Preface

The publication of *The FAIR Guiding Principles for Scientific Data Management and Stewardship* [1] addressed a persistent challenge within the research data management community. Although the importance of responsible research data management was widely recognized among data professionals, its objectives and benefits often remained difficult to communicate to researchers, decision-makers, and other stakeholders outside dedicated RDM teams. In particular, data managers frequently encountered uncertainty regarding the value of data documentation, the manner in which such documentation should be structured, and the benefits that systematic data stewardship could provide.

The FAIR Guiding Principles offered a concise and broadly applicable framework through which these objectives could be articulated. By defining four high-level properties—Findability, Accessibility, Interoperability, and Reusability—the principles provided a common vocabulary for describing the intended outcomes of research data management. These overarching objectives were complemented by a set of more specific sub-principles—F1–F4, A1–A2, I1–I3, and R1–R1.3—which describe characteristics and practices intended to support their realization.

The FAIR framework was readily adopted by the RDM community and increasingly informed the development of data infrastructures, services, and research data ecosystems. In many cases, these systems were designed or adapted to satisfy the more detailed FAIR sub-principles. However, the principles were deliberately formulated at a high level and therefore present several limitations for their practical implementation:

1. **FAIR is not a technical standard.** It defines desired properties of digital research objects but does not prescribe a specific technical architecture or implementation.

2. **FAIR provides limited implementation guidance.** The principles do not determine which formats, metadata schemas, software systems, protocols, or technologies should be used.

3. **FAIR depends on community standards.** Effective implementation requires research communities to agree upon relevant standards and to apply them consistently.

4. **FAIRness is incremental.** Digital objects may satisfy individual principles to different degrees and may therefore exhibit varying levels of FAIRness.

5. **Machine actionability remains limited.** The complete and autonomous interpretation and processing of digital objects by machines may rarely be achievable.

6. **Rich metadata alone do not ensure interoperability.** Interoperability additionally requires shared representation languages, controlled vocabularies, semantic alignment, and explicitly defined relationships between digital objects.

7. **FAIR does not imply unrestricted openness.** Data subject to access restrictions may nevertheless be FAIR, provided that their metadata, access conditions, and access procedures are clearly described.

8. **FAIR is not a comprehensive governance framework.** It focuses primarily on the properties of digital research objects and does not encompass all responsibilities of data producers, repositories, research infrastructures, and institutions.

The central implementation challenge may therefore be summarized as follows: the FAIR Guiding Principles define the properties that well-managed digital research objects should exhibit, but they do not themselves provide the shared standards, technical specifications, or coordinated governance required to realize those properties. Their practical effectiveness consequently depends on research communities agreeing upon and consistently applying persistent identifiers, metadata schemas, semantic vocabularies, access protocols, provenance models, licences, and other domain-relevant standards.

The present wiki seeks to address this implementation gap by supporting the coordinated application of FAIR practices across the Helmholtz Association. It provides guidance on the selection and consistent use of relevant standards, technologies, and community practices, with the aim of enabling research data products to attain the highest practicable level of FAIRness.

Introduction

Contributions

The contributors to this wiki are

- HMC Hub Earth and Environment
- Working group Arbeitskreis Metadaten
- Working group Arbeitskreis Semantik

Both working groups are formed by the HMC Hub Earth and Environment and the DataHub Earth and Environment.

For questions, comments and suggestions, please write to hmc-hub_ee@geomar.de.

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