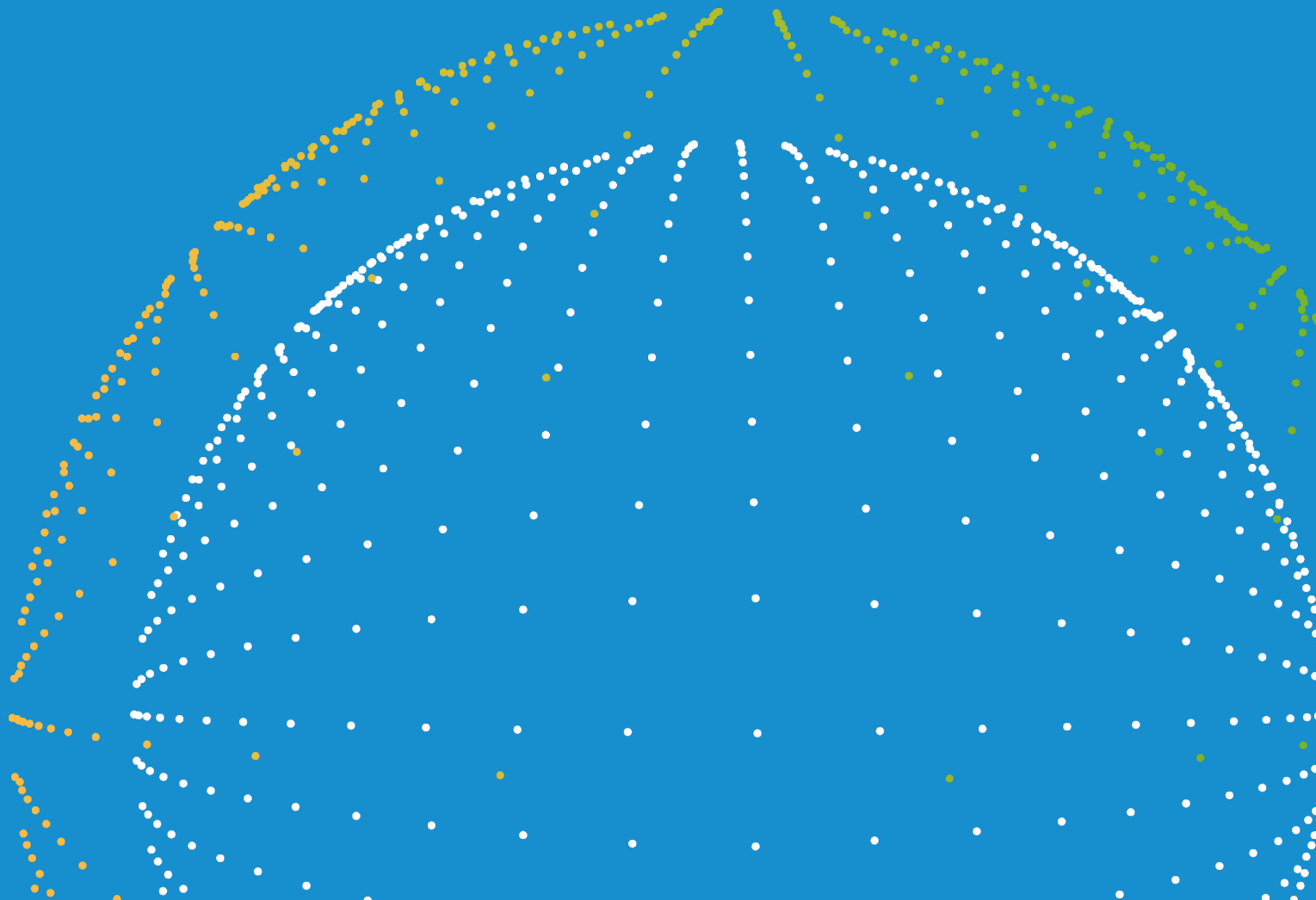
Data Spaces Symposium

FIWARE Data Space Connector



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