European Cloud Accelerator

Project Kick off
Milan, June 2025

Agenda | Day 1

Day 1, June 4	
10:00 – 11:00	Welcome, Project Overview and Update – Alexis Corcoran, Babak Jahromi
11:00 – 11:20	Fraunhofer Presentation – Professor Boris Otto
11:20 – 11:40	Intro to Dataspaces – Eric Samson
11:40 – 11:50	Break
11:50 – 13:15	Industry Partner Presentations from Catena-X, Manufacturing-X, OPC Foundation, IDSA and iShare trust framework
13:15 – 14:00	Lunch
14:00 – 14:40	Industrial Data Sharing – Erich Barnstedt
14:40 – 14:50	Break
15:00 – 17:00	Partner Presentations from Aruba and Opiquad
19:30	Dinner at Duo Milan Bistro

Schedule | Day 1

Upcoming	
10:00 – 11:00	Welcome, Project Overview and Update – Alexis Corcoran, Babak Jahromi
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Create hosted dataspaces-as-a-service:

To enable complex supply chains to meet new regulatory & business requirements

- Facilitate B2B supply chain data sharing projects to address one of their biggest challenges – scaling to 1M+ participant companies
- Empower small firms to participate in the supply chains where regulatory mandated requirements will force them to provide data (i.e. digital product passports, IoT device owners' data, sustainability reporting…)

To create economic opportunity for European cloud providers

- Deploy hosted services solutions that meet the market demand created by regulatory and business requirements (e.g. Catena-X)
- Build services consumption business based on trusted, industrial data exchange

To build open solutions

- Open-source software
- Open standards
- Platform-independent
- Multi-cloud / Federated cloud

Why is Microsoft hosting this event?

An outcome of our joining CISPE is a commitment to foster a more competitive and dynamic cloud marketplace in EU

It is also part of our recently announced European digital commitments (that go beyond CISPE relationship)

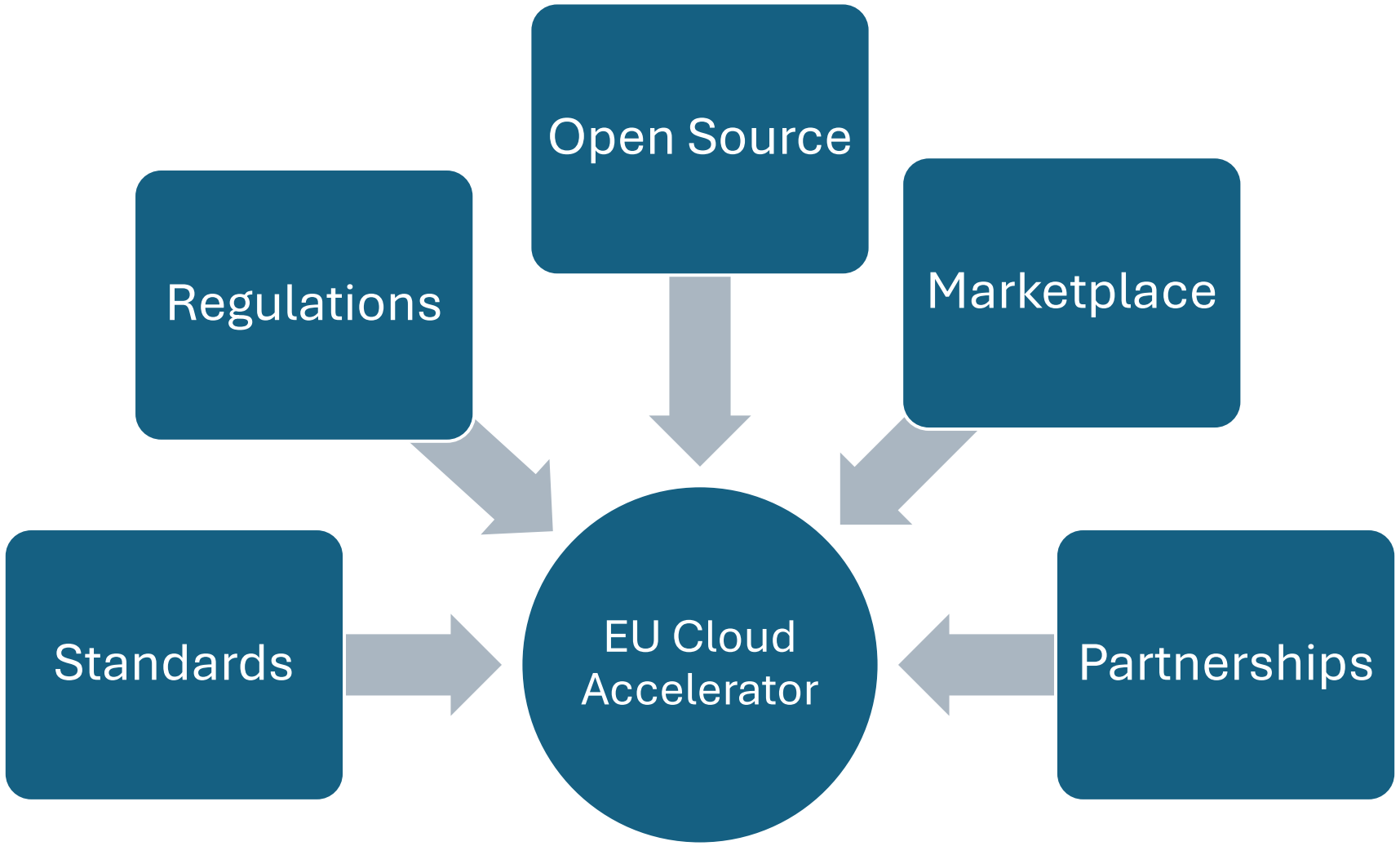
Microsoft is investing engineering and community resources to follow through on the commitments we've made

