



Call for proposals	DIGITAL-2023-CLOUD-DATA-AI-05	Type of action	DIGITAL-SIMPLE
Grant Agreement No.	101173388	Start date	1 October 2024
Project duration	36 months	End date	30 September 2027

Contact: projects@anysolution.eu

Website: www.deploytour.eu

Project consortium – Coordinator: ANYSOLUTION			
POLITENICO DE MILANO	BEN - POLIMI	NTT DATA SPAIN	BEN - NTTDES
AMADEUS DATA PROCESSING GmbH	BEN - ADP	AMADEUS GERMANY GmbH	AE - AMADEUS GERMANY
EONA-X	BEN – EONA-X	ITALIAN MINISTRY OF TOURISM	BEN - MITUR
FUNDACIÓN TECNALIA RESEARCH & INNOVATION	BEN - TECNALIA	NECSTOUR	BEN - NECSTOUR
CITY DESTINATIONS ALLIANCE	BEN - CityDNA	INTELLERA	BEN - INTELLERA
ARCTUR	BEN - ARCTUR	INSTITUTO TECNOLÓGICO DE INFORMÁTICA	BEN - ITI
GMV SOLUCIONES GLOBALES INTERNET	BEN - GMV	AVORIS CENTRAL DIVISION	BEN - AVORIS
AUSTRIA TOURISM (OSTERREICH WERBUNG)	BEN – AUSTRIA TOURISM	EUROPEANA	BEN - EF
TURISMO ANDALUCIA	BEN – EPGTDA SA	AMADEUS SAS	BEN – AMADEUS SAS
PLEXUS TECH	BEN – PLEXUS TECH	TECNOLOGÍAS PLEXUS SL	AE - PLEXUS
FRAUNHOFER	BEN - FRAUNHOFER	HIBERUS TECNOLOGIAS DIFERENCIALES SL	BEN - HIBERUSTECH
HIBERUS IT DEVELOP	AE - HIBIT	UNPARALLEL INNOVATION	BEN - UNPARALLEL
PLEIADES CLUSTER	BEN - PLEIAD	UNI SYSTEMS SYSTMATA	AE - UNIS
THE DATA APPEAL COMPANY	BEN – DATA APPEAL CO	INDUSTRY INNOVATION CLUSTER SLOVAKIA	BEN - ICC
TOURISM BOHINJ SLOVENIA	BEN – TURIZEM BOHINJ	LAPLAND UNIVERSITY OF APPLIED SCIENCES	BEN – LAPLAND UAS
DISSET CONSULTORES	BEN - DISSET	UNIVERSITY ILLES BALEARIS	BEN - UIB
ADQUIVER	BEN - ADQUIVER	AE-ADQUIVER DATA & ADVANCED ANALYTICS, SOCIEDAD LIMITADA	ADDATA
TRENITALIA	BEN - TRIT	TOURISM PORTUGAL	BEN – TURISMO PT
UNIVERSITY NOVA LISBOA	BEN - UNL	LIBELIUM LAB	BEN – LIBELIUM
MODUL UNIVERSITY VIENNA GMBH	AP - MODUL	YPOURGEIO TOURISMOU	AP - MINTUR
AGENCIA D ESTRATEGIA TURISTICA DE LES ILLES BALEARIS	AP - AETIB	STICHTING BREDA UNIVERSITY OF APPLIED SCIENCES	BEN - BUAS
FIWARE FOUNDATION EV	AP - FIWARE		

Document name:	D2.1 ETDS Interoperability & Data Sharing	Page:	1 of 145
Reference:	D2.1	Dissemination:	PU
	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



D2.1 ESTDS Interoperability & Data Sharing

Document Identification			
Status	Final	Due Date	31/05/2025
Version	1.0	Submission Date	27/05/2025

Related WP	WP2	Document Reference	D2.1
Related Deliverable(s)	D2.4	Dissemination Level (*)	PU
Lead Partner	NTTDES	Lead Author	NTDESS
Contributors	Amadeus Germany GmbH, ADP, EF, FRAUNHOFER, HIBERUSTEC, LIBELIUM LAB, GMV, ANYSOL, UNL, LAPLAND, EONA-X, TECNALIA, PLEXUS, PLEIAD, DATA APPEAL	Reviewers	GMV

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	2 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Document Information

List of Contributors	
Name	Partner
Dr. Andreas Eisenrauch	Amadeus Germany GmbH
Anastasia Koufaki	ADP
Mario Bravo Candel	NTTDES
Eduardo Martin Crespo	NTTDES
Carme Moreu Alfós	NTTDES
Rebeca Barcena Orero	NTTDES
Peio Oiz Arruti	ANYSOL
Victor Barrientos	ANYSOL
Tayne Alexandra Butler	ANYSOL
Dr. Dolores Ordóñez	ANYSOL
Jonathan Huffstutler	EONA-X
Marie Texier	EONA-X
Jesús Santamaria	TECNALIA
Jesús Herrero	TECNALIA
Valentin Sanchez	TECNALIA
Flavie de Bueil	CITYDNA
Beatrice Dorenti	INTELLERA
Alessio Sidoti	INTELLERA
Vesna Kobal	ARCTUR
Joan Escamilla	ITI
Jordi Arjona Aroca	ITI
Antoni Gimeno	ITI
Fabián Avilés Martínez	GMV
Rubén Alconada	GMV
Pablo Pérez	GMV
Antoine Isaac	EF
Yago González Rozas	PLEXUS TECH
Laura Sande Alonso	PLEXUS TECH
Maik Mannsfeld	FRAUNHOFER
Blanca Adiego	HIBERUSTEC
Maria Pahoula	PLEIAD
Nicolò Carletti	DATA APPEAL
Federica Amati	DATA APPEAL
Anssi Tarkiainen	LAPLAND
Nuno Antonio	UNL
Américo Rio	UNL
Juan Francisco Inglés	LIBELIUM LAB

Document History			
Version	Date	Change editors	Changes
0.1	16/01/2025	Eduardo Martin	Initial version
0.2	19/05/2025	Partners involved in the WP activities	Overall contributions
0.3	21/05/2025	Eduardo Martin	Final version before correcting and formatting
1.0	27/05/2025	Tayne Butler	Final version to submit

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	3 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Quality Control		
Role	Who (Partner short name)	Approval Date
Deliverable leader	NTTDES	21/05/2025
Project coordinator	ANYSOL	27/05/2025

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	4 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Table of Contents

Document Information	3
Table of Contents	5
List of Tables.....	7
List of Figures.....	8
List of Acronyms.....	9
Executive Summary.....	10
1 Introduction	11
1.1 Objectives	11
2 Review of documents and preparation	13
2.1 Analysis of the preparatory action blueprint.....	13
2.1.1 ETDS Key success factors	14
2.1.2 Recommendations regarding the technical implementation of the data space	15
2.1.3 Tourism specific issues and their associated challenges	16
2.1.4 Interoperability and federation strategy and challenges	17
2.2 Analysis of documents of Data Spaces related projects or initiatives	17
2.2.1 Existing Data Space initiatives.....	17
2.2.2 Data Spaces related projects: intra- and inter-interoperability.....	25
2.2.3 Data Spaces related projects: value generation	27
2.3 Canvas design	30
2.4 Conformance.....	31
2.4.1 Standardisation conformity	31
2.4.2 Data space definitions disclaimer.....	32
3 Information collection.....	34
3.1 Canvas analysis	34
3.1.1 Canvas analysis: phase one, go-through session and content explanation.....	34
3.1.2 Canvas analysis: phase two, follow-up session and document refinement.....	35
3.1.3 Canvas analysis: phase three, data product (offering) identification and capabilities.....	35
3.2 Map capabilities to DSSC Building Blocks and reference data space frameworks.....	36
3.2.1 DSSC Building Blocks	37
3.2.2 SIMPL.....	37
3.2.3 SIMPL-Labs	46
3.3 Use-case pilots.....	47
3.3.1 Use case 1.....	47
3.3.2 Use case 2.....	48
3.3.3 Use case 3.....	48
3.3.4 Use case 4.....	48
3.3.5 Use case 5.....	49
3.4 Results of the canvas analysis and requirements inference.....	49
3.4.1 Interpretation of the canvas analysis.....	49
3.4.2 Final data product-oriented analysis of the canvases	50
3.4.3 Requirements inference	52
4 Analysis of Data Products and Data Models	54
4.1 Tourism data sharing initiatives.....	54
4.1.1 Datahub.tirol.....	54
4.1.2 Austria Tourism Data Space	55
4.1.3 Cultural Heritage	56
4.1.4 Google Places.....	59
4.1.5 European Group on Museum Statistics.....	59

Document name:	D2.1 ETDS Interoperability & Data Sharing	Page:	5 of 145
Reference:	D2.1	Dissemination:	PU
	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



4.1.6	UiTwisselingsplatform (UIP)	60
4.2	Public administrations' initiatives	62
4.2.1	Spain	62
4.2.2	France	64
4.2.3	Italy	64
4.2.4	Germany	64
4.3	DATES and DSFT conclusions	64
4.4	Prescription of data space participants in the tourism sector	66
4.5	Current and Future Enrichment of Catalogues	67
4.5.1	Metadat	67
4.5.2	Data Standardisation	69
5	Requirements identification and specification	70
5.1	SIMPL's requirements and components	70
5.2	Requirements specification	74
5.2.1	Identity and Access Management	74
5.2.2	Assets Management	76
5.2.3	Policies and contracts	77
5.2.4	Publication and discovery	80
5.2.5	Data quality	82
6	Conclusions	85
	Glossary	86
	Annexes	90
	Annex I Sample of a Data Source file	90
	Annex II: Sample of Data Product Offering	90
	Annex III: Sample of Data Product Offering Analysis (Mapping with DSSC building blocks)	91
	Annex IV: Results of canvas analysis	92
	Annex V: Solutions	103

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	6 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



List of Tables

Table 1 DATAMITE and Wisephre key features	30
Table 2 List of technical capabilities mapped to SIMPL components GAIA-X and integration of solutions	42
Table 3 List of technical capabilities mapped to Gaia-X components	46
Table 4 Metadata categories	68
Table 5 SIMPL Open requirements	73
Table 6 Identity and Access Management Requirements	76
Table 7 Assets Managements Requirements	77
Table 8 Policies and contracts requirements	80
Table 9 Publication and discovery requirements	82
Table 10 Data quality requirements	84

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	7 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



List of Figures

Figure 1 Datamite Architecture.....	28
Figure 2 Wisephare Architecture	29
Figure 3 Architecture of SIMP	38
Figure 4 Gaia-X Ecosystems.....	43
Figure 5 DPOs by Use case pilot	50
Figure 6 Data models in DPOs.....	51
Figure 7 Metadata models in DPOs	51
Figure 8 Schemas/Transfer models in DPOs	52
Figure 9 Additional software or services in DPOs	52
Figure 10 Austrian Tourism operating according to Gaia-X principles.....	55
Figure 11 Key layers from Europeana Platform.....	57
Figure 12 EGMUS's data table.....	60
Figure 13 UiTwisselingsplatform high level architecture (publiq.be).....	61
Figure 14 Benefits of open government data initiatives (data.europa.eu)	62

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	8 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



List of Acronyms

Abbreviation / acronym	Description
AB	Advisory Board
AE	Affiliated entity
AIA	Artificial Intelligence Act - Regulation (EU) 2024/1689
AP	Associated Partner
BEN	Beneficiary
CA	Consortium Agreement
COO	Coordinator
DCM	Dissemination & Communication Manager (DCM)
DMOs	Destination Management Organisation
DPO	Data Protection Officer
Dx.y	Deliverable number y, belonging to WP number x
EC	European Commission
ETDS	European Tourism Data Space (the ecosystem of Tourism data spaces)
EU	European Union
GA	Grant Agreement
GDPR	General Data Protection Regulation - Regulation (EU) 2016/679
KPI	Key Performance Indicator
NTO	National Tourism Office
PC	Project Coordinator
PCT	Project Coordination Team
PMB	Project Management Board
QA	Quality Assurance
QM	Quality Manager
RASCI	Responsible/Accountable/Supportive/Consulted/Informed
TL	Task Leader
WP	Work Package
WPL	Work Package Leader

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	9 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Executive Summary

DEPLOYTOUR is a three-year project, starting in October 2024, aiming to develop and deploy a European Tourism Data Space (ETDS). It is preceded by two preparatory actions, DATES and DSFT, for which this deliverable has adopted their recommendations.

This first deliverable concerning Interoperability & Data sharing gathers requirements based on five pilot initiatives defining a series of use cases. The document summarises the content of both preceding preparatory actions, adding the updates on the field of the DSSC 2.0, and sets a methodology to engage these five pilots in the development of the use cases that will give sense to the dataspace. These pilots continue to undergo extensive development beyond the delivery of this document, remaining in an active development phase. It is essential to treat the present document as a key reference, supporting the identification and description of assets and needs for the effective deployment of a dataspace upon completion.

The gathering of requirements is defined in a high-level viewpoint, where the components and technologies used by the larger dataspace initiatives have set the roadmap for the depiction of requirements. The interoperability standards and technical specifications, as well as frameworks, software and the like, have been manually selected from these initiatives and expanded with the analysis of the pilots. As a matter of fact, these use cases often use domain-specific vocabularies and ontologies for their catalogue of services and products; the pilots have identified relevant standards and related-technical specifications (i.e., API, protocols). Further research will assess whether a common ontology is necessary to define the dataspace's key characteristics and core components, such as the connector.

The Consortium conducted a preliminary analysis of how the various elements of the dataspace will integrate and potential interoperability challenges that may arise. However, it became evident that without a solid development of the use cases, it is still too early to determine the full impact of interoperability on the project and the measures required to address it effectively.

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	10 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



1 Introduction

The present document unites efforts to launch DEPLOYTOUR and to kick-start the European Tourism Data Space (ETDS). This first deliverable draws on the knowledge gained from previous and ongoing initiatives about methodologies, best practices, and lessons learned in the development of this data space. The Consortium is composed of organisations (“partners”) that contributed key insights into the state-of-the-art and the maturity of the tourism ecosystem, which is necessary for the design and development of this sectoral data space. Among the partners, coordinators from the two preparatory actions (DATES/DSFT Blueprint) participate and guarantee that there is continuity during the deployment of the ETDS.

DEPLOYTOUR aims to involve key actors ensuring a collaborative and multi-stakeholder approach, uniting knowledge in the selection of standards and interoperability procedures within the EU and, if the project timeline allows, establishing connections with space programs, like Galileo and Copernicus, or the Green Deal Data Space (GDDS).

This first deliverable, along with a second (“ETDS Architecture”) and third deliverable (“ETDS Rulebook”), sets requirements to make the ETDS interoperable with different platforms and other data space initiatives. These identified initiatives are the Cultural Heritage Data Space, the European Mobility Data Space, EONA-X and the Austrian Data Space. Among the proposed work packages (WP1 to WP6), WP2 (“TOURISM DATA SPACE BUILDING BLOCKS AND OPERATIONALIZATION.”) and WP4 (“REAL-WORLD DEPLOYMENT OF ETDS THROUGH USE CASES BASED ON THE VARIOUS TYPES OF DATA IN THE TOURISM SECTOR”) serve to elaborate the strategic decisions for shaping this deliverable structure and its content.

The final document covers the foundations of the technical infrastructure of the ETDS in alignment with existing building blocks and sets the basis on which the use cases will be implemented and how this implementation will be tested.

This document is divided in seven broad sections:

- Section 1 covers the Project Executive Summary;
- Section 2 introduces the first deliverable and the objectives;
- Section 3 covers the preparatory action blueprint and defines the methodology for the design of the data space;
- Section 4 describes the collection of information, how the methodology is applied for the use case analysis and results;
- Section 5 synthesises the results of the analysis;
- Section 6 describes the data product offering as well as the iterative approach that will enable the data catalogue and metadata adaptation to the evolvement of the data space;
- Section 7 proposes the set of requirements for the ETDS.

1.1 Objectives

The following objectives are tackled in this deliverable:

- Integrate and adapt established data space frameworks to the ETDS;
- Establish uniform ETDS infrastructure standards;
- Align ETDS with European and international standards;
- Analyse and, if applicable, develop standards for effective data exchange across different sectoral data spaces.

The European Tourism Data Space (ETDS) roadmap lays a strong foundation for a sustainable, efficient, and future-proof data-sharing framework in the European tourism sector.

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	11 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



In this section we will analyse the blueprint from the preparatory action (DATES) and other initiatives in the Data Spaces domain.

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	12 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



2 Review of documents and preparation

The European Tourism Data Space (ETDS) roadmap lays a strong foundation for a sustainable, efficient, and future-proof data-sharing framework in the European tourism sector. In this section, we will analyse the blueprint from the preparatory action (DATES) and other initiatives in the Data Spaces domain.

2.1 Analysis of the preparatory action blueprint

The preparatory action blueprint¹ for the European Tourism Data Space (ETDS) aimed to establish a roadmap for a trusted, interoperable and efficient data-sharing ecosystem. The blueprint builds on the OpenDEI Design principles² document and the DSSC Blueprint³, as well as other relevant EU-funded programs (i.e., GAIA-X, EONA-X, IDSA, among others).

The blueprint emphasises stakeholder engagement and the building of a data-sharing ecosystem. To this end, the document provides a roadmap with five action points, or streams, which will ensure the transition to an operational and interoperable data sharing ecosystem.

The first action point focuses on aligning the ETDS with European data regulations and other sectoral data spaces, such as culture and mobility. This is the convergence phase, which is relevant to the extent that financial and data resources and capabilities are identified, ensuring that the establishment of a governance and technical framework for data exchange is well conducted.

The second action point is the set-up of the governance model that will determine the deployment phase of the ETDS. It is paramount the continuous monitoring of legal, technological, and stakeholder requirements, alongside training programs to develop the necessary skills to engage all parties in the data space. Alongside the standardisation of data models, this monitoring is achieved by a close alignment with the work developed by initiatives (calls for proposals) binded to the Strategic blueprint for the European Tourism Data Space⁴, such as the EU Competence Centre to support data management in tourism destinations⁵, the European Digital Innovation Hubs Network⁶ (EDIH), the DSSC, among others.

The third and fourth action points are about focusing on a communication strategy (an awareness phase) that emphasises the data space benefits, including cost reduction, accessibility, or even collaboration between Small and Medium-sized Enterprise (SMEs), and the standardisation to ease of use of the data space.

And finally, the fifth action point is about establishing an iterative approach of experimentation, ensuring a continuous testing and refinement of use cases in response to market needs and new technologies that will integrate in the data space.

¹Blueprint and Roadmap for Deploying the European Tourism Data Space: <https://transition-pathways.europa.eu/knowledge-documents/strategic-blueprint-european-tourism-data-space-pathway-innovation-and>

² OpenDei 2021: Design Principles for Data Spaces: <https://h2020-demeter.eu/wp-content/uploads/2021/05/Position-paper-design-principles-for-data-spaces.pdf>

³ The new DSSC Blueprint 1.5: <https://dataspace-support-centre.atlassian.net/wiki/spaces/bv15e/pages/766061169/Data+Spaces+Blueprint+v1.5+-+Home>

⁴ Strategic blueprint for the European Tourism Data Space: A pathway to innovation and sustainability: <https://transition-pathways.europa.eu/knowledge-documents/strategic-blueprint-european-tourism-data-space-pathway-innovation-and>

⁵ EU Tourism Data Competence Center: https://eisma.ec.europa.eu/funding-opportunities/calls-proposals/eu-competence-centre-support-data-management-tourism-destinations_en

⁶ European Digital Innovation Hubs Network: <https://european-digital-innovation-hubs.ec.europa.eu/home>

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	13 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final



From the technological perspective, the blueprint includes a set of recommendations, some open issues and specific topics of special interest for the tourism sector that should be considered in the design of the EDTS architecture.

Next, the main results of the blueprint from the technical point of view are presented including:

- Success factors that can be thought of as a set of high-level requirements.
- Recommendations regarding technical implementation of the data space.
- Tourism specific issues and their associated challenges.
- Interoperability and federation strategy and challenges.

The information including in the next subsections is taken from the blueprint and includes the summary of its main findings. However, since the blueprint was produced more than one year ago, its content, results and conclusions should be considered a starting point to be revised and updated during the project.

2.1.1 ETDS Key success factors

The preparatory action blueprint gathered a list of key success factors that can be considered as high-level requirements from different perspectives, including business, regulatory, governance and technical points of view. Besides some tourism specific success factors have been included.

Next, the success factors related to the technical perspective are highlighted:

- Before establishing the ETDS, the founding members should sign a **vision and mission statement for the data space** that clearly outlines why the data space is needed, describes how the data space will provide added value for real use cases, and what **governance and technologies** will be applied to ensure its operation.
- The ETDS should provide clear guidance on **semantic interoperability standards** regarding data types, attributes, and value (e.g., OTA⁷, AlpineBits⁸, ODTA⁹).
- The ETDS should feature **easily installable software** (e.g., **Connector as a Service**) for participants with limited IT skills and resources.
- The ETDS should be flexible and inclusive to support **federation** with other tourism data ecosystems and **interoperability** with other data spaces.
- The ETDS should define **data quality requirements** and offer **data-sharing support services** (e.g., quality validation support, duplicate detection, global-ID-matching, data enrichment, etc.).
- The ETDS should align with the building blocks of the Data Space Support Centre (DSSC)

The tourism sector specific factors are:

- The ETDS should align with the European Tourism Transition Pathway (<https://op.europa.eu/en/publication-detail/-/publication/404a8144-8892-11ec-8c40-01aa75ed71a1>)

⁷OTA: https://www.tourismdataspace-csa.eu/wp-content/uploads/2023/08/D3.2_Technical_Standards_v1.pdf

⁸AlpineBits: <https://www.alpinebits.org/open-standard/>

⁹ODTA: <https://open-data-germany.org/en/open-data-germany/>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	14 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



- The ETDS should align with the Code of Conduct for Data Sharing in Tourism to foster trust and security among data space users. (<https://etc-corporate.org/reports/code-of-conduct-on-data-sharing-in-tourism/>)

2.1.2 Recommendations regarding the technical implementation of the data space

According to the preparatory action blueprint the core function of a data space is to **broker trust between participants** and to **negotiate available data contracts**. A data space enables **control over data sharing** and creates value for all involved parties. A data space is both a multi-organisational agreement and a supporting **technical infrastructure** for data sharing.

The data space technical infrastructure must support the main data space processes: onboarding, publish/search data products, transfer data, monitoring and auditing of the data space.

The blueprint analysed the current initiatives relevant to data spaces and their expected evolution in the near future, with focus on those deemed most influential: DSSC¹⁰, IDSA¹¹, Gaia-X¹², the Data Space Business Alliance (DSBA)¹³, SOLID¹⁴, and SIMPL¹⁵.

The conclusion of the analysis was summarised as follows:

Several ongoing initiatives are now running in parallel to design and implement the data space concept. Gaia-X and SIMPL provide, by now, more comprehensive data space architectures and specifications, including infrastructure, data and services in the same framework, while IDSA and FIWARE provide solutions dealing with more specific aspects of the data space technology landscape.

The DSBA convergence effort and SIMPL project add even more complexity to the data space scenario. However, even with this complex scenario, some solutions and approaches to specific aspects of the data space architecture are common or quite similar in all the initiatives, emerging as the most promising ones.

- The concept of a **data space governance authority** defining and implementing the rules to be part of a data space is paramount to generate trust. These rules should include the tourism specific criteria. Gaia-X provides the so-called “trust framework” to operationalise the data space on-boarding process, including the definitions of the participant and data product models.
- The need for a **decentralised solution for identity management**. Self-sovereign identity solutions along with verifiable presentation and verifiable credentials for self-descriptions. The use of verifiable credentials signed by trusted organisations to describe the entities participating in a data space provides an additional level of trust, which is very important in an open data sharing framework. However, the protocols to exchange and verify the credentials among the data space participants are still in development and no convergence is envisaged.

¹⁰ DSSC: <https://dssc.eu/>

¹¹ IDSA: <https://internationaldataspaces.org/>

¹² Gaia-X: <https://gaia-x.eu/event/data-spaces/>

¹³ DSBA: <https://data-spaces-business-alliance.eu/>

¹⁴ SOLID: <https://solidproject.org/>

¹⁵ SIMPL: <https://simpl-programme.ec.europa.eu/>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	15 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



- **Decoupling of control and data planes** in data transfer technologies makes it possible to use any transfer protocol or technology available. The IDS (now Eclipse¹⁶) Dataspace Protocol implements this strategy.
- Use **common and well-established standards** if available, both for generic (sector agnostic) models as well as tourism specific domain models.
 - DCAT for data product¹⁷
 - ODRL for data usage policies¹⁸
 - W3C DQV for data quality (based on ISO)¹⁹.

2.1.3 Tourism specific issues and their associated challenges

Based on the Current EU Data Sharing Landscape and state of the art data practices; the following specific issues and recommendations must be considered in the process of creating the ETDS.

Personal data management: People are at the centre of the ETDS, so privacy protection and compliance with data protection legislation and initiatives play a very important role.

SMEs: Most companies in the tourism sector are SMEs. Both the process to onboard in a data space and the technology required to participate in it are currently too complex, too costly and very far from their usual business practices. Most SMEs have neither the technical nor operational skills required to handle the complexities of a data space. Approaches, such as **connector-as-a-service**, within the context of IDS and Gaia-X, could be very useful for SMEs.

Public and private actors: Tourism sector stakeholders include both public administrations and private companies with different strategies and objectives regarding data sharing. Open data public administrations' strategy should be aligned with data protection, value generation and monetisation strategies of private companies.

Geographic data: Almost all tourism-related data have a geographic scope that can be a region, a specific geographic address or a set of addresses forming a line or a path. Also, vector and raster data are used. Geographic data can be organised in a layer of different types that facilitates geographic based reasoning and analysis. Geographic data requires the use of some specific models and standards.

Interoperability with other data spaces: The tourism sector is directly related to other sectors such as transport, mobility, environment, energy, cultural heritage and construction. In this way, data from these sectors should also feed the ecosystem of the ETDS. Inter- and intra-data space interoperability is a critical issue for the ETDS.

Local vs regional vs national vs international scope. The geographic scope of tourism data might also induce a tendency to set up local, regional and/or national tourism data spaces. The implementation of such should be thoroughly controlled in order to avoid a too fine-grained substructure of the European tourism data ecosystem on one hand, which will inevitably challenge interoperability, and might reduce the cross-border data visibility. On the other hand, a certain degree of decentralisation facilitates resilience by avoiding single points of failure. It

¹⁶ Eclipse: <https://projects.eclipse.org/projects/technology.edc>

¹⁷ DCAT: <https://docs.internationaldataspaces.org/ids-knowledgebase/dataspace-protocol/catalog/catalog.protocol>

¹⁸ ODRL: <https://international-data-spaces-association.github.io/DataspaceConnector/Documentation/v5/UsageControl>

¹⁹ DQV: <https://www.w3.org/TR/vocab-dqv/>

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	16 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final



may be a task for EDIB²⁰ and the future EDIC²¹ for Tourism to define the right equilibrium of (de)centralisation, considering both strategic and technical arguments.

2.1.4 Interoperability and federation strategy and challenges

Since the EDTS needs to interact with other data spaces, both from other domains and from other scopes, interoperability and federation are paramount. The technical challenge to solve is: What happens if one company needs data from a company participating in another data space?

Two main strategies were identified:

- **Participate in several data spaces.** The company needs to follow several on-boarding processes. This strategy probably implies the use of different data models, identity providers, connectors, etc. This approach is not scalable but nowadays is the more pragmatic one.
- **Federation among data spaces.** With this strategy, the participation in several data spaces is transparent for the companies. However, this approach is not feasible from the technical point of view unless the data spaces use the same data space governance framework.

2.2 Analysis of documents of Data Spaces related projects or initiatives

This section aims to present a short state-of-the-art of sectoral data spaces and contextualises their deployment and how they operate. This synthesis serves to find synergies in the current paradigm and clarify how the ETDS will intertwine in the data space ecosystem.

2.2.1 Existing Data Space initiatives

The European Union is spearheading a series of innovative initiatives to create data spaces that enhance collaboration, sustainability, and digital transformation across various sectors. These initiatives include the European Data Space for Smart Communities (DS4SSCC), the European Green Deal Data Space (SAGE), the European Language Data Space (LDS), and the European Data Space for Trusted European Media (TEMS). While each initiative has a specific focus, they all share the common goal of improving interoperability, security, and efficiency in data usage.

Common European data spaces are a flagship concept outlined in the EU Data Strategy, envisioning up to 14 sector-specific data spaces. Each one is tailored to the unique needs of its field but is based on common technical and governance principles. These initiatives form the backbone of the EU's efforts to unlock data-driven innovation while safeguarding European values such as privacy, transparency, and digital sovereignty. They create an ecosystem where public and private actors can securely share high-quality data, paving the way for new products, services, and research breakthroughs across the continent.

2.2.1.1 DS4SSCC: (European Data Space for Smart Communities)²²

Project overview:

The DS4SSCC-DEP project aims to accelerate the digital transformation of Europe's society and economy by creating data spaces for smart and sustainable cities and communities. It will

²⁰ EDIB: https://www.eu-data-act.com/Data_Act_Article_42.html

²¹ EDIC: https://language-data-space.ec.europa.eu/help/faq/what-edic_en

²² DS4SSCC: (European Data Space for Smart Communities) : <https://www.ds4sscc.eu/>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	17 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



validate the smart communities' data space through 10-12 pilots, delivering a sustainable European data space that benefits all citizens.

The DS4SSCC initiative seeks to create a well-governed, federated, and place-based data space for smart communities. Its primary objectives include:

- Establishing a federated and innovative data space: developing a large-scale data space controlled by public data holders, ensuring alignment with the smart middleware platform and broader data space ecosystems.
- Pilots and refinement of the data space blueprint: validating and refining the data space blueprint through 10-12 cross-sectoral data pilots in various EU communities.
- Fostering innovation and ecosystem alignment: engaging stakeholders, ensuring compliance with sector-specific legislation, and enhancing ethical considerations and AI-enabled local solutions.

Stakeholders and Participants

The DS4SSCC initiative involves a diverse range of stakeholders, including:

- Public administrations: local and regional governments across EU member states.
- Private sector: companies providing technological solutions and services.
- Academia: research institutions and universities contributing to knowledge development.
- Civil society organisations: entities representing citizens' interests and ensuring inclusivity.
- Developers and infrastructure providers: key players in building and maintaining the data space.
- Local, regional, and national entities: provide or consume data for analytics, manage consents, and ensure compliance with regulations.
- Citizens: beneficiaries of improved services and data-driven innovations.
- European commission and regulatory bodies: ensure alignment with European data regulations and policies.

Technical Framework:

Based on the data spaces support centre (DSSC) Blueprint v.1.0.

Use cases and Application:

- Smart city services: enhancing urban management, transportation, and public safety.
- Sustainable communities: promoting energy efficiency, waste management, and environmental monitoring.
- Citizen engagement: facilitating participatory governance and community-driven initiatives.
- Cross-Sector collaboration: connecting various sectors like tourism, manufacturing, and healthcare for holistic development.

The initiative has identified and prioritised several use cases relevant to smart and sustainable cities and communities, including:

- Predictive traffic management: enhancing traffic flow and reducing CO₂ emissions through real-time data sharing and better infrastructure planning.
- Environmental monitoring: deploying sensors for real-time environmental data collection to support urban planning and event management.

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	18 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



These use cases aim to demonstrate the added value of data sharing across various domains, contributing to the sustainability goals of European citizens.

Interoperability and Integration

To ensure seamless data sharing and integration, DS4SSCC emphasises:

- Common language for interoperability: establishing standardised access rights and business models for ecosystem management.
- Stable and standard interfaces (APIs): utilizing existing building blocks and following architecture templates to facilitate integration.
- Minimal interoperable mechanisms (MIMs Plus): implementing mechanisms promoted by the living-in.EU initiative to ensure compatibility across systems.

Governance and Policies

A multi-stakeholder governance scheme has been developed in collaboration with local authorities and broader stakeholders. This scheme addresses:

- Roles and responsibilities: defining the roles of different stakeholders within the data space.
- Access rights and business models: standardizing access rights and establishing business models for ecosystem management.
- Data quality assurance: implementing guidelines and standards to ensure data quality.
- Compliance: Ensuring adherence to existing European policies, legislation, and regulations.

Challenges and Lessons Learned

Key challenges identified during the initiative include:

- Data interoperability: aligning diverse data models and standards across different communities.
- Stakeholder engagement: ensuring active participation and collaboration among a diverse group of stakeholders.
- Scalability: developing solutions that are scalable across various regions and adaptable to different contexts.

Lessons learned emphasize the importance of establishing a common language for interoperability, using stable and standard interfaces, and relying on existing building blocks to facilitate integration.

Impact and Outcomes

The DS4SSCC initiative aims to:

- Enhance service delivery: improve the quality and efficiency of services provided to citizens through better data utilisation.
- Promote sustainability: contribute to environmental goals by enabling smarter resource management and reducing emissions.
- Foster innovation: create opportunities for new services and business models through data-driven insights.

By establishing a federated data space, the initiative supports the development of smart and sustainable cities and communities across Europe.

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	19 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



2.2.1.2 SAGE (European Green Deal Data Space)²³

Project overview:

The SAGE project aims to establish the foundation of the European Green Deal Data Space by uniting key stakeholders from environmental and data ecosystems. It contributes to digital transformation, enhancing competitiveness, resilience, and sustainability in line with Europe's goals. SAGE will facilitated interconnectivity among various Data Spaces such as agriculture, mobility, energy, smart cities, tourism communities, and other Green Deal-related areas, as well as with significant initiatives like DestinE, Copernicus Services, Iliad Digital Twin, EuroGeo Action Group, etc.

