Catena-X

# Onboarding Guide: Information for Application and Service Providers

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# 1. MANAGEMENT SUMMARY

Catena-X is the first collaborative open data ecosystem for the automotive industry of the future, linking global players into end-to-end value chains as simply, securely, and independently as never before. Within Catena-X, various providers operate and maintain Catena-X solutions to enable participants to use the data space. These provider activities range from enablement services, such as providing technical access to the data space, to the development of commercial business applications, solving specific industry challenges. Multiple providers help the data space to become more decentral and resilient. Provisioning of customized applications, access to new markets, and connecting with participants along the automotive value chain via the Catena-X Operating Environment, are strong arguments to become a certified provider.

This document specifically focuses on **Enablement Service Providers** and **Business Application Providers** who aim to become part of the Catena-X Ecosystem. It provides **know-how on how the given Catena-X principles** should be interpreted from the perspective of a Service and/or Application Provider (see Chapter 2. Introduction). Furthermore, the document guides through an end-to-end Application and Service Provider Journey illustrating the steps and activities that need to be followed to **successfully offer solutions on a Catena-X Marketplace.** This includes roles and responsibilities to orchestrate and ease the Catena-X user journey (see Chapter 3. Application and Service Provider Journey). Readers of the document who want to familiarize themselves more with the overall concepts of the Catena-X Data Space and their relevance for Application and Service Provider can find an overview in Chapter 4.1. The Catena-X Ecosystem.

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# 2. INTRODUCTION

Catena-X foresees multiple providers as enablement and support functions to build and grow the ecosystem. Service Providers develop and offer commercial business services linking data providing and consuming companies in their peer-to-peer data exchange to allow for secure and standardized data exchange. Participating as a provider in the Catena-X Ecosystem can be differentiated into **five main areas**:[1]

1) **Core Service Providers** operate Core Services that enable the basic functionality of the Catena-X Data Space such as Discovery Services, Marketplaces, Catena-X Portals. A Core Service Provider is responsible for providing the services commercially, operating and maintaining them, and supporting the release of the Core Services in the data space.
2) **Onboarding Service Providers** enable data providers/consumers to be integrated into the Catena-X Data Space. This includes e.g. the technical and organizational onboarding of an existing network of potential data providers and consumers
3) **Consulting Providers** offer consulting services, such as assistance how to use the Catena-X Data Space or business development consulting for participants in the ecosystem.
4) **Enablement Service Providers** provide convenient solutions for using data in the Catena-X Data Space such as Connector as managed services.
5) **Business Application Providers** who develop applications tailored to specific use cases, solving industry challenges of the automotive value chain.

This guide serves as a manual for the roles of **(4) Enablement Service Providers** and **(5) Application Providers,** specifically focusing on their user journey to accelerate their contribution to Catena-X. Any reference to "Service Provider" in this guide specifically addresses the role of Enablement Service Providers.

## 2.1 Application and Service Providers in the Context of Catena-X

New regulations such as the Supply Chain Act or the "CO2 tax", lead to pressure on companies to be responsive – These obligations require new ways of collaborating with a high level of security. Based on **sovereignty** and **standardization**, Catena-X creates an ecosystem in which **data exchange** as well as the provision and use of solutions are offered to its participants.

**Enablement Service Providers equip data space participants** with solutions to provide or consume data within the Catena-X Data Space and operate data services e.g., Connector as managed services, which can be used by each data space participant independent of the Catena-X use cases. Enablement Service Providers must comply with relevant standards to ensure interoperability and data sovereignty between data space participants and business applications on a use case level. As Enablement Service Provider it is mandatory to certify the managed services as a Catena-X solution.

[1] How to operate Catena-X I Catena-X

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**Business Application Providers may build upon these services to offer solutions that** enable data-driven business processes. These applications in Catena-X solve a specific business problem (e.g., traceability, demand and capacity management, circular economy). Business applications can range from enterprise solutions to specialized solutions for small and medium sized enterprises. Business applications must comply with use case standards (e.g., product carbon footprint rule book) and must be certified according to certification criteria to get listed in a Catena-X Marketplace or to be a part of an interoperable value chain process.[2] When planning to offer business applications on a Catena-X Marketplace, it is mandatory to certify them as a Catena-X solution.

## 2.2 About this Document

This guide is intended for software companies who aim to offer their solutions on a Catena-X Marketplace; giving an overview of the onboarding process and the relevant steps, to enable providers to develop and **offer their solutions under the right technical, organizational, and legal conditions.** In other words, the guide provides the most relevant information for providers to make strategic and operative decisions on **how to plan and execute** their **Catena-X Application and Service Provider Journey**.

It is important to keep in mind, that the content of this **guide** needs to be **interpreted** considering the **context** of **the individual organization**. For example, internal roles and responsibilities will vary between different enterprises joining Catena-X. Thus, sections of this guide such as the role and responsibilities descriptions have been generalized so they can be utilized by multiple different enterprises.

Even though internal processes for, e.g., solution development and release management may already exist, this document will give guidance on what to look out for when developing solutions in the context of Catena-X. Thereby, Chapter 3 of this guide helps to identify special requirements that must be adhered to (e.g., interoperability, shared semantic) and highlights useful information to Application and Service Providers to ease the onboarding process.

For readers who want to learn more about Catena-X, related terminology as well as general principles, Chapter 4.1. The Catena-X Ecosystem provides an introductory overview.

[2] Catena-X Standards Library

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# 3. APPLICATION AND SERVICE PROVIDER JOURNEY

Application and Service Providers play a crucial role in enabling data exchange and by providing solutions that are interoperable for all participants. Understanding the **end-to-end onboarding process regarding different roles and responsibilities**, is a fundamental requirement to become part of the Catena-X Ecosystem. This chapter **suggests Catena-X roles for Application and Service Providers** to orchestrate and ease the onboarding process to Catena-X. As a helpful overview, the Figure 1 provides an end-to-end "**Application and Service Provider Journey**" illustrating the steps and activities that need to be followed to successfully offer solutions on a Catena-X Marketplace.

This journey is divided into four steps that need to be considered when planning to publish solutions on a Catena-X Marketplace.

