Module 3 – RDM Knowledge Blocks

- Persistent Identifiers
- Metadata standards
- Licenses
- Repositories
- Version Control Systems

Persistent Identifiers (PIDs) Optimised Research

Leibniz Association

DRESDEN concept

Leibniz Institute of Ecological Urban and Regional Development

Persistent Identifiers (PIDs)

- PID is a unique code 
- There are various PIDs for various type of objects 

- PID are persistent and linked to essential info (Metadata) 
- PIDs helps to track objects itself 
- PIDs link to other resources 

Persistent Identifiers (PIDs)

- PIDs are created by PID Authorities Providers (DataCite, Crossref, ROR, ORCiD, etc.)

- PIDs help in a number of things:

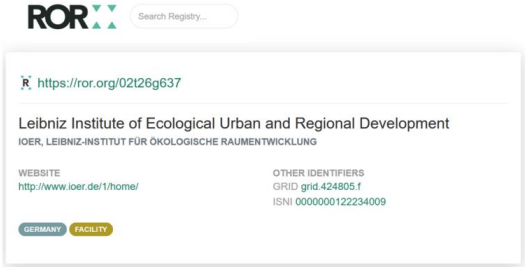
- PIDs make your research FAIR

PIDs examples

People

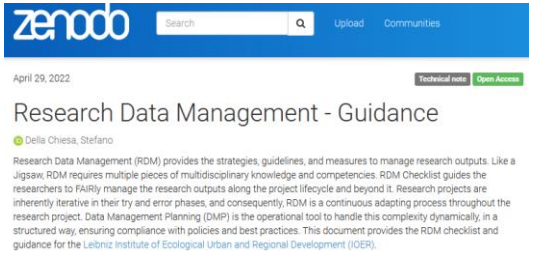
https://orcid.org/0000-0002-6693-2199

Organization



https://ror.org/02t26g637

Research output



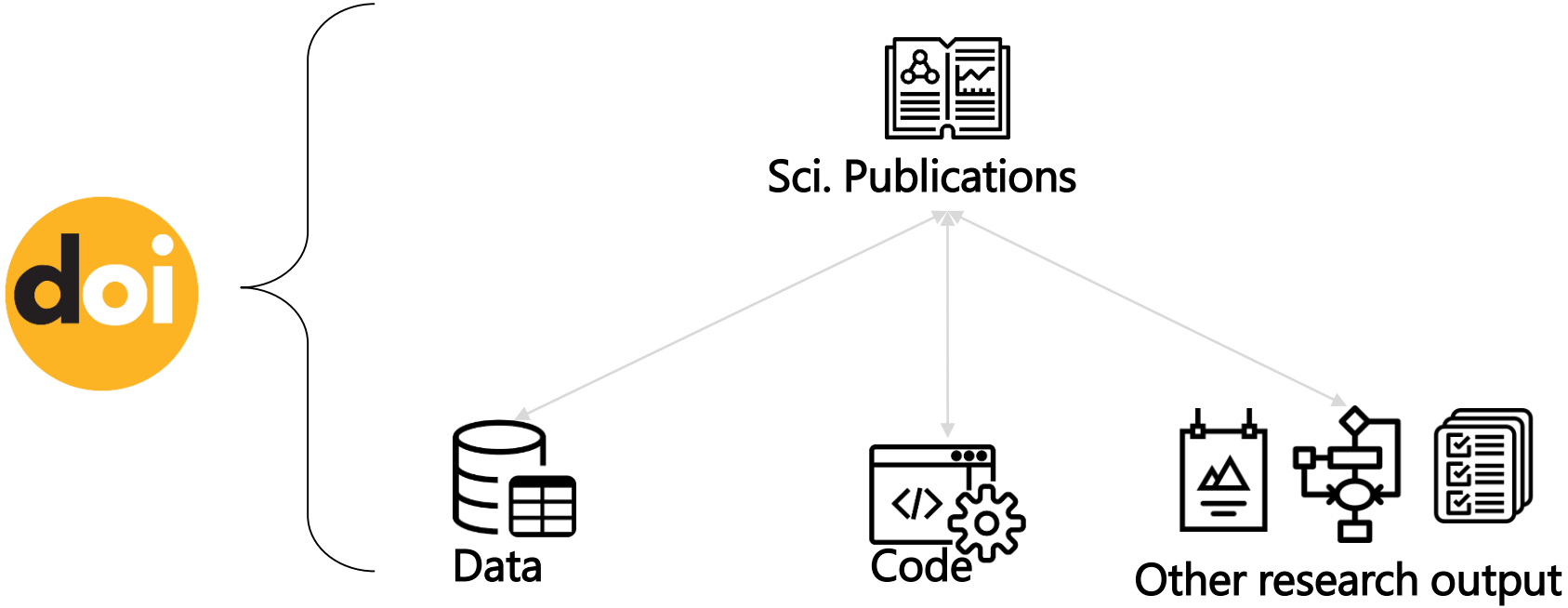
https://doi.org/10.5281/zenodo.6504928

Controlled syntax

Host name | Prefix | Suffix

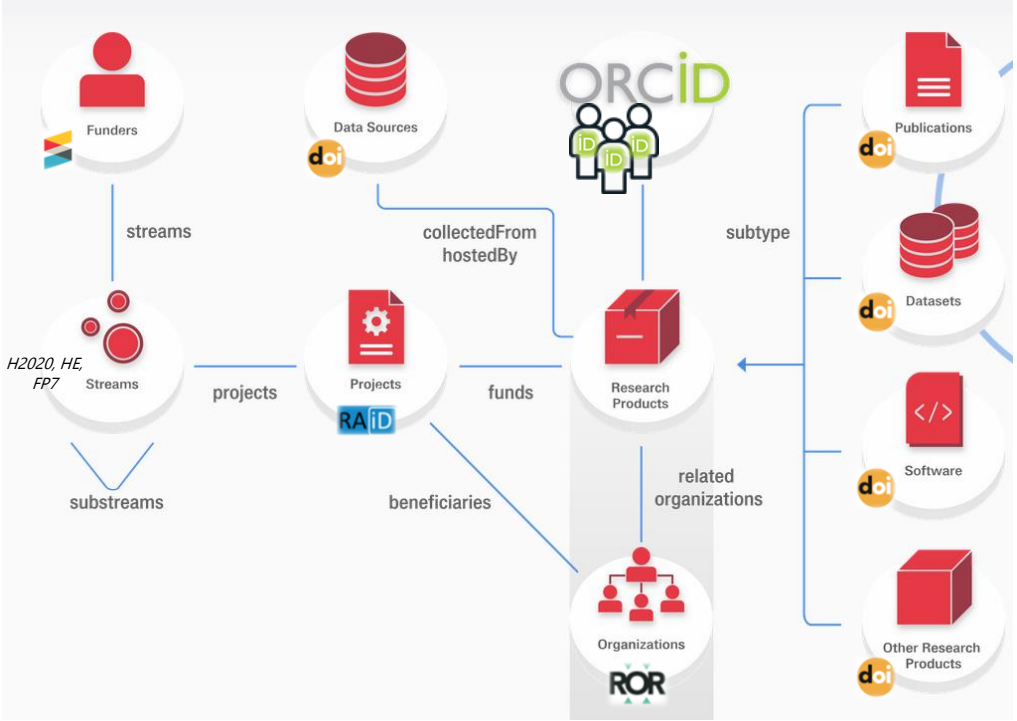
https://doi.org/10.26084/ioerfdz-r10-urbgrn2018

DOI (Digital Object Identifier)



PID linked research

- Crossref
- Datacite
- ORCID
- Digital Object Identifiers (DOI)
- Research Activity Identifier (RAiD)
- Research Organization Registry (ROR)



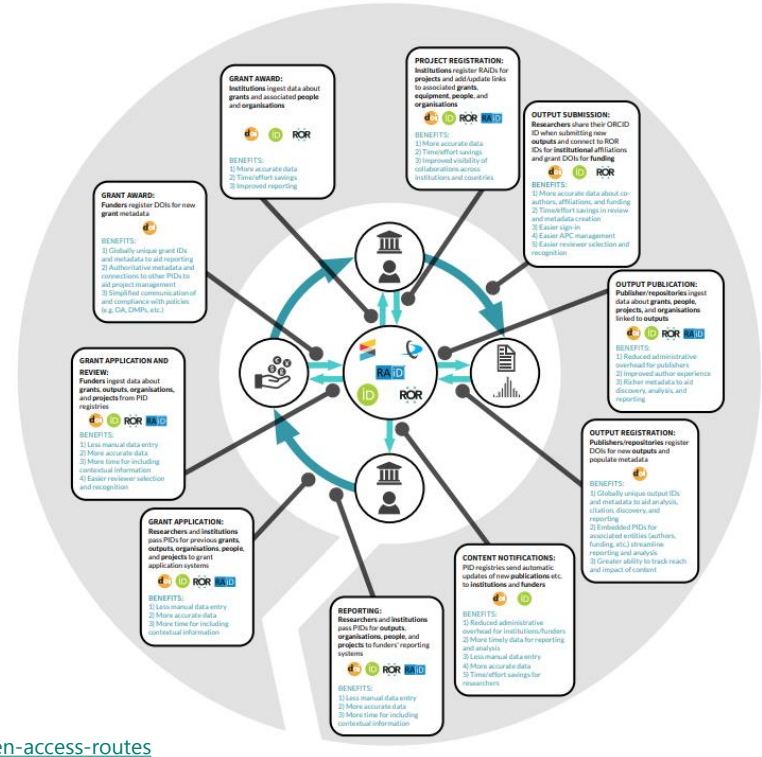
Graphic adapted from: https://graph.openaire.eu/