Stakeholders and Participants

- European commission (EC)
- Data space support centre: support in the development of data spaces.
- JRC: policy reports on European data spaces.
- Reference projects: EMODNET, EPOS, GOS4M, copernicus services, and copernicus DIAS.
- Public consultations: Eurostat, JRC, EuroGeographics, among others.

Technical Framework:

Digital ecosystem paradigm: The GDDS is based on the heterogeneity of existing data systems. Soft Infrastructure: Composed of two fundamental elements:

- Agreements and technical standards: define the rules for participation.
- Minimal logical components: provide interoperability solutions.
- Core components: include the data sources registry, data catalog, status checker, PID provider, and PID resolver.
- Facilitator components: include the dataset transformer, computing infrastructure registry and catalog, data mover, data processing enabler, and metadata enhancer.

Use cases and application:

Specific use case for Forest Ecosystem Monitoring: This use case involves the generation of forest indicators to monitor pressures and hazards in forest ecosystems. Its application is illustrated through the interaction of logical components of the GDDS DE, such as the Data Catalog (for searching EO and forest data), the data mover and dataset transformer (for accessing and transforming data), and the data processing enabler (for executing machine learning algorithms). It also analyses how trust and confidentiality are enabled through the GDDS DE security framework for this use case.

Interoperability and Integration

Fundamental at the technical level (APIs and standards) and semantic level (controlled vocabularies and ontologies), aiming for alignment with initiatives like:

- DPP: compatibility between the GDDS technical framework and the DPP.
- Data Space Support Centre (DSSC): alignment with DSSC technical blocks.
- Destination Earth (DestinE): conceptual alignment with the destinE data lake (DEDL).
- SIMPL: possibility of interconnecting the GDDS DE with other data spaces based on SMP.

²³SAGE: (European Green Deal Data Space): <https://www.egi.eu/project/sage/>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	20 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



- JRC Report on European Data Spaces: analysis of how the GDDS addresses the requirements of the JRC report.

Governance and Policies

- The GDDS will integrate existing data infrastructures and must be flexible and adaptable.
- It should involve stakeholders from multiple sectors and levels (quadruple helix).
- Specific roles for the GDDS should be defined, based on generic roles (data provider, user, intermediary, etc.) and those identified in the use cases.
- A governance structure should be established to ensure the fulfilment of GDDS objectives and represent the interests of its stakeholders. This will include the governance of the Community of Practice, data providers, and the digital platform.

Challenges and Lessons Learned

Fragmentation and inconsistency of data: difficulty in harmonizing data due to different formats and standards between countries and organisations. Scarcity of data in key sectors such as biodiversity and human health. Costly and limited access to valuable data for SMEs.

Impact and Outcomes

An inventory was created with two main databases: high-priority datasets and high-priority data services, listed with selected metadata. Data services were prioritised based on their utility for use cases, relevance to EGD objectives, sustainability, and spatial and temporal coverage. Identification of data gaps: data gaps were identified with the help of the SAGE community of practice, and specific examples were provided. A pan-European and multisectoral community of data providers, users, and intermediaries was established, which is fundamental for the GDDS. Six categories of high-value data were prioritised, highlighting earth observation and environment, geospatial, and meteorological as the highest priorities.

2.2.1.3 LDS: (European Language data space)²⁴

Project overview:

The European Language Data Space (LDS) is a strategic initiative by the European Commission aimed at establishing a secure and efficient platform for the exchange, monetisation, and reuse of multilingual and multimodal language data. Aligned with the European data strategy, the LDS seeks to bolster technological sovereignty, enhance economic competitiveness, and unlock innovation potential across Europe's language technology sector.

The European Language Data Space (LDS) aims to build a trustworthy and effective data market for the exchange of language resources in both the public and private sectors, in line with the EU data strategy.

Stakeholders and Participants

The LDS user group includes stakeholders from industry, cultural associations, research, public administration, and academia, who contribute to and benefit from the LDS by bringing in their requirements and validating the emerging infrastructure.

²⁴ LDS: https://language-data-space.ec.europa.eu/index_en

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	21 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



Technical Framework

The LDS operates as a distributed and decentralised ecosystem, featuring both central and local components. A key element is the LDS connector, a software installed on users' systems, enabling them to publish, search, negotiate, and transfer data products securely and in full compliance with EU laws and regulations.

Use cases and Application

The LDS caters to various use cases, including:

- Language technology developers: accessing datasets to train large language models (LLMs) covering specific languages or genres.
- Data providers: offering language datasets, either freely or for a fee, while maintaining full control over their data.
- Data preprocessing services: providing services such as anonymisation to prepare datasets for sharing within the LDS.

These applications facilitate the development of multilingual and multimodal language technologies and language-centric AI.

Interoperability and Integration

The LDS aims to integrate seamlessly with existing European data infrastructures and initiatives, promoting interoperability and data sovereignty. It aligns with the European data strategy and collaborates with projects like the European language grid (ELG), which provides access to language technology resources across Europe.

Governance and Policies

The governance framework of the LDS ensures that data holders retain control over their data, aligning with EU rules and values. The LDS user group, comprising stakeholders from industry, public administration, and academia, actively contributes to and validates the emerging LDS infrastructure, bringing in their own requirements and ensuring compliance with legal frameworks such as GDPR.

Challenges and lessons learned

Developing the LDS involves addressing challenges such as:

- Legal barriers: navigating issues related to intellectual property rights and data protection.
- Technical barriers: ensuring interoperability and secure data transactions.

The initiative builds upon previous efforts like the European language resource coordination (ELRC), which highlighted the importance of language data sharing and addressed related legal and technical challenges.

Impact and Outcomes

By increasing the availability of high-quality language data, the LDS aims to:

- Support the development of advanced European language technologies.
- Enhance the competitiveness of European businesses in the global market.
- Preserve linguistic and cultural diversity across Europe.

The LDS represents a significant step toward a more integrated and innovative European language technology landscape, fostering collaboration and ensuring data sovereignty.

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	22 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



2.2.1.4 TEMS: (European Data Space for Trusted European Media) ²⁵

Project overview:

The Trusted European Media Data Space (TEMS) is a flagship European initiative aimed at creating a resilient, data-driven ecosystem in the media sector. It supports media organisations through data-driven collaboration, addressing digital economy challenges and competing against dominant online platforms. TEMS focuses on enhancing the competitiveness of the European media industry by fostering cross-border collaboration and innovative technology.

Stakeholders and Participants:

TEMS involves a diverse group of stakeholders, including:

- Media organisations: news media, broadcasters, and other media entities.
- Technology companies: firms providing technological solutions and infrastructure.
- Public institutions: government bodies and public service media.
- Research Centres: Academic and research institutions contributing to media technology advancements.
- SMEs: small and medium-sized enterprises in the media sector

Technical Framework:

The TEMS vision is based on the implementation of an interoperable, sovereign, secure and trusted European data space that could lead to competitive and transformative opportunities for federated exchange of audiovisual content.

TEMS will use building blocks provided by projects such as the Data Spaces Support Centre (DSSC) and coalitions like the Data Space Business Alliance.

Use cases and Application:

B2B Exchange platform for fact-checking and news content:

- Sharing news content produced by certified fact-checkers and media organisations.
- Enhancing the credibility and reliability of news through verified sources.
- Content syndication: distribution of media content across various platforms and organisations.
- Media monitoring: tracking media trends and analysing content performance.
- Personalised content delivery: providing personalised media content to users based on their preferences and behaviours.
- Data-driven decision making: utilizing data analytics to inform strategic decisions in media production and distribution.
- These use cases and applications aim to enhance the competitiveness and innovation of the European media industry through data-driven technologies and cross-border collaboration.

Interoperability and Integration:

Interoperability is a key objective of TEMS. The project aims to facilitate the connection and integration of various stakeholders and existing platforms. Work will be done on designing common vocabularies and a framework for data space interoperability. The TEMS metadata design strategy aims to enable and optimize the discoverability, understandability, and usability

²⁵ TEMS: <https://tems-dataspace.eu/>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	23 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



of multimedia content through an anchoring model capable of managing the diversity of existing metadata models. Various AI-based tools developed by project partners will be analysed and potentially integrated to address specific technical requirements in the different trials. Examples: PEACH, EuroVOX, Facial recognition, Layout, Creation of audio content.

Governance and Policies:

TEMS seeks to facilitate the adoption of directives from the Data Governance Act and the Data Act (DGA and DA), enabling data space governance, industrial agreements, and data licensing models among stakeholders in the Media Data Value Chain (MDVC). A legal framework for governance and data management will be designed. Respect for intellectual property and ensuring access to verified and reliable data are crucial aspects of TEMS governance. TEMS may also offer techno-legal solutions to facilitate compliance with European legislation.

Challenges and Lessons Learned:

- Heterogeneity: diverse expectations, practices, standards, and legislation.
- Maturity levels: trials from exploratory to operational stages.
- Integration: harmonizing diverse trials and platforms.
- Architecture: ensuring flexibility and openness for future participants.

Impact and Outcomes:

- Establish a secure and trusted data space for media sector collaboration.
- Prototype and experiment with data-driven media value chains in areas like news, audience data, production collaboration, and new media formats.
- Reduce barriers for adopting the Data Governance Act (DGA) and Data Act (DA).
- Facilitate new digital alliances among media stakeholders and digital actors.
- Leverage a pan-European ecosystem of data service providers and infrastructure.
- Enhance data exchange capabilities and competitiveness of SMEs.
- Improve data reuse for innovative content production, curation, and distribution across Europe.
- Open new opportunities for the media sector and pave the way for expanding media data spaces.

2.2.1.5 DeployEMDS: (European mobility data space)²⁶

Project Overview

The deployEMDS project aims to establish a common European mobility data space (EMDS) to accelerate the digital and green transformation of the European mobility and transport sector. It builds on PrepDSpace4Mobility and is the first deployment action under the EMDS initiative. The project advances EU policy priorities by developing a technical infrastructure for an operational data space in the mobility sector, aligning with the European Data Strategy's goal to facilitate data access, pooling, and sharing. It supports the European Green Deal's aim to accelerate sustainable and smart mobility, contributing to a reduction in transport emissions.

²⁶ EMDS: <https://mobility-dataspace.eu/>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	24 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



Stakeholders and Participants

The project involves a diverse consortium of partners implementing 16 use cases across nine European cities and regions. Key stakeholders include government bodies, private companies, research institutions, and other relevant organisations.

Technological Framework

The deployEMDS project leverages frameworks from the Open Data Product Specification (ODPS) and the Data Space Business Alliance (DSBA) Technical Convergence document. It adopts a bottom-up approach to address the diverse requirements of the nine implementation sites, emphasizing a capability-driven design to establish a scalable, secure, and flexible data space.

Use Cases and Applications

The project implements data-driven use cases to tackle issues such as traffic congestion, environmental pollution, accessibility challenges, and urban growth. It aims to make data available in machine-readable format, facilitating innovative services and applications while contributing to the development of a European mobility data sharing ecosystem.

Interoperability and Integration

The project ensures interoperability and integration with other data spaces and systems by specifying components such as data governance mechanisms, authentication, authorisation, and accounting protocols, along with interoperability standards crucial for the efficient management and exchange of mobility data.

Governance and Policies

The project outlines governance structures and policies governing the data space, including data privacy, security measures, and regulatory frameworks. It emphasises the importance of data sovereignty, interoperability, and trust.

Challenges and Lessons Learned

The project identifies challenges such as the need for further refinement in governance and business strategies, the requirement for detailed analysis in the subsequent project phase, and the importance of cross-domain interoperability.

Impact and Outcomes

The deployEMDS project consolidates over 100 data sources across nine regions, playing a pivotal role in standardizing mobility data. It aims to create and deploy an operational data space with a common technical infrastructure, contributing to the development of a European mobility data sharing ecosystem.

2.2.2 Data Spaces related projects: intra- and inter-interoperability

This section compiles the considerations that ensure interoperability inside and outside the ETDS. The ETDS is unique since it must adopt a wider interoperability scope with existing data space initiatives that have been already deployed. Apart from introducing key data space topics such as data catalogue services and federated data ecosystems, relevant solutions to adopt policies and ensure data quality in an operational data space are also foreseen.

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	25 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



This section enumerates the most relevant aspects to be considered from the point of view of interoperability, both internally and across Data Spaces. From the internal perspective, the dimensions usually considered are:

- **Technical interoperability:** The different participants must use common protocols or standards in order to be able to communicate. An example in the Data Space context would be the use of connectors that are compliant with IDS Data Space protocol²⁷. Not using compliant connectors may result in not being able to negotiate an exchange or to actually exchange data once the negotiation has been completed.
- **Semantic interoperability:** The participants must speak a common language in order to assure that the communication among them is effective. In the context of Data Spaces, this is expected to be supported by the use of a common vocabulary or ontology. If the different participants enrich their data using different vocabularies it will complicate the findability of the data (e.g., datasets enriched with terms in different languages or using synonyms for a single meaning) or pose doubts on whether the content a user is finding actually meets her needs.
- **Organisational interoperability:** It is usually defined as an agreement on the governance model, operational processes or on the policies to be applied in the context of a Data Space. This can relate to sector specific regulations, to GDPR compliance, or to the use of particular data sovereignty policies.
- **Syntactic interoperability:** The exchange of information must be performed in a way that can be consumed by the different involved parties. In general, this can be related to how metadata is shared, the format being used (e.g., JSON-LD, JSON, XML), or the metadata structure or model. In a Data Space context this is usually handled by the Data Space connector.
- **Legal and Compliance interoperability:** The access to data must comply with some policies or regulations. In the case of European Data Spaces, for instance, the access to data or its exchange must comply with EU data regulations like the GDPR or the Data Act. Data Sovereignty Use Control policies or the Trust mechanisms in Gaia-X serve this purpose.
- **Process interoperability:** Refers to the alignment of certain common processes amongst different participants. Examples of process interoperability could be the use of common authentication mechanisms such as Self Sovereign Identity for authentication in Gaia-X or Data Spaces.
- **Security and Trust interoperability:** Relates to how data integrity, confidentiality or authentication is handled. Again, this can imply the use of Self Sovereign Identity or Verifiable Credentials in Gaia-X or the IDS certification with IDSA connectors.

While most of these aspects can be agreed amongst participants, or managed or enforced by a data space operator, interoperability complicates when the scope moves from a data space to multiple data spaces. In order to ensure interoperability with the future European Tourism Data Spaces some relevant aspects could be:

- **Technical interoperability:** The most critical aspect is data spaces that have to be interoperable using versions of connectors that can communicate and are compliant to the IDS Data Space Protocol. Still, it may be possible that some sort of gateway has to be used to ensure interoperability.
- **Semantic Interoperability:** This aspect is complex, as different Data Spaces are bound to use different vocabularies if the topic is different. Hence, unless there is a common topic, and both data spaces are using concrete vocabularies, it may be needed to implement a translation mechanism, mapping or an alternative metadata alignment across them.

²⁷ IDS-DSP: <https://docs.internationaldataspaces.org/ids-knowledgebase/dataspace-protocol>

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	26 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final



- **Organisational interoperability:** Although it is early from the European Tourism Data Space to specify what kind of policies or governance will be in place, it will be necessary to perform an alignment on this dimension. This may require alignment on access rules or authentication mechanisms.
- **Syntactic interoperability:** This aspect should not be a challenge as long as the different data spaces use connectors that are compliant to the IDS Data Space protocol.
- **Legal and compliance interoperability:** If the data spaces that have to interact are in Europe, interoperability should not be challenging as the legal framework would be common for them. Still, it may be needed to verify that data sovereignty policies are compatible across them.
- **Process interoperability:** The most challenging issue could be that the different data spaces are using authentication policies that are not compatible. From this point of view, ideally, the use of standard approaches like Self Sovereign Identities, OAuth 2.0 or Open ID Connect can assist in this interoperability.
- **Security and Trust interoperability:** It is intimately linked to the previous point, as authentication is also critical in this perspective. Ideally, having common identity issuers or trust anchors would help in this regard.

The different issues mentioned above are all relevant but there may be other aspects arising while working on the interoperability between the European Tourism Data Space and other Data Spaces. Even when ETDS is still in an early stage, there is work in progress regarding how it will be interoperable with other initiatives. Below are the projects that will be studied in order to ensure interoperability with the ETDS:

- The EONA-X project²⁸
- deployEMDS²⁹
- Cultural heritage data space³⁰
- Austrian Data Space³¹

2.2.3 Data Spaces related projects: value generation

There are data space initiatives operating which serve to different ends such as discoverability of resources, their visualisation and monetisation. This section focuses on how data assets “can be monetised by exchanging and trading data between organisations as data products and services.”³² A data asset not only is exchanged between organisations but also end users may manage their own data store.

2.2.3.1 DATAMITE³³

The DATAMITE project is developing a simple but impactful technical framework that enables European enterprises and public administrations to overcome existing challenges and facilitate the monetisation of their data. This framework is modular, open-source (under a MIT license) and multi-domain, composed of different software modules, training and business materials for European companies, empowering them to become new relevant players in the data economy; its architecture can be seen in Figure 1. The key modules being built in the project are:

- **Data Governance:** includes a metadata repository, data catalogue, glossary, and data lineage functionalities. It allows for the enriching, organising and easing the findability

²⁸ Eona-X: <https://eona-x.eu/>

²⁹ deployEMDS: <https://deployemds.eu/>

³⁰ Cultural heritage dataspace: <https://pro.europeana.eu/page/common-european-data-space-for-cultural-heritage>

³¹ Austrian Dataspace: <https://www.tourism-dataspace.com/de>

³² “Data product” reference, found in the ODPS: <https://opendataproductions.org/v3.1/#terms-used>

³³ Datamite: <https://datamite-horizon.eu/>

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	27 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

and usability of data. This is achieved by providing organisations the tools to create their own business vocabularies whose terms can be afterwards linked to their datasets, improving its semantic interoperability.

- **Data Quality:** Provides a library of KPI indicators as well as a tool for creating user defined rules. Both the KPIs and user defined rules can be used to profiler and evaluate que quality of datasets. This evaluation provides insights on the data, informing users on different indicators that can let them know whether it can be used for a particular task or it must be curated beforehand, or whether there may be problems during the data ingestion processes, affecting the quality of the data being stored.
- **Data Sharing:** Allows for the creation of data products from existing datasets in the framework. It also provides means to share these data products in two different kinds of ecosystems: 1) integrates EDC connector to enable the interaction with data spaces or Gaia-X; and 2) a series of plugins to facilitate the publication of data to other portals or initiatives such as EOSC, the AIOD platform or Pontus-X based data markets. Additionally, regarding data sovereignty, it provides a policy library with policy templates for data access and use control that can be deployed with the EDC, as well as a policy engine for their validation.
- **Data Support Tools:** Include additional tools for anonymisation, harmonisation, or to detect and mitigate data biases, aiming to improve its fairness. This is complemented by data ingestion and storage tools, allowing the ingestion and storage of bulk data, streaming data from different sources (e.g., MQTT or Kafka streams) or Database Queries using Trino; it also provides data discovery tools allowing to catalogue data in different database technologies (e.g., PostgreSQL, MongoDB, MySQL/MariaDB, etc.) following an extendable plugin-based approach.

Finally, the technical effort is complemented by technical and business documentation material. The goal of the former is facilitating the use of the framework from the technical point of view. The latter, however, focuses on providing exploitation strategies, business models and recommendations on how to better monetise data.

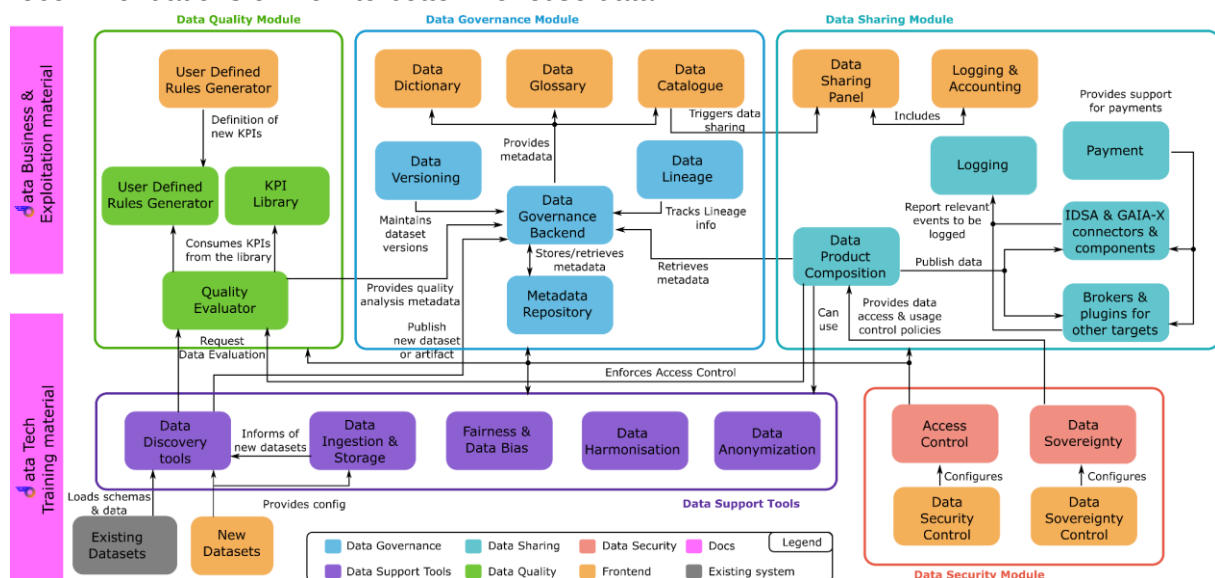


Figure 1 Datamite Architecture

2.2.3.2 WISEPHERE

Wisephare is a technological environment developed by ITI, funded with different regional projects, which enables organisations to manage, share, and leverage data in a reliable and secure setting, with the goal of transforming that data into knowledge and value. Its high-level architecture is depicted in Figure 2. As DATAMITE, its main focus is around data governance,

Document name:	D2.1 ETDS Interoperability & Data Sharing	Page:	28 of 145
Reference:	D2.1	Dissemination:	PU
Version:	1.0	Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



quality and sharing, also including functionalities like a data catalogue, glossary or a wide number of KPI indicators to be used in the profiling of a dataset. From the sharing point of view, it is currently focused on the integration and use of the EDC connector, as well as developing plugins to implement data sovereignty policies or privacy preservation techniques. It also offers different means of ingesting or discovering data, following a plugin-based approach.

Despite of these similarities, Wisephre goes one step beyond, integrating data processing tools such as AITANA, a framework to manage the entire lifecycle of an AI model, from its training to its exploitation, as well as an Visual Studio Code interface to work with AI code projects and manage AI models. Similarly, it is conceived to not only be deployed in small or medium organisations, but also in scenarios such as a large enterprise or a Digital Innovation Hub to provide service to different companies. To this purpose, it follows a multi-tenant management where tenants can be assigned to different organisations or different departments or areas within an organisation. Finally, it is also currently extending its functionalities to include advanced data visualisation.

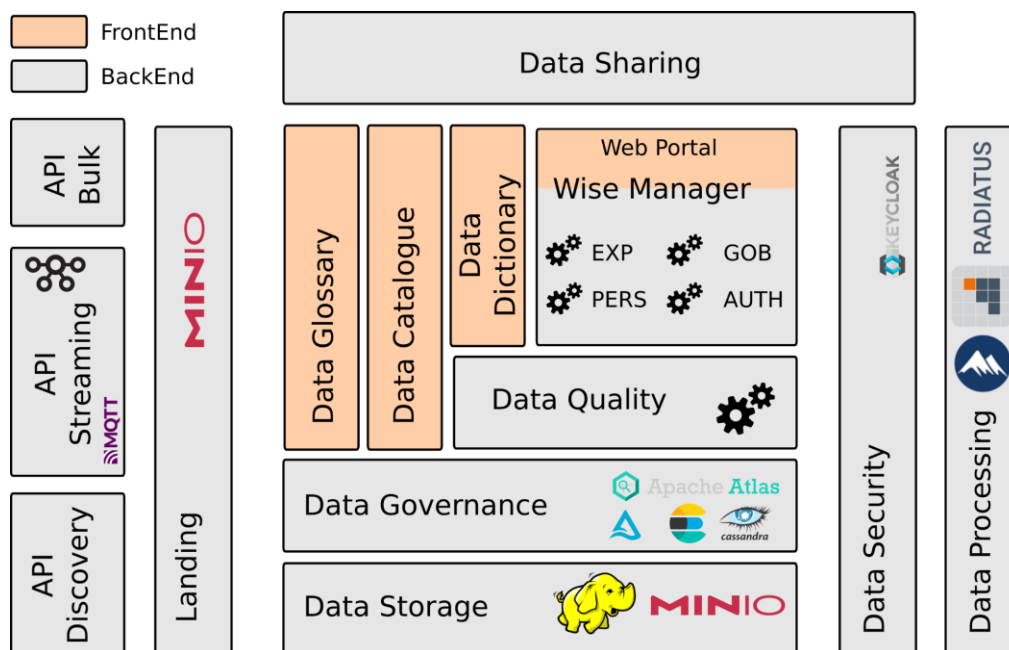


Figure 2 Wisephre Architecture

Given the similarities between DATAMITE and Wisephre, Table 1 shows some of the key features and differences between both solutions.

Features	DATAMITE	WISEPHERE
Data Discovery (from Databases)	S3, PostgreSQL, MongoDB, MySQL, Cassandra, Azure, other	S3, PostgreSQL, MongoDB, MySQL, Cassandra, Azure, other
Data Ingestion Bulk	Yes	Yes

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	29 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Data Ingestion Streaming	Plugin Based (MQTT, Kafka, OPC-UA)	Plugin Based (MQTT, Kafka, OPC-UA)
Data Catalogue & Glossary	Yes	Yes
Data Quality: Inherent metrics	Yes	Yes
Data Quality: User defined metrics	Yes	Yes
Creation of Data Products	Yes	Yes
Data Sovereignty	Basic rules, being extended	Basic rules, being extended
Data Spaces Sharing	EDC	EDC
Sharing to other initiatives	Yes (marketplaces, AloD, Pontus-X)	No
Data Processing	No	Yes
Extra functionalities (Anonymisation, harmonisation, ...)	Yes	No
Data Visualisation	No	Yes
Organisation Management	No	Yes

Table 1 DATAMITE and Wisephare key features

2.3 Canvas design

The objective of this section is to define the methodology for the identification of functional and non-functional requirements of the ETDS. The methodology will result in the depiction of a roadmap for implementing data products in DEPLOYTOUR.

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	30 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



This methodology was based on the canvas developed by the deployEMDS project³⁴. The canvas is structured following the ODPS model, to work on the data product concept, which is the unit of work for all the use cases of the data space. The data product concept is articulated on data sources, on the data product itself, the data product offering (DPO), and the final use case (or data project; in this document the concept of final use case is preferred to the one of data project).

The canvas is composed of twenty-five questions grouped in four categories that were identified as elementary for a minimal viable data space for the deployEMDS, taking into consideration aspects such as relevant patterns of data sharing, access control, or the expectations of the data space participants when integrating the data space. This canvas resulted from a reference canvas that expanded on the former in both form and scope; these other questions considered the technical stacks on use in the data space, the data sources transformed into data assets in the data space, and the lifecycle of the data product.

As a matter of fact, the methodology is aligned with the DSSC blueprint Business Building Block³⁵. The *Use Case Development* relies on three iterative phases that proposes a flexible process to identify use cases scenarios, refining use cases scenarios and implementing these use cases. A use case scenario is a potential use case envisaged to solve challenges and create value, being implemented as a use case multiple times in one or more data spaces. This is relevant to the extent that the answers that will determine how data products will be offered in the data space, mapping to the DSSC building blocks and allowing the identification of requirements.

The canvas template will follow the format of a form that collects questions divided into the four blocks. A canvas template is assigned to one data product offering, providing the consortium the flexibility to create new templates as additional data product offerings emerge from the formerly identified during the completion of the existing templates (further details on this process in section 4.1.3).

2.4 Conformance

This section aims to address the ongoing evolution of the DSSC blueprint, which has undergone three different versions since 2023. Today, the blueprint has reached version 2.0, and the consortium recognises the need to mitigate any conceptual variation that may arise. Furthermore, this section aims to clarify concepts common to different projects and initiatives, such as data source, data product, or data intermediary.

2.4.1 Standardisation conformity

In this document, the final use case is replacing the DSSC *data project* term, which is understood as the implementation of the data space with regards to a given use case. The DSSC Blueprint Use Case Development³⁶ (Business) Building Block serves as the DSSC guidelines to initiate the process of creating a data space. This building block proposes an

³⁴ This methodology was taken from the canvas developed by deployEMDS; section 3.1, “Canvas design”: <https://deployemds.eu/wp-content/uploads/2024/05/D2.1-Requirements-analysis-of-the-technical-infrastructure-3.pdf>

³⁵ “Business Model”, reference found in DSSC blueprint: <https://dataspace-supportcentre.atlassian.net/wiki/spaces/bv15e/pages/766064638/Business+Model>

³⁶ “Use Case Development” section, the DSSC Blueprint v1.5: <https://dataspace-supportcentre.atlassian.net/wiki/spaces/bv15e/pages/766064885/Use+Case+Development>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	31 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



iterative design that leads to the identification of functional requirements³⁷, from where technical, legal, and business agreements will emerge.

The Open Data Product Specification model³⁸ (ODPS) defines the objects and attributes as well as the structure of digital data products³⁹, decoupling data products from the systems often directly associated with it.

The Data Catalog Vocabulary⁴⁰ (DCAT) is a vocabulary designed to facilitate interoperability between data catalogs published on the Web. DCAT is relevant for the implementation of diverse DSSC building blocks, notably in the depiction of data models and the use of the Dataspace protocol⁴¹, although its implementation should be extended to cover functionalities in the value creation services, such as data fusion, Artificial Intelligence models or load balancing⁴². Catalogues, datasets and services are typified as any extension of the DCAT (*Data*) *Resource* class⁴³, being possible to extend it to define other types of resources. The DCAT v3.0 either recommends creating a suitable sub-class of the *Resource* class or use the class with a DCTerms (*Resource*) *type* property⁴⁴. Moreover, the integration (or adoption) of tourism-specific ontologies and data models that are based on the schema.org standard is another recommendation to be considered. The schema.org standard is a solution to integrate since it is widely adopted in the definition of ontologies and data models in the tourism domain: Open Data Tourism Alliance specifications⁴⁵ (ODTA), Italian Tourism Data Hub ontologies⁴⁶ (TDH022), DATAtourisme ontology⁴⁷.

2.4.2 Data space definitions disclaimer

2.4.2.1 Data service intermediary

The intermediary is generally a term adopted from the Data Governance Act⁴⁸ (DGA). Different discussions in different platforms have pointed out the fact that, when referring to a data intermediary, what it should be talking about is other data participants to the extent that they provide further services in an environment.

Moreover, SIMPL-Open also mentions an intermediary as part of the participant's architecture that enables the succession of data services between different participants.

³⁷ “Develop use cases and identify functional requirements” section, the DSSC Blueprint v1.5: <https://dataspace-support-centre.atlassian.net/wiki/spaces/bv15e/pages/766063305/Develop+Use+Cases+and+Identify+Functional+Requirements>

³⁸ Open Data Product Specification model v3.1: <https://opendataproductions.org/v3.1/#open-data-product-specification-3-1>

³⁹ Open Data Product Specification model definition: <https://github.com/Open-Data-Product-Initiative/v3.1/tree/main>

⁴⁰ DCAT v3.0: <https://www.w3.org/TR/vocab-dcat-3/>

⁴¹ “DCAT catalog” reference found in Dataspace protocol 2024-1: <https://docs.internationaldataspaces.org/ids-knowledgebase/dataspace-protocol>

⁴² “DCAT” reference found in DSSC Blueprint 1.5, section Value creation service: <https://dataspace-support-centre.atlassian.net/wiki/spaces/bv15e/pages/766069419/Data+Services+and+Offerings+Descriptions#4.-Links-to-other-building-blocks>

⁴³ “dcat:Resource” class reference found in DCAT v3.0: <https://www.w3.org/TR/vocab-dcat-3/#Class:Resource>

⁴⁴ “dct:type” property reference found in DCAT v3.0: https://www.w3.org/TR/vocab-dcat-3/#Property:resource_type

⁴⁵ ODTA: <https://odta.sti2.org/?dsb-list=CRkyvvcqGqeUu>

⁴⁶ TDH022: <https://docs.italia.it/italia/mitur/gl-tourism-digital-hub-interoperabilita-docs/it/main/index.html>

⁴⁷ DATAtourisme: <https://www.datatourisme.fr/ontology/core/index-en.html>

⁴⁸ DGA: <https://eur-lex.europa.eu/eli/reg/2022/868/oj/eng>

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	32 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final



2.4.2.2 Data source

There is no consensual definition of what a data source is. This is implicitly contained in the data product concept, where a data source can be seen not only as data or a data service but also as any data sharing unit, metadata describing license terms or any other type of information. An important shift from the DSSC Blueprint v1.0 to v1.5 is the adoption of the CEN CENELEC Trusted Data Transactions Working Group's data product definition⁴⁹.

A data asset can be monetised by exchanging and trading data between organisations as data products and services. A data product is formalised using the ODPS model. Although the ODPS provides its own perspective to define a data source, the data product term fully aligns with the DSSC in the sense that any data asset can be shared and traded between organisations following some associated license terms.

