INTERNATIONAL DATA SPACES ASSOCIATION

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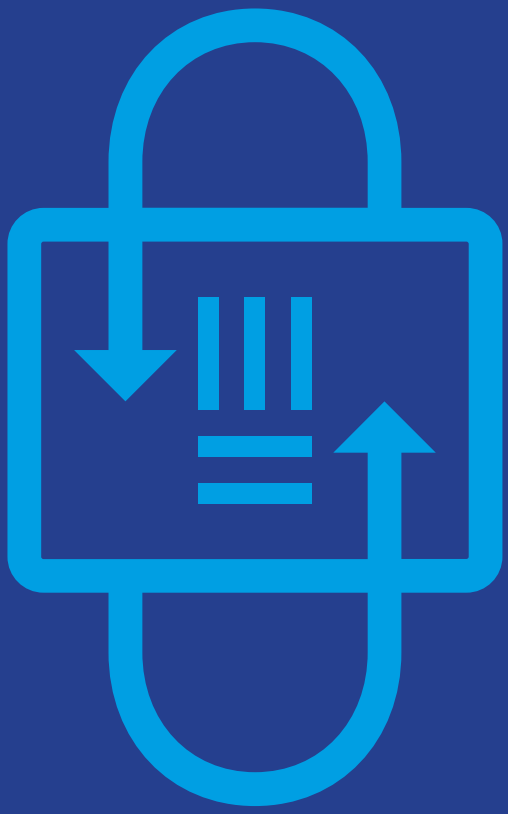
Data Connector Report



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1 Introduction

1.1 The Data Connector Report

The usage and access to data becomes crucial for the economy. A common understanding of data sharing and data usage technology is an important aspect for the data economy and therefore for organizations, projects, and initiatives. The IDSA Connector report focuses on technologies and concepts to participate in data spaces based on data connectors.

This report provides an analysis of the current state of data connector requirements, needs and available solutions. Various implementations are available today and in use. This report captures **16 Data Connector variants** and provides insights into their current development and usage status. Beyond the Data Connectors, this report provides insights into emerging technologies and concepts in data spaces and fundamental technologies that form a basis for data spaces. The IDSA Data Spaces Report will be published monthly to provide insights into current developments in this area.

You can actively contribute to the report via this Data Connector Report Contact Form, in three ways:

- Let us know your general feedback and comments on the report and recommend additional insights. Please refer to Section 1 of the form.
- Add a new connector to the report. Please refer to Section 2 of the form.
- Update the information on a connector already on the report. Please refer to Section 3 of the form.

The Data Connector Report is structured as follows:

1. General information on Data Connectors, their usage, capabilities, and functionalities.
2. An overview of the existing Data Connector implementations. The continuous assessment and the evolution of Data Connectors over the time shall provide clarity about their application potential, maturity, and certification status, as well as their adoption in industrial use cases and research. Please also refer to the Data Space Radar for an overview on Data Spaces.
3. Insights into emerging and foundation technologies.
4. Conclusion

