Enablement Services 101

Simplified participation and standardized interaction for network effects

Catena-X
Your Automotive Network

Why Enablement Services?

To access a data space like Catena-X, a participant needs standardized connectivity methods to ensure interoperability, trust and a compliant use of common interaction patterns. Therefore, enablement services combine the three aspects of identity management, data exchange via a connector and access to compatible digital twins. Enablement services must be deployed in a decentralized manner under the responsibility of each data space participant to ensure a trusted identity and sovereign data exchange.

The enablement services are a bundle of decentralized services that **enable** participation in the Catena-X ecosystem as shown in **Figure 1.**

The Eclipse Data Space Components (EDC) and the Identity Wallet form the basis of the enablement services. All Catena-X participants can use them to establish a basic connection to the Catena-X network, independent of the use case.

In addition to the generic data-exchange capability, enablement services include context-specific service offerings. To support use cases based on digital twins, participants can register their digital twins in a Digital Twin Registry (DTR) following the Asset Administration Shell (AAS) standard. The Item Relationship Service (IRS) particularly facilitates building data chains and iterates through a tree structure of digital twins.
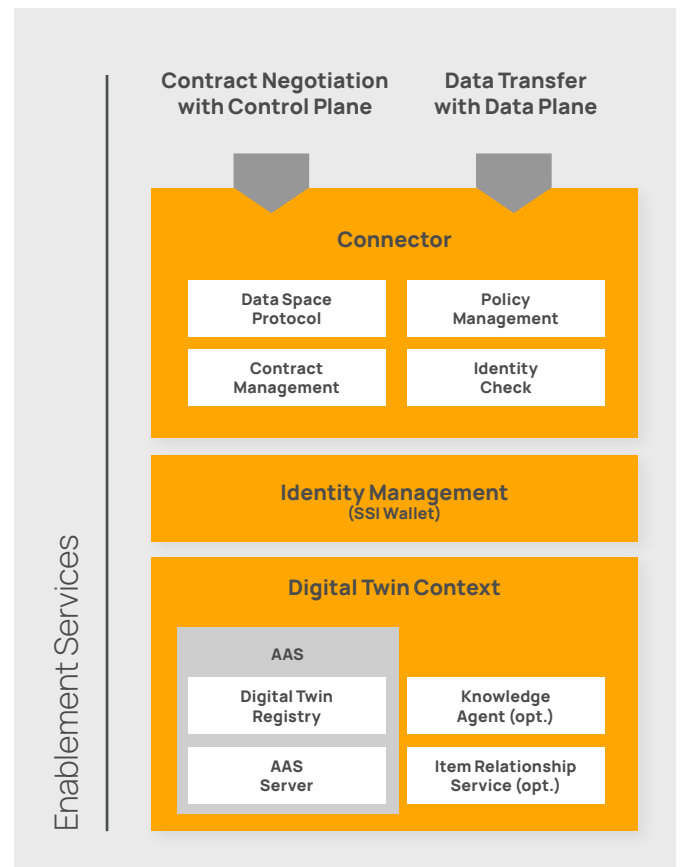

Figure 1   Overview of the Enablement Services.

Standardization & Interoperability

Enablement services address the challenges of sharing data between organizations, helping prevent participants' business models being compromised by the leakage of business-critical data, and they help prevent legal problems arising from sharing data that is not approved for exchange in an economic network. Establishing standards for describing and sharing data sets and the corresponding policies inside and outside of data spaces is essential to facilitate compliant exchanges.

Enablement services help decouple a company's internal IT landscape from its connection to the data space.

They cover various aspects, such as standardized authentication, publishing and procuring data offers, negotiating conditions for data use, orchestrating data exchange based on modern protocols, and managing digital twins.

Catena-X introduces these standards in a defined context, focusing on current partners and use cases. The decision to adopt these standards to promote interoperability or to separate conventions and create individual data spaces is to be made by each strategic initiative (e.g., Manufacturing-X).

Context
Maximum Efficiency

The API standards for contextualization, classification, and restriction of use are implemented within Catena-X by the concepts of

- **EDC** – for data contract discovery and negotiation, and data exchange
- **Identity Wallets** - enabling every participant to maintain a secure identity and verify identities in the network
- **AAS** - for standardized interfaces and semantics regarding digital twins
- **DTR** - registry for service lookup
- **IRS** - shows trees of digital twins

This allows for maximum efficiency and interoperability within the Catena-X Ecosystems and beyond.

