



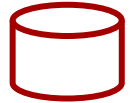
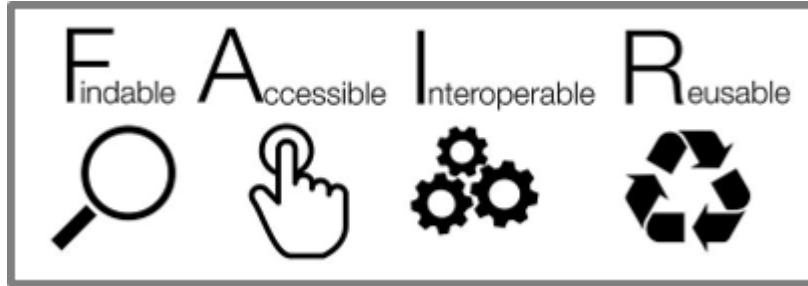
FAIR Semantic Artefact Assessment: A Methodology and Implementation

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Oct, 2024

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Data (initially) [1]



Research Software



Methods



Semantic artefacts

Other guidelines:

- Guidelines for Transparency and Openness Promotion (TOP) [2]
- Reproducibility Enhancement Principles (REP) [3]
- ...



[1] Wilkinson, M., Dumontier, M., Aalbersberg, I. *et al.* The FAIR Guiding Principles for scientific data management and stewardship. *Sci Data* **3**, 160018 (2016). <https://doi.org/10.1038/sdata.2016.18>

[2] <https://www.cos.io/initiatives/top-guidelines>

[3] Stodden, V *et al* Enhancing reproducibility for computational methods <https://www.science.org/lookup/doi/10.1126/science.aah6168>

- Linked Data principles [1] and 5-star ranking
 1. Use URIs ☆ Available
 2. HTTP URIs ☆☆ Machine readable
 3. Resolve and provide useful info ☆☆☆ Open format
 4. Link to other URIs ☆☆☆☆ Use standards
☆☆☆☆☆ Link to other resources
- LD Principles adapted to ontologies [2] [3]
- Best practices for accessing vocabularies [4]
- Tutorials for publishing vocabularies [5]
- FAIR guides [5] [6] [7] [8]

How does all come together?

[1] <https://www.w3.org/DesignIssues/LinkedData.html>

[2] https://bvatant.blogspot.com/2012/02/is-your-linked-data-vocabulary-5-star_9588.html

[3] Janowicz, K., Hitzler, P., Adams, B., Kolas, D., Vardeman, I., et al.: Five stars of linked data vocabulary use. *Semantic Web* 5(3), 173–176 (2014)

[4] Best Practice Recipes for Publishing RDF Vocabularies. <https://www.w3.org/TR/swbp-vocab-pub/>

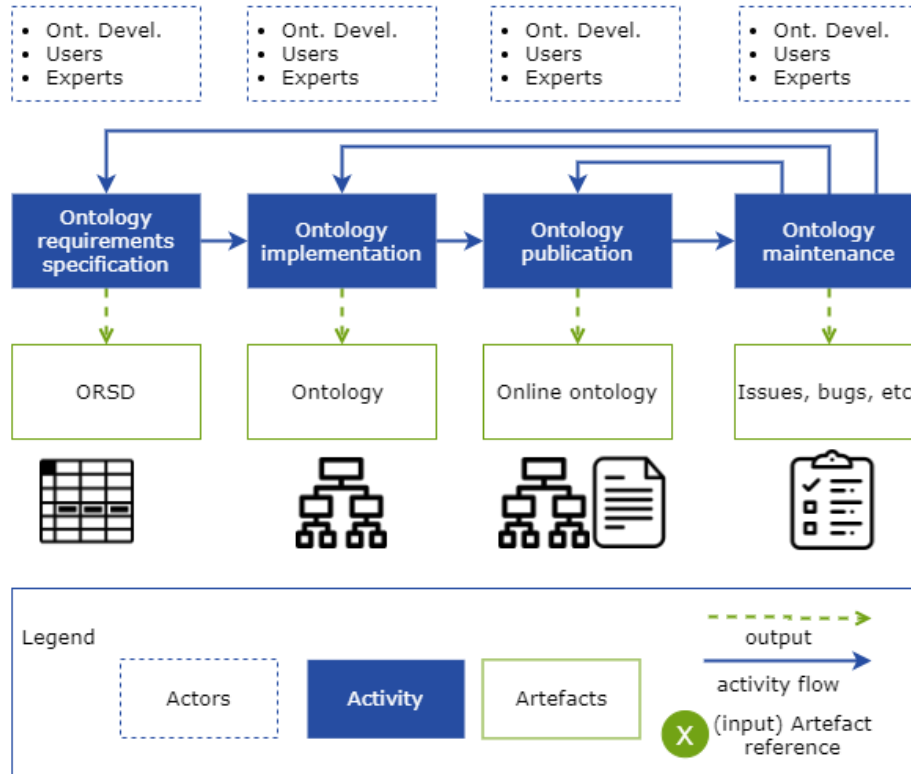
[5] Garijo, Daniel (2013): How to (properly) publish a vocabulary or ontology in the web. figshare. Journal contribution. <https://doi.org/10.6084/m9.figshare.881824.v1>

