

Proceedings of the FDO Implementation Summit 2024 in Berlin

Editors' Note

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It is with great enthusiasm that we present the proceedings of the second conference of the FDO Forum, dedicated to advances in the rapidly evolving field of FAIR Digital Objects (FDOs). The proceedings of the FDO Summit Berlin in March 2024 present a collection of pioneering research that reflect the depth, diversity, quality and innovation that is driving both application-specific and foundational advances in the field. The FDO Summit 2024 showcased the next phase in the deployment of the disruptive FDO technology, building on the conceptual and standardisation work presented at the first international FAIR Digital Objects conference in Leiden in October 2022. No longer a theoretical concept, **FDOs are already being implemented** in laboratories and research facilities worldwide.

A key insight from this collection of papers is that FDOs' development is progressing along **two complementary dimensions**. The majority of efforts are focused on **vertical scientific applications**, where FDOs are being tailored to specific domains, ensuring efficient and structured data management within fields such as life sciences, geospatial research, and material science. At the same time, an important subset of researchers is addressing **horizontal core FDO technologies**, working to build the **underlying infrastructure** that will support interoperability, scalability, and sustainability across multiple data spaces.

Another important topic in this volume is the emergence of **different "flavors" of FDO implementations**, reflecting the adaptability of the technology to varying needs and architectures. Among these, **RO Crates**, **Nano Publications** and **FDO One** stand out as key approaches, each offering distinct advantages in managing, orchestrating, and leveraging digital objects in the **Global Interoperable Data Space (GIDS)**. These implementations illustrate the flexibility of FDOs in addressing the challenges of data-intensive research and cross-domain integration but are also raising some questions: (1) Are these flavors all compliant with the FDO specifications defined by the FDO Forum? (2) Do they all agree on the basic principles, such as machine actionability, the appropriate level of abstraction, the importance of typing, and so forth?

The research featured in this volume not only enhances our understanding of FDOs but also highlights its transformative role in the Global Interoperable Data Space. As data spaces become increasingly interconnected, FDOs provide a **robust, scalable, and secure** foundation for handling data across diverse domains. The studies presented here explore novel methodologies, frameworks, and applications that are shaping the next generation of **interoperable, efficient, and trustworthy** data infrastructures.

This proceedings volume is a direct outcome of the **FDO Summit 2024 held in Berlin**, where the latest advancements were presented and discussed. The program of the FDO Summit with links to the slides and videos of the sessions can be found in the following section of the preface.

The selection process for presentations was highly competitive — **approximately half of the submitted abstracts** were chosen through a rigorous review process for presentation at the conference. Following the event, speakers were invited to **develop their presentations into full papers**, and about half of them took up this opportunity. These full papers underwent another round of anonymous peer review, with the majority receiving approval for publication.

As a result, this volume is structured into **two parts**:

1. **Extended Abstracts** – capturing the essence of the conference presentations and offering a broad perspective on current FDO research.
2. **Full Papers** – providing in-depth explorations of specific topics, showcasing the detailed methodologies, implementations, and findings that are driving FDOs forward.

We would like to extend our sincere gratitude to all the contributors who submitted their exceptional work, the peer reviewers who provided invaluable feedback, and the editorial team at TIB whose dedication made this volume possible. We are excited about the future of this technology and its transformative impact on global data interoperability and the emerging Global Interoperable Data Space.

Thank you for your support, and we hope you find this volume insightful and inspiring.

Claudia Binossek, Peter Wittenburg, Larry Lannom, Dirk Betz

Editors-in-Chief