Linked Research Outputs

The bigger picture

The PID-optimised research lifecycle

- Crossref
- Datacite
- ORCID
- Digital Object Identifiers (DOI)
- Research Activity Identifier (RAiD)
- Research Organization Registry (ROR)



https://doi.org/10.5281/zenodo.4991733

OpenAIRE MONITOR

Example Funding dashboard: https://monitor.openaire.eu/dashboard/cnr/funding
Example Publication dashboard: https://monitor.openaire.eu/dashboard/cnr/research-output/publications
Example OA routes dashsboard: https://monitor.openaire.eu/dashboard/cnr/open-science/open-access/open-access-routes
Example Impact dashboard: https://monitor.openaire.eu/dashboard/cnr/impact-

The PID Landscape

Heterogeneous PID Landscape & PID maturity

Mature PIDs

Emerging PIDs

Immature PIDs

Table 1. A Landscape Analysis of Research Entities, Identifying PID Types and Infrastructure Maturity (as of May 2018)

Research Entity	PID Types Used	Maturity of PID Infrastructure
Publication	DOI, accession number, handle, URN, Scopus EID, Web of Science UID, PMID, PMC, arXiv identifier, BibCode, ISSN, ISBN, PURL	mature
Citation	OCI (secondary aggregation of information)	emerging
Conference	DOI, accession number	emerging
Researcher (or scholar)	ORCID IDs, ISNI (also DAIs, VIAFs, arXivIDs, OpenIDs, ResearcherIDs, ScopusIDs)	mature
Organization	DOI, ISNI, GRID, Ringgold IDs, ROR IDs	emerging
Data	DOI, accession number, handle, PURL, URN, ARK	mature
Data repository	none	immature
Grants	DOI, PURL	emerging
Project	local identifier, accession number, RaiD	emerging
Experiment	none	immature
Investigation	DOI, accession number	emerging
Analysis	GitHub gist	immature
Software	DOI, SHA-1 hash	emerging
Computer simulation	UUID	emerging
Software license	none	immature
Equipment		
Instrument, device, sensor, platform, research facility	DOI, RRID, UID	emerging
Archival/storage facility	URI, DOI, UUID	emerging
Field station	none	immature
Sample		
Geological or biological sample	accession number, RRID, DOI, IGSN	emerging
Cultural artifact	DOI, URN, accession number	emerging
Historical or mythical person	URI	emerging
Temporal period and historical place	ARK, URI, accession number	immature
Study Registration		
Clinical trial; non-clinical registration	accession number, DOI	immature
Data management plan	DOI	immature
Workflow	URI, DOI	immature
Protocol	DOI	immature

Adapted from Ferguson et al.[12]. ARK: Archival Resource Key, BibCode: Bibliographic Codes, DAI: Digital Author Identifier, DOI: Digital Object Identifier, ID: Identifier, IGSN: International Geo Sample Number, ISBN: International Standard Book Number, ISNI: International Standard Name Identifiers, ISSN: International Standard Serial Number, OCI: Open Citation Identifier, ORCID: Open Researcher and Contributor ID, PMID: PubMed ID, PURL: Persistent Uniform Resource Locators, RAiD: Research Activity identifier, RRID: Research Resource ID, SHA-1: Secure Hash Algorithm 1, UUID: Universally Unique Identifiers, URI: Uniform Resource Identifier, URN: Uniform Resource Name, VIAF: Virtual International Authority Files

Connected Research: The Potential of the PID Graph

DOI minting process

Traditional research outputs

ISI Peer-review	DOI Minting Service	Landing page
Publications *(Sci.Pub., Data Paper, Software Paper, Methods Paper)*	Journal	Journal

Other publications	DOI Minting Service	Landing page
Book, IOER collecitons	IOER Data Cite or Zenodo like	Zenodo, FDZ, QUCOSA, etc.

Emerging scientific outputs

SPECIFIC doi Suffix	DOI Minting Service	Landing page
Data	IOER Data Cite	Zenodo, FDZ, Other Repo. or Domain Specific Repository
Code	IOER Data Cite	Zenodo, Other Repo. (github for code versioninig)
Other research output	IOER Data Cite	Zenodo, FDZ, Other Repo.

NO SPECIFIC doi Suffix	DOI Minting Service	Landing page
Data	Zenodo, Domain Specific Repository	Zenodo, Domain Specific Repository
Code	Zenodo	Zenodo (github for code versioninig)
Other research output	Zenodo	Zenodo

Metadata

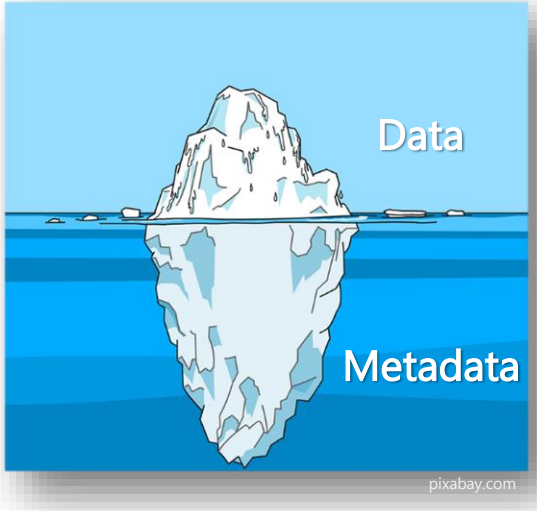
No Metadata

Metadata

hiclipart.com

Data and Metadata (MD)

- Research data includes **measurements, audio-visual information, texts, survey data, samples, questionnaires, algorithms, software, simulations**, etc.
- Metadata represents all the **information that add context and meaning** in a **structured** way to the (research) data.



