

FAIRness in Research Software

VLIR-UOS - SoRDS Summer School - 15072025



Naeem Muhammad

Research Data Manager @ Research Coordination Office, KU Leuven

Agenda

- What is Research Software
- FAIR Principles for Research Software
- Source Code Version Control
- Software Licenses
- Example FAIR assessment

Background

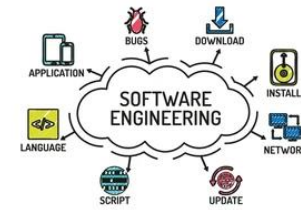
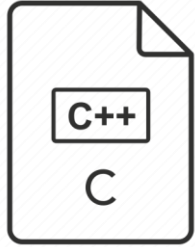
- Research data
 - Documents, lab notebooks, databases, lab specimens
 - Also, source code of your software/tools/scripts
 - Python, R, Matlab, Java, C/C++
- FAIR principles apply to all kind of research data
- Demands FAIRness in research software
- FAIR software initiatives
 - From open science, open source and FAIR communities

What is Research Software

- “A computer-based application that converts inputs into outputs to support the user in one or more research tasks.”
- Tools developed by researchers
- Simulation scripts
- Analysis scripts
- Data processing scripts



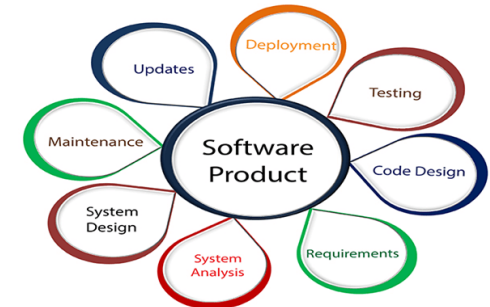
What is Research Software



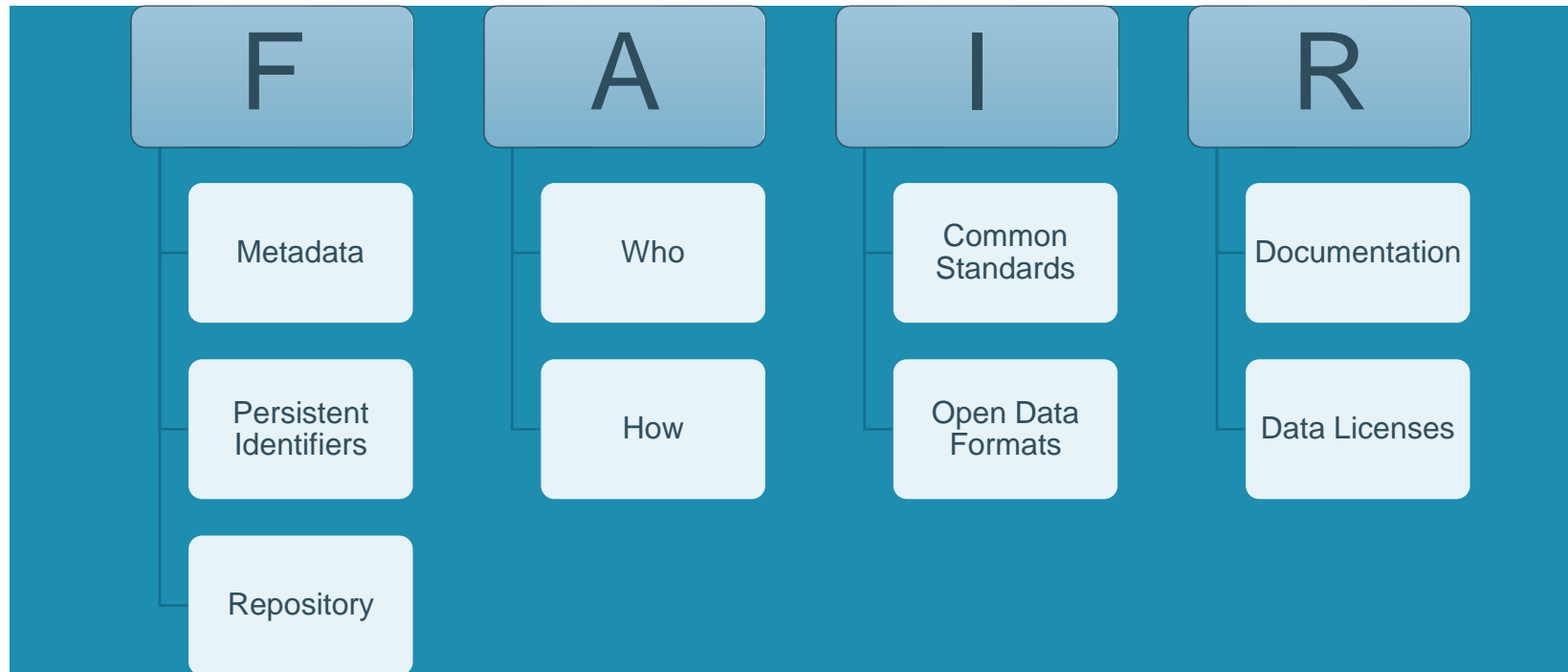
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{ **REST:API** }