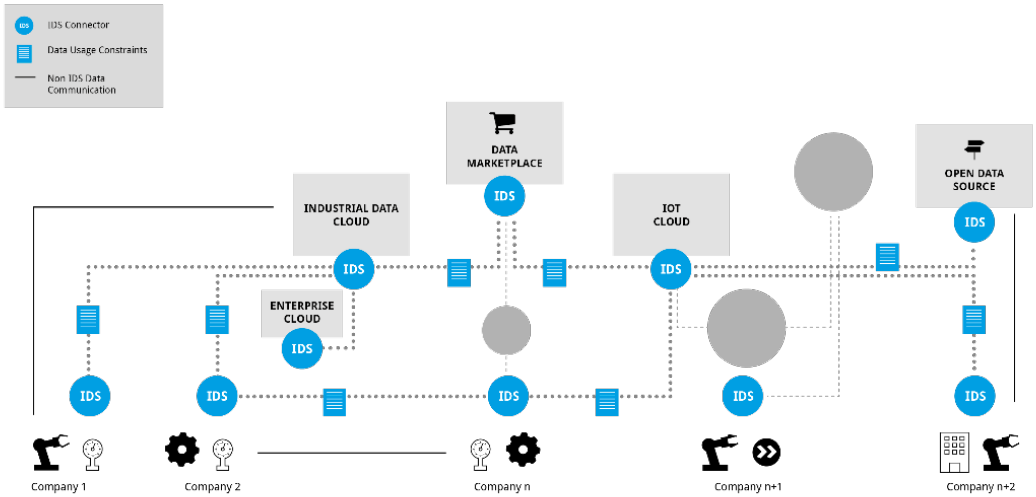
1.2 Why do we need data connectors

We need data connectors because they are a means to combine as many data endpoints as possible and with that enlarge the pool of available data – to accelerate the data economy. With linking data connectors, data spaces are created that are protected environments in which the participants can freely exchange data by adhering to a fixed set of rules that guarantees data sovereignty, transparency, and fairness. Data connectors with their nature as linked nodes in a data space provide data sovereignty by design.

Sharing and exchanging data is not a new thing, but the requirements to it grow beyond the bare exchange of data. Therefore, a data connector realizes basically two relevant aspects:

Data Exchange Services are (1) the interface or API towards other participants in data space to achieve interoperability and (2) the realization of a trustworthy component which can handle data with care by implementing policy enforcement mechanisms and a common baseline for cybersecurity. But, as data is different and the requirements for data exchange and data sharing are different, different variants of data connectors are needed (For more information visit the IDS Reference Architecture Model section 2.2 and section 2.4). This report shall give an overview of those different data connectors, their purpose, use and differentiations.

The figure below shows the variety of requirements in industrial ecosystems. A data connector for (I)IoT devices in the field may have substantial different requirements (with regards to resource consumption, efficiency, and cyber security), as it connects to the OT, then a connector that consumes such data as a data marketplace or an industrial cloud platform. At the same time such services have to seamlessly integrate Open Data. A Data Connector will enable baseline interoperability and trustworthy data sharing in such ecosystems. It will act as a generic component to put data into usage, to link it with other data and to enable modern concepts such as (shared and distributed) Digital Twins, AI, or federated learning. To do so, data connectors realize archetypical patterns for enterprise-grade service management, cloud-based service orchestration, lightweight API-Gateways, or IoT Gateways. They may use concepts like Distributed Ledgers, but they will rely on state-of-the-art data management capabilities.



1.3 What is a data connector

The current landscape for data sharing is highly scattered and this complexity does not support interoperability and data sovereignty as a capability. The ongoing creation of data spaces itself currently witnesses the definition of different implementation and standards, it is therefore important to create convergence, so that data spaces do not end up as the new data silos. It is important to have different solutions and implementations of Data Connectors with different functionalities, it is nonetheless crucial to enable interoperability, data

continuity and common governance models to enable data sovereignty. An IDS Connector realizes such Data Exchange Services as described in the IDS-RAM section3.5.2[1]. (see also figure below).

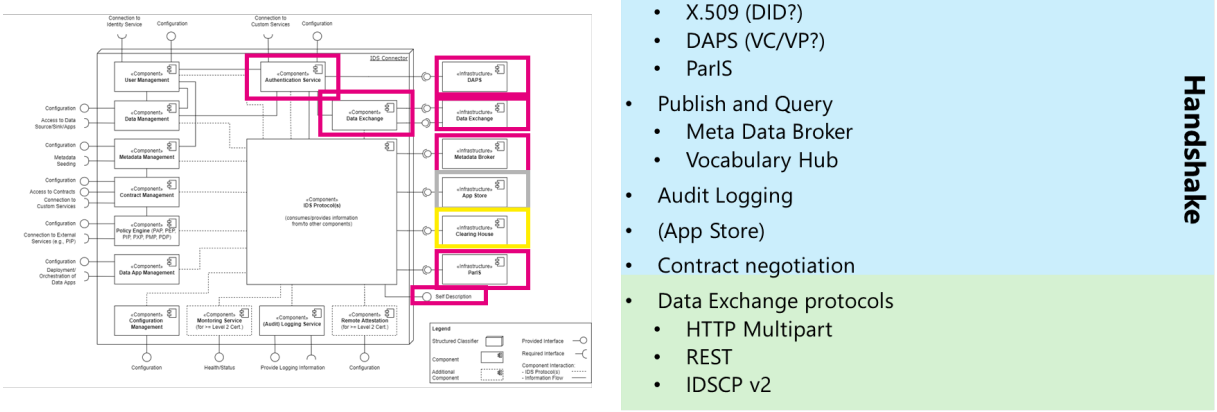


Figure 2: Data Exchange Services realized by a Data Connector as described in the IDS-RAM section3.5.2

