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Talk

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Facilitating the Creation of FDO Records With Tangible FDO Designs

Introducing the FAIR DO Designer, a Visual Tool to Design FDOs and Generate Code

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Abstract. To accelerate the adoption of FAIR Digital Objects (FDOs), their creation and usage needs to be implemented in software. Our work targets the task of creating and maintaining FDO records. We introduce an application to build designs for FDO records in an intuitive and visual way, targeting non-experts and experts in the field alike. From a design, code can be generated to automatically create FDO records from given information.

Keywords: FDO Record Design, Code Generation, Batch Processing, FAIR Digital Objects, Automation

1. Extended Abstract

Creating FAIR Digital Objects (FDO) is a manual, time-consuming, and error-prone process. This is because FDOs come in a great diversity [1], [2], [3], as they are a common layer for describing all kinds of objects in a machine-actionable way. FDO records need to properly describe their objects according to machine-processable type definitions to ensure machine-interpretability. Creating records requires a more or less complex mapping from available information to an FDO record. This modeling phase can be tedious, as metadata input, type definitions, and type mappings exist at different places, in different formats, or not at all. Once defined, the execution of a mapping can be automated and applied to an arbitrary number of metadata documents.

Simplifying and automating this process would therefore be crucial for the adoption of FDOs. Existing tools already help with FDO creation by providing validation and simplified APIs [4], or by visualizing FDO records [5], [6]. But to the best of our knowledge, there currently is no adequate solution for modeling and automatically creating FAIR Digital Objects from real-world information. We introduce the FAIR DO Designer [7], an application offering a visual building block approach to counter this problem.

The FAIR DO Designer workflow is simple: First, a user provides a set of sample metadata files in JSON format. The user then selects relevant information from the

metadata to build a graphical representation of the FDO's structure. This graphical representation is an FDO design (see figure 1). It can be stored, shared, or exported to a Python [8] project.

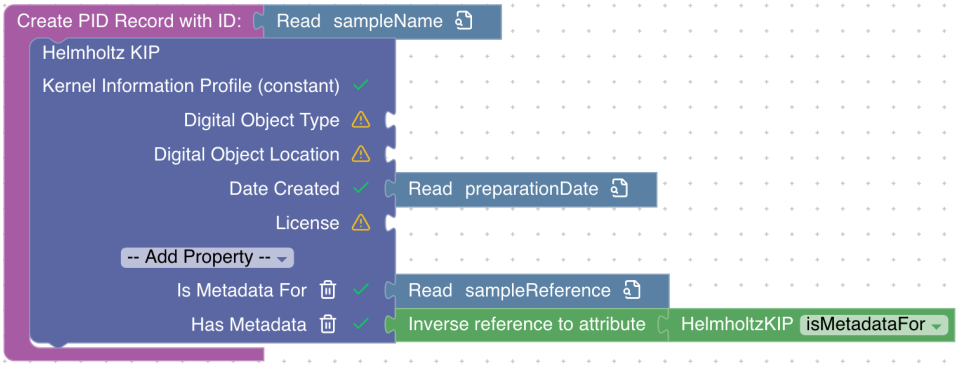

Figure 1. *The FAIR DO Designer is using an intuitive and visual approach to build up the design of an FDO record. Specialized blocks exist for the concept of a record, for profiles, for values, and for many logical and functional concepts. In this image, the profile is based on [9]*

An FDO design, as the FAIR DO Designer realizes it, is a collection of mapping rules from metadata documents to a typed FDO record that complies with a certain profile. Over time, changes to a design may be required or desired, for example, due to changes in available information, software capabilities, or policies. Therefore, FDO designs aim to be reusable, easy to understand, and easy to interact with. Furthermore, it is possible to generate code from a design to allow its automatic execution. The generated code can easily be integrated into new and existing software, or be used directly as a command line tool.