FAIR Principles



FAIR Principles for Research Software by FAIR4RS

- F Software and its associated metadata is findable
- A Software and its metadata is retrievable via standardized protocols
- I Software interoperates with other software
- R Software is both usable and reusable

- Persistent identifiers for
 - Software
 - Software components
 - Different versions
- Metadata for software
 - Searchable
- Use trusted repositories
- Examples
 - **bio.tools** (catalogue of bioinformatics tools)
 - **Zenodo** (general purpose repository)

The screenshot shows the Zenodo website with a blue header containing the 'zenodo' logo, a search bar, and links for 'Upload' and 'Communities'. A large teal box highlights the following features:

- Has good integration with GitHub
- Harvests/Fetches version specific code
- Generates DOI
- Makes code citable

Below this box is a sidebar with three options: 'Applications' (with a shield icon), 'Shared links' (with a link icon), and 'GitHub' (with a GitHub logo icon and highlighted in blue). To the right of the sidebar, there is a section with a toggle switch labeled 'ON' and text: 'preserve, and toggle the switch below to turn on automatic preservation of your software.' Below this is a section titled 'Enabled Repositories' which lists a repository: 'naeemmuhammad/LeuvenKnights' with a DOI of '10.5281/zenodo.7334827'. A yellow highlight is visible under the repository list.

- Software retrievable/downloadable
 - Using standardized protocols
 - via web e.g.
 - Open, free
- Authorization information
- Provide metadata if software cannot be shared

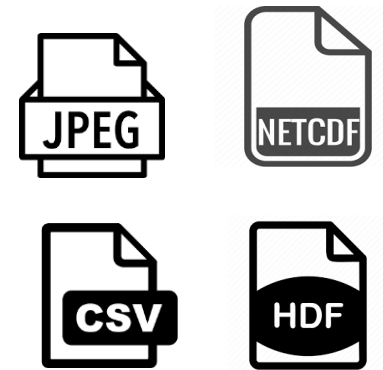
404 error: File not found

The [URL](#) you requested was not found. Maybe you would like to look at:

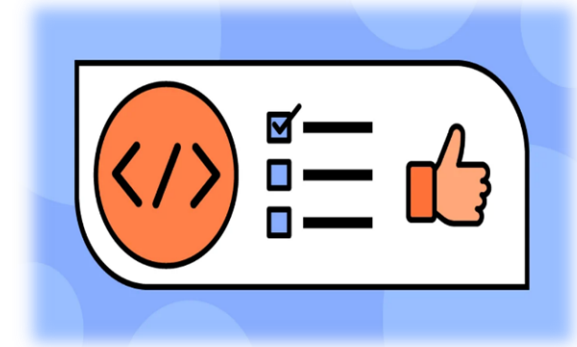
- [The main page](#)
- [The list of Wikimedia downloads](#)

A project of the [Wikimedia foundation](#).

