Catena-X: Exploring and Deploying its Open Source Components

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What is Catena-X ?

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.

Catena-X is the industrial policy **lighthouse** project for the digitalization of supply chains.

Shared global DATA SPACE

- One **operating model** and **federated operating system** for the data space
- **Customer value journeys** for common GOALS enabled by open, multi vendor marketplaces

- Foundational services and **standards** built upon **OSS** (KITs) with dedicated **developer journeys**
- **Neutral governance**, incl. conformity assessment body
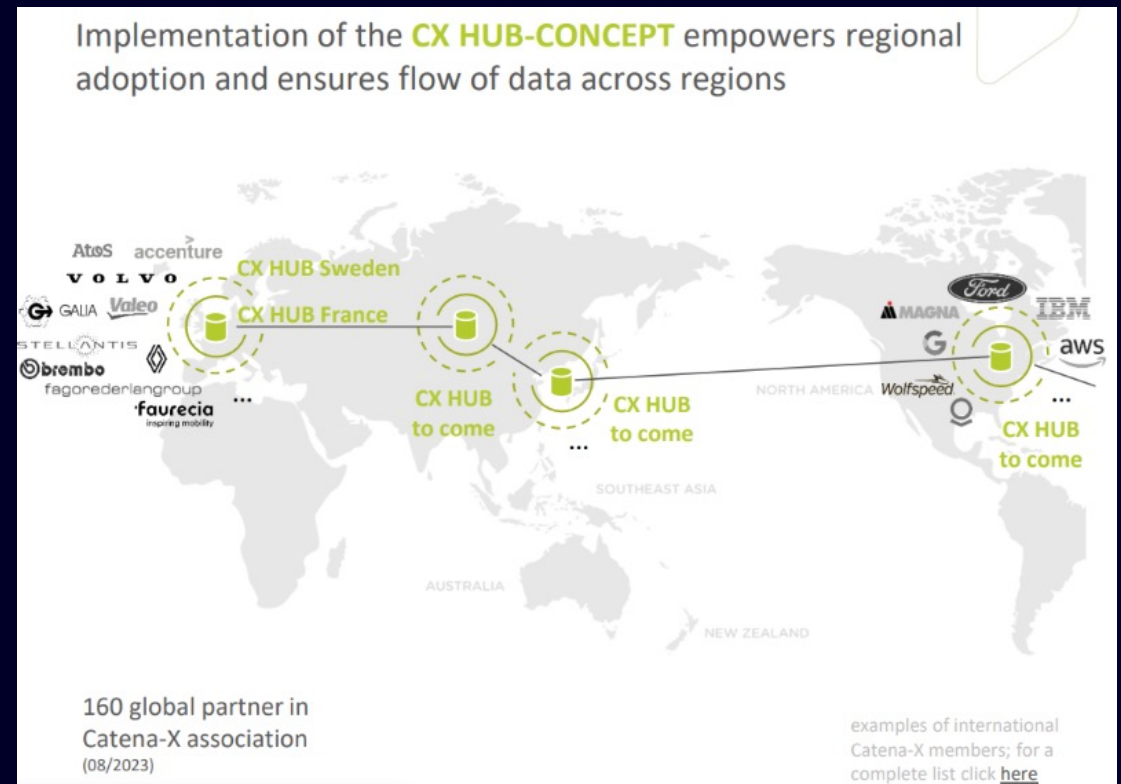
Driving forces of policies:
- CBAM: Carbon Border Adjustment Mechanism
- Battery Passport

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What is Catena-X ?

- Initiation & status quo
  Proposed by BMW and SAP in 2021, 160
  members as of: 08.2023.

Catena-X Automotive Network

Open for more partners.