The envisioned main actors involved in an FDO design are not only FDO experts. For example, a data curator may create a design in the FAIR DO Designer and then export it to code. The code can then be fine-tuned by a software developer. This raises the need for a low-barrier graphical user interface. We evaluated the usability of graphs and building-blocks as interactive visual representations and settled with the building-block approach, as it matched the FDO idea best. We are additionally able to make use of the Blockly [10], [11] library, which provides a solid and established foundation for block-based visual editors. We observed that this visualization may also be of use to ease communication about FDOs.

Even with a visual editor, defining a mapping is a complicated process. To simplify the mapping step in FDO designs, we implemented a specialized visualization for the provided metadata sample documents (see figure 2). Instead of visualizing all documents, they are incorporated into a summary representation which exposes the contained information and expresses how often a value occurs across all samples. This view quickly exposes which information is widely available within the provided samples and may be reliably used for automated mapping.

While the FAIR DO Designer does not make any assumptions on schema or structure of the provided sample documents, the sample metadata should be representative of the documents that will be available later for automated processing. This means that they should contain all structures and values relevant for the mapping. In a typical case, a repository developer would provide a selection of representative documents from an existing repository instance and use them as samples in the FAIR DO Designer.

Currently, the FAIR DO Designer implements a workflow which results in Python code for registering FDOs. Future extensions or variations are conceivable and desir-

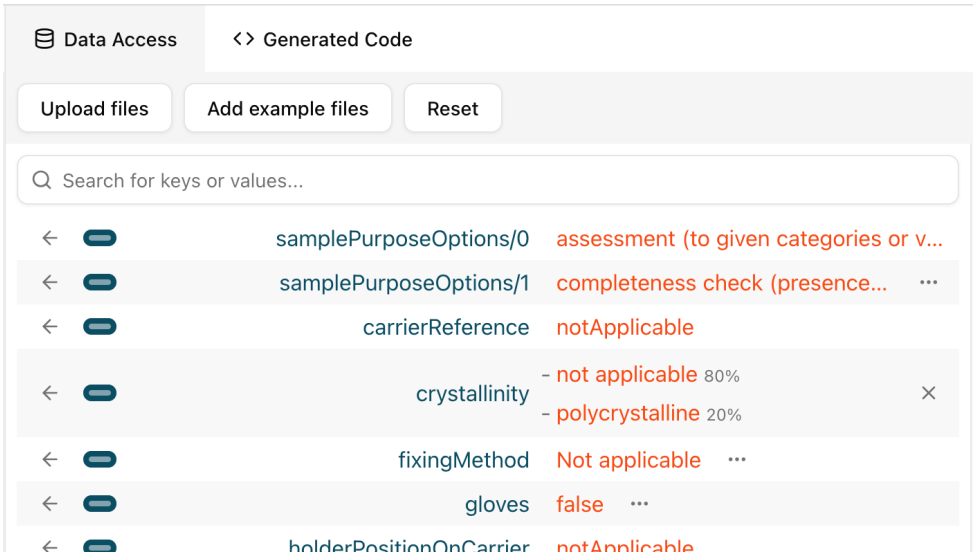

Figure 2. *The information visualization filters out all atomic information from the given sample document, shows the percentage of availability in all given documents, and allows getting information on value distribution. Each value can be dragged into the design to create a block representing it.*

able. To enable this, its architecture allows adding other generators easily, such as for other programming languages or record serializations. This may also help to support other FDO implementations. Though in some cases, it may be more feasible to modify and finalize the generated code according to custom needs.

To the best of our knowledge, this is the first approach that enables the interactive visual design of FDO records, including code generation, potentially accelerating the application of the FDO concept in general.

Data availability statement

This work presents a new open-source software and is not related to specific data. The source code of the FAIR DO Designer is available on GitHub [7] and is licensed with the Apache 2.0 open source license. The source code of each release will be mirrored on Zenodo.

Underlying and related material

We host the state of the source code's main branch of the FAIR DO Designer on GitHub Pages [12]. This instance serves for demonstration and quick testing.

Author contributions

Andreas Pfeil and Thomas Jejkal developed the initial concept of this software. T.J. was responsible for project administration. Christopher Raquet and A.P. developed the software. C.R. designed the visual appearance of the software. A.P. wrote the initial draft of this document. All authors discussed the results and contributed to the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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