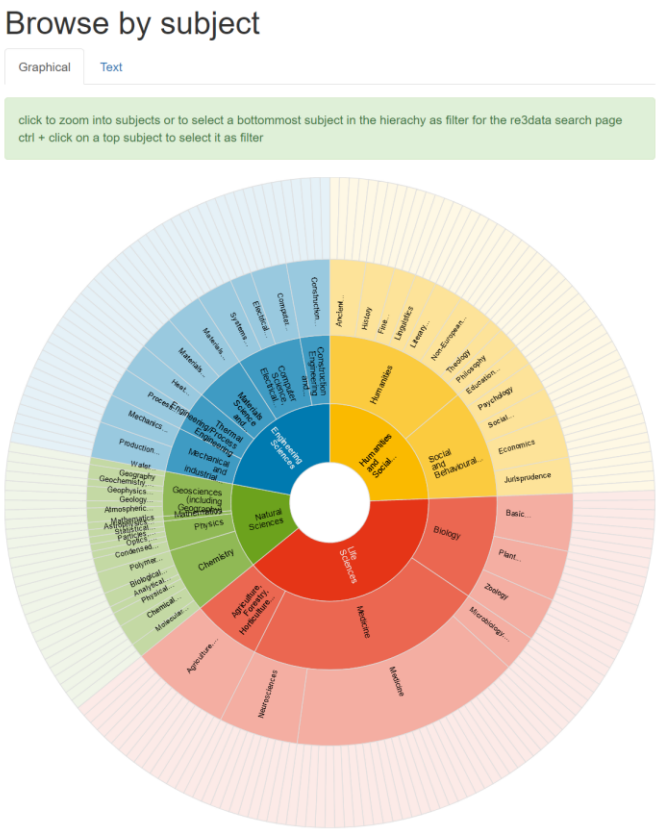


# Types of Repositories

- Topical, national, institutional, catch-the-all, …
- A common procedure for working with research data is to divide it by disciplines, not by country or institution.
  - We do not consider national/institutional/… specifics, but research topic specifics.
- If we are dealing with a project/institutional/national standard, we must be compatible with international industry practices.
  - Industry standards are addressed by, for example, EOSC Task Forces: https://www.eosc.eu/task-force-faq

# How to Find/Select a Data Repository

- Repository directories:
  - Open Access Repositories: OpenDOAR
  - Data repositories: re3data.org
- OpenAIRE: How to find a trustworthy repository for your data
  - Trusted certified repositories are preferred.
  - CoreTrustSeal (list of certified repositories).
  - Nestor Seal (verification according to DIN 31644).
  - ISO 16363.
  - For example, the well-known Zenodo has no certification…
- The most used general repositories include
  - Zenodo,
  - Figshare, or
  - Dryad.

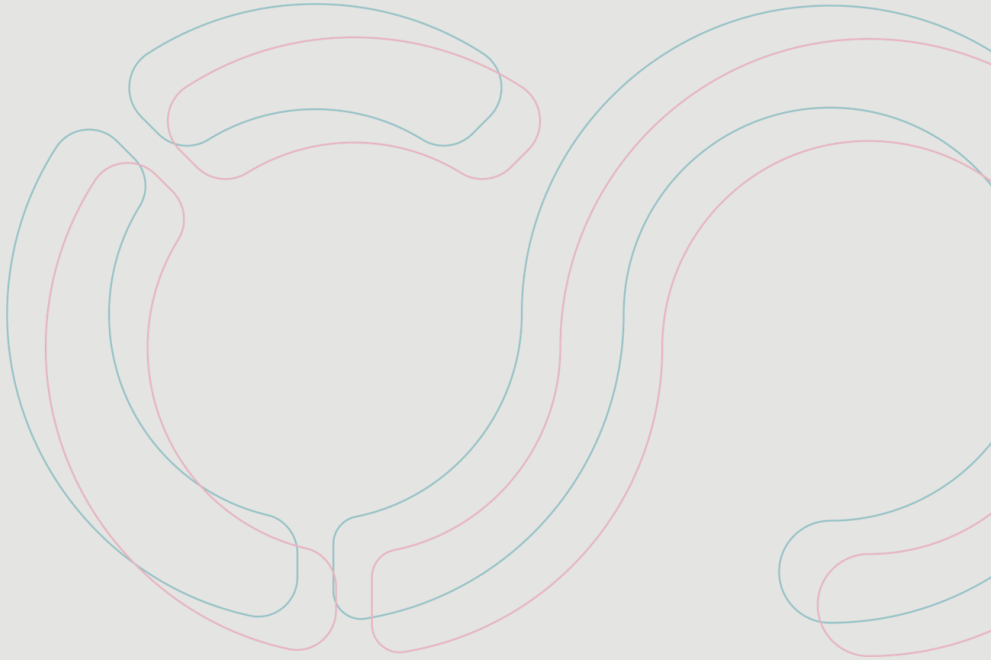



Source: https://www.re3data.org/browse/by-subject/

# What to Look Out for when Choosing a Repository

- Will the repository assign a persistent identifier (e.g. DOI) to your data?
  Persistent identifiers make your data easier to find and cite.
- Is the repository trustworthy/certified?
  With certified repositories, you can be more sure that your data is well taken care of.
- Does the selected repository provide open access to the stored data?
  If you want to share your data openly, then this is the key information.
- Will the repository license your data? Does it state clear conditions under which the data stored in the repository can be used?
  It's important that users of your data know how they can handle it.
- Will the repository provide a landing page for your data?
  Metadata will help others find the data, find out what the data is, and also how to cite it.
- Does the repository allow versioning?
  If you update your dataset, you can upload the updated version as a new version to the original dataset. The new dataset is assigned its own persistent identifier and users can easily find out what the latest version is or which version was used in the original study.

# European Open Science Cloud (EOSC)



# European Open Science Cloud (EOSC)

- Initiative to support data management – the entire data life cycle
  - Since 2016, mainly at the EU level, the search for a suitable setting through a series of projects
  - Currently the concept of EOSC Federation, de facto a large meta-infrastructure
- The key concept is data management
  - Not just any data, but FAIR data – i.e. well managed, described, reliably stored and reusable
  - FAIR data is not necessarily Open data – support for data access management is included
- Ecosystem of data and related services
  - Built on existing foundations, i.e. mainly large research infrastructures and e-infrastructures

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# EOSC CZ

- Supported through OP JAK (MEYS)
- Series of projects:
  - EOSC-CZ, CARDS, NRP, partly Research Environments, OS II (submitted), OS III (planned)
- Related to Data Management Plans (DMPs)
- Supports objectives:
  - Create an environment for working with FAIR research data
  - Primarily Preserve, Share, Reuse
  - Plan and collect is a matter of research
  - Process and Analyse are related to (e-)infrastructures

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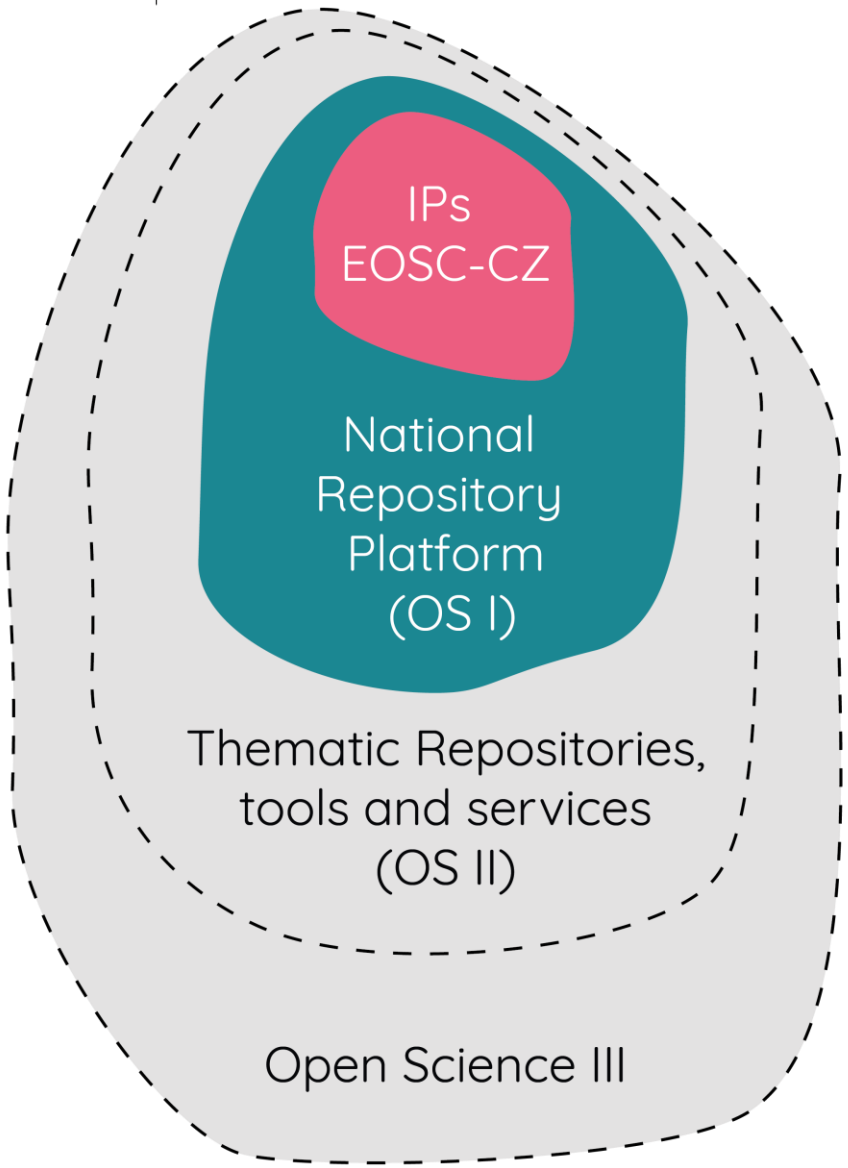
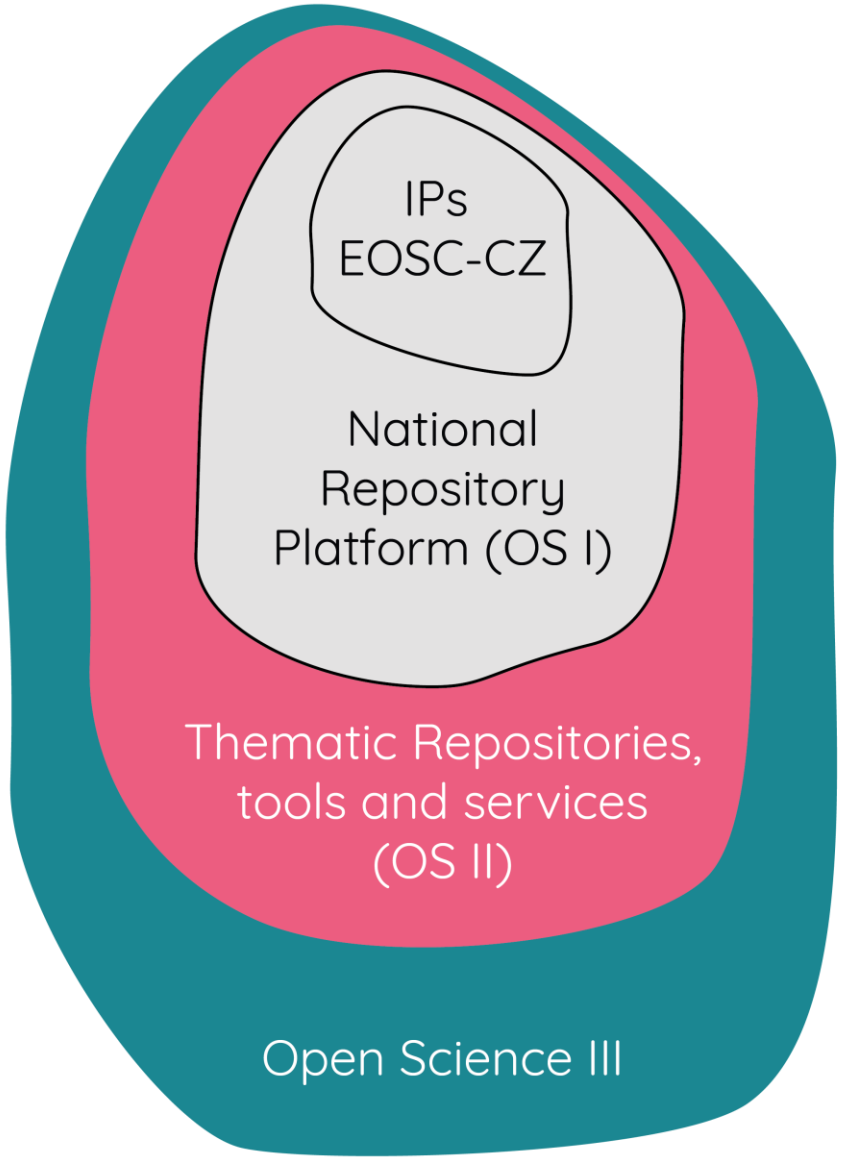