Metadata Standards

- Metadata is fundamental as makes data findable and reusable.
- Metadata **standards** or **schemas** allow a structured description of your data by using specific MD elements.
- There are general purpose MD schemas.
- There are also disciplines with subject/domain specific metadata standards.

List of Disciplinary Metadata

Use cases

Metadata Standards

General purpose MD standard (e.g. Simple Dublin Core)

Table 1. The Fifteen Elements of "Simple Dublin Core"

Identifier	Definition
Title	A name given to the resource.
Creator	An entity primarily responsible for making the content of the resource.
Subject	The topic of the content of the resource.
Description	An account of the content of the resource.
Publisher	An entity responsible for making the resource available.
Contributor	An entity responsible for making contributions to the content of the resource.
Date	A date associated with an event in the life cycle of the resource.
Type	The nature or genre of the content of the resource.
Format	The physical or digital manifestation of the resource.
Identifier	An unambiguous reference to the resource within a given context.
Source	A reference to a resource from which the present resource is derived.
Language	A language of the intellectual content of the resource.
Relation	A reference to a related resource.
Coverage	The extent or scope of the content of the resource.
Rights	Information about rights held in and over the resource.

DublinCore
Metadata Innovation

https://www.dublincore.org/specifications/dublin-core/usageguide/2001-04-12/generic/#coverage

Metadata Standards

General purpose MD standard (e.g. DataCite)

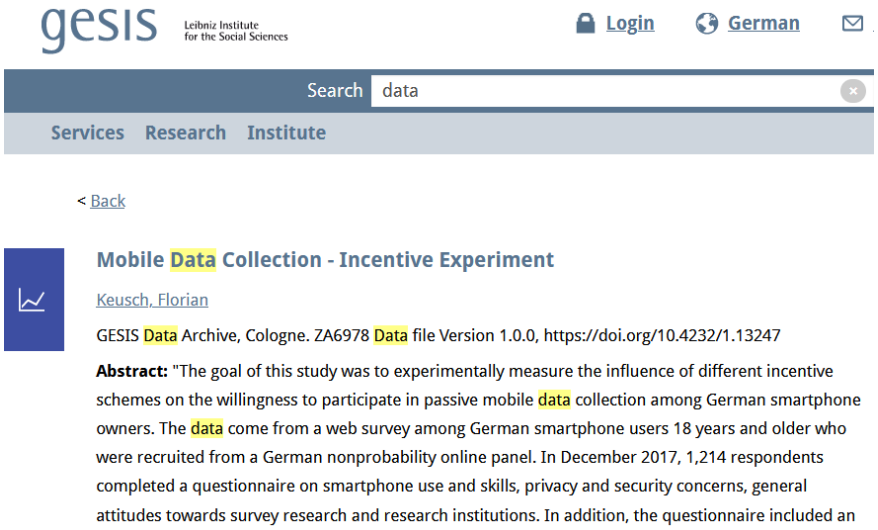
Mandatory	Recommended	Optional
Identifier	Subject	Language
Creator	Contributor	Alternate ID
Title	Date	Size
Publisher	Resource Type	Format
Publication year	Related identifier	Version
	Description	Rights
	GeoLocation	

https://schema.datacite.org/meta/kernel-4.4/doc/DataCite-MetadataKernel_v4.4.pdf

Metadata Standards

Disciplines MD standard (e.g. Data Documentation Initiative - DDI)

"For describing the data produced by surveys and observational methods in the **social and economic sciences**".



Metadata Standards

ISO 19115-1:2014
Geographic information — Metadata

Disciplines MD standard (e.g. ISO 19115)

"For describing for **Geographical data**".

Copernicus Europe's eyes on Earth — Land Monitoring Service

Resource title: Corine Land Cover Change (CHA) 2012 - 2018, Version 2020_20u1

Resource abstract: CHA1218 is one of the Corine Land Cover (CLC) datasets produced within the frame the Copernicus Land Monitoring Service referring to land cover / land use status between the years 2012 and 2018. CLC service has a long-time heritage (formerly known as "CORINE Land Cover Programme"), coordinated by the European Environment Agency (EEA). It provides consistent and thematically detailed information on land cover and land cover changes across Europe.