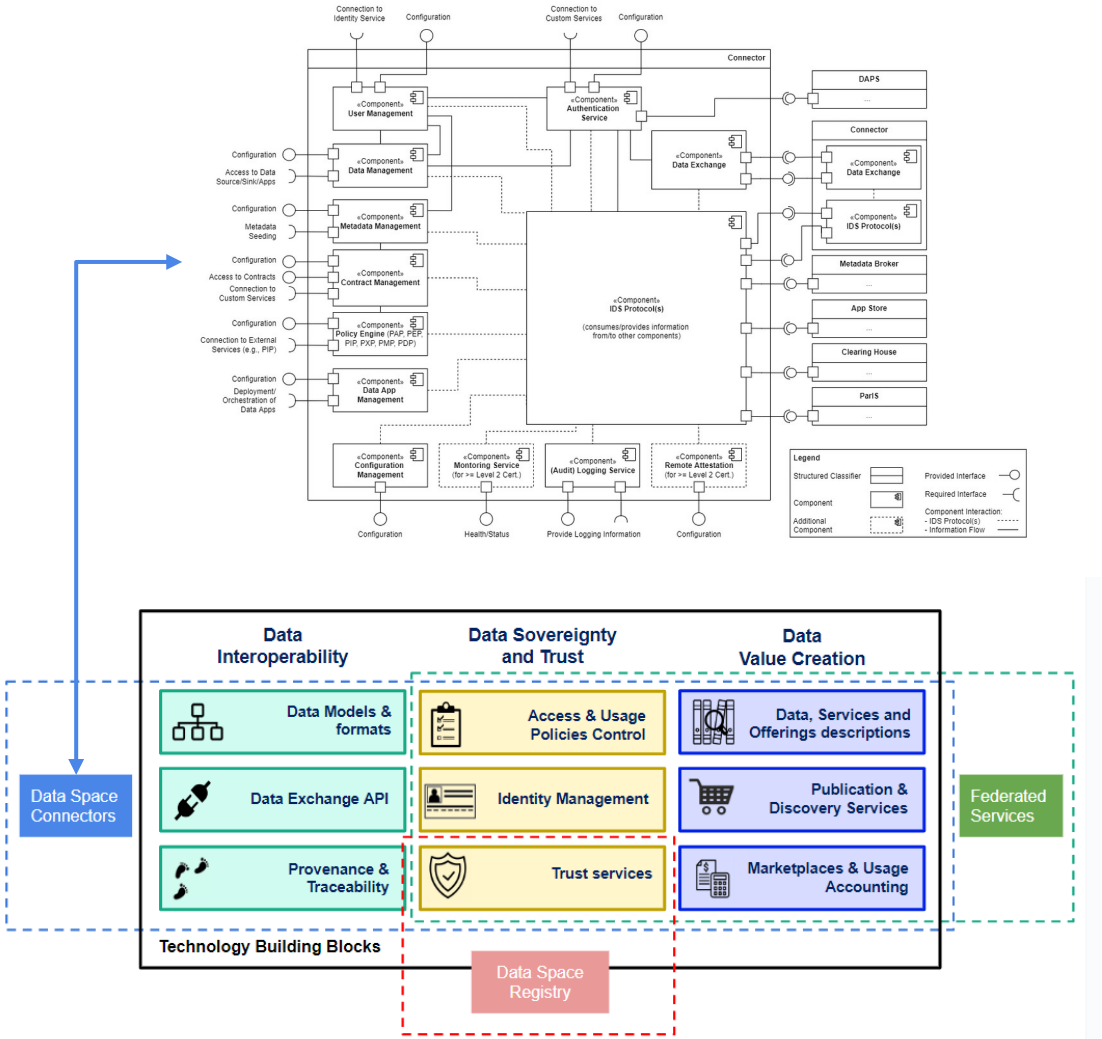
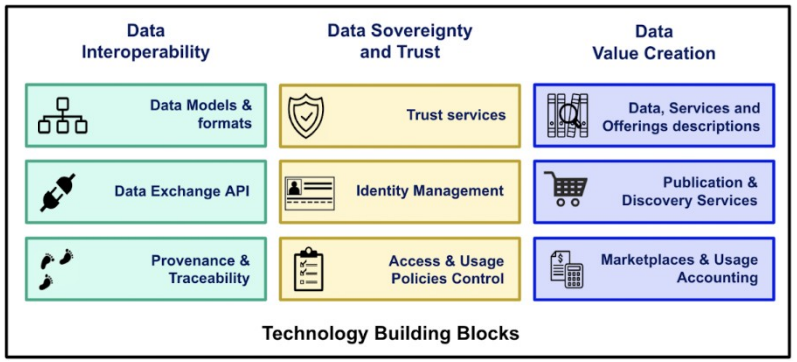
Evolution of Data Space Connector concept