- Communication with other systems
- APIs (Application Programming Interfaces)
- Data sharing with other software/tools
- Open data types
- Community specific standards



- Usable
 - Should work, executable
- Reusable
 - Modifiable
 - Build upon
- Appropriate license
 - Clear and Accessible
- Well documented
- Meets domain-specific community standards

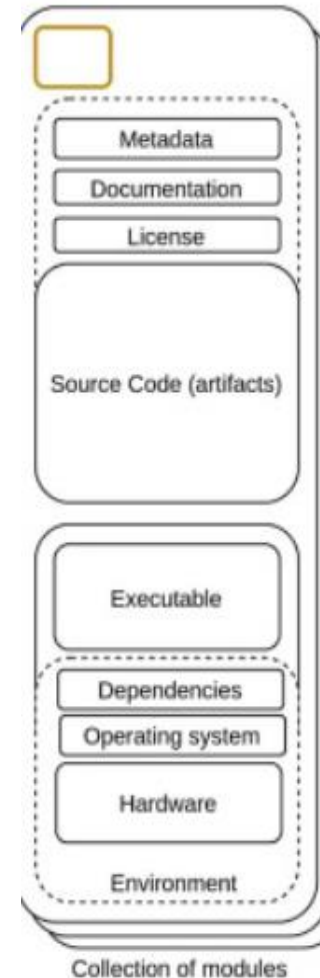


FAIR vs unFAIR

FAIR software, Open
Source and Reproducible



unFAIR Software



Software Management

- Version Control
 - Keep track of changes
 - Who, what, when, why
 - Latest copy of the code
 - Easy collaboration
 - Disaster recovery
- Version control tools
 - Github, Gitlab, BitBucket
- Ku Leuven Gitlab Server
 - <https://gitlab.kuleuven.be/>



Software Management

- Central Git space for research group
 - Git repository per project/researcher
- Personal git accounts to group Git accounts
- Example: <https://gitlab.kuleuven.be/rdm/software-fairification>

Software Documentation

- Good documentation increases reusability
- Project/tool level
 - User guide
 - Readme file
 - Design document
- Item level
 - Comments
 - Comment/code style guides are helpful
 - e.g. <http://docs.twoears.eu/en/1.3/dev/coding-style-guide/#comments>

```
/**
 * Creates an array of elements split into groups the length of `size`.
 * If `array` can't be split evenly, the final chunk will be the remaining
 * elements.
 *
 * @since 3.0.0
 * @category Array
 * @param {Array} array The array to process.
 * @param {number} [size=1] The length of each chunk
 * @returns {Array} Returns the new array of chunks.
 * @example
 *
 * chunk(['a', 'b', 'c', 'd'], 2)
 * // => [['a', 'b'], ['c', 'd']]
 *
 * chunk(['a', 'b', 'c', 'd'], 3)
 * // => [['a', 'b', 'c'], ['d']]
 */
function chunk(array, size = 1) {
  // logic
}
```

Software Quality Checklist

- General
 - Does the software have a descriptive name?
 - Is copyright and authorship clear?
- Documentation
 - Is the development setup documented
 - Is there a test suite?
- Interoperability
 - Are file formats standard compliant and documented?
- Administration
 - Are software requirements such as operating system, required libraries and dependencies specified including versions?