- EU Operator: Cofinity-X 10.2023
  https://www.cofinity-x.com/products-and-services

Implementation of the **CX HUB-CONCEPT** empowers regional adoption and ensures flow of data across regions

160 global partner in Catena-X association (08/2023)

examples of international Catena-X members; for a complete list click here

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Catena-X Data Ecosystem Concept

IDSA International Data Spaces	GAIA-X European Data Strategy	Catena-X （for Automotive） Collaborative Data Ecosystem

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Catena-X Data Ecosystem

Build a global data space that can host our industry

275.000+ legal entities
x
locations globally
x
digital twins machines, products
x
apps business processes
x
users business responsibility

Optional adjacent industries

Create the first data driven value chain; incorporating all participants via interoperable and trusted solutions

Tier-n   Tier-3   Tier-2   Tier-1   OEM   ...   Recycling

Recyclate: xx%   Marketplaces

+2   +5   +20   +9   +4   +2

PCF = x kg CO_{2e}

Example: Sustainability
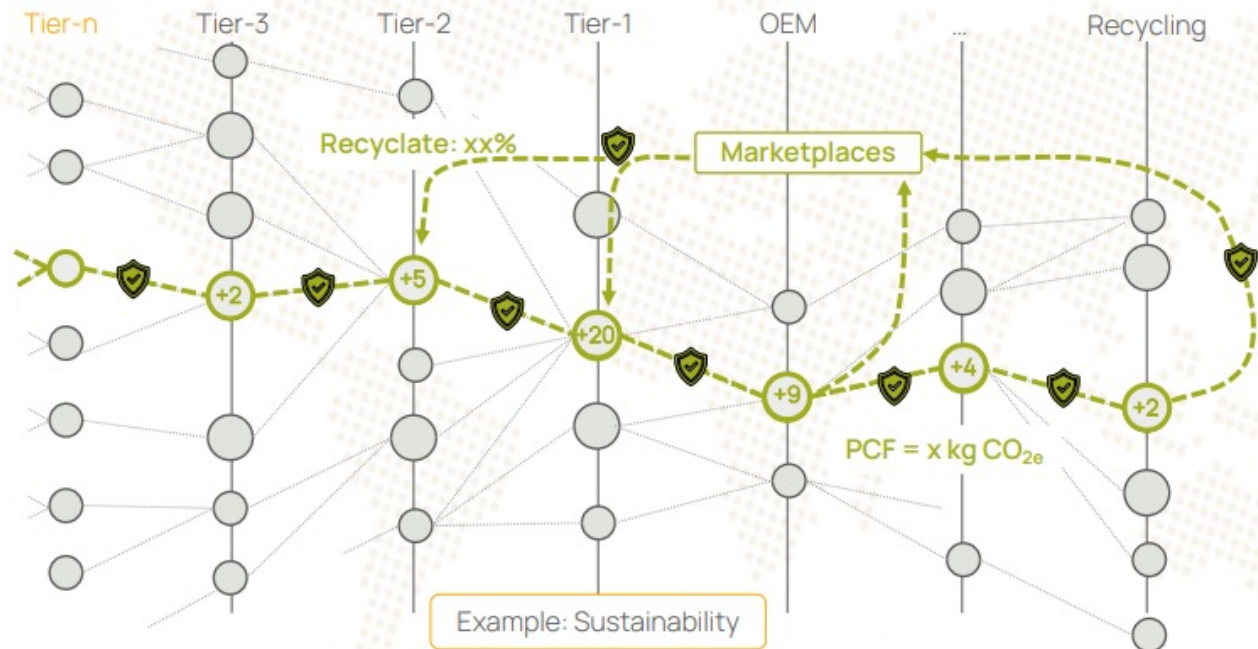
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How Catena-X Works – GAIA-X Ready Architecture

- Core assets: EDC, Portal

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Use cases of Catena-X

Siemens participates and contributes to 8 of 10 use cases

Use Case Integration

- ★ Traceability
- ★ Sustainability
- ★ Circular Economy
- ★ Quality Management
- Demand and Capacity Management
- ★ Business Partner
- Data and model-centric Dev. & Operat. support
- Modular Production
- Manufacturing as a Service
- Online Control and Simulation