CLC datasets are based on the classification of satellite images produced by the national teams of the participating countries - the EEA members and cooperating countries (EEA39). National CLC inventories are then further integrated into a seamless land cover map of Europe. The resulting European database relies on standard methodology and nomenclature with following base parameters: 44 classes in the hierarchical 3-level CLC nomenclature; minimum mapping unit (MMU) for status layers is 25 hectares; minimum width of linear elements is 100 metres. Change layers have higher resolution, i.e. minimum mapping unit (MMU) is 5 hectares for Land Cover Changes (LCC), and the minimum width of linear elements is 100 metres. The CLC service delivers important data sets supporting the implementation of key priority areas of the Environment Action Programmes of the European Union as e.g. protecting ecosystems, halting the loss of biological diversity, tracking the impacts of climate change, monitoring urban land take, assessing developments in agriculture or dealing with water resources directives. CLC belongs to the Pan-European component of the Copernicus Land Monitoring Service (https://land.copernicus.eu/), part of the European Copernicus Programme coordinated by the European Environment Agency, providing environmental information from a combination of air- and space-based observation systems and in-situ monitoring. Additional information about CLC product description including mapping guides can be found at https://land.copernicus.eu/user-corner/technical-library /clc2018technicalguidelines_final.pdf. CLC class descriptions can be found at https://land.copernicus.eu/user-corner/technical-library/corine-land-cover-nomenclature-guidelines/html/.

Resource type: Dataset

Resource Locator: https://land.copernicus.eu/pan-european/corine-land-cover/lcc-2012-2018

CLASSIFICATION OF SPATIAL DATA

Topic of category: Environment, Imagery/Base Maps/Earth Cover

Keyword: Copernicus | Land | Satellite Image Interpretation | 2018 | Corine | Corine Land Cover | Change | 2012

GEOGRAPHIC REFERENCE

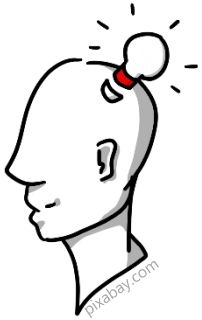
Bounding Box: West = -31.561261
East = 44.820775
North = 71.409109
South = 27.405827

Bounding Box: West = -61.906047
East = -60.905616
North = 16.607552
South = 15.736333

IP, IPR & Licenses

IP & IPR

Intellectual Property (IP)



"Creation of the mind" (inventions, literary& artistic work, designs, names)

Intellectual Property Right (IPR)

© TM ®

"Legal tool that protect IP"

IP & IPR

Copyright is the common IPR for research output

* Corresponding author.
E-mail address: stefano.dellachiesa@eurac.edu (S. Della Chiesa).

https://doi.org/10.1016/j.geoderma.2019.02.010
Received 19 June 2018; Received in revised form 1 February 2019; Accepted 4 February 2019
Available online 16 February 2019

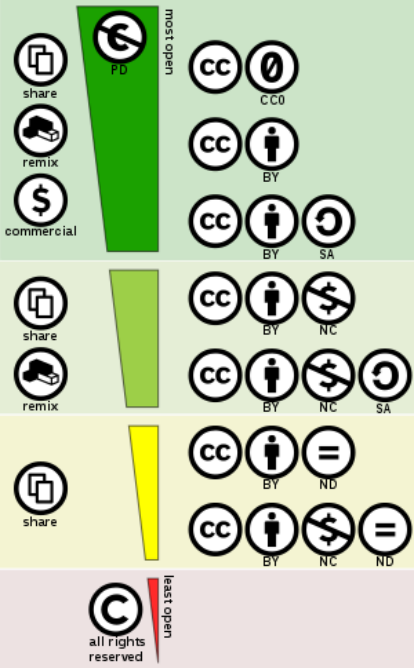
Work protected from the moment is created (No registration authority)

Database IPR *sui generis database right*
Note: RAW data is generally not protected by IPR.

Copyright protect you by default.
License provides the use conditions.

External resources: The EU IP-Helpdesk

Research Output Licenses



--→ CC0 (Public domain)

--→ BY (Attribution)

--→ SA (Share Alike)

--→ NC (Non-Commercial)

--→ ND (Non-Derivative)

--→ © (Exclusive rights)

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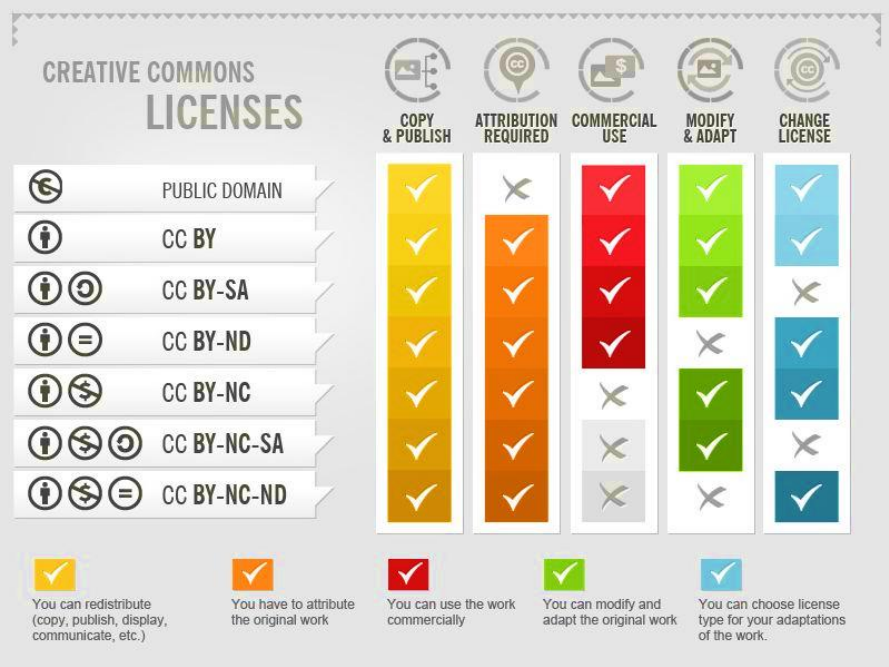