[6] Le Franc, Y.; Bonino, L.; Koivula, H.; Parland-von Essen, J. & Pergl, R. (2022). 'D2.8 FAIR Semantics Recommendations Third Iteration (V1.0),' FAIRsFAIR, Zenodo. Available at: <https://doi.org/10.5281/zenodo.6675295>.

[7] Xu, F. et al. (2023) 'Features of a FAIR vocabulary', *Journal of Biomedical Semantics*, 14(1), p. 6. Available at: <https://doi.org/10.1186/s13326-023-00286-8>.

[8] Cox, S.J.D. et al. (2021) 'Ten simple rules for making a vocabulary FAIR', *PLOS Computational Biology*, 17(6), p. e1009041. Available at: <https://doi.org/10.1371/journal.pcbi.1009041>.

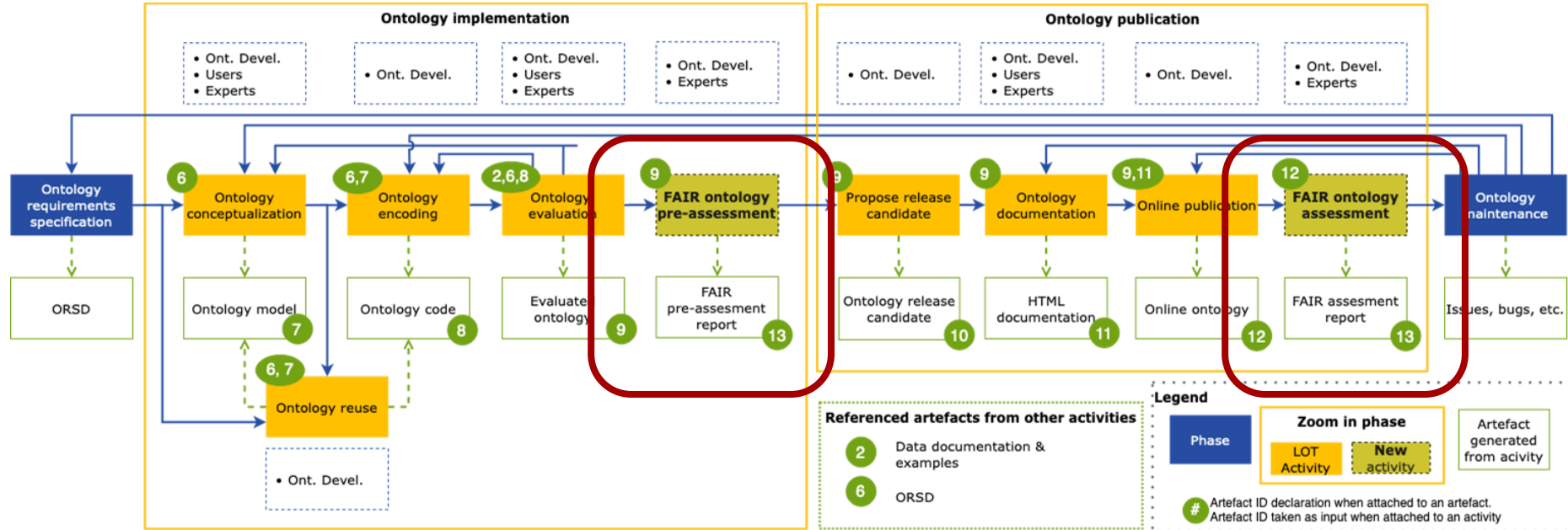
Adapting existing methodologies: Linked Open Terms (LOT)