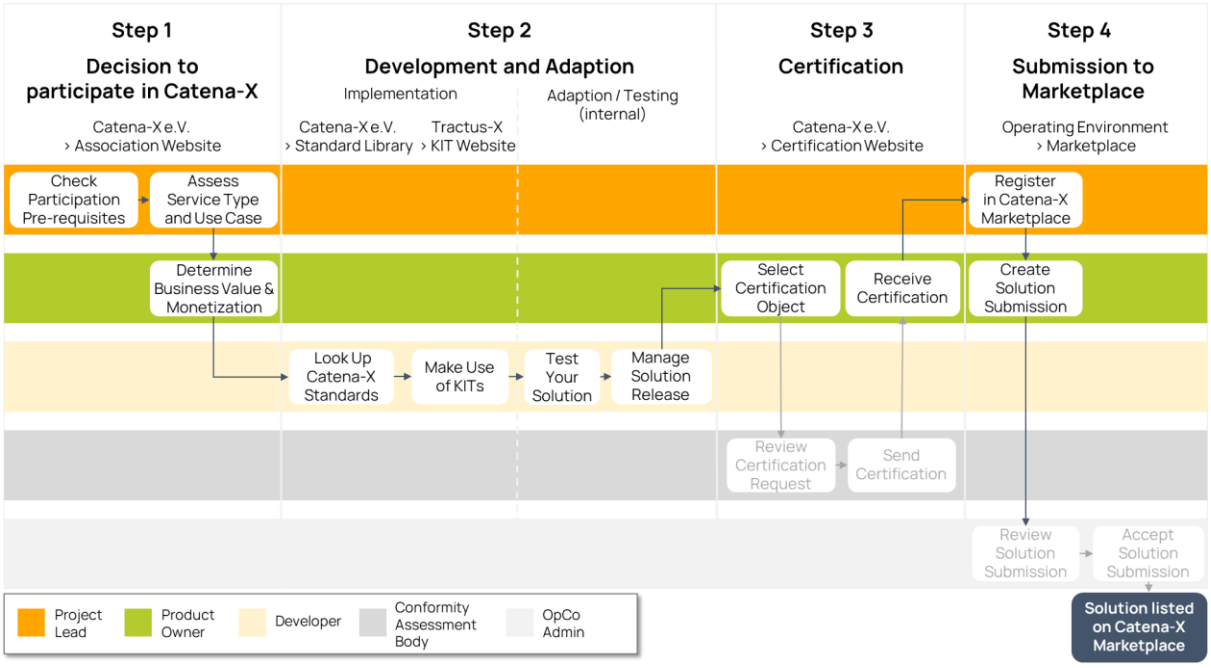


*Figure 1: Application and Service Provider Journey*

Each of these four steps are explained in detail in the respective chapters of this Guide. It must be noted that the first two steps need to be considered from an internal organizational perspective, for example solution development or release management. Steps three and four have external interdependencies, companies must contact Conformity Assessment Bodies and certified Operating Companies of the Catena-X Network, to comply with Catena-X standards to offer the individual solution on a marketplace.

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The list below serves to navigate to specific tasks and chapters of the Application and Service Provider Journey.

**Step 1: Decision to participate in Catena-X**

- Check participation pre-requisites including Catena-X principles and standards, identify or map relevant roles within your company and benefits of joining the ecosystem.
- Assess service type and use cases within Catena-X.
- Uncover the underlying business value and monetization methods of solutions.

**Step 2: Development and Adaption**

- Develop solutions in accordance with Catena-X Standards.
- Use KITs as a helpful set of standards, open-source resources, and documentations.
- Adhere to the concept of data sovereignty in development and testing of solutions.
- Familiarize yourself with the release management of solutions and external updates.

**Step 3: Catena-X Certification**

- Identify your certification role, and receive an overview of certification objects and the certification process.
- Be aware of the Interaction of Application and Service Providers with Conformity Assessment Bodies and Operating Companies in the certification process.

**Step 4: Submission to Marketplace**

- Inform yourself about Roles and responsibilities on a Catena-X Marketplace.
- Get used to Catena-X Portals and Catena-X Marketplace registrations.
- Look at the initial Application and Service Publishing Process on a Catena-X Marketplace.

In each of these steps, this Guide incorporates the suggested company roles Project Lead, Product Owner, and Developer into this process to help providers orchestrate their user journey. These roles are explained in Chapter 3.1 to help companies understand responsibilities and tasks in their Catena-X Journey.

## 3.1 Roles and Responsibilities

Companies planning to offer business applications and services on Catena-X Marketplaces, will have their own internal governance processes and pre-defined roles and responsibilities. Nevertheless, the development and distribution of their solutions within the Catena-X context will **require certain roles** to act as an intermediary link between their own company and Catena-X. This chapter provides a general overview of **roles and responsibilities that should be considered** when planning the Catena-X Application and Service Provider Journey. The roles and responsibilities were generalized to serve as an orientation and are not mandatory. However, the tasks and responsibilities need to be covered and should be interpreted and mapped in the context of the individual organization.

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### 3.1.1 Project Lead

The Project Lead focuses on the evaluation of **business and market potentials** that arise for an organization in the context of the Catena-X Ecosystem. In addition, the Project Lead is the **main decision-maker** for all Catena-X admin related topics. The main task of the Project Lead is to convince high management to join the ecosystem and manage the onboarding process assuring quick business value realization. The Project Lead oversees one or more solutions offered in the Catena-X context.

The role has basic **technical and business knowledge** and is well positioned in the company to engage potential Catena-X sponsors. Hence, the Project Lead evaluates business potential, but also must communicate and compare efforts of solution development to benefits derived by joining the Catena-X Data Space. This end-to-end perspective is crucial in enabling the project's success by ensuring that the offered solution(s) fulfill Catena-X defined standards.

He ultimately is **accountable** for a **successful enablement** of his organization to the Catena-X Ecosystem and checking prerequisites to place solutions on Catena-X Marketplaces. These pre-requisites include assessing whether an Application or Service Provider wants to develop new solutions for the purpose of Catena-X, or if existing solutions can be adapted to Catena-X standards. Additionally, the role coordinates any other roles needed (not described in this guide) along the user journey, such as specific roles within a Catena-X Portal.

### 3.1.2 Product Owner

The **Product Owner** is the main decision maker for one specific solution offering. The role of the product owner may vary depending on company size, product team, or capabilities. The main responsibility of the Product Owner is to **bridge the gap** between product strategy and development. The Product Owner, therefore, combines functional requirements with business logic, by ensuring that principles like adhering to a shared semantic model are met. The Product Owner, therefore, is responsible for conceptualizing the solution, including dashboards, UX/UI, and checking the use case to identify the target audience. In this context, the product owner also assesses potential monetization methods of the solution to provide a business value.

Within this role, Product Owners are responsible for prioritizing product developments and requirements, shaping ideas, and answering questions from developers each development cycle. Therefore, a clear business perspective is required to define a product roadmap, and **at least basic IT knowledge** to delegate development tasks.

They collaborate with the **Project Lead** and refine their input into actionable pieces of value and work with **Developers** to fulfill the requirements.

In the context of Catena-X, the Product Owner **requires a thorough understanding of Catena-X related processes**, such as certification and release management. In collaboration with the Developers, the Product Owner prioritizes and plans needed actions for the solutions to fulfill Catena-X requirements.

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### 3.1.3 Developer

The **Developer** is responsible for the individual solution development, implementation, and **technical integration** into the Catena-X Data Space. The developer ensures that the offered solutions meet company internal technical requirements as well as requirements defined by Catena-X e.g., certifications.

With regards to the certification processes, the Developer needs to understand the **technical requirements** to meet Catena-X standards like, for example, ensuring interoperability, the **security** of confidential data and interfaces **and** how **data sovereignty** is maintained from a technical point of view. By ensuring Catena-X standards are met, the interoperability of an application or service can be secured.[3]

As part of the Application and Service Provider Journey, the **Developer** must ensure that proper **testing of any product version against the given reference implementation** is done to ensure necessary downward compatibility**.** This includes the internal UAT testing and the integration testing with Catena-X. Hence, aligning the internal release management with Catena-X release requirements is an essential task to be fulfilled by the Developer. He is further very well interconnected with the internal roles along the development process.

## 3.2 Overview Catena-X Application and Service Provider Journey

Different steps need to be considered, to be eligible to provide solutions on a Catena-X Marketplace. This chapter outlines these steps according to the **Application and Service Provider Journey** and divides it into four main chapters based on the steps defined in Figure 1: 3.2.1 Decision to participate in Catena-X, 3.2.2 Development and Adaption, 3.2.3 Catena-X Certification, and 3.2.4 Submission to Marketplace.

### 3.2.1 Decision to participate in Catena-X

For companies in the automotive value chain and their networks, a Catena-X Marketplace **allows for** the exploring and **accessing of new solutions** to enable data-driven business processes. Many companies in the data space will rely on **Enablement Service Providers** and **Business Application Providers,** to comply with standards and securely exchange data. The Catena-X principles will create new interactions between participants and this network effect will create new market potentials, incentivizing providers to develop solutions based on Catena-X standards. Providers need to consider their capabilities in context of the Catena-X Ecosystem since the service offering and use case participation may differ, depending on the aspired role. The Project Lead decides on the participation in the Catena-X Ecosystem, whereas the Product Owner assesses specific use case or solution requirements. Accordingly, Application and Service Providers need to adapt or

[3] Catena-X Standard-Library I Catena-X

extend their business offering to suit the Catena-X Ecosystem and define monetization methods, to leverage the advantages of the data space.