Figure 2 shows how the decentralized enablement services fit into the overall framework of Catena-X to exchange data. The enablement services handle access to data sources, communication, and data exchange with other network participants by using the Catena-X core services. Accordingly, interoperability can be achieved between business applications that consume and provide data within the network.
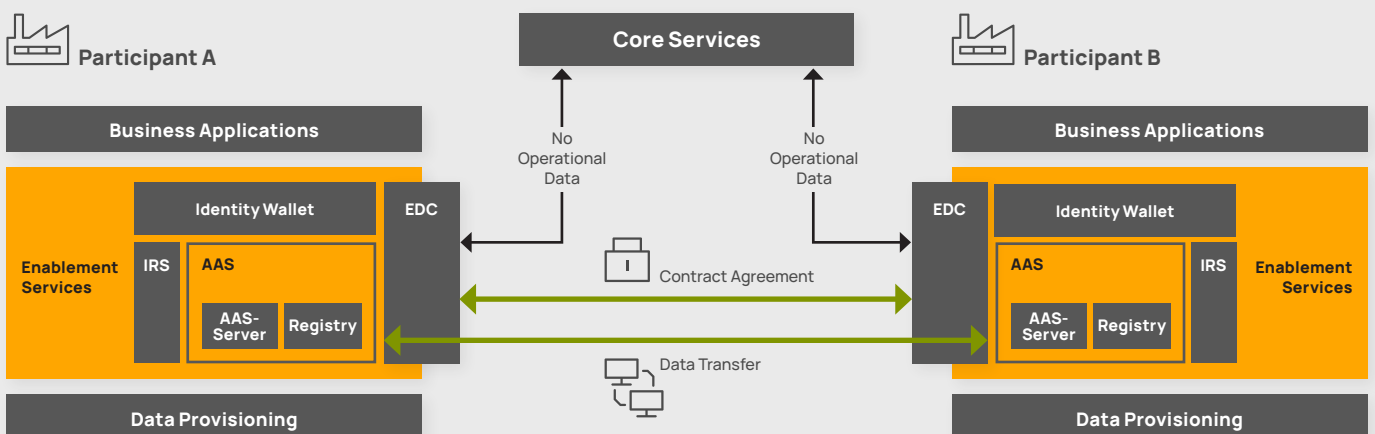
Figure 2   The Enablement Services Within the Framework of Data Exchange.

Decentralized Modules

Eclipse Dataspace Components (EDC)

The EDCs provide a framework, based on the Dataspace Protocol specification (DSP), for sovereign, interorganizational data exchange. This framework contains modules for performing data queries, data exchange, policy enforcement, monitoring, and auditing. Specifically, it can be integrated with existing identity, data catalog, and transfer technologies to provide compliance, policy, and control capabilities across the network. The EDC can be assembled as a connector that serves all the requirements of the Catena-X data space and the participant (e.g., with an IT stack based on Kubernetes) at the same time.

Identity Wallet

Catena-X uses decentralized Identities (DID) based on the Gaia-X philosophy. During the Catena-X onboarding process, the partner goes through various steps regarding identification and examination. One of these steps will generate a Business Partner Number (BPN) that uniquely identifies the company in the network. Based on this unique number, a technical identity is created and stored in an identity wallet. The identity can be enriched with additional properties, describing, e.g., characteristics of the business partner. The properties must be assigned by a trusted verifier such as an operating company. The identity functions like an ID card within the network. Connectors can request the ID, including properties, or decide to make a contract offer, negotiate a contract agreement, or process a data exchange.

Asset Administration Shell (AAS)

The AAS is a key concept of the "Plattform Industrie 4.0," and is maintained by the Industrial Digital Twin Association (IDTA). The AAS is used for the standardized electronic description of an asset. Moreover, the AAS includes a concept of sub models, each of which can characterize the asset by describing its aspects in different domains. In other words, the AAS is a set of API methods and resources that describes how to access digital twin data.

Digital Twin Registry (DTR)

The DTR is a solution that lists all digital twins (DT) and references their aspects including information about the underlying asset, asset manufacturer, and access options, like aspect endpoints. The DTR is also used to register and find data related to DTs. In general, every partner must proactively register their DTs/aspects to this service to reveal their "order" to share respective data sets. The data ordered by the DT is semantically described via mapping to the data models stored in the semantic hub.

Item Relationship Service (IRS)

The IRS provides a top-down Bill of Materials (BoM) tree structure along the value chain of a product that uses the connector for communicating with the Catena-X network. As a functional federated component, the IRS provides a technical API endpoint in the Catena-X Network, which builds an item-tree representation of given digital twins stored across the industry based on EDC enforced data sovereignty rules. The IRS provides data chains along the value chain and forms the basis for all Catena-X use cases that require end-to-end data chains, such as product carbon footprint or circular economy.