IDS based data connectors - gateway software components of a technology made in Europe to incentivize the exchange of data among organizations and individuals across Europe, a technology 'made in Europe' is needed. This technology must ensure data sovereignty across different industries and on a non-competitive basis by means of appropriate digital infrastructure components and a standard, interoperable format. This must enable data exchange between all ecosystems (edge, cloud, mobile, server-based, ...). Therefore, a global standard is needed in order to prevent data spaces creating the next silos of data economy.

The **IDS initiative** is on its way to create this global standard for data connectors and has developed a software architecture that ensures data ¬sovereignty by facilitating secure exchange of data between trusted parties. Certified users are granted access to the data ecosystem, in which they can attach usage restriction policies to their data before they make it available to other users. This is made possible by a dedicated gateway software component, the IDS-based Data Connector, which can be installed on a server, in a cloud, on an IoT device, and on a smartphone.

This way, data is generated in a distributed way before it can be exchanged with the help of IDS technology, stored in any kind of cloud (public, private, etc.), and processed in line with data usage policies specified. The IDS Connector concept uses special container technology ensuring "trusted execution "; i.e., data inside the container is always protected against unauthorized access and manipulation and can be used only as agreed upon by the parties involved.

With the IDS standard for data spaces in place, leveraging synergies with other pioneering initiatives like Gaia-X, FIWARE, SITRA, MyData, and several others can finally make the vision of data spaces happen. Since data spaces merge technical, organizational, and legal

[1] https://docs.internationaldataspaces.org/ids-ram-4/layers-of-the-reference-architecture-model/3-layers-of-the-reference-architecture-model/3_5_0_system_layer/3_5_2_ids_connector#ids-connector-functionalities

complexities, the IDS Standard tackles both technical, operational and legal agreements to enable data sharing in data spaces[2]. Focusing on the technical perspective, the IDS standard has its foundations in its **Reference Architecture Model**[3], which provides guidelines for a secure and standardized data exchange and data linkage in a trusted data space. To achieve this, the RAM revolves around a **data connector** with specific features and requirements, like Identity Management, Communication Security, Usage Control, and others. Details on the architecture of an IDS Connector can be found in the RAM 3.5.2[4]. The IDS Connector is currently a DIN SPEC in Germany[5] and it is on its way for the ISO.

To be able to prove compliance to these functionalities and requirements the **IDS Certification**[6] process was launched at Hannover Fair 2022. The IDS Certification offers different Trust Levels and Assurance Levels, for both Connectors and Operational environments. Certification for all the other IDS Components is also on its way. Some connectors are labelled as **'IDS-Ready'**: this means that they successfully underwent a pre-certification third-party assessment to prepare for Certification.

Implementations of data connectors based on the IDS standard can be found open source. To this regard the **IDS Graduation Scheme**[7] was created to provide a set of rules, processes, and criteria to manage these open-source implementations on the IDSA GitHub[8].

[2] https://internationaldataspaces.org/rule-book-on-structures-and-processes-for-implementing-ids-in-the-real-world/
[3] https://docs.internationaldataspaces.org/ids-ram-4/introduction/1_1_goals_of_the_international_data_spaces
[4] https://docs.internationaldataspaces.org/ids-ram-4/layers-of-the-reference-architecture-model/3-layers-of-the-reference-architecture-model/3_5_0_system_layer/3_5_2_ids_connector
[5] https://internationaldataspaces.org/ids-is-officially-a-standard-din-spec-27070-is-published/
[6] https://internationaldataspaces.org/use/certification/
[7] https://github.com/International-Data-Spaces-Association/idsa/tree/main/graduation_scheme
[8] International-Data-Spaces-Association/idsa: This is the main repository of International Data Spaces Association on GitHub, where you can find general overview and useful information on IDS Landscape.

