

#### **Erik Schultes, PhD**

International Science Coordinator GO FAIR International Support and Coordination Office & Leiden University Medical Center Leiden Center for Data Science

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NeIC conference, 16 May 2019, Copenhagen https://osf.io/2vngs/

# February 2019

#### THE WESTIN ALEXANDRIA



# Happy birthday, Internet

• 50 years old this year!

 First 20 years of R&d supported generously by DARPA produced first NCP then TCP/IP for the ARPAnet (a few hundred nodes)

 Then 10 years of r&D supported generously by NSF produced the NSFnet (thousands of nodes)

 Then the private sector "took over" just as the Internet rocket took off (first millions now billions of nodes)

#### **A Framework for Distributed Digital Object Services**

Robert Kahn Corporation for National Research Initiatives

Robert Wilensky University of California at Berkeley

#### 1. Introduction

This document describes fundamental aspects of an infrastructure that is open in its architecture and which supports a large and extensible class of distributed digital information services. Digital libraries are one example of such services; numerous other examples of such services may be found in emerging electronic commerce applications. Here we define basic entities to be found in such a system, in which information in the form of **digital objects** is stored, accessed, disseminated and managed. We provide naming conventions for identifying and locating digital objects, describe a service for using object names to locate and disseminate objects, and provide elements of an access protocol.

We use the term **digital object** here in a technical sense, to be defined precisely below. Files, databases and so forth that one may ordinarily think of as objects with a digital existence are not digital objects in the sense used here, at least not until they are made into an appropriate data structure, etc., as we will describe shortly.

Only the most basic elements of the infrastructure are described herein. These elements are intended to constitute a minimal set of requirements and services that must be in place to effect the infrastructure of a universal, open, widearea digital information infrastructure system ("the System"). We anticipate that many other services and elaborations will come into existence as the System is further developed, either building upon or otherwise added to these elements.

This paper focuses on the network-based aspects of the infrastructure, namely those for which knowledge of the contents of digital objects is not required. Definition of the content-based aspects of the infrastructure is purposely not addressed in this paper. An important goal in limiting the description of the infrastructure in this way is not to constrain the higher level user and service level choices that, for many reasons, might be inappropriate to fix upon at this point in time. With only the most basic elements of the infrastructure in place, technological evolution would not be overly constrained. Further, the likelihood of achieving widespread interoperability of services at some early point in the future will be preserved. No doubt the resulting capability will have a greater potential for enhancement and evolution through the participation of many others in helping to define it.

#### 2. Overview and Definitions

In this section, we first present an informal overview of the elements of the System, sketching its elements and how they are supposed to function together. These elements include the notions of **digital objects**, **handles**, **metadata** and **key metadata**, **repositories**, **handle generators**, **originators**, **users**, **global naming authorities** and **local naming** 



### 2016

nature > scientific data > comment > article

SCIENTIFIC DATA

#### Comment | OPEN | Published: 15 March 2016

# The FAIR Guiding Principles for scientific data management and stewardship

Mark D. Wilkinson, Michel Dumontier, IJsbrand Jan Aalbersberg, Gabrielle Appleton, Myles Axton, Arie Baak, Niklas Blomberg, Jan-Willem Boiten, Luiz Bonino da Silva Santos, Philip E. Bourne, Jildau Bouwman, Anthony J. Brookes, Tim Clark, Mercè Crosas, Ingrid Dillo, Olivier Dumon, Scott Edmunds, Chris T. Evelo, Richard Finkers, Alejandra Gonzalez-Beltran, Alasdair J.G. Gray, Paul Groth, Carole Goble, Jeffrey S. Grethe, Jaap Heringa, Peter A.C 't Hoen, Rob Hooft, Tobias Kuhn, Ruben Kok, Joost Kok, Scott J. Lusher, Maryann E. Martone, Albert Mons, Abel L. Packer, Bengt Persson, Philippe Rocca-Serra, Marco Roos, Rene van Schaik, Susanna-Assunta Sansone, Erik Schultes, Thierry Sengstag, Ted Slater, George Strawn, Morris A. Swertz, Mark Thompson, Johan van der Lei, Erik van Mulligen, Jan Velterop, Andra Waagmeester, Peter Wittenburg, Katherine Wolstencroft, Jun Zhao & Barend Mons <sup>™</sup> - Show fewer authors

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"Data and services that are findable, accessible, interoperable, re-usable both for machines and for people."

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Scientific Data 3, Article number: 160018 (2016)

#### 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
- 13. (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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#### Internet of FAIR Data and Services

Sci. Data 3:160018 doi: 10.1038/sdata.2016.18 (2016)

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## 2017 What FAIR is not...

Cloudy, increasingly FAIR; revisiting the FAIR Data guiding principles for the European Open Science Cloud DOI: 10.3233/ISU-170824

- FAIR is not a standard
- FAIR is not a semantic web / LOD
- FAIR is not equal to 'Open' or 'Free'
  - Data are often Open (Access) but not FAIR
  - Some data can never be Open, yet be perfectly FAIR
- By design, FAIR is not explicit about data quality, trustworthiness, responsibility, ethics, etc.