While the DSSC Blueprint v1.0 describes the DCAT resource⁵⁰, the DSSC Blueprint v1.5 omits it⁵¹. This action was probably encouraged by the fact that data sources was not appropriate to be a synonym of resource (which is, according to the DSSC Blueprint v1.0 -aligned with the DCAT definition, “an entity that is curated by a single party that represents value and can be identified, described, accessed and utilised”).

This document, however, addresses a data source as any piece of data, or a data unit, which possesses a license and belongs to an organisation. In practice, a data source will be typified as any extension of the DCAT (*Data*) *Resource* class⁵², not only referring to datasets and data services but to any other piece of data. The DCAT v3.0 either recommends creating a suitable sub-class of the *Resource* class or use the class with a DCTerms (*Resource*) *type* property⁵³.

⁴⁹ “Data and data product” reference, found in the DSSC Blueprint v1.5, referencing to the “Trusted Data Transaction - Part 1: Concepts, terminology, and mechanisms” document of the CEN CENELEC Trusted Data Transactions Working Group: https://www.cenelec.eu/media/CEN-CENELEC/News/Workshops/2024/2024-01-16%20-%20Data%20Transactions/cwa-draft-part1-0-8_clean.pdf

⁵⁰ “Resource” reference found in the DSSC Blueprint v1.0, section “Data products and transactions”: <https://dssc.eu/space/BVE/357073819/6+Data+products+and+transactions>

⁵¹ The DSSC Blueprint v1.5, section “Data products and transactions”: <https://dataspace.supportcentre.atlassian.net/wiki/spaces/bv15e/pages/766062077/5+Data+Products+and+Transactions>

⁵² “dcat:Resource” class reference found in DCAT v3.0: <https://www.w3.org/TR/vocab-dcat-3/#Class:Resource>

⁵³ “dct:type” property reference found in DCAT v3.0: https://www.w3.org/TR/vocab-dcat-3/#Property:resource_type

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	33 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final



3 Information collection

The objective of this section is to apply the methodology described in section 4.3 for the identification of functional and non-functional requirements of the ETDS. By eliciting data sources and extracting data products from a series of use cases, the consortium will identify requirements from a bottom-up approach, which will be refined in successive sessions during the canvas analysis.

For this analysis, the consortium will adopt the data source overview⁵⁴ document elaborated by the deployEMDS reference data space initiative. At the end of the analysis, the consortium will decide how to implement these requirements, the architecture and governance framework that best suit the use cases.

3.1 Canvas analysis

The canvas analysis also leads to three major phases: the first phase is to work on five canvas templates (one per pilot) based on the data source of each use case (that is, one per pilot) (Annex I); the second phase is about depicting specific requirements binded to the use cases (Annex II); and the third phase generates the relation of functional, non-functional and technical requirements for the data space (Annex III).

The use case and data model perspectives will serve to fulfil these canvas templates where data product offerings are identified prior to the depiction of the set of data sources associated with each use case. The components perspective, on the other hand, will set up the data space building blocks that identify the technical requirements for the deployment of an operational data space, or in other words the capabilities to achieve. Sections 3.1.1, 3.1.2 and 3.1.3 describe these phases in detail.

3.1.1 Canvas analysis: phase one, go-through session and content explanation

Phase one consisted of the elaboration of the data source overview and the presentation of the canvas template to the consortium, the go-through session, which is completed once the list of data product offerings is identified. The analysis of the use cases (pilots 1 to 5) leads to the data gathering of local implementation sites, aligned with their requirements, to create the different data product offerings of the DEPLOYTOUR. The document resulting from the data gathering consisted of five canvas templates containing the following columns:

- Pilot region,
- Use case number,
- Data source number,
- Data source name,
- Data owner,
- Usage,
- Availability level,
- Current availability state,
- Accessibility,
- Reprocessing,
- Conformity now,
- Conformity later,
- Comment.

⁵⁴ This data source overview was taken from the canvas analysis performed by deployEMDS; section 3.3, “Canvas analysis”: <https://deployemds.eu/wp-content/uploads/2024/05/D2.1-Requirements-analysis-of-the-technical-infrastructure-3.pdf>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	34 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



These five canvas templates are living documents that will be reviewed and modified until the elaboration of the intake canvas, notably for the data product proposal and the information about the compliance of data sources with regards to standardised formats. The organisation of data sources serves ultimately to describe these conformance elements of the existing data and metadata catalogs for each use case (i.e., the “Conformity” labels). The organisation of data sources enabled the identification of assets available in the use cases, which will facilitate the identification of data products and the definition of data product offerings for the ETDS. The assets were categorised in six broad areas, among which are hospitality data, strictly financial data, mobility and transportation data, environmental and sustainability data, customer review data, and cultural and heritage data.

Ultimately, the canvas template is developed for each pilot to fill in. Following the deployEMDS, the DSSC blueprint provides the concepts and terminology used in the canvas. The five canvas templates are presented to the consortium and will be followed by a detailed go-through session to solve doubts, since the consortium partners lead different pilots.

In this phase of the project, it has been decided to carry out this activity exhaustively with pilots 1, 3 and 4, and partially with pilot 2, focusing on the data related to data product offerings and their relationships with other data spaces, in order to lay the foundation for the project requirements and the data space federation.

This exercise will also be carried out in the future to collect data from less mature pilots, thus enriching the project requirements in future deliverables.

3.1.2 Canvas analysis: phase two, follow-up session and document refinement

Following the deployEMDS project, the canvas template should be and provide a structured method to articulate data sharing intentions. The intake canvas is a derivative of the canvas template resulting from the first iteration with the pilots (the intake process). The intake canvas contains a subset of questions relevant in five categories: data product, data product offering, data product governance, business model, and data space federation. As for the canvas templates, the intake canvas are also living documents:

- The proposed questions should be clear and exemplified;
- The questions should be rephrased to make them as intuitive as the data product offering evolve, either in context or use case;
- Since there is an intake canvas per data product offering, an intake canvas will be separated into two if the data product offering significantly differs in one the following aspects: scope of the data product, the governance of the data product, the transferring protocol, the consumption pattern, or the data source conformity.

The follow-up session is scheduled two weeks after the first go-through session. The aim of this iterative process is to adopt a use case-oriented design approach in the implementation phase and to ultimately generate a refined document from which elicit the most suitable architecture or framework of the ETDS. To ensure a minimum viable data space, these canvas templates include doubts to be discussed in the follow-up session which are immediately tackled to produce requirements with no gaps.

3.1.3 Canvas analysis: phase three, data product (offering) identification and capabilities

Phase two pursues the identification and mapping of data product offerings with the different use case, data model and components perspectives. Each perspective will result in sets of common requirements that are grouped in the identified building blocks or capabilities in section 6.2.

The sharing and discussion of questions formulated by the consortium in the two previous sessions led to a questions document per data product. Questions were categorised in five areas (listed and exemplified below) once the data product offerings were validated and accepted by the consortium.

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	35 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Below there is the description of the five different areas adopted from the deployEMDS initiative, which also are aligned with the necessary building blocks (data interoperability, data sovereignty and trust, and data value creation) outlined in the BSBA Technical Convergence Discussion Document⁵⁵.

- Data product scope

Identification and definition of the data product, which is composed of different data sources; there is normally a data product per use case, although it is recommended to divide into other data products as highlighted in the phase two.

- Data product offering

The data product offering is the implementation of the data product in DEPLOYTOUR and determines how a data product becomes a data asset. The data offering could be implemented in the data space connector, and handles usage control, formats, data assets publication, data asset catalogue, etc. In other words, it defines how the data product is offered to the data space. The information we request here might not be immediately available during the intake phase of the project. The goal is to define a prioritised roadmap for implementing data products in the data space.

- Data product governance

The information in this section will help identify standard practices in data management and product compliance, including industry/domain standards and governance models relevant for various use cases. Data product owners should outline their trust-building processes, which will guide our decision on supporting identity management and data sovereignty, and to see if a fully managed trust model is needed by the DEPLOYTOUR.

- Business model(s)

The information in this template will help determine how diverse the participants' business expectations are. Some business models require specialised components at data space level. We also want to determine if a shared business model is viable or rather fostering an ecosystem of value returns. DEPLOYTOUR should provide the necessary building blocks to support this diversity.

- Data space federation

There are cases where data products are already part of an existing data space. The information must help us to find the most flexible and sustainable way to integrate them in DEPLOYTOUR.

For this exercise we will include the questions regarding Data Product Scope, Data Product Offering and Data Space Federation since the pilots need more refinement in order to answer questions regarding the governance and business model of their Data Products.

3.2 Map capabilities to DSSC Building Blocks and reference data space frameworks

This section aims to perform a cross-check of identified requirements against those of the data spaces initiatives described in Section 3. The consortium will be able to incorporate technical requirements (e.g., on how data consumers access data products) without disabling the functional requirements elicited from the use cases.

⁵⁵ BSBA Technical Convergence Discussion Document: <https://data-spaces-business-alliance.eu/dsba-releases-technical-convergence-discussion-document/>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	36 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



3.2.1 DSSC Building Blocks

This section primarily aims to identify the minimal, viable set of data space building blocks realising a functional ETDS, and to solve the possible insufficient requirements not directly elicited from the intake canvas. Following the component's mapping process of deployEMDS⁵⁶, the Consortium aims to adopt a capability-driven design⁵⁷ approach to similarly extract the list of building blocks or capabilities using as a starting point the DSSC taxonomy.

In this approach, a data product is represented by the ODPS and mapped to either one or more business or technical capabilities. By aligning these capabilities with the DSSC building blocks, it is aimed to infer one or more requirements for each of these building blocks. This allows the Consortium and pilots to make technical decisions in an informed way. Not all of the building blocks will cover the whole set of requirements, being the DSSC building blocks insufficient during the intake canvas. The consortium will widen the set of building blocks from the state-of-the-art data space initiatives which are analysed in the following sections.

To infer the requirements, each question in the canvas is matched to one or more of the building blocks or selected from other initiatives by the Consortium. The requirements will clarify which data space components should implement each of the building blocks through a specific solution. Moreover, in alignment with deployEMDS, each requirement will be evaluated against the state-of-the-art in data spaces to determine their feasibility in relation to the data spaces initiatives and frameworks outlined below.

3.2.2 SIMPL

In this section, the results of the canvas analysis are mapped to the SIMPL initiative in the data space domain.

SIMPL⁵⁸ builds on five key layers: integration, data, infra, administration, and governance. Each layer includes a set of services or capabilities that are necessary for the platform's seamless functioning. These capabilities are grouped into two categories: user capabilities, which are directly accessed by platform users, and supporting capabilities, which operate in the background to enable the former.

Additionally, it is important to note that SIMPL differentiates between capabilities accessible via the platform and those integrated into it. Capabilities that are accessible through the platform are compatible with existing solutions and their APIs, whereas integrated capabilities require the incorporation of additional solutions into the platform's software stack.

The Figure 3 shows the loosely coupled, self-contained architecture of SIMPL which groups components into building blocks, capability by capability, showing whether it will be included in the MVP to be ready by the middle half of 2025.

⁵⁶ The component's mapping process was taken from the canvas analysis performed by deployEMDS; section 3.3.1, "From technical capabilities to data space building blocks": <https://deployemds.eu/wp-content/uploads/2024/05/D2.1-Requirements-analysis-of-the-technical-infrastructure-3.pdf>

⁵⁷ The capability-driven design approach is referenced in deployEDMS, which also references the paper "Bērziša et al. (2015). Capability Driven Development: An Approach to Designing Digital Enterprises. *Business & Information Systems Engineering*, 57, 15-25."; section 3.3.1, "From technical capabilities to data space building blocks": <https://deployemds.eu/wp-content/uploads/2024/05/D2.1-Requirements-analysis-of-the-technical-infrastructure-3.pdf>

⁵⁸ SIMPL D1.3.1.2 Functional and Technical Architecture Specifications: Ø <https://simpl-programme.ec.europa.eu/system/files/2024-12/Simpl-Open%20Functional%20and%20Technical%20Architecture%20Specifications.pdf>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	37 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final

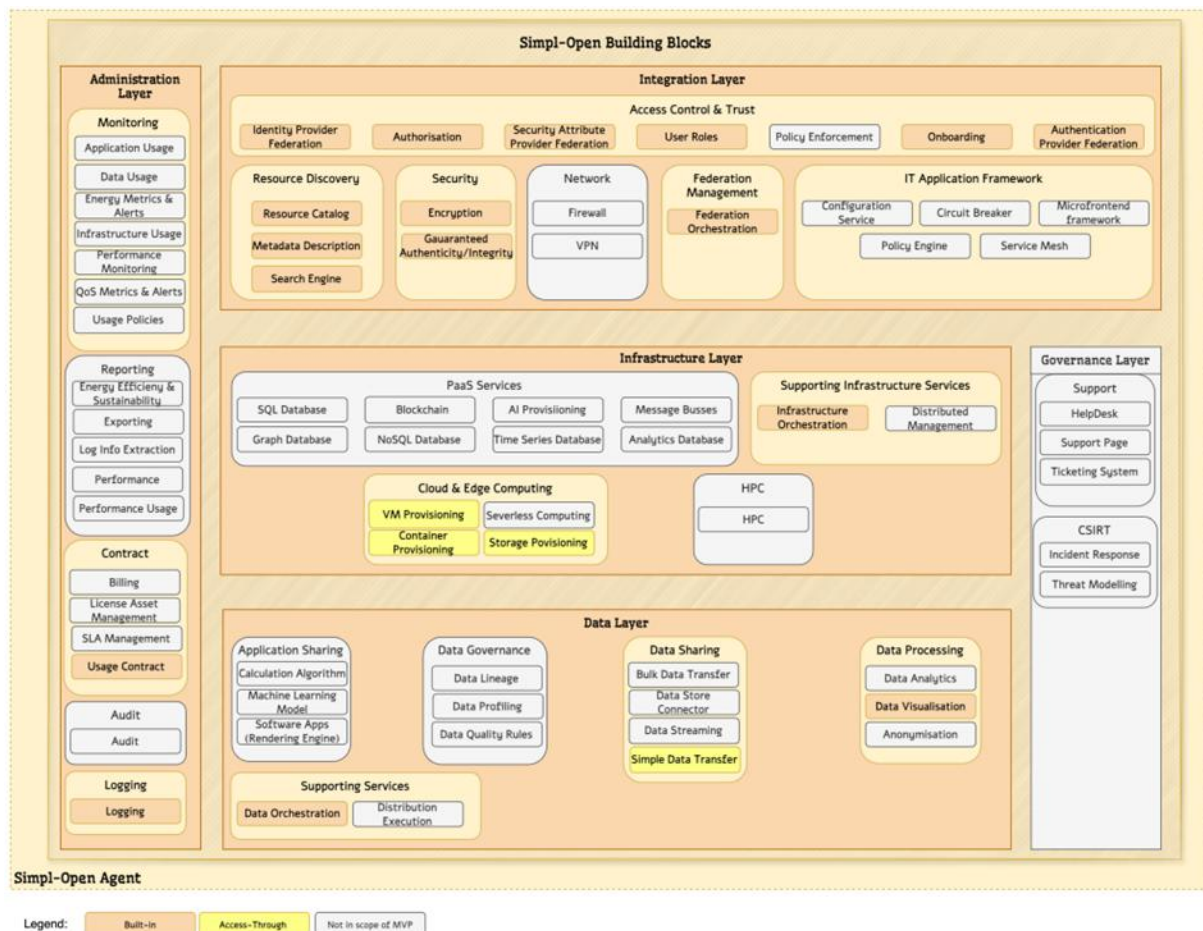


Figure 3 Architecture of SIMP

In the Table 2 we enlist the capabilities, provided by deployEMDS and we map them to the relevant components in SIMPL:

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	38 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Cap . #	Capability	SIMPL functional component(s)	SIMPL Building Block(s)	Synopsis
1.	ID binding	Onboarding, IAA	Onboarding, Identity Provider Federation	During onboarding, the participant's credentials (e.g. public keys, certificates) are linked to their real-world identity. Federation enables recognition across domains.
2.	Identification, Authorisation	IAA	Identity Provider Federation, Authentication Provider, Authorisation, Security Attribute Provider Federation, Policy Enforcement	SIMPL uses federated identity providers, local auth providers, and attribute-based policies to authenticate and authorize participants across components.
3.	Trust Anchor	Onboarding, IAA	Onboarding, Authentication Provider, Security Attribute Provider Federation	The IAA of the governance authority acts as the trust anchor. Participants trust its signed credentials (certificates or tokens) and use them to validate identities and claims.
4.	Onboarding and participation	Onboarding	Onboarding	The Onboarding component allows applicants to submit participation requests, validates eligibility, and issues security credentials.
5.	Authorisation and Credentials Interoperable Presentation	IAA	Security Attribute Provider Federation, Authorisation	Participants receive credentials (e.g., role, org) from attribute providers. These are interoperable and are verified at runtime for access decisions.
6.	Jurisdiction	Onboarding, IAA	Onboarding, Security Attribute Provider Federation, Policy Enforcement	Jurisdiction is evaluated at onboarding (e.g. EU-only), encoded in attributes, and enforced via policies.
7.	Data residency	Infrastructure Management, Data Transfer, IAA, Contract Management (opt)	Infrastructure Orchestration, VM/Container/Storage Provisioning, Data Orchestration, Simple Data Transfer, Policy	Data residency rules are encoded in contracts or policies. Infrastructure management handles location-aware deployment; IAA enforces access based on origin/destination.

Document name:	D2.1 ETDS Interoperability & Data Sharing	Page:	39 of 145
Reference:	D2.1	Dissemination:	PU
	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



			Enforcement, Authorisation, Usage Control (opt)	
8.	Access and Usage Policies enforcement	Contract Management, Data Space Connector, IAA	Usage Contract, Data Orchestration, Policy Enforcement, Authorisation	Contracts are negotiated via the Data Space Connector and signed through Contract Management. The IAA enforces access policies at runtime based on credentials and contract terms.
9.	Federated algorithms	Infrastructure Management, Data Space Connector, IAA	Infrastructure Orchestration, Data Orchestration, Policy Enforcement, Authorisation	Workflows are executed near data (on participant infra) using orchestrated tasks via the Data Space Connector. Policies restrict data movement and secure output aggregation.
10.	Data and services offering	Resource Offering Editor, Vocabulary Management, Schema Management, Federated Catalogue, Contract Management	Metadata description, Resource Catalogue, Usage Contract	Data space mechanisms to describe and publish a data product, associate a usage contract.
11.	Publication and discovery	Federated Catalogue, Search, Resource Offering Editor, Vocabulary Management	Resource Catalogue, Search Engine, Metadata description	Data space mechanisms to publish, announce, and discover data products and services via catalogue and search components.
12.	Data Interoperability: semantic framework and semantic equivalence	Vocabulary Management, Schema Management, Resource Offering Editor	Metadata description	Schema and vocabulary components define ontologies and controlled terms. The Resource Offering Editor ensures offerings use standardized, semantically meaningful descriptors.
13.	Business observability / audit	Observability, Data Space Connector	Logging and Monitoring, Data Orchestration	The Observability component collects logs from data exchanges. The Data Space Connector emits usage events; these can be aligned with contracts for billing, clearing, and compliance.
14.	Provenance	Observability,	Logging,	Provenance is captured in

Document name:	D2.1 ETDS Interoperability & Data Sharing	Page:	40 of 145
Reference:	D2.1	Dissemination:	PU
	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	and Traceability	Resource Offering Editor, Federated Catalogue, IAA	Monitoring, Metadata Description, Resource Catalogue, Policy Enforcement	metadata via the Resource Offering Editor. SIMPL logs access and transformations to support data lineage, aligned with usage conditions and catalogue entries.
15.	Supported data models and formats	Schema Management, Vocabulary Management, Resource Offering Editor, Federated Catalogue	Metadata description, Resource Catalogue	Schema Management defines structure, vocabularies define terminology. These are applied via the Resource Offering Editor and validated on publish.
16.	Metadata and vocabulary services	Schema Management, Vocabulary Management, Resource Offering Editor, Federated Catalogue	Metadata description, Resource Catalogue	SIMPL uses Vocabulary and Schema Management to define terms and semantic labels. These ensure self-descriptions are meaningful and interoperable across domains.
17.	(Environment-agnostic) deployable components	Infrastructure Management, Data Space Connector	Infrastructure Management, VM/Container/Storage Provisioning, Data Orchestration	SIMPL components are containerized and provisioned via Infrastructure Management, allowing deployment in environment-agnostic setups (public cloud, private cloud, or on-prem).
18.	Flexible data planes	Data Transfer, Data Space Connector	Simple Data Transfer, Data Orchestration	Supports adaptable data exchange using pluggable protocols. The Data Space Connector negotiates and orchestrates transfers, while Data Transfer executes them.
19.	Autonomous data services	Resource Offering Editor, Data Space Connector, Data Transfer	Metadata description, Data Orchestration, Simple Data Transfer	Enables low-configuration data publishing. SIMPL supports the creation of self-descriptions via the Resource Offering Editor using shared schemas. When data sources and connectors are preconfigured, self-descriptions can be generated and published with minimal manual effort.
20.	Marketplace	Federated Catalogue, Contract	Resource Catalogue, Usage Contract,	SIMPL enables marketplace functions like publishing offerings, negotiating usage

Document name:	D2.1 ETDS Interoperability & Data Sharing	Page:	41 of 145
Reference:	D2.1	Dissemination:	PU
	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



		Management, Observability	Logging and Monitoring	contracts, and logging usage. Billing, payments, and rating are not included and must be handled externally.
21.	Marketplace-oriented data sharing negotiation	Data Space Connector, Contract Management, Federated Catalogue	Usage Contract, Data orchestration, Resource Catalogue	Formats and services that standardise business transactions for the exchange of data services and data products.
22.	Billing and Payments	Observability, Contract Management	Logging and Monitoring, Usage Contract	SIMPL tracks usage through Observability and defines billing terms in contracts. It does not include a billing engine but can connect to external billing or payment systems via APIs.
23.	Data intermediaries	Federated Catalogue, Contract Management, Data Space Connector, Observability, IAA	Resource Catalogue, Usage Contract, Data Orchestration, Logging, Monitoring, Policy Enforcement	SIMPL supports intermediaries as neutral agents operating catalogue, contract, and governance services. Data flows peer-to-peer between participants; intermediaries do not access or profit from the data, and compliance is ensured through policy enforcement and observability.

Table 2 List of technical capabilities mapped to SIMPL components GAIA-X and integration of solutions

This section aims to map all capabilities to existing GAIA-X services that were deployed in related projects, normally following some adjustments (i.e., DSBA) for a better integration of components, as well as the integration of specific solutions from the tourism domain (e.g., Arazzo OTA-OpenAPI) and other agnostic-domains (e.g., SOLID).

Gaia-X⁵⁹ is a European initiative aimed at creating a federated and secure data infrastructure that prioritises sovereignty. Its primary mission is to enable trusted, transparent, and sovereign data exchange across digital ecosystems. Rather than functioning in a centralised manner, Gaia-X establishes a decentralised framework where participants can interoperate under a shared set of policies, standards, and governance models.

The Gaia-X Architecture⁶⁰ enables data infrastructure ecosystems using the elements of the Gaia-X Conceptual Model, Operational Model, and Federation Services, along with the Gaia-X Trust Framework, whose specification provides the foundation for compliance and interoperability across the initiative.

In the Gaia-X context, an ecosystem is a virtual set of Participants, Service Offerings, and Resources that fulfil the requirements of the Gaia-X Trust Framework and collectively

⁵⁹ Gaia-X Specifications: <https://docs.gaia-x.eu/>

⁶⁰ Gaia-X Architecture: <https://docs.gaia-x.eu/technical-committee/architecture-document/24.04/>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	42 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



contribute to the broader Gaia-X ecosystem. The Gaia-X ecosystem itself consists of all individual ecosystems that use the Gaia-X architecture and conform to its requirements. The common governance of the Gaia-X ecosystem includes Policy Rules (statements of objectives, rules, practices, or regulations that govern the activities of Participants within the ecosystem) as well as adherence to the Gaia-X Trust Framework.

At its core are concepts of trust and transparency, enforced through Self-Descriptions—structured, verifiable, and cryptographically signed metadata that describe participants, services, and data assets. These Self-Descriptions⁶¹ are used to automate the validation of participants, services, and resources. Trust Anchors validate the authenticity and compliance of these entities, while Access and Usage Policies define the rules for data access and permissible use (usually enforced within the connectors). Additionally, Gaia-X includes Federation Services that provide essential capabilities such as identity verification, compliance checking, and service discovery to support the operation of a federated data infrastructure. Service offerings are typically made available through Federated Catalogues, allowing participants to discover and connect with services across domains.

Gaia-X defines an architecture based on planes and ecosystems. These planes structure how governance and technical components interact:

- The trust plane reflects global share rules (e.g., compliance, credentialing, trust anchors).
- The management plane extends this governance to address specific business or domain-specific governance.
- The usage plane focuses on technical interoperability, ensuring that services and data products work together.

This is depicted in Figure 4.

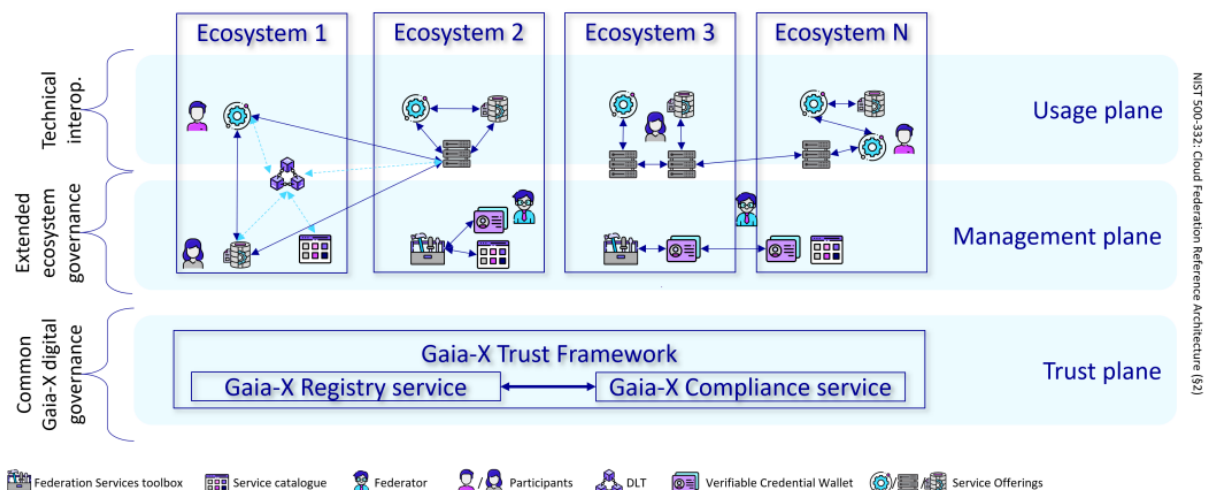


Figure 4 Gaia-X Ecosystems

Analogously to the previous subsection, a table with the mapping of capabilities given by deployEMDS and Gaia-X is presented here in Table 3.



Cap. #	Capability	Gaia-X component(s)	Synopsis
1.	ID binding	Gaia-X IAM (Credential Management)	Binding is achieved by linking identity attributes to cryptographic keys within Verifiable Credentials (DIDs), managed via IAM. Wallets store these DIDs and private keys, enabling secure identity binding in support of Self-Sovereign Identity (SSI).
2.	Identification, Authorisation	Gaia-X IAM, Verifiable Credentials, PDP/PEP	Participants are identified via Verifiable Credentials and authenticated using federation IAM services. Authorisation is enforced via PDP/PEP.
3.	Trust Anchor	Federation Identity & Trust Services	Trust Anchors are trusted entities or organizations that serve as the root of trust which verify and issue credentials. Trust Anchors must adhere to Gaia-X policies and be listed in the Gaia-X Trust Framework Registry (or Gaia-X Compliance Service).
4.	Onboarding and participation	Federation Onboarding Workflow, Gaia-X Compliance Service	Participants go through an onboarding process where Self-Descriptions are validated for identity, jurisdiction, and compliance. Compliance Service ensures conformity with Gaia-X rules before participation.
5.	Authorisation and Credentials Interoperable Presentation	Gaia-X Credential Format (W3C Verifiable Credentials), Federation Identity & Trust Services	Verifiable Credentials are presented in standard interoperable formats (W3C), validated through cryptographic signatures and schema conformance.
6.	Jurisdiction	Gaia-X Credential (Self-Descriptions), Gaia-X Compliance Service	Jurisdiction is declared in Verifiable Credentials using the Gaia-X Schema. During onboarding, these credentials are validated, and compliance is ensured by the Compliance Service.
7.	Data residency	Gaia-X Registry Service, Gaia-X Data Connectors	Service and Data Offerings must specify geographic data storage locations in their Self-Descriptions, validated through the Gaia-X Schema and Registry. Data flow is then enabled by Gaia-X compliant connectors.

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	44 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



8.	Access and Usage Policies enforcement	Policy Decision Point (PDP), Policy Enforcement Point (PEP), Gaia-X Data Connectors	Usage policies are expressed using ODRL, evaluated by the PDP based on credential claims, and enforced at runtime by the PEP and Data Connectors.
9.	Federated algorithms	Gaia-X Data Connectors, Federated Catalogue, Sovereign Data Exchange Services	Federated algorithms run locally on distributed data sources. Connectors facilitate computation without moving the data, preserving sovereignty.
10.	Data and services offering	Federated Catalogue	Services and data offerings are described using Self-Descriptions and published as Verifiable Credentials in the Gaia-X Federated Catalogue.
11.	Publication and discovery	Federated Catalogue, Gaia-X Registry Service	Participants publish their offerings in the Federated Catalogue using standard schemas, making them discoverable based on trusted metadata.
12.	Data Interoperability: semantic framework and semantic equivalence	Ontology Services, Gaia-X Schema Repository	Semantic models and controlled vocabularies are used to align meanings across domains.
13.	Business observability / audit	Usage Logging and Monitoring, Gaia-X Compliance Service	All interactions are validated, logged, and audited via Federation Services running on Gaia-X Digital Clearing Houses (GXDCHs) which serve as trusted nodes within federated ecosystems. Those enable enforcement of compliance and auditing rules ensuring visibility over business actions.
14.	Provenance and Traceability	Asset Credential Metadata, Usage Logs, Provenance Tracking within Data Connectors	Provenance is captured through credential metadata, data transaction logs, and usage policies. Data Connectors ensure traceability and policy-controlled data flows.
15.	Supported data models and formats	Gaia-X Schema	Supports RDF, JSON-LD, and SHACL to express data models in a machine-readable format within Verifiable Credentials. Ensures interoperability and machine-readability across participants.
16.	Metadata and	Vocabulary Services,	Uses SHACL shapes and RDF

Document name:	D2.1 ETDS Interoperability & Data Sharing	Page:	45 of 145
Reference:	D2.1	Dissemination:	PU
	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	vocabulary services	Gaia-X Schema	vocabularies to structure metadata and ensure semantic equivalence across data services.
17.	(Environment-agnostic) deployable components	Gaia-X Service Descriptions, Infrastructure Abstraction via Federation Services	Services are described and published in a standardized, infrastructure-independent format, allowing deployment in any compliant environment.
18.	Flexible data planes	Sovereign Data Exchange, Data Connectors, Federation-specific Extensions	Data connectors and federation services abstract the data transfer mechanisms, enabling dynamic and adaptable data flows between parties.
19.	Autonomous data services	Self-Descriptions, Usage Control	Data services include embedded policies and operate semi-independently through automated enforcement and reasoning systems (opt)
20.	Marketplace	Federated Catalogue, Marketplace Integration Layer	Catalogues support marketplace functionality by indexing services with pricing, policies, and trust information for discoverability.
21.	Marketplace-oriented data sharing negotiation	Policy Engine, Contract and Negotiation Services	Participants negotiate data usage terms with support from smart contracts, policy engines, and verifiable commitments.
22.	Billing and Payments	Federation Extensions, Third-party Payment Gateways, GXDCH	Usage data and contractual interactions enable calculation and triggering of payments, which may be supported by third-party integrations or processed through the Gaia-X Digital Clearing House (GXDC) for standardized, auditable clearing and settlement.
23.	Data intermediaries	Data Intermediary Roles, Trust Framework, Compliance and Usage Monitoring	Data intermediaries act as neutral brokers facilitating data exchange and ensuring compliance, validated by Trust Anchors and monitored through federation services.

Table 3 List of technical capabilities mapped to Gaia-X components

3.2.3SIMPL-Labs

This section focuses on the mapping of capabilities of SIMPL-Open and the ETDS. Through the mapping of SIMPL capabilities with the sectoral data space, the ETDS will integrate open-source software and will be enabled to use SIMPL-Labs to assess the level of interoperability with SIMPL deployments.

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	46 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



SIMPL-Open offers building blocks which have already been deployed by using specific technologies. Although these deployments do not necessarily be SIMPL-compliant, they prove to be generic technologies that are coherent to these building blocks and interoperable. Among these technologies, the GAIA-X Federated Services⁶² (XFSC), EDC Connector⁶³, the suite Elasticsearch, Logstash, and Kibana⁶⁴ (ELK), Keycloak⁶⁵, the Enterprise JavaBeans Certificate Authority⁶⁶ (EJBCA) software package, Spring Cloud Gateway⁶⁷, and Crossplane⁶⁸ in combination with ArgoCD⁶⁹. These current SIMPL-Open covers these components:

- Self-Description Creator
- Data Space Catalogue
- Signer Service
- Wallet
- Data Space Connector
- Infrastructure Provisioning
- Tier 1 Authentication Provider
- Certificate Authority
- Monitoring

SIMPL-Labs reuses Interoperability Test Bed⁷⁰ to generate a sandbox where experimenting within the data space ecosystem. The platform also enables the discovery of alternative SIMPL components that have been already tested and provides a mechanism to evaluate them as well as monitoring any data space in its early stage. For the experimentation purpose, a SIMPL-Open Proof of Concept⁷¹ was presented and some wizards⁷² are now available in GitLab. A Test Bed environment⁷³ to realise conformance tests is also available.