2 Implementations of Data Connectors (October 2022)

Several data connectors have been already implemented and some are under development. This section provides an overview of some of the available connectors and provides additional information for each of them. This list is not exhaustive and will be kept updated to the head office of IDSA on a regular basis to show progress and new developments

2.1 Overview of Data Connectors

	Name of connector	Maintainer	Open source
1	Dataspace Connector (DSC)	Sovity	✓
2	ECI IDS Connector powered by TNO	ECI Software Solutions	
3	Eclipse Dataspace Connector (EDC)	EDC consortium	✓
4	EGI DataHub connector	EGI	✓
5	GAIAboX	nicos AG	
6	IIOC (Intel IONOS Orbiter Connector)	truzzt	✓
7	MPAD-C	Mondragon	✓
8	Tech2B SCSN Connector	Tech2B	
9	Telekom DIH Connector	T-Systems International GmbH	
10	TeraLab Connector	TeraLab	✓
11	TNO Security Gateway (TSG)	TNO	✓
12	TRUE connector	Engineering	✓
13	Trusted connector	Fraunhofer AISEC	✓
14	Trusted Supplier Connector (TSC)	German Edge Cloud	
15	VTT IDS Connector	VTT	
16	WeTech Smart Data Connector	WeTech	

2.2 Description of the connectors

The connectors are described based on the following aspects:

- Name of the connector
- Logo of the connector (or company logo)
- Maintainer (company name)
- Short description, describing Unique Selling Point and/or main field of application of the connector (for example: cloud, IoT...)
- Maturity level. This is described with different indicators based on the preferences of the company. Examples of indicators are the levels of the IDS Graduation Scheme, IDS Certification, TRL.
- License type
- Features of the connector, e.g., usage control capabilities, Information Model version used, protocols supported.
- Adoption of the connector. This field provides information on the application of the connector. It therefore gives visibility to the projects where the connector is used.
- External resources. This represents a list of links to external resources to dive deeper into each connector.

2.2.1 Dataspace Connector by Sovity

Name of the connector	Dataspace Connector
Logo of the connector or company logo	
Maintainer	Sovity GmbH
Short description	Open-Source Connector for easy sharing of data between data space participants with usage-control functionality. Reference Implementation for other connectors.
Maturity level	IDS Ready, approved for IDS graduation (IDS Sandbox) In productive use
License type	Open-Source Software
Features	Connects to data sources and sinks (REST, data bases or via Camel) Exchanges data between IDS Connectors HTTP Multipart and IDSCP protocols Use IDS Apps and Routes to incorporate business logic Enforcement of Usage Control
Adoption of the connector	Adopted in several solutions. Some examples are in the following list (not exhaustive): • Mobility Data Space • Sovity product • IDSA Reference Testbed
External resources	https://github.com/International-Data-Spaces-Association/DataspaceConnector

2.2.2 EGI DataHub connector

Name of the connector	EGI DataHub connector
Logo of the connector or company logo	
Maintainer	EGI Foundation
Short description	Policy based access via IDS to multiple storage backends supported by EGI DataHub (e.g. S3, Swift, NFS, GlusterFS, etc)
Maturity level	TRL4/TRL5
License type	Open Source Software
Features	All Usage Control supported by IDSA Data Space Connectors (9 in total) Information model version 4.2.7 Protocol supported: https
Adoption of the connector	EUHubs4data
External resources	https://egitlab.iti.es/euhubs4data/egi-datahub-connector (not public yet)

2.2.3 ECI IDS Connector by TNO

Name of the connector	ECI IDS Connector - powered by TNO
Logo of the connector or company logo	
Maintainer	ECI Software Solutions B.V.
Short description	From digital spaghetti to EDI lasagna! No more one-to-one EDI connections, but companies can exchange digital messages with all connected and yet to be connected companies after the one-time connection.
Maturity Level	We are using the TNO IDS connector live for users of our EDI platform ECI Gatewise. The TNO IDS connector is on its way to become IDS-Cerified.
License type	The standardized message format SCSN is Open Source and specially developed for companies in the manufacturing industry and its suppliers.
Features	We use the TNO IDS connector to exchange digital messages safely and reliably between multiple parties.
Adoption of the connector	For our EDI platform ECI Gatewise we use the TNO IDS connector and all digital messages are based on the standardized SCSN message format. SCSN is a kind of evolved UBL2.1 message
External resources	https://www.ecisolutions.com/nl/supply-chain-management/gatewise/ https://youtu.be/vapiKD3xzbE https://smart-connected-supplier-network.gitbook.io/processmanual/ https://smart-connected.nl/en