## IPs EOSC-CZ – fundamentals for EOSC implementation in CZ

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

## National repository platform – „technical core"

- **Repository systems** (DSpace, CESNET Invenio, ASEP-ARL)
- **Pilot repositories**
- **Core services** (PIDs, DSW, licenses, …)
- **Compliance** and UX (Cybersecurity, ServiceDesk, …)
- **Training** – technical aspects




## OS II – "domain-specific outputs"

**Based on the inputs from 8 thematic working groups**

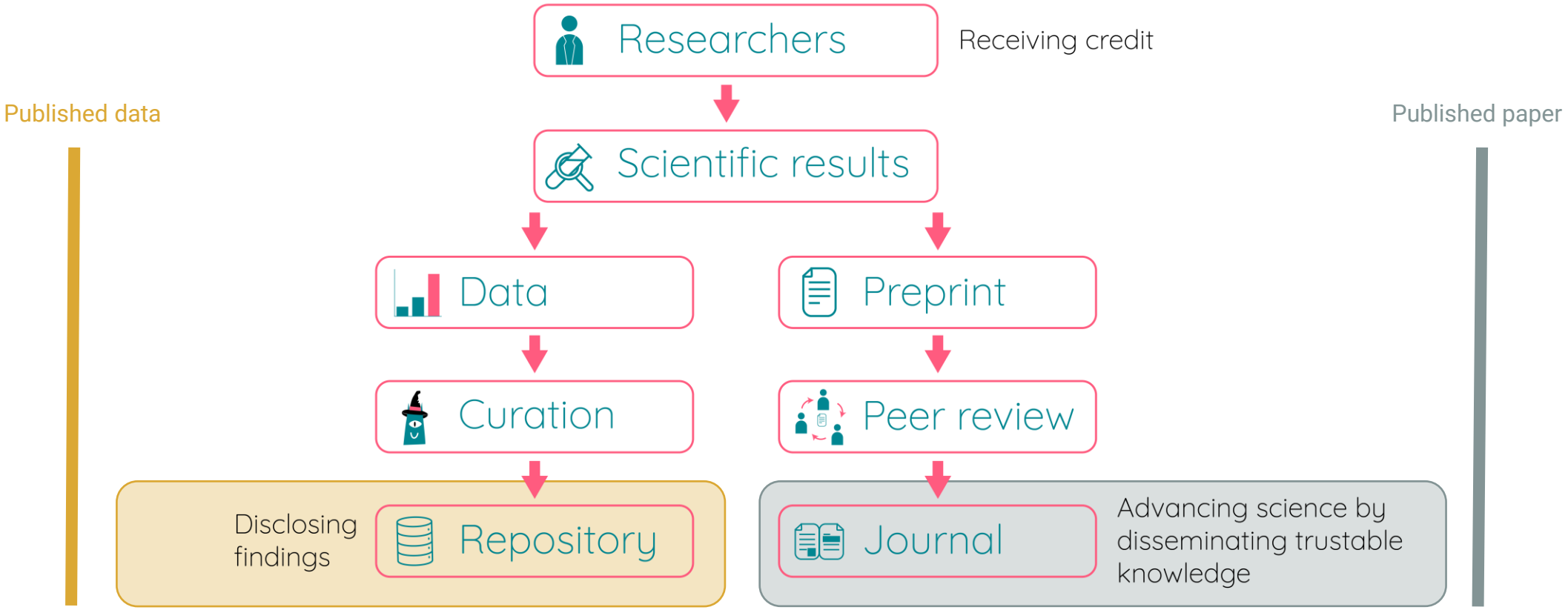
- Domain-specific and interdisciplinary activities
- Development of thematic repositories and tools for FAIR data management
- Bio/Health/Food, Matech, AI & ML, Social Sciences, Physics, Humanities & Arts, Environmental Sciences, Sensitive Data
- https://www.eosc.cz/en/working-groups

## OS III – "development of knowledge and skills"

**Development of human resources and competencies in research data management**

- Involvement of institutions where the topic of data management is in early stages
- Communication and educational activities
- Establishing institutional support for FAIR data management
- Funded through mini-projects

