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Implementing the STAP Principles for FAIR Digital Objects in Europe's Green Deal Data Space

Plans for SAGE: the Data Space for a Sustainable Green Europe

Mark J. Dietrich[1,*] https://orcid.org/0000-0003-1181-7684 {additional authors may be added}

[1]Bloodstone Consulting OŰ, Tallin, Estonia

*Correspondence: Mark J. Dietrich, mjdietrich@bloodstone-consulting.com

Abstract. The SAGE project is implementing the Green Deal Data Space consistent with the FDO framework and the trust principles of sovereignty, transparency, accountability, and persistence (STAP). Technical and governance plans for SAGE's initial implementation are described to illustrate pragmatic approaches for integrating open, public, restricted and private data, including data generated by researchers, respecting the data control conditions set by data rights holders, aligned with the European Interoperability Framework.

Keywords: Data Sovereignty, Trust Framework, Credentials, Data Space, Connector, XACML, ODRL

1. Context

The European Strategy for Data [1] described data spaces and the rationale for creating them in several domains, including to support both research (through the European Open Science Cloud) and the European Union's (EU's) Green Deal Action Plan [2]. The SAGE consortium has been awarded funding through the EU's Digital Europe Programme to execute a 3-year project to deploy the Green Deal Data Space (GDDS). SAGE commenced in March 2025 and will implement the GDDS to support 10 use cases relevant to the Green Deal Action Plan, addressing challenges in pollution, climate adaptation, biodiversity, and enabling the circular economy. Find the latest information about SAGE at www.greendealdata.eu.

Use cases will combine open, public, restricted and private data to generate data products that authorised users (citizens, organisations, public authorities, etc.) can use to help them contribute the goals of the Green Deal, while respecting and enforcing data control conditions set by each data provider and/or data rights holder. SAGE will offer prototype capabilities for testing by partner use cases by Q2 2026, iteratively improving its capability to allow production use of the GDDS by those use cases, as well as by external use cases, in the later stages of the SAGE project (late 2027). Production releases will enable full data sovereignty for data providers and data rights holders.

By the end of the project, SAGE will establish appropriate operating and governance entities to continue the operation of the GDDS following a sustainable business model to be developed during the project.

2. Technical Architecture Overview

The technical components of the GDDS are organized in 4 "planes": data, control, governance and trust.

The data and control planes reflect the characterization described in the Data Space Blueprint v2.0 [3] and by others. The control plane is the heart of any data space, including components that implement the data control conditions associated with each data object. Control plane functions interact with "connector" software working in the data plane operated by each data space participant. Connectors were proposed by Otto et alia [4] and, among other functions, implement the policy decision point (PDP) function from eXtensible Access Control Markup Language (XACML) on behalf of the participant, and to the extent feasible the policy enforcement point (PEP) function from XACML on behalf of any data source providing data to the participant. These connector-based functions are supported by policy administration and information points (PAP and PIP) implemented within the control plane. The GDDS also implements access control for participants and assets through its own PDP/PEP functions.

In the GDDS, functions performed in the control plane and by connectors in the data plane are configured to implement data control policies set by data providers for each individual asset (either data or a service) that link to transparently declared policy templates stored, as a metadata, in the openly accessible governance plane. These statements conform to defined specifications such as the Open Digital Rights Language (ODRL) and the Architecture and Reference Framework (ARF) for the European Digital Identity Wallet. GDDS extends ODRL functionality with a domain-agnostic vocabulary for describing asset visibility, access and use/re-use policies. GDDS is collaborating with various data sharing initiatives (both data spaces and research-intensive data infrastructures) to develop this vocabulary.

Policy metadata in the governance plane refer to openly-accessible trust service providers (TSPs) that comprise the trust plane, including identity providers (e.g. from eduGain or national TSPs complying with eIDAS or eIDAS 2.0 in the future) as well as credential issuers and verifiers (complying with W3C's VC/VP specifications). The GDDS itself will act as an identity provider and credential issuer to the extent these functions are not provided externally, and other actors (e.g. other data space) can include the GDDS' TSP functions in their own trust planes.

3. Complementary Legal and Organisational Components

The GDDS Trust Framework relies on both technical as well as legal and organisational arrangements to ensure that data providers, and the assets they make available to the data space, comply with the rules of participation set by the GDDS. The GDDS' own PDP and PEP functions handle the technical functions of onboarding only compliant participants and assets, but these rules include participants' agreement to a Participation Agreement associated with the GDDS. This Participation Agreement also establishes a consistent legal basis for data exchange between parties as well as links to policy templates defined in the governance plane.

Digital actors interacting with the GDDS are linked through higher-assurance digital identities with legal or natural persons in the real world, translating actions performed in the GDDS into real world events and actions governed by relevant agreements.

4. Conclusion: Implementing STAP in the GDDS

The GDDS' pragmatic approach to data sovereignty leverages the STAP principles by defining a transparent governance plane for the GDDS linked to openly-accessible trust service providers in the trust plane. GDDS maintains accountability by binding digital and real world identifiers, supported by legal agreements that also link to policies exposed in the governance plane.

Data availability statement

No data is related to this contribution. All data and supplementary materials relevant to the SAGE project will be made available at www.greendealdata.eu and to the extent feasible zenodo.com.

Underlying and related material

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Author contributions

Mark Dietrich: all CRediT roles.

Competing interests

No competing interests.

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[1] European Commission, "European Strategy for Data" (2020).
[2] European Commission, Green Deal Action Plan. (?)
[3] Data Spaces Support Centre, Blueprint version 2.0 (2025)
[4] Otto, Boris, et al. [1st reference to connectors in data spaces]