# FDO Testbed

Sven Bingert[1] , Tibor Kalman[1] , George Strawn[2] , Christophe Blanchi[3] ,
Thomas Jejkal[4] , Nicolas Blumenröhr[4] , and Peter Wittenburg[1,*]

[1]GWDG, Germany

[2]National Academy of Sciences, Board Director, US

[3]DONA Foundation, Switzerland

[4]KIT, Germany

*Correspondence: Peter Wittenburg, peter.wittenburg@mpi.nl

**Abstract.** A project has been started to create a distributed testbed based on FDOs and using the DOIP protocol. This paper describes the intentions and the required components to build such a testbed. It can be seen as a first step towards an international FDO testbed.

**Keywords:** Data Management, International Testbed, FAIR Digital Objects

## 1. Introduction

Our contribution presents components, concepts and activities needed to set up an initial trustworthy environment, which can be used to check FDO specifications, integration and compliance in a distributed testbed.

*According to Wikipedia a **testbed** (also spelled **test bed**) is a platform for conducting rigorous, transparent, and replicable testing of scientific theories, computing tools, and new technologies. In software development, testbedding is a method of testing a particular module (function, class, or library) in an isolated fashion. It may be used as a proof of concept.*

Translated to the FDO domain, an FDO Testbed would enable a set of FDOs to be integrated to an existing FDO domain and those FDOs could be checked for compliance with FDO specifications published by the FDO community [1, 2, 3]. This raises a few questions that need to be answered: (1) What exactly is the "FDO Domain"? (2) Who represents it and carries out the compliance checks? (3) Who contacts the "FDO Domain" to integrate their FDOs? (4) Are the FDO specifications detailed enough? (5) Which kind of testbed framework needs to be implemented?

The FDO Domain consists of a set of FDO service providers, which ideally have shown their trustworthiness [4] and have been certified as FDO compliant according to the FDO Specifications, i.e. act to the outside as proper FDO servers. Typically, these are certified repositories/registries that host FDOs and want to integrate their collections. If the repository is already an accepted service provider in the FDO domain, then only the new FDO collections to be integrated need to be checked on compliance. Assuming that the FDO Forum will continue to

guide the development of the FDO specifications, the FDO testbed needs to have two dimensions: (1) A set of assessment and validation procedures to be carried out to check FDO compliance. (2) An initial testbed infrastructure of trustworthy actors.
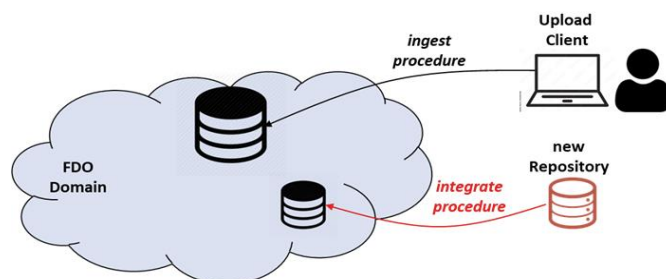


**Figure 1.** *Figure 1 indicates the two options of integrations to an international FDO testbed: (1) A new collection of FDOs is being ingested into the FDO domain. (2) A new repository that offers FDOs needs to be registered.*

## 2. Required Components

To kick-off an FDO-based infrastructure the following components need to be available: (1) An FDO compliant repository, which can be used to store digital artifacts, to exchange data with, etc.; (2) A PID registration and resolution service usable for all requesters; (3) At least one well-managed Type Registry for kernel attributes and specific metadata attributes; (4) A registry service for PID Profiles; (5) A search index to integrate metadata to enable discovery in the connected FDO domain; (6) A registry to list trustworthy FDO service providers; (7) A suitable AAI system.

In addition, the following components should be made available: a prototype of a repository adapter, a collection parser, the DOIP SDK, a (basic) FDO Manager, the mandatory kernel attributes and a set of optional ones, and a basic example PID profile [5].

## 3. Validation, existing Components & distributed Nature

Essential for a testbed is the availability of validators and a "compliance-suite[1]" that can be used by everyone interested to check FDO specification compliance. FDO validation does not include checks on the FAIRness of the external resources. However, in a second step existing FAIR validators could be analyzed and eventually be integrated.

With respect to all these components we can build on existing pilot installations but need to professionalize them and create redundant services. The testbed work can rely on existing components such as DOIP V2.0 [6], DO-IRP [7], Handle system, FDO Profile registry, FDO Attribute registry, CORDRA repository, FAIR DO Scope, Typed PID Maker, etc. All components will need to be analyzed in detail to see whether they can be integrated, need an update or be re-developed.

Any such testbed must lead to fully distributed system of services with as few authorities as necessary. In the case of the Web, it is W3C which decides about compliance and some authorities regulate domain name services. In this case the FDO Forum needs to define compliance and a network of authorities will manage the system of name spaces.

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[1] For the Internet this was called Interop suite.

## 4. Next Steps

Since our goal is to create a testbed, which is international from the beginning, a number of collaboration agreements are being negotiated currently. Furthermore, the participation in this evolving testbed is open to everybody. Different testbeds might exist for an integrated FDO domain, but all testbeds need to be based on the FDO specifications as released by the FDO Forum. In this first testbed we will rely on mature and well-known technologies (like the Handle.Net System specified by the DO-IRP Specification). Other implementations can be applied in future versions of the testbed.

The FDO testbed also needs to be based on a basic core infrastructure with ready to use components as sketched above. Also, this work is in progress and the state will be shown.

## Data availability statement

There is no data directly included.

## Author contributions

All authors contributed at the same level to the paper.

## Competing interests

The authors declare that they have no competing interests.

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