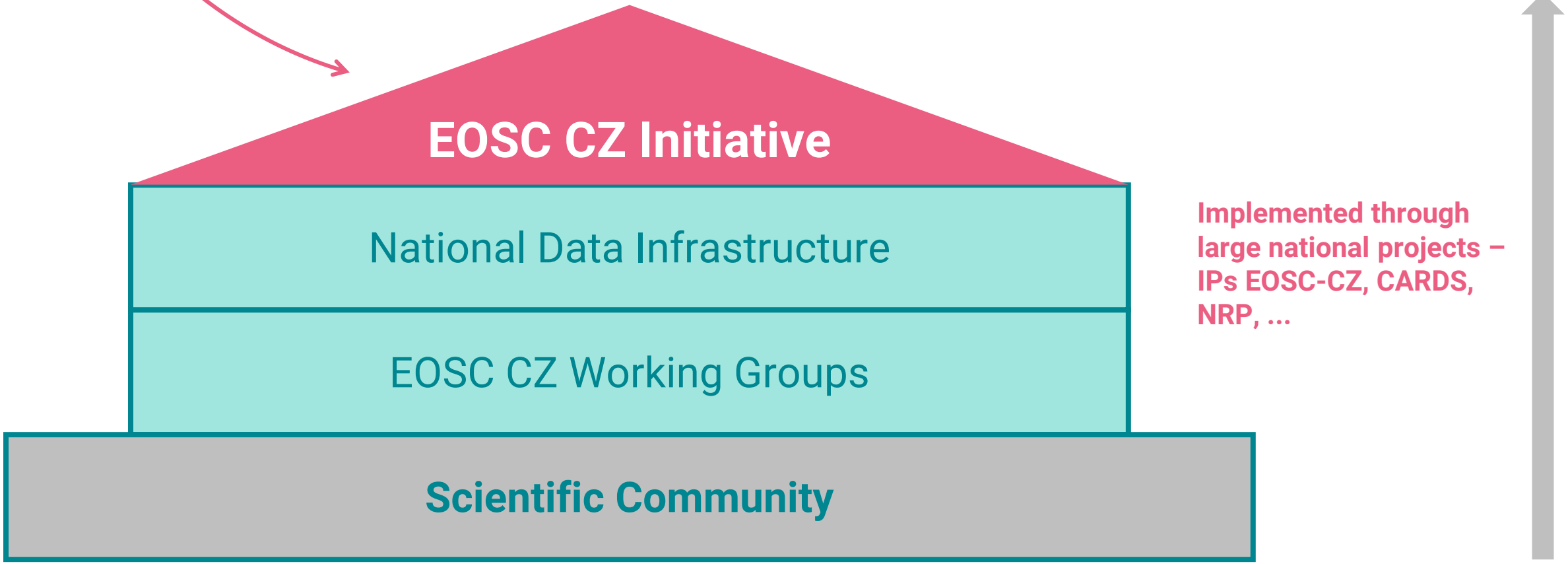
# Peer reviewed research

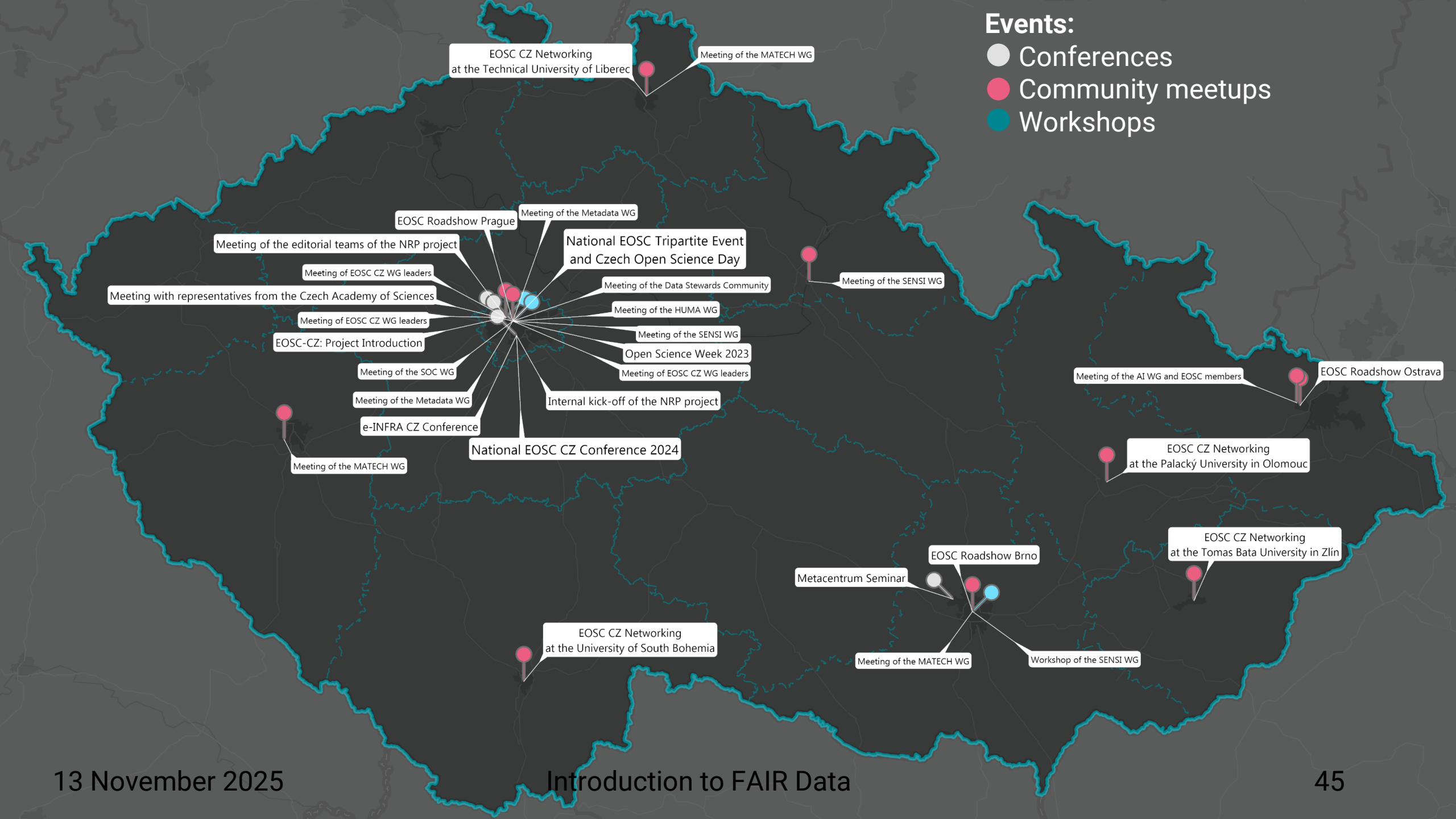


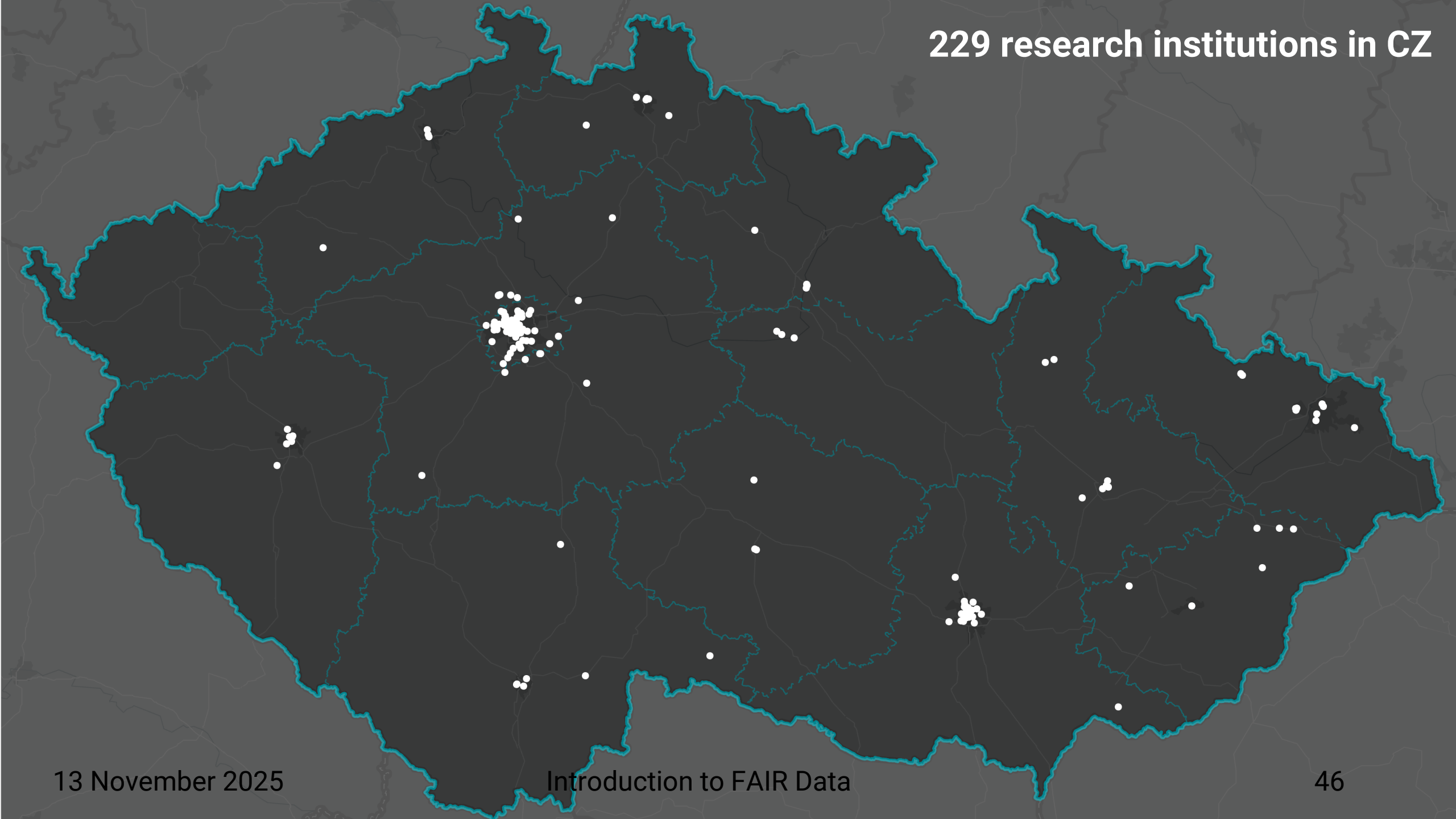

This ALSO is a figurative checkmark in your career

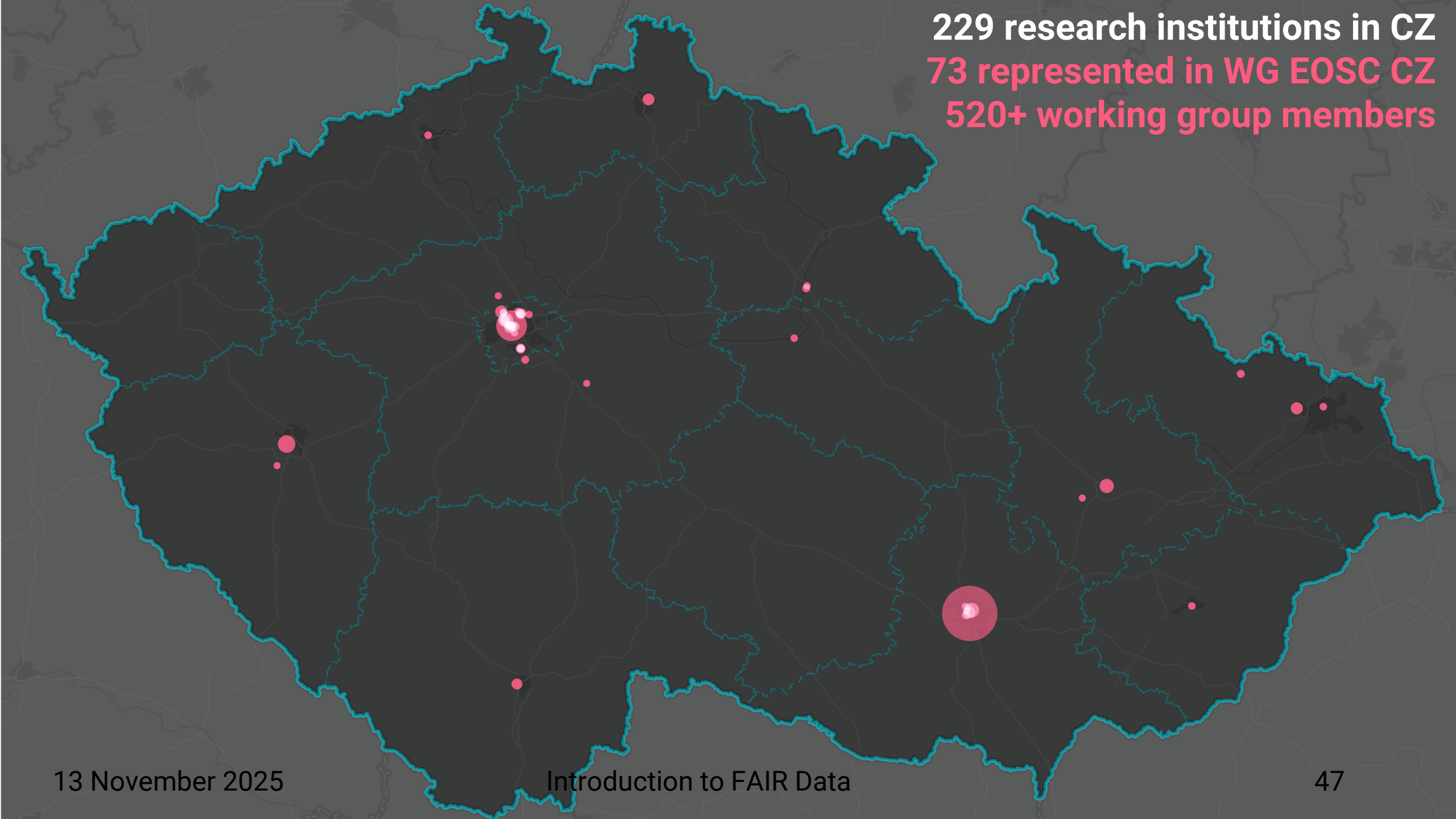
This is a figurative checkmark in your career

# FAIR Support in Czechia




Events:
Conferences
Community meetups
Workshops
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 of the Data Stewards Community
Meeting with representatives from the Czech Academy of Sciences
Meeting of the HUMA WG
Meeting of EOSC CZ WG leaders
Meeting of the SENSI WG
EOSC-CZ: Project Introduction
Open Science Week 2023
Meeting of the SOC WG
Meeting of EOSC CZ WG leaders
Meeting of the Metadata WG
Internal kick-off of the NRP project
e-INFRA CZ Conference
National EOSC CZ Conference 2024
Meeting of the MATECH WG
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
EOSC CZ Networking at the University of South Bohemia
Meeting of the MATECH WG
Workshop of the SENSI WG


229 research institutions in CZ


229 research institutions in CZ
73 represented in WG EOSC CZ
520+ working group members

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# EOSC CZ Working Groups

National Data Infrastructure (NDI) Architecture

Metadata

Core Services

Education and Human Resources

Bio/Health/Food

Materials Sciences and Engineering

Data Management for Artificial Intelligence and Machine Learning

Social Sciences

Physical Sciences

Humanities and the Arts

Environmental Sciences

Sensitive Data

## Open Platform for EOSC CZ Implementation

- Main EOSC CZ Building Blocks (scientists for scientists)
- 4 cross-sectional and 8 field-specific groups
- Open to new members at any time
- Operating throughout the duration of the initiative

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# EOSC CZ Working Groups

## How do WGs work?

- Regular meetings
- Notes and recordings
- Open membership on a voluntary basis

## Why get involved?

- Expertise and awareness
- Building connections
- Opportunity to make an impact

**Are you interested in becoming a member?**

https://www.eosc.cz/en/working-groups

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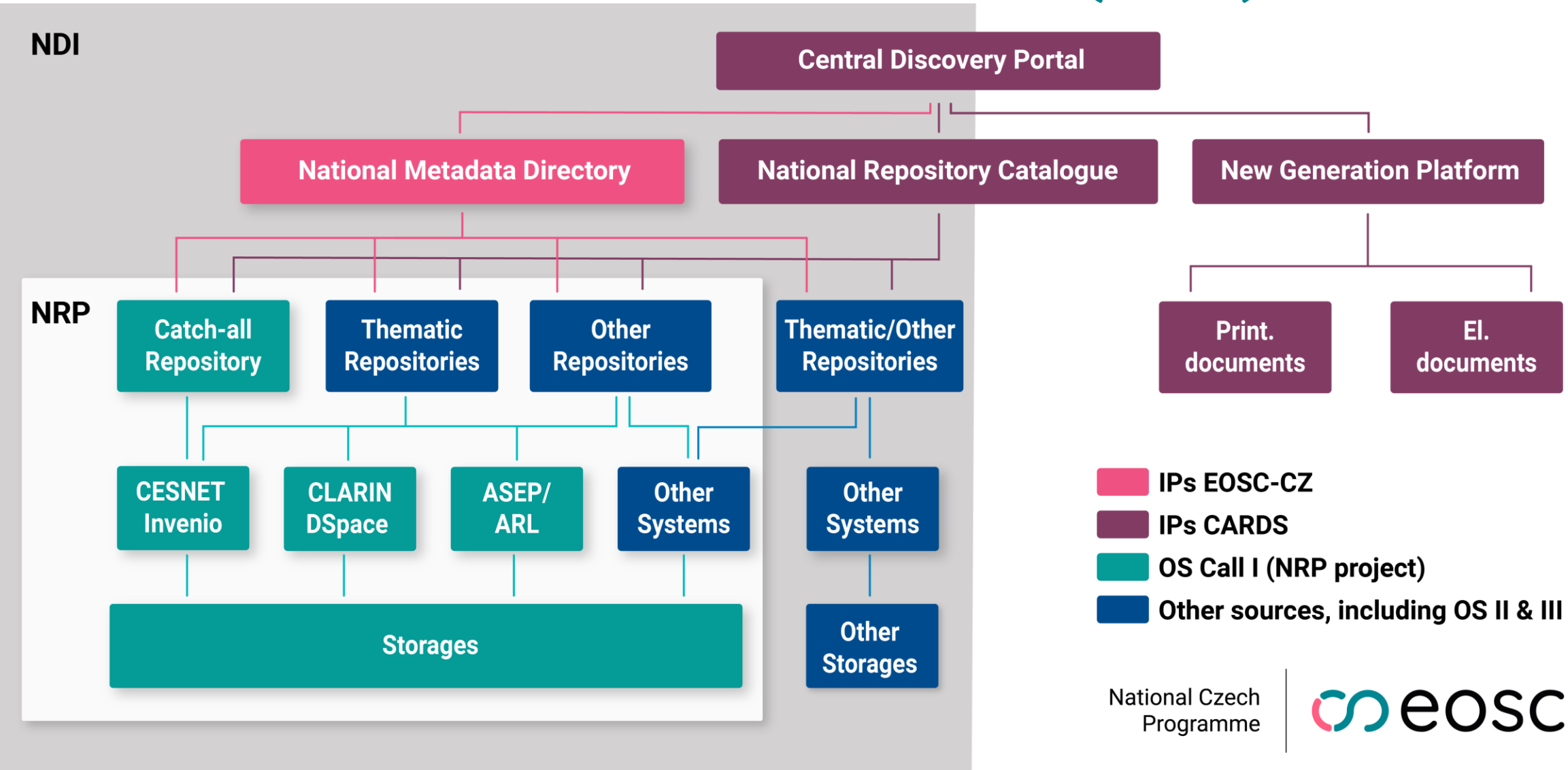
# National Data Infrastructure (NDI)