### FAIR Principles



### FAIR Implementations



### FAIR Principles



### FAIR Implementations









#### International Support and Coordination Office



# **GO FAIR Modus**

#### **Common Patterns in Revolutionary Infrastructures and Data**

Peter Wittenburg, Max Planck Computing and Data Facility

George Strawn, US National Academy of Sciences

February 2018

https://www.rd-alliance.org/sites/default/files/Common\_Patterns\_in\_Revolutionising\_Infrastructures-final.pdf



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- Minimal standard + Freedom to operate
- Voluntary participation
- Critical mass of users

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February 2018

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- Rough consensus, running code
- Minimal standard + Freedom to operate
- Voluntary participation
- Critical mass of users

#### Creolization

**Attractors** 







![](_page_27_Figure_1.jpeg)

**Survey** https://docs.google.com/forms/d/1Oug6GowuG1jNZNsjklXOeEvPbUrhyuS\_F-d185SOy6A/edit **Kristina Hettne, CDS University Library** 

![](_page_28_Picture_1.jpeg)

2. IN Coordinator name \*

SUBJECT	PREDICATE	OBJECT	
name of IN (UPRI)	has-coordinator	ORCID	inles
name of IN (UPRI)	has-participant	ORCID	princip
name of IN (UPRI)	has-member-organisation	VIVO / CrossRef	EAIRF
name of IN (UPRI)	uses-repository	CTS?	
name of IN (UPRI)	uses-registry-service	PW ?	F1
name of IN (UPRI)	provides-registry-service		F1
name of IN (UPRI)	uses-data-format	format-PID	F2
name of IN (UPRI)	provides-data-format	format-PID	F2
name of IN (UPRI)	provides-access-protocol	format-PID	A1
name of IN (UPRI)	uses-access-protocol	protocol-PID	A1
name of IN (UPRI)	has-persistence-policy	policy	F1 / A2
name of IN (UPRI)	is found by	Search engine	F4
name of IN (UPRI)	uses-term-system	Term System-PID	I
name of IN (UPRI)	provides-term-system	Term System-PID	1
name of IN (UPRI)	uses-license	MR-license ID	R1.1
name of IN (UPRI)	uses-metadata-format	format-PID	R1.2
name of IN (UPRI)	provides-meta-data-format	Format-PID	<b>R1.2</b>
name of IN (UPRI)	provides-training-material	Resource-ID	
name of IN (UPRI)	uses-uses-training-material	Resource-ID	
name of IN (UPRI)	provides-DS-tools	Resource-ID	
name of IN (UPRI)	uses-DS-tools	Resource-ID	
name of IN (UPRI)	uses-workspace-tool	Resource-ID	
name of IN (UPRI)	Provides-workspace-tool	Resource-ID	

## **G** FAR IN Profile Matrix January 15-16, Leiden

**Survey** https://docs.google.com/forms/d/1Oug6GowuG1jNZNsjklXOeEvPbUrhyuS\_F-d185SOy6A/edit **Matrix** https://docs.google.com/spreadsheets/d/1MUZn7uh4x5YLPjqxi-V8XubsSEEonQWvx2jBlcyyNdU/edit#gid=0

IN Profile Matrix ☆ 🖿 File Edit View Insert Format Data Tools Add-ons Help <u>All changes saved in Drive</u>											
F		100% - \$%	$.0_{\leftarrow} .00_{\rightarrow} 123 =$ Helvetica $=$ 10	- B I S /	A À. 🖽	53 · <b>E</b> · 1	<del> </del> - 🏷 -	cə 🛨 🔟	Υ - Σ		
fx				I							
	A	В	С	D	E	F	G	н	I		
1	FAIR Im	plement	ation Matrix								
2	On the OSF	https://osf.io/n7uwp	<u>p/</u>								
3	Red indicates waist	of hourglass									
4	Blue is an Implemen	ntation Choice									
5	Orange is Implemen	tation Challenge									
6	Green highlight indic	ates a service provid	led by the IN or spin-off								
7	Blank cell is not rele	vant for IN									
8	FAIR Principle	Services	Component	Most used	C2CAMP	OPEDAS	PHT	<b>Rare-Diseases</b>	GER		
9		central to all	DOIP	DOIP	DOIP	DOIP	DOIP	DOIP			
10		central to all	Metadata format	RDF		RDF	RDF	RDF			
11		central to all	Metadata access protocol			LDP/FDP	LDP/FDP	LDP/FDP			
12		central to all	Metadata core elements	TBD on M4M		TBD on M4M	TBD on M4M	TBD on M4M			
13		Technology	Data Format			RDF for interop.	RDF for interop.	RDF for interop.			
14		Technology	Data Access Protocols (MR/A)			LDP/FDP	PHT-standard	PHT-standard			
15		Technology	Computer-actionable license description language			RDF	RDF	RDF			
16		Tooling	Repository (Data/Metadata)		DONA	IFDS Data Station	IFDS Data Station	ERN?	GER		
17		Tooling(Repository)	https://www.dataone.org								
18		Tooling	Registry Service		DONA	IFDS Station Registry	IFDS Station Registry	ERN?			
19		tooling	Metadata forms/creators			CEDAR/CASTOR					
20		Tooling	Search capability		DOIP	IFDS Station Registry	IFDS Station Registry	IFDS Station Registry			
21		Policy	Persistence Policy			TBD	TBD	TBD			
22		Technology	Computer-actionable policy description language			RDF	RDF	RDF			
23		Tooling	License protocols			TBD	TBD	TBD			
24		Tooling	Training Materials			Training-IN	Training-IN	EJP			