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License: Inbound vs Outbound

Compatibility Checker

	PUBLIC DOMAIN	PUBLIC DOMAIN	BY	BY SA	BY NC	BY ND	BY NC SA	BY NC ND
PUBLIC DOMAIN	✓	✓	✓	✓	✓	✗	✓	✗
PUBLIC DOMAIN	✓	✓	✓	✓	✓	✗	✓	✗
BY	✓	✓	✓	✓	✓	✗	✓	✗
BY SA	✓	✓	✓	✓	✗	✗	✗	✗
BY NC	✓	✓	✓	✗	✓	✗	✓	✗
BY ND	✗	✗	✗	✗	✗	✗	✗	✗
BY NC SA	✓	✓	✓	✗	✓	✗	✓	✗
BY NC ND	✗	✗	✗	✗	✗	✗	✗	✗

https://wiki.creativecommons.org License Compatibility

Repositories for Research Output

Where is my data?

The needle in a haystack

Data repository

A data repository is an archiving space for researchers to deposit research data linked with their research.

"A trusted digital repository is one whose mission is to provide reliable, long-term access to managed digital resources to its designated community, now and in the future".

CORE TRUST SEAL

www.coretrustseal.org

Repositories

General-purpose Repositories

zenodo

The Dataverse® Project

figshare

DRYAD

Domain/Subject/Discipline Specific Repositories

gesis Leibniz Institute for the Social Sciences

ISRIC World Soil Information

Copernicus Europe's eyes on Earth

Institutional Repositories

MOSES

OpARA TECHNISCHE UNIVERSITÄT DRESDEN

RADAR

FIZ Karlsruhe – Leibniz Institute for Information Infrastructure

Zenodo Community

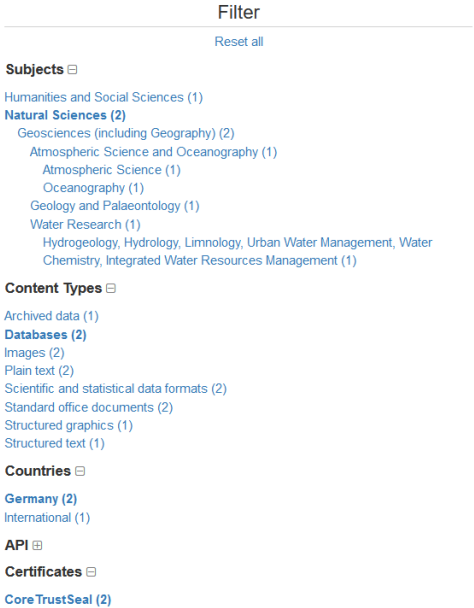
- Create your own research output collection
- Establish your own repository
- Central hub linking research outputs

[Zenodo IOER Community]

Registry of research data repositories

Browser resources in the global registry of research data repositories

re3data.org
REGISTRY OF RESEARCH DATA REPOSITORIES



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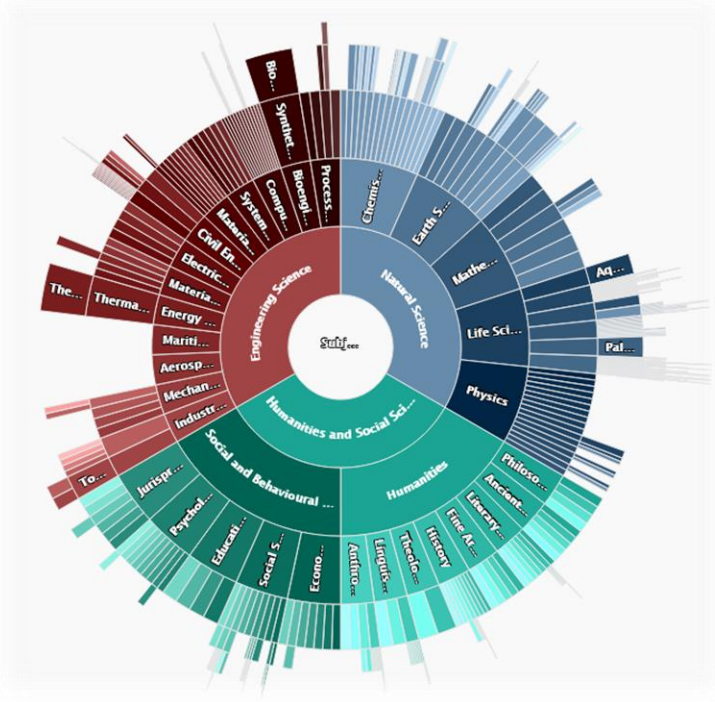
Browse resources by subject