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# NDI Outputs: Storage Capacities

## Repositories

- Catch-all repository (2025)
- **Thematic (domain-specific) repositories**

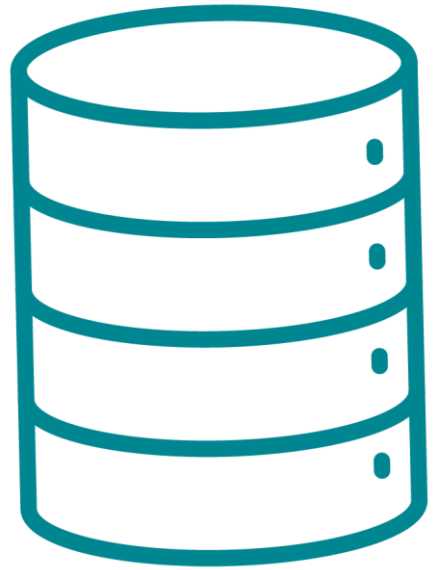
  4 pilots: Molecular Biophysics Database*, National Repository for Biodiversity Data, Repository for Biological Imaging Data, ArchaeoVault (end of 2025)
  - Others from 2025/2026
- National Metadata Directory

## Repository systems

- CESNET Invenio, CLARIN-DSpace, ASEP-ARL

## Hardware

- Physical, distributed storage infrastructure
- Total of 50+ PB of user data storage capacity



* in production mode already

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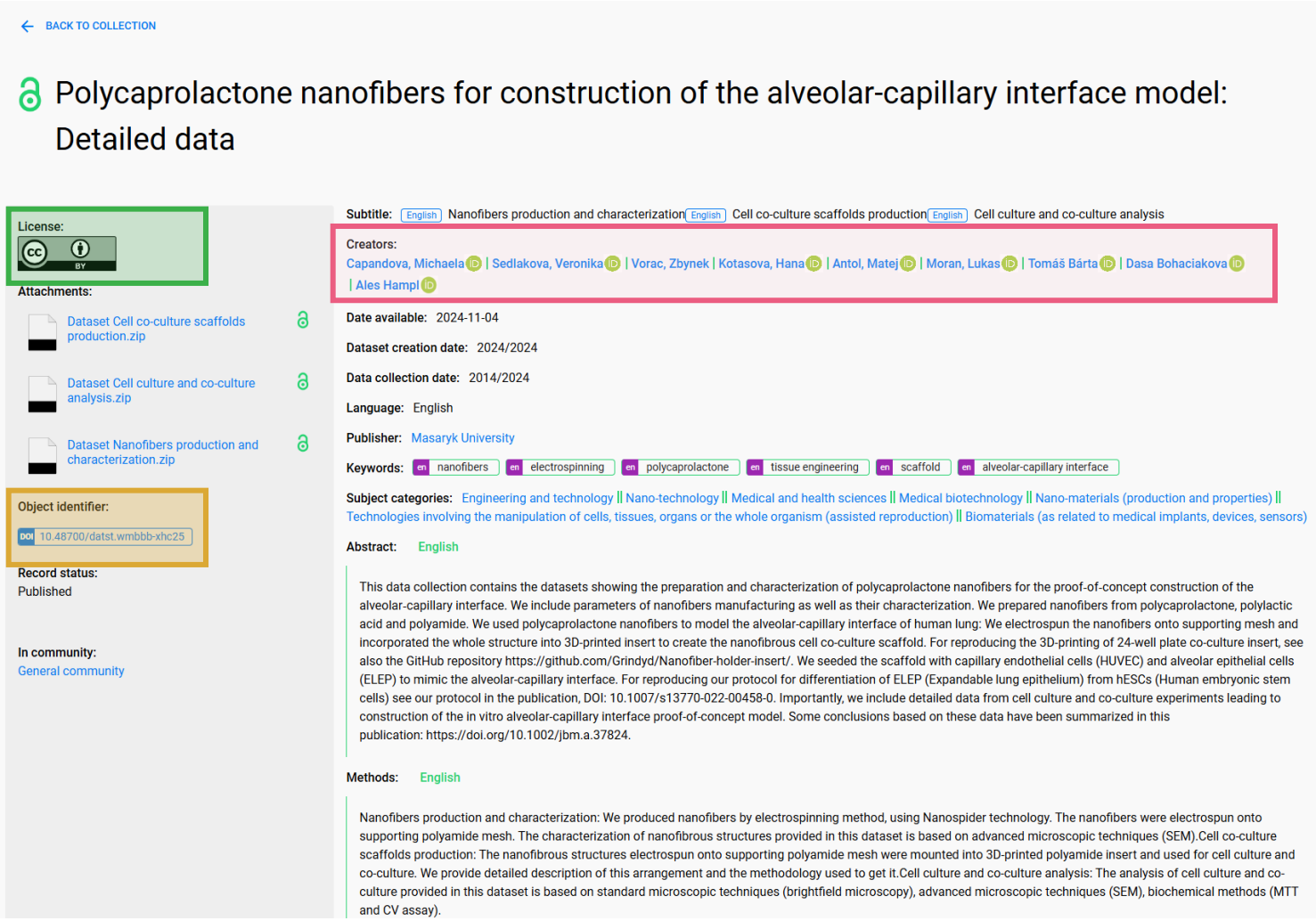
# AI-ready (Valuable) Data



BACK TO COLLECTION

Polycaprolactone nanofibers for construction of the alveolar-capillary interface model: Detailed data

License:

Attachments:

- Dataset Cell co-culture scaffolds production.zip
- Dataset Cell culture and co-culture analysis.zip
- Dataset Nanofibers production and characterization.zip

Object identifier: 10.48700/datst.wmbbb-xhc25

Record status: Published

In community: General community

Subtitle: Nanofibers production and characterization | Cell co-culture scaffolds production | Cell culture and co-culture analysis

Creators: Capandova, Michaela | Sedlakova, Veronika | Vorac, Zbynek | Kotasova, Hana | Antol, Matej | Moran, Lukas | Tomáš Bárta | Dasa Bohaciakova | Ales Hampl

Date available: 2024-11-04

Dataset creation date: 2024/2024

Data collection date: 2014/2024

Language: English

Publisher: Masaryk University

Keywords: nanofibers, electrospinning, polycaprolactone, tissue engineering, scaffold, alveolar-capillary interface

Subject categories: Engineering and technology || Nano-technology || Medical and health sciences || Medical biotechnology || Nano-materials (production and properties) || Technologies involving the manipulation of cells, tissues, organs or the whole organism (assisted reproduction) || Biomaterials (as related to medical implants, devices, sensors)

Abstract: English

This data collection contains the datasets showing the preparation and characterization of polycaprolactone nanofibers for the proof-of-concept construction of the alveolar-capillary interface. We include parameters of nanofibers manufacturing as well as their characterization. We prepared nanofibers from polycaprolactone, polylactic acid and polyamide. We used polycaprolactone nanofibers to model the alveolar-capillary interface of human lung: We electrospun the nanofibers onto supporting mesh and incorporated the whole structure into 3D-printed insert to create the nanofibrous cell co-culture scaffold. For reproducing the 3D-printing of 24-well plate co-culture insert, see also the GitHub repository https://github.com/Grindyd/Nanofiber-holder-insert/. We seeded the scaffold with capillary endothelial cells (HUVEC) and alveolar epithelial cells (ELEP) to mimic the alveolar-capillary interface. For reproducing our protocol for differentiation of ELEP (Expandable lung epithelium) from hESCs (Human embryonic stem cells) see our protocol in the publication, DOI: 10.1007/s13770-022-00458-0. Importantly, we include detailed data from cell culture and co-culture experiments leading to construction of the in vitro alveolar-capillary interface proof-of-concept model. Some conclusions based on these data have been summarized in this publication: https://doi.org/10.1002/jbm.a.37824.

Methods: English

Nanofibers production and characterization: We produced nanofibers by electrospinning method, using Nanospider technology. The nanofibers were electrospun onto supporting polyamide mesh. The characterization of nanofibrous structures provided in this dataset is based on advanced microscopic techniques (SEM).Cell co-culture scaffolds production: The nanofibrous structures electrospun onto supporting polyamide mesh were mounted into 3D-printed polyamide insert and used for cell culture and co-culture. We provide detailed description of this arrangement and the methodology used to get it.Cell culture and co-culture analysis: The analysis of cell culture and co-culture provided in this dataset is based on standard microscopic techniques (brightfield microscopy), advanced microscopic techniques (SEM), biochemical methods (MTT and CV assay).

Your (author)

Citable (DOI) + **F**indable

**A**ccessible + **I**nteroperable

**R**eusable (licence)

Machine actionable (metadata)

= AI-ready record (dataset)

**VALUABLE SCIENTIFIC RESULT**

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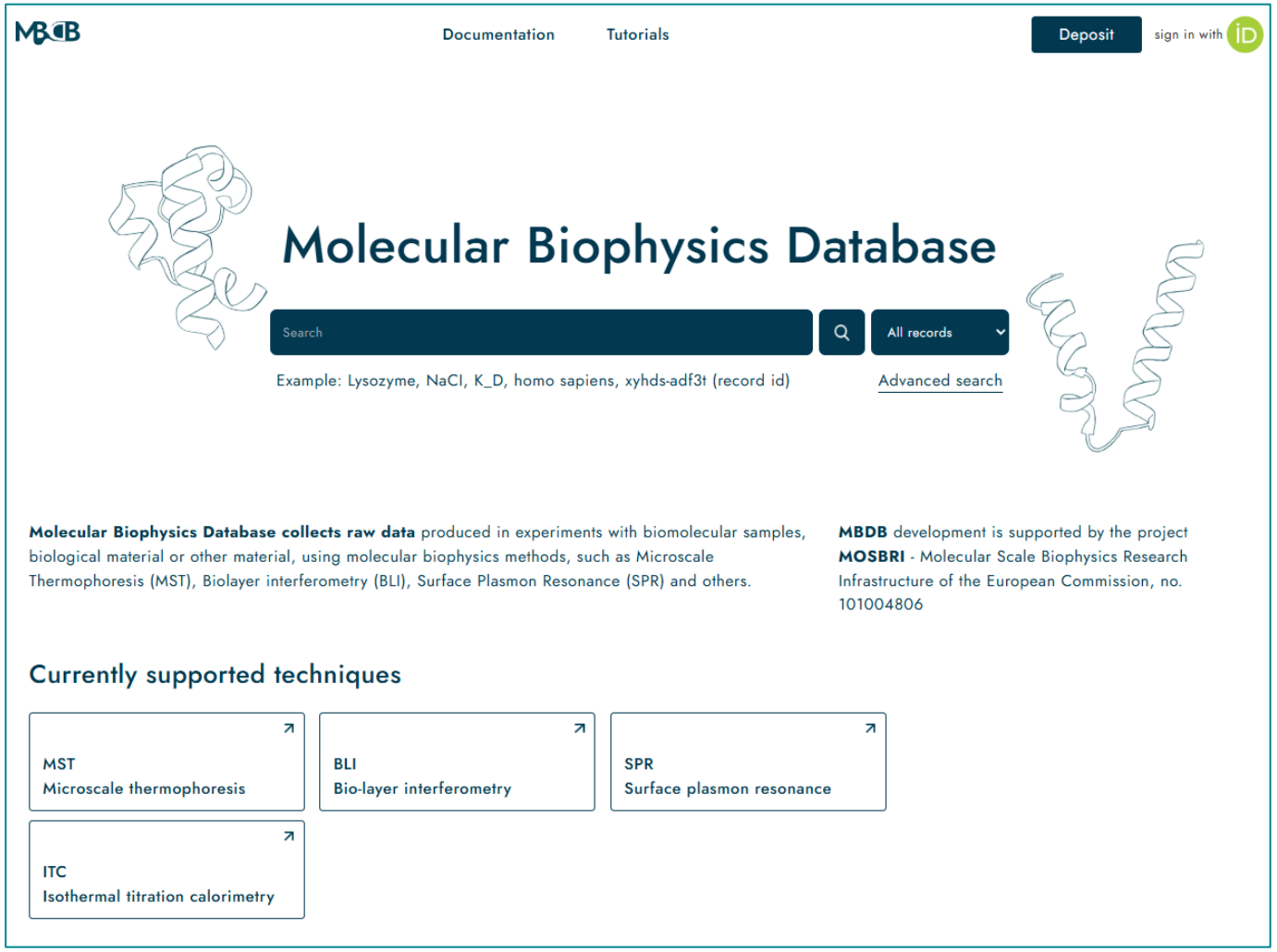
# Molecular Biophysics Database




