

NEXT
GENERATION
ATION IoT

NGIoT Thematic
Workshop

Agrifood and Rural communities

30 MARCH 2021 | 13:30 - 16:30 CET

FAIR for Food:

What is your FIP?



LCDS
LEIDEN CENTRE
OF DATA SCIENCE

Dr. Erik Schultes, PhD
International Science Coordinator
GO FAIR Foundation
<http://orcid.org/0000-0001-8888-635X>
erik.schultes@go-fair.org
go-fair.org

March 30, 2021
Slides: <https://osf.io/n2zt8/>

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

[Open Access](#) | [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  -Show fewer authors

Scientific Data **3**, Article number: 160018 (2016) | [Cite this article](#)

184k Accesses | **2317** Citations | **1801** Altmetric | [Metrics](#)

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
- 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

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

[Open Access](#) | [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 [✉](#) [-Show fewer authors](#)

Scientific Data **3**, Article number: 160018 (2016) | [Cite this article](#)

184k Accesses | **2317** Citations | **1801** Altmetric | [Metrics](#)

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:

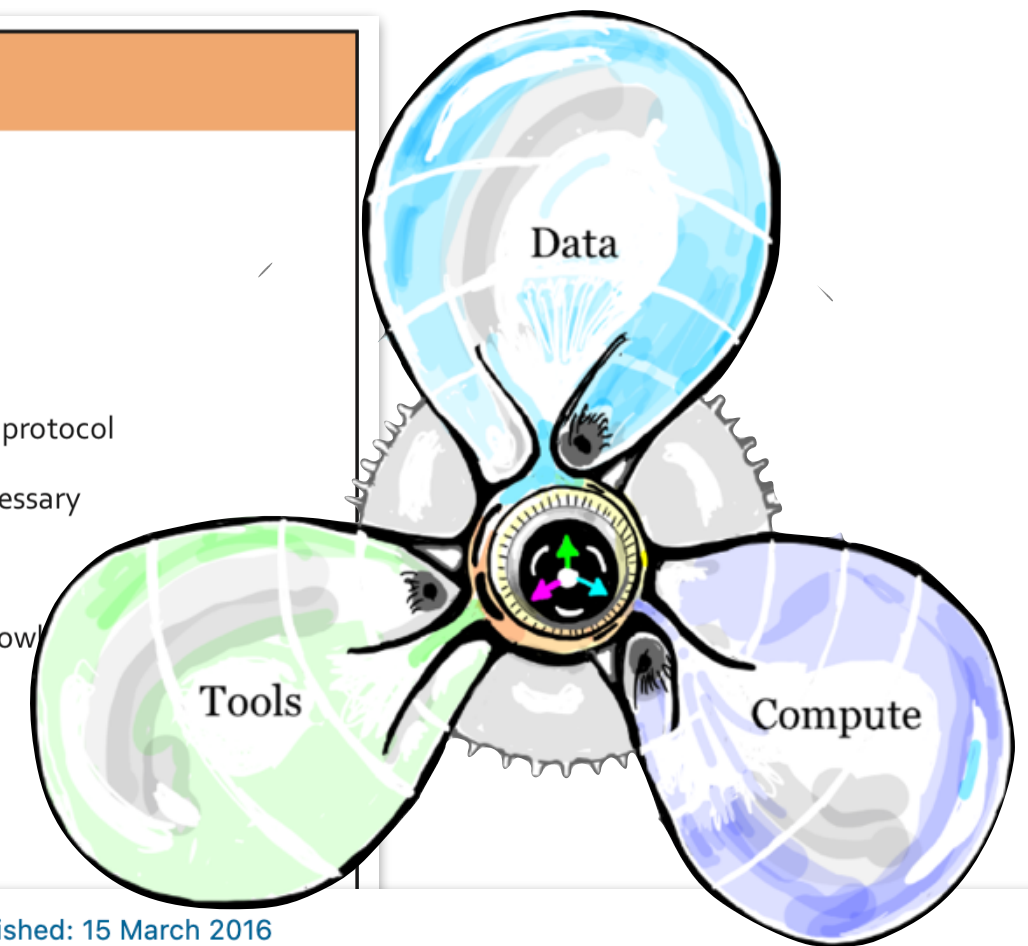
- A1. (meta)data are retrievable by their identifier using a standardized communications protocol
 - A1.1 the protocol is open, free, and universally implementable
 - A1.2 the protocol allows for an authentication and authorization procedure, where necessary
- A2. metadata are accessible, even when the 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
- 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