■ Product teams with Siemens participation □ No Siemens contribution

10 Initial Use Cases
Solutions to current top issues
in the European automotive industry

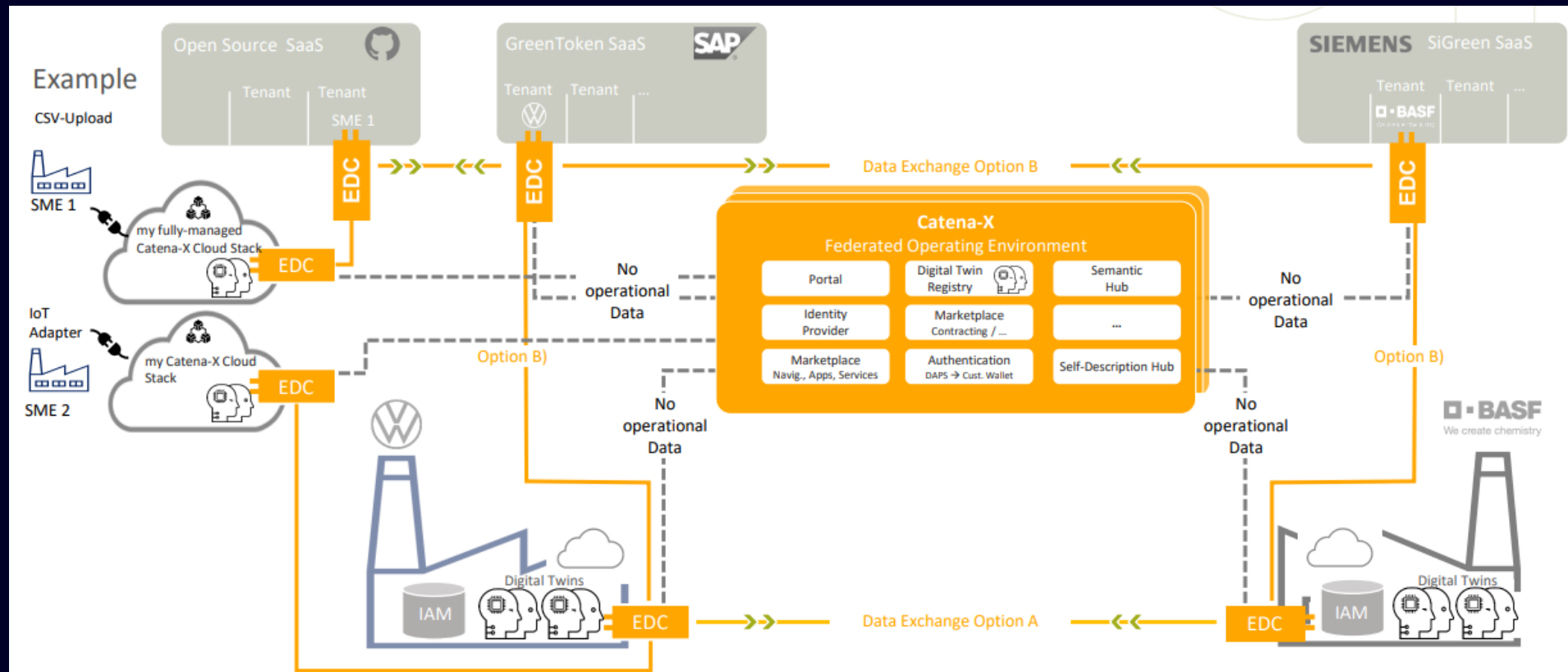**One operating system**
GAIA-X, Catena-X modules and services
combined result in an operational overall system

Transfer & Scale Out
Activation and onboarding of users and
providers, especially with a focus on SMEs

★ Top use cases

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Tractus-X

Tractus-X: official *open-source* project for Catena-X under Eclipse Foundation ([Github](#)).

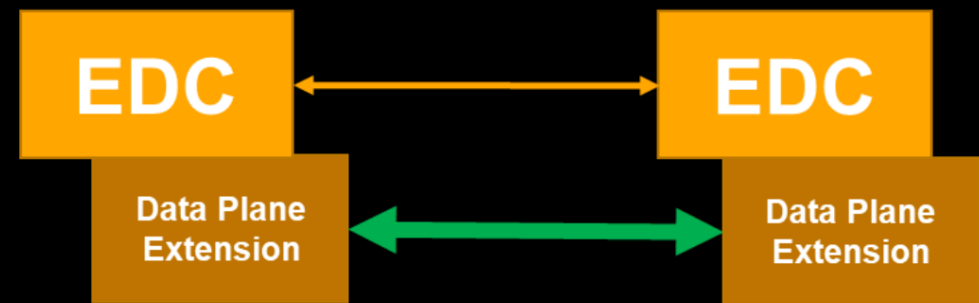**SIEMENS**

Tractus-X

KIT, short for Keep It Together, offers open-source resources and comprehensive documentation designed for the use cases of Catena-X ecosystem.