- The concept of Data Space Connector has evolved to match the idea of an integrated suite of components every organization participating in a data space should deploy to “connect” to the data space
- These components would be deployed and configured in controlled environments (e.g., a Kubernetes cluster) and implement a number of services which may be required for an organization to connect in its role as provider of data services, consumer of data services or both:
  - Authentication (including the interface to trust services)
  - Authorization (policy enforcement)
  - Connection to Data Exchange APIs
  - Data resources publication (Metadata Management)
  - Contract Management
  - Logging
  - Remote Attestation
  - …
- The concept of [Data Space Connector in IDS RAM 4.0] has evolved to support this vision

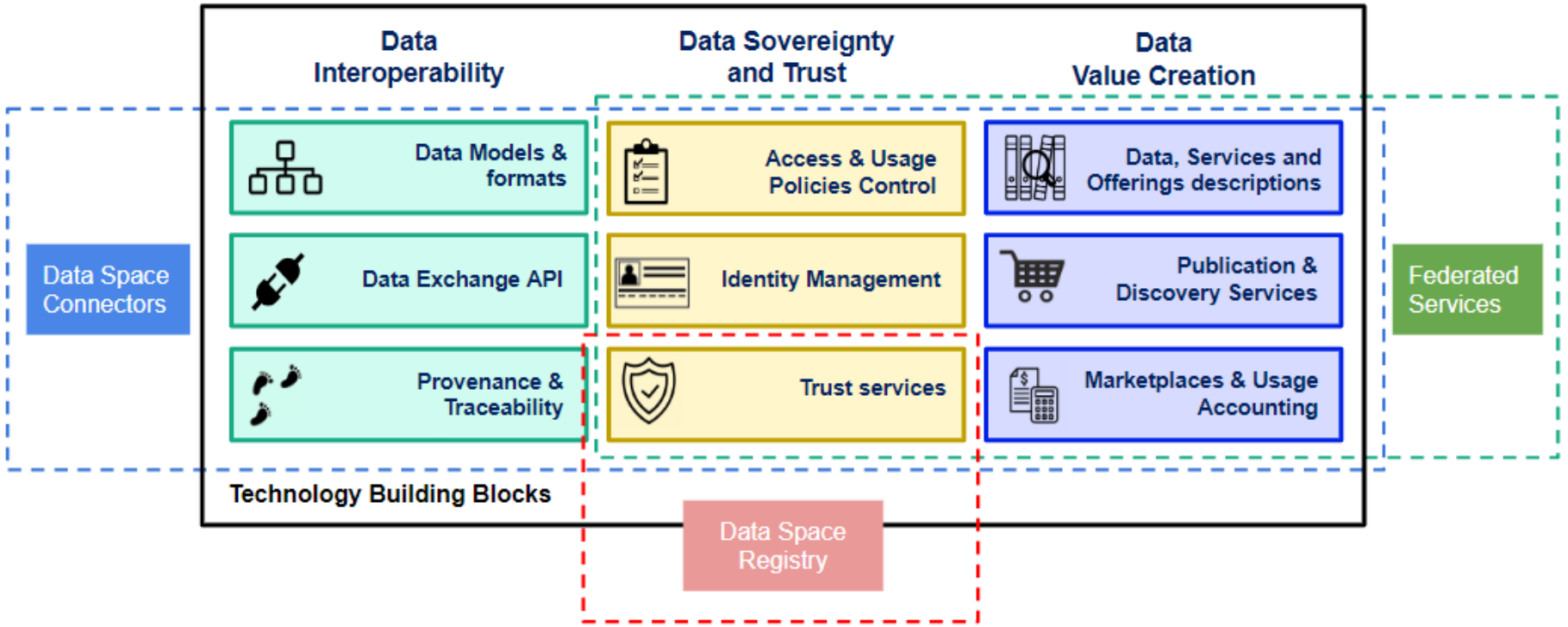


DSBA Technical Convergence version 2.0

- The DSBA Technical Convergence (TC) delivers a Minimum Viable Framework (MVF) enabling the creation of data spaces
- This MVF is based on the convergence of existing architectures and models, leveraging each other's efforts on specifications and implementations.
- A new edition of the DSBA TC (version 2.0) was released on April 21st - Major highlights
  - Description of common vision and conceptual model
  - Identification of major standards per technology pillar and specifications of how they get integrated