2.2.4 Eclipse Dataspace Connector

Name of the connector	Eclipse Dataspace Connector
Logo of the connector or company logo	
Maintainer	Committer Group in Eclipse Foundation
Short description	Whatever the individual setup is — on-premises bare-metal, different cloud vendors, hybrid, even single end-user machines — the EDC can be customized to work within any environment at scale. The connector's added value is achieved through the separation of control and data plane, which enables a modular and thereby customizable way to build dataspaces. Due to common interfaces and mapping of existing standards, the connector adds capabilities of contract negotiating and policy handling in an interoperable manner. As an open-source project hosted by the Eclipse Foundation, it provides a growing list of modules for many widely deployed cloud environments "out-of-the-box" and can easily be extended for more customized environments, while avoiding any intellectual property rights (IPR) headaches.
Maturity Level	TRL 8/9
License type	Apache 2.0
Features	• Modular and highly extensible framework • Separate control and data planes • System is asynchronous and highly available • Policy Negotiation and Data Transfer Orchestration • Transfer processes are fully auditable • Eliminate single points of failure • Cloud aware policy enforcement and projection • Default implementations and blueprints available
Adoption of the connector	• Catena-X • Eona-X • Health-X DataLOFT • Various research projects (PoC phase)

External resources	URL of code repository: https://github.com/eclipse-dataspaceconnector/DataSpaceConnector Website: https://projects.eclipse.org/projects/technology.dataspaceconnector

2.2.5 IIOC (Intel IONOS Orbiter Connector) by truzzt

Name of the connector	IIOC (Intel IONOS Orbiter Connector)
Logo of the connector or company logo	truzzt
Maintainer	truzzt
Short description	IoT Version of IDSA Connector – compatible to EDC. Extra resource-saving executable for sensors and small devices.
Maturity level	Connector is already live and usable Connector is a part of IDSA Base Camp.
License type	Open-Source Software, part of IDS Graduation Scheme (Sandbox)
Features	• DAPS, Connector, Connector Communication, Intel – SGX • Protocols supported: http, neuropil, IDSCP2
Adoption of the connector	• IDS Base Camp • Daimler Witte Car Online Logical Unit
External resources	• www.truzzt.com • https://gitlab.truzzt.com/ionos/gsc-setup

2.2.6 GAIAboX by nicos AG

Name of the connector	GAIAboX®.IDS. BasicConnector
Logo of the connector or company logo	
Maintainer	nicos AG
Short description	IDS BasicConnector, based on IDS-G specifications and ready to be equipped with additional protocols and/or application-functionalities.
Maturity level	• Up and running for and in nicos.testbed.IDS, following given IDS Certification Criteria for Components. • Starting with Certification Trust Level 1 – Assurance Level 1 (Checklist Approach) and preparing for next level of certification.
License type	Closed Source Software
Features	• Uses IDS DAPS as Identity Provider • Ready for VC/VP • Usage Control (subset of IDS Usage Control, plus superset of well-known Access Control features) • Aligned to current IDS Information Model (IDS-IM) • Works as a Linked Data Platform (LDP, so aligned to W3C “solid”) • Aims to work with gRPC as an additional (but IDS-aligned) application protocol.
Application of the connector	• Used by nicos.testbed.IDS as “Alice and Bob” • Base for “Delegated Access Control Service” (expressed by DACL, the “Dynamic Access Control Language”) • Base for Clearing House / Logging Service, too (Linked Data Notification, IDS Multipart Message, etc.).
´External resources	Homepage will be provided in the next version of the Report

2.2.7 MPAD-C by Mondragon

Name of the connector	MPAD-C (Manufacturing Process Anomaly Detection Connector)
Logo of the connector or company logo	
Maintainer	
Short description	The technologies and tools for anomaly detection analysis are not always available within the company and 3rd party experts and algorithms are required to analyze those data. The IDS connector can assure that those data is used only by the desired company agreeing to the terms established in the contract
Maturity Level	4-5 The solution presented is a prototype using the connector available in Github where we have implemented/tested different control capabilities and connection modes (direct, subscription ...)
License type	Open-Source Software
Features	Different control capabilities (temporarily, certificates ...) have been implemented, as well as connection modes (direct, subscription ...) creating different resources in the IDS connector
Adoption of the connector	QU4LITY project
External resourses	The repository is currently closed for the Qu4lity consortium. Updates will be provided in the next versions of this Report.