https://mbdb-data.org/

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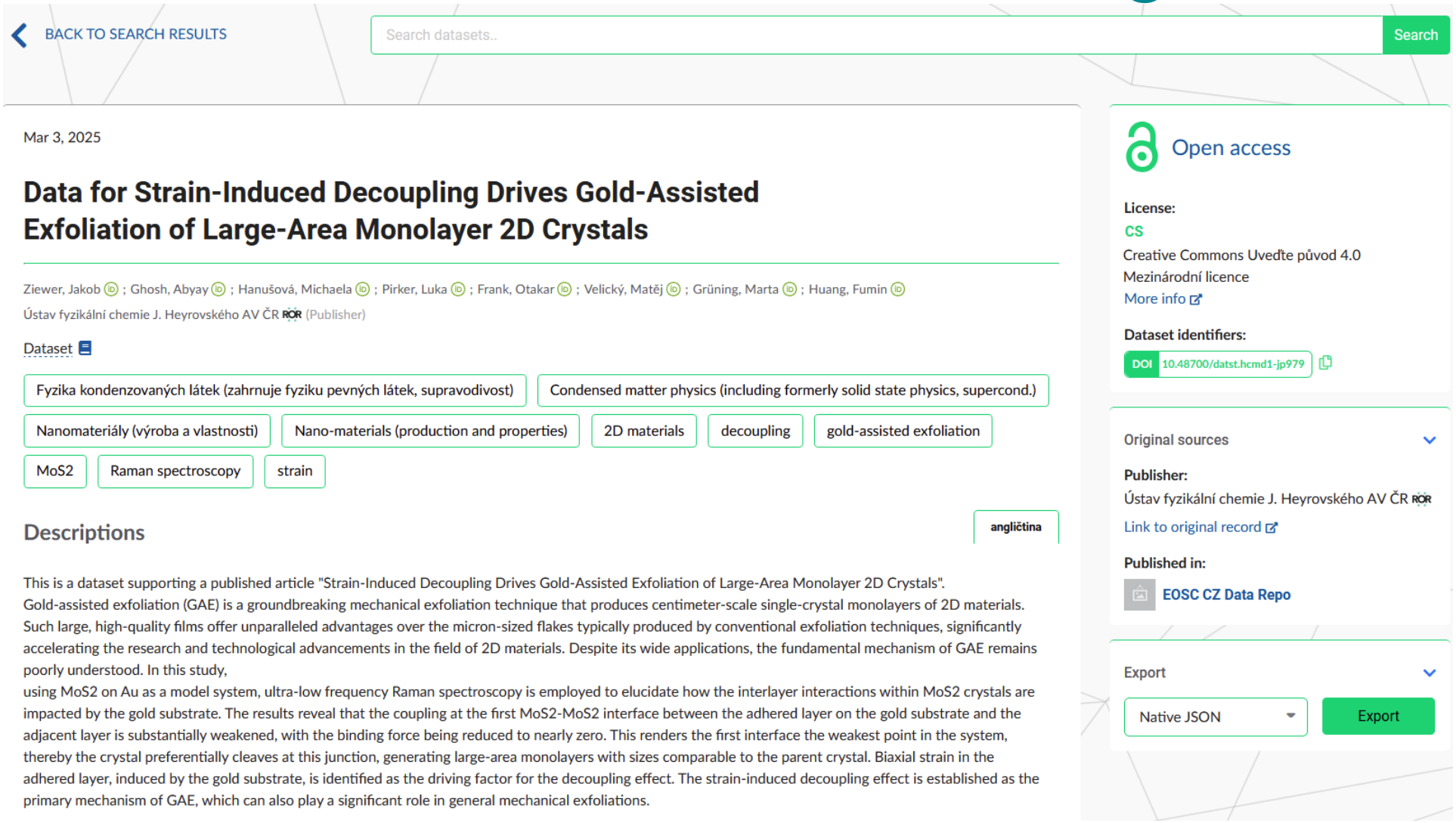
# National Metadata Directory




https://nma.eosc.cz/

# CZECH DATA REPOSITORIES

ARTS

AGROFOOD

AI

CORPUS

GENASIS

OMICS

ZOOLOGY

SIMULATIONS

SENSORS

DUNE

ARCHAEO-LOGY

BIOIMAGING

SOLAR

PLANTS

MAPS AND DATA

LINGUISTICS

ISOARCH


SOCIAL

FUNGI

SENSITIVE SOCIAL DATA

MOLECULAR BIOPHYSICS

BIO/CHEM

OBSERVA-TORY

ARCHAEO-VAULT

IMAGING

ARCHAEO-MAPS

BIODIVER-SITY

CRYSTALO-GRAPHY

PLASMA

PHENOTYPE

LASER PHYSICS

LAUEDB

MATERIALS

EXPOSOME

TELESCOPE

BIBLIO-GRAPHY

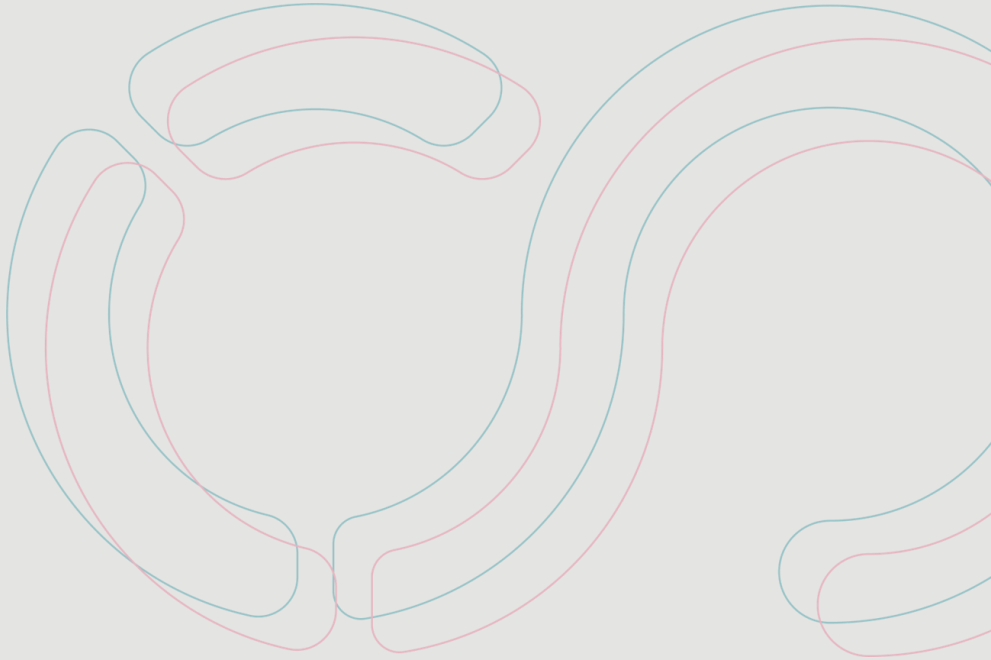
BIOPHYSICS

BIOMONI-TORING

REPO CZ

# National Repository Platform (NRP) Project

## Focusing



# NRP for End-Users

- The main objective of NRP:
  - provide various research data-related services for NRP users:
    - academic institutions and
    - individual scientists and researchers.
- What NRP will provide
  - to enhance their abilities to fulfil FAIR principles and
  - data management requirements
  - through the life cycle of research data in projects.

# NDI Outputs: Tools and Services

- Support for data management planning (DMP).
- Metadata profile management.
- Support for license handling.
- Support for working with persistent identifiers.
- Support for FAIRification of research data.
- Automation of data collection.
- Electronic laboratory notebooks.
- Overall cybersecurity and system compliance.

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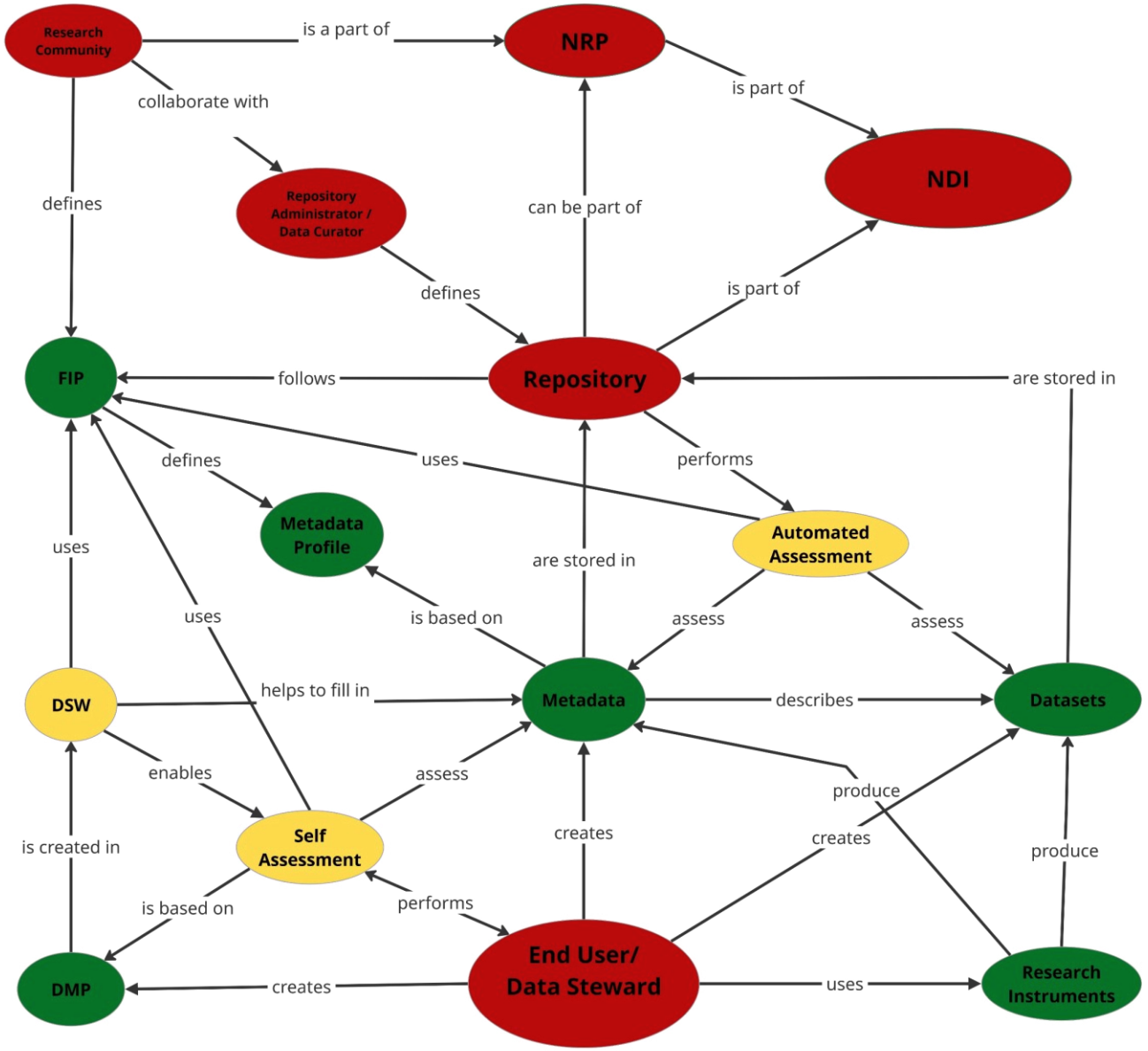
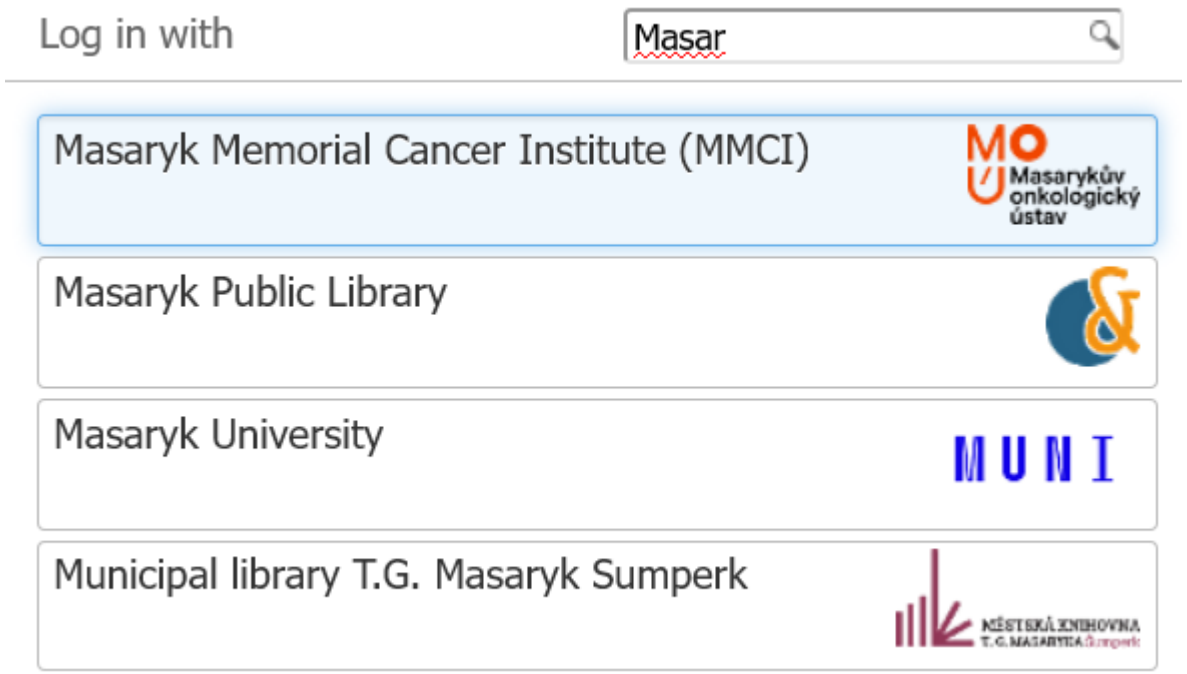
# Schema of FAIR Implementation in NDI/NRP