- Some initiatives committed to follow DSBA technical recommendations (others welcome to do the same!):
  - FIWARE Data Space Connector
  - iSHARE Trust Framework
  - DOME project under Digital Europe Programme



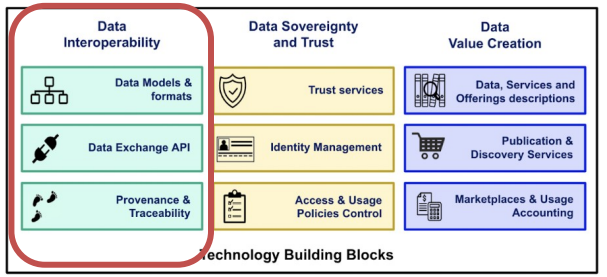
Technology Building Blocks for Data Spaces



MATERIALIZING DATA SPACES REQUIRES TO TAKE OPTIONS AND ADOPT A MINIMUM BUT ENOUGH SET OF TECHNOLOGY STANDARDS

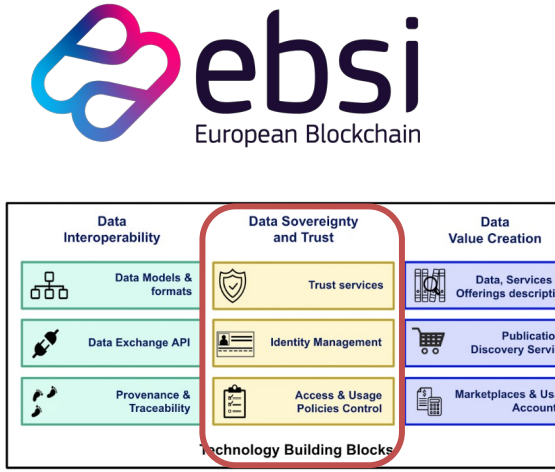
Data interoperability

- Providers of data products within data spaces must be able to offer data services at well defined endpoints knowing that customers, unknown by them a priori, will know how to consume their data services through those endpoints.
- This means that all participants in data spaces should ‘speak the same language’, addressing interoperability at several levels (see ISO/IEC 21823-1):
  - transport and syntactic level → common APIs
  - semantic level → common data models/vocabularies
- DSBA proposes NGSI-LD for transfer of digital twin data and Dataspace Connector Protocols for the Control of data transfer
- Adoption of common data models is encouraged and there are multiple references that may consider (ISO/IEC CIM for Energy, SAREF, …) - the Smart Data Models initiative brings a hub that solves how different data models are mapped into JSON, JSON-LD and other data serialization formats
- In some data spaces, it may be necessary to make the data sharing process observable - to be addressed in future versions