Technically, it could be containerized images (Kubernetes based).

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Tractus-X for Catena-X example

Open source kits deployed at data consumer/provider side exchange data to realize different use cases.

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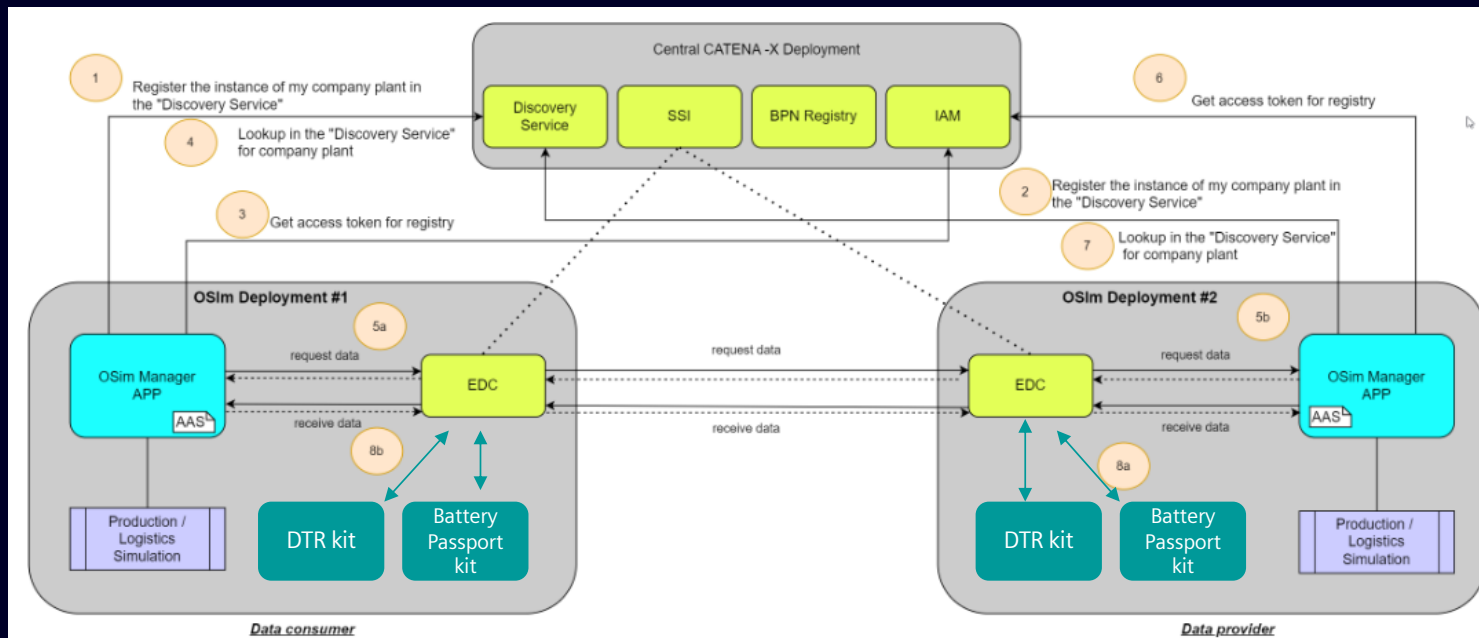
EDC Kit: Core of exchange between dataspaces