#### 3.2.1.1 Assess Service Type and Catena-X Use Case

When becoming a member of the Catena-X Ecosystem, it is important to consider how to contribute value to the data space. The next section will explain different ways to contribute as either an Enablement Service Provider or a Business Application Provider.

**Enablement Service Provider Considerations**

Enablement Services must be deployed and run by each data space participant in a decentralized manner. The basis for this is the EDC. The EDC is a reference implementation and a mandatory service of the Catena-X operating model to ensure data sovereignty and interoperability until standards (e.g., API specification) are available. In addition, it is possible to integrate several EDC extensions (e.g., alternative Vault-Systems like Azure Vault) or backend data services (e.g., Item Relationship Service). EDC extensions and backend data services vary depending on the use case and the legacy system. These services are not synchronized with each other. Potential services to offer include[4]:

- **Eclipse Data Space Connector (EDC)**: Providing a connector framework for sovereign interorganizational data exchange.
- **Sub-Model Registration Agent:** Registering new Digital Twins and their sub-models in the Digital Twin Registry by sending specific requests to the Digital Twin Registry API.
- **Item Relationship Service (IRS):** Building data chains and providing custom business logic (e.g., aggregation of certificates) for business apps and other services.
- **Tools for simple Data Provisioning:** Enabling small and medium-sized companies to provide data, manage EDC contracts and usage policies in the Catena-X Data Space via an EDC in a simplified way.
- **Digital Twin Registry:** Enabling decentral digital twin registry, listing all digital twin meta data and reference of all their relevant aspects.

**Application Provider Considerations**

Business applications (e.g., traceability applications) are either run by a Business Application Provider or by data providers / consumers themselves. All business applications need to ensure that cross-company communication is initiated via the Connector to ensure data sovereignty (e.g., using EDC). In addition to COTS business application, there will be reference implementations of open-source business applications. Open-source business applications are initially provided by the Development Area in the Eclipse Tractus-X project.

While developing applications based on standardized semantic models may require some effort, having a shared semantic in the future eliminates the costs, of continuously adapting applications

[4] Refer to Operating Environment | Catena-X for more information

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to different systems. For Applications Providers, the resulting customers' ease of application selection results in a potentially large target audience and scaling potential. Collaborations that previously were not possible (e.g., exchanging data bilaterally across tier levels) result in a new target audience for Application Providers.

Applications should be designed to solve an existing challenge for participants across the automotive value chain based on one or more of the **ten initial Catena-X Use Cases** that have been identified e.g., developing an application capable of tracing CO2 data across the value chain and distributing it to all participants.[5]

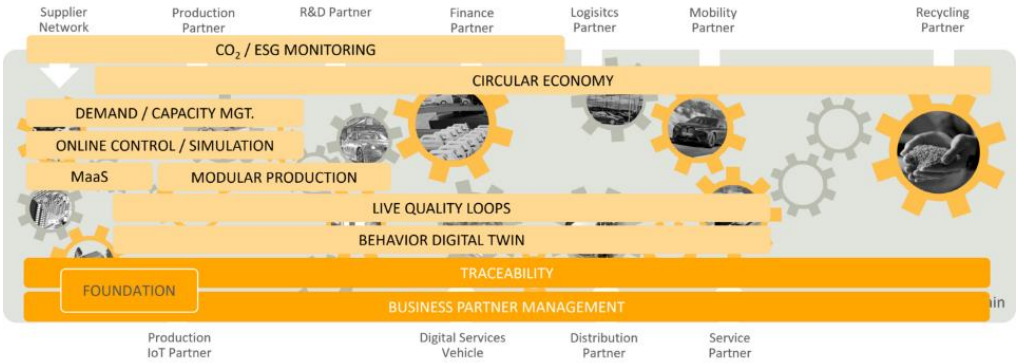


*Figure 2: Catena-X Use Cases*

In other words, the offered solutions should be targeted to solve a specific business problem and range from enterprise solutions to specialized solutions for SMEs. An application should help realize different Catena-X **use case business logics** and **visualize them based on standards**; this may include but is not limited to, creating synergy between data for efficient analysis and creating business intelligence processes that previously were not possible, for example CO2 footprint calculations.

#### 3.2.1.2 Determine Business Value and Monetization

Application and Service Providers will aim **to generate value by offering their solution on a Catena-X Marketplace.** Catena-X Marketplaces are hosted by the certified Operating Companies where the offering ranges from business-relevant applications to support a company's own business strategy to enabling services to participate in the Catena-X data ecosystem.

Depending on the offered solution, monetization methods may vary based on the demand. For example, an application may be available for a fixed price and include variable pricing for the needed amount of data. In a subscription model, the pricing model could also vary by required usage or additional support needed to run an EDC, implementing updates, or even number of EDCs needed. Monetizing the offered solution, therefore, depends on the context of the use case and solution

[5] Benefits | Catena-X

provided, and highly depends on the amount of data exchange needed. Other monetization methods may include partnerships and additional services such as maintenance.

### 3.2.2 Development and Adaption

Catena-X defines **interoperable solution development** within its Data Space as the capacity of various systems, devices, applications, or products to connect and communicate seamlessly. The functions of interoperable components include cross-organizational collaboration, data access, and data transmission, regardless of their developer or origin. For Application Providers, therefore, it is **essential that developed applications share given standards, for example semantic models and interfaces**. As explained above, the EDC or even provider-specific data exchange solutions, must adhere to the IDSA Data Space Protocol[6] (in this Guide referred to as "the Data Space Protocol"), so that a common business logic and interoperability can be ensured.

Following these standards is a must to equalize interfaces across different applications. This form of standardization does not include user dashboard, experiences, or for example added functionalities. The core principle that must be followed is ensuring interoperability in terms of the abovementioned factors, so that applications can communicate with each other in the most effective way to solve challenges and enable use cases to flourish.

#### 3.2.2.1 Look Up Catena-X Standards

Standards are the basis of the Catena-X Ecosystem, defining the principles of data exchange between participants. **Unified standards** provide an added value to all participants: no effort for isolated data exchange solutions is required.[7]

New standards in Catena-X are defined by a dedicated process, beginning with so-called standard candidates. These standard candidates include API descriptions, semantic models, protocols, calculation approaches, and even processes. These are implemented by reference implementations (which are not mandatory to use). While standards are necessary to be fulfilled, the underlying requirements to be met are not limited. Compliance of standards beyond the needed requirements, therefore, is possible and encouraged. Each standard is reviewed by subject matter experts on the Technical Committee and then cross-checked with the members of the association. In the next step, the standards will be introduced as reference implementations, depending on the state of discussion.

All standards developed for the Catena-X data ecosystem are **based on the technological and industry-specific requirements** of the automotive industry. Catena-X also wants to consider the latest industry-relevant solutions and ensure that the data ecosystem is compatible with them. As an example, Catena-X collaborates with the Digital Twin Association, to integrate the asset administration shell in the architecture.

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[6] Home - International Data Spaces
[7] Benefits I Catena-X

If a Catena-X use case such as traceability or sustainability requires specific certificates for participation, these can be requested bilaterally between the different participants according to policies for the connector. There will be standardized policies in the Eclipse Tractus-X project that can be used in the use cases. Policies can also be used to show, that a connector implementation of a data provider / consumer is certified by a Conformity Assessment Body (CAB). More information regarding standards and use case specific requirements can be found on the Catena-X website for the most actual and updated information.[8]

#### 3.2.2.2 Make Use of KITs

KITs stand for Keep-It-Together. They are focused on two stakeholder groups: Solution Providers and Data Providers. They are basically a toolbox that allows software developers to build solutions and companies to connect to the Catena- X data space. With them, we ensure, for example, that the Catena-X standards are implemented easier and technical self-onboarding is enabled.