![](_page_31_Figure_1.jpeg)

#### **Community Implementation Choices & Challenges**

![](_page_32_Picture_1.jpeg)

![](_page_32_Picture_2.jpeg)

#### Peter Wittenburg

![](_page_32_Picture_4.jpeg)

![](_page_32_Picture_5.jpeg)

MAX-PLANCK-GESELLSCHAFT

# Tobias Kuhn VU

![](_page_32_Picture_8.jpeg)

![](_page_32_Picture_9.jpeg)

#### https://osf.io/n7uwp/

![](_page_32_Picture_11.jpeg)

![](_page_32_Picture_12.jpeg)

![](_page_32_Picture_13.jpeg)

![](_page_32_Picture_14.jpeg)

![](_page_32_Picture_15.jpeg)

![](_page_33_Picture_1.jpeg)

G FAIR Open FAIR Data Point (hosted by trusted party, e.g. NeIC)

![](_page_34_Figure_1.jpeg)

![](_page_35_Figure_1.jpeg)

![](_page_36_Figure_1.jpeg)

![](_page_37_Figure_1.jpeg)

(hosted by trusted party, e.g. NeIC)

![](_page_38_Picture_0.jpeg)

Hotel International Prague, Czech republic January 14-16, 2019 Register at www.envri.eu

ENVRI-FAIR

**KICK OFF MEETING** 

ENVRI-FAIR KICKOFF MEETING January 14 @ 1:00 pm - January 16 @ 3:00 pm

Powered by G FAIR

#### **ENVRIFAIR** questionnaire

Please provide information on the FAIRness of the data at your research infrastructure. Fill out this form for an example dataset of each different "data entity". As example: SeaDataNet offers the CDI metadata catalogue for observation data, and it offers a catalogue with metadata of dataproduct/data aggregations. These are two different entities, with a different metadata model and data access services.

More detailed information on the FAIR metrics that is used is available here: <u>https://github.com/FAIRMetrics/Metrics/blob/master/ALL.pdf</u>

\* Required

#### Contact name \*

Your answer

![](_page_40_Picture_0.jpeg)

### **Site Report** Survey Summary

**CS3 Conference** Rome, January 28-30 2019

delle Ricerche

# Programme Highlights Attention to collaborative add-on services moving to

- production grade
- Data science on EFSS now a real thing
- Links up to policy and governance around open science / EOSC finally beginning to form (new track!)

(thought: is EFSS emerging as the waist of the hourglass for data?)

![](_page_40_Figure_10.jpeg)

# MPS FAIR Hackathon Questionnaire https://osf.io/fn25g/

#### INTRO

This Questionnaire supports preparation for the FAIR Hackathon for Mathematical and Physical Sciences (MPS) Research Communities. The questionnaire contains ~30 questions and will take about 12 -15 minutes to complete. The entire survey can be downloaded here as a <u>PDF</u>.

This survey serves three functions: (1) Cursory inventory of participants' FAIR awareness (2) Help participants start narrowing down what to tackle or contribute during the hackathon (3) To help meaningfully group researchers with data librarians, data analysts, and FAIR experts

Many of the questions below relate directly to the FAIR Principles and are noted as such in the question. Your answers will enable organizers and advisors to better exploit synergies so we can work on gaps together for maximizing re-use of FAIR solutions. We hope this helps to guide respondents to better understand the questions in the context of FAIR and potential hackathon opportunities.

#### CONTACT

Click to write the question text

### **FAIR Principles**

Sci. Data 3:160018 doi: 10.1038/sdata.2016.18 (2016)

![](_page_42_Picture_2.jpeg)

### Findable:

F1 (meta)data are assigned a globally unique and persistent identifier;

F2 data are described with rich metadata;

F3 metadata clearly and explicitly include the identifier of the data it describes;

F4 (meta)data are registered or indexed in a searchable resource;

### Interoperable:

11 (meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation.

I2 (meta)data use vocabularies that follow FAIR principles;

13 (meta)data include qualified references to other (meta)data;

### 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;

### **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;

## **Metadata for Machines**

![](_page_43_Picture_1.jpeg)

#### Making it easy for humans to make metadata for machines

https://www.go-fair.org/resources/go-fair-workshop-series/metadata-for-machines-workshops/

![](_page_44_Figure_0.jpeg)