3.3 Use-case pilots

This section has the aim to provide a brief introduction to the use-case pilots, which are five diverse implementations from the consortium across Europe.

The high-overview of the pilots is to showcase varied destinations, offerings, data-sharing models, proving the viability of the data space in real-world scenarios and advancing the creation of the European Tourism Data Space.

3.3.1 Use case 1

- **Use case title:** Sustainable Tourism Management in Alpine Regions
- **Use case description:** It is aimed to leverage AI and data analytics to promote sustainable tourism towards building a resilient infrastructure in the Alpine regions since the reports point at significant challenges:

⁶² XFSC (migrated to the Eclipse Foundation): <https://gitlab.eclipse.org/eclipse/xfsc/>

⁶³ EDC Connector: <https://github.com/eclipse-edc/Connector>

⁶⁴ ELK: <https://www.elastic.co/elastic-stack/>

⁶⁵ Keycloak: <https://www.keycloak.org/downloads>

⁶⁶ EJBCA: <https://docs.keyfactor.com/ejbca/latest/>

⁶⁷ Spring: <https://docs.spring.io/spring-cloud-gateway/docs/current/reference/html/>

⁶⁸ Crossplane combined with ArgoCD: <https://docs.crossplane.io/latest/guides/crossplane-with-argo-cd/#:~:text=Argo%20CD%20provides%20GitOps%20while%20Crossplane%20turns%20any,This%20doc%20will%20help%20you%20understand%20these%20requirements.>

⁶⁹ ArgoCD: <https://argo-cd.readthedocs.io/en/stable/>

⁷⁰ TestBed: <https://interoperable-europe.ec.europa.eu/interoperable-europe/interoperability-test-bed>

⁷¹ SIMPL-Open PoC: <https://simpl-programme.ec.europa.eu/topic/simpl-stakeholder-workshop-slide-deck>

⁷² SIMPL wizards (Installation guide): <https://code.europa.eu/simpl/simpl-open/documentation/installation-guide>

⁷³ SIMPL-Labs: <https://code.europa.eu/simpl?filter=labs>

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	47 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final



- Overcrowding in natural areas and environmental impacts of tourism, stressing fragile ecosystems and lowering the touristic experiences.
- Climate change, which implies temperature raise and shifting weather patterns, affecting accessibility.
- Lack of tourist awareness about sustainable practices, which leads to harmful environmental behaviours.
- **Regions:** Austria-Slovenia

3.3.2 Use case 2

- **Use case title:** Resilience and Competitiveness in Mature Destinations
- **Use case description:** The principal aim is to create a sustainable tourism corridor, connecting Andalusia, the Canary Islands and the Balearic Islands in Spain, through data-driven strategies. In this case, there are some challenges that require to be attained:
 - The need to transform the tourism offerings in these mature destinations in order to conceive them as competitive, resilient as well as sustainable across socioeconomic and environmental dimensions.
 - Access and use to relevant data from Destination Management Organizations (DMOs) and tourism SMEs to improve decision-making and service-offerings.
 - Developing tailored, data-driven solutions that empower tourism SMEs, adopting sustainable practices in addition to delivering greater touristic experiences.
- **Regions:** Canary Islands, Andalusia and the Balearic Islands.

3.3.3 Use case 3

- **Use case title:** Supporting the MICE Industry
- **Use case description:** The MICE (Meetings, Incentives, Conferences and Exhibitions) Industry is evolving, prioritizing sustainable travel options and adopting new trends among business travellers. The aim for this use case is to generate a real-time data tool for MICE professionals that offers a personalised, AI-driven tool to meet the diverse and dynamic needs.

However, there are challenges associated to this pilot, which are as follow:

- Adapting to post-COVID market, prioritizing sustainable travel and accommodating the increasing trend of blending personal and business trips.
- Managing last-minute bookings as well as flexibility, a feature that specifically requires access to real-time, high-quality data.
- Meeting hyper-personalised client demands, in which MICE professionals provide diverse services that blend business activities with leisure or everyday needs.
- Responding to the increasing demand for sustainable travel options, assuring that Congress and Events organizers, agencies, hotels, concierges and DMOs have actionable insights tailored to MICE travellers.
- **Region:** France

3.3.4 Use case 4

- **Use case title:** Leveraging Cultural Heritage for Tourism Diversification
- **Use case description:** Ano Syros, located in Greece, is reliant on sun-and-sea tourism. The aim of the pilot is to diversify tourism by digitizing cultural heritage to create immersive experiences and enhance site accessibility. The critical challenges from this pilot are the following:
 - Seasonality limits sustainability, reducing the opportunities to year-round streams.

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	48 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



- Vulnerability to climate change, where weather patterns affect tourist preferences and accessibility.
- **Region:** Greece

3.3.5 Use case 5

- **Use case title:** Empowering SMEs in Tourism
- **Use case description:** Tourism SMEs in Lapland use complex data which limit their ability to optimize operations and improve customer satisfaction. Creating an ecosystem of intermediaries, SMEs are connected along with TravelTech providers and data-driven solutions, simplifying data access and innovation. Those data management challenges referenced previously are as follow:
 - Difficulty in dataset collection, processing and interpreting which limits informed decision-making as well as strategic planning.
 - Resources such as tech expertise are limited, impeding the complete leveraging of European Data Spaces.
 - A centralised platform is not present, which is not providing the curated, industry-specific applications, fostering innovation.
- **Region:** Finland

3.4 Results of the canvas analysis and requirements inference

This section aims to tackle the conclusions and main findings of the canvas analysis with regards to the final data product. The second subsection lists the conclusions of the analysis, and the second subsection compiles the requirements that were inferred from this analysis.

3.4.1 Interpretation of the canvas analysis

The process focuses on the completion and analysis of answers provided in each of the 25 questions addressed to each of the DPOs. The set of questions excludes the Data Product Governance and Business Model categories (leaving only questions from 1 to 12, and 21 to 25) due to a lack of available data. Responses to these questions, originally recorded by pilot, are transposed into this analysis (exemplified in Annex II).

After the transposing of answers into the document “Data Product Offering Analysis” (Annex III) in five fields: Data models, Metadata models, Schemas/Transfer models, Transfer protocol, and Additional software/services, the referenced standards and technologies are grouped, calculating their coverage percentage across the DPOs from pilots.

A deeper focus is done on semantic standards and service-related technologies. The extension of the analysis of the answers enables the Consortium to aggregate the list of related services and software solutions (e.g., protocols, platforms, tools) identified in the “Additional software” field and map each identified standard under a requirement. For every requirement, and based on the DPOs mapping with the DSSC building blocks, a list of generic requirements are provided grouped by one of the following technical components:

- Identity and Access Management
- Assets Management
- Policies and Contracts
- Publication and Discovery
- Data Quality

Where a standard/solution lacks associated requirements or is not linked to one of these technical components, this is flagged in the “Comments” field. Iteratively, all DPOs and service-related technologies will be covered in a bottom-up requirement approach.

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	49 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



3.4.2 Final data product-oriented analysis of the canvases

The scope of the current analysis is based on use case pilot 1, use case pilot 2 and use case pilot 4, which equals 60% of use case pilots. However, it is expected that the entirety of the use case pilots contribute to this canvas analysis in further iterations.

Collectively, 31 Data Product Offerings (DPOs) were found, and are distributed by 14 DPOs attributed to use case pilot 1, 5 DPOs use case pilot 2 and finally, 12 DPOs for use case pilot 4. Pilots 3 and 5 will be completed in future iterations.

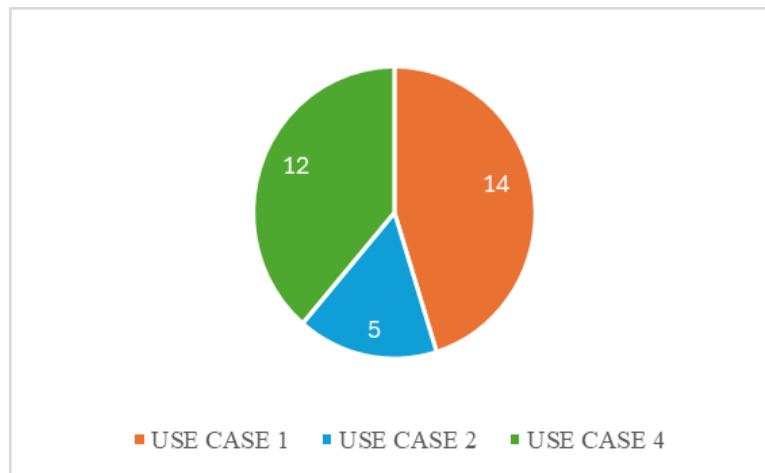


Figure 5 DPOs by Use case pilot

None of the 31 DPOs present personal data, which is significant in terms of both European and national legal regulations, as well as providing a solid foundation for data exchange and sovereignty. These results are noteworthy, since they stem from the nature of data from every DPO. Primarily, many of the DPOs extracted pertain to locations, itineraries, environmental indicators, which are inherently impersonal. However, in a few cases, there are data sets that include tourist profiles or customer preferences. Given the maturity level of the use case pilots, some of these data sets are anonymised.

Regarding standards and data models, the canvas analysis found the majority of the DPOs are not standardised, with a percentage of 58% to the total DPOs falling into this category. Nonetheless, certain semantic standards are found in this case, acknowledging the percentage is drastically differential. DATEX II v3.3⁷⁴ is at 3%, representing one DPO whereas GTFS⁷⁵ and EDM⁷⁶ share the percentage, which represents 2% of the total.

⁷⁴ DATEX II <https://docs.datex2.eu/v3.0/general/index.html>

⁷⁵ GTFS <https://gtfs.org/>

⁷⁶ Europeana Data Model (EDM) <https://pro.europeana.eu/page/edm-documentation>

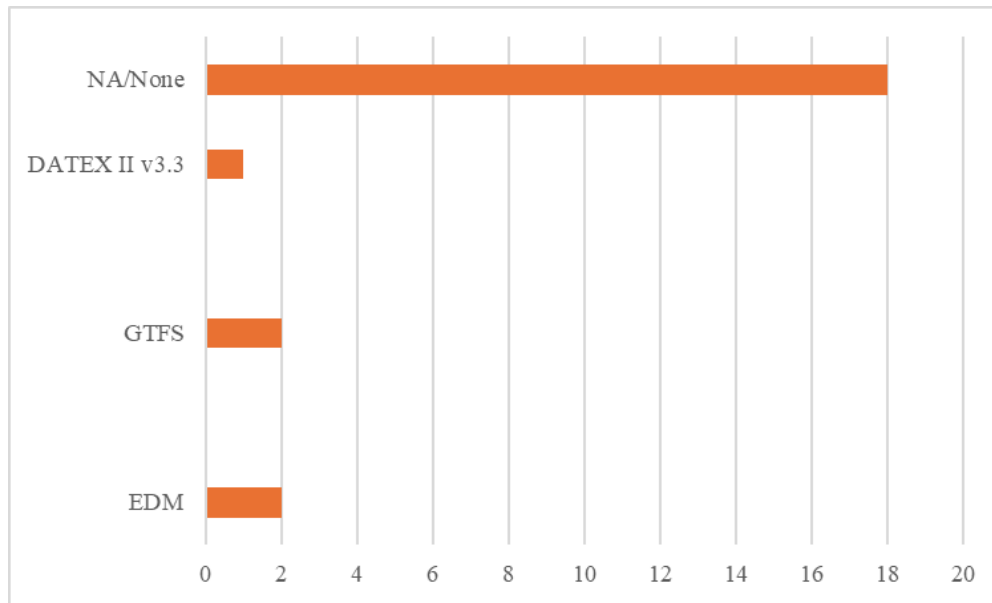


Figure 6 Data models in DPOs

Regarding metadata standards, the percentages for Not Applicable are increasing up to 26 points, being 84% of DPOs where metadata standards are not applied. However, the main finding is that DCAT-AP is present in up to 4 different DPOs, accounting for a solid 13%. On the other hand, Dublin Core and Schema.org represent 3% of metadata models present in the DPOs.

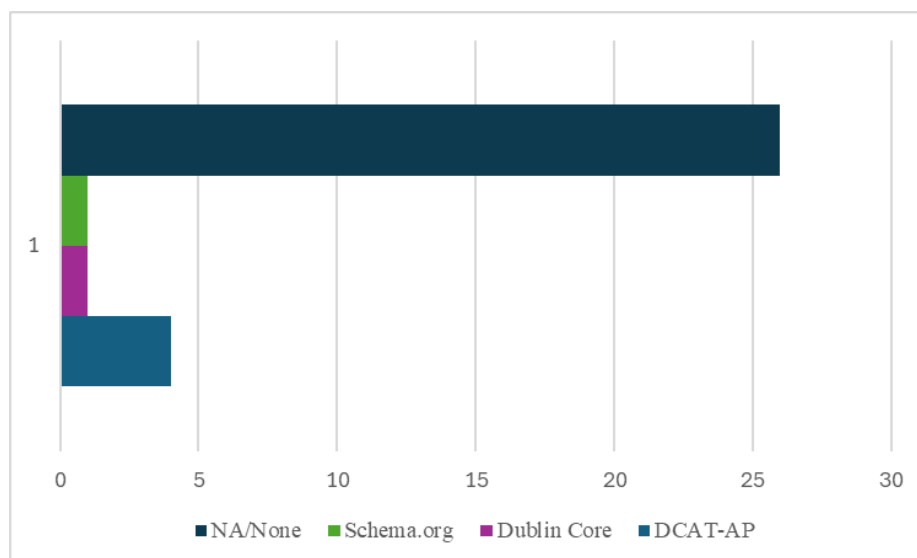


Figure 7 Metadata models in DPOs

Schemas and transfer models were included in the DPOs analysis as a whole given the similarities of the process. This resulted in 58% of DPOs not contemplating those standards. Nevertheless, JSON format is the most prevalent in the graph with a percentage of 13%. Tightly follow CSV and XLSX formats, both with a percentage of 10%. Eventually, NetCDF and DATEX II v3.3

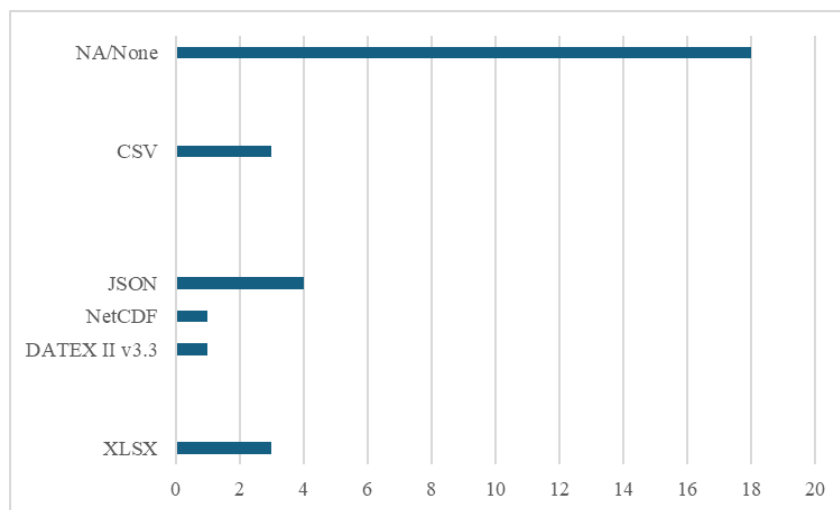


Figure 8 Schemas/Transfer models in DPOs

The final column examined in this analysis refers to additional software and services, in which the majority of DPOs are not supported by additional software or services, with a percentage of 94%. The only software found is Excel, representing 6% of the greater DPOs total.

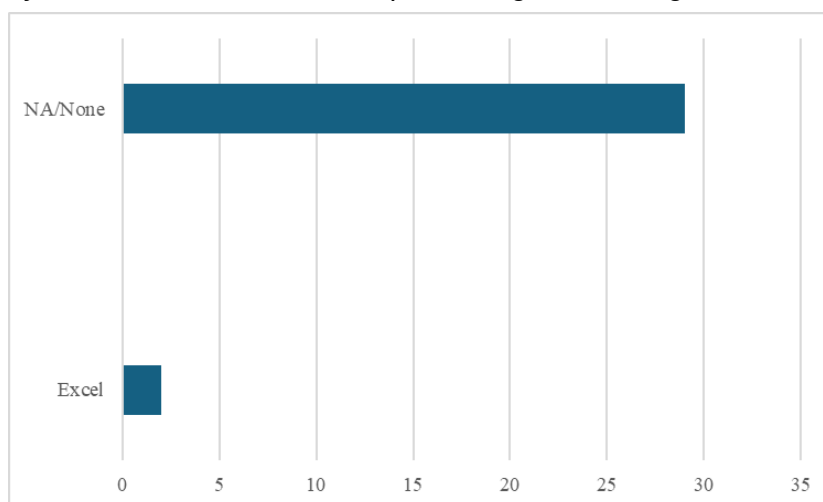


Figure 9 Additional software or services in DPOs

3.4.3 Requirements inference

As covered in section 3.4.1, Data Product Offerings (DPOs) are aligned alongside generic requirements proposed from section 5.2 onwards, which derive from DSSC building blocks. As a consequence, the fields curated for semantic solutions and related services highlight standards that shall be incorporated into the vocabulary services of the ETDS. This integration enhances the interoperability alongside connectors.

All the generic requirements that were matched to the canvas analysis can be found in Annex IV about the canvas analysis results.

3.4.3.1 Data models

The data models that shall be integrated in the ETDS vocabulary services, considering this approach as well as the canvas analysis result of the following:

- Europeana Data Model (EDM), described as the structured and representative data model in which diverse cultural heritage institutions such as libraries, archives and museums, contribute to the European interoperability framework.

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	52 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



It is of important relevance given the use case pilot 4, giving a deeper semantic description on the DPOs that cater cultural heritage.

- General Transit Feed Specification (GTFS) which is a standardized format for sharing public transportation schedules, routes, and geographic data. Which may be used for participants like Trenitalia, in use case pilot 1.

3.4.3.2 Metadata models

Given the canvas analysis, data assets and offerings should be discoverable and comprehensible across systems. For this aim, requirements on the use of standardised metadata schemas are paramount. The metadata standards identified through the DPOs analysis are already mapped to DCAT-AP⁷⁷.

3.4.3.3 Schemas/Transfer models

In this case, one schema or transfer model appears to not be mapped to general requirements through the DPOs analysis. It is precisely Network Common Data Form (NetCDF), which refers to a set of software libraries and machine-independent data formats that support the creation, access and sharing of array scientific data, being a standard for the scientific community. It shall be of great use in the case of data exchange.

Besides, the identification of participants and of data product offerings implies the use of ways of digital identity standardisation (i.e., DID) and the implementation of the Verifiable Credentials schema to facilitate the secure mechanisms between parties in the data space. These standards provide these capabilities through a machine-readable format, notably for the implementation of self-descriptions (e.g., critical metadata about the participant's function, ownership and access terms).

3.4.3.4 Additional software

Regarding the additional software, Microsoft Excel is identified in this field, as could not be mapped to general requirements. It shall be considered to further interoperability given that it may have a greater impact on additional DPOs.

It is relevant to note that the interoperability of self-descriptions for data products and software (or platforms) should facilitate the usage of control policies, control access mechanisms and provenance, all in all in an automated and enforced manner. This software should receive a means to define and assess data quality and to build trust in the value of the shared data.

⁷⁷DCAT Application Profile for data portals in Europe <https://op.europa.eu/es/web/eu-vocabularies/dcat-ap>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	53 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



4 Analysis of Data Products and Data Models

The primary objective of data spaces is to extract value from data, where data sharing serves as a crucial enabler rather than an end goal. To maximize the potential of data spaces, the canvas analysis highlighted that it will be essential to standardise and structure data to ensure interoperability across different systems.

This section complements the results of the canvas analysis and will focus on the implementation of an iterative approach to adapt or enrich data models to future pilots and needs. In line with the implementation of data products, another key component of this section will be approaching an efficient and operational way to commonly describe data products' catalogs. This is determinant to decide whether to develop a tourism-specific ontology or to adopt a broadly-used data model in this sector.

Finally, a prescription for data space participants has been created based on the European tourism sector development objectives, the experience of existing initiatives, and the analysis of the state of the sector from the blueprint created by the DATES and DSFT preparatory projects.

4.1 Tourism data sharing initiatives

The potential of tourism data has led various regions and institutions to invest in the digitalisation of information and the development of data exchange platforms. The way data is stored is the main difference between the initiatives active in Europe, where few venture into the technical and organisational complexity of a data space. Data lakes and databases are the basis of the most notable tourism data collection projects in terms of maturity.

4.1.1 Datahub.tirol

Datahub.tirol⁷⁸ is a data exchange platform created within the framework of initiatives for the digitalisation of the Austrian region of Tyrol. Born in 2022, this is the first regional data space that follows the requirements of the European strategy for data. Data sovereignty, decentralisation, interregional interoperability and data protection are the core of the project, which aims to encourage cross-industry cooperation and to enhance the data sets generated by Tyrol companies, research institutions and public entities.

The use cases of the project focus on tourism, environmental sustainability and smart communities. MountResilience gathers remote sensing data obtained by drones and earth-based laser scanners for the intelligent evaluation of the region. The data products of this use case employ open data⁷⁹ from the Tyrol government, which shares datasets and maps describing hydrography, land use, buildings, environmental monitoring... Winter sports tourism is the field of other pilots. Wintersafe⁸⁰ is the database provider of accident descriptions to create products that, checked against weather conditions, snow quality and density of people, produce safety recommendations.

The remaining use cases focus on e-mobility, through data from electrical charging stations in Austria, Italy and Bavaria; the efficiency of the heating supply in the Inn Valle, and the digitalisation of Lienz municipalities to evolve to a smart region.

⁷⁸ Datahub.tirol: <https://www.datahub.tirol/ueber-datahubtirol>

⁷⁹ Open Government Data - Tirol/tiris: <https://data-tiris.opendata.arcgis.com/>

⁸⁰ Wintersafe: <https://www.winter-safe.at/en/wintersafe-en/>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	54 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



4.1.2 Austria Tourism Data Space

The Austrian Tourism Data Space⁸¹ is a national initiative with a strong focus on enhancing interoperability and driving innovation within Austria's tourism sector. This data space initiative is designed in alignment with both the IDSA and the Gaia-X Federated X (Split) Model to support secure, sovereign, and interoperable data sharing. They implement an IDS RAM-like architecture to manage the technical aspects of the data exchange. A key element of this setup is the Eclipse Dataspace Connector (EDC) provided by Nexyo (an Austrian IT company), which facilitates secure data sharing and consumption, while also enforcing usage policies and ensuring traceability. By aligning with X split model of the Gaia-X, the data space further promotes technical compliance and fosters trust at the ecosystem level, while preserving data sovereignty for all participating actors.

Within this framework, Austria Tourism (Austria's national tourism organisation) plays a pivotal role acting as a Trust Anchor and Governance figure, ensuring the data space operates according to Gaia-X principles. (See Figure 10)

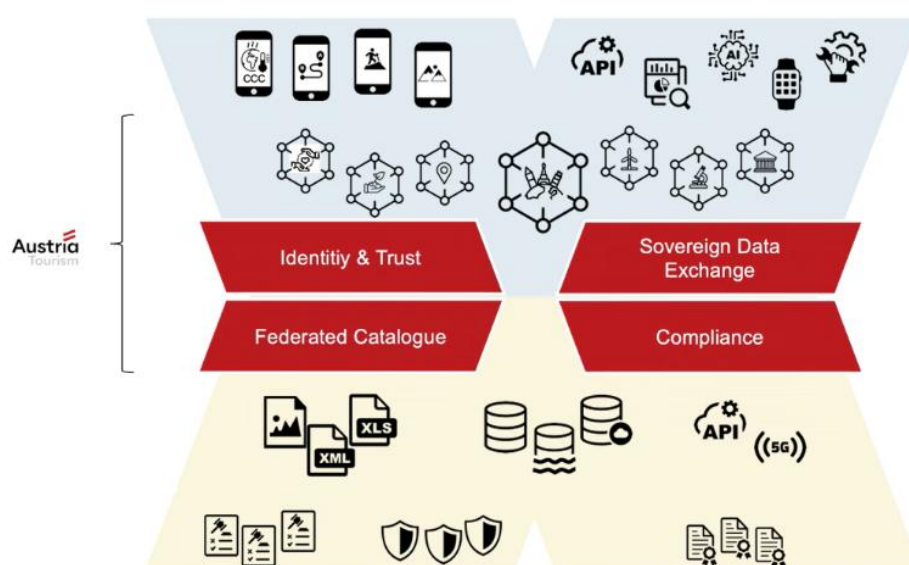


Figure 10 Austrian Tourism operating according to Gaia-X principles

Similarly to the European landscape, the Austrian tourism sector is largely made up of SMEs with basic or limited technical expertise. To address this, the data space is designed as a B2B solution with a major motivation of creating SIMPLE, intuitive tools that lower entry barriers and actively encourage data sharing across the sector. Although this data space is intended to connect a wide range of businesses, stakeholders, and actors within the tourism sector, it is currently made up primarily of federal states' tourism organisations in its early stage of implementation (9 hubs in the federal states and one for Austria Tourism were implemented).

The onboarding process concludes with the creation of a dedicated DataHub (SaaS) for each participant in the data space. This hub serves as the participant's interface to the ecosystem. For data providers, it is where data assets and usage policies are defined and managed. For data consumers, once a data offer is accepted, the resulting contractual agreements and access terms are stored and enforced. The identity of participants is ensured through the use of Decentralised Identifiers (DIDs) to foster compatibility, and each participant's DataHub

⁸¹ <https://www.tourism-dataspace.com/en>

Document name:	D2.1 ETDS Interoperability & Data Sharing	Page:	55 of 145
Reference:	D2.1	Dissemination:	PU
Version:	1.0	Status:	Final



manages the decentralised identity of the organisation which is part of. This setup ensures clarity, traceability, and full control over data sharing and usage within the trusted environment.

Most of the data shared by these organisations adhere to open data principles and, only in some cases, include additional defined access and usage policies. These policies are defined based on the ODRL model, in alignment with the standards established by the W3C. Access to the data is governed through an Attribute-Based Access Control (ABAC) mechanism. Sensitive data have not yet been shared within the data space, not due to technical limitations, but because there is no clear consensus on how to meet the legal and contractual obligations among the participant parties. This framework aims to provide full access control to the participants, so they can share only the desired data and nothing in addition. For those who wish to share highly sensitive data, vector embeddings, etc. it is foreseen that anonymisation, and/or any required pre-processing will take place on the data provider's own infrastructure and will be offered to the data space in the same way as any other data asset.

Looking ahead, the goal is to implement a fully decentralised, federated catalogue. This setup is shaped by the current maturity level of related EDC components, which limit immediate realisation. In parallel, the roadmap includes developing a marketplace and billing capabilities, alongside the integration of more advanced identity management standards, such as Verifiable Credentials (VCs), EU digital wallets, and full compliance with decentralised identity claims protocols. Additionally, the team is closely following the evolution of the SIMPL framework and remains open to a potential migration if requested by its customers.

4.1.3 Cultural Heritage

This section aims to introduce the infrastructure underlying the Europeana platform⁸², as well as the future basic architectures of the Cultural Heritage Data Space and the European Collaborative Cloud for Cultural Heritage (ECCCH) and their mapping.

The Europeana Platform is the European Union's leading digital platform for cultural heritage, designed to support the digital transformation of the cultural sector across Europe. It aggregates and provides access to millions of cultural heritage items from museums, libraries, archives, and galleries, enabling users to explore, access, and reuse a vast amount of digitised cultural content.

It operates on a **centralised** aggregation model, where metadata from cultural institutions flows through trusted intermediaries, referred as aggregators, into a centrally managed infrastructure. These aggregators ensure high data quality, legal compliance, and metadata standardisation.

The key layers of the platform, depicted in Figure 11, are:

- Europeana Portal. The public-facing platform where users can search and explore cultural heritage collections which are available through the platform. Each item includes metadata and links to the actual digital content, typically hosted on the provider's own site, and often some low-resolution representation or preview of the actual content. Access and usage policies are also provided for each asset, ensuring secure and compliant data sharing.
- Europeana APIs. A suite of programmatic interfaces that provide access to structured cultural metadata and content. They allow both Europeana Portal and external applications to query, retrieve, and reuse metadata from Europeana's central repository.

⁸² <https://pro.europeana.eu/page/common-european-data-space-for-cultural-heritage>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	56 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



- Indexing and storage Layer, including such components.
- Europeana Pro complements the public portal by serving as the professional interface of the platform. It offers a comprehensive knowledge base for cultural heritage professionals, including documentation, standards, guidelines, case studies, and updates on policy and funding opportunities.
- Aggregation includes components from METIS, Europeana's metadata ingestion system, responsible for the ingestion and processing of metadata. METIS validates incoming metadata submissions, enriches them through services like multilingual label generation and linked data entity recognition, and publishes them in line with Europeana's quality standards. This system is essential for ensuring that the data shared through Europeana is clean, consistent, and ready for discovery and reuse.

Additionally, the Europeana Data Model (EDM) is the semantic framework that ensures metadata is standardised and interoperable across institutions. It provides an RDF-based framework for describing cultural heritage objects and their contextual relationships. EDM enables rich, interoperable metadata by capturing information about the object itself, its digital representations, its creators, subjects, associated places, and much more. The model supports multilingualism, linked open data principles, and aligns with major cultural heritage standards like Dublin Core, LIDO, and CIDOC CRM.

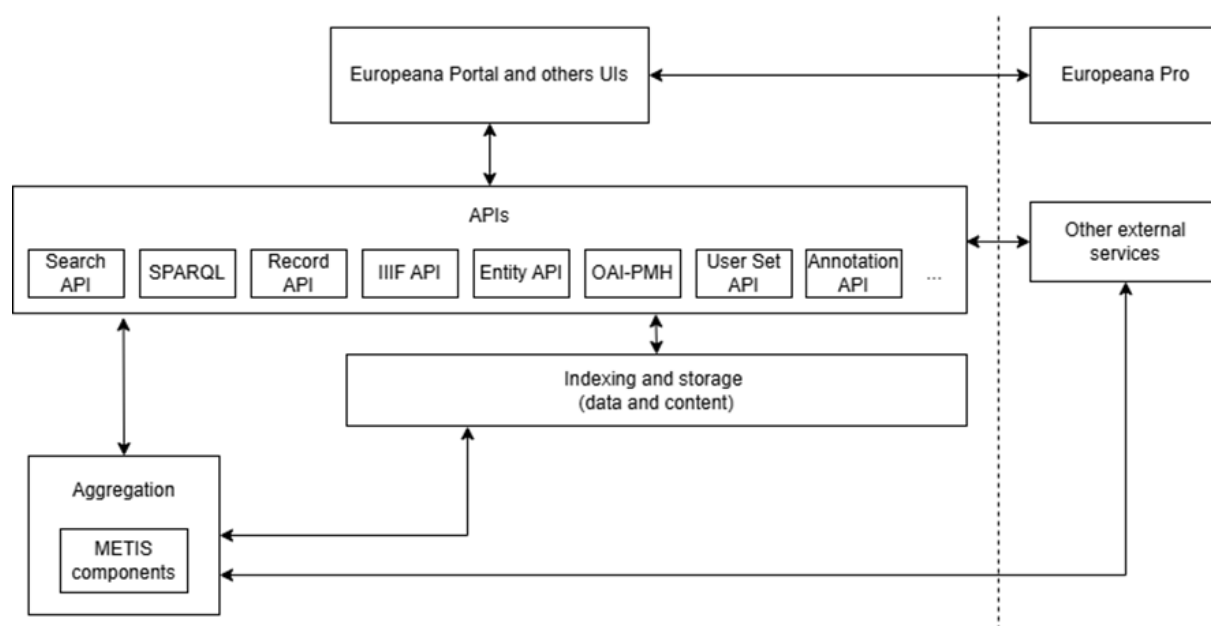


Figure 11 Key layers from Europeana Platform

Regarding asset publication, Europeana follows a centralised process where cultural institutions, mostly via the aggregators, submit metadata about their digital objects. Once validated and ingested through Europeana's Metis system, these records are made accessible through standardised APIs, allowing third-party systems to query, filter, and reuse cultural heritage metadata at scale. Unlike federated data spaces, where metadata remains distributed and is accessed via decentralised, peer-to-peer API frameworks, Europeana aggregates and indexes the data centrally, offering a unified and optimised API layer.

While the metadata flow is centralised, the federated aspect is supported by the distribution of the actual content, which resides in the data providers' own repositories. Most of the organisations participating in this initiative adhere to open data principles as Europeana

Document name:	D2.1 ETDS Interoperability & Data Sharing	Page:	57 of 145
Reference:	D2.1	Dissemination:	PU
	Version:	1.0	Status:

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



initiative strongly encourages to share the data as openly as possible to boost the reuse of digitalised cultural data. For the possible few that do not, efforts have been made to avoid the inclusion of overly complex mechanisms for data acquisition or related negotiations.