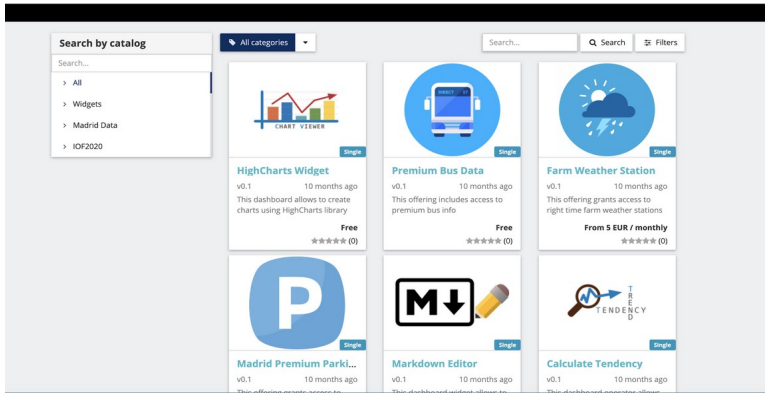
Data sovereignty and trust

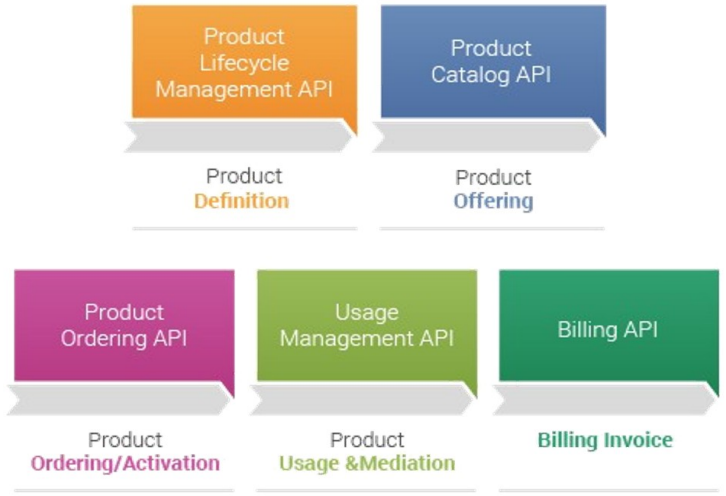
- Any data space requires a Trust Framework bringing
  - Mechanisms for verifying legal identity
  - Mechanisms for verifying compliance with data space participation rules
  - Mechanisms for verifying trustworthiness of credential issuers
- On the other hand, it requires a decentralized Identity and Authorization Management (IAM) framework through which manage authentication and the enforcement of access/usage policies
- DSBA proposes a decentralized Trust framework compatible with the EU Digital ID Wallet Architecture and EBSI
- Decentralized IM based on latest W3C and OIDC standards:
  - W3C DID (Decentralized Identifiers), Verifiable Credentials (VC)
  - Verifiable Credentials Issuance Protocols: OIDC4VCI
  - Self-Issued OpenID Provider: SIOPv2
  - Verifiable Credentials Exchange Protocols: OIDC4VP
- Authorization framework following PEP-PDP-PIP and PRP/PAP architecture for ABAC (attributes ⇔ claims in VCs), and adopting ODRL as Policy Definition Language

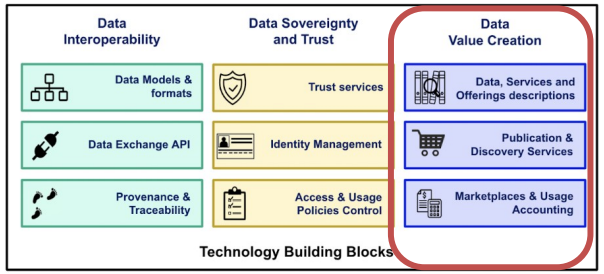


Data value creation

- Creating value out of data based on data sharing is the ultimate goal in data spaces.This follows basically the steps to:
  - Describe data, services, resources, products, offerings in an interoperable manner
  - Include data and service publication services to discover offerings facilitating connection of providers and consumers
  - Support contract negotiation peer-to-peer or through value–added services such as marketplaces
- Providers will be able to self-issue Verifiable Credentials linked to descriptions of their products/services/resources/data → goal is to align on common specifications for future editions
- Descriptions will be available through catalogs at connector level (supporting DCAT v3) or at data space level (Metadata Brokers or Marketplaces)
- TM Forum APIs bring the basis for managing offerings and support contract negotiation via marketplaces → to be supported in DOME, goal is to align on how to support them at connector level

