Semantic Interoperability of Metadata for Cross Domain Research of the Future

FAIR Convergence
&
Semantic Interoperation

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https://www.go-fair.org
http://orcid.org/0000-0001-8888-635X
## Box 2 | The FAIR Guiding Principles

### To be Findable:
- F1. (meta)data are assigned a globally unique and persistent identifier
- F2. data are described with rich metadata (defined by R1 below)
- F3. metadata clearly and explicitly include the identifier of the data it describes
- F4. (meta)data are registered or indexed in a searchable resource

### To be Accessible:
- A1. (meta)data are retrievable by their identifier using a standardized communications protocol
  - A1.1 the protocol is open, free, and universally implementable
  - A1.2 the protocol allows for an authentication and authorization procedure, where necessary
- A2. metadata are accessible, even when the data are no longer available

### To be Interoperable:
- I1. (meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation.
- I2. (meta)data use vocabularies that follow FAIR principles
- I3. (meta)data include qualified references to other (meta)data

### To be Reusable:
- R1. meta(data) are richly described with a plurality of accurate and relevant attributes
  - R1.1. (meta)data are released with a clear and accessible data usage license
  - R1.2. (meta)data are associated with detailed provenance
  - R1.3. (meta)data meet domain-relevant community standards

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Wilkinson, M. D. et al. The FAIR Guiding Principles for scientific data management and stewardship. 
Automating F, A, I, and R

Box 2 | The FAIR Guiding Principles

To be Findable:
F1. (meta)data are assigned a globally unique and persistent identifier
F2. data are described with rich metadata (defined by R1 below)
F3. metadata clearly and explicitly include the identifier of the data item
F4. (meta)data are registered or indexed in a searchable resource

To be Accessible:
A1. (meta)data are retrievable by their identifier using a standard protocol
A1.1 the protocol is open, free, and universally implementable
A1.2 the protocol allows for an authentication and authorization
A2. metadata are accessible, even when the data are no longer

To be Interoperable:
I1. (meta)data use a formal, accessible, shared, and broadly applicable knowledge representation.
I2. (meta)data use vocabularies that follow FAIR principles
I3. (meta)data include qualified references to other (meta)data

To be Reusable:
R1. meta(data) are richly described with metadata
R1.1. (meta)data are released with a clearly defined domain
R1.2. (meta)data are associated with data and services
R1.3. (meta)data meet domain-relevant standards

Wilkinson, M. D. et al. The FAIR Guiding Principles for scientific data management and stewardship.
Automating F, A, I, and R

Box 2 | The FAIR Guiding Principles

To be Findable:
F1. (meta)data are assigned a globally unique and persistent identifier
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To be Accessible:
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To be Interoperable:
I1. (meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation.
I2. (meta)data use vocabularies that follow FAIR principles
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To be Reusable:
R1. metadata are richly described with a plurality of accurate and relevant attributes
   R1.1. (meta)data are released with a clear and accessible data usage license
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R1.3. (meta)data meet domain-relevant community standards

Wilkinson, M. D. et al. The FAIR Guiding Principles for scientific data management and stewardship.
FAIR Principles versus FAIR Implementations

Some chemical identifier systems
Convergence
Convergence
Convergence

Common Patterns in Revolutionary Infrastructures and Data
Peter Wittenburg, Max Planck Computing and Data Facility
George Strawn, US National Academy of Sciences
February 2018
Convergence

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Implementation

Challenge

Community accepts challenge to create new resources as needed to implement FAIR

Domain
Communities

15 FAIR Guiding Principles

A matrix of Communities x Resources

Implementation
Choice
Community chooses to re-use existing resources as needed to implement FAIR

Implementation
Challenge
Community accepts challenge to create new resources as needed to implement FAIR

Declaration / Registration

Optimal Reuse

* every “choice” was once a “challenge”
Implementation Network (IN) Profile

We ask each IN Coordinator to complete this survey as a way for GO FAIR to begin profiling the FAIR-related resources found among more than 30 INs.

The survey contains 14 questions, and will take 30-45 minutes to complete. The entire form can be downloaded here as a PDF: http://bit.ly/2BvxAH8.

This survey serves two functions:
1. Cursory inventory of FAIR-related resources of the IN (this will enable GO FAIR to better search for and to exploit synergies maximising re-use of FAIR solutions).
2. A first step in helping INs to frame their own consortia and objectives in the context of the GO FAIR community.

Many of the questions below relate directly to the FAIR Principles (https://www.go-fair.org/fair-principles/) and are noted as such in the question. We hope this helps to guide the IN Coordinator to better understand the question.

1. Name of the Implementation Network *

   Short answer text

2. IN Coordinator name *

   Short answer text
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## FAIR Implementation Matrix

### On the OSF
https://osf.io/n7wp/

**Red indicates waist of hourglass**

**Blue is an implementation Choice**

**Orange is Implementation Challenge**

**Green highlight indicates a service provided by the IN or spin-off**

**Blank cell is not relevant for IN**

### FAIR Principle

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<th>D</th>
<th>E</th>
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Community FAIR Implementation Choices & Challenges
https://osf.io/4v9pm/

INs
Resource
Shared resource

Kristina Hettne, CDS University Library
FAIR Convergence Matrix
Trusted 3rd party endorsement of FAIR best practices

FAIR Convergence Matrix Development

1. FAIR Experts
   - Preparing the Questionnaire
2. Matrix Wizard Interface
   - Creating the Knowledge Model
3. FAIRsharing
   - Provide identifiers for standards, policies and databases for autocomplete
4. Community
   - Spokesperson fills-in the Questionnaire
5. Nanopublications
   - Nanopublication assertion
   - Nanopublication provenance
   - Nanopublication publication info
   - Make nanopublications serialisation
6. Nanopublication Server Network
7. Store nanopublications
8. Analyses and Visualisations
## FAIR Convergence Matrix