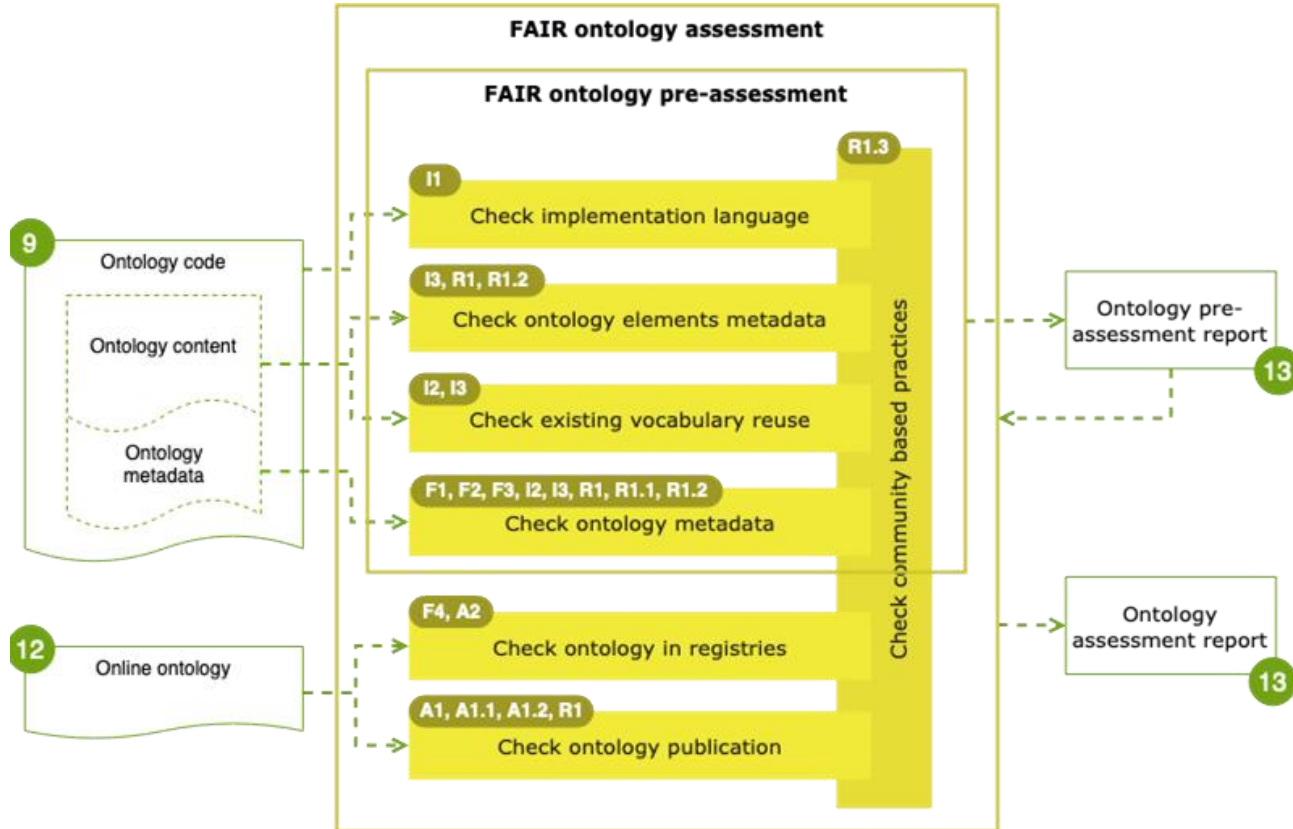
LOT Methodology <http://lot.linkedata.es>
@Ontology Engineering Group