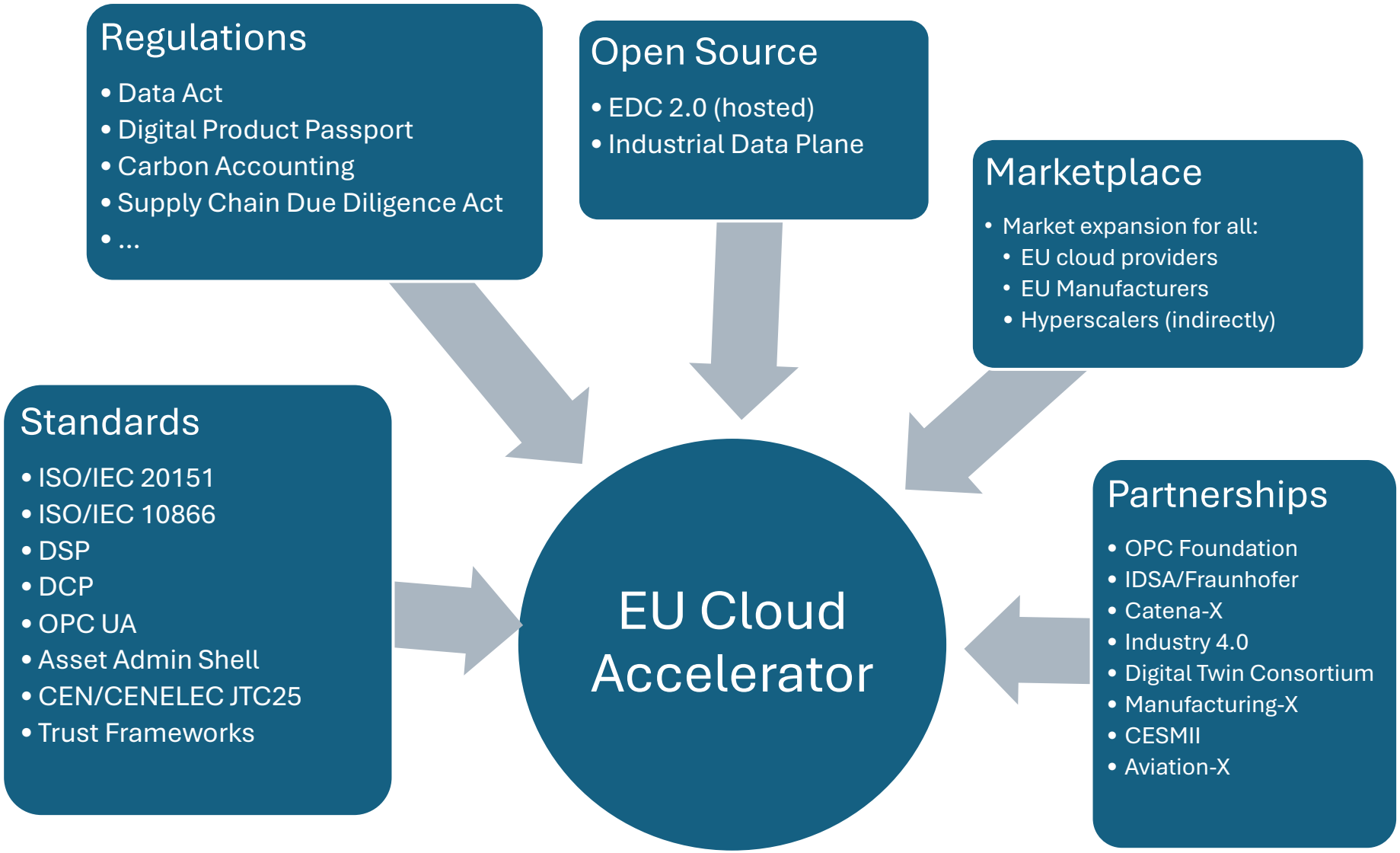
This project is also influenced by our experiences working in organizations such as Gaia-X, CEN/CENELC, ISO/IEC, IDSA, and more.