2.2.8 Tech2B SCSN Connector

Name of the connector	Tech2B SCSN Connector
Logo of the connector or company logo	
Maintainer	Tech2B
Short description	NextGen manufacturing ecosystem to enable data sharing, resulting in an optimized and transparent international supply chain. Significantly accelerating adoption of digitalization by pointedly appealing to small & medium sized enterprises in the manufacturing and adjacent industries.
Maturity level	TRL8 - Actual system completed and operational and extensively tested in test and staging environments.
License type	Closed Source Software
Features	**Supported Models:** Request, Quotation, Order, Order Response, Invoice **Use Cases:** **1on1 Transactions** Share daily order transactions with suppliers that have none or an outdated software system. Standardized, secure and easy to use for companies without digitization knowledge, to build a future-proof and connected supply chain. **Supply & Demand** Enable the opportunity for buyers to use the reach of our network in the quotation phase. Our service provider will act as a proxy to place incoming RFQ on Tech2B Supply & Demand and return the quotations directly to the buyer.
Adoption of the connector	Smart Connected Supplier Network - Market 4.0
External resources	https://www.tech2b.cc

2.2.9 Telekom DIH connector

Name of the connector	Telekom DIH connector
Logo of the connector or company logo	T Systems
Maintainer	T-Systems International GmbH
Short description	Based on the Eclipse Data Connector (EDC) – an up-and-coming, extensible Connector development framework. We provide managed EDC service which is compliant with IDSA specification as well as DSC.
Maturity level	Preparing for IDS Certification (Trust Level 1 Assurance Level 2)
License type	This EDC extension work is conducted within GX4AI project, which requires the result delivered in open source. Therefore, we will open source part of our work, within GX4AI delivery.
Features	Sovereignty: Connect to existing and emerging dataspaces, to enable data transactions with sovereignty protection. Interoperability: one connector solution to be compatible with any platforms and ecosystems, including contract negotiation from edc to dsc/ dsc to edc, filetransfer from edc to dsc/ dsc to edc. Reliable and efficient: cloud agnostic Info Model Version: 4.1.3 Protocols: IDS Identity provider: DAPS
	The connector can be used I autonomous driving, robotic production, ML training pipeline The connector is used in the Data Intelligence Hub and in the GAIA-X4AI as a sub-project of the project family "GAIA-X 4 Future Mobility" in the mobility domain of the German Gaia-X Hub.
External resources	- Eclipse Dataspace Connector repository - Data Intelligence Hub (DIH) website - Gaia-X4AI project website. The project is part of the - GAIA-X 4 Future Mobility

2.2.10 TeraLab Connector

Name of the connector	TeraLab Connector
Logo of the connector or company logo	
Maintainer	TeraLab
Short description	Test connector used to get familiar with IDS and interact with EUHubs4Data partners.
Maturity	TRL 3 – Experimental proof of concept
License type	Open Source Software
Features	
Adoption	TeraLab Marketplace: Enabling data to move between the Marketplace and the connector using a back-end server.
External resources	

2.2.11 TNO Security Gateway (TSG)

Name of the connector	TNO Security Gateway (TSG)
Logo of the connector or company logo	
Maintainer	Netherlands Organisation for Applied Scientific Research (TNO)
Short description	Multi-purpose connector
Maturity level	Preparing for IDS Certification (Trust Level 1 Assurance Level 2)
License type	Open-Source Software
Features	Technological stack: Kotlin combined with Spring Boot & Apache Camel, IDS Multipart & IDSCPv2, Kubernetes/Docker
Adoption connector	Used in several projects, e.g. Smart Connected Supplier Network (SCSN)
External resources	URL to repository: https://tno-tsg.gitlab.io/, https://gitlab.com/tno-tsg. SCSN: Introduction - Smart Connected Supplier Network (gitbook.io)