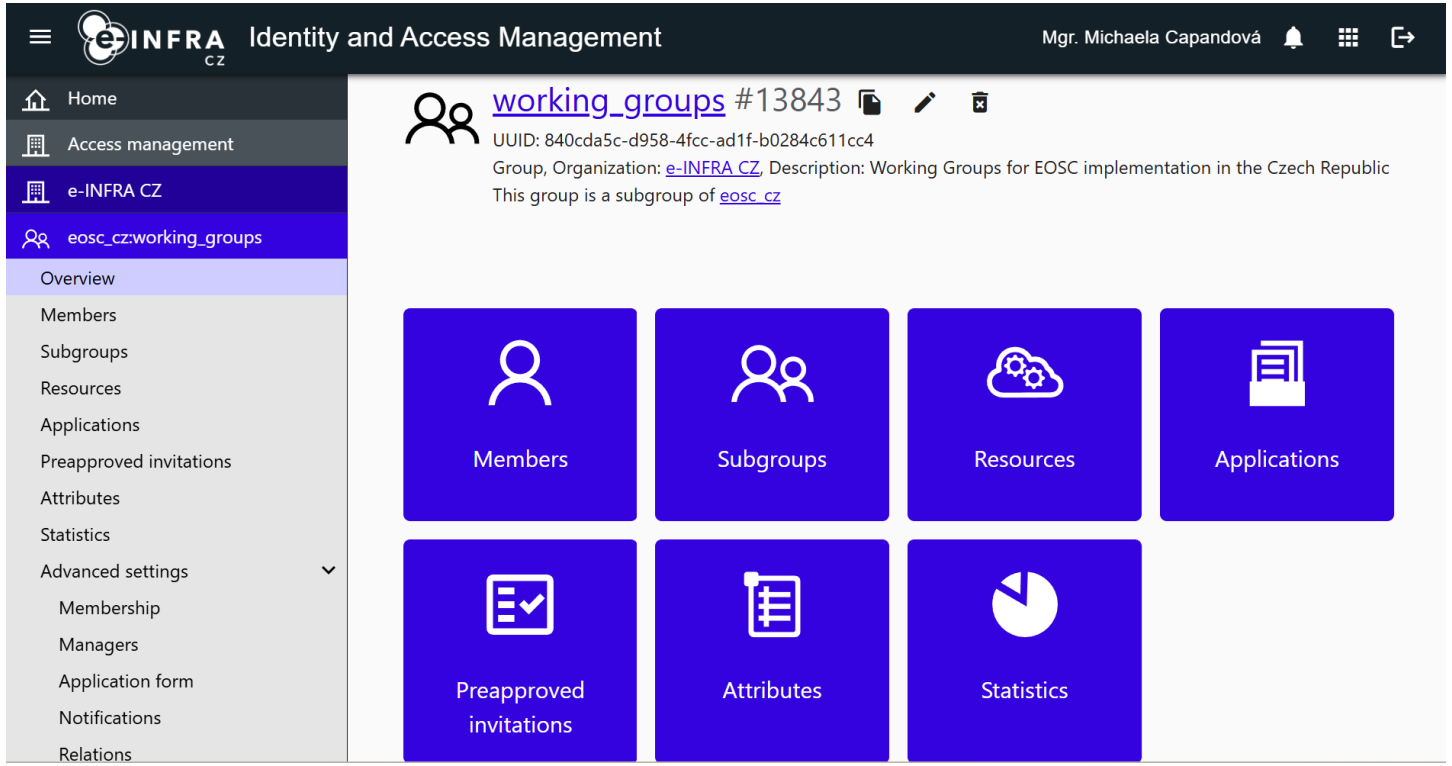
# Data Access Control

- FAIR Data, “As open as possible, as closed as necessary”.
  - We need precise access control to data, metadata, services.
- Federative system – use your institutional identity, your well-known authentication web page.
  - Effective collaboration across institutions, individuals, …



# Authentication and Authorization Infrastructure

Enabling users from different institutions to easily access data and services.




- Access and identity management
- Group and role management
- Permission assignment

https://perun-aai.org/

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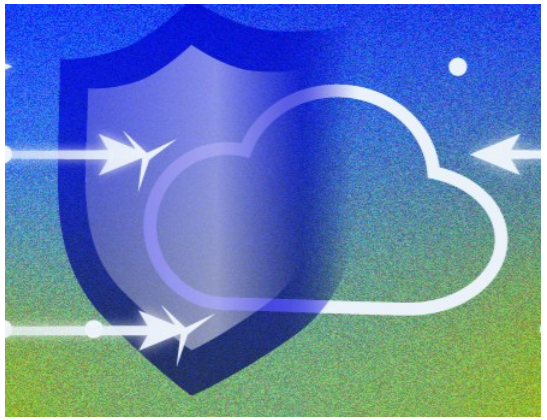
# SensitiveCloud



SensitiveCloud

## Secure environment for storing, sharing and processing sensitive data.

- Primarily designed for work with your own sensitive data.
- Gradually extended to support controlled data sharing.
  - Main technical component for handling sensitive data within NDI.
- Includes storage, computing resources and support for ready-to-use web applications.

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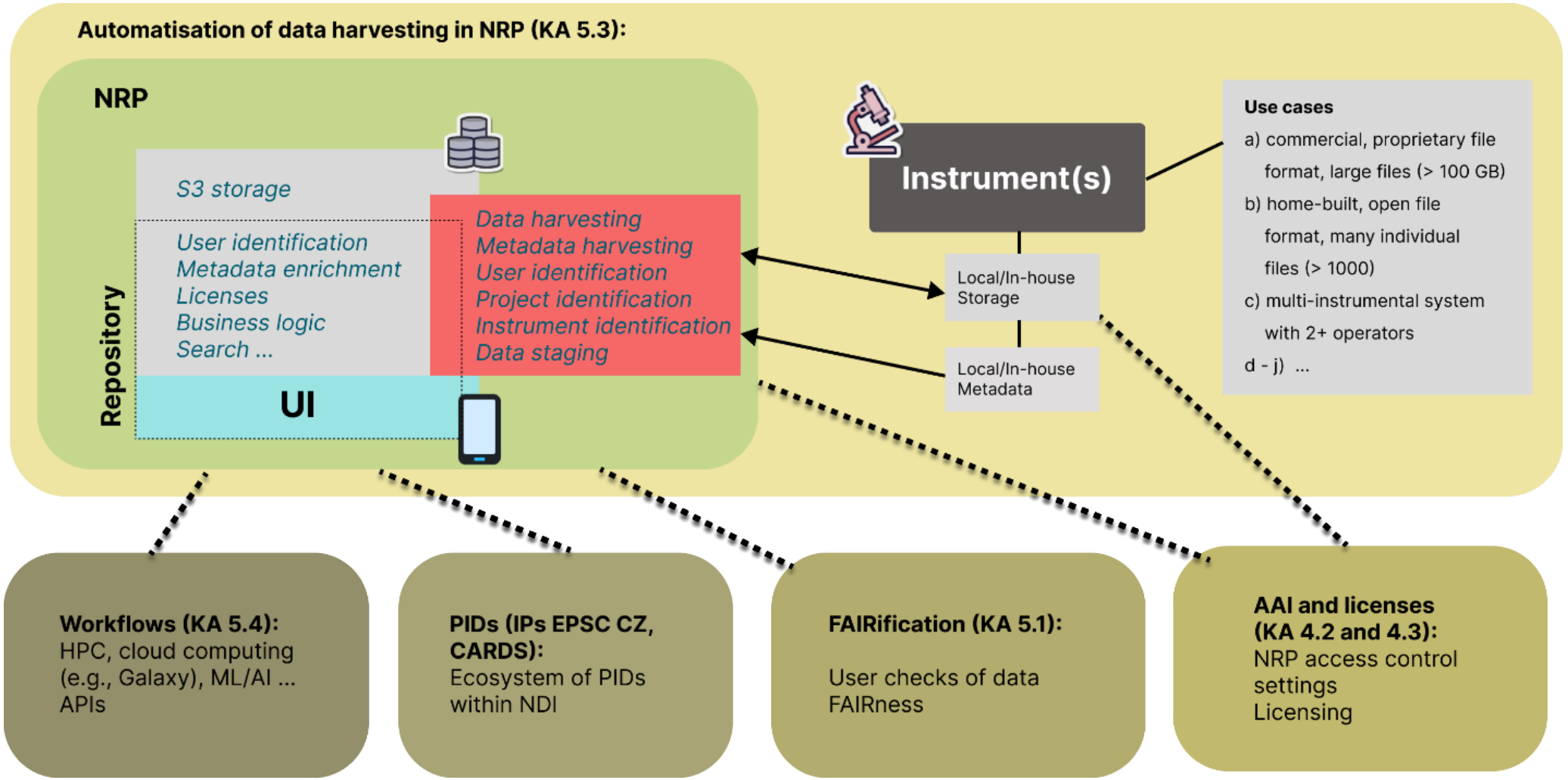
# Automation of Data and Metadata Collection