We recognize the importance of trusted, sovereign, open, interoperable, decentralized, and distributed data sharing technologies as a foundational starting point

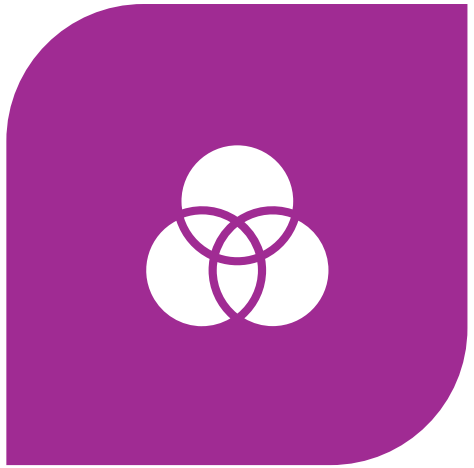
Leading voices on dataspaces attending

- Goal is to recognize the mix of business and technical challenges that will allow for the demand side created by regulatory and market requirements to be met with supply side of solutions that enable new economic opportunity on all sides of modern supply chains.





Let’s bring two communities together



DATASPACE CONSORTIUMS/INITIATIVES
SUCH AS CATENA-X, EONA-X, OMEGA-X

EU CLOUD PROVIDERS TO HOST TURNKEY
SOVEREIGN DATASPACES SOLUTIONS

A Workshop is not a marketing exercise!

It is the kick-off of an open-source project.

Today and Tomorrow…

- Become familiar with different parts of the technology
- Architecture
- Components
- Project plans
- Timelines
- Technical choices still to be made
- How to stay involved and help

By the end of the second day...