Standards

Database/Repositories

Policies

freeicons.io/



https://fairsharing.org/browse/subject

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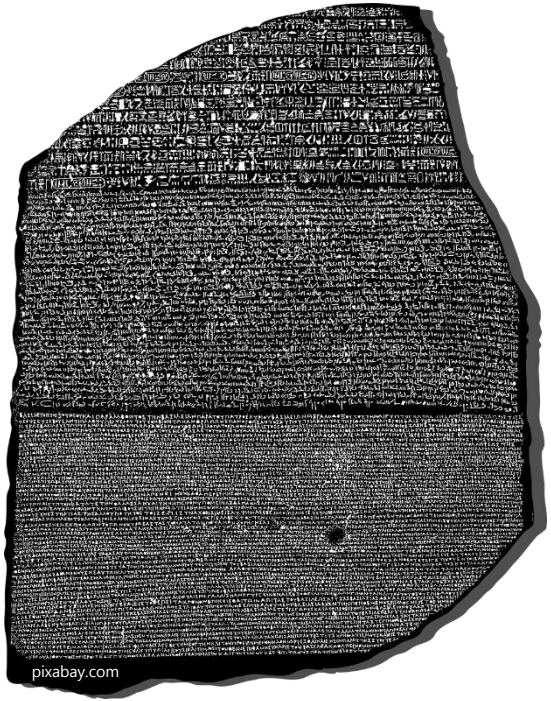
Data organization

Naming conventions



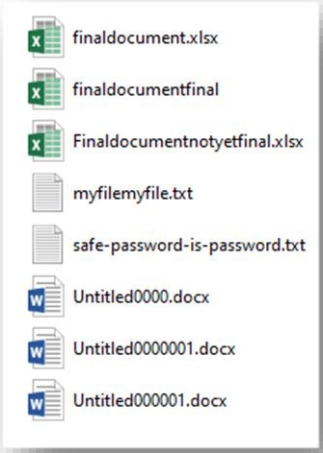
Naming convention

No way!

Outline.docx
My.conf~abstrc#qwertz><
Presentation 1 .ppt
figure.jpg

Better!

2022-05-20_RDM_Seminar_Outline_v01.docx
2022-05-22_Abstract_Nexus_Conference.docx
01_DMP_Introduction.pptx
Fig01_ScatterPlot_QuercusPetrea_Height_vs_Age.jpg



Someone else´s folder?

Naming convention

Machine readable

(is not their fault if you are human)

- **No spaces, or special characters** {[(" § $%&?*+#,.:;`´^<>°)]}

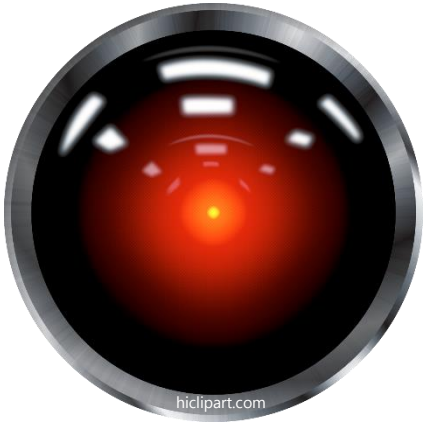
  programs might not be able to read the files

- **Use delimiters "_" or "-" to frame keywords and metadata**

(*makes search easier, listing and extract info from file names*)

- **File ordering, left pad numbers with zeros** (01_Draft_*

  02_Draft_* and not 1_Draft_*, 10_Draft_*)

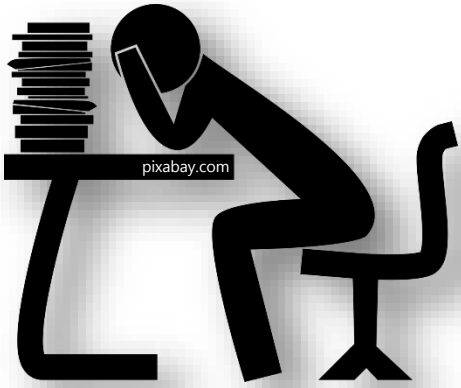


Naming convention

Human readable

(pepl mght undrst ths bt isnt tht practcl)

- **Use the standard ISO 8601** strings for dates (*2022-05-20 or 20220520*)
- **Left pad numbers with zeros** for logical ordering (*01_Introduction.txt 02_StudyArea) or use the dates (20220520_Kickoff_Presentation.pptx)*
- Use **Capital letters** *20220520_MeetingNotes_ProjectKickoff)*
- **File versioning** *(01_Introduction_v01.txt)*
- **Encode other Metadata** *(Author/Revision John Smith 01_Introduction_v01_Rev_JoS.txt)*



Think you search a file one hour before a deadline

Naming convention

Document your Naming Convention

- Some naming best practices are project independent
- Some other are specific
- Think about what better fits your needs/project
- Attach your documentation as appendix to the DMP