2.2.12 TRUE Connector by Engineering

Name of the connector	TRUE Connector
Logo of the connector or company logo	
Maintainer	ENGINEERING INGEGNERIA INFORMATICA SpA
Short description	The TRUE Connector enables the trusted data exchange in order to be an active part of an IDS Ecosystem, a virtual data space leveraging existing standards and technologies, as well as governance models well-accepted in the data economy, to facilitate secure and standardized data exchange and data linkage in a trusted business ecosystem. The TRUE connector is also part of the FIWARE Catalogue: the integration of existing FIWARE ecosystems is guaranteed by the dedicated Data APP, enabling the IDS-based interaction in a plug-and-play way.
Maturity level	TRL 6 Part of the IDSA Graduation Scheme (Sandbox).Preparing for IDS Certification (Trust Level 1 Assurance 2).
License type	Open-Source Software and part of the IDSA Graduation Scheme (Sandbox), released under aGPLv3 license
Features	• OSS Usage Control (it can work also with FhG MyData optionally) plus Personal Data/GDPR Enforcement (integratable with ENG CAPE digital solution). • Information Model 4.1.1 • HTTP/HTTPS, WS over HTTPS, IDSCPv2
Adoption of the connector	The connector is used in the following projects: MARKET4.0, AI REGIO, EUR3KA, PLATOON, MUSKETEERS, ONENET
External resources	Engineering website: TRUE Connector: easing data sharing in Gaia-X (eng.it) URL of code repository: https://github.com/Engineering-Research-and-Development/true-connector YouTube video: Data Spaces Dialogue | Unboxing Data Spaces – Celebrating the New Status Quo - YouTube

2.2.13 Trusted Connector by Fraunhofer AISEC

Name of the connector	Trusted Connector
Logo of the connector or company logo	Fraunhofer AISEC
Maintainer	Fraunhofer AISEC
Short description	IoT edge platform "Trusted Connector" for the International Data Spaces. The connector is based on Apache Karaf, includes Camel message routing, a Camel component for remote attestation with other connectors, and a management web console.
Maturity level	IDS Ready Review, v1.1, 14.01.2021
License type	Open Source Software
Features	It supports Docker and trust|me as containerization environments and provides the following features: • Message routing and conversion between protocols with Apache Camel • Apps in isolated containers • Data flow- and data usage control • An Apache Camel component for secure communication and remote attestation between Connectors. The Trusted Connector has acquired the IDS_ready label. Trusted Connector is a composite of the Core Container and the overall system.
Adoption of the connector	
External resources	URL of code repository: International-Data-Spaces-Association/trusted-connector: IoT edge platform "Trusted Connector" of the International Data Spaces. Based on Apache Karaf, includes Camel message routing, a Camel component for remote attestation with other connectors, and a management web console. (github.com) Fraunhofer AISEC webpage on the Trusted connector: (in German) Trusted Connector - Fraunhofer AISEC

2.2.14 Trusted Supplier Connector (TSC) by German Edge Cloud

Name of the connector	Trusted Supplier Connector (TSC)
Logo of the connector or company logo	
Maintainer	German Edge Cloud GmbH & Co. KG
Short description	The TSC can be used in any industry or domain. It stands out is in usability and operability in an enterprise context, especially by non-technical people. The TSC strives to be interoperable with all major IDS Connectors available.
Maturity level	„IDS_ready“ Tested interoperability with major IDS Connectors on the market
License type	Closed Source Software
Features	Supported Protocols: IDS Header, IDS Multipart Contract Negotiation, Usage Control, Info Model 4.1.0
Adoption of the connector	• ICNAP Data Space project • Fraunhofer Edge Cloud • SmartFactory-KL with TNO
External resources	https://www.gec.io

2.2.15 VTT DSIL Connector by VTT Technical Research Centre of Finland

Name of the connector	VTT DSIL Connector
Logo of the connector or company logo	
Maintainer	VTT Technical Research Centre of Finland
Short description	The VTT DSIL Connector extends the dataspace connector reference implementation with two additional features: support for OPC UA communication protocol and user / role-based access management of shared data resources. Main field of application is in the manufacturing sector.
Maturity level	As the VTT DSIL connector is based on the Dataspace connector, the maturity level is the same. The Dataspace connector is labelled as "IDS_ready component" and it is tested for the Base certification level.
License type	Closed Source Software
Features	The connector supports the enforcement of eight usage condition classes of the International Data Spaces Association. Supported Info Model versions: Outbound: "4.2.7"; Inbound: "4.0.0", "4.1.0", "4.1.2", "4.2.0", "4.2.1", "4.2.2", "4.2.3", "4.2.4", "4.2.5", "4.2.6", "4.2.7". Protocols supported: Multipart, IDSCP2
Adoption of the connector	OSME (Open Smart Manufacturing Ecosystem) project; manufacturing supply chain transparency use case. TRUSTEE project; Multi-disciplinary data exchange pilot.
External resources	https://www.idsa-finland.fi/