FAIR: Accessible, Interoperable, Reusable



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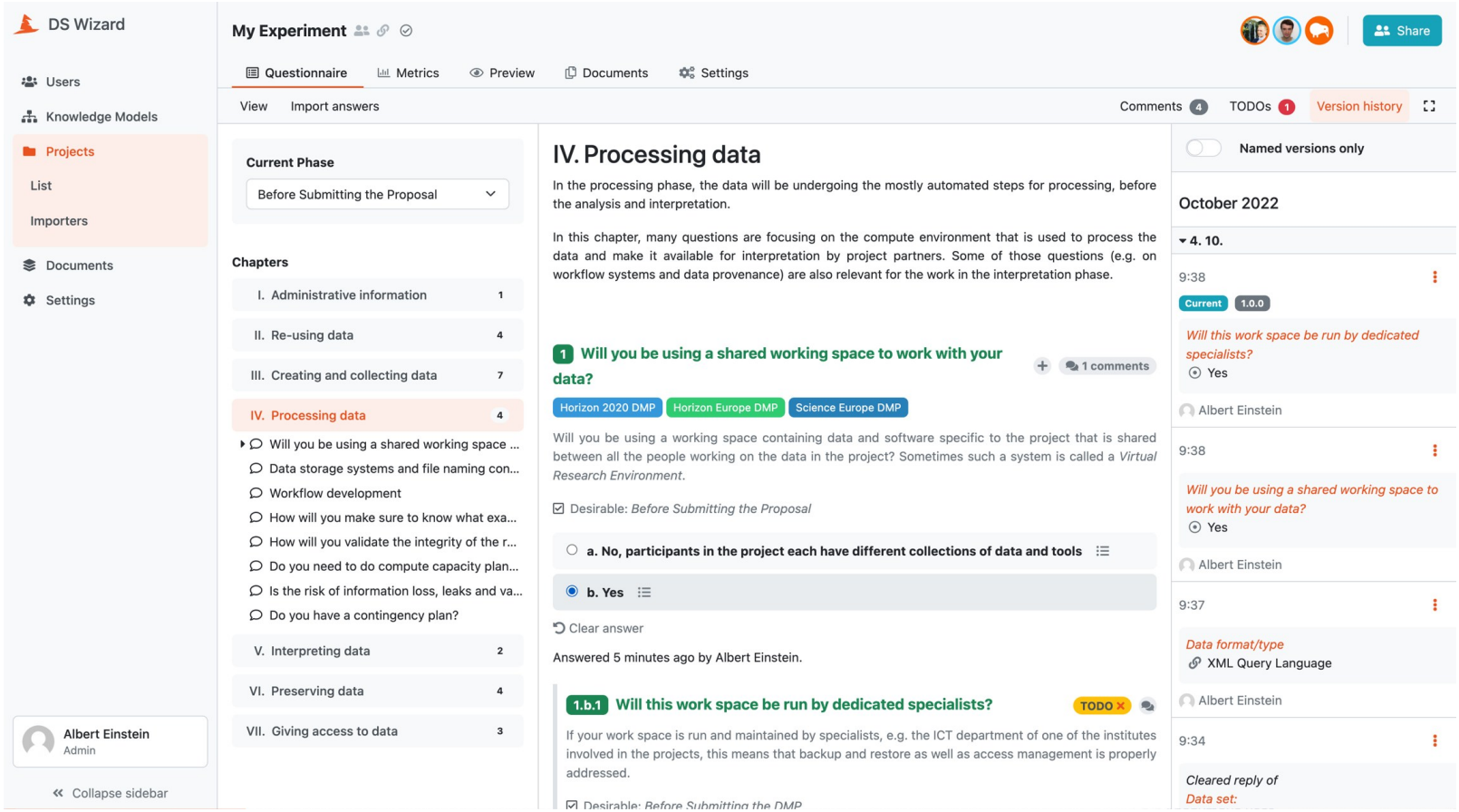
# Support for Data Management Planning

- We expect integration of tools like Data Stewardship Wizard (DSW) directly to the platform.
  - https://dmp.eosc.cz/
- Integration allows effective re-use of available (meta)data.



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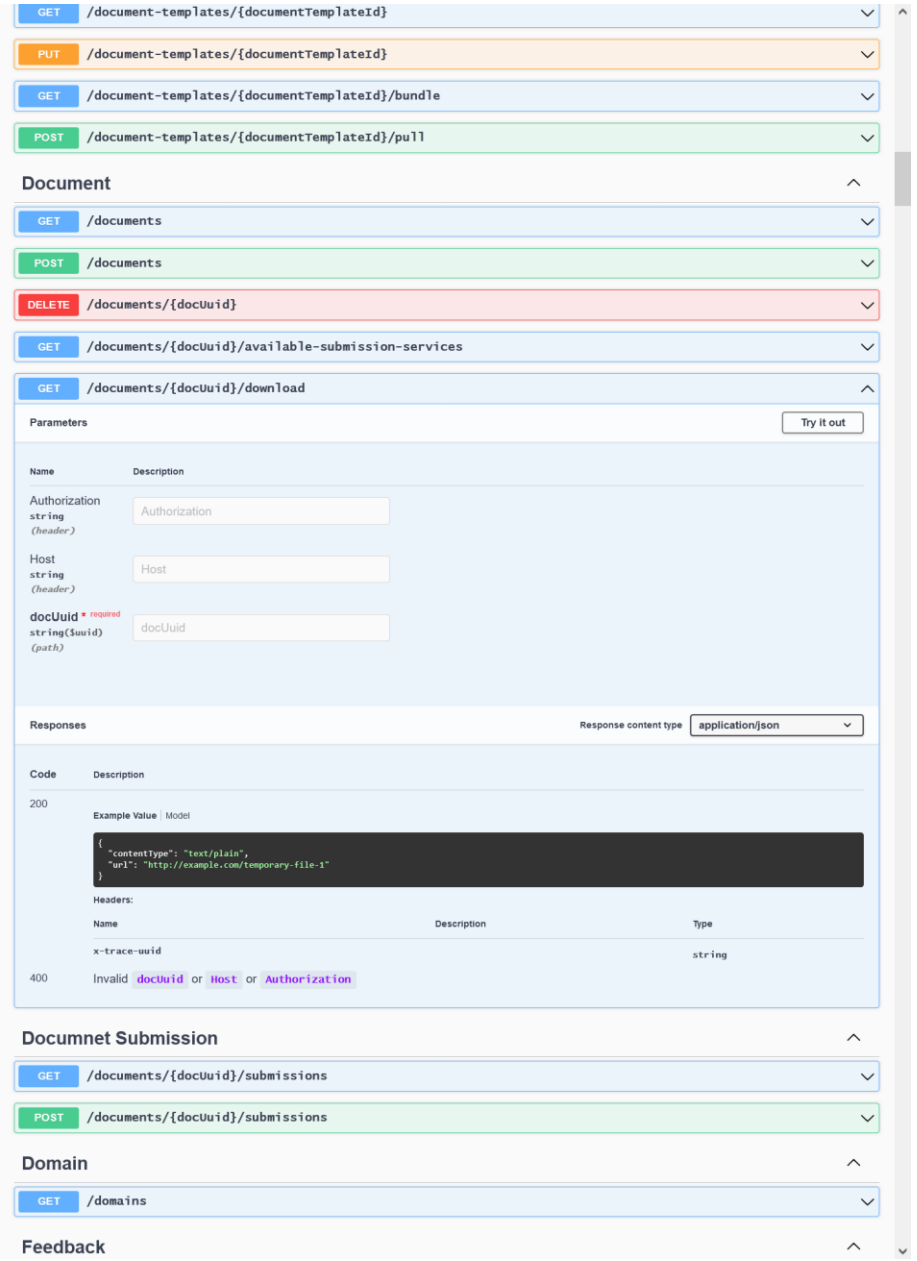
FAIR: Findable, Accessible, Interoperable

# Machine-Actionable

- Automate as much as possible.
  - API and machine-readability for data and metadata.
- As much as possible read from metadata of the datasets, from infrastructure configuration, …



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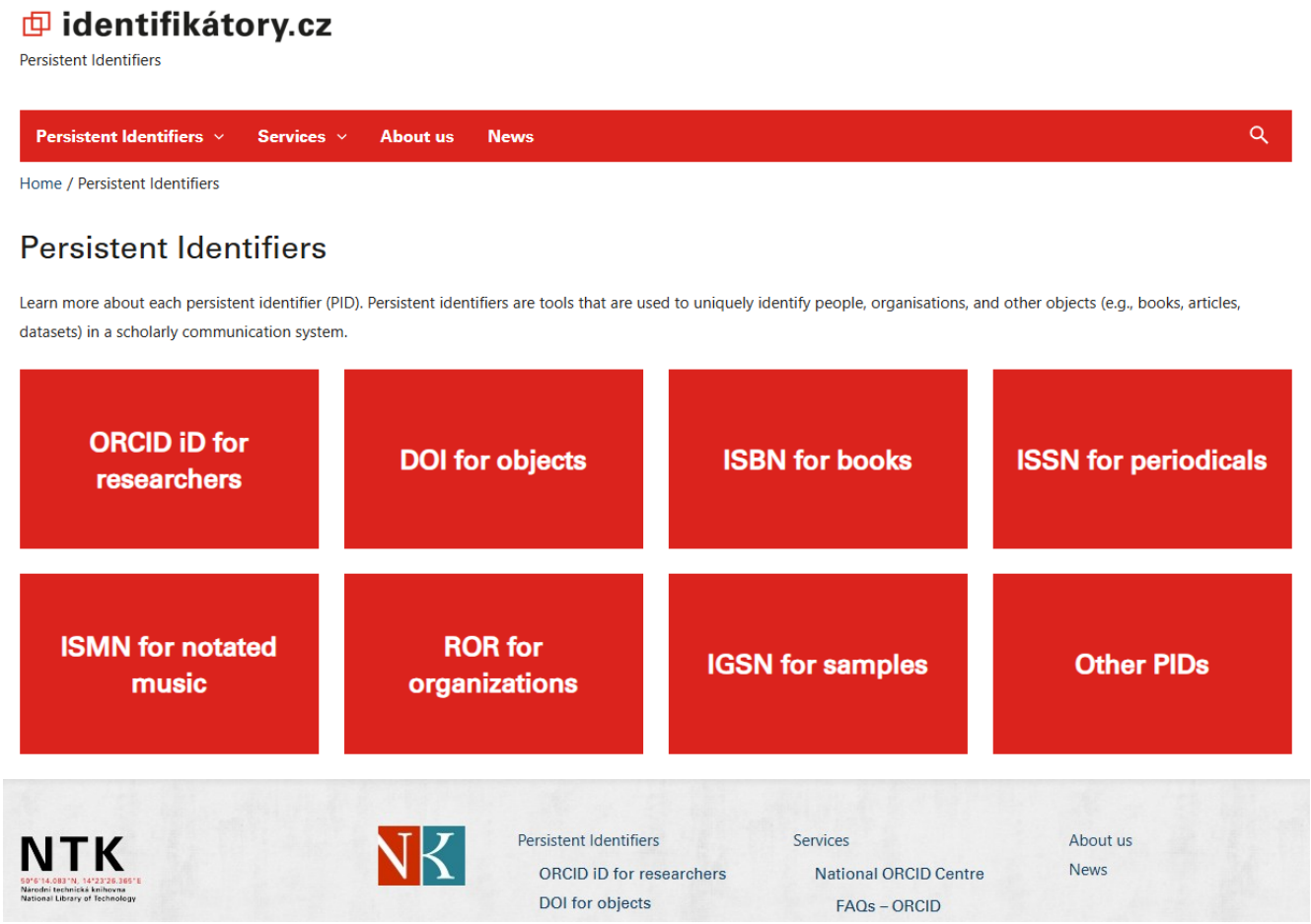
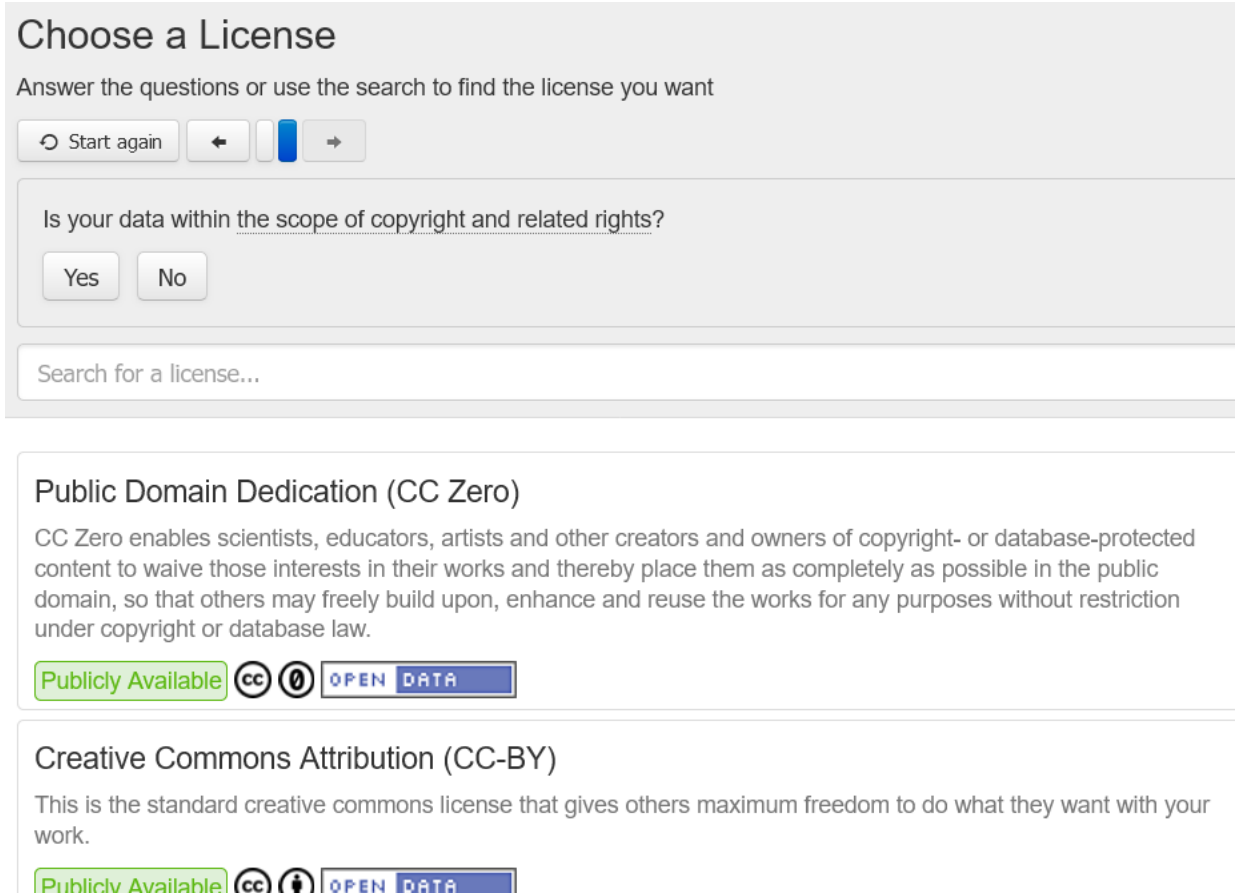
# Persistent Identifiers