- **Control-Plane**: administration, resource management, contract negotiation and administer data transfer.
- **Data-Plane**: heavy lifting of transferring and receiving data streams.
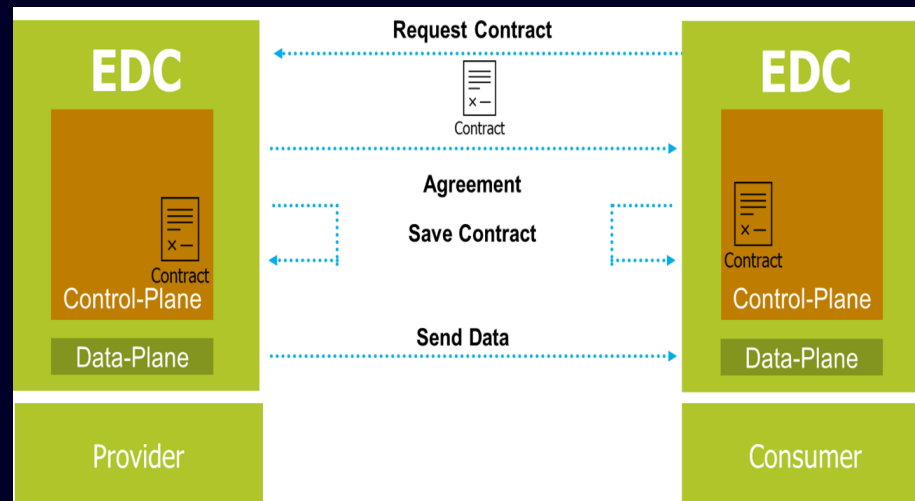
- ❖ **Control plane**
  - **Asset**: stores only meta data, like dataAddress filed.
  - **Policy**: Policies are used to express what requirements a subject (e.g. a communication partner) must satisfy in order to be able to perform an action. Policies are [ODRL](https://www.w3.org/TR/odrl-model/) serialized as JSON-LD.
  - **Contract definition**: Contract definitions are how assets and policies are linked together, comprised of a contract policy and an access policy.
  - **Catalog**: data offerings of a connector and one or multiple service endpoints to initiate a negotiation for those offerings.
  - **Contract negotiation**: target one asset between a provider and a consumer connector.
  - **Contract agreement**: both provider and consumer reached FINALIZED state. Final offer is approved always by provider.
  - **Transfer process**: record data transfer.
- ❖ **Data plane**
  - Url location of data

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Tractus-X EDC and MXD (Minimum Tractus-X Dataspace)

- MXD: requires a provider EDC and a consumer EDC
- Bi-directional: additional corresponding provider EDC and consumer EDC