2.2.16 WeTech Smart Data Connector

Name of the connector	WeTech Smart Data Connector
Logo of the connector or company logo	
Maintainer	WeTech Holding Co., Limited
Short description	With the standard data usage strategy and asymmetric encryption technology define in IDS, this connector achieves safe and reliable data transmission between the data sharing parties, and the implementation of the data provider's policies in the control of data usage time interval, usage times, usage methods and other policies. It can be applied to the sharing, use and control of important official documents, finance data, and market or business opportunities etc. between internal departments of large enterprises. A big tech firm in China has been using the connector, and its reliability has been proven.
Maturity level	Preparing for IDS Certification (Trust Level 1 Assurance Level 2)
License type	Closed Source Software
Features	Technological stack: Java, IDSCP, Personal Host
Adoption of the connector	Cross-border data sharing for a major Chinese telecom operator
External resources	-

3 Additional initiatives and promising emerging solutions

Beyond the currently existing IDS-based data connectors described above, other approaches support the usage of data in data-driven business-ecosystems and data spaces. The variety of requirements towards data sharing, based on confidentiality, regulatory aspects, technology limitations and more, provides space for additional initiatives and promising (emerging) technologies. In order to leverage the whole potential of the biggest pool of data available, all data exchange concept need to be interoperable – therefore IDSA envisages to build the global standard for data connectors, gradually including other technologies and concepts. As this is a decade project, we provide an ongoing assessment, and we will continuously update this section with further information and items in the list:

- Ocean Protocol: The Ocean Protocol is a comprehensive framework for data services in crypto ecosystems. Based on crypto tokens it provides mechanisms for smart contracts, marketplaces and compute 2 data. Ocean is available as Open Source. For more information visit https://oceanprotocol.com .
- OKP4 Protocol: OKP4 is a domain-specific layer-1 dedicated to trust-minimized data sharing.
  The blockchain orchestrates assets shared by participants into the Dataverse: data, algorithms, software, storage and computation to enable a new generation of applications.
  Any contributor earns rewards thanks to these new value chains.
  For more information visit https://okp4.network/ .

4 Other technologies contributing to trustworthily share data

Data Sharing and data space build on more than just the use of data connectors in distributed networks. A Soft Data Infrastructure based on centralized or decentralized essential and base services set up the foundation for data sharing. At the same time, it goes beyond bare technology to put into practice. The BLOFT (Business, Legal, Operational, Functional, Technological) thinking provides a frame for solutions that will extend the data connectors to data spaces. Additionally it makes a difference if the data to be shared is personal data or not and if the data is shared by an organization, a service or an individual. These aspects are subject of various initiatives and approaches. We will list some of them below and continuous assess and extend those.

- Gaia-X trust framework (https://gaia-x.eu/gaia-x-framework/) and GXFS (https://www.gxfs.eu/)
- iShare (https://ishare.eu/)
- MyData Operators (https://oldwww.mydata.org/mydata-operators/)
- SOLID (https://solidproject.org/)

Data connectors and the Soft Data Infrastructure does not aim to reinvent the wheel but to use common standards and frameworks and to combine them into a comprehensive solution. Important standards to be considered are for the realization of identity and access management, claim management, data and data contract policies. Some of the relevant standards are listed below:

- The W3C Tech Stack:
- RDF (https://www.w3.org/RDF/)
- ODRL (https://www.w3.org/TR/odrl-model/)
- DCAT (https://www.w3.org/TR/vocab-dcat-3/)

5 Conclusion

As mentioned in the introduction, the purpose of this report is to clarify the importance of data connectors, underline the variety of their usage, capabilities and functionalities and to provide examples of existing data connector implementations. It also includes valuable insights into emerging and foundation technologies to ensure a more complete overall picture. The report will be an evolving document to support the continuous assessment and evolution of data connectors over the time, aiming to bring clarity on their application potential, maturity, certification status, as well as their adoption in industrial use cases and research.
Feedback and suggestions, information on new connectors or updates on connectors already listed in the Report can be provided to the IDSA Head Office via this Data Connector Report - Contact Form.

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