Sourcing Options and Component Operation

There are multiple options for a Catena-X partner to establish a set of enablement services that seamlessly integrate into their infrastructure and IT operation strategy. These options vary from SaaS to a tailored refactoring of provided open-source reference implementations.
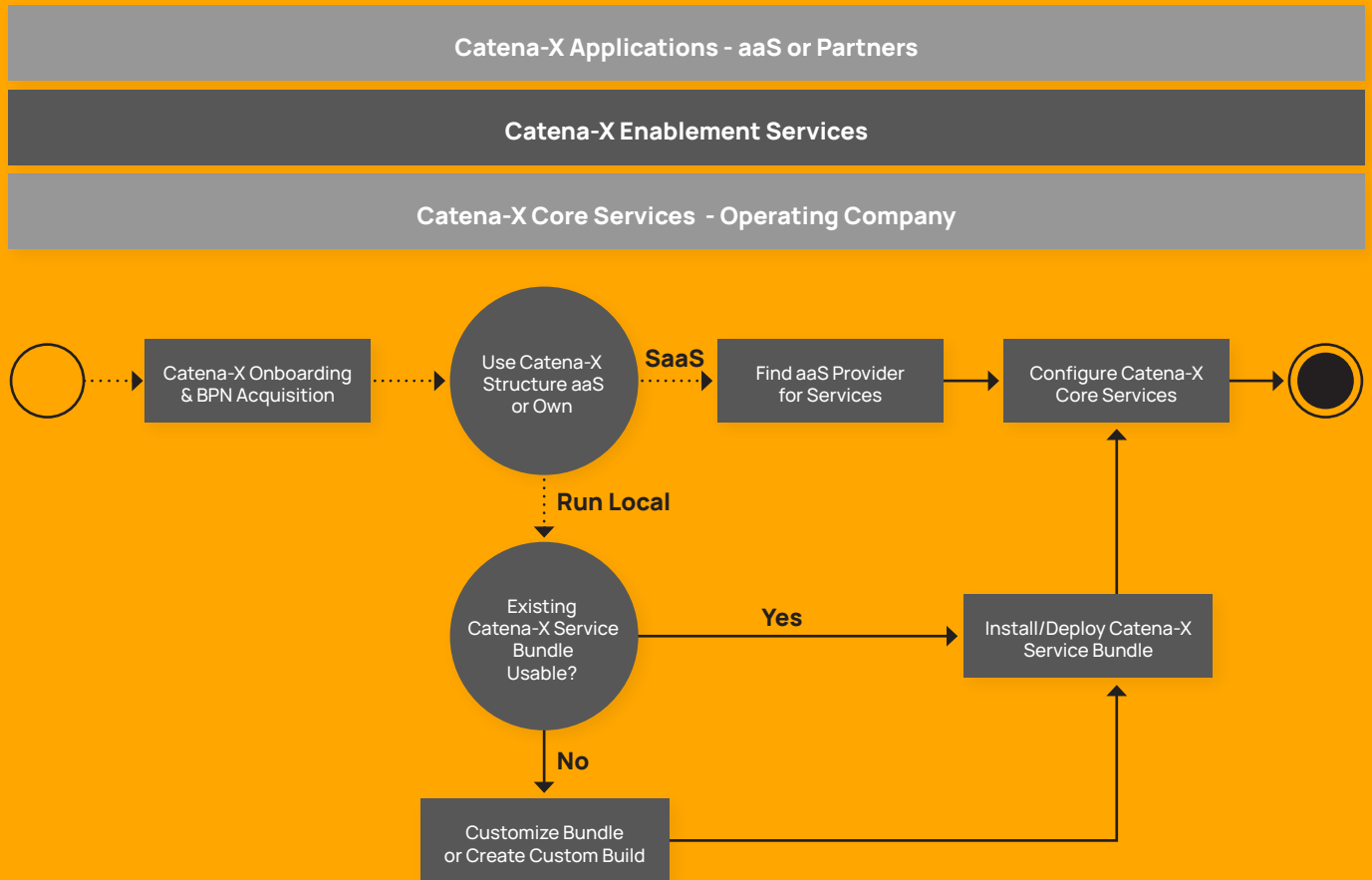

Figure 3 Options for Sourcing and Operations.

Roadmap
Ongoing Stabilization

The community around enablement services is continually working on industrialization and stabilization of the components using the use cases and their feedback as proof points for success. An important milestone will be the acceptance of the Dataspace Protocol (DSP) as W3C standard.

Introducing self-sovereign identities and fostering decentralized identity management is one of the most important steps for enablement services. This will improve overall identity management within Catena-X to guarantee trust, sovereignty, and interoperability within the network.

In conclusion, the enablement services will strive for a trustworthy, interoperable, and sovereign base-framework for Catena-X. As a product suite, they enable participants to remain in full control of critical components of their infrastructure and they are maintained by a strong open-source community under the umbrella of the Eclipse Foundation.

Additional Resources

EDC	Catena-X Homepage - EDC ↗
	Tractus-X Homepage – Connector Kit ↗
	GitHub – Tractus-X ↗
	Eclipse Dataspace Components ↗
Identity Wallets	GitHub – Tractus-X ↗
AAS Specification 3.0	API Specification ↗
	IDTA – Content Hub (for a full set of standards) ↗
DTR	GitHub – Tractus-X ↗
	API Specification as part of the AAS API Spec ↗
IRS	Tractus-X arc42 ↗
	GitHub - Tractus-X ↗
Data Space Protocol	IDSA ↗
Tractus-X Repositories/ Up-Stream, Tractus-X	GitHub – Tractus-X ↗
On-Boarding Guides (Adopter/Solution Provider)	Catena-X Homepage – Document Large Adopters ↗
	Catena-X Homepage – Document Solution Providers ↗
Data Integration Patterns	Catena-X Homepage – Document ↗
	Catena-X Homepage ↗
Catena-X Standards	Catena-X Standard Library ↗