KITs contain open-source artifacts designed to inspire and encourage software developers to build interoperable applications and services. There are many different KITs and new ones are being developed all the time. They differ in their capabilities and are assigned to our first four domains. However, it can be generally said that they are open for use in diverse applications and different services. For example, solution providers can combine multiple KITs and use API specifications and semantic models to develop new Catena-X compatible applications and services. As part of the Eclipse project Tractus-X, we also invite any solution provider to shape and contribute to our open-source KIT artifacts.[9]

#### 3.2.2.3 Data Sovereignty and Applications

Application Providers need to ensure that data providers and consumers who are using their applications and services can fulfill the various levels of the governance framework for data space operations. This mainly concerns the use case as well as data offering and usage levels. As the obligations and duties for Application Providers vary, depending on the use-case, it is important to first determine for which use-cases an application shall be used and then implement those specific requirements.

To understand the scope that Application Providers need to be aware of regarding the use case policy, some exemplary aspects are provided below. For a comprehensive documentation of data sovereignty, mandatory use case requirements, and other legal considerations that are relevant please refer to the current governance framework for data space operations.[10]

1. Providers **must** either ensure that an **EDC can be connected** to the application or that an EDC for each company using the application is provided.

[8] Catena-X Standard-Library I Catena-X
[9] Hello from Eclipse Tractus-X I Eclipse Tractus-X (eclipse-tractusx.github.io)
[10] Governance Framework for Data Space Operations

2. The Application Provider must enable the data provider to add the correct "framework condition ID" during the contract definition of an asset.
3. In case of data consumption, the application must be able to check if the "framework condition ID" refers to a valid framework condition document.
4. Applications must check, if a data provider or consumer in Catena-X has signed the overall and use case specific framework conditions, because else, they are not allowed to share data via the application.

To create data assets, a **contract offer** for each EDC asset must be defined, assigning a usage-based policy that references to at least one framework condition. In this context, data providers must be enabled to add the right framework condition to a contract offer, and consumers must be able to verify them. After data has been consumed, the application must also ensure that consumed data can be deleted based on the framework conditions of the use case. For legal matters, applications need to log contract negotiations according to the EDC standard so that these can be made available for needs of clarification.

The adherence to these rules is guaranteed by the certification process that only certifies applications and services that apply the respective standards and the data sovereignty concept correctly.

#### 3.2.2.4 Test Your Solution (internal)

The operationalization of testing, such as provision of test environments, is a topic handled by the Operating Environment. Please refer to any future information published by the Association and Operating Companies to gather more information.

#### 3.2.2.5 Manage Solution Release (internal)

It is no concern of the Catena-X Association or of the Operating Companies, how Application and Service Providers release their solutions to the market, within their enterprises and according to their in-house processes.

However, these providers need to be aware of the regular open-source software updates: Open-Source-Code provided by the Tractus-X project and standards publicly released by the CX Association. Both of which are to be subsequently implemented by the Operating Companies.

A Tractus-X Release Bundle may contain:

- Core Components of the network run by Operating Companies.
- Decentral components such as, for example, the Tractus-X EDC or the Digital Twin Registry used by data providers and consumers and partially operated by application and Service Providers.

Furthermore, the association independently releases new versions of standards such as semantic models or protocols.

Releases are currently planned four times per year and should define upfront from when on and how long business applications and services need to be compatible with the respective release.

A coordinated release guarantees that all components are tested together and work without errors. If a release contains breaking changes for certain components, the need for migration to a new version also needs to be considered by all network participants, including Application and Service Providers.

Release management will be a central component for Application and Service Providers to consider. New releases will need to be coordinated based on principles developed by the Association, Tractus-X and the operationalization considerations defined by the Operating Companies.

Please refer to any future details published by the Association to gather more information.

### 3.2.3 Catena-X Certification

The **certification process** ensures the required trust for cross-company interactions and compliance to the major Catena-X principles like Interoperability and Data Sovereignty. It is **mandatory** for all Applications and Services to ensure beneficial participation for all participants in the data space.

To prove that developed solutions are aligned with Catena-X standards and principles, **Application and Service Providers** can initiate this step by identifying their certification role contacting one of the accredited **Conformity Assessment Bodies** (CABs) and conclude a contract for certification with them. These CABs are proven auditing companies that closely follow Catena-X principles, provide certification criteria to applicants, and carry out the certification itself according to **one consistent framework**. The results are then handed over to the Catena-X Association, and if awarded a certificate, the provider is ready for registration in the Catena-X Ecosystem – this may already be started in parallel to certification – and listing of their solution.

For an overview of the current end-to-end certification process, further details and contacts, please refer to the respective Catena-X Certification webpage.[11] It also illustrates the different certification roles and certification scope as well as a specific example from the point of view of Business Application Provider.

The same applies for already existing commercial applications or services: in order to make them available as part of the Catena-X Ecosystem, a provider will need to adapt the given solution to comply with the relevant Catena-X requirements and standards and then undergo the same certification process.

[11] Certification | Catena-X

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As an illustration, we refer to an overview of initial certification objects (Rel 3.0 reference).

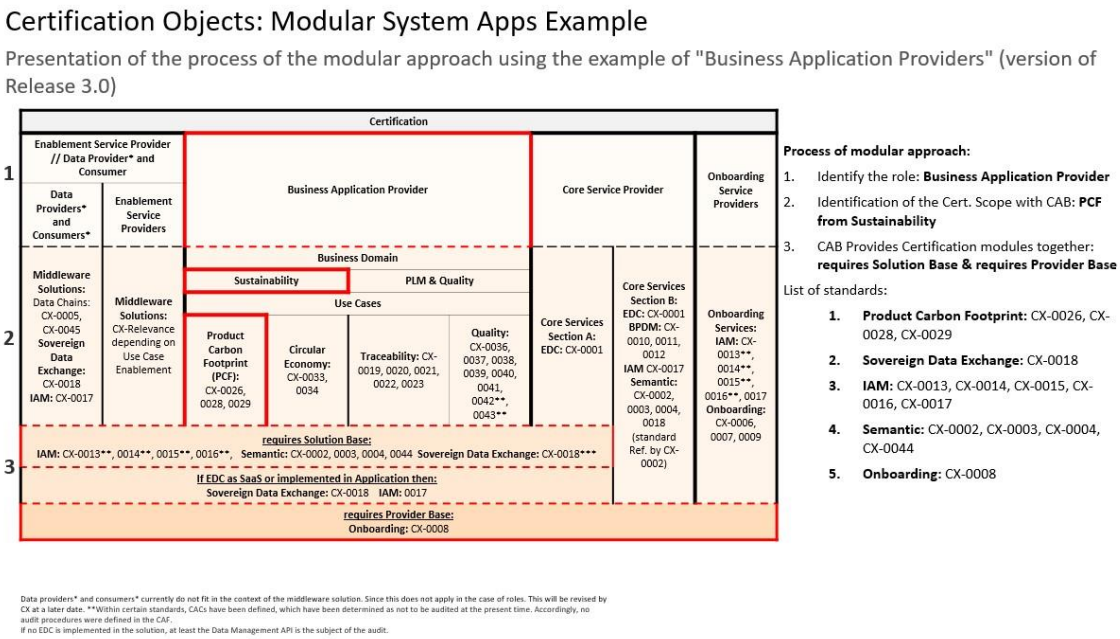


*Figure 3: Framework of Certification Objects*

Here, the Business Application Provider aims to participate within the business domain sustainability in the product carbon footprint use case. In turn, the CAB would then provide all required **certification modules**, including the required Solution and Provider Base. As shown in Figure 3, these standards vary depending on the chosen business domain and use case. A list of to be assessed standards including **conformity assessment criteria** can be found in the Catena-X Standard Library.[12]

Note that certificates may have a limited validity. Depending on the respective characteristics, it is important to regularly assess status of certification and plan and implement necessary steps towards re-certification.