Usage policies are translated into standardised rights statements, machine-readable declarations that indicate the copyright status of a digital object and clarify whether, and under what conditions, it can be reused. These statements, provided by the content owners, accompany each digital asset and serve as both legal and technical indicators to help users understand how the content may be reused. However, the actual enforcement of access and usage policies is the responsibility of the content providers themselves, carried out through their own legal terms and technical measures. While rights statements are essential for ensuring transparency and enabling content filtering, it is ultimately up to each provider to implement and enforce the appropriate policies. Each data provider retains full control over access to their digital assets.

Following that, the Common European Data Space for Cultural Heritage builds on the existing functionalities and services of the Europeana Platform, which already provides access to millions of digitised cultural heritage items from across Europe. As mentioned, the platform offers mature tools for metadata ingestion, semantic enrichment, multilingual discovery, and API-based reuse. Their goal is to move away from the centralised Europeana approach and implement and provide access to these additional services in a decentralised manner.

This data space initiative aims to expand the functionalities of the existing infrastructure to increase the availability, quality, and interoperability of cultural heritage data, with a special focus on 3D content, open licensing, and reuse in education, tourism, research, and creative sectors. Major efforts are being invested in identifying and implementing additional data services that may be of use within the cultural heritage domain as well as improving the quality and availability of cultural data, by investing in data annotation and enrichment services with a focus on completeness, semantic enrichment and multilingualism.

To summarize, while several principles of the CHDS, such as data sovereignty and metadata interoperability, are aligned with the IDSA framework, the initiative does not fully adhere to it. IDSA, along with initiatives like Gaia-X, promotes a decentralised, federated approach to data sharing, where both data and metadata remain distributed and are accessed through secure and transparent peer-to-peer mechanisms. In contrast, this initiative lacks a basic data catalogue (e.g., DCAT), opting instead for built-in functionalities that allow direct interaction with the data content. It adopts a centralised aggregation model for metadata, which is stored and accessed via a central infrastructure. Furthermore, the absence of essential components such as connectors, identity and trust services, and usage control mechanisms highlights a significant departure from IDSA-like architectures.

Finally, The European Collaborative Cloud for Cultural Heritage (ECCCH) is a Horizon Europe initiative running from June 2024 to May 2029, designed to create a digital, collaborative working space for cultural heritage professionals and researchers. The ECHOES project⁸³ is responsible for building the core infrastructure, governance model, and virtual environment that will form the backbone of the ECCCH. Anchored in Open Science principles, ECHOES will enable the secure flow of data between the Cultural Heritage Data Space and the Cloud, promoting reuse and the creation of semantically rich Digital Commons. Projects funded under ECCCH-related calls are expected to integrate with ECHOES by implementing modular, API-accessible services and aligning their data models with the platform's evolving architecture. Interoperability with common data formats (e.g., RDF), open metadata models, and open-

⁸³ <https://www.echoes-eccch.eu/>

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	58 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final



access APIs is essential, and detailed integration guidelines will be provided by ECHOES. Funded projects must dedicate resources to ensure technical compatibility, flexible design, and effective collaboration within the ECCCH ecosystem.

4.1.4 Google Places

The Google Places API⁸⁴ is a widely adopted digital infrastructure developed by Google that provides detailed information about places, including tourist-related points of interest (POIs) such as hotels, restaurants, museums, landmarks, and attractions. Although not formally structured as a European data space, it serves as a central data hub used by numerous travel and tourism applications globally. The project is fully operational worldwide, and Google maintains extensive technical documentation and frequent updates.

Data is collected from user contributions (e.g., reviews, photos) and business owners. It includes geographic and descriptive information about a wide range of tourism-related locations and services.

Data is accessible through a RESTful API and the responses are in JSON format. The metadata include structured fields such as name, geometry, opening_hours, types, rating, and photos.

Google Places provides Tourism-specific data products, such as:

- Real-time availability of POIs for trip planning apps and tourism portals.
- Integration with mapping services (e.g., Google Maps).
- Enriched experiences via user-generated reviews and media content.

4.1.5 European Group on Museum Statistics

The European Group on Museum Statistics (EGMUS⁸⁵) is an institutional group established in 2002 that collects, harmonises, and disseminates statistical data on museums across Europe. Currently, the network comprises 30 European countries, including both EU Member States and associated countries, giving the initiative a pan-European scope with a strong transnational dimension.

EGMUS is a database defined around twenty structured indicators that cover fields such as number of museums, visitors, staff, and educational activities. The Abbreviated List of Key Museum Indicators (ALOKMI) compiles data from national surveys and official registers, forming a robust comparative analysis of the European museum sector.

The harmonised data provided by EGMUS is particularly valuable in the field of cultural tourism, offering quantitative indicators on both the supply and demand of services offered by museums. These datasets offer a better understanding of the cultural mobility to design heritage-based tourism products and evaluate trends.

⁸⁴ Google Places: <https://developers.google.com/maps/documentation/places/web-service/overview>

⁸⁵ EGMUS: <https://www.egmus.eu>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	59 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



EGMUS

European Group on Museum Statistics

Country Ireland

Year

Show selected

[back to mainpage](#)
[export as CSV](#)
[print](#)

Country				Austria	Belarus	Belgium	Bosnia and Herzegovina	Bulgaria	Croatia
Year				2021	2009	2004	2015	2017	2014
Definition	Working group definition	1a		X	X				
	National criteria	1b					X	X	X ¹⁷¹⁾
Number of museums according to type of collection	total	2a		510 ⁹⁵⁾	155	162	35	191	284 ¹⁷²⁾
	of which	2b	Art, archaeology and history museums	168	136	192	19	140	114 ¹⁷³⁾
		2c	Science and technology museums, ethnology museums	60	12	58		16	61
		2d	Other museums	282	7	56	16	35	109 ¹⁷³⁾
Ownership	state-owned museums	3a	Total	31	13	8 ¹⁰⁶⁾		25	33 ¹⁷⁴⁾
	local-, regional-owned museums	3b	Total	225	137	74	31	162	167 ¹⁷⁵⁾
	other public-owned museums	3c	Total	5	5	6		4	83 ¹⁷⁵⁾
	private-owned museums	3d	Total	249		47	4		1 ¹⁷⁵⁾

Figure 12 EGMUS's data table

The most relevant indicators of the dataset⁸⁶ for the tourism sector include:

- Total number of museum visits, which helps to detect increases and decreases in visitors and assess the cultural attractiveness of specific regions.
- Percentage of foreign visitors, which supports the estimation of international tourism's impact on museum infrastructure and reports cross-border cultural marketing strategies.
- Frequency of temporary exhibitions and number of visitors to these events, useful for scheduling cultural events aligned with peak tourism seasons.
- Geographic location and territorial distribution of museums, which can be integrated into thematic maps or cultural routes developed through regional policies or tourism operators.
- Digital presence of museums (dedicated websites, online catalogues, social media), a factor that is increasingly important for attracting international visitors and enhancing pre- and post-visit engagement.

Although EGMUS does not produce complex analytical outputs (such as interactive visualisations or dashboards), it provides a highly structured database that serves as a solid foundation for the development of customised tools for analysis, visualisation, or benchmarking. The main data products, which datasets are not updated regularly, include harmonised data tables, national reports and country profiles, that aggregate information about museums, visitors, budgets, and human resources per country.

EGMUS offers its open datasets in highly reusable data formats: CSV (Comma-Separated Values) and XLS/XLSX (Microsoft Excel). And the metadata used to ensure consistent interpretation and minimize ambiguity include key concepts such as "officially recognized museum," "free visit", or "paid staff".

4.1.6 UiTwisselingsplatform (UIP)

UiTwisselingsplatform⁸⁷ (UIP) is an initiative led by the Department of Culture, Youth and Media of Flanders that enables DMOs and service providers to share information about events,

⁸⁶ EGMUS dataset: https://www.egmus.eu/nc/en/statistics/complete_data/

⁸⁷ UiTwisselingsplatform: <https://data-product-management.uitwisselingsplatform.be/>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	60 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final

venues, and attractions. Its primary objective is to drive innovation and generate insights that encourage participation in leisure and cultural activities across the region. Destinations like Friesland, Zeeland, and Limburg participate in the ecosystem.

The platform (Figure 13) provides local administrations and cultural organisations with useful analytical tools, accelerates the development of innovative services and enables cultural institutions to better understand their audiences and adapt their offerings to meet the evolving needs of the community.

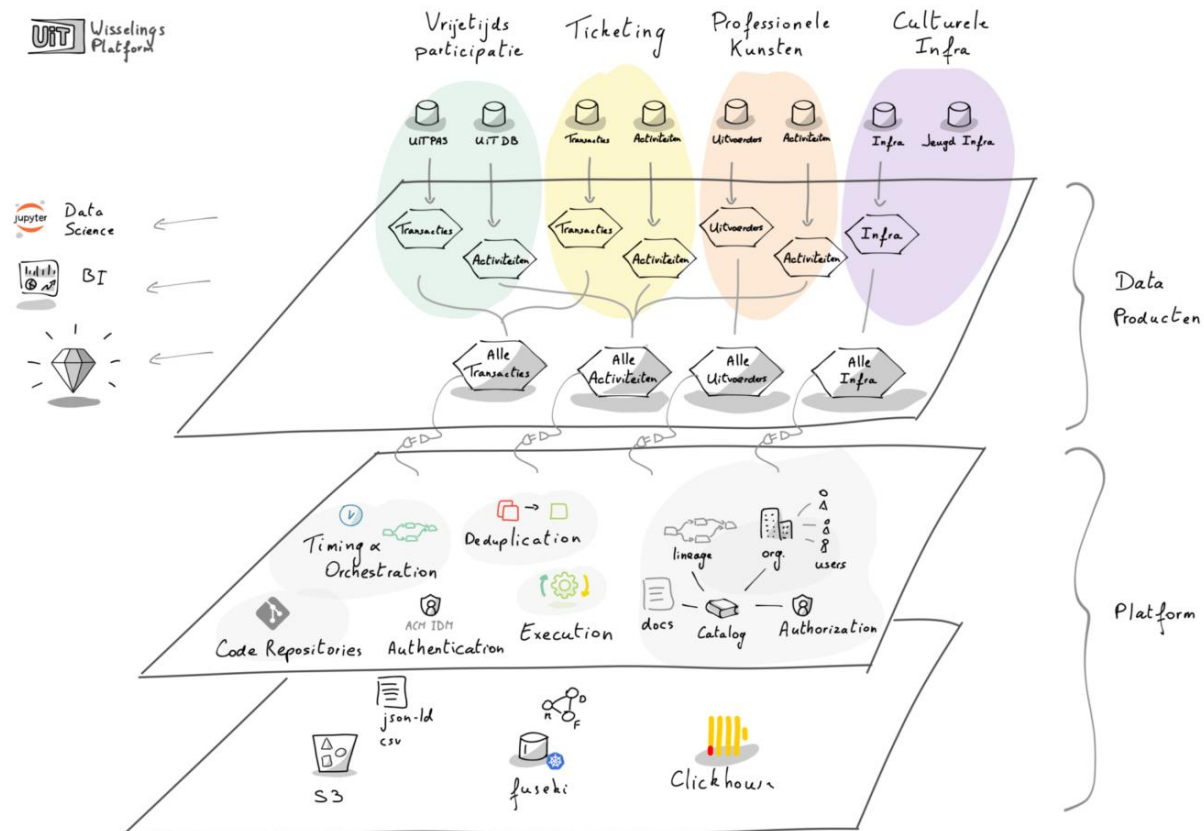


Figure 13 UiTwisselingsplatform high level architecture (publiq.be⁸⁸)

UiTwisselingsplatform integrates⁸⁹ various data sources that can be particularly valuable for the tourism sector in Flanders. Although the platform focuses on the cultural domain, the information enriches the tourism offer and enhances the visitor experience. Some of the most relevant data sources include:

- Cultural event information: Details about concerts, exhibitions, festivals, and other cultural activities that may attract both residents and tourists.
- Location data of cultural institutions: Geographical information about museums, theatres, galleries, and other cultural venues, enabling the creation of thematic tourist routes.

⁸⁸ Publiq.be: <https://www.publiq.be/nl/inzichten-en-praktijk/het-uitwisselingsplatform-van-dichterbij-bekeken>

⁸⁹ The Common Data Exchange Platform: <https://www.tnmnlab.com/wp-content/uploads/2025/03/20240429-Data-Alliance-Forum-UiTwisselingsplatform-Flanders-2.pdf>

Document name:	D2.1 ETDS Interoperability & Data Sharing	Page:	61 of 145
Reference:	D2.1 Dissemination: PU	Version:	1.0
		Status:	Final



- Participation statistics: Data on attendance at events and visits to cultural institutions, useful for analysing trends and planning tourism marketing strategies.
- Intangible heritage information: Data related to traditions, festivals, and other cultural expressions that are part of the local identity and may be of interest to visitors.

The platform complies with semantic models such as schema.org and Open Culture Data. In order to allow a smooth data transfer, it is necessary that the data is arranged in a structured and uniform way in an XML file. The metadata uses DCAT vocabulary.

UIP provides APIs for data ingestion and distribution across digital channels. JSON is the main format used for the platform's data products, although some datasets can also be exported to CSV. The system also provides tools to manage product versions, ensure data updates, and track changes—an essential feature in data-intensive environments.

4.2 Public administrations' initiatives



Figure 14 Benefits of open government data initiatives (data.europa.eu)

4.2.1 Spain

The Spanish government launched the Aporta⁹⁰ initiative in 2009 seeking to promote the openness and reuse of public information to develop advanced data-based services.

The data catalog is available through an API. The paths of the GET requests are the endpoints that expose the information, with URIs corresponding to the primary sectors taxonomies, geographic coverage, publishers, distribution, and themes. The queries offer information in different formats, including CSV, XML, JSON, HTML, and TSV.

A major national effort is underway to create a tourism data space aligned with European digital principles and the vision of interoperable, secure, and sovereign data ecosystems. This initiative is being driven by **SEGITUR** (State Society for the Management of Innovation and Tourism Technologies), under the Ministry of Industry and Tourism, through the development

⁹⁰ Aporta: <https://datos.gob.es/es/>

Document name:	D2.1 ETDS Interoperability & Data Sharing	Page:	62 of 145
Reference:	D2.1	Dissemination:	PU
Version:	1.0	Status:	Final



of two key platforms: the **Plataforma de Innovación Abierta (PIA)**⁹¹ and the **Plataforma Inteligente de Destinos (PID)**.

The **PIA** (Open Innovation Platform) is conceived as the core framework for Spain's national tourism data space. It aims to foster collaboration, experimentation, and innovation by facilitating data sharing among public administrations, tourism businesses, technology providers, and research institutions. The PIA includes three main components: a **sectoral data space**, a **sandbox environment** for testing innovative solutions, and a **digital marketplace** for tourism-related services and technologies. This setup not only encourages the development of new digital tools but also ensures that these tools can operate in a real data-driven context, respecting privacy, interoperability, and sovereignty standards.

The **sectoral data space** within the PIA is particularly significant, as it enables the voluntary and secure sharing of structured and unstructured tourism data. The types of data that may be included in this environment range widely and offer considerable potential to improve tourism planning, management, and innovation. Examples of such data include:

- **Accommodation and hospitality data**, such as availability, pricing, booking trends, and occupancy rates.
- **Visitor mobility and flows**, derived from transportation services, mobile network operators, or smart city infrastructure.
- **Cultural and natural assets information**, including points of interest, opening hours, accessibility features, and conservation status.
- **Tourist satisfaction and feedback**, through aggregated data from social media, surveys, and review platforms.
- **Sustainability indicators**, such as energy consumption, waste generation, water usage, and carbon footprint in tourist destinations.
- **Public infrastructure and events**, including schedules of local events, guided tours, festivals, and infrastructure usage data.
- **Weather, environmental, and safety data**, which can support real-time decision-making, improve visitor experience, and risk management.

Complementing the PIA, the **PID** (Smart Destinations Platform) provides the technological infrastructure necessary to interconnect data sources at the local, regional, and national levels. It acts as a hub that integrates data from multiple destinations and tourism operators, enabling real-time data flows, standardisation, and orchestration of services. The PID is designed to improve destination management, enhance the tourist experience, and support public decision-making by enabling more efficient and sustainable tourism policies.

Together, the PIA and PID represent one of the most advanced national efforts in Europe to materialize a functional tourism data space. Their architecture not only aligns with the foundational principles of European data spaces—such as data sovereignty, interoperability, and trust—but also demonstrates a scalable model for how sector-specific data spaces can evolve from existing digital infrastructures and governance frameworks. Spain's approach

⁹¹PIA: <https://www.segittur.es/plataforma-inteligente/proyectos-plataforma-inteligente/espacio-de-datos-de-turismo/>

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	63 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



could serve as a reference for other Member States seeking to develop smart and resilient data ecosystems in the tourism sector.

4.2.2 France

The open platform for French public⁹² data seeks to simplify the access, strengthen transparency and improve public data. The catalog includes more than sixty thousand datasets and five thousand organisations.

The platform website collects information from the available datasets and redirects to the APIs of the organisations participating in the initiative. Between the organisations sharing data becomes relevant for the ETDS the ministries of economy, ecological transition, and culture, including open and restricted access data.

France has a specific initiative for sharing data related to the tourism sector, DATAtourisme⁹³. The National Federation of Institutional Tourism Organizations backs the national OpenData platform that gathers information from tourist offices, Departmental Agencies and Regional Tourism Committees. The heterogeneity of the ecosystem of data warehouses is the main obstacle of the project, that not only faces the geographical organisation, but also the multitude of format, technologies, collection methods and dissemination policies.

4.2.3 Italy

The Agency for Digital Italy⁹⁴ is in charge of the open data of the public administration. Data is available through an API and a SPARQL client and in multiple formats, including XLS, JSON, CSV, PDF, ZIP, PNG,. Environment, population, and transport are some of the categories to build tourism data products.

4.2.4 Germany

The Data Portal for Germany⁹⁵ aims to convert administrative data into transparent, open, and freely usable. The website allows users to navigate through metadata of 136k datasets, including 6k high value datasets, and redirects to the endpoints that expose them.

4.3 DATES and DSFT conclusions

The preliminary framework of the tourism ecosystem in Europe has been established through the research and analysis work carried out in the DATES⁹⁶ and DSFT⁹⁷ projects. The conclusions, collected in *Blueprint and Roadmap for Deploying the European Tourism Data Space*⁹⁸, define the starting point of Deploytour to establish the phases of development of the project in accordance with the particularities of the tourism sector.

⁹² Open Platform for French Public Data: <https://www.data.gouv.fr/en/>

⁹³ DATAtourisme: <https://www.datatourisme.fr/>

⁹⁴ Agenzia per l'Italia Digitale: <https://www.dati.gov.it/>

⁹⁵ GovData: <https://www.govdata.de/>

⁹⁶ DATES: <https://www.tourismdataspace-csa.eu/>

⁹⁷ DSFT: <https://www.dsft.modul.ac.at>

⁹⁸ Blueprint and Roadmap for Deploying the European Tourism Data Space: https://www.tourismdataspace-csa.eu/wp-content/uploads/2024/01/DRAFT-BLUEPRINT-Tourism-Data-Space-v3.3_final.pdf

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	64 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final



The main objective of the European Data Strategy is to enhance a European single market for data across key sectors of the EU's economy. Tourism, as one of them, will benefit the data space ecosystem through the use of the exchanged information to improve the competitiveness of the sector and align its growth with the obligations of the European Green Deal. Therefore, the benefits of the ETDS will impact the European economy, the environmental policies of the area, the digitalisation of the tourism sector and the European data market.

To achieve these ambitious challenges, it is necessary to start from the current picture of the European tourism sector. The conclusions of the preparatory projects allow us to establish its characteristics and singularities.

- Climate change:
 - Tourism is responsible for 8% global carbon emissions.
- Economy:
 - Tourism is a very fragmented sector, 99% of companies are SMEs.
- Digitalisation:
 - Most workers in the tourism sector do not have a technical background.
 - Data sharing security and legal implications are the main concerns of the potential participants, showing uncertainty and distrust towards using, accessing, and sharing data.
- Data
 - 92.1% of the data have publication lag.
 - 18.4% of the data are in remotely accessible format.
 - The most necessary data are provided by hotel and catering industries, public authorities, and private organisations.
 - The stakeholders most interested in retrieving data from the ETDS are public authorities, tourism service providers and DMOs (destination marketing organisation).
 - In the current EU Data Sharing Landscape: economic data is 77.3% economic data and social impact data is 22.3%.
 - Existing data sharing initiatives' partnership schemes are based on associations of SMEs and DMOs, non-profit associations and research consortia.
 -

Based on this representation of the tourism sector, the active data sharing initiatives, and the information available for consumption, these are the challenges of the ETDS:

- Climate change:
 - The ETDS will promote the incorporation of environmental data to create data products that support the European Green Deal. These data can come from sources within the data space itself or from federation with other European Sectoral data spaces.
 - The information collected should allow creating data products that reduce the rising tendency of the global carbon emissions of the tourism sector.
 - The ETDS should facilitate the sustainable management of destinations.
- Economy
 - The new data-driven products will foster the creation of new highly specialised job profiles in the tourism sector.
- Digitalisation:
 - The ETDS should support the digitalisation of the tourism sector.

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	65 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



- The ETDS should overcome the technological gap and facilitate the incorporation of non-specialised participants.
- The ETDS will promote the development of approaches like “connector as a service and the more ambitious data space as a service” to reduce the technical complexity of onboarding a data space.
- **Governance:**
 - The ETDS will have a clear governance structure with rules, legislations, consultation procedures and legal incidents management.
 - The ETDS governance framework will have supervisory mechanisms to ensure compliance with the contracts established between participants.
 - The ETDS governance framework should be clear and understandable to non-specialist participants, with “clear and transparent contracts, terms and conditions, and/or licences for data sharing.”
 - The ETDS will foster multiplied data exchange partnership schemes, monetised or not.

4.4 Prescription of data space participants in the tourism sector

The environmental, economic, and technological objectives described in the previous section directly involve the ETDS to tourism institutions and statistical agencies. However, the thriving data market and the federation between sectoral data spaces expand the scope of the ecosystem to participants beyond the public sector for the development of new smart solutions.

The institutions and business areas formerly participants of the ETDS are described below. Their roles may vary from data sources and consumers to other specialised profiles that enrich the traditional vision of the tourism sector. This diverse ecosystem of participants will adhere to the same ethical principles, security policies and interoperability regulations.

- **Public institutions:** Several public administration initiatives (described in section 5.2) have been promoted by national and regional governments to promote transparency through the free sharing of public information. ETDS will facilitate the sharing of its datasets. As consumers, they can use the information of the data space to evaluate the impact of tourism in their areas, develop marketing strategies or for statistical analysis.
 - EU countries.
 - Tourism ministries, regional administrations, and local governments.
 - Destination Marketing Organizations (DMOs).
 - National Institutes of Statistics.
- **Private tourism companies** will benefit from a new influx of profits through the monetization of their data.
 - Tourism operators, hotels and airlines.
 - Travel agencies.
 - Online platforms: aggregators, reservation services, booking brokers, comparison pages with user-generated content.
- **Technology companies** and innovation startups require high volumes of data for the design of their tools, which can also be marketed as data products in the ETDS.
 - Data analytics platforms, AI companies.
 - Smart tourism companies.
 - Research centres.

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	66 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



- **Technology providers and counselling:** The data market has created a new industry and specialised services around it.
 - Infrastructure providers.
 - Cybersecurity services.
 - Legal advisors.
- **Tourists and service users** will benefit through the voluntary sharing of data to obtain personalised services and experiences.

4.5 Current and Future Enrichment of Catalogues

Data spaces are decentralised, domain-specific ecosystems that enable trusted data sharing among stakeholders. In this context, metadata is a foundational element for making data discoverable and governable across organisational boundaries.

4.5.1 Metadata

Metadata is structured, contextual information that describes other data. It enables data to be identified, discovered, retrieved, interpreted, and reused in a meaningful way. Metadata plays a critical role in making data assets interoperable, traceable, and usable across systems, particularly in distributed data ecosystems such as data spaces. In the context of data spaces, metadata includes technical descriptors (such as format and size), administrative information (such as ownership and access rights), and semantic annotations (such as keywords or ontological mappings) that together describe a data product or service. Metadata thus ensures that data shared across domains can be found, understood and processed without ambiguity. In the context of data spaces, its key principles include:

- Decentralised data, centralised metadata: While data remains under the control of its original provider, metadata is registered in federated catalog to enable discovery.
- Transparency and control: Metadata communicates the terms of use, lineage and compliance criteria.
- Semantic interoperability: Shared vocabularies and ontologies are used to describe content in a machine-interpretable way.

4.5.1.1 Metadata categories

Metadata contributes to several essential data management functions:

- Identification and discovery: Enables cataloging and search functionalities.
- Documentation and comprehension: Provides descriptive context for interpreting data correctly.
- Governance and regulations: Specifies ownership, access conditions, and licensing terms.
- Integration and interoperability: Supports semantic alignment between heterogeneous systems.
- Preservation and traceability: Facilitates version control, auditability, and long-term usability.

Type	Function
Descriptive	Identifies and characterises data content (e.g., title, keywords, abstract)
Structural	Describes technical and legal information (e.g., relationships, between files or components)
Administrative	Documents technical and legal information (e.g., file type, creator,

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	67 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



	license)
Preservation	Facilitates digital archiving and integrity validation
Reference	Explains provenance, source methodologies, and lineage
Legal	Indicates rights management and regulatory constraints

Table 4 Metadata categories

From a conceptual standpoint, metadata transforms isolated datasets into usable, discoverable and compliant digital assets within larger data ecosystems. Table 4 shows the categories of the information classified by metadata. These types may overlap depending on the domain, but they provide a useful conceptual structure for analysing metadata functions.

4.5.1.2 Metadata formats

Standardisation is fundamental for ensuring that metadata is machine-readable and interoperable. Common metadata formats include:

- DCAT (Data Catalog Vocabulary): A W3C RDF vocabulary recommended by the European Commission for describing datasets in catalogs.
- JSON-LD: A JSON-based format for Linked Data, widely used for web metadata.
- Dublin Core: A set of general-purpose metadata elements (e.g., title, creator, subject).
- XMP (Extensible Metadata Platform): Used for embedding metadata in media files.
- SDMX (Statistical Data and Metadata Exchange): Used by statistical agencies for standardizing and metadata interchange.

The adoption of these formats ensures syntactic and semantic consistency across platforms.

4.5.1.3 Metadata interoperability

Metadata interoperability⁹⁹ refers to the capacity of different systems and organisations to exchange and interpret metadata consistently.

- Standard vocabulary and schemas: E.g., DCAT-AP, schema.org, Dublin Core.
- Ontology alignment: Linking domain-specific concepts (e.g., location, service, event).
- Machine-readable serialisation: Using RDF, XML, or JSON-LD for automated parsing.

Achieving interoperability enables metadata aggregation across federated catalogs and cross-domain applications.

4.5.1.4 Metadata enrichment

Metadata enrichment is the process of augmenting existing metadata with additional information to enhance its quality, granularity, and usability. Typical enrichment actions include:

- Multilingual labelling: Supporting accessibility and localisation.
- Semantic annotations: Linking to reference ontologies and controlled vocabularies.
- Automated tagging: Using artificial intelligence or NLP techniques to derive metadata from content.

Enriched metadata improves discoverability, facilitates data integration and supports personalised data services.

⁹⁹ IDSA Position Paper on Semantic Interoperability: https://internationaldataspaces.org/wp-content/uploads/dlm_uploads/IDSA-Position-Paper-Semantic-Interoperability-in-Data-Spaces.pdf



4.5.2 Data Standardisation

The information collected from the pilots and their data sources shows the heterogeneity of formats and vocabularies that must be resolved for the integration and navigability of data in ETDS.

To standardize data and build a tailored metadata catalog, a procedure based on source inventory and analysis must be followed. This process does not end with the design of data models and the implementation of metadata catalogs; rather, it will continue to ensure their maintenance and guarantee continued enrichment in parallel with the evolution of the data space's participants.

Decisions regarding vocabularies, ontologies and formats must be based on the scenarios presented by the use cases. The data collected according to the canvas analysis detailed in previous sections will be processed in the following procedure to compose the data and metadata catalogs.

Inventory of data sources:

- Evaluate the information: source, owner, update frequency, format, etc.
- Identify data schemas.
- Classify data types: statistical, transactional, geospatial, etc.

Analysis of formats and structures of each source:

- Identify metadata vocabularies.
- Detect semantic inconsistencies.
- Analyse names, data types, values, units, and their relationships.

Semantic mapping and vocabulary alignment:

- Compile tourism vocabularies and ontologies.
- Create a mapping table with all the terms and equivalences.

Data normalization and transformation:

- Define standard units, date formats, geographic coding, etc.
- Validate the quality and consistency of the data.

Designing the catalog metadata model:

- Evaluate cataloging standards.
- Define mandatory and optional properties.

Implementation of the data catalog:

- Data catalog deployment.
- Integration with navigation tools.
- Integration with APIs and SPARQL endpoints.
- Integration with governance tools.

Continuous maintenance and enrichment

- Establish source and vocabulary update procedures.
- Evaluate user feedback and activate corresponding update procedures.

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	69 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



5 Requirements identification and specification

This section aims to compile all the requirements that were elicited from the canvas analysis, the final data product, and related initiatives that are considered necessary for the deployment of the ETDS. This section also includes a subsection about best practices which will be contrasted against lessons learnt from other initiatives.

5.1 SIMPL's requirements and components

EC's Simpl has already published the architecture document in which a mapping between the different components of the system and the requirements to which they provide an answer is done. The following table gives us a view of this mapping:

Req. ID	Summary	Component(s)
SIMPL-1612	Tier 2 attributes management - workflow	IAA
SIMPL-1613	Tier 2 attributes management - services	Onboarding, IAA
SIMPL-1614	Controlling communication between participants	IAA
SIMPL-1615	Ensure ABAC compliance	IAA
SIMPL-1616	Authentication between participant agents	IAA
SIMPL-1650	Participants list	IAA
SIMPL-1653	Participants detail operations - workflow	Onboarding, IAA
SIMPL-1654	Participants detail operations - services	Onboarding, IAA
SIMPL-1672	View the onboarding process documentation and initiate the onboarding	Onboarding
SIMPL-1673	Register onboarding application	Onboarding
SIMPL-1674	Onboarding request - tracking by applicant	Onboarding, IAA
SIMPL-1676	Onboarding requests - verification support	Onboarding, IAA



SIMPL-1677	Onboarding requests - manual approval support	Onboarding, IAA
SIMPL-1679	Onboarding requests - rejection support	Onboarding, IAA
SIMPL-1681	Attribute selection	Onboarding, IAA
SIMPL-1682	Create credential request	Onboarding, IAA
SIMPL-1683	Credential creation	Onboarding, IAA
SIMPL-1684	Credential request - tracking by participant	Onboarding, IAA
SIMPL-1686	Credentials installation and review - services	Onboarding, IAA
SIMPL-1687	Credentials installation and review - status and information	Onboarding, IAA
SIMPL-1689	Users and roles configuration	Onboarding, IAA
SIMPL-1696	Mandatory quality rules	Federated Catalogue
SIMPL-1698	Validation of a resource description - feedback to the provider	Federated Catalogue, Resource Offering Editor, Schema Management
SIMPL-1699	Syntax Validation	Federated Catalogue, Resource Offering Editor, Schema Management
SIMPL-1704	Creating self-description	Resource Offering Editor
SIMPL-1705	Uploading self-description	Federated Catalogue, Resource Offering Editor
SIMPL-1715	Access policy definition	Resource Offering Editor
SIMPL-1719	Advanced Search	Federated Catalogue, Search
SIMPL-1720	Search Results Limitation	Search
SIMPL-1734	Advanced search - Search parameters compliant with constraints and vocabularies	Schema Management, Search, Vocabulary Management



SIMPL-1738	Infrastructure Specific Features	Infrastructure Management
SIMPL-1739	Triggering Mechanism	Data Space Connector, Federated Catalogue, Infrastructure Management
SIMPL-1745	Roles management operations	IAA
SIMPL-1748	End user authentication process - API	IAA
SIMPL-1784	Data sharing	Data Space Connector, Data Transfer
SIMPL-1789	Integration with Cloud APIs through Crossplane	Infrastructure Management
SIMPL-2916	Pre-configured monitoring dashboard	Observability
SIMPL-2921	Monitoring Simpl-Open agent infrastructure metrics	Observability
SIMPL-2941	Simpl shall store technical logs of agent (software) components in a log repository	Observability
SIMPL-2945	Store technical logs of the infrastructure on which Simpl-Open is deployed in a log repository	Observability
SIMPL-2946	Log Simpl agent infrastructure metrics	Observability
SIMPL-2949	Simpl shall log all business actions in the central logs repository	Observability
SIMPL-3363	Contract negotiation protocol	Contract Management, Data Space Connector
SIMPL-3370	Usage contract signature	Contract Management
SIMPL-3381	The Usage Contract Agreement stored in machine-readable format	Contract Management
SIMPL-3886	Monitoring Simpl business logs	Observability
SIMPL-3995	Define the onboarding process documentation	Onboarding



SIMPL-402	Create usage policy	Resource Offering Editor
SIMPL-409	Assign usage policy	Resource Offering Editor
SIMPL-415	Enforce usage policies	Contract Management, Data Space Connector
SIMPL-4417	Automated deployment of Simpl-Open pre-configured monitoring dashboard	Observability
SIMPL-4422	Monitoring Simpl-Open agent infrastructure technical logs	Observability
SIMPL-4495	Filter search result based on access policy	Federated Catalogue, Search
SIMPL-4497	Returning query results	Federated Catalogue, Search
SIMPL-469	Quick Search	Federated Catalogue, Search
SIMPL-4889	Publishing self-description	Federated Catalogue, Resource Offering Editor
SIMPL-500	Semantic Validation	Federated Catalogue, Schema Management, Vocabulary Management
SIMPL-503	Access policy publication	Resource Offering Editor
SIMPL-514	Assign Contract Template	Contract Management, Resource Offering Editor
SIMPL-5396	Request a data resource	Data Space Connector, Data Transfer
SIMPL-6100	Requesting an infrastructure resource	Infrastructure Management
SIMPL-6109	Access policy enforcement	EDC Connector
SIMPL-6122	Data Visualization	Data Transfer, Infrastructure Management

Table 5 SIMPL Open requirements

Although EDTS shall provide its own set of requirements, it is important to consider these requirements to be aligned with other initiatives that are ongoing, related with the implementation of European data spaces.