[Open Access](#) | [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 [✉](#) [-Show fewer authors](#)

Scientific Data **3**, Article number: 160018 (2016) | [Cite this article](#)

184k Accesses | **2317** Citations | **1801** Altmetric | [Metrics](#)

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

[Home](#) › [How to GO FAIR](#)

How to GO FAIR

Since its beginning in early 2018, the GO FAIR community has been working towards implementations of the **FAIR Guiding Principles**. This collective effort has resulted in a three-point framework that formulates the essential steps towards the end goal, a global Internet of FAIR Data and Services where data are **F**indable, **A**ccessible, **I**nteroperable and **R**eusable (**FAIR**) for machines.

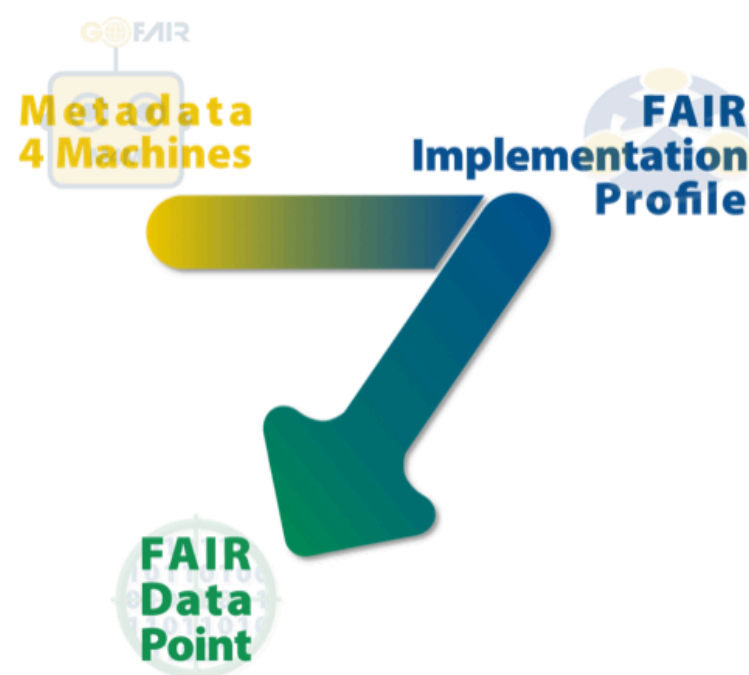


A framework guiding FAIRification

The Three-point FAIRification Framework provides practical “how to” guidance to stakeholders seeking to go FAIR.

Moreover, by following this framework, stakeholders can rest assured that their efforts toward FAIRification will be optimally coordinated with the efforts of other stakeholders in the GO FAIR community. The three-point framework maximizes reuse of existing resources, maximizes interoperability, and accelerates convergence on standards and technologies supporting FAIR data and services.

- Typically, the FAIRification process begins when a community of practice considers its domain-relevant metadata requirements and other policy considerations, and formulates these considerations as machine-actionable metadata components. These considerations can be guided in **Metadata for Machines** (M4M) Workshops.



“FAIR is 90% Metadata”

December 2020

- Mark Wilkinson, Universidad Politécnica de Madrid
- Mark Musen, Stanford University

Box 2 | The FAIR Guiding Principles

<https://www.nature.com/articles/sdata201618>

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

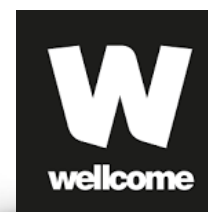
To be Reusable:

- 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



Metadata for Machines Workshops

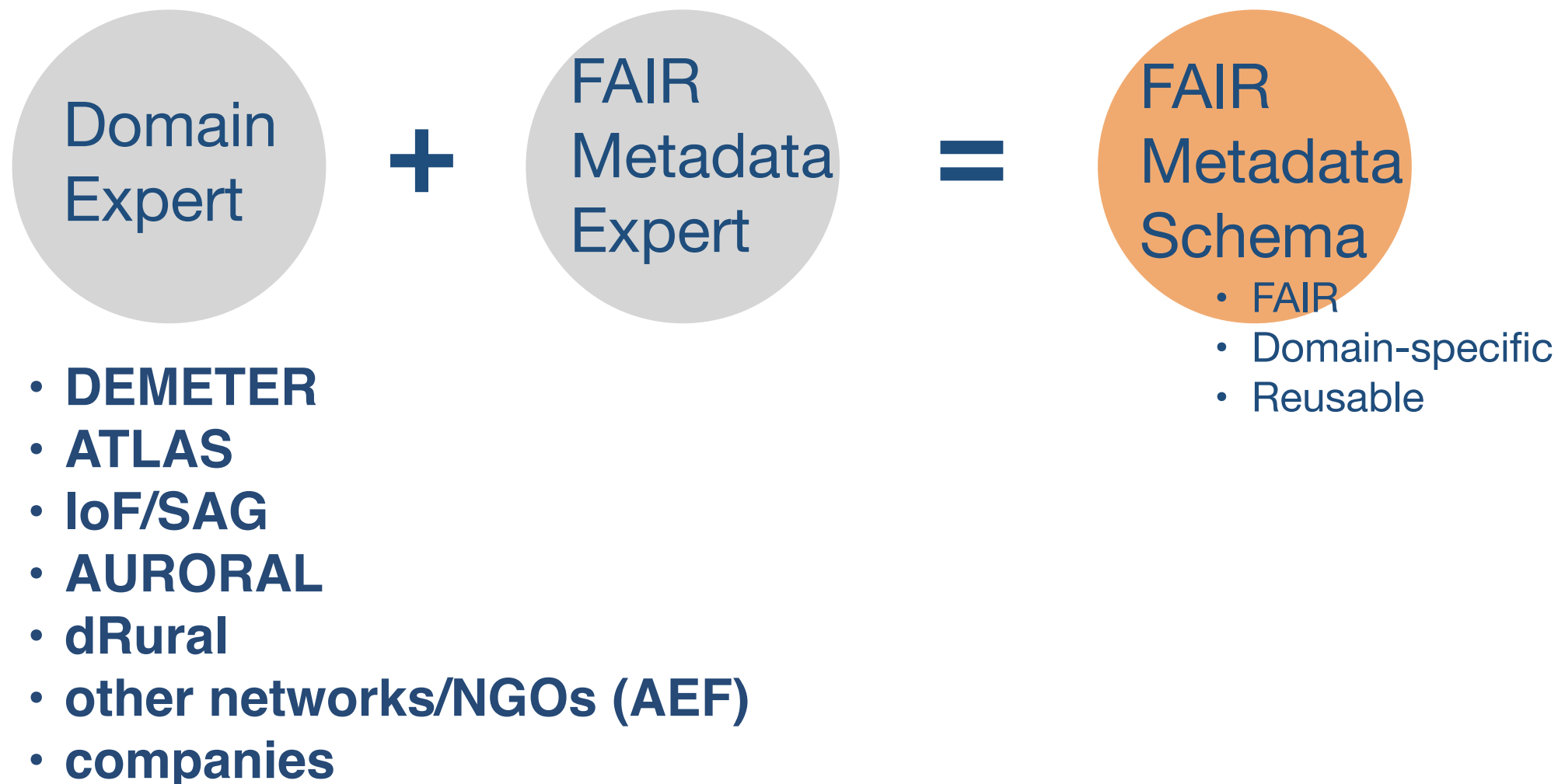
<https://www.go-fair.org/today/making-fair-metadata/>





Metadata for Machines Workshops

<https://www.go-fair.org/today/making-fair-metadata/>



FAIR Implementation Profile

FAIR principle	Question	FAIR enabling resource types	Your answers
F1	What globally unique, persistent, resolvable identifiers do you use for metadata records?	Identifier type	<i>e.g. PURL, DOI</i>
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	

FIP Mini Questionnaire <http://bit.ly/FIPminiquestionnaire>

Magagna, B., Schultes, E. A., Pergl, R., Hettne, K. M., Kuhn, T., & Suchánek, M. (2020, September 21). Reusable FAIR Implementation Profiles as Accelerators of FAIR Convergence. <https://doi.org/10.31219/osf.io/2p85g>