### 3.2.4 Submission to Marketplace

Catena-X shares the vision of transparent and continuous data chains along the automotive value chain. Provided for all participants of the data space, these data chains solve the daily challenges of the industry quickly and easily. The access to the Catena-X Ecosystem is provided via a **Catena-X Portal**.

[12] Catena-X Standard-Library I Catena-X

There are three roles that are relevant to the application and service release process within a Catena-X Marketplace that have been defined by the association, namely:[13]

1) **Core Service Providers** responsible for developing and maintaining the Core Services and components of a Catena-X Marketplace. This includes defining the release process and requirements for application and service releases.
2) **Business Application Providers** responsible for developing and maintaining the applications and services that run on top of the Core Services of a Catena-X Marketplace. This includes following the release process and requirements defined by the core Service Provider.
3) **Enablement Service Providers** responsible for providing services that enable the integration of external systems within a Catena-X Marketplace. This includes following the release process and requirements defined by the core Service Provider when releasing their services.

The first role includes, for example, an operating company. This guide focuses on explaining the process for the **latter two**: Providers of enablement services and applications.

#### 3.2.4.1 Register in Catena-X Marketplace

The access to the Catena-X Data Space is provided via a Catena-X Portal.[14] A Portal can be run by each **certified operating company** that decides to host a core service / marketplace, hence, there can be multiple entry points for Application and Service Providers. Contacting the operating company in question and accepting associated contracts and frame conditions, therefore, is the first step in registering for a Catena-X Marketplace. Before accessing a Catena-X Marketplace, however, an Application or Service Provider **must register its role** within the data space. After registration to the data space, Business Application Providers and Enablement Service Providers can **unlock the individual application and service release functionalities**. These functionalities include viewing agreed upon contracts and assigning company users the roles that are required to publish and manage apps and services in the Catena-X Data Space. These roles need to be considered in context of the individual organization. Regardless of company size and IT capabilities - a Portal ensures that participation in the data space is easily accessible for every user. Participants of the ecosystem get a consolidated access to different services and business applications. Based on individual specifications and information, a Portal highlights relevant offers and business operations.

Participation in the Catena-X Data Space takes place via a registration in a Portal. The registration enables the initial creation of company accounts in the data space and must be completed once at the beginning. The registration consists of **few steps** and should not take more than 10 minutes. For a quick processing it is recommended having the company's commercial register ready or to assign a person authorized by the company with the registration. Depending on the information provided,

[13] Catena-X Standard-Library | Catena-X
[14] Portal & Marketplace | Catena-X

the offer and presentation within a Portal will be regulated later. This will enable **access to all relevant applications** and services for a participating company.

The initial registration is followed by the technical onboarding. This includes the optional configuration of the company's own Identity Provider (IdP). This secures and manages users' digital identities. As part of the technical onboarding, the company's own IdP can be connected to Catena-X. Participation in the Catena-X Data Space requires the **use of a connector**. For this purpose, a Portal **offers a simple interface** for registering and installing the EDC developed in the data space as well as the company's own connectors.

For companies already connected to existing industry networks, the registration for Catena-X can be simplified soon. Based on standardization and certification, Catena-X aims to develop and design a **Network of Networks**. This will realize participation in Catena-X and the use of data-driven solutions across network boundaries.

#### 3.2.4.2 Create Solution Submission

The **application and service publishing process** are relevant for both providers. To support providers in publishing their solution on a Catena-X Marketplace, features that ease the process may be provided, **depending on the marketplace**. These features **could** for example include a tab to manage offered applications and services, a tool to handle subscription management, and a supporting feature to manage the publishing process. An exemplary publishing process is illustrated by Figure 4. This process describes **the first reference implementation**; accordingly, the solution publishing process **may differ** depending on the associated marketplace. As soon as a standardized process has been defined, it will be published by the association on the standard library.[15] The process begins by setting up solution card details such as solution name, provider, pricing, use case / service type, and language. This **eases selection** for customers as they can search for specific solutions and parameters they are looking for.

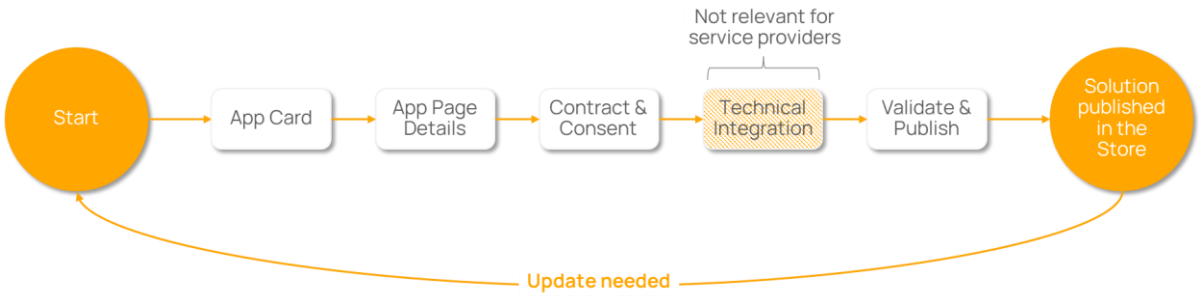


*Figure 4: Application and Service Publishing Process*

The second step involves inserting an application description, images, and contract information. The description and lead picture of the solution shall provide **indication of its use**, for example,

[15] Catena-X Standard-Library | Catena-X

describing and illustrating the added value for a specific use case. The underlying contract information may also be extended by **technical documentation** of the solution to foster understanding and help customers find the solution they are looking for.

In step three the Application or Service Provider needs to consent to **mandatory Catena-X terms and conditions** of publishing their solution on the respective marketplace, indicating that defined rules & standards will be followed.

Step four involves the **technical integration** of the application roles. The roles are necessary to enable in the customer subscription scenario the possible user federation including assigned user roles. Applications can be directly accessed via a marketplace; accordingly, users need to be assigned to enable immediate functionality of the application in question. Since services are not directly accessible by end users via the Catena-X Data Space, this step **is not relevant** for Service Providers, **unless** offering EDC-as-a-service.

Finally, the solution needs to be submitted for a **review by the CAB** to be published. Before being able to list the application on a Catena-X Marketplace, solutions developed for Catena-X must receive the "Catena-X Certified Solution" certificate by an official CAB to prove that they comply with the Catena-X business domain standards. This **certificate must be demonstrated** during the solution publishing process. After compliance of standards is verified, the application can be listed on a Catena-X Marketplace. When updates are required, a change process is initiated, adapting necessary details such as contracts and descriptions, and **re-validating** the offered solution.

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# 4. APPENDIX

The appendix of this document provides background information on general concepts of Catena-X in Chapter 4.1 to help receive an overview about relevant information for Application and Service Providers. In addition, a glossary of frequently used terms is provided in Chapter 4.2 and essential further sources for reference are listed in Chapter 4.3.

## 4.1 The Catena-X Ecosystem

Before diving into the specific requirements for Application and Service Providers in their Catena-X user journey, this chapter provides an overview about Catena-X and its surrounding ecosystem. It is necessary to understand the premise of Catena-X as an Application and Service Provider, as solutions will be developed within the context of pre-existing Catena-X principles and use cases; the relevant concepts and underlying use cases are described below.