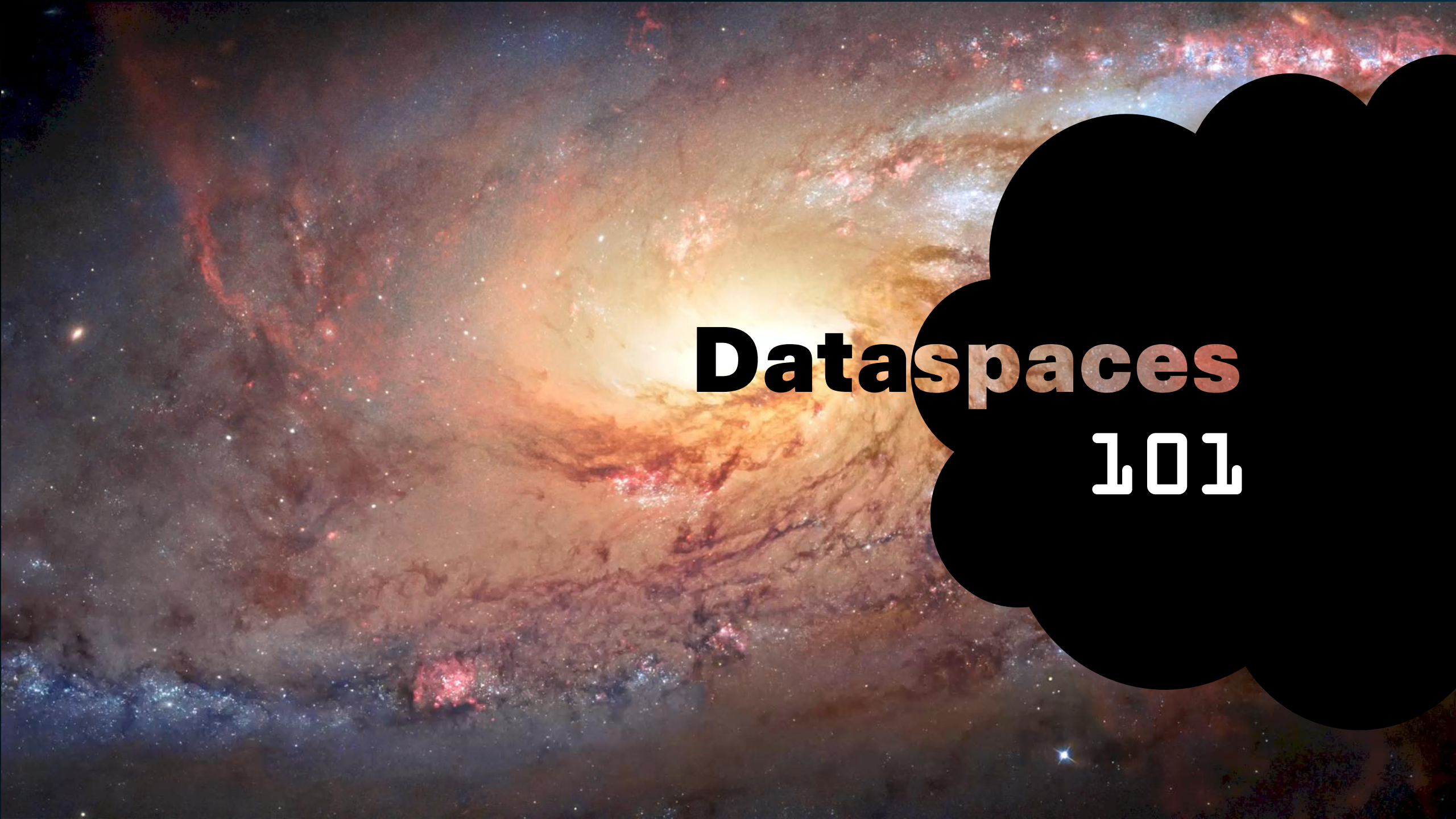
Hope is to have mapped out the key projects, essential milestones, and identified volunteers willing to take leadership / committers roles in the OSS project components.

And the next steps for a sustained collaboration

Thank you!

Schedule | Day 1

Upcoming	
11:20 – 11:40	Intro to Dataspaces – Eric Samson
11:40 – 11:50	Break


Dataspaces
101

Why? →Data value

Create value from data:

- Data at rest has **little to zero** value.
- Data only has value when it is **shared, used and analyzed** in combination with other's data.
- → value = f(share)