FAIR Convergence Matrix: Optimizing the Reuse of Existing FAIR-Related Resources

Hana Pergl Sustkova, Kristina Maria Hettne, Peter Wittenburg, Annika Jacobsen, Tobias Kuhn, Robert Pergl, Jan Slifka, Peter McQuilton, Barbara Magagna, Susanna-Assunta Sansone, Markus Stocker, Melanie Imming, Larry Lannom, Mark Musen, and Erik Schultes

Data Intelligence 2020 2:1-2, 158-170

https://doi.org/10.1162/dint_a_00038

FIP Workshops 2020

Social Sciences
Life Sciences 2 (Biodiversity)

Oceanography

Environmental Sciences
Materials

Life Sciences 1

Pistoia Alliance

imi

Week 41

Week 42

Week 43

Week 44

Week 45

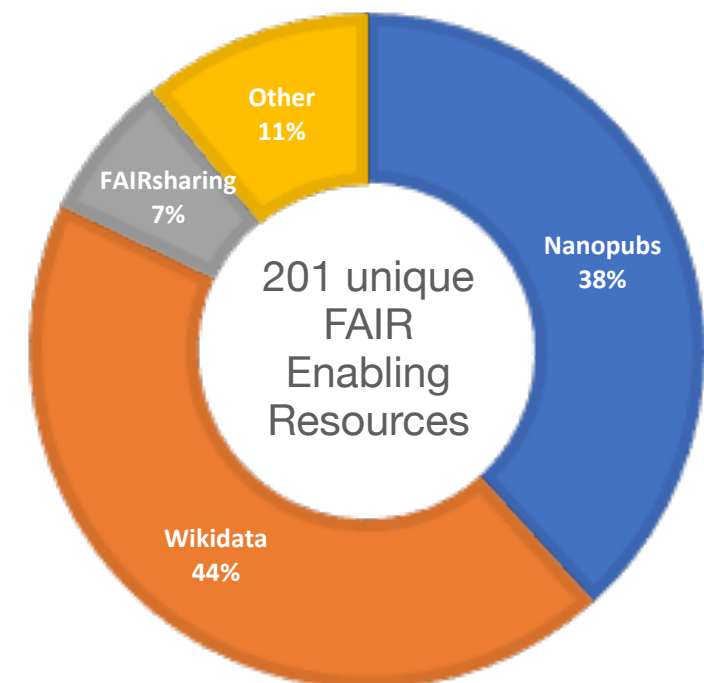
Week 46

Week 47

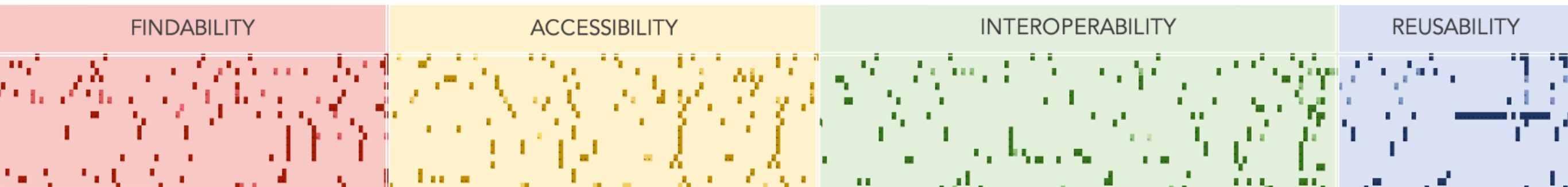
Week 48

Week 49

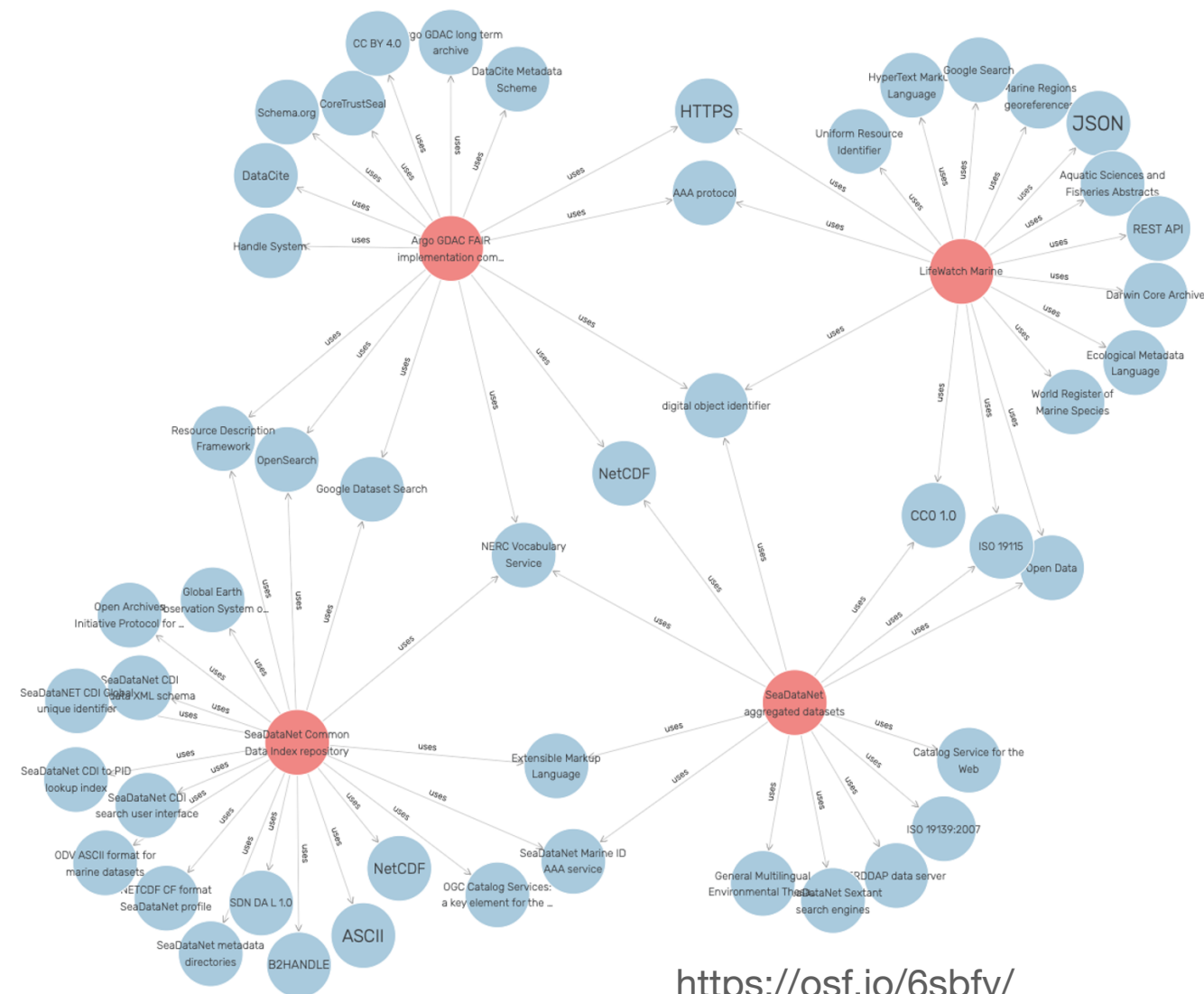
- 6 Workshops (7 hours, 2 days)
- 25 communities
- 81 participants
- 46 contact hours
- Outputs:
 - 25 Human-readable FIPs <https://osf.io/r2hzc/>
 - Convergence Matrix <https://bit.ly/3IKCGFI>