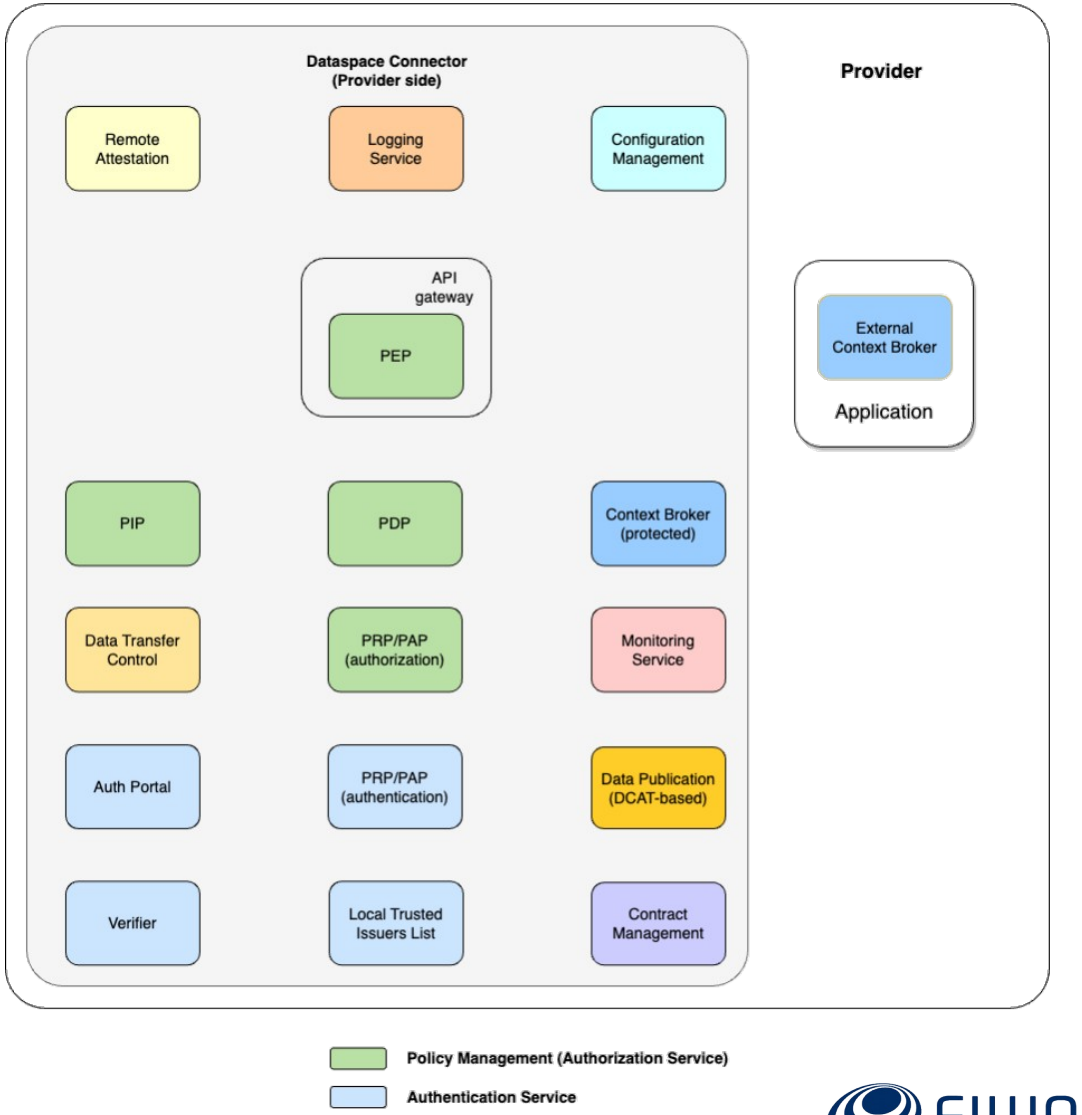






Compliance of Data Space Connectors with DSBA recommendations

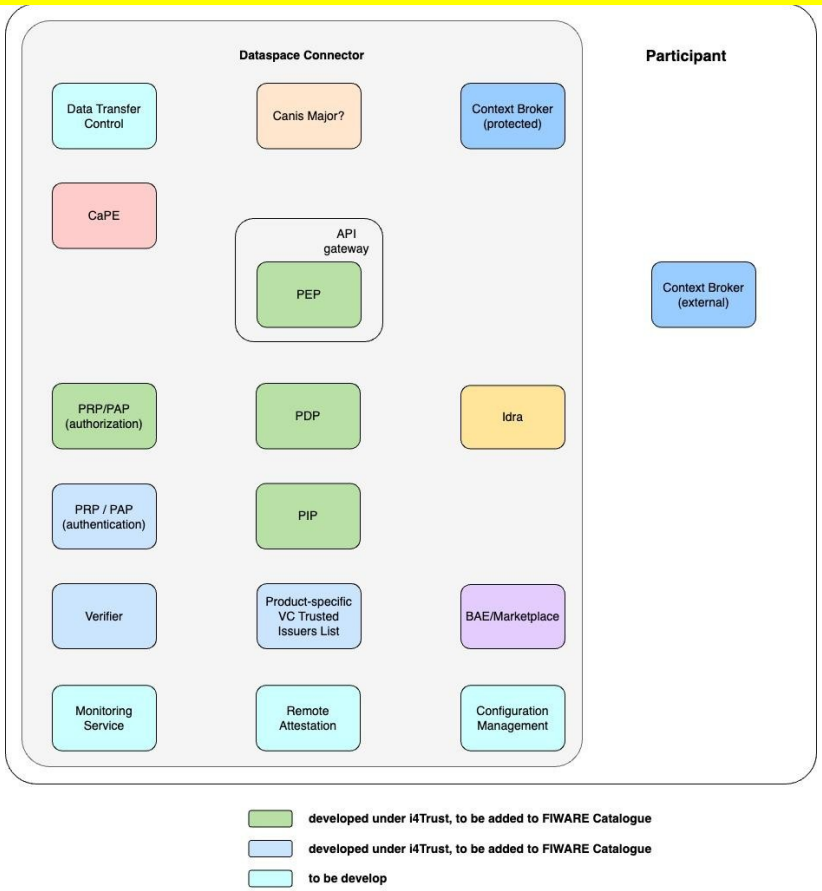
- Aligning with DSBA TC recommendations have several implications:
  - Interface with Trust Services should align with EBSI specifications (DID-Registry, Trusted-Issuers-Registry APIs but extended to support authentication based on VCs)
  - Authentication should be based on W3C DID + VC/VP standards and SIOPv2/OIDC4VP protocols and implement the interface to trust services
  - Authorization should implement a P*P architecture implementing ABAC using ODRL as policy language
  - IDS Dataspace Protocols considered a relevant input
  - Compatibility with NGSI-LD as data exchange API
- How to implement Contract Management is under analysis since there are two approaches to reconcile:
  - In principle, TM Forum APIs would be a good candidate for Contract Management API
  - There has been some initial work in IDS RAM 4.0 regarding specification of a Contract Management protocol
  - Reconciliation is required



FIWARE Data Space Connector

- A first release of FIWARE Data Space Connector components together with recipes for deployment was released September 2023 combining components already aligning with DSBA TC recommendations:
  - Context Broker technology for Data Exchange/Transfer
  - Trust and IAM components implementing W3C DID + VC/VP standards, SIOPv2/OIDC4VP protocols and interface to trust services based on EBSI APIs (DID-registry, Trusted Issuers Registry)
  - BAE modules implementing TM Forum APIs for contract negotiation
- For future releases, following modules will be incorporated:
  - Personal Data Consent Management modules (based on CaPE product from Engineering).
  - Idra product from Engineering as DCAT-compliant data resources catalog function for Metadata Management → aligning with IDS Dataspace Protocol
  - Transfer Control Protocol → aligning with IDS Dataspace Protocol
  - logging modules based on either BAE/marketplace functions for logging or, if we want to rely on blockchain, Canis Major
- The FIWARE Data Space Connector is the best aligned with DSBA recommendations available in the market

https://github.com/FIWARE/data-space-connector



Thank you!