<https://github.com/eurise-network/technical-reference/blob/v0.1/quality/software-checklist.rst>

Software Licenses

Public Domain	LGPL (Lesser General Public License)	Permissive	Copy Left	Proprietary
<ul style="list-style-type: none">• Most permissive• No restriction	<ul style="list-style-type: none">• Link open source libraries to your code• Redistribute resulting code under any license	<ul style="list-style-type: none">• Constraints on: Use Modification Redistribution	<ul style="list-style-type: none">• Restrictive• Redistribution under same license	<ul style="list-style-type: none">• Most restrictive• No modifications• No redistribution• Illegal to copy, modify and redistribute



Software Licenses

- License selection tools
- <https://choosealicense.com/>
- <https://ufal.github.io/public-license-selector/>

Choose an open source license

An open source license protects contributors and users. Businesses and savvy developers won't touch a project without this protection.

{ Which of the following best describes your situation? }



I need to work in a community.

Use the **license preferred by the community** you're contributing to or depending on. Your project will fit right in.

If you have a dependency that doesn't have a license, ask its maintainers to **add a license**.



I want it simple and permissive.

The **MIT License** is short and to the point. It lets people do almost anything they want with your project, like making and distributing closed source versions.

Babel, **.NET**, and **Rails** use the MIT License.



I care about sharing improvements.

The **GNU GPLv3** also lets people do almost anything they want with your project, *except* distributing closed source versions.

Ansible, **Bash**, and **GIMP** use the GNU GPLv3.

{ What if none of these work for me? }

My project isn't software.

There are licenses for that.

I want more choices.

More licenses are available.

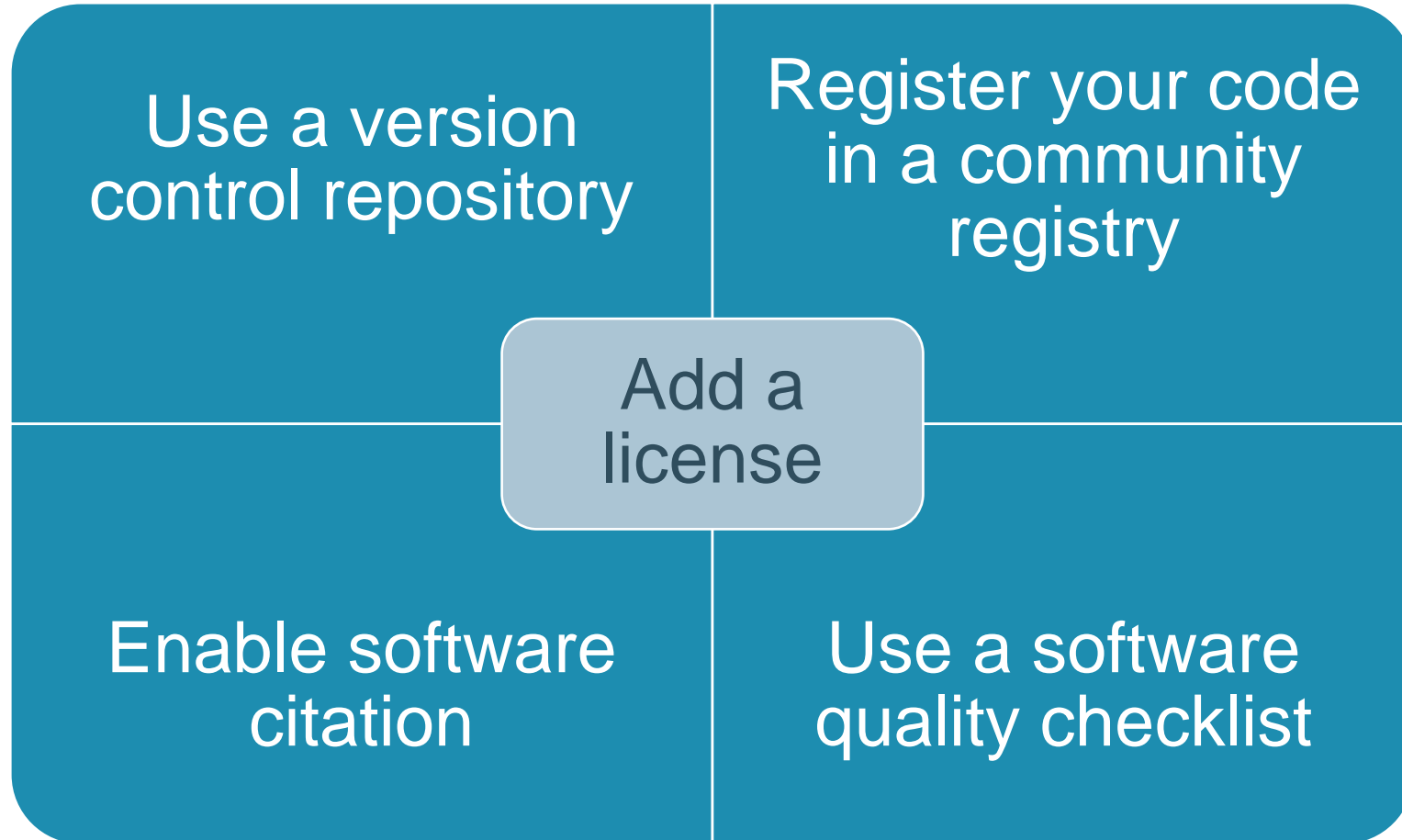
I don't want to choose a license.