https://identifikatory.cz/en/

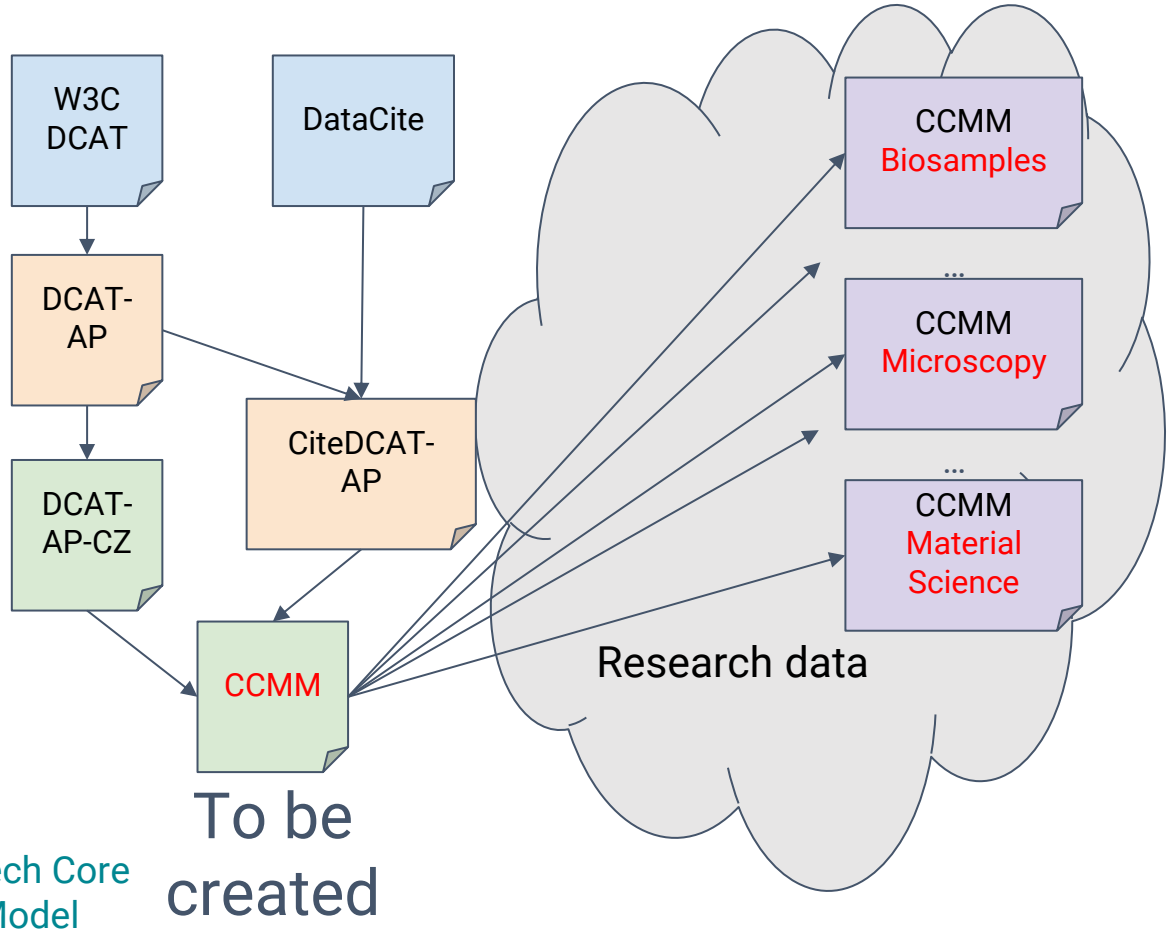
# Support Work with Licenses

- Templates of deposition licenses governing the rules for upload of datasets to repositories.
- License chooser for users‘ datasets on upload.
- Framework for dataset‘s license-based access control to dataset with limited access.
- Integration and machine actionability.
  - Connection to data management, access control, …



# Managing Metadata Profiles in NRP

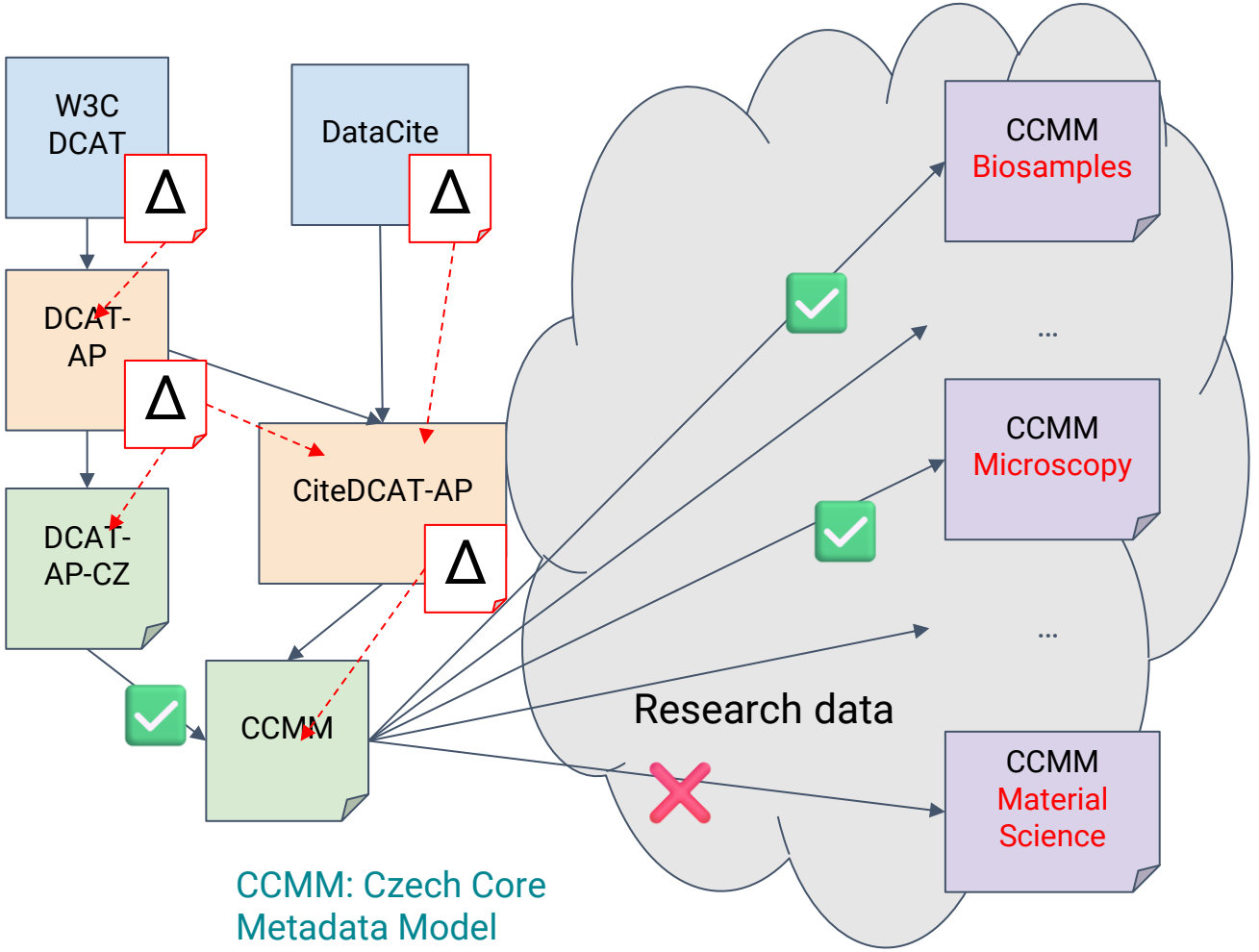
- https://dataspecer.com/
- Research data metadata profiles:
  - What happens, when
    - DCAT v2 → DCAT v3?
    - DCAT-AP v2.1.1 → DCAT-AP 3.0.1?
    - DataCite 4.4 → DataCite 4.5?
- We want changes to be propagated automatically.



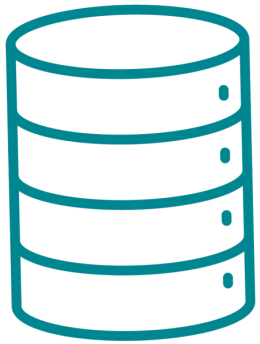

CCMM: Czech Core Metadata Model

# Managing Metadata Profiles in NRP

- https://dataspecer.com/
- But also
  - profile compliance validation (✅ ❌),
  - description of changes in specifications (Δ),
  - change propagation mechanism ( ⇢ ),
  - implementation in tools.



# NDI Outputs: Summary



**Storage capacities**

**Tools and services**

**Computing capacities**

# Useful Links and Contacts

EOSC CZ Website

EOSC CZ Newsletter

- Any questions?
  - info@eosc.cz
- Ideas for a lecture or a training?
  - events@eosc.cz
- Get in touch with our PR
  - pr@eosc.cz

@EOSC Czech Republic

@eosccz.bsky.social

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# Thank you for your attention

E: ruzicka@ics.muni.cz

E: info@eosc.cz W: www.eosc.cz/en

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