FIP Workshops 2020



<https://bit.ly/3IKCGFI>



<https://osf.io/6sbfy/>

Convergence by Resource Overlap

		biodiversity-ecosystem sciences					marine sciences				atmosphere sciences			material sciences			health sciences								social sciences		gen eric	SUM/Community
		GBIF	AnaEE	eLTER-RI	DiSSCo	LWERIC Ecosystem	LW marine	ARGO	SeaDataNet-CDI	SeaDataNet-Sextant	ICOS	SIOS	IAGOS	materialscloud	Materiom	optimade	VODAN	HPA	AZCD	AZTM	BRWE	NIBRNXFIP	RCTP	SSSR	EduSocDL	OSURIS		
biodiversity-ecosystem sciences	GBIF		4	4	5	8	5	7	0	3	6	2	2	6	0	2	1	3	2	2	0	2	3	2	3	2	74	
	AnaEE	4		5	3	7	2	6	2	5	8	4	8	3	0	2	3	3	1	1	3	2	3	1	2	9	87	
	eLTER-RI	4	5		2	7	3	2	2	9	9	5	6	6	0	0	2	1	0	0	0	1	1	4	4	3	76	
	DiSSCo	5	3	2		3	1	3	0	1	3	1	0	3	0	4	1	0	0	0	0	0	0	1	5	2	38	
	LWERIC Ecosystem	8	7	7	3		7	11	4	5	9	3	3	7	0	4	4	5	2	2	2	5	5	1	7	4	115	
marine sciences	LW marine	5	2	3	1	7		2	0	3	2	1	4	5	0	1	1	2	0	0	0	1	0	2	4	1	47	
	ARGO	7	6	2	3	11	2		3	1	8	2	2	5	0	2	4	5	2	2	2	3	4	2	5	2	85	
	SeaDataNet-CDI	0	2	2	0	4	0	3		3	3	2	1	3	0	0	1	1	0	0	1	2	1	1	1	1	32	
	SeaDataNet-Sextant	3	5	9	1	5	3	1	3		5	3	7	3	0	0	1	1	0	0	0	1	1	3	4	3	62	
atmosphere sciences	ICOS	6	8	9	3	9	2	8	3	5		5	4	12	0	1	8	7	2	2	2	4	6	3	7	3	119	
	SIOS	2	4	5	1	3	1	2	2	3	5		6	5	0	0	3	2	1	1	0	2	2	2	2	2	56	
	IAGOS	2	8	6	0	3	4	2	1	7	4	6		3	0	0	0	2	0	0	2	1	1	1	3	5	61	
material sciences	materialscloud	6	3	6	3	7	5	5	3	3	12	5	3		0	2	4	3	2	2	0	4	4	3	5	2	92	
	Materiom	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	
	optimade	2	2	0	4	4	1	2	0	0	1	0	0	2	0		0	0	0	0	0	1	0	0	4	2	25	
health sciences	VODAN	1	3	2	1	4	1	4	1	1	8	3	0	4	0	0		18	2	2	2	3	6	1	3	0	70	
	HPA	3	3	1	0	5	2	5	1	1	7	2	2	3	0	0	18		2	2	2	3	6	1	3	0	72	
	AZCD	2	1	0	0	2	0	2	0	0	2	1	0	2	0	0	2	2		14	2	4	2	0	0	0	38	
	AZTM	2	1	0	0	2	0	2	0	0	2	1	0	2	0	0	2	2	14		2	4	2	0	0	0	38	
	BRWE	0	3	0	0	2	0	2	1	0	2	0	2	0	0	0	2	2	2	2		3	3	0	1	2	29	
	NIBRNXFIP	2	2	1	0	5	1	3	2	1	4	2	1	4	0	1	3	3	4	4	3		3	0	2	1	52	
	RCTP	3	3	1	0	5	0	4	1	1	6	2	1	4	0	0	6	6	2	2	3	3		0	3	0	56	
social sciences	SSSR	2	1	4	1	1	2	2	1	3	3	2	1	3	0	0	1	1	0	0	0	0	0		8	0	36	
	EduSocDL	3	2	4	5	7	4	5	1	4	7	2	3	5	0	4	3	3	0	0	1	2	3	8		0	76	
generic	OSURIS	2	9	3	2	4	1	2	1	3	3	2	5	2	0	2	0	0	0	0	2	1	0	0	0		44	
SUM/Community		74	87	76	38	115	47	85	32	62	119	56	61	92	0	25	70	72	38	38	29	52	56	36	76	44		

What is the FIP for:

- DEMETER**
- ATLAS**
- IoF/SAG**
- AURORAL**
- dRural**
- other networks/NGOs
(AEF)**
- companies**

FAIR well !

Acknowledgements



Barbara Magagna
Environment Agency Austria
(PhD student Univ. Twente)



Nikola Vasiljevic
FAIR Data Collective

Jeroen Belien, AUMC
John Graybeal, Stanford University
Kristina Hettne, Leiden University
Tobias Kuhn, Assistant Professor at Vrije Universiteit Amsterdam
Robert Pergl, Czech Technical University in Prague
Jan Slifka, Czech Technical University in Prague
Wouter van Stralen, Low Code Solutions
Tieneke Schaaij-Visser, Lygature, Health-RI
Sofie Hansen, Lygature, Health-RI
Rita Azevedo, Lygature, Health-RI
Mijke Jetten, DTL, Health-RI International Science Coordinator



ZonMw



FAIR
foundation



CODEVENANCE