### 4.1.1 The Purpose of Catena-X

The Catena-X Automotive Network pursues the goal of creating a data space for participants in the automotive value chain. Together, its members **address challenges** such as **resilience**, **sustainability**, and **geopolitics** through data exchange along the value chain. Ultimately, Catena-X will help companies to become (more) data driven.

The shared goal: a **standardized global data exchange** based on **European values**. The claim is data sovereignty. Participation is rewarded with above-average resilience, innovative strength, and earnings opportunities. For the most recent Catena-X Roadmap please refer to the currently published Catena-X Overview document on the Catena-X website.[16]

#### 4.1.1.1 One Ecosystem

While today companies who aim to exchange data must negotiate contracts and build up data pipelines individually, the goal of the Catena-X Ecosystem will be to give data providers and consumers access to one common data space. Exchanging data based on electronically agreed data contracts, usage policies, established standards and common data models thus reduces the complexity and in turn can help to reduce costs. It can be used in context of available use cases (n:m) but is also available for bilateral (1:1) data exchange.

#### 4.1.1.2 Entities Within the Catena-X Ecosystem

Currently, Catena-X is divided into three entities, (1) **Development Area**, (2) the **Association**, (3) an **Operating Environment**. These different entities are visualized in Figure 5.

[16] Vision & Goals I Catena-X

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Catena-X

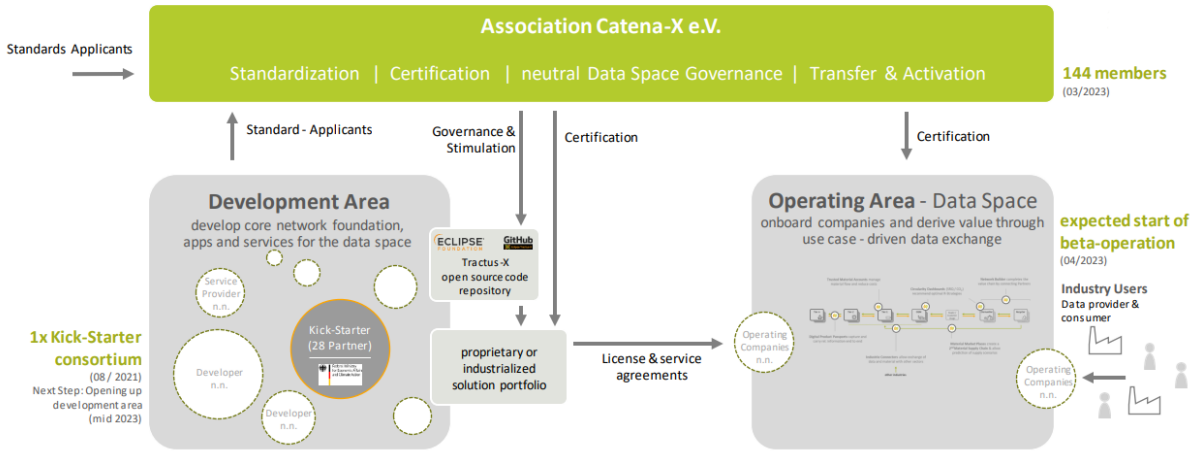


*Figure 5: Entities within the Catena-X Ecosystem*

The Catena-X Consortium has been the starting point of the Catena-X Ecosystem. The Catena-X Consortium will perform the core development work during the funding period until mid-2024.

The Catena-X Association was founded in 2021 as a legal organization and carrier of the brand Catena-X. Association members range from start-ups to automotive OEMs, collaborating in creating technical standards, certification criteria, and development cooperations.[17] The Association is complemented by a Development Area, where the actual development work is done.

Certified Operating Companies build the Operating Environment and operationalize the activities and adhere to the defined Catena-X principles, creating a data space in a trusted environment for all participants of the Catena-X Data Space. [18]

For Application and Service Providers, the Catena-X Association is the first point of contact for the topics of certification, conformity and standards and an operating company for aspects such as registration in the data space, submission of a solution, release management and operations.

### 4.1.2 Introduction to the Data Space

This chapter explains fundamental concepts of Catena-X, such as the data space and its underlying concepts (e.g., data exchange, data sovereignty, and interoperability). In case the reader of this guide is already familiar with these concepts and no further insights are needed, Chapter 3 focuses on the specific onboarding requirements for Application and Service Providers.

Data spaces provide an end-to-end solution for data integration and data exchange between organizations. Data spaces help to overcome the traditional practice of engaging in data silos by allowing to manage and exchange your data in a shared space. There are several major initiatives

[17] Catena-X Association
[18] Catena-X Operating Environment

that shape and drive the creation of data spaces. Catena-X is inspired and guided especially by the following two organizations.

**International Data Spaces Association (IDSA)**[19] is a collaborative effort by over 140 members companies to derive the value of their data to the greatest extent by inculcating a culture of trust and equal partnership. The goal of IDSA is to drive data economy across industries by realizing and implementing global standards for international Data Spaces (IDS). IDS connector has been developed further to enable direct metadata transmission via Eclipse Data Space Connector (EDC)[20] interface. The EDC is a reference implementation to ensure data sovereignty and interoperability until standards (e.g., API specification) are available. In this context, Service Providers operate **one or multiple EDC** per customer to realize global standards. This form of EDC operation is also known as "**EDC-as-a-service**" and enables providers and consumers to participate in the decentralized data exchange (see chapter 4.2.1.4 for more information).

**Gaia-X** aims to create a federated open data infrastructure based on European values regarding data and cloud sovereignty. Gaia-X and Catena-X share the same values including openness, transparency, trust, and data sovereignty. You can find more about Gaia-X on their website.[21] Further initiatives that are worth mentioning are: the Data Space Business Alliance[22] and Data Space Support Center.[23]

#### 4.1.2.1 Concept of the Catena-X Data Space

The Catena-X Data Space contains most of the features which can be found in any data space such as decentral data sharing or data discovery mechanisms. In addition to that, Catena-X puts special emphasis on the following concepts:

- Data Sovereignty
- Interoperability
- Multi-Level Data Chains

The following chapters describe these concepts on a high level.

##### 4.1.2.1.1 Data Sovereignty

Data Sovereignty can be defined as a natural person's or corporate entity's capability of being entirely self-determined with regards to its data.[24] Data sovereignty is a principle that spans multiple layers of the data space. These layers range from identity and attributes of the Catena-X Ecosystem participants and services that are trusted and verifiable, through middleware provisions for data sovereignty, such as ability to define access and usage policies, sign participation statement and

[19] Home - International Data Spaces
[20] Eclipse Project Data Space Connector
[21] Gaia-X
[22] Data Space Business Alliance
[23] Data Space Support Center
[24] Gaia-X Glossary

verify the validity of the conditions before the data exchange takes place, through the end-user applications on both data consumer and data provider sides being able to integrate with the Catena-X services to read and enforce usage policies.

Data sovereignty can be enforced in two ways – **legally and technically**. Legally enforcing data sovereignty means that a data provider can formulate the rules and obligations that a data consumer needs to follow when consuming the data in a legally binding way by data contracts. The issue is that the data provider has little to no control mechanisms if the data consumer in fact does follow those rules. Technically enforcing data sovereignty means that the applications on data consumer side can understand imposed usage restrictions and automatically execute them, such as a "delete data after 30 days" usage restriction.

Currently, legal enforcement of usage policies is **the only viable option**, however eventually, the technical enforcement could be made possible by Application Providers. This means integrating an engine that can read and understand usage policies and apply them to data within applications. Access policies are already enforced technically by the EDC and data is only transferred to partners that meet the requirements stated in those access policies.

To ensure data sovereignty within the Catena-X Data Space, a governance framework for data space operations is established, which contains multiple levels.