Poveda-Villalón, M., Fernández-Izquierdo, A., Fernández-López, M., & García-Castro, R. (2022). LOT: An industrial oriented ontology engineering framework. *Engineering Applications of Artificial Intelligence*, 111, 104755. <https://doi.org/10.1016/j.engappai.2022.104755>

Extending LOT for FAIRness assessment



Garijo, D., Poveda-Villalón, M., Flohr, P., Gonzalez-Beltran, A., le Franc, Y., & Verburg, M. (2023). M5.3 Semantic artefact assessment methodology (Version 1). Zenodo. <https://doi.org/10.5281/zenodo.8305173>



MOD Category name	Total	Total #	Total i	Support by %	Comments	Ranking based on support
Title	26	12	2528	1	Note: total numb	Mandatory (20-100%)
Description	15	6	2389	0,9450158228	Number of insta	Mandatory
Creator	32	18	1314	0,519778481		Mandatory
Version information	19	10	1227	0,4853639241		Mandatory
License	23	10	972	0,3844936709		Mandatory
Imports	5	2	844	0,3338607595		Mandatory
Version IRI	4	2	719	0,284414557		Mandatory
Modification date	14	6	705	0,2788765823		Mandatory (but may be optiona
Creation date	24	10	667	0,2638449367		Mandatory
Preferred Namespace URI	8	2	657	0,2598892405		Mandatory
Preferred Namespace Prefix	8	2	608	0,2405063291		Mandatory
Contributor	12	4	540	0,2136075949		Mandatory (but may be optiona
Access rights	5	1	503	0,198971519		Recommended (5-20%)
Submission date	7	2	466	0,184335443		Recommended
Publisher	8	2	418	0,1653481013		Recommended (but may be opt
Source	9	1	361	0,1428006329		Recommended
Notes or comments	14	1	295	0,116693038		Recommended (but may be opt
Prior version	6	1	219	0,08662974684		Recommended
Status	12	3	183	0,07238924051		Recommended
Root resources	3	0	133	0,05261075949		Recommended (optional, as it i
Natural language	7	2	119	0,04707278481		Optional (1-5%)
Has format	2	0	111	0,04390822785		Optional
Subject	9	1	109	0,04311708861		Optional
Other identifier	5	0	107	0,04232594937		Optional
Homepage	4	1	84	0,0332278481		Optional
Relies on	3	0	79	0,03125		Optional
Generic Type	5	0	50	0,01977848101		Optional
Specializes	4	0	46	0,01819620253		Optional
Bibliographic reference	8	4	41	0,01621835443		Optional

Recommendations based on a semantic artefact landscape analysis (**over 5k resources** analysed)

- Aligned metadata categories to MOD (<https://github.com/FAIR-IMPACT/MOD>)
- Metadata support based:
 - Existing vocabularies
 - Expert votes
 - Alignment to FAIR principles

Methodology implementation:
**FOOPS! The Ontology Pitfall Scanner for
FAIR (Beta)**

<https://w3id.org/foops>

Garijo, D., Corcho, O., & Poveda-Villalón, M. (2021). FOOPS!: An Ontology Pitfall Scanner for the FAIR principles. In *ISWC (Posters/Demos/Industry)*.



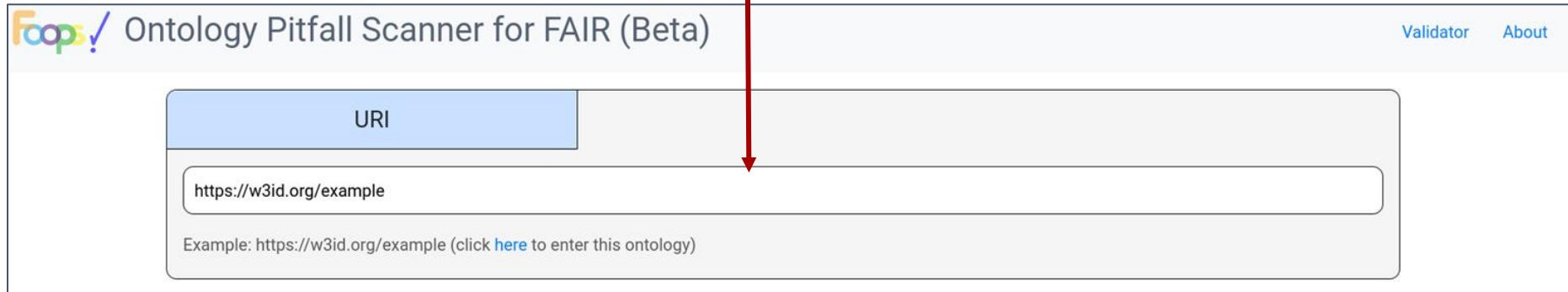
- Validation service inspired by OOPS! (Ontology Pitfall Scanner)