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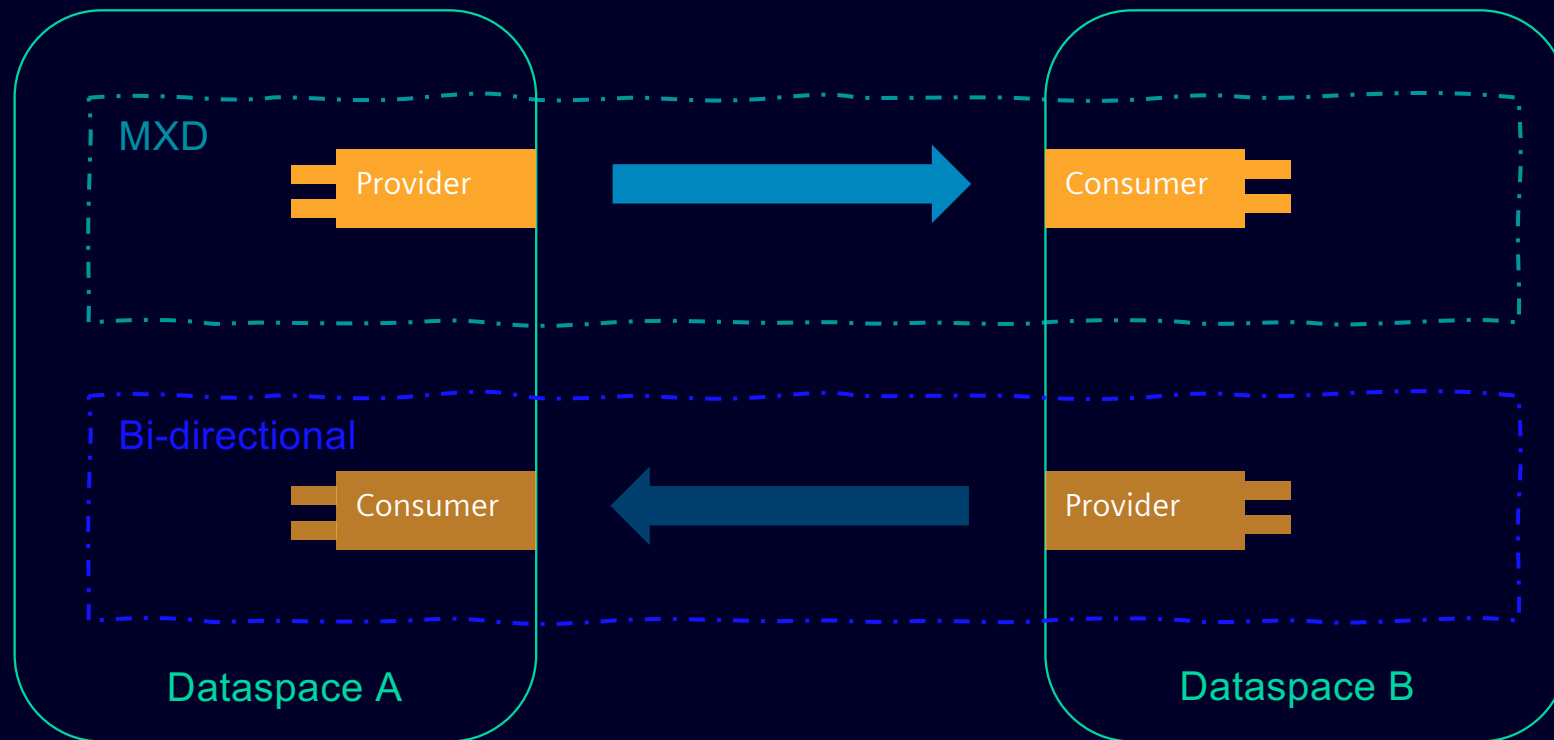
Digital Twin Kit: trace parts and materials across the entire value chain

Digital Twin (DT) describes a digital representation of an asset sufficient to meet the requirements of a set of use cases.

Digital Twin Registry (DTR) is an operated solution which lists Digital Twins and their respective Aspects.

Asset Administration Shell (AAS) is a key concept of Industry 4.0 (or "Industrie 4.0" in German), maintained by the Industrial Digital Twin Association (IDTA), and is used to describe an asset electronically in a standardized manner.

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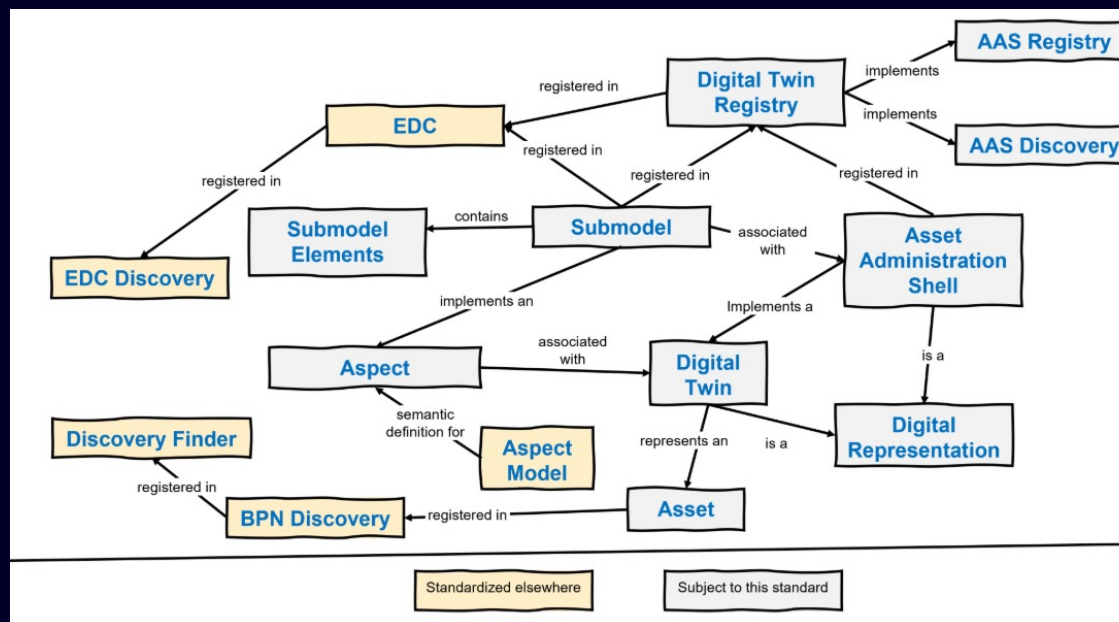
CATL Deployment @202412