### Data Space Level

The "golden rules" on data space level outline the basic principles which all participants in the data space need to follow. It anchors the framework conditions per use case as well as the usage and access policies as binding principles.

### Use Case Level

The "Use Case Policy" per use-case regulate the obligations and duties of data providers and consumers within a use-case. They are based on the latest standards and data sovereignty guidelines.[25] Among others, the policy defines, which semantic models will be exchanged within a use-case, which usage-policies can be used or for how long data is exchanged. Frame conditions can be referenced technically with a framework condition ID. Application Providers need to ensure that data providers and consumers can fulfil the framework conditions while using their apps.

### Data Offering Level

On the level of concrete data offers, policies govern who can access the data (access policies) and under which conditions the data is shared and can be used (usage policies).

[25] Catena-X Standards | Catena-X

#### 4.1.2.1.2 Interoperability

Interoperability, along with data sovereignty, is one of the two core architecture principles in Catena-X.

In today's business world, many issues cannot be resolved by a single corporation in isolation but only in collaboration. Collaboration is the striving of multiple entities (individuals or organizations) to achieve a common goal. To support that, it is essential that the IT systems supporting the individual entities' processes can be integrated appropriately to run processes and joint issue resolution across organizations.

Interoperability is the ability of different systems, devices, applications, or products to **connect and communicate in a coordinated way**, without effort from the end user. Functions of interoperable components include data access, data transmission and cross-organizational collaboration regardless of its developer or origin.

The idea is that no matter which application or service is used by a company within a use case, data can be exchanged with other participants. Interoperability builds on top of the concept of a shared semantic, standardized data exchange mechanisms and calculation logics.

For example, company A can use a completely different application than its supplier B to calculate its CO2 footprints, and because both apps are interoperable the application of company A can calculate its footprint based on the values provided by its supplier. Thus, Application and Service Providers must consider the concept of interoperability based on shared semantic models to enable such a data exchange scenario.

#### 4.1.2.1.3 Multi-Level Data Chains

Catena-X is organized around use-cases, many of those use-cases only work when a complete supply chain from Tier-X up to the OEM or even recycler combine their data in a meaningful way.:

The goal of Catena-X is **not** to send all data to the OEMs and store them in a central platform, as the data space is decentral in nature. Rather, the idea is to keep a "1 up – 1 down" principle: Data is only shared with direct customers or suppliers to keep data sovereignty and not disclose any information about customer-supplier relations to other parties in the tier-chain. For the use-cases this means that data is recursively collected and aggregated before it's sent from lower to higher tier-levels.

#### 4.1.2.1.4 Eclipse Data Space Connector (EDC)

Peer-to-peer data exchange in Catena-X as a decentral ecosystem is possible due to the IDSA Data Space Protocol (in this guide referred to as "the Data Space Protocol"), which is implemented by the EDC.[26]

[26] Home - International Data Spaces

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The **Data Space Protocol is defined as** "a set of specifications designed to facilitate interoperable data sharing between entities governed by usage control and based on Web technologies. These specifications define the schemas and protocols required for entities to publish data, negotiate usage agreements, and access data as part of a federation of technical systems termed a ***data space***."[27]

The interaction of participants in a data space is conducted by the participant agents, **so-called Connectors**, in case of Catena-X the EDC, which **implements the protocols described above**. While most interactions take place between Connectors, some interactions with other systems are required.

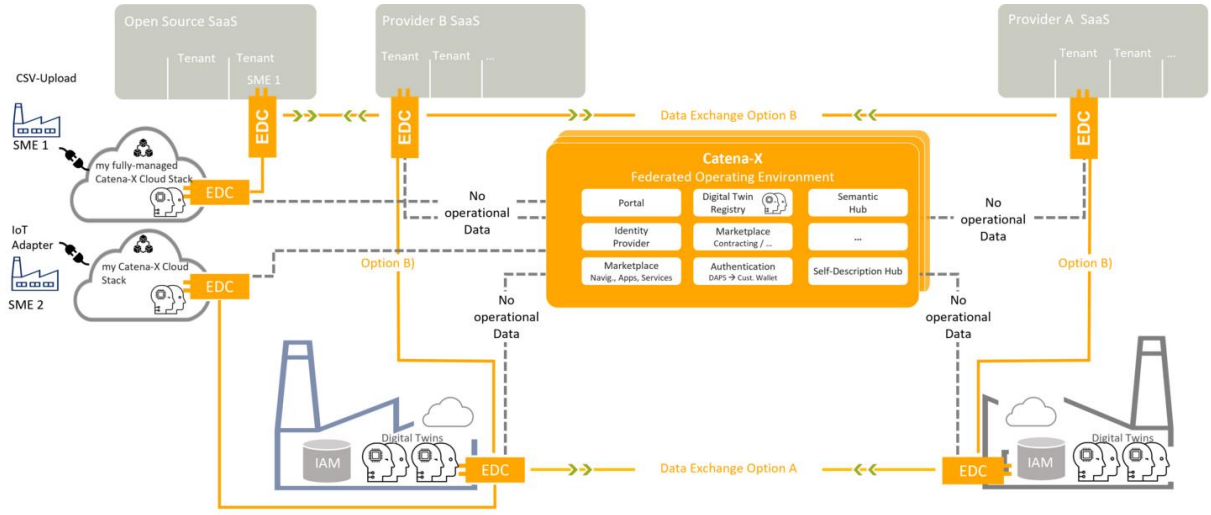


*Figure 6: Catena-X Data Space*

The guiding principles of the data space are illustrated by Figure 6.

Catena-X is actively involved in implementing the specifications of the Data Space Protocol in the Eclipse EDC. In that context, the EDC is the gatekeeper for incoming external data as well as outgoing internal data. When making use of the EDC, software providers need to ensure and test that developed applications are compatible with the most recent Data Space Protocol and that data standards and usage policies are followed. However, in the future software providers will also be able to develop their own data exchange solutions (based on the Data Space Protocol) – which they will need to certify to proof interoperability with other solutions.

In addition to technical interoperability measures described in the specification, a shared semantic should also be addressed by the participants. On the perspective of the data space, interoperability needs to be addressed also on the level of trust, on organizational level and on legal level. The

[27] Data Space Protocol v0.8

aspect of cross data space communication, however, is not subject of this guide, as this is addressed by the data spaces' organizational and legal agreements.

Identity Providers facilitate necessary information for required interfaces to implement a Trust Framework of a data space. A fundamental mechanism is the validation of the identify of a given participant agent and validation of additional claims. The structure and content of such claims and identity may vary between different data spaces, as well as the structure of such an Identity Provider, e.g., a centralized system, a decentralized system, or a federated system.

Implementing additional internal functionalities like poly engines or monitoring will be possible by using a connector, however, the specification does not cover the actual implementation.[28]

The same applies for the data, which is transferred between the systems. Accordingly, a specification for the transport protocol, the structure, syntax and semantics of the data is required – subject to the agreements of the participants of the data space.

Further information and a detailed description of the Data Space Protocol can be found using the link below.[29]

#### 4.1.2.2 Decentral Data Sharing

As opposed to existing data platforms, where data is collected and distributed by an intermediary, the Catena-X Data Space is decentral in nature. There is **no third party** that has control over the data that is shared between data provider and data consumer. Every data exchange happens on a peer-to-peer basis. Central components are only used to facilitate the data exchange by e.g., providing data discovery mechanisms or lookup functionality for semantic models.