- Designed to guide users
 - Tests have an explanation
 - Tests indicate potential errors
- Practical
 - Based on years of ontology engineering practices at UPM
- Aligned to FAIR

Live demo: <https://w3id.org/foops/>

Enter a ontology URI



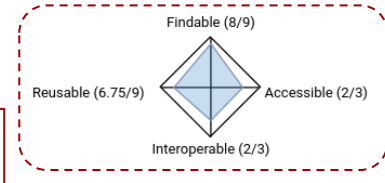
The screenshot shows the web interface for the FOOPS! Ontology Pitfall Scanner for FAIR (Beta). The page title is "foops! Ontology Pitfall Scanner for FAIR (Beta)" and there are links for "Validator" and "About" in the top right. The main form has a light blue header with the text "URI". Below this is a text input field containing the URI "https://w3id.org/example". Underneath the input field, there is an example text: "Example: https://w3id.org/example (click [here](#) to enter this ontology)". A red arrow points from the text "Enter a ontology URI" above to the input field.

Title:

URI:

License:

} Ontology metadata summary



FAIRness coverage by category

FAIRness overall score. **Note:** this may be a **quality indicator**, but there is no defined threshold for FAIRness.

Findable

Accessible

Interoperable

FAIR Category

I1: (meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation

Check

RDF1: RDF Availability



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

Check coverage

VOC1: Vocabulary reuse (metadata)



VOC2: Vocabulary reuse



Check description

Description: This check verifies if the ontology imports/extends other vocabularies (besides RDF, OWL and RDFS)

Check explanation

Explanation: Could not find any imported/reused vocabularies



Findable

- Ontology URI is resolvable
- Ontology URI is persistent
- Version IRI exists (and resolves)
- Ontology id is ontology URI
- Minimum metadata is available (e.g., title, description, version info, etc.)
- Ontology prefix is in registry
- Ontology is in registry

Accessible

- Ontology is available in RDF/HTML (content negotiation)
- Ontology is in a registry (repeated)
- Ontology is URI is defined in HTTP/HTTPS



Interoperable

- Ontology is at least available in RDF
- Ontology reuses known vocabularies for declaring metadata (DC, Schema, PROV, etc.)
- Ontology extends other vocabularies

Reusable

- HTML representation of the ontology exists
- Extensive metadata is provided with the ontology
- Labels and descriptions exist for all terms
- License is provided and resolvable
- Metadata includes provenance information



Support for **pre-assessment** (files and ontology snippets)

Ontology Pitfall Scanner for FAIR (Beta) Validator About

URI

Example: <https://w3id.org/example> (click [here](#) to enter this ontology)

Support for files / ontology snippets

Support for **specific suggestions** when a check is not passed:

A2: metadata are accessible, even when the data are no longer available

FIND_3_BIS: Metadata are accessible, even when ontology is not 0%

Description: Metadata are accessible even when the ontology is no longer available. Since the metadata is usually included in the ontology, this check verifies whether the ontology is registered in a public metadata registry (LOV)

Explanation: Ontology not found in a public registry

Suggestion:

- Click [here] to register the ontology in LOV
- Click [here] to suggest the ontology in BioPortal
- ...

Help us improve **FOOPS!**

Errors? (please be gentle)

New tests?

Suggestions?

Drop us a message:

foops@delicias.dia.upm.es



<https://w3id.org/foops/>

https://github.com/oeg-upm/fair_ontologies



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