Additional resources

Data organization

Storage, Backup & Recovery Strategy

Storage, Backup & Recovery Strategy

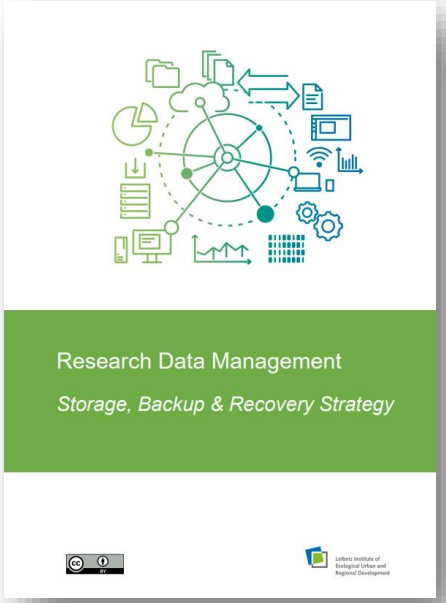
Organizations → 3-2-1 Backup rule

Primary data

3 copies

2 types Storage Media

1 Off-Site



https://doi.org/10.5281/zenodo.5792643

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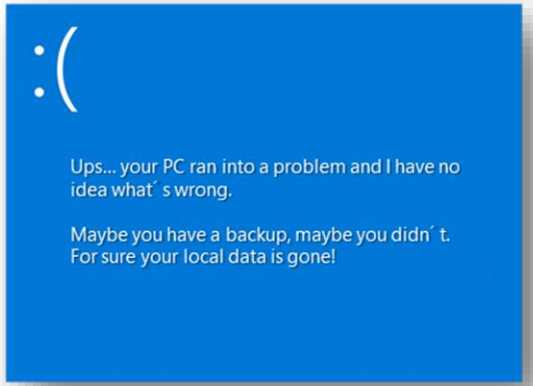
Cloud and collaboration

- Never save you data on your local PC!
- Your organization can provide you cloud storage for collaboration, with versioning and backup (FILR/MS SharePoint)



Blue screen of death

RDM horror stories Episode 1 - Lost Data

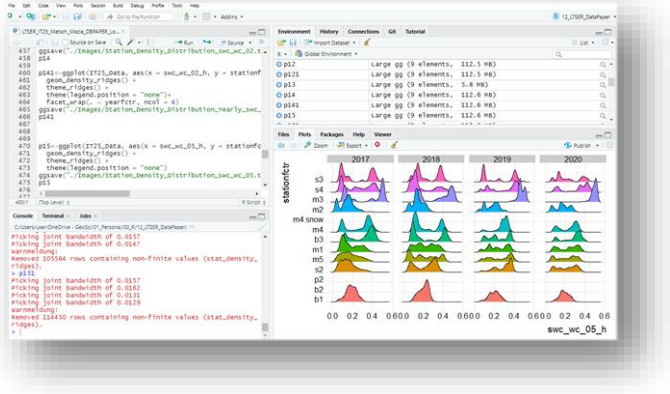
Version Control Systems

Where is my **FAIR** code?

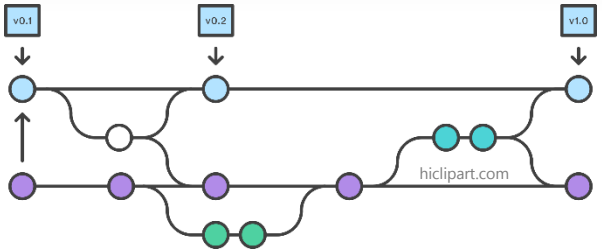
Nowadays many journals require FAIR algorithms that reproduce results described in a scientific publication.

Management of algorithm and software

Data processing, model building are commonly executed in a scripting environment using various high-level programming languages (e.g. R, Python, MATLAB)

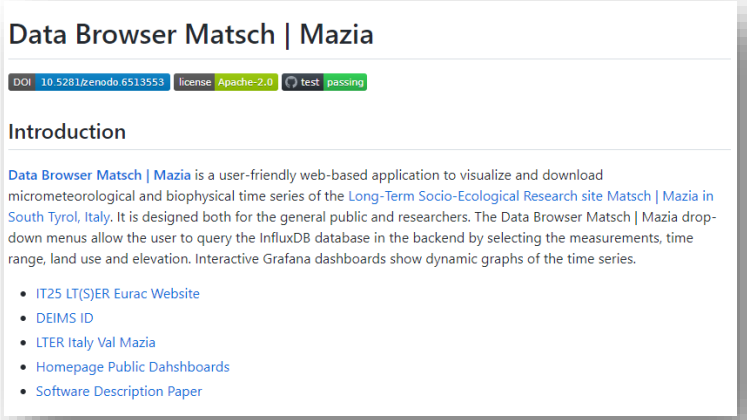


Researcher that work with code and scripts use version control systems to manage changes and collaborate. GitHub and GitLab are web-based hosting platform to manage and publish code.



Github-Zenodo Integration

- Easy to publish on Zenodo your Github repository
- Ensure reproducibility and long-term archiving
- Zenodo version management by issuing a new DOI each time you create a new GitHub release



How to link Github and Zenodo

Coding best practices

Make sure you can understand and reuse your code *(six months later)*

Checkout some simple best practices

When your code is working…

…but it is a mess