#### 4.1.2.3 Identity and Trust

Because the Catena-X Data Space is decentral and business-critical data is involved, the correct and reliable identification of business partners with which data is shared, is of utmost importance. A data provider needs to be sure that the data consumer is really who he claims to be, and vice versa. This requirement puts special emphasis on the concept of identity and trust. During onboarding, each member company needs to undergo a **know your customer (KYC)** process where the identity of the company is validated by a trusted third party. The third-party certifies the identity and guarantees for its correctness, acting as a so-called trust anchor. During data exchange, the data provider and consumer can, by the means of cryptographic keys and certificates proof their identity to each other.

#### 4.1.2.4 Data Discovery

Because the data is distributed across all participants and each participant offers different data, mechanisms, and tools to discovery, browse, and filter all the various data assets are needed. Each

[28,29] Data Space Protocol v0.8

company stays in full control over which of his partners can see which data assets. Those discovery mechanisms can be fine-tuned to a degree that only one specific partner can discover a certain data asset. On the Catena-X platform Operating Companies play the intermediary role of connecting the data provider and data consumer. Having **multiple Operating Companies** fosters decentralization, thereby preventing a single point of failure in the data space. Data discovery and semantic models should be core components of any Catena-X business application, e.g., when it comes to the digital twin registry, to make data discoverable and accessible.

#### 4.1.2.5 Standardized Semantic Models

A standardized semantic model - or **standardized meaning of data** - is one of the prerequisites for the growth and adoption of the Catena-X Data Space[30]. Catena-X is organized around sharing data in predefined use-cases. Imagine that each participant within those use-cases would come up with its own descriptions of the fieldnames in a dataset and then would need to explain to all its customers and suppliers, what the fieldnames mean. This surely is not a scalable approach. To overcome this challenge, Catena-X creates standardized semantic models which are shared by every participant in a use-case. Each participant must ensure that data that he sends to partners follows that standardized semantic model and in turn the recipient knows the exact meaning of the data that he is receiving.

Semantic models are described using specific semantic modelling languages, which are also standardized within Catena-X.

In case two partners decide to share data outside of the agreed use-cases, they do not necessarily have to standardize a semantic model for the data they exchange.

[30] Catena-X Standard-Library | Catena-X

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## 4.2 Glossary

| Term | Description |
|---|---|
| Asset Administration Shell (AAS) | The Asset Administration Shell is a standard format for digital twins allowing multi-vendor and cross-industry information transfer. |
| Conformity Assessment Body (CAB) | Conformity Assessment Bodies are proven auditing companies that closely follow Catena-X principles, provide certification criteria to applicants, and carry out the certification itself according to one consistent framework. |
| Catena-X Marketplace | A Catena-X Portal gives you access to the respective Catena-X Marketplace where you can acquire, sell, or exchange data assets, apps or services. Application and Service Providers, accordingly, need to register in their respective role with one of the operators of the Data Space. The first operator of a Catena-X Marketplace is Cofinity-X. |
| Dynamic Attribute Provisioning Service (DAPS) | A Dynamic Attribute Provisioning Service (DAPS) is used to provide dynamic, up-to-date attribute information about Participants and Connectors. |
| Data Asset | A data asset may be a system or an output file of an application, database, document, or a web page. It may also include provided services to access data from an application, such as a service that returns individual records from a database, which would be considered as a data asset. |
| Data Space | A Data Space is a virtual data integration concept defined as a set of participants and a set of relationships among them, where participants provide their data resources and computing services. Data spaces have following design principles: a) data resides in its sources; b) only semantic integration of data and no common data schema; c) nesting and overlaps are possible; d) spontaneous networking of data, data visiting, and coexistence of data are enabled. Within one Data Ecosystem, several Data spaces can emerge. |
| Digital Twin | The Digital Twin is a virtual representation of assets and adheres to the following characteristics: |

- The Digital Twin has at least one Catena-X-wide unique ID.
- Digital Twins are organized by a set of Aspects. The set can be extended over lifetime.
- An Aspect of a Digital Twin includes both structural as well as behavioral data and models (including operations and simulation models).
- The semantics of an Aspect can be described via semantic models.
- A single Aspect can be connected to different heterogenous data sources (including behavioral models).
- The Digital Twin can represent asset types (e.g., virtual prototype of a car) and asset instances (e.g. real car).
- A Digital Twin can cover the whole asset lifecycle including (e.g., planning phase, production, sales, use and decommissioning phase). However, in practice there may be more than one twin with different IDs representing different lifecycle phases (e.g., a twin for types and multiple twins for instances).
- An asset can have more than one Digital Twin.
- The Digital Twin represents current available information about an asset (synchronized at a specified frequency and fidelity) which can be leveraged for simulation and business process integration.

By using aspects, the Digital Twin can reference other Digital Twin to express "part of" or "consists of" relations.

| | |
|---|---|
| Digital Twin Registry (DT Registry) | The Digital Twin Registry is a Catena-X component and currently realized through a central registry, listing all digital twin meta data and references of all their relevant aspects. With future releases, a decentral Digital Twin Registry is planned to ensure data sovereignty. |
| Eclipse Data Space Connector (EDC) | Eclipse Data Space Connector: Open-source IDS connector designed to easily integrate different parties. The EDC requires a protocol implementation for policy enforcement among participants. Moreover, it implements the International Data Spaces standard (IDS) as well as relevant protocols and requirements associated with Gaia-X. However, the connector will be extensible so that alternative protocols can be supported. |
| Identity | An Identity is a representation of an entity (Participant / Asset / Re-source) in the form of one or more |

| | |
|---|---|
| | attributes that allow the entity to be sufficiently distinguished within context. An Identity may have several Identifiers. |
| Identity Provider (IdP) | The Identity Provider will allow you to authorize and authenticate yourself in the Catena-X Data Space.<br><br>**IdP at Catena-X:** You may use the Catena-X Identity Provider Management or your own company IdP by connecting your IdP with Catena-X. |
| KITs (Keep it Together) | KITs provide a set of standards, documentation, reference implementations, quick setup guides, etc., that enable participants to build and operate interoperable and certified applications / services easier and faster. Developers can find documentation, APIs, SDKs and more on the Eclipse Tractus-X website. |
| Use Case | Catena-X splits into 10 different thematic clusters (use cases), each developing usable software for the automotive supply chain. |

*Table 1: Glossary of Terms Used Throughout the Guide*

## 4.3 Additional Sources and References

This guide serves as an introductory frame document to outline the Catena-X App & Service Provider Journey. Its content is meant to be complemented by more detailed information and documentation available at different sources like, for example, the Catena-X Association Website, Eclipse Tractus-X. The table below, accordingly, provides a direct link to the most important sources and a description of the information to be found.

| Reference / Link | Description |
|---|---|
| Catena-X Standards Library | List of relevant standards in Context of Catena-X. This includes standards for applications, services, use cases, the certification process, and more. |
| Certification I Catena-X | To become a part of the Catena-X Ecosystem, the components of the network need to prove that they comply with Catena-X major principles. Here, you can find an explanation of how to certify individual solutions for Catena-X. |
| Eclipse Tractus-X | Eclipse Tractus-X website, explaining the purpose of KITs, linking most relevant information, and elaborating on the different views of KITs and reference implementations. Further, a designated section for developers including specifications of use case KITs and reference implementations can be found here. |
| Governance Framework for Data Space Operations | This framework with its dedicated layers, will act as a guide and mutual foundation, all participants can rely on to ensure interoperability and therefore scalability. This framework outlines the requirements and responsibilities for all participants operating in the Catena-X Data Space or its dedicated Use Cases. |
| Offers I Catena-X | For additional information on core assets, Core Services and solutions (e.g., EDC, Portal, DT registry…) an overview can be found on the offers section of the Catena-X website. |
| Operating Environment I Catena-X | Information on the architecture of the Catena-X Data Space including its three main areas (Core Services, enablement services, business applications) and the Catena-X Operating Model Whitepaper, can be found here. |

*Table 2: List of Additional Source and References*