Why? →Compliance

Enable a new **economy of data**

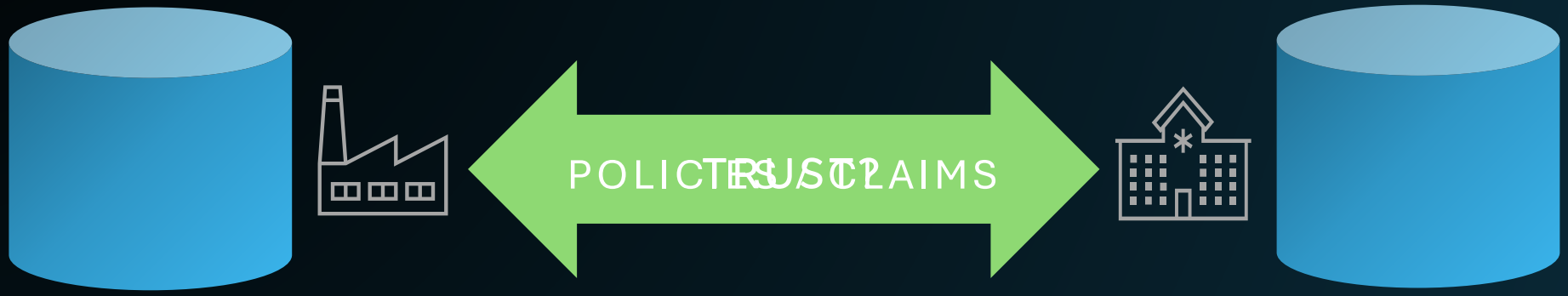
Be **compliant** with data regulations

Why? →Risks

Risks increase with uncontrolled data sharing:

- Transfer of data to non legitimate users
- Misuse of data
- → risk = f(share)

What? →Trust contexts

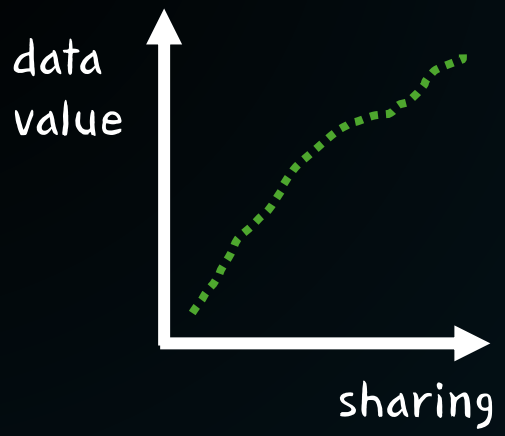


POLICIES

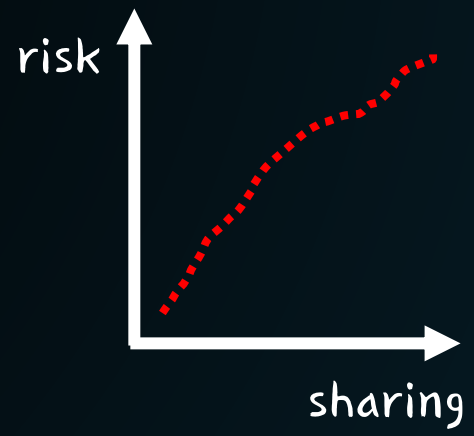
Data sharing policies define **conditions**, **constraints**, **obligations**, **interdictions** about how data can be shared. They provide a **flexible and powerful** way to keep control over shared data.

Dataspaces are trust contexts:

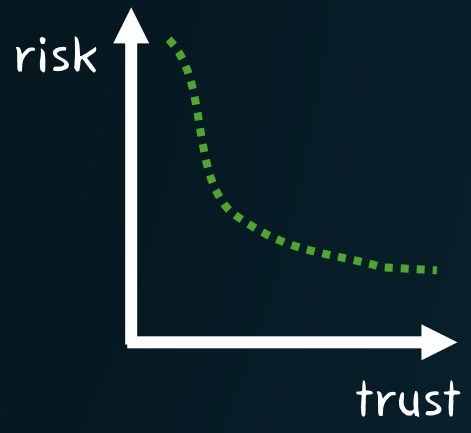
- Combination of **legal, economic and technical components** to establish trust between participants
- With **trust**, data can be shared with known, limited and accepted risks
- → risk = 1 / f(trust)