FAIR Implementation Profiles

<table>
<thead>
<tr>
<th>Resources</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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## FAIR Convergence Matrix

**FAIR Implementation Profiles**

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FAIR Convergence Matrix

FAIR Implementation Profiles

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FAIR Implementation Profile for Community C = \{0,1,0,1,0,1,0,1\}
FAIR Implementation Profile for Community C = {0,1,0,1,0,1,0,1}

Community E, F, G, H, and I have reused the FIP of Community C
**FAIR Convergence Matrix**

**FAIR Implementation Profiles**

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<th>Communities</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
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FAIR Implementation Profile for Community C = \{0, 1, 0, 1, 0, 1, 0, 1\}

Community E, F, G, H, and I have reused the FIP of Community C

Community I has made two modifications of Community C
### FAIR Implementation Profiles

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<th>Communities</th>
<th>A</th>
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<th>C</th>
<th>D</th>
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**FAIR Implementation Profile for Community C = \{0, 1, 0, 1, 0, 1, 0, 1\}**

Community E, F, G, H, and I have reused the FIP of Community C

Community I has made two modifications of Community C

Community J reused the FIP of Community D
FAIR Interoperability Challenges

Given FAIR Implementation Profiles:

(1) Create practical metrics for the degree of semantic interoperation.

(2) Create practical optimization methods for maximizing semantic interoperation.
The FAIR Funder Components: https://preclinicaltrials.eu

**Preclinicaltrials** aims to provide a comprehensive listing of preclinical animal study protocols. Preferably registered at inception in order to **increase transparency**, help **avoid duplication**, and **reduce the risk of reporting bias** by enabling comparison of the completed study with what was planned in the protocol.

**Registration** of your study requires you to create an account that is
- Anonymous
- Free of charge
- Has an optional embargo period

This register is web-based, open to all types of animal studies and freely accessible and searchable to all with a preclinicaltrials.eu account.

The **registration form** is designed by experts on preclinical animal studies and preclinical evidence synthesis.

Please **join** us and create an user account, this will provide access to the database and enables you to register your preclinical trial.

Contact us at [info@preclinicaltrials.eu](mailto:info@preclinicaltrials.eu).
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Please join us and create an user account, this will provide access to the database and enables you to register your preclinical trial.

Contact us at info@preclinicaltrials.eu.
Section 1. General information

1. * Title of the study
   Enter the full title of the study

2. Acronym/short title
   Enter optional acronym/short title for the study

3. * Contact details
   Give the name of the main administrative contact for the study

   Name

   Role
   What is the role of the main contact in the study (e.g. executive researcher, research group supervisor)?

   Email address
   Provide the email address of the main contact

4. * Study centre details
   Give the details of the institutions where the experiments will be undertaken. Add additional lines if there is more
Metadata for Machines Workshops

Making it easy for humans to make metadata for machines

Machine-actionable metadata are core to the FAIR Principles. GO FAIR and RDA members have launched the “Metadata for Machines” workshop series (M4M) to assess the state of metadata practices in data-related communities and stimulate the creation and re-use of FAIR metadata standards and machine-ready metadata templates (definitions of metadata categories).

The M4M workshops are agile, hackathon-style events that bring together domain experts with metadata and technical specialists to accomplish 5 objectives:

1. Assess the state of metadata practices in the various scientific communities, look for improvements of the current fragmentation and promote good FAIR compliant practices.
2. Using the FAIR principles as a guide, define essential metadata elements and standards to support F, A, I, and R by machines, drawing on the deep domain knowledge of existing communities.
3. Formulate these decisions as machine-actionable templates in a unified way:
There is no FAIR Data without machine-actionable metadata
The FAIR Funder Components: https://metadatacenter.org/#about

CEDAR
Better metadata means better science
The FAIR Funder Components: https://metadatacenter.org/#about
A curated, informative and educational resource on data and metadata standards, inter-related to databases and data policies.

HOW CAN WE HELP?

We guide consumers to discover, select and use these resources with confidence, and producers to make their resource more discoverable, more widely adopted and cited.

Journal editors & publishers
Create and maintain an interrelated list of citable standards, databases and repositories to recommend to your authors, users or their community, and revise this recommendation over time...
[read more]
Box 2 | The FAIR Guiding Principles

To be Findable:
F1. (meta)data are assigned a globally unique and persistent identifier
F2. data are described with rich metadata (defined by R1 below)
F3. metadata clearly and explicitly include the identifier of the data it describes
F4. (meta)data are registered or indexed in a searchable resource

To be Accessible:
A1. (meta)data are retrievable by their identifier using a standardized communications protocol
A1.1 the protocol is open, free, and universally implementable
A1.2 the protocol allows for an authentication and authorization procedure, where necessary
A2. metadata are accessible, even when the data are no longer available

To be Interoperable:
I1. (meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation.
I2. (meta)data use vocabularies that follow FAIR principles
I3. (meta)data include qualified references to other (meta)data

To be Reusable:
R1. meta(data) are richly described with a plurality of accurate and relevant attributes
R1.1. (meta)data are released with a clear and accessible data usage license
R1.2. (meta)data are associated with detailed provenance
R1.3. (meta)data meet domain-relevant community standards
• Farm Data
• Personal Health Data
• Banking Data
FAIR Convergence Matrix

- Farm Data
- Personal Health Data
- Banking Data