- 1st real data exchange between automotive manufacturer(BMW) and battery supplier(CATL) for digital twin and battery passport use case.
- Tight schedule: very last week before 2024 Christmas.
- Battery passport digital twin example
  - Vehicle
    - Battery
      - Cell
    - Transmission
    - Paint

Step-wise approach

Digital twin mapping

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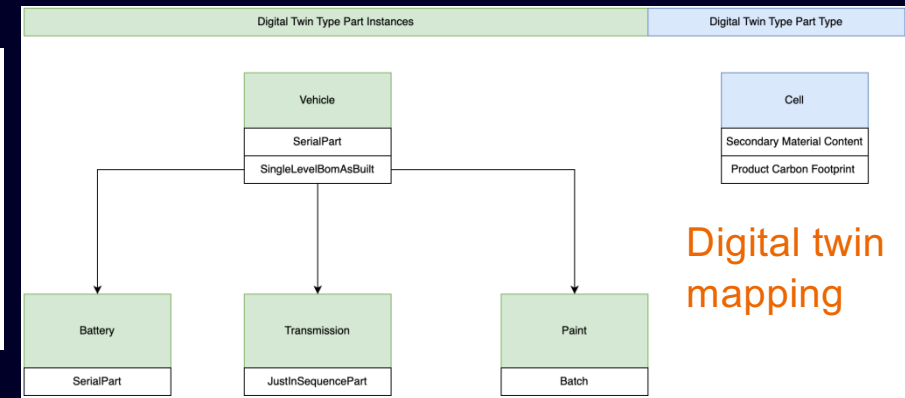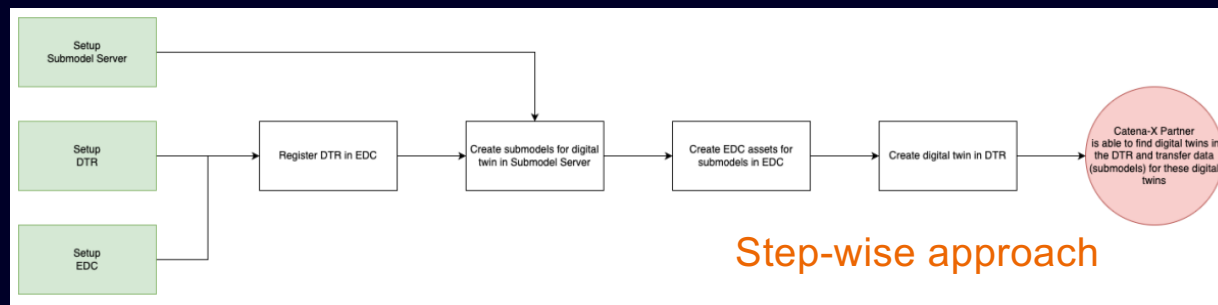
Summary

With **open data** and **open source**, we can quickly integrate different companies around the globe.

This is precisely what **Catena-X** aims to achieve as an open and collaborative data ecosystem for the automotive industry. It leverages a shared global data space and an architecture built on open standards, including components like the Enterprise Data Catalog (EDC) and Digital Twin Registry, to facilitate seamless data exchange.

Furthermore, **Tractus-X**, a suite of open-source tools, actively supports Catena-X use cases, enabling scalable and transparent data flows. This approach tackles critical industry challenges like traceability, sustainability, and quality management, fostering rapid integration and collaboration across complex value chains, with Siemens actively participating in its development.

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QA
& Thank you!

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