Here's what happens if you don't.

The content of this site is licensed under the Creative Commons Attribution 3.0 Unported License.

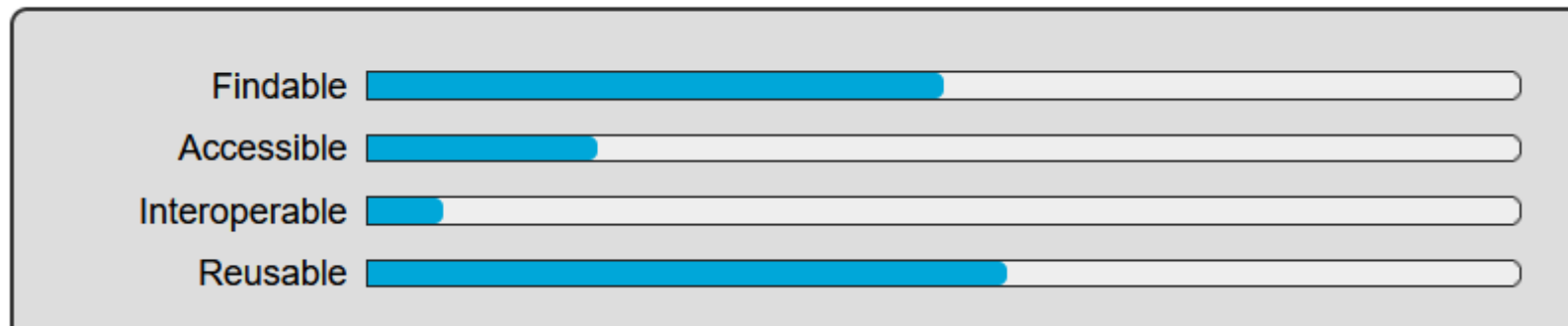
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Curated with ❤ by GitHub, Inc. and You!

Five Recommendations for Fair Software



Self-assessment for FAIR research software

- <https://fairsoftwarechecklist.net/v0.2/>



FAIR Software Resources

- <https://github.com/force11/FAIR4RS>
- <https://fair-software.nl/>
- <https://github.com/eurise-network/technical-reference/blob/v0.1/quality/software-checklist.rst>
- https://everse.software/RSQKit/licensing_software
- https://everse.software/RSQKit/software_metadata
- <https://github.com/NLeSC/awesome-research-software-registries>
- <https://github.com/FAIR-IMPACT/RSMD-guidelines>

Take-Home Message

- Your script/tool/source code is research data
- Use version control tool/repository to track source code changes
- Make your software citable by using persistent identifiers
- Provide documentation to use/extend your software
- Use a quality checklist to assess the quality of your software
- Use suitable license

Questions