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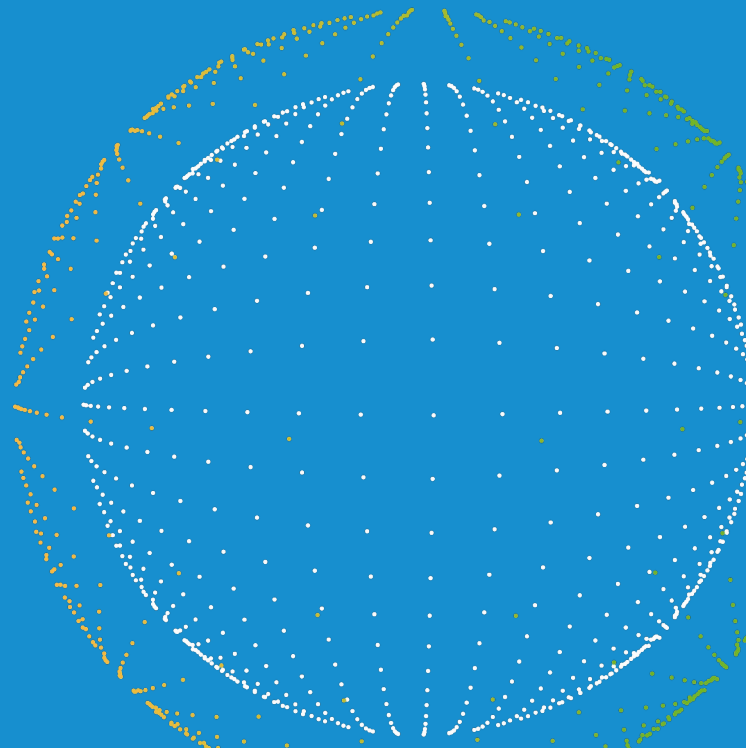
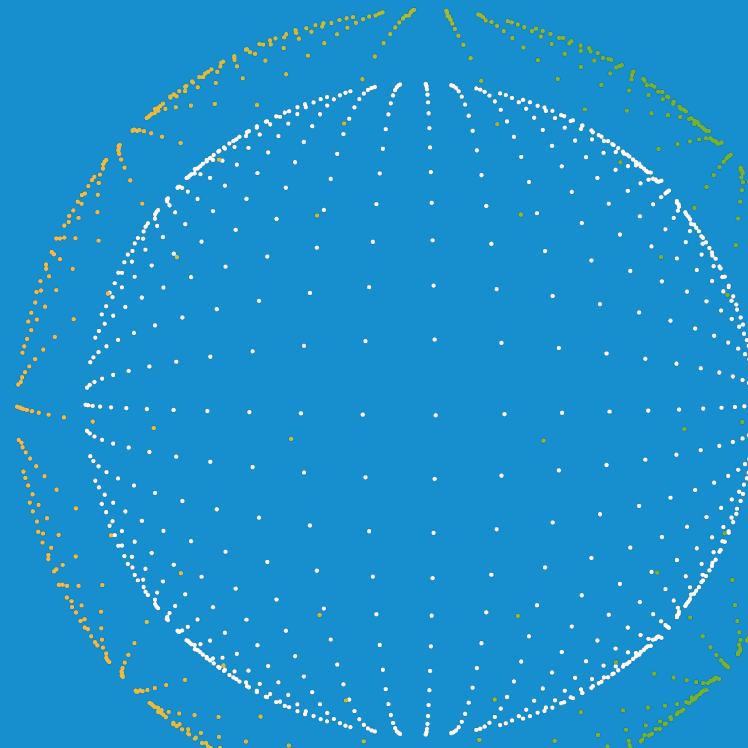


Backup



Data Spaces Business Alliance (DSBA): joining forces

BDVA, FIWARE, GAIA-X and IDSA launched the [Data Spaces Business Alliance (DSBA)] to accelerate Business Transformation in the Data Economy (Sep 23rd, 2021)

- **One voice and a common framework** to make **interoperable Data Spaces** happen;
- Together, **the Alliance's founding organisations represent 1,000+ leading key industry players**;
- With its combined **cross-industry expertise, resources and know-how**, the Alliance drives awareness and rely on **more than 100 Hubs** for dissemination
- **Technical Convergence discussions** towards common reference technology framework for creation of Data Spaces:
  - Agile approach based on delivery of subsequent versions of a Minimum Viable Framework (MVF) specification where we do not only identify standards and target components but how to integrate them
  - Once alignment on relevant topics within several of the ongoing workstreams is achieved, the publication of a new version of the DSBA Technology Convergence document will be published to incentivize development of compliant implementations