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FDO nanopublications for FAIR Implementation Profiles

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Abstract.

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1. Extended abstract

FAIR has become a mandatory requirement in European research projects to maximize the long-term value and impact of research investments, enabling future studies and scientific investigations to build on existing work. Although the necessity to go FAIR is widely recognised, many research communities are still struggling to understand the concrete added value of FAIR and how to actually implement it. This situation suggests that it is necessary to support researchers on their journey there with easy-to-follow frameworks.

Many efforts have been made to address these knowledge gaps. The European Open Science Cloud (EOSC) has made FAIR data stewardship a central pillar of EU research infrastructure policy [1]. Many European countries have adopted national open science strategies that explicitly promote FAIR practices. Research Infrastructures have integrated FAIR principles into their data policies. Capacity building initiatives such as Skills4EOSC [2] have been implemented to professionalize FAIR data stewardship. Metadata specifications and semantic frameworks for making digital resources FAIR, such as the FAIR Digital Object (FDO) [3], have been proposed to improve interoperability and data reuse.

Various FAIR evaluators have emerged to assess the FAIRness level of digital objects with sometimes divergent results that confuse rather than guide the users of such tools [4]. The complexity and number of approaches developed are overwhelming for communities that are just getting started. This is where FAIR Implementation Profiles

(FIPs) come in, offering an onboarding and roadmapping strategy for communities of practice that want to go FAIR together. Originated from questionnaires based on the Research Database Management and the Data Maturity Indicator initiatives, the ENVRI FAIR project collaborated with the GO FAIR Foundation to develop a very concise survey aimed at addressing data and metadata-related questions targeting each of the FAIR principles. The aim of the survey was to document the FAIR technology choices employed to FAIRify digital objects as a collective decision by a community. By disclosing the implementation strategy to the public, the FIP infrastructure can accelerate convergence onto robust FAIR implementations [5]. Since their advent in 2020, more than 200 communities have shared around 600 FIPs documenting the use of 1300 so-called FAIR Supporting Resources (FSRs). In many Horizon Europe and EOSC projects such as ENVRI FAIR [6], PARC[7], WorldFAIR [8] and FAIR2Adapt [9], FIPs are used as an inventory of resources used also with the aim of detecting FAIR implementation gaps. Furthermore, reference FIPs are now used to inform parties within communities on the recommended resources to use, guiding FAIRification and convergence.

Nanopublications (or nanopubs) are used to represent FIPs and their components, the FSRs, in a machine-actionable way. Nanopublications are Semantic Web-compliant knowledge graphs with three basic elements using the RDF standard: the assertion entailing the main content, the provenance describing how the assertion came to be, and publication info providing metadata about the nanopublication itself. Nanopubs are used in the FIP ecosystem to provide metadata and global, unique, persistent and resolvable identifiers (GUPRIs) to the resources used. To categorize the resources, the GO FAIR Foundation developed a typology (see Figure 1) published in the FIP ontology [10]. This typology is a main instrument to guide implementers in a systematic way to define and then ultimately select the resources needed to FAIRify digital objects. The FIP specification is used to inform Knowledge Models in the FIP Wizard[11], a tool that provides project templates used as questionnaires to define FIPs and their FERs. When compiled, the FIPs can then be published within the FIP Wizard infrastructure as a nanopub index containing FER usage declarations.

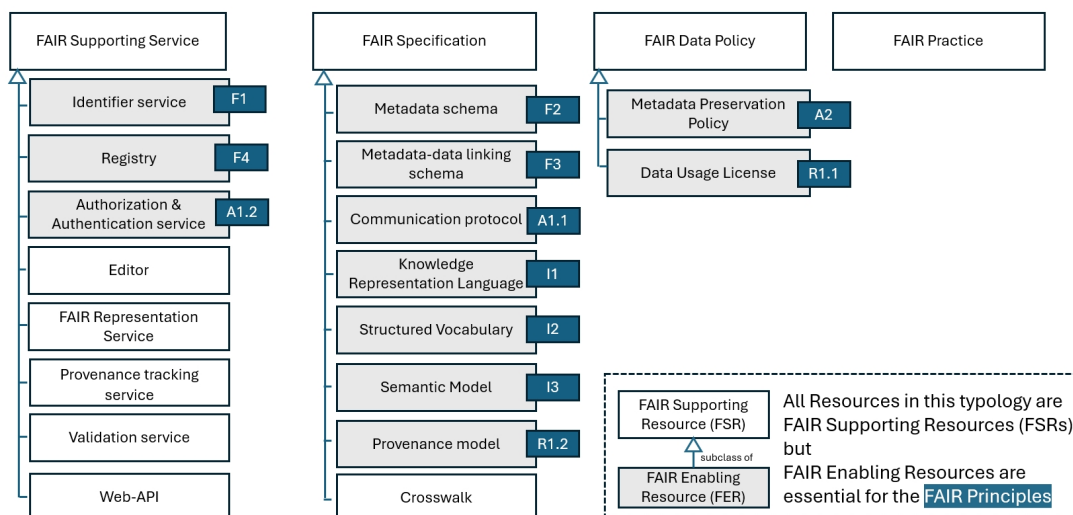


Figure 1. Typology of FAIR Supporting Resources (FSRs).

This paper highlights two particular features of nanopublications: the flexibility of their application to meet specific requirements and their suitability to represent FAIR Digital Objects. This is exemplified by their implementation in the FIP ecosystem. By virtue of their nature, nanopublications enable to make statements about other nanop-

ublications. This feature is used, for example, to verify and approve metadata created via the FIP Wizard using a peer review system involving at least two trained curators. The approval is a nanopublication itself that refers to the original nanopub. Because of their RDF structure, SPARQL queries can be run on the nanopublication network to provide the information required for the analysis and visualization of such curated resources in applications like the FIP Wizard.

Nanopublications' suitability to represent FAIR Digital Objects has already been shown in a previous paper[12]. Because the FDO specification evolved over time and their compliance requirements changed, the FIP ecosystem is not yet fully implemented as an FDO. Once the specifications are fully approved by the FDO community, the nanopublication templates will be adapted to implement them. However, the paper illustrates an exemplary application of the FDO specifications as used in the FDO Connect project by implementing the profile definition using SHACL within nanopublications for describing a FAIR vocabulary.

Author contributions

All authors: Writing - Review and Editing **Barbara Magagna:** Conceptualization, Writing - Original Draft

Competing interests

The authors declare that they have no competing interests.

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