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	73 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



5.2 Requirements specification

This section will introduce the requirements that have been identified as pertinent in existing initiatives and are formulated as if they correspond to ETDS needs. The requirement topic is based on the deployEMDS capabilities, and they are only used for classification purposes within this deliverable. The core taxonomy of capabilities in this deliverable is the DSSC building blocks.

5.2.1 Identity and Access Management

In the context of the European Tourism Data Space (ETDS), establishing a robust Identity and Access Management (IAM) framework is of high importance to allow secure and trustworthy interactions among the data space participants. Requirements within this section will focus on facilitating the management of digital identities and regulate access to resources within the ETDS, considering the following key aspects:

- **Unique Identification:** Every participant within the ETDS must possess a unique identifier, ensuring that each entity, being an organisation or an individual, is distinctly recognizable. This uniqueness is foundational to maintain the system's integrity and trust.
- **Legal and Organizational Binding:** Identifiers are required to have legal associations with organisations or natural persons acting as legal representatives. This binding ensures accountability and aligns with European regulatory standards.
- **Standardization and Compliance:** Adherence to EU-recognised standards for identifier issuance and management is mandatory. This standardisation facilitates interoperability and mutual recognition of identities across different regions and platforms within the tourism sector.
- **Self-Descriptive Metadata:** Participants must provide standardised, machine-readable metadata about themselves, encapsulated as Verifiable Credentials. These self-descriptors include essential information such as legal names, contact details, operational regions, and credential lists, enhancing transparency and trust.
- **Federated Access and Authentication:** System access is managed through federated identity providers supporting Single Sign-On (SSO) using standard protocols (e.g., OAuth2, OpenID Connect, SAML). Additionally, multi-factor authentication (MFA) mechanisms are implemented to enhance security during user accesses.
- **Authorization and Account Management:** Role-based access control (RBAC) is enforced, to clearly define access levels and permissions per role.

ID	Req. Topic	Requirement Description
REQ_IAM_001	ID Binding	Every participant must have at least one unique identifier.
REQ_IAM_002	ID Binding	Participants must unequivocally link their identifier to a real-world entity via an approved data space mechanism.
REQ_IAM_003	ID Binding: Legal person	Identifiers must be legally bound to organisations or natural persons acting as legal representatives, including public administration employees.

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	74 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



REQ_IAM_004	ID Binding: Organisation	Data intermediaries within the Tourism Data Space require unique identifiers legally linked to their role as providers of data intermediation.
REQ_IAM_005	ID Binding: EU standards	Identifiers must hold legal and contractual validity, issued by authorities recognized cross-border within the EU.
REQ_IAM_006	Identification: Self-descriptors	Participants must describe themselves using standardized, machine-readable metadata encapsulated as Verifiable Credentials (Self-Descriptors).
REQ_IAM_007	Identification: Minimal descriptors	Self-Descriptors must minimally contain: Organisation legal name, resolvable endpoint addresses (FQDN), registration & operation countries, city, contact email, identity issuer details, and credentials list.
REQ_IAM_008	Identity Management	System access must be managed through federated identity providers supporting Single Sign-On (SSO) using standard protocols (e.g., OAuth2, OpenID Connect, SAML).
REQ_IAM_009	Identity Management	Authentication mechanisms must include multi-factor authentication (MFA) for secure user access.
REQ_IAM_010	Identity Management	Authorization policies must adhere to role-based access control (RBAC), clearly defining access levels and permissions per role.
REQ_IAM_011	Identity Management	Account lifecycle management must include provisions for secure account creation, updates, suspension, and deprovisioning.
REQ_IAM_012	Identity Management	Identity management solutions must be interoperable across EU borders, facilitating seamless access and recognition of identities within the tourism sector.
REQ_IAM_013	Identity Management	The identity management system must provide comprehensive logging and auditing capabilities to trace user activities and maintain accountability.



REQ_IAM_014	Identity Management	User accounts and credentials management must comply with GDPR, ensuring privacy and data protection requirements are strictly enforced.
-------------	---------------------	--

Table 6 Identity and Access Management Requirements

5.2.2 Assets Management

Effective Assets Management is fundamental for the European Tourism Data Space (ETDS), ensuring the structured, secure, and interoperable sharing of data assets among participants. The following requirements outline are focusing on data sovereignty, standardised metadata practices, lifecycle management, and secure access mechanisms. These measures are essential for transparent, reliable, and efficient data interactions across the tourism sector. Participants will keep the authority and flexibility over their data assets, ensuring compliance with interoperability standards and regulatory requirements, to enable an effective collaboration within the ETDS ecosystem.

ID	Req. Topic	Requirement Description
REQ_AM_001	Data Offering: Minimal Self-Descriptors	Data Self-Descriptors must contain semantic references, product identification information, ownership, type, human-readable descriptions, usage control policies, and access information.
REQ_AM_002	Data Offering: Minimal Self-Descriptors	Data Self-Descriptors should contain intended usage, language profiles, provenance, SLA details, and data quality indicators (accuracy, timeliness).
REQ_AM_003	Semantic Framework	Self-Descriptors must embed or link to semantic information including schema and vocabulary descriptions and should have machine-readable upstream ontologies.
REQ_AM_004	Data Offering: Self-Descriptor Builder	A system must be provided to create, maintain, and update Self-Descriptors, including tracking changes and securely managing repositories of embedded resources (Vocabulary Hubs, Linked Ontologies).
REQ_AM_005	Connector Assets	Self-Descriptors shall be interoperable with assets in the connector to avoid redundant management of asset offerings.
REQ_AM_006	Data Sovereignty	Data providers must retain full control over data usage conditions, enforcing data sovereignty principles.



REQ_AM_007	Metadata Management	Data assets must be described using standardized metadata schemas to support accurate discovery and comprehension.
REQ_AM_008	Data Lifecycle Management	Complete lifecycle management from data creation, storage, sharing, to deletion must be implemented to maintain data integrity and relevance.
REQ_AM_009	Access Control Mechanisms	Robust policies must be established for data access control based on roles and permissions, protecting sensitive information.
REQ_AM_010	Asset Hosting	Participants must have the flexibility to host shared data assets on infrastructure of their choice, respecting data sovereignty and compliance requirements.

Table 7 Assets Managements Requirements

5.2.3 Policies and contracts

Robust Policies and Contracts are critical for the effective governance and secure operation of the European Tourism Data Space (ETDS). These requirements ensure clarity, enforceability, and compliance for all the interactions done between ETDS participants. They address aspects such as data findability, data sharing agreements, contractual standardisation, legal compliance, and dispute resolution mechanisms. Policies must be defined using standardised languages, such as ODRL, and connectors must facilitate policy creation and validation throughout metadata discovery, agreement negotiation, and data transfer execution. These requirements shall ensure transparency, accountability, and collaboration within the ETDS ecosystem.

ID	Req. Topic	Requirement Description
REQ_PC_001	Data Sharing Agreements	Agreements must explicitly define terms for data sharing, including usage rights, access conditions, and participant responsibilities.
REQ_PC_002	Contractual Standardization	Standardized contractual templates must be provided to streamline agreements, reducing negotiation overhead and enhancing consistency across ETDS.



REQ_PC_003	Compliance Framework	All policies and contractual agreements must comply fully with EU regulations (e.g., GDPR, ePrivacy Directive, Data Governance Act), ensuring legal robustness.
REQ_PC_004	Usage Control Policies	A usage control policy framework must be established, clearly specifying conditions for data consumption, sharing restrictions, and enforcement mechanisms.
REQ_PC_005	Policy Enforcement Mechanisms	Mechanisms must enforce contractual policies at multiple points: metadata discovery, agreement negotiation, and data transfer execution.
REQ_PC_006	Contractual Change Management	Changes to Self-Descriptors having contractual implications must be logged, versioned, and auditable to trigger necessary contractual actions.
REQ_PC_007	Auditing and Transparency	Policies must ensure transparency via logging data sharing agreements, transfer requests, negotiation outcomes, and policy changes to enable auditing.
REQ_PC_008	Liability and Risk Allocation	Contracts must define clear liability and indemnification clauses, allocating risks explicitly among participants, covering potential data misuse or breaches.
REQ_PC_009	Dispute Resolution	Policies and contracts must include structured dispute resolution mechanisms, ensuring prompt and fair handling of conflicts arising from data transactions.



REQ_PC_010	Intellectual Property Management	Contractual agreements must explicitly define intellectual property rights, usage licenses, and data ownership to foster clear governance and innovation.
REQ_PC_011	Confidentiality and Data Security	Contractual obligations must enforce strict confidentiality and data protection measures, aligning explicitly with EU cybersecurity and privacy standards.
REQ_PC_012	Termination and Renewal	Policies must clearly outline the conditions and procedures for contract termination or renewal, ensuring transparency and operational predictability.
REQ_PC_013	Participant Eligibility	Agreements must specify criteria for participant eligibility and obligations, clearly defining roles and responsibilities within the data space.
REQ_PC_014	Cross-border Enforcement	Contracts must ensure enforceability and recognition across borders, complying with international and EU legal standards for cross-border data sharing.
REQ_PC_015	ODRL Policy Definition	Policies shall be defined using the ODRL (Open Digital Rights Language) standard to ensure consistent interpretation and automated enforcement across the ETDS.
REQ_PC_016	Connector Policy Creation and Validation	Connectors must provide user-friendly tools for creating policies that will be stored in ODRL language.



REQ_PC_017	Connector Policy Creation and Validation	Connectors must provide the functionalities to create a contract for an asset allowing to choose one or several existing policies.
REQ_PC_018	Connector Policy Creation and Validation	Connectors must allow users to sign contracts for asset sharing.
REQ_PC_019	Connector Policy Creation and Validation	Connectors must be able to validate the compliance of policies defined in the contracts, which will be executed at metadata discovery, agreement negotiation, and data transfer execution

Table 8 Policies and contracts requirements

5.2.4 Publication and discovery

The publication and discovery of data offerings is one of the main functionalities of the European Tourism Data Space (ETDS), which allows a transparent and trustworthy access to data across a federated ecosystem. This functionality ensures that data products can be exposed by providers and located by potential consumers, both human and machine, through catalog interfaces and connector-driven mechanisms.

Data offerings may be registered in local catalogs, in their own connectors, and synchronised with federated catalogs to improve visibility and access. To ensure semantic consistency and technical interoperability, metadata describing data offerings must follow recognised standards such as DCAT-AP or NGSI-LD. The system must also support rich semantic annotations using shared ontologies to facilitate meaningful discovery. Also, publication mechanisms must enforce policies that respect data sovereignty, access rights, and contractual obligations.

Connectors deployed will play an active role in this process. They are responsible for exposing their local catalogs in a standardised and machine-readable format, enabling external discovery and facilitating automated harvesting.

The following requirements define the technical and functional capabilities necessary for publication and discovery in the ETDS.

ID	Req. Topic	Requirement Description
REQ_PD_001	Standardized Metadata for Data Offerings	Data offerings must be described using standardized metadata schemas to ensure consistency, discoverability, and interoperability across platforms.

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	80 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



REQ_PD_002	Federated Catalog Integration	The system must support integration with federated catalogs, enabling unified access to distributed data offerings across multiple domains and platforms.
REQ_PD_003	Semantic Interoperability	Metadata descriptions should utilize common vocabularies and ontologies to achieve semantic interoperability, facilitating accurate data discovery and integration.
REQ_PD_004	Compliance with Data Sovereignty Principles	Ensure that data publication and discovery mechanisms comply with data sovereignty principles, allowing data providers to retain control over their data.
REQ_PD_005	Automated Policy Enforcement	Implement automated policy enforcement to ensure compliance with data usage agreements during data publication and discovery processes.
REQ_PD_006	User-Friendly Interfaces for Data Discovery	Provide intuitive and user-friendly interfaces for data consumers to search, filter, and access data offerings effectively.
REQ_PD_007	Data Quality Indicators	Include data quality indicators in metadata descriptions to inform data consumers about the reliability and suitability of data offerings.
REQ_PD_008	Versioning and Provenance Tracking	Implement versioning and provenance tracking for data offerings to maintain data integrity and support traceability.
REQ_PD_009	Scalability and Performance	Ensure that the data publication and discovery infrastructure is scalable and performs efficiently under varying loads.
REQ_PD_010	Catalog Access via Connector (Federated)	Connectors must enable querying and retrieving data offerings from remote or federated catalogs using standardized APIs (e.g., IDS, DCAT, NGSI-LD).
REQ_PD_011	Metadata Parsing by Connector	Connectors must be capable of parsing metadata (e.g., in DCAT or IDS format) to display and interpret data offerings properly.

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	81 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



REQ_PD_012	Automated Discovery via Connector	Connectors must enable automated catalog synchronisation or discovery mechanisms (e.g., polling, subscription) for continuously updating visible data offerings.
REQ_PD_013	Semantic Support at Connector Level	Connectors must support semantic annotations or linked data (e.g., OWL, SHACL) to allow context-aware discovery of datasets.
REQ_PD_014	Standard-Based Catalog Endpoint	Catalog endpoints exposed by connectors must conform to agreed data space protocols (e.g., IDS Information Model, NGS-1D) for discoverability.

Table 9 Publication and discovery requirements

5.2.5 Data quality

Data quality shall be one of the pillars when constructing the European Tourism Data Space (ETDS), ensuring that shared data assets are accurate, consistent, and reliable. High-quality data is essential for ensuring trust between participants and to facilitate interoperability. Data quality encompasses several critical dimensions, including:

- **Completeness:** Ensuring that all necessary data attributes are present and accounted for.
- **Accuracy:** Guaranteeing that data correctly represents the real-world entities or events it describes.
- **Consistency:** Maintaining uniformity of data across different datasets and systems.
- **Timeliness:** Providing data that is up-to-date and available when needed.
- **Validity:** Confirming that data conforms to defined formats and standards.

These dimensions are vital for the ETDS to function effectively, as poor data quality can lead to misinformed decisions, reduced operational efficiency, and diminished user trust.

ID	Req. Topic	Requirement Description
REQ_QA_001	UI and API for Defining Data Quality Rules	The system shall provide tools (UI and API) to allow data providers and consumers to define data quality rules associated with specific datasets or data offerings.

Document name:	D2.1 ETDS Interoperability & Data Sharing	Page:	82 of 145
Reference:	D2.1 Dissemination:	Version:	1.0
		Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



REQ_QA_002	Calculation of Quality Score	It shall be possible to define how a data quality score is calculated and presented for each dataset, based on configured rules and quality dimensions.
REQ_QA_003	Metadata Quality Rules Definition	The system shall provide a UI and API where users can define rules for metadata completeness and consistency (e.g., mandatory fields, controlled vocabularies, logical constraints).
REQ_QA_004	Quality Dimensions and Evaluation Rules	The system shall provide the means for evaluating data quality across predefined dimensions (e.g., accuracy, timeliness, completeness) and allow users to configure rules for assessment per dimension.
REQ_QA_005	Data Self-Descriptors: Quality Metadata	Self-descriptors must include quality-related metadata such as accuracy, timeliness, completeness, and provenance information as part of the minimum descriptive elements.
REQ_QA_006	SLA and Update Frequency Declaration	Self-descriptors must support inclusion of SLA-related information such as update frequency, ensuring consumers can assess freshness and reliability of the data offering.
REQ_QA_007	Provenance Tracking	The system must enable tracking of the provenance of data offerings to ensure traceability and auditability of quality indicators across the lifecycle of a data product.
REQ_QA_008	Versioning of Descriptors	The system must maintain a versioned registry of Self-Descriptors, allowing quality-related changes to be documented, compared, and traced over time.
REQ_QA_009	Interoperability Standards Compliance	Data quality frameworks must adhere to established interoperability standards to facilitate seamless data exchange across different data spaces and platforms.



REQ_QA_010	Common Data Quality Metrics	Establishment of common data quality metrics and indicators to enable consistent assessment and comparison of data quality across various data spaces.
REQ_QA_011	Data Quality Certification	Implementation of certification processes for data quality, ensuring that datasets meet predefined quality standards before being shared within the data space.
REQ_QA_012	Real-Time Data Quality Monitoring	Systems should support real-time monitoring and reporting of data quality metrics, allowing for immediate detection and rectification of quality issues.
REQ_QA_013	User Feedback Integration	Mechanisms to collect and incorporate user feedback on data quality should be established, promoting continuous improvement and user satisfaction.

Table 10 Data quality requirements



6 Conclusions

The integration and adaptation of the existing data space frameworks to the ETDS must be informed by real-case pilot implementation and contextualised data modelling. The canvas analysis provided a structured methodology to help the Consortium elicit use case needs. Through the canvas templates, the intake canvas, and the refined requirements mapping, the ETDS pursues to align with existing initiatives (to not reinvent the wheel) and extend these initiatives' achievements for integrating multiple data spaces.

The use case development is still in progress and needs to be refined in successive sessions; this means that the iterative elaboration will probably indicate specific components of the ETDS that are more relevant in the context of the tourism sector than in other initiatives. This is paramount in the sense that even if the existing initiatives, such as deployEMDS, offer confidence in the implementation of specific components, these might not be relevant in DEPLOYTOUR. Besides, the Data Product Governance and the Business model(s) categories in the intake canvas were not filled up in this first iteration and will have to be addressed in the future.

The analysis conducted within this deliverable has justified the validation of the solutions implemented to address the technological requirements derived from previous initiatives. Frameworks like ODPS or components related to data space federation have demonstrated their ability to meet the needs of any data product by providing the necessary capabilities in an effective manner. However, since the use case requirements need to be further refined, there are no conclusive solutions (the identified solutions are gathered in Annex V) at this stage where the Data Product Offerings (DPOs) analysis will be determinant.

In regard to the DPOs analysis, each pilot filled a template considering their DPOs. Subsequently, every DPO was transferred to a shared excel file, along with curated fields where every DPOs values were compared and contrasted. The three-phase canvas analysis approach revealed inconsistencies in data source conformity, as well as for the access protocols, and metadata structures across pilots. In successive stages, a well-structured documentation about the intake canvas and DPOs mappings with the capabilities will ensure that each component of the ETDS is backed by validated, operational requirements. Furthermore, common grounds across use cases will provide a foundation to propose harmonised interfaces and components in future deployments. That said, the DSSC building blocks (for matching DPOs with capabilities) serve as a critical starting point, but gaps remain. This DSSC taxonomy of building blocks should be extended based on the technical and governance capabilities derived from the pilots.

Overall, this deliverable showcases that the deployment of the ETDS will be grounded in real data and use cases, reducing the gap between distinct frameworks and operational infrastructures. As the intake process continues and more pilots mature, the Consortium will finalise a standardised and interoperable ETDS architecture.

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	85 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Glossary

Term	Description ¹⁰⁰
Business model	A description of the way an organisation creates, delivers, and captures value. Such a description typically includes for whom value is created (customer) and what the value proposition is. Typically, a tool called business model canvas is used to describe or design a business model, but alternatives that are more suitable for specific situations, such as data spaces, are available.
Canvas	See Business model.
Capability	See Data Space Building Block.
Data Model	A structured representation of data elements and relationships used to facilitate semantic interoperability within and across domains, encompassing vocabularies, ontologies, application profiles and schema specifications for annotating and describing data sets and services. These abstraction levels may not need to be hierarchical; they can exist independently.
Data Model Provider	An entity responsible for creating, publishing, and maintaining data models within data spaces. This entity facilitates the management process of vocabulary creation, management, and updates.
Data Product	Data sharing units, packaging data and metadata, and any associated license terms. Explanatory Texts: • We (the DSSC) borrow[s] the definition from the CEN Workshop Agreement Trusted Data Transactions. • The definition of data products is still evolving in the data space community. • The data product may include, for example, the data products' allowed purposes of use, quality and other requirements the data product fulfils, access and control rights, pricing and billing information, etc.
Data Product Offering ¹⁰¹	An offering, in a general sense, refers to data, services, or a combination of both that a data provider offers to data recipients", and includes attributes such as description, provider, creator, pricing, license, data format, current version, previous version, and access rights.
Data Service	A collection of operations that provides access to one or more datasets or data processing functions. For example, data selection, extraction, data delivery.
Dataset ¹⁰²	A collection of data, published or curated by a single agent or identifiable community.

¹⁰⁰ Term and description provided by the DSSC Glossary: <https://dssc.eu/space/BVE2/1071252161/Alphabetical+List+of+All+Defined+Terms+in+Blueprint+v2.0;> otherwise, term source is provided in footnote.

¹⁰¹ "Data Product Offering", found in the DSSC "Data, Services, and Offerings Descriptions" section: <https://dataspace-support.atlassian.net/wiki/spaces/bv15e/pages/766069419/Data+Services+and+Offerings+Descriptions>

¹⁰² "Dataset", found in DCAT: <https://www.w3.org/TR/vocab-dcat/#dcat-scope>



Term	Description ¹⁰⁰
Data source ¹⁰³	System or entity that generates information, and provides this data and metadata, but they are not yet integrated in the governance of the dataspace.
Data Space	Interoperable framework, based on common governance principles, standards, practices and enabling services, which enables trusted data transactions between participants. Explanatory Texts: - Note for users of V0.5 and V1.0 of this blueprint: we (the DSSC) have[as] adopted this new definition from CEN Workshop Agreement Trusted Data Transactions, in an attempt to converge with ongoing standardisation efforts. Please note that further evolution might occur in future versions. For reference, the previous definition was: "Distributed system defined by a governance framework that enables secure and trustworthy data transactions between participants while supporting trust and data sovereignty. A data space is implemented by one or more infrastructures and enables one or more use cases." - Note: some parties write dataspace in a single word. We (the DSSC) prefer[s] data space in two words and consider that both terms mean exactly the same.
Data Space Agreement	A contract that states the rights and duties (obligations) of parties that have committed to (signed) it in the context of a particular data space. These rights and duties pertain to the data space and/or other such parties.
Data Space Building Block	A description of related functionalities and/or capabilities that can be realised and combined with other building blocks to achieve the overall functionality of a data space. Explanatory Texts: - In the data space blueprint, the building blocks are divided into organisational and business building blocks and technical building blocks. - In many cases, the functionalities are implemented by Services.
Data Space Component	A specification for a software or other artefact that realises one service or a set of services that fulfil functionalities described by one or more building blocks. Explanatory Text: For technical components, which would typically be software, but for business components, this could consist of processes, templates or other artefacts.
Data Space Component Architecture	An overview of all the data space components and their interactions, providing a high-level structure of how these components are organised and interact within data spaces.
Data Space Connector	A technical component that is run by (or on behalf of) a participant and that provides participant agent services, with similar components run by (or on behalf of) other participants.

¹⁰³ The "Final Data Product" concept is chosen by the Consortium, aligning with deployEMDS.



Term	Description ¹⁰⁰
	Explanatory Text: A connector can provide more functionality than is strictly related to connectivity. The connector can offer technical modules that implement data interoperability functions, authentication interfacing with trust services and authorisation, data product self-description, contract negotiation, etc. We use “participant agent services” as the broader term to define these services.
Data Space Functionality	A specified set of tasks that are critical for operating a data space and that can be associated with one or more data space roles. Explanatory Text: The data space governance framework specifies the data space functionalities and associated roles. Each functionality and associated role consist of rights and duties for performing tasks related to that functionality.
Data Space Initiative	A collaborative project of a consortium or network of committed partners to initiate, develop and maintain a data space.
Data Space Pilot	A planned and resourced implementation of one or more use cases within the context of a data space initiative. A data space pilot aims to validate the approach for a full data space deployment and showcase the benefits of participating in the data space.
Data Space Role	A distinct and logically consistent set of rights and duties (responsibilities) within a data space, which are required to perform specific tasks related to a data space functionality, and that are designed to be performed by one or more participants. Explanatory Texts: • The governance framework of a data space defines the data space roles. • Parties can perform (be assigned, or simply ‘be’) multiple roles, such as data provider, transaction participant, data space intermediary, etc.. In some cases, a prerequisite for performing a particular role is that the party can already perform one or more other roles. For example, the data provider must also be a data space participant.
Data Space Rulebook	The documentation of the data space governance framework for operational use. Explanatory Text: The rulebook can be expressed in human-readable and machine-readable formats.
Data Space Use Case	A specific setting in which two or more participants use a data space to create value (business, societal or environmental) from data sharing. Explanatory Texts: • By definition, a data space use case is operational. When referring to a planned or envisioned setting that is not yet operational we can use the term use case scenario. • Use case scenario is a potential use case envisaged to solve societal, environmental or business challenges and create value. The same use case scenario, or variations of it, can be

Document name:	D2.1 ETDS Interoperability & Data Sharing					Page:	88 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status:	Final



Term	Description ¹⁰⁰
	implemented as a use case multiple times in one or more data spaces.
Data Spaces Blueprint	A consistent, coherent and comprehensive set of guidelines to support the implementation, deployment and maintenance of data spaces. Explanatory Text: The blueprint contains the conceptual model of data space, data space building blocks, and recommended selection of standards, specifications and reference implementations identified in the data spaces technology landscape.
DSSC Asset	A sustainable open resource that is developed and governed by the Data Spaces Support Centre (DSSC). The assets can be used to develop, deploy and operationalise data spaces and to enable knowledge sharing around data spaces. The DSSC also develops and executes strategies to provide continuity for the main assets beyond the project funding.
Federated Data Spaces	A data space that enables seamless data transactions between the participants of multiple data spaces based on agreed common rules, typically set in a governance framework. Explanatory Texts: • The definition of a federation of data spaces is evolving in the data space community. • A federation of data spaces is a data space with its own governance framework, enabled by a set of shared services (federation and value creation) of the federated systems, and participant agent services that enable participants to join multiple data spaces with a single onboarding step.
Final Data Product ¹⁰⁴	The data product offering value for the end users of the dataspace use cases i.e., business apps, training models, etc.
Intra-data Space Interoperability	The ability of participants to seamlessly access and/or exchange data within a data space. Intra-data space interoperability addresses the governance, business and technical frameworks (including the data space protocol and the data models) for individual data space instances.
Resource ¹⁰⁵	A dataset, a data service or any other resource that may be described by a metadata record in a catalog.

¹⁰⁴ The “Final Data Product” concept is chosen by the Consortium, aligning with deployEMDS.

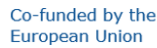
¹⁰⁵ “Resource”, found in DCAT: <https://www.w3.org/TR/vocab-dcat/#dcat-scope>



Annexes

Annex I Sample of a Data Source file

DataSources_Overview_Pilot1											
File Home Insert Page Layout Formulas Data Review View Automate Help Acrobat											
D54											
A	B	C	D	E	F	G	H	I	J	K	L
Pilot region	Use case ID	Data source ID	Data source NAME	Data owner	Usage	Availability	Current availability	Accessibility	Representing	Conformity NOV	Conformity LATER
Sustainable	PL.02	PL.02.01	Registry of POIs, GeoInfo, Tourist and Events by region, incl. precise location	Open Data/ Austria Tourism (ITP provider) / Austria Austria (2024-)	Mapping of points of interest	national	available / potential	open / not-access			
Sustainable	PL.02	PL.02.02	Tourist arrivals and overnights by region (flow) or municipality (Subscription from Statistics Austria StatCube / Forecast (2024-))	Statistics Austria StatCube / Forecast (2024-)	measuring off-peak tourism	national	available / potential	open, paid-access (for			End users: research
Sustainable	PL.02	PL.02.03	Traffic schedules of public transportation	Austria's Public Transport Information Service (VAG)	Schedules of public transportation	national	available	open, paid-access			
Sustainable	PL.02	PL.02.04	Weather data & weather forecasts	Geosphere	Current weather	national	available	open, paid-access			
Sustainable	PL.02	PL.02.05	Guest card data ("Kärntner Card")	Tourist region (winter + summer)	Data from the use of	national	available	proprietary			which kind of data is
Sustainable	PL.02	PL.02.06	Forecast of overnight stays by commune (12 months ahead)	Forecast of	national	available	open				
Sustainable	PL.02	PL.02.07	Visitor flows	Data on the number	national	available	open	paid-access			
Sustainable	PL.02	PL.02.08	Cable cars schedules / data from ski visitors	Sliders	Data from entrance system of the cable cars	national	can be acquired	Proprietary			
Management of	PL.02	PL.02.09	Data from Webcams in ski regions	Fertanet	Pictures and videos from the webcams in the ski regions	national	can be acquired	proprietary			
Management of	PL.02	PL.02.10	Google hotel search index	Austria Tourism (we have scraped data)	Google Destination Insights (Initial searches in Austria by country from ca. 10 main source markets). Daily hotel search index)	national	available	paid-access (Austria tourism can provide the data for the project (unrestricted publication rights)			
Sustainable	PL.02	PL.02.11									
Management of	PL.02	PL.02.12	Forecast of hotel prices and occupancy rate	MyRate and HQ Revenue (lighthouse)	Daily Booking status and average rates for 3*, 4* and apartments in selected Austrian regions (32 tourism regions)	national	available	paid-access / access limited by the contract			
Sustainable	PL.02	PL.02.13	Tripadvisor guest reviews for POIs	Austria Tourism (we have scraped data)	Guest reviews for POIs and Accommodations in Austria (Feedback from the visitors from the location of the guest and the date of the stay)	national	available (Austria Tourism can provide the data for the project)	proprietary, open			
Management of	PL.02	PL.02.14	Tours, heatmaps	Outdooractive		national	available	paid-access			
Sustainable	PL.02	PL.02.15	Real-time traffic information	EVS-AT	measuring tourist arrivals and overnight stays, increases from Tourist Tax, occupancy of accommodations, tourist demographic data (age, sex, country of origin), length of stay, date of arrival, date of departure, tourist visualisations of locations of accommodations on the map,	national	available	open	transformation of format, calculation of length of stay, calculation of age of guest	NA	End users: FLNWS
Sustainable	PL.02_JA	PL.02.17	Tourist arrivals/stays data & tourist tax in the municipalities of JA, on the level of individual accommodation	(Municipalities at JA: data is collected by APIS (guest book)							
Management of	PL.02_JA	PL.02.18	Registry of accommodations in the region JA	APIS - Registry of accommodation facilities		national	available	open	Transformation of address to GPS	NA	End users: FLNWS
Ready Accessibility: Investigate											



File Home Insert Page Layout Formulas Data Review View Automate Help Acrobat

AI < > << >> f v

3. Data product governance

The information in this section will help identify standard practices in data management and product compliance, including Industry/Business standards and governance models relevant for various use cases. Data product owners should outline their trust-building processes, which will guide our decision on supporting identity management and data sovereignty, and to see if a fully m needed by the DEPLOYTOUR.

No	Question to be answered	Answer	Comment
13	Which data model (if any) would you like		This question refers to the desired conformity of the data sources. Possible answers are for example: OSLO, MMTIS, MOS, DATEX-II, TOPP, GTFS, GTFS-RT, NeTEx, ... or none.
14	Are there any requirements for		We need to know if participants are bound to specific identity management governance or processes and verifications when they want to use the data product. Think of claims participants could need, specific identity standards they must
15	Are there any requirements for access		We need to know which claims can be verified by which trust anchor.
16	Self assess your data product governance		We would like you to think carefully on the maturity of the data product governance and to indicate this on a scale from 1 (not discussed yet) to 5 (all partners agree on the roadmap). Please also elaborate on why you chose this number. This self assessment will allow us to identify

4. Business model(s)

Background The information in this template will help determine how diverse the participants business expectations are. Some business models require specialised components at data space level. We also want to determine if a shared business model is viable, or rather fostering an eco-system of value returns. DEPLOYTOUR should provide the necessary building blocks to support th

No	Question to be answered	Answer	Comment
17	Can you specify your expected/relevant		The goal is to determine specific supporting infrastructure for enabling the intended business model. Possible answers are: open public, open subscription, value exchange, recurring time, period based, one-time payments, pay-as-you-go, revenue sharing, data volume, dyn
18	Does the data product offering fall under		The GDPR applies to the processing of personal data of living individuals in the EU, but the implementation might slightly differ in each member state (e.g., in Italy the heirs of a deceased person can request data erasure, in Belgium they cannot). Additionally, there might b
19	What is the value proposition (if any) of		Why is this data offering interesting for the community, what value does it bring to the ecosystem? Why will participants want this data offering?
20	Self assess your business model maturity		We would like you to think carefully on the maturity of your business model and to indicate this on a scale from 1 (not discussed yet) to 5 (all partners agree on the roadmap). Please also elaborate on why you chose this number. This self assessment will allow us to identify

5. Data space federation

Background There are cases where data products are already part of an existing data space. The information must help us to find the most flexible and sustainable way to integrate them in DEPLOYTOUR.

No	Question to be answered	Answer	Example	Comment
21	In which other data space is your	No other Data Space		Name the data space. Describe if managing or part of an existing data space. Describe the data space architecture standard used.
22	Does this data space have an asset -		Yes, it is part of EMOS, using	We need to ensure that existing asset catalogue technologies and standards can interoperate with the DEPLOYTOUR asset catalogue.
23	Is there a data space mechanism to -		Yes, it uses Data Space	Yes, it uses Data Space
24	How is trust established in this		Yes, it uses Decentralised	We need to know if a trust anchor is involved, how credentials are issued, which authorities are involved, etc. This is to ensure that DEPLOYTOUR can interoperate with these trust mechanisms.
25	Does the data space implement -		Yes, it uses Decentralised	We need to ensure that the existing usage control policies and enforcement methods are compatible with DEPLOYTOUR mechanisms.

< > P2.DPO.01 P2.DPO.02 P2.DPO.03 P2.DPO.04 P2.DPO.05 +

Ready Accessibility Good to go

[illegible]

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Annex IV: Results of canvas analysis

DPO_info-01_Personal_data	Num of DPOs	%	Specific DPOs	Further information	Req. ID
No personal data	31	100%	P1.DPO.01	Some of it is already anonymized	
			P1.DPO.02		
			P1.DPO.03		
			P1.DPO.04		
			P1.DPO.05		
			P1.DPO.06		
			P1.DPO.07		
			P1.DPO.08		
			P1.DPO.09		
			P1.DPO.10		
			P1.DPO.11		
			P1.DPO.12		
			P1.DPO.13		
			P1.DPO.14		
			P2.DPO.01		
			P2.DPO.02		
			P2.DPO.03		
			P2.DPO.04		
			P2.DPO.05		
			P4.DPO.01		
			P4.DPO.02		
			P4.DPO.03		

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	92 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



			P4.DPO.04		
			P4.DPO.05		
			P4.DPO.06		
			P4.DPO.07		
			P4.DPO.08		
			P4.DPO.09		
			P4.DPO.10		
			P4.DPO.11		
			P4.DPO.12		
DPO_info-02_Data_models	Num of DPOs	%	Specific DPOs	Further information	
EDM	2	6%	P4.DPO.01		
			P4.DPO.08		
GTFS	2	6%	P1.DPO.13		
			P1.DPO.14		
DATEX II v3.3	1	3%	P1.DPO.04	For interoperability for Mobility DS.	REQ_PD_003
DPO_info-03_Metadata_models	Num of DPOs	%	Specific DPOs	Further information	
DCAT-AP	4	13%	P1.DPO.01		REQ_AM_001, REQ_QA_005, REQ_PD_001
			P2.DPO.03		REQ_AM_001, REQ_QA_005, REQ_PD_001
			P2.DPO.04		REQ_AM_001, REQ_QA_005, REQ_PD_001
			P2.DPO.05		REQ_AM_001, REQ_QA_005, REQ_PD_001



Dublin Core	1	3%	P4.DPO.02	DC is mapped already to DCAT-AP	REQ_AM_001, REQ_QA_005, REQ_PD_002
Schema.org	1	3%	P1.DPO.01	Schema.org as additional semantic interoperability	REQ_PD_001
DPO_info-04_Schemas/Transfer models	Num of DPOs	%	Specific DPOs	Further information	
DATEX II v3.3	1	3%	P1.DPO.04	Commonly used with RESTful APIs and HTTP	REQ_PD_004, REQ_IAM_006
NetCDF	1	3%	P4.DPO.06		
JSON	4	13%	P1.DPO.07	API through JSON transfer model:	REQ_AM_007, REQ_PD_006
			P4.DPO.03		REQ_AM_007, REQ_PD_006
			P4.DPO.07		REQ_AM_007, REQ_PD_006
			P4.DPO.09		REQ_AM_007, REQ_PD_006
CSV	3	10%	P1.DPO.07	FTPS through CSV transfer format	
			P4.DPO.02		REQ_AM_007
			P4.DPO.10		REQ_AM_007
DPO_info-05_Additional_software					
XLSX	3	10%	P1.DPO.05		
			P1.DPO.07		
			P1.DPO.12		
DPO_info-06_Transfer_protocol	Num of DPOs	%	Specific DPOs	Further information	
API	24	77%	P1.DPO.01	APIs: Google Maps using Place API Google Calendar API RESTful API Mapillary API API Intermediary to ETDS	REQ_PC_005, REQ_QA_001



			P1.DPO.06		REQ_PC_005, REQ_QA_001
			P1.DPO.07		REQ_PC_005, REQ_QA_001
			P1.DPO.08		REQ_PC_005, REQ_QA_001
			P1.DPO.09		REQ_PC_005, REQ_QA_001
			P1.DPO.10		REQ_PC_005, REQ_QA_001
			P1.DPO.11		REQ_PC_005, REQ_QA_001
			P1.DPO.12		REQ_PC_005, REQ_QA_001
			P1.DPO.13		REQ_PC_005, REQ_QA_001
			P1.DPO.14		REQ_PC_005, REQ_QA_001
			P2.DPO.01		REQ_QA_001
			P2.DPO.02		REQ_QA_001
			P2.DPO.03		REQ_QA_001
			P2.DPO.04		REQ_QA_001
			P2.DPO.05		REQ_QA_001
			P4.DPO.01		REQ_QA_001
			P4.DPO.03		REQ_QA_001
			P4.DPO.04		REQ_QA_001
			P4.DPO.05		REQ_QA_001
			P4.DPO.06		REQ_QA_001
			P4.DPO.07		REQ_QA_001

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	95 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



			P4.DPO.09		REQ_QA_001
			P4.DPO.11		REQ_QA_001
			P4.DPO.12		REQ_QA_001
			P1.DPO.08		
			P1.DPO.09		
			P1.DPO.10		
			P1.DPO.11		
			P4.DPO.02		
			P4.DPO.10		
			P4.DPO.11		
FTPS	8	26%	P4.DPO.12		
			P1.DPO.05	HTTPS is linked to API or TBD cases	
			P1.DPO.06		
			P4.DPO.03		
			P4.DPO.05		
			P4.DPO.06		
			P4.DPO.07		
HTTPS	7	23%	P4.DPO.09		
DPO_info-07_Acess_contro I	Num of DPOs	%	Specific DPOs	Further information	
			P1.DPO.01		
			P1.DPO.07		
			P1.DPO.08		
			P1.DPO.09		
			P1.DPO.10		
API Key	18	58%	P1.DPO.11		



			P2.DPO.01		
			P2.DPO.02		
			P2.DPO.03		
			P2.DPO.04		
			P2.DPO.05		
			P4.DPO.03		
			P4.DPO.04		
			P4.DPO.07		
			P4.DPO.08		
			P4.DPO.09		
			P4.DPO.11		
			P4.DPO.12		
Authorization required	3	10%	P1.DPO.12	TBD how	
			P1.DPO.13		
			P1.DPO.14		
Open Data	2	6%	P1.DPO.03		
			P4.DPO.10		
SFTP security protocol	4	13%	P1.DPO.08		
			P1.DPO.09		
			P1.DPO.10		
			P1.DPO.11		
DPO_info-08Performance concerns	Num of DPOs	%	Specific DPOs	Further information	
Latencies	7	23%	P1.DPO.08		REQ_QA_004
			P1.DPO.09		REQ_QA_004
			P1.DPO.10		REQ_QA_004



			P1.DPO.11		REQ_QA_004
			P4.DPO.03		REQ_QA_004
			P4.DPO.11		REQ_QA_004
			P4.DPO.12		REQ_QA_004
Data refresh	4	13%	P1.DPO.02		REQ_QA_004
			P1.DPO.03		REQ_QA_004
			P1.DPO.04		REQ_QA_004
			P4.DPO.05		REQ_QA_006
SLA	3	10%	P2.DPO.01		REQ_AM_002
			P2.DPO.02		REQ_AM_002
			P4.DPO.08		REQ_AM_002
DS_Business_Building_Blocks	Num of DPOs	%	Specific DPOs	Further information	
Data Space Offering, Participation Management, Contractual Framework	31	100%	P1.DPO.01		
			P1.DPO.02		
			P1.DPO.03		
			P1.DPO.04		
			P1.DPO.05		
			P1.DPO.06		
			P1.DPO.07		
			P1.DPO.08		
			P1.DPO.09		
			P1.DPO.10		
			P1.DPO.11		
			P1.DPO.12		
			P1.DPO.13		



			P1.DPO.14		
			P2.DPO.01		
			P2.DPO.02		
			P2.DPO.03		
			P2.DPO.04		
			P2.DPO.05		
			P4.DPO.01		
			P4.DPO.02		
			P4.DPO.03		
			P4.DPO.04		
			P4.DPO.05		
			P4.DPO.06		
			P4.DPO.07		
			P4.DPO.08		
			P4.DPO.09		
			P4.DPO.10		
			P4.DPO.11		
			P4.DPO.12		
DS_Technical_Building_Blocks	Num of DPOs	%	Specific DPOs	Further information	
Identity & Attestation Management, Data Exchange, Publication & Discovery	27	87%	P1.DPO.01		
			P1.DPO.02		
			P1.DPO.03		
			P1.DPO.04		
			P1.DPO.05		
			P1.DPO.06		

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	99 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



			P1.DPO.07		
			P1.DPO.08		
			P1.DPO.09		
			P1.DPO.10		
			P1.DPO.11		
			P1.DPO.12		
			P1.DPO.13		
			P1.DPO.14		
			P2.DPO.01		
			P2.DPO.02		
			P2.DPO.03		
			P2.DPO.04		
			P2.DPO.05		
			P4.DPO.02		
			P4.DPO.03		
			P4.DPO.04		
			P4.DPO.05		
			P4.DPO.07		
			P4.DPO.09		
			P4.DPO.11		
			P4.DPO.12		
Data Exchange, Publication & Discovery	3	10%	P4.DPO.01		
			P4.DPO.06		
			P4.DPO.10		
Identity & Attestation	1	3%	P4.DPO.08		

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	100 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Management, Data Exchange					
DSF_01- Federation_req	Num of DPOs	%	Specific DPOs	Further information	
Required	2	6%	P1.DPO.01		REQ_PD_002, REQ_PD_014, REQ_QA_009
			P4.DPO.01		REQ_PD_002
TBC	3	10%	P1.DPO.12		
			P1.DPO.13		
			P1.DPO.14		
DSF_02- DS_where_DP O_is	Num of DPOs	%	Specific DPOs	Further information	
Trenitalia DS	3	10%	P1.DPO.12		REQ_IAM_005, REQ_IAM_012, REQ_PC_003, REQ_PC_014
			P1.DPO.13		REQ_IAM_005, REQ_IAM_012, REQ_PC_003, REQ_PC_014
			P1.DPO.14		REQ_IAM_005, REQ_IAM_012, REQ_PC_003, REQ_PC_014
Austrian Tourism DS	1	3%	P1.DPO.01		REQ_IAM_005, REQ_IAM_012, REQ_PC_003, REQ_PC_014
DSF_03- DS_asset_catalogue	Num of DPOs	%	Specific DPOs	Further information	
REST API	3	10%	P1.DPO.12		REQ_PD_002, REQ_PD_014
			P1.DPO.13		REQ_PD_002, REQ_PD_014
			P1.DPO.14		REQ_PD_002, REQ_PD_014



hub.austria.info	1	3%	P1.DPO.01		REQ_PD_002, REQ_PD_014
EUScreen for TEMS	1	3%	P4.DPO.01		
DSF_04- ID_mechanism	Num of DPOs	%	Specific DPOs	Further information	
Trenitalia	3	10%	P1.DPO.12		
			P1.DPO.13		
			P1.DPO.14		
DIDs	1	3%	P1.DPO.01		REQ_IAM_001, REQ_IAM_002
DSF_05- Trust_mechanism	Num of DPOs	%	Specific DPOs	Further information	
Trenitalia	3	10%	P1.DPO.12		REQ_IAM_002
			P1.DPO.13		REQ_IAM_002
			P1.DPO.14		REQ_IAM_002
Creator as Trust Anchor	1	3%	P1.DPO.01		REQ_IAM_002
DSF_06- Policies_enforcement	Num of DPOs	%	Specific DPOs	Further information	
Proprietary Data Space Protocols	3	10%	P1.DPO.12		REQ_PC_005, REQ_PC_004, REQ_PC_001
			P1.DPO.13		REQ_PC_005, REQ_PC_004, REQ_PC_001
			P1.DPO.14		REQ_PC_005, REQ_PC_004, REQ_PC_001
Open Data	1	3%	P1.DPO.03	The Austrian government agreed to share data within all the Austrian federation.	REQ_PC_001
			P1.DPO.01		REQ_PC_001



Annex V: Solutions

This table lists the different solutions, including software on-premises and services, specifications, standards, frameworks, reference implementations and architectures -solution as understood by the Interoperable Europe Portal: https://interoperable-europe.ec.europa.eu/interoperable_solutions.

Domain	Solution long name	Solution short name	URL	Reference	Comment
Data Catalog Services	AlpineBits DestinationData	AlpineBits DestinationData REST API	https://www.alpinebits.org/open-standard/destination-data/	DATES Technical specifications for interoperability	
Data Catalog (domain-specific)	AlpineBits Open Standards	AlpineBits DestinationData ontology	https://www.alpinebits.org/open-standard/	DATES Technical specifications for interoperability	
Cooperation Agreements	aNewGovernance Manifesto	aNewGovernance Manifesto	https://www.anewgovernance.org/1241-2/	DATES Technical specifications for interoperability	
	Apache Hadoop	Hadoop	https://hadoop.apache.org/docs/current/	DATES Technical specifications for interoperability	
Data Analytics Engine	Apache Kafka	Kafka	https://kafka.apache.org/20/documentation.html	DATES Technical specifications for interoperability	
Data Analytics Engine	Apache Spark	Spark	https://spark.apache.org/docs/latest/	DATES Technical specifications for interoperability	

Document name:	D2.1 ETDS Interoperability & Data Sharing	Page:	103 of 145
Reference:	D2.1 Dissemination: PU	Version: 1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Data Catalog Services	Arazzo	OTA-OpenAPI	https://spec.openapis.org/arazzo/latest.html	OTA Standards	
Model Development and Deployment	Archi modelling toolkit	Archi	https://www.archimatetool.com/download/	By browsing	
	ArchiMate Specification	ArchiMate	https://pubs.opengroup.org/architecture/archimate32-doc/archimate32-specification.html		
	Attribute-Based Access Control	ABAC		Austrian Tourism Data Space	
Data Analytics Engine	Azure confidential computing	Azure confidential computing	https://learn.microsoft.com/en-us/azure/confidential-computing/	deployEDMS Requirement s analysis of the technical infrastructure document	
Workflow Management Engine	Batch file transfer	SFTP	https://sftpcLOUD.io/learn/sftp/sftp-batch-file-a-comprehensive-guide	deployEDMS Requirement s analysis of the technical infrastructure document	
Blueprint, Reference architecture, rulebook	Blueprint and Roadmap for Deploying the European Tourism Data Space	Blueprint and Roadmap for Deploying the ETDS	https://transition-pathways.europa.eu/knowledge-documents/strategic-blueprint-european-tourism-data-space-pathway-innovation-and	ETDS Grant Agreement	

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	104 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Quality, Conformance criteria	BSI Cloud Computing Compliance Criteria Catalogue	BSI C5	https://www.bsi.bund.de/EN/Themen/Unternehmen-und-Organisationen/Informationen-und-Empfehlungen/Empfehlungen-nach-Angriffszielen/Cloud-Computing/Kriterienkatalog-C5/C5_AktuelleVersion/C5_AktuelleVersion_node.html	DATES Technical specifications for interoperability	
Workflow Management Engine	Business Process Model and Notation (BPMN)	BPMN	https://www.omg.org/spec/BPMN	DATES Technical specifications for interoperability	
Cooperation Agreements	Catena-X governance framework	Catena-X governance framework	https://catena-x.academy/wp-content/uploads/2024/09/3.1-CX-Dataspace-Governance-How-organised.pdf	DATES Technical specifications for interoperability	
Identity Management	Catena-X IDENTITY ACCESS MANAGEMENT 001 Identity of Member Companies	Catena-X IAM 001 Identity of Member Companies	https://catena-x.net/fileadmin/user_upload/Standard-Bibliothek/Update_PDF_Maerz/4_IAM/CX_-_0013_Identity_of_Memb	DATES Technical specifications for interoperability	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	105 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



			er Companies Platform CapabilityIAM v 1.0.1.pdf		
Identity Management	Catena-X IDENTITY ACCESS MANAGEMENT 002 Identity of Employees and Technical Users	Catena-X IAM 002 Identity of Employees and Technical Users	https://catena-x.net/fileadmin/user_upload/Standard-Bibliothek/Archiv/4_PC_IAM_v2.1/IAM_002_PlatformCapabilityIAM_v2.1.pdf	DATES Technical specifications for interoperability	
Identity Management ; Access & Usage Policies and Control	Catena-X IDENTITY ACCESS MANAGEMENT 003 IAM & Access Control Paradigm	Catena-X IAM 003 IAM & Access Control Paradigm	https://catena-x.net/fileadmin/user_upload/Standard-Bibliothek/Archiv/4_PC_IAM_v2.1/IAM_003_PlatformCapabilityIAM_v2.1.pdf	DATES Technical specifications for interoperability	
Access & Usage Policies and Control	Catena-X IDENTITY ACCESS MANAGEMENT 006 Company Role by the Connector	Catena-X IAM 006 Company Role by the Connector	https://catena-x.net/fileadmin/user_upload/Standard-Bibliothek/Archiv/4_PC_IAM_v2.1/IAM_006_PlatformCapabilityIAM_v2.1.pdf	DATES Technical specifications for interoperability	
Operational Governance	Catena-X ONBOARDING 001 PROCESS SPECIFICATION: Registration and	Catena-X ONB 001 P.: Registration and Onboarding	https://catena-x.net/fileadmin/user_upload/Standard-Bibliothek/Archiv/6_PC_Onboarding_v	DATES Technical specifications for interoperability	

Document name:	D2.1 ETDS Interoperability & Data Sharing	Page:	106 of 145
Reference:	D2.1 Dissemination: PU	Version: 1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	Onboarding		2.1/ONB-001 Registration and Initial Onboarding Platform Capability Onboarding v2.1.pdf		
Operational Governance	Catena-X ONBOARDING 002 PROCESS SPECIFICATION: Minimal Data Provider Services Offering	Catena-X ONB 002 PS Minimal Data Provider Services Offering	https://catena-x.net/fileadmin/user_upload/Standard-Bibliothek/Archiv/6_PC_Onboarding_v2.1/ONB-002_Minimal_Data_Provider_Services_Offering_PlatformCapabilityOnboarding_v2.1.pdf	DATES Technical specifications for interoperability	
Operational Governance	Catena-X ONBOARDING 003 PROCESS SPECIFICATION: Relevant Standards for Conformity Assessment	Catena-X ONB 003 Relevant Standards for Conformity Assessment	https://catena-x.net/fileadmin/user_upload/Standard-Bibliothek/Archiv/6_PC_Onboarding_v2.1/ONB-003_Conformity_Assessment_PlatformCapabilityOnboarding_v2.1.pdf	DATES Technical specifications for interoperability	
Operational Governance	Catena-X ONBOARDING 004 CX: Registration API	Catena-X ONB 004 CX Registration API	https://catena-x.net/fileadmin/user_upload/Standard-Bibliothek/Archiv/UpdateStandard_PDF_Feb_2023/6_Onboarding_v1.0/CX_Registration_API.pdf	DATES Technical specifications for interoperability	

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	107 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



			X - 0009 CX Registration API Platform Capability Onboarding v 1.0.0.pdf		
Access & Usage Policies and Control	Catena-X SOVEREIGN DATA EXCHANGE 002 ECLIPSE DATASPACE CONNECTOR (*also referred to as SOV-001)	Catena-X SC 002 EDC (SOV-001)	https://catena-x.net/fileadmin/user_upload/Standard-Bibliothek/Archiv/3_PC_Sovereign_Data_Exchange_v2.1/SC-002_EDC_PC_Self-Sovereign_Data_Exchange_v2.1.pdf	DATES Technical specifications for interoperability	replaced by Dataspace Protocol
	CIDOC object-oriented Conceptual Reference Model	CIDOC CRM	https://cidoc-crm.org/sites/default/files/Documents/cidoc_crm_version_7.1.3.html	Europeana	
Data Discoverability	CloudEvents Specification	CloudEvents	https://github.com/cloudevents/spec	Eclipse	
System Adaptation	Constrained Application Protocol	CoAP	https://www.rfc-editor.org/rfc/rfc7252.html	DATES Technical specifications for interoperability	
Data Analytics Engine; Model Evaluation and Validation	Cross-Industry Standard Process for Data Mining	CRISP-DM	https://www.kde.cs.uni-kassel.de/wp-content/uploads/lehre/ws2012-13/kdd/files/CRISPWP-0800.pdf	DATES Technical specifications for interoperability	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	108 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Law	Data Act	DA	https://eur-lex.europa.eu/eli/reg/2023/2854/oj	By browsing	
Data Catalog (domain-agnostic)	Data Catalog Vocabulary Application Profile	DCAT-AP	https://semic.eu.github.io/DCAT-AP/releases/3.0.0/	DATES Technical specifications for interoperability	
System Adaptation	Data Distribution Service	DDS	https://www.omg.org/spec/DDS/1.4/PDF	DATES Technical specifications for interoperability	only ETSI NGSI-LD and NGSI v2 in use
Law	Data Governance Act	DGA	https://eur-lex.europa.eu/eli/reg/2023/868/oj	DATES Reference Architecture	
	Data Monetization, Interoperability, Trading & Exchange software	DATAMITE	https://gitlab.eclipse.org/eclipse-research-labs/datamite-project	ETDS Grant Agreement	
Quality, Conformance criteria	Data on the Web Best Practices: Data Quality Vocabulary	W3C DQV	https://www.w3.org/TR/vocab-dqv/	DATES Blueprint	
Blueprint, Reference architecture, rulebook	Data Space Support Centre Blueprint	DSSC Blueprint	https://dssc.eu/space/BVE2/1071251457/Data+Spaces+Blueprint+v2.0+-+Home	DATES Technical specifications for interoperability	
Blueprint, Reference architecture, rulebook	Data Space Support Centre Glossary	DSSC Glossary	https://dssc.eu/space/BVE2/1071251749/Glossary	DATES Technical specifications for interoperability	
Marketplaces & Usage	Data Spaces Business	BSBA Technical	https://data-spaces-	DATES Technical	integrated in IDS RAM

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	109 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Accounting	Alliance Technical Convergence Discussion Document	Convergence Discussion Document	business-alliance.eu/dsba-releases-technical-convergence-discussion-document/	specifications for interoperability	
Data Visualisation	Data Visualization Style Guides	Data Visualization Style Guides	https://www.datavisualizationsociety.org/	DATES Technical specifications for interoperability	
	DataHub	DataHub	https://datahubproject.io/docs/features	deployEDMS Requirements analysis of the technical infrastructure document	
Data Catalog (domain-specific)	DATAtourism ontology (schema.org)	DATAtourism ontology (schema.org)	https://www.datatourism.fr/ontology/core/index-en.html	DATES Technical specifications for interoperability	
Blueprint, Reference architecture, rulebook	DATES Roles and Dynamics of the Tourism industry in the EU highlights	DATES Roles and Dynamics of the Tourism industry in the EU highlights	https://www.tourismdataspace-csa.eu/wp-content/uploads/2023/09/DATES_D4.1_Roles-and-Dynamics-of-the-Tourism-Industry-in-the-EU_v1.1.pdf	DATES Reference Architecture	
	DATEX Information Delivery EP	DATEX II	https://docs.datex2.eu/exchange-2020/information-delivery/	deployEDMS Requirements analysis of the technical infrastructure document	
Data Catalog	DCAT-AP	DCAT-AP	https://semic	DATES	

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	110 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



(domain-agnostic)	High Value Datasets	HVD	eu.github.io/DCAT-AP/releases/2.2.0-hvd/	Reference Architecture	
Data Catalog Services	deployEDMS Knowledge Hub (use cases)	deployEDMS Knowledge Hub	https://deployemds.eu/knowledge-hub/	deployEDMS Requirement s analysis of the technical infrastructure document	
Blueprint, Reference architecture, rulebook	deployEDMS Requirement s analysis of the technical infrastructure document	deployEDMS Requirement s analysis of the technical infrastructure document	https://deployemds.eu/wp-content/uploads/2024/05/D2.1-Requirement s-analysis-of-the-technical-infrastructure-3.pdf	deployEDMS	
	Digital Europe Building Blocks (eID, eDelivery)	DIGITAL BB (eID, eDelivery)	https://ec.europa.eu/digital-building-blocks/sites/display/DIGITAL/Digital+Homepage	DATES Technical specification s for interoperability	
Marketplaces & Usage Accounting	Digital Open Marketplace Ecosystem	DOMe	https://dome40.eu/deliverables	DATES Technical specification s for interoperability	not aligned with GXFS components nor SmashHit
Blueprint, Reference architecture, rulebook	DSSC Building Blocks taxonomy	DSSC taxonomy	https://dssc.eu/space/BBE/178421761/Building+Blocks+%7C+Version+0.5+%7C+September+2023	DATES Blueprint	
Blueprint, Reference architecture, rulebook	DSSC Conceptual Model of Data Spaces	Key Concepts of Data Spaces	https://dssc.eu/space/bv15e/766061351/Introduction+-	DATES Blueprint	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	111 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



			+Key+Concepts+of+Data+Spaces		
Workflow Management Engine	Eclipse Requirements For Azure DevOps	Requirement s4DevOps	https://marketplace.visualstudio.com/items?itemName=easesol.requirements	By browsing	
	Eclipse Cross Federation Services Components	Eclipse XFSC	https://gitlab.eclipse.org/eclipse/xfsc	DATES Technical specifications for interoperability	
	Eclipse Data Exchange Logging Service	Eclipse DELS	https://gitlab.eclipse.org/eclipse/xfsc/del	DATES Technical specifications for interoperability	
	Eclipse Dataspace Components	EDC	https://github.com/eclipse-edc	DATES Technical specifications for interoperability	
	Eclipse Dataspace Components Connector	EDC Connector	https://github.com/eclipse-edc/Connector	DATES Technical specifications for interoperability	
Data Discoverability	Eclipse Dataspaces Components Federated Catalog	EDC Federated Catalog	https://github.com/eclipse-edc/FederatedCatalog	DATES Reference Architecture	
	Eclipse Minimum Viable Dataspace	Eclipse MVDS	https://github.com/eclipse-edc/MinimumViableDataspace	DATES Technical specifications for interoperability	
	eIDAS eID Implementation	eIDAS eID Implementation	https://ec.europa.eu/digital	DATES Reference	

Document name:	D2.1 ETDS Interoperability & Data Sharing	Page:	112 of 145
Reference:	D2.1 Dissemination: PU	Version: 1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	on	on	-building-blocks/sites/display/DIGITAL/How+to+implement+or+operate+an+eIDAS-Node#	Architecture	
Blueprint, Reference architecture, rulebook	eIDAS toolbox	eIDAS Dashboard	https://eidas.ec.europa.eu/efda/home	By browsing	
Data Analytics Engine	Elastic	Elastic	https://www.elastic.co/docs	deployEDMS Requirement s analysis of the technical infrastructure document	
Quality, Conformance criteria	ENISA Cloud Computing Risk Assessment	ENISA Cloud Computing Risk Assessment	https://www.enisa.europa.eu/publications/cloud-computing-risk-assessment	deployEDMS Requirement s analysis of the technical infrastructure document	
Identity Management	ETSI Certificate Profiles; Part 3: Certificate profile for certificates issued to legal persons	ETSI EN 319 412-3	https://www.etsi.org/deliver/etsi_en/319400_319499/31941203/01.03.01_60/en_31941203v010301p.pdf	DATES Technical specification s for interoperability	
	ETSI Context Information Management (CIM); Next Generation Service Interfaces with Linked Data	NGSI-LD API 1.8.1	https://www.etsi.org/deliver/etsi_gs/CIM/001_099/09/01.08.01_60/gs_CIM009v010801p.pdf	DATES Technical specification s for interoperability	
Identity Management	EUDI Wallet Architecture & Reference Framework	EUDI Wallet ARF (eIDAS2)	https://github.com/eu-digital-identity-	DATES Technical specification s for	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	113 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	(eIDAS2)		wallet/	interoperability	
	EUHUBS4D ATA Catalogue Services	EUHUBS4D ATA Catalogue Services	https://euhubs4data.eu/services/	deployEDMS Requirement s analysis of the technical infrastructure document	
	eUI Platform	eUI	https://eui.ecdevops.eu/	By browsing	
	European Blockchain Services Infrastructure Hub (specifications)	EBSI Hub (specifications)	https://hub.ebsi.eu/	DATES Blueprint	
	European Union Cybersecurity Certification Scheme on Cloud Services	EUCS	https://www.enisa.europa.eu/publications/eucs-cloud-service-scheme	DATES Technical specifications for interoperability	
	Extended Validation Secure Sockets Layer	EV SSL		DATES Blueprint	
Access & Usage Policies and Control	Extensible Access Control Markup Language	XACML	https://docs.open.org/xacml/3.0/xacml-3.0-core-spec-os-en.pdf	DATES Technical specifications for interoperability	
Quality, Conformance criteria	FAIR Guiding Principles for scientific data management and stewardship'	FAIR principles	https://www.go-fair.org/fair-principles/	By browsing	
	FIWARE	FIWARE	https://github	DATES	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	114 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	(NGSI v2, NGSI-LD, Smart Data Models, Fiware Catalogue)		.com/FIWARE	Technical specifications for interoperability	
	FIWARE CKAN	FIWARE CKAN	https://fiwaretourguide.readthedocs.io/en/latest/data-publication/introduction/	DATES Reference Architecture	
	FIWARE CKAN extensions	FIWARE CKAN extensions	https://fiware-ckan-extensions.readthedocs.io/en/latest/installation-administration-guide.html	DATES Reference Architecture	
	FIWARE Context broker (NGSIV2 REST API)	Orion	https://github.com/telefonicaid/fiware-orion/	DATES Reference Architecture	
	FIWARE Data Space Connector	FIWARE Data Space Connector	https://github.com/FIWARE/data-space-connector	DATES Blueprint	
	FIWARE European Next Generation Service Interfaces	NGSI API 2.0	https://fiware.github.io/specifications/ngsiv2/stable/	DATES Technical specifications for interoperability	
Data Catalog (domain-specific)	FIWARE Smart Destination model (Smart Destination model)	Smart Destination model	https://github.com/smart-data-models/SmartDestination	DATES Technical specifications for interoperability	
Marketplaces & Usage Accounting	FIWARE/TM Forum Business API Ecosystem	FIWARE/TM Forum Business API Ecosystem	https://github.com/FIWARE-TMForum/Bu	DATES Technical specifications for	

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	115 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	(FIWARE Business Application Ecosystem)	(FIWARE BAE)	siness-API-Ecosystem	interoperability	
	Gaia-X Architecture Data Space Self-Description	DSSD	https://docs.gaia-x.eu/technical-committee/architecture-document/22.04/self-description/	DATES Reference Architecture	
Blueprint, Reference architecture, rulebook	Gaia-X Architecture Document (Gaia-X Conceptual Model, Component details, Operating details, Gaia-X Trust Framework components, Enabling and Federation Services, Gaia-X and Data Meshes, Computational Contracts)	Gaia-X Architecture Document	https://docs.gaia-x.eu/technical-committee/architecture-document/23.10/	deployEDMS Requirements analysis of the technical infrastructure document	
Data Discoverability	Gaia-X Architecture Federated Catalogue	Gaia-X Federated Catalogue	https://gaia-x.gitlab.io/data-infrastructure-federation-services/catalogue/architecture/catalogue-architecture.html	DATES Reference Architecture	
Blueprint, Reference architecture,	GAIA-X Compliance Document	Gaia-X Compliance	https://docs.gaia-x.eu/policy-	DATES Blueprint	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	116 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



rulebook			rules-committee/compliance-document/latest/		
	Gaia-X Compliance Registry	Gaia-X Compliance Registry	https://gitlab.com/gaia-x/lab/compliance/gx-registry	deployEDMS Requirement s analysis of the technical infrastructure document	
	GAIA-X Federated Services (GXFS Clearing House, XFSC repository; GXFS Authentication/Authorization, Notarization (VC) Services, VP Wallets, Service Catalogue)	GXFS	https://gitlab.com/gaia-x/data-infrastructure-federation-services	DATES Technical specification s for interoperability	
Identity Management ; Access & Usage Policies and Control	GAIA-X Federated Services Authentication/Authorization	GXFS IDM AA	https://gxfs.eu/download/1752/	DATES Technical specification s for interoperability	
	GAIA-X Federated Services Continuous Automated Monitoring	GXFS CAM	https://gitlab.eclipse.org/eclipse/xfsc/cam	DATES Technical specification s for interoperability	
	GAIA-X Federated Services Continuous Automated Monitoring Compliance	GXFS CAM Compliance Specification	https://www.gxfs.eu/download/1731	DATES Technical specification s for interoperability	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	117 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	Specification				
	GAIA-X Federated Services Data Exchange Logging Service	GXFS DELS	https://www.gxfs.eu/data-exchange-logging-service/	DATES Technical specifications for interoperability	
Operational Governance	GAIA-X Federated Services Onboarding & Accreditation Workflows	GXFS OAW	https://gaia-x.gitlab.io/technical-committee/federation-services/federation-service-specifications/L11_CP_OAW/cp_oaw/#:~:text=This%20document%20specifies%20Onboarding%20and%20Accreditation%20Workflows%20%28OAW%29,to%20achieve%20transparency%20for%20both%20Consumers%20and%20Providers.	DATES Technical specifications for interoperability	
Identity Management	GAIA-X Federated Services Organizational Credential Manager	GXFS OCM	https://www.gxfs.eu/download/1746/	DATES Technical specifications for interoperability	
Identity Management	GAIA-X Federated Services Personal Credential Manager	GXFS PCM	https://www.gxfs.eu/download/1749/	DATES Technical specifications for interoperability	
Identity	GAIA-X	GXFSv2 IAM	https://docs.g	DATES	

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	118 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Management ; Access & Usage Policies and Control	Federated Services v2 Identity and Access Management		aia-x.eu/technical-committee/entity-credential-access-management/22.10/product_overview/	Technical specifications for interoperability	
	Gaia-X Federation Services - GXFSv2 Data Exchange	GXFS Data Exchange	https://docs.gaia-x.eu/technical-committee/data-exchange/22.10/	DATES Blueprint	
	GAIA-X Framework	GAIA-X Framework	https://docs.gaia-x.eu/#/framework	DATES Blueprint	
Blueprint, Reference architecture, rulebook	Gaia-X Glossary	Gaia-X Glossary	https://gaia-x.gitlab.io/glossary/	DATES Blueprint	
	GAIA-X Identity, Credential and Access Management Document	ICAM	https://docs.gaia-x.eu/technical-committee/entity-credential-access-management/24.07/	DATES Blueprint	
Quality, Conformance criteria	Gaia-X Policy Rules Conformity Document	Gaia-X PRCD	https://docs.gaia-x.eu/policy-rules-committee/policy-rules-conformity-document/23.10/	DATES Blueprint	
Trust	GAIA-X Self-description	GAIA-X SD Participant	https://gaia-x.gitlab.io/po/	DATES Technical	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	119 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	model: Participant		icy-rules-committee/trust-framework/participant/	specifications for interoperability	
Trust	GAIA-X Self-description model: Resource	GAIA-X SD Resource	https://gaia-x.gitlab.io/policy-framework/resource-and-subclasses/	DATES Technical specifications for interoperability	
Trust	GAIA-X Self-description model: Service	GAIA-X SD Service	https://gaia-x.gitlab.io/policy-framework/service-and-subclasses/	DATES Technical specifications for interoperability	
	Gaia-X Self-Description of Resources, Service Offerings and Participants within Gaia-X Ecosystems Whitepaper	Whitepaper Self-Descriptions	https://www.gxfs.eu/download/4304/	By browsing	
	Gaia-X Trust Framework	Gaia-X Trust Framework	https://docs.gaiax.eu/policy-rules-committee/trust-framework/2.10/	DATES Reference Architecture	
	GAIA-X Wizard User Guide	GAIA-X Wizard	https://wizard.lab.gaiax.eu/userGuide	DATES Blueprint	
Law	General Data Protection Regulation	GDPR	https://eur-lex.europa.eu/eli/reg/2016/679/oj	DATES Reference Architecture	

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	120 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



			6/679/oj		
	GitHub	GitHub	https://github.com/	By browsing	
Data Analytics Engine; Ethical Considerations and Fairness	Google Responsible AI practices	Google Responsible AI practices	https://ai.google/responsibility/principles/	DATES Technical specifications for interoperability	
Blueprint, Reference architecture, rulebook	Governance framework roadmap for the European Tourism Data Space: DATES project deliverable	Roadmap for the Governance Framework	https://transition-pathways.europa.eu/knowledge-documents/governance-framework-roadmap-european-tourism-data-space-dates-project	ETDS Grant Agreement	
Data Visualisation	Grafana	Grafana	https://grafana.com/docs/	DATES Technical specifications for interoperability	
Data Analytics Engine	Grafana Open-source	Grafana	https://grafana.com/docs/grafana/latest/	deployEDMS Requirement analysis of the technical infrastructure document	
Data Catalog (domain-specific)	Hotel Data and Destination Data Standards (Smart Destination model)	Smart Destination model	https://github.com/smart-data-models/SmartDestination	DATES Technical specifications for interoperability	
	i4Trust (FIWARE/IS HARE) Building	i4Trust	https://github.com/i4Trust/building-blocks	DATES Blueprint	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	121 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	Blocks				
	IDS App Store	IDS App Store	https://international-data-spaces-association.github.io/IDS-AppStore/introduction	DATES Blueprint	
	IDS Building Blocks (OpenDEI) Catalog	IDS Building Blocks	https://docs.internationaldataspaces.org/ids-knowledgebase/open-dei-building-blocks-catalog	DATES Blueprint	
	IDS Connector	IDS Connector	https://international-data-spaces-association.github.io/DataSpaceConnector/		
Quality, Conformance criteria	IDS Data Spaces Radar	Data Spaces Radar	https://internationaldataspaces.org/adapt/data-spaces-radar/	DATES Reference Architecture	
	IDS Enterprise Integration Connector	IDS Connector	https://github.com/International-Data-Spaces-Association/IDS-Enterprise-Integration-Connector		
	IDS Meta Data Broker Specification	IDS Meta Data Broker	https://internationaldataspaces.org/wp-content/uploads/dlm_uploads/IDSA-White-Paper-Specification	IDSA	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	122 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



			-IDS-Meta-Data-Broker.pdf		
	IDS Reference Testbed	IDS Testbed	https://docs.internationaldataspaces.org/ids-knowledgebase/ids-reference-testbed	DATES Reference Architecture	
Quality, Conformance criteria	IDSA Certification	IDSA Certification	https://internationaldataspaces.org/offers/certification/	DATES Technical specifications for interoperability	
Blueprint, Reference architecture, rulebook	IDSA Data Spaces Landscape: Overview and relations of data spaces initiatives, standards and tools	IDSA Data Spaces Landscape	https://internationaldataspaces.org/wp-content/uploads/dlm_uploads/IDSA-Position-Paper-Data-Spaces-Landscape-1.pdf	DATES Blueprint	
	IDSA Dataspace Protocol	DSP	https://docs.internationaldataspaces.org/ids-knowledgebase/dataspace-protocol	DATES Reference Architecture	
	IDSA Position paper - Usage Control in the International Data Spaces	IDSA Usage Control Concept	https://internationaldataspaces.org/wp-content/uploads/dlm_uploads/IDSA-Position-Paper-Usage-Control-in-the-IDS-V3..pdf	IDSA	

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	123 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	Dataspace Protocol	DSP	https://eclipse-dataspace-protocol-base.github.io/DataspaceProtocol/2025-1-RC1/	IDSA	
Access & Usage Policies and Control	IDSA Dynamic Attribute Provisioning Service	IDSA DAPS	https://github.com/International-Data-Spaces-Association/IDS-G/blob/main/Components/IdentityProvider/DAPS/README.md	DATES Technical specifications for interoperability	
Blueprint, Reference architecture, rulebook	IDSA Information Model	IDSA IM	https://github.com/International-Data-Spaces-Association/InformationModel	DATES Technical specifications for interoperability	discontinued on behalf of Spark SQL engine
	IDSA-Eclipse Minimum Viable Dataspace	IDSA-EDC MVDS	https://github.com/International-Data-Spaces-Association/EDC-MinimumViableDataspace	DATES Technical specifications for interoperability	
Data Analytics Engine	Intel Software Guard Extensions (SGX) device plugin for Kubernetes	SGX	https://intel.github.io/intel-device-plugins-for-kubernetes/cmd/sgx_plugin/README.html	deployEDMS Requirements analysis of the technical infrastructure document	
Blueprint, Reference architecture, rulebook	International Data Spaces Association Rulebook	IDSA Rulebook	https://docs.internationaldataspaces.org/ids-knowledgebase/idsa-	DATES Technical specifications for interoperability	

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	124 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



			rulebook		
Trust	Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile	RFC5280	https://www.rfc-editor.org/rfc/rfc5280.html	DATES Technical specifications for interoperability	
	iSHARE Trust Framework	iSHARE	https://framework.ishare.eu/main-aspects-of-the-ishare-trust-framework	DATES Technical specifications for interoperability	
	iSHARE Trust Framework (Participant Registry)	Satellite	https://trustbook.ishare.eu/apply-ishare/participant-registry		
Operational Governance; Continuity Model	iSHARE Trust Framework Detailed descriptions	iSHARE Trust Framework Detailed descriptions	https://framework.ishare.eu/detailed-descriptions/operational/operational-processes	DATES Technical specifications for interoperability	
Data Catalog (domain-specific)	ISO/CD 20525 Tourism and related services - Semantics applied to tourism destinations (under development)	ISO/DIS 20525 (under development)	https://www.iso.org/standard/86307.html#lifecycle	DATES Technical specifications for interoperability	
Continuity Model	ISO/IEC 20000-1:2018 Information technology -	ISO/IEC 20000-1:2018	https://www.iso.org/standard/70636.html	DATES Technical specifications for interoperability	

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	125 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	Service management - Part 1: Service management system requirements			ty	
Continuity Model	ISO/TS 10020:2022 Quality management systems - Organizational change management - Processes	ISO/TS 10020:2022	https://www.iso.org/standards/82213.html	DATES Technical specifications for interoperability	
Data Catalog (domain-specific)	Italian Tourism Data Hub ontologies (schema.org)	TDH022 ontologies (schema.org)	https://docs.italia.it/italia/ministero-della-sanita/docs/it/main/index.html	DATES Technical specifications for interoperability	
System Adaptation	Java Database Connectivity	JDBC	https://docs.oracle.com/javase/8/docs/technotes/guides/jdbc/	DATES Technical specifications for interoperability	
Blueprint, Reference architecture, rulebook	JRC Mapping the landscape of data intermediaries Emerging models for more inclusive data governance	JRC Mapping the landscape of data intermediaries	https://publications.jrc.ec.europa.eu/repository/handle/JRC133988	deployEDMS Requirement analysis of the technical infrastructure document	
System Adaptation	JSON transformation language	JSLT	https://github.com/schibsted/jslt	DATES Technical specifications for interoperability	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	126 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Trust	JSON Web Key	JWK	https://www.rfc-editor.org/rfc/rfc7517	DATES Technical specifications for interoperability	
Workflow Management Engine	Kafka streams	Kafka	https://kafka.apache.org/documentation/streams/	deployEDMS Requirements analysis of the technical infrastructure document	
	Kantara	NIST SP 800-63 Digital Identity Guidelines	https://pages.nist.gov/800-63-4/	DATES Reference Architecture	
Data Visualisation	Kibana	Kibana	https://www.elastic.co/docs/api/doc/kibana/	DATES Technical specifications for interoperability	
Data Analytics Engine	Kubernetes	Kubernetes	https://kubernetes.io/docs/concepts/overview/	DATES Technical specifications for interoperability	
Data Analytics Engine	Kubernetes Container Runtime Interface	Kubernetes CRI	https://kubernetes.io/docs/concepts/architecture/cri/	DATES Technical specifications for interoperability	
Identity Management	Leveraging the Self-Sovereign Identity (SSI) Concept to Build Trust	Digital Identity: Leveraging the SSI Concept to Build Trust	https://www.enisa.europa.eu/publications/digital-identity-leveraging-the-ssi-concept-to-build-trust	By browsing	
	Lightweight Information Describing	LIDO Primer	https://lido-schema.org/documents/p	Europeana	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	127 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	Objects (LIDO) Primer		rimer/2023-02-28/lido-primer.html		
System Adaptation	Message Queuing Telemetry Transport	MQTT	https://docs.open.org/mqtt/mqtt-v5.0/mqtt-v5.0.html	DATES Technical specifications for interoperability	
Data Visualisation	Metabase Cloud	Metabase	https://www.metabase.com/docs/latest/	DATES Technical specifications for interoperability	
Data Catalog (domain-agnostic)	Microdata (schema.org)	Microdata (schema.org)	https://schema.org/docs/gs.html	DATES Technical specifications for interoperability	
Workflow Management Engine	Microsoft Message Queuing	MSMQ	https://learn.microsoft.com/en-us/openspecs/windows_protocols/msmqod/644be85f-7a78-4bcc-b8a1-389e4b24b2cc	deployEDMS Requirements analysis of the technical infrastructure document	reuses DSSD
Data Visualisation	Microsoft Power business intelligence	Microsoft Power BI	https://learn.microsoft.com/en-us/power-bi/guidance/	DATES Technical specifications for interoperability	
Data Analytics Engine; Ethical Considerations and Fairness	Microsoft Responsible AI Standard	Microsoft Responsible AI Standard	https://www.microsoft.com/en-us/ai/principles-and-approach	DATES Technical specifications for interoperability	
Data Catalog (domain-	mobilityDCA T-AP	mobilityDCA T-AP	https://github.com/mobility	deployEDMS Requirement	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	128 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



specific)			DCAT-AP/mobilityD CAT-AP	s analysis of the technical infrastructure document	
	MyData	MyData	https://julkaisut.valtioneuvosto.fi/handle/10024/78439	DATES Reference Architecture	
Identity Management	OAuth 2.0 Authorization Server Metadata	RFC 8414	https://www.rfc-editor.org/rfc/rfc8414.html	DATES Technical specifications for interoperability	
	OGC Points of Interest Encoding Specification	OGC PoI	https://github.com/opengeospatial/poi	By browsing	
	Open API Specifications (NGSI v2 API, IoT Agent library, Wirecloud API, Keyrock API)	FIWARE Generic Enablers	https://fiware.github.io/specifications/	DATES Reference Architecture	
	Open Data Product Specification	ODPS	https://opendataproducts.org/v3.1/#open-data-product-specification-3-1	deployEDMS Requirements analysis of the technical infrastructure document	
Data Catalog (domain-specific)	Open Data Tourism Alliance specifications (schema.org)	ODTA specifications (schema.org)	https://odta.sti2.org/?dsb-list=CRkyvcqGqeUu	DATES Technical specifications for interoperability	
Blueprint, Reference architecture, rulebook	Open DEI Building Block Data Models & Formats	OpenDEI Data Models & Formats		DATES Technical specifications for interoperability	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	129 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	Open DEI Building Blocks Catalog (Data Models and Formats, Metadata & Discovery Protocol, Data Exchange APIs, Data Provenance and Traceability)	Open DEI Building Blocks Catalog	https://docs.internationaldataspaces.org/ids-knowledgebase/open-dei-building-blocks-catalog	DATES Reference Architecture	
Blueprint, Reference architecture, rulebook	Open DEI Design Principles for Data Spaces - Position Paper	Open DEI position paper	https://design-principles-for-data-spaces.org/	DATES Technical specifications for interoperability	Documentation updated in EDC dataspace protocol
Workflow Management Engine	Open Source Requirements Management Tool	OSRMT	https://github.com/osrmt/osrmt	By browsing	
Data Analytics Engine	Open Source Solutions to Build Enclave Applications	Enclave	https://learn.microsoft.com/en-us/azure/confidential-computing/enclave-development-oss	deployEDMS Requirements analysis of the technical infrastructure document	
Data Catalog Services	Open Standaarden voor Linkende Overheden	OSLO	https://github.com/v-ict-or/oslo_xml_schemas?tab=readme-ov-file	deployEDMS Requirements analysis of the technical infrastructure document	
Workflow Management Engine	Open Telemetry	OTel	https://opentelemetry.io/	deployEDMS Requirements analysis of the technical infrastructure document	

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	130 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Marketplaces & Usage Accounting	OpenDEI “State of the Art” report (FIWARE Business Application Ecosystem)	OpenDEI “State of the Art” report (FIWARE BAE)	https://internationaldataspaces.org/wp-content/uploads/dlm_uploads/Report-OPENDEI-State-of-the-Art.pdf	DATES Technical specifications for interoperability	
Identity Management	OpenID Connect	OIDC	https://openid.net/specs/openid-connect-core-1_0.html	DATES Technical specifications for interoperability	
Identity Management	OpenID Connect for Verifiable Presentations	OID4VP	https://openid.net/specs/openid-connect-4-verifiable-presentation-1_0-07.html	DATES Technical specifications for interoperability	
Identity Management	OpenID for Verifiable Credential Issuance	OID4VCI	https://openid.net/specs/openid-4-verifiable-credential-issuance-1_0.html	DATES Technical specifications for interoperability	
	OpenID for Verifiable Presentations - draft 23 (Decembre 2024)	OIDC4VP - draft 23 (Decembre 2024)	https://openid.net/specs/openid-4-verifiable-presentation-1_0.html	DATES Blueprint	
Data Analytics Engine	OpenMessaging Specification	OpenMessaging	https://github.com/openmessaging/specification/blob/master/specification-schema.md#0-overview	DATES Technical specifications for interoperability	
Data Catalog (domain-specific)	OpenTravel Alliance Standards	OTA Standards	https://opentavel.org/download-the-	DATES Technical specification	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	131 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



			opentravel-specification/	s for interoperability	
Data Analytics Engine	Oracle Extensions to Standard SQL	SQL extensions	https://docs.oracle.com/en/database/oracle/oracle-database/19/sqlrf/Oracle-Extensions-to-Standard-SQL.html	DATES Technical specifications for interoperability	
Data Catalog (domain-agnostic)	OWL 2 Web Ontology Language	OWL	https://www.w3.org/TR/owl2-overview/	DATES Technical specifications for interoperability	
Workflow Management Engine	Pipeline Builder (Workflow Description Language)	Pipeline Builder (WDL)	https://github.com/epam/pipeline-builder	WDL docs	
Continuity Model	Plan-do-check-act cycle	PDCA cycle+	https://asq.org/quality-resources/pdca-cycle	DATES Technical specifications for interoperability	
Data Analytics Engine	Predictive Model Markup Language	PMML	https://dmg.org/pmml/v4-4/GeneralStructure.html	DATES Technical specifications for interoperability	
	Prometheus	Prometheus	https://prometheus.io/docs/introduction/overview/	deployEDMS Requirement analysis of the technical infrastructure document	
Data Catalog (domain-specific)	PROV Data Model	PROV-DM	https://www.w3.org/TR/prov-dm/	DATES Technical specifications for interoperability	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	132 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	Public-Key Cryptography Standards (DES/Triple DES keys)	PKCS (DES/Triple DES keys)	https://en.wikipedia.org/wiki/Triple_DES	Gaia-X Architecture Document	
	Public-Key Cryptography Standards (RSA keys)	PKCS (RSA keys)	https://www.rfc-editor.org/rfc/rfc8017.html		
	Public-Key Cryptography Standards (X.509 certificates)	PKCS (X.509 certificates)	https://www.rfc-editor.org/rfc/rfc5280.html		
Data Analytics Engine; Model Development and Deployment	PyTorch	PyTorch	https://pytorch.org/docs/stable/index.html	DATES Technical specifications for interoperability	
Data Visualisation	Qlik Cloud	Qlik	https://help.qlik.com/en-US/cloud-services/Subsystems/Hub/Content/Global/Common/HelpSites/introducing-qlik-cloud.htm	DATES Technical specifications for interoperability	
System Adaptation	RDF Mapping Language	RML	https://rml.io/specs/rml/	DATES Technical specifications for interoperability	
Blueprint, Reference architecture, rulebook	Reference Architecture Model for the International Data Spaces	IDS-RAM	https://docs.internationaldataspaces.org/ids-knowledgebase/ids-ram-4	DATES Technical specifications for interoperability	
Identity Management	Regulation (EU) 2024/1183	EIDAS2	https://eur-lex.europa.eu/legal-	DATES Technical specification	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	133 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



			content/EN/XT/?uri=celext%3A32024R1183	s for interoperability	
	representational state transfer	REST	https://restfulapi.net/	DATES Technical specifications for interoperability	
Data Visualisation	Salesforce Tableau	Tableau	https://help.salesforce.com/s/articleView?id=analytics_analytics_tableau.htm&type=5	DATES Technical specifications for interoperability	
Data Catalog (domain-agnostic)	schema.org	schema.org	https://schema.org/	DATES Technical specifications for interoperability	
Data Analytics Engine; Model Development and Deployment	Scikit-learn	Scikit-learn	https://scikit-learn.org/stable/user_guide.html	DATES Technical specifications for interoperability	
	Secure Software Development Framework (SSDF) Version 1.1: Recommendations for Mitigating the Risk of Software Vulnerabilities (to assess EDC Connector)	NIST SP 800-218 (SSDF) (to assess EDC Connector)	https://csrc.nist.gov/pubs/sp/800/218/financial	deployEDMS Requirement analysis of the technical infrastructure document	
Identity Management	Security Assertion	SAML	https://www.rfc-	DATES Technical	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	134 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



; Access & Usage Policies and Control	Markup Language (SAML) 2.0 Profile for OAuth 2.0 Client Authentication and Authorization Grants		editor.org/rfcs/rfc7522.html	specifications for interoperability	
Data Catalog (domain-specific)	Segittur Tourism Conceptual Reference Model	UNE 178503:2019	https://ontologia.segittur.es/turismo/modelo.html	DATES Blueprint	
Identity Management	Self-Issued OpenID Provider v2	Self-Issued OP	https://openid.net/specs/openid-connect-self-issued-v2-1_0.html	DATES Technical specifications for interoperability	
	Self-Issued OpenID Provider v2	SIOPv2	https://openid.net/specs/openid-connect-self-issued-v2-1_0.html	DATES Blueprint	
Identity Management	Self-Sovereign Identity and the AARC Blueprint Architecture (education domain)	SSI and the AARC BPA	https://wiki.giant.org/display/gn43wp5/SSI+and+the+AARC+BPA	By browsing	
	Simpl Preparatory Study	Simpl Preparatory Study	https://digital-strategy.ec.europa.eu/en/policies/simpl#1712822729753-0	DATES Reference Architecture	
Blueprint, Reference architecture, rulebook	Simpl requirements	Simpl requirements	https://simpl-programme.ec.europa.eu/book-page/simpl-requirements	Simpl Programme	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	135 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Cooperation Agreements	SITRA "Rulebook for a fair data economy"	SITRA Rulebook	https://www.sitra.fi/en/publications/rulebook-for-a-fair-data-economy/	DATES Technical specifications for interoperability	
Marketplaces & Usage Accounting	Smart Connected Supplier Network	SCSN	https://euhubs4data.eu/members/smart-connected-supplier-network/	DATES Technical specifications for interoperability	
	Smart middleware platform	SIMPL	https://simpl-programme.ec.europa.eu/dashboard/development	DATES Reference Architecture	
	SmashHit	SmashHit	https://smashhit.eu/open-source/	DATES Technical specifications for interoperability	
	SOLID Hosted Pod Services	SOLID Pod	https://solidproject.org/for-developers	DATES Reference Architecture	
	SOLID specification	SOLID specification	https://github.com/solid/specification?tab=readme-ov-file	DATES Reference Architecture	
	Spark SQL engine	Spark SQL engine	https://archive.apache.org/dist/spark/docs/3.0.0/structured-streaming-programming-guide.html		
System Adaptation	SPARQL 1.1 Query Language	SPARQL	https://www.w3.org/TR/sparql11-query/	DATES Technical specifications for interoperability	
Quality,	Starter Kit for	DSSC	https://dssc.e	DATES	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	136 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Conformance criteria	Data Space Designers	Starter Kit	u/download/attachments/29523973/DS-SC-Starterkit-Version-1.0.pdf?download=true	Reference Architecture	
Data Analytics Engine	Statistical Data and Metadata eXchange	SDMX	https://sdmx.org/standards-2/	DATES Technical specifications for interoperability	
Data Analytics Engine	Streaming SQL standard	StreamSQL	https://github.com/intel-spark/stream-sql	DATES Technical specifications for interoperability	
System Adaptation; Data Analytics Engine	Structured Query Language	SQL	https://www.iso.org/standard/76583.html	DATES Technical specifications for interoperability	
Data Catalog Services	Study on Mastering data for tourism by EU destinations	Study on Mastering data for tourism by EU destinations	https://op.europa.eu/en/publication-detail/-/publication/9df86541-fba5-11ec-b94a-01aa75ed71a1/language-en	DATES Reference Architecture	
Workflow Management Engine	TDH022 - TECHNICAL INTEROPERABILITY GUIDELINES AND API MANAGEMENT	TDH022 Orchestration Service	https://docsitalia.it/media/pdf/gl-tourism-digital-hub-interoperability-docs/main/gl-tourism-digital-hub-interoperability	DATES Technical specifications for interoperability	

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	137 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



			ta-docs.pdf		
Data Catalog Services	TDH022 – TECHNICAL INTEROPERABILITY GUIDELINES AND API MANAGEMENT	TDH022 – TECHNICAL INTEROPERABILITY GUIDELINES AND API MANAGEMENT	https://docs.italia.it/media/pdf/gl-tourism-digital-hub-interoperabilita-docs/main/gl-tourism-digital-hub-interoperabilita-docs.pdf	DATES Blueprint	
Blueprint, Reference architecture, rulebook	Technical infrastructure and blueprint for a secure European data ecosystem: DATES project deliverable (DATES Design for the Data Space for tourism)	DATES Blueprint	https://transition-pathways.europa.eu/knowledge-documents/technical-infrastructure-and-blueprint-secure-european-data-ecosystem-dates	deployTour Grant Agreement	
Data Analytics Engine; Model Development and Deployment	TensorFlow	TensorFlow	https://www.tensorflow.org/api_docs	DATES Technical specifications for interoperability	
Data Catalog (domain-specific)	Thesaurus on Tourism & Leisure Activities	Thesaurus on Tourism & Leisure Activities	https://vocabularyserver.com/tla/en/index.php	DATES Blueprint	
Data Catalog (domain-specific)	Travel Connect standard	Travel API	https://rapidapi.com/collectio/travel-api	DATES Reference Architecture	
System Adaptation	UK Legacy Standards (AVLABL, REScon,	UK Legacy Standards (AVLABL, REScon,	https://www.ti.org/legacy-standards	DATES Technical specifications for	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	138 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	TOPAS, TORIX)	TOPAS, TORIX)		interoperability	
	Unified Modeling Language	UML	https://www.omg.org/spec/UML/2.5.1/About-UML/		
Data Catalog (domain-specific)	UNWTO Glossary of tourism terms	UNWTO Glossary of tourism terms	https://www.unwto.org/glossary-tourism-terms	DATES Reference Architecture	
Access & Usage Policies and Control	User-Managed Access (OAuth)	UMA (OAuth)	https://docs.kantarinitiative.org/uma/wg/rec-oauth-uma-grant-2.0.html	DATES Technical specifications for interoperability	
Data Catalog Services	VocBench	VocBench	https://vocbench.uniroma2.it/doc/	By browsing	
Data Catalog (domain-agnostic)	W3C Data Catalog Vocabulary	DCAT	https://www.w3.org/TR/vocab-dcat-3/	DATES Technical specifications for interoperability	
Identity Management ; Trust	W3C Decentralised Identifier Resolution	DID resolution	https://w3c.github.io/did-resolution/	DATES Technical specifications for interoperability	
Identity Management	W3C Decentralised Identifiers	DID	https://www.w3.org/TR/did-core/	DATES Technical specifications for interoperability	
	W3C JSON-based Serialization for Linked Data	JSON-LD	https://www.w3.org/TR/json-ld11/	DATES Technical specifications for interoperability	
Access &	W3C Open	ODRL	https://www.	DATES	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	139 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Usage Policies and Control	Digital Rights Language (ODRL)		w3.org/TR/odrl-model/	Technical specifications for interoperability	
Data Catalog (domain-agnostic)	W3C Provenance Data Model	W3C PROV-DM	https://www.w3.org/TR/prov-dm/	DATES Technical specifications for interoperability	
Data Catalog (domain-agnostic)	W3C Provenance Ontology	W3C PROV-O	https://www.w3.org/TR/2013/REC-prov-o-20130430/	DATES Blueprint	
Data Catalog (domain-agnostic)	W3C Resource Description Framework	RDF	https://www.w3.org/TR/rdf11-concepts/	DATES Technical specifications for interoperability	
Data Catalog (domain-agnostic)	W3C Resource Description Framework in Attributes	RDFa	https://www.w3.org/TR/rdfa-primer/	DATES Technical specifications for interoperability	
Data Catalog (domain-agnostic)	W3C Shapes Constraint Language	SHACL	https://www.w3.org/TR/shacl/	DATES Technical specifications for interoperability	
Data Catalog (domain-agnostic)	W3C Simple Knowledge Organization System	SKOS	https://www.w3.org/2009/08/skos-reference/skos.html	DATES Technical specifications for interoperability	
Identity Management ; Trust	W3C Verifiable Credentials Data Model v1.1	VC DM 1.1	https://www.w3.org/TR/vc-data-model/	DATES Technical specifications for interoperability	

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	140 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



Identity Management ; Trust	W3C Verifiable Credentials Data Model v2.0	VC DM 2.0	https://www.w3.org/TR/vc-data-model-2.0/	DATES Technical specifications for interoperability	
Data Catalog (domain-agnostic)	W3C Vocabulary of Interlinked Datasets	W3C VoID	https://www.w3.org/TR/void/	DATES Technical specifications for interoperability	
Data Catalog (domain-agnostic)	W3C XML Schema Definition Language	XSD 1.1	https://www.w3.org/XML/Schema	DATES Technical specifications for interoperability	
Data Discoverability	Web electronic identity	Web eID	https://web-eid.eu/	By browsing	
Workflow Management Engine	Web Services Business Process Execution Language	WS-BPEL	https://docs.oasis-open.org/ws-bpel/2.0/OS/ws-bpel-v2.0-OS.html	DATES Technical specifications for interoperability	
Quality, Conformance criteria	WHITE PAPER CERTIFICATION FRAMEWORK FOR THE IDS CERTIFICATION SCHEME	IDS Certification Scheme	https://internationaldataspaces.org/wp-content/uploads/dlm_uploads/IDSA-White-Paper-certification-scheme-V.2.pdf	IDSA	
Workflow Management Engine	Workflow Description Language	WDL	https://github.com/openwdl/wdl/blob/wdl-1.2/SPEC.md	DATES Technical specifications for interoperability	
	XACML 3.0 Specification Set	XACML architecture	https://groups.oasis-open.org/communities/tc-	DATES Blueprint	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	141 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



			community-home2?CommunityKey=67afe552-0921-49b7-9a85-018dc7d3ef1d#XACML30		
Workflow Management Engine	XML Process Definition Language	XPDL	https://wfmc.org/wp-content/uploads/2022/09/TC-1025_xpdl_2_2005-10-03.pdf	DATES Technical specifications for interoperability	
System Adaptation	XML Query Language	XQuery	https://www.w3.org/TR/xquery-30/	DATES Technical specifications for interoperability	
System Adaptation	XML transformation language	XSLT	https://www.w3.org/TR/xslt-30/	DATES Technical specifications for interoperability	
	Eclipse Decentralised Claims Protocol	DCP	https://github.com/eclipse-dataspace-dcp/decentralised-claims-protocol	Eclipse Dataspace Components	
	Eclipse Management API	eclipse-management-api	https://eclipse-edc.github.io/Connector/openapi/management-api/	Eclipse Dataspace Components	
	Micrometer metrics library	Micrometer	https://github.com/eclipse-edc/Connector/tree/main/extensions/common/metrics/micrometer	Eclipse Dataspace Components	

Document name:	D2.1 ETDS Interoperability & Data Sharing				Page:	142 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0	Status: Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



			r-core		
	Java Development Kit Logger Monitor	JDK logger	https://github.com/eclipse-edc/Connector/tree/main/extensions/common/monitor/monitor-jdk-logger	Eclipse Dataspace Components	
	Europeana Metis sandbox	Metis sandbox	https://metis-sandbox.europeana.eu/	Europeana	
	European standard for traffic and travel information	DATEX2	https://docs.datex2.eu/downloads/	P1	
	Statistical programs for px files	PX	https://www.scb.se/en/services/statistical-programs-for-px-files/	P1	
	Common Format and MIME Type for Comma-Separated Values Files	CSV	https://www.rfc-editor.org/rfc/rfc4180.html	P1	
	JavaScript Object Notation Data Interchange Format	JSON	https://www.rfc-editor.org/rfc/rfc8259	P1	
	Office Open XML file formats	XLSX	https://ecma-international.org/publications-and-standards/standards/ecma-376/	P1	
	JSON-stat Dataset Format	JSON-stat	https://json-stat.org/format/	P1	
	SiStat PX-	PX-Web API	https://pxweb	P1	

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	143 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	Web API		.stat.si/SiStat/en/Home/Help		
	File Transfer Protocol	FTP	https://www.rfc-editor.org/rfc/rfc959.html	P1	
	Secure File Transfer Protocol	SFTP	https://www.rfc-editor.org/rfc/rfc913.html	P1	
	Europeana Data Model	EDM	https://pro.europeana.eu/page/edm-documentation	P4	
	Network Common Data Form	NetCDF	https://www.unidata.ucar.edu/software/netcdf/	P4	
	Open Archives Initiative Protocol for Metadata Harvesting	OIA-PMH	https://www.openarchives.org/OAI/openarchivesprotocol.html	P4	
	Data connector report	Data connector report	https://internationaldataspaces.org/wp-content/uploads/dlm_uploads/Data-Connector-Report-1.pdf	PPDS	
	Secure Hash Standard (SHS)	SHA-2	https://csrc.nist.gov/pubs/fips/180-4/upd1/final	Proposed by AnySolution	Review https://csrc.nist.gov/projects/hash-functions
	SHA-3 Standard: Permutation-Based Hash and Extendable-Output	SHA-3	https://csrc.nist.gov/pubs/fips/202/final	Proposed by AnySolution	Review https://csrc.nist.gov/projects/hash-functions

Document name:	D2.1 ETDS Interoperability & Data Sharing			Page:	144 of 145
Reference:	D2.1	Dissemination:	PU	Version:	1.0
				Status:	Final

This document translates some of the obligations from the grant agreement and in case of discrepancies, it is the grant agreement which prevails over this deliverable



	Functions				
	WSO2 API Manager	WSO2 API Manager	https://apim.docs.wso2.com/en/latest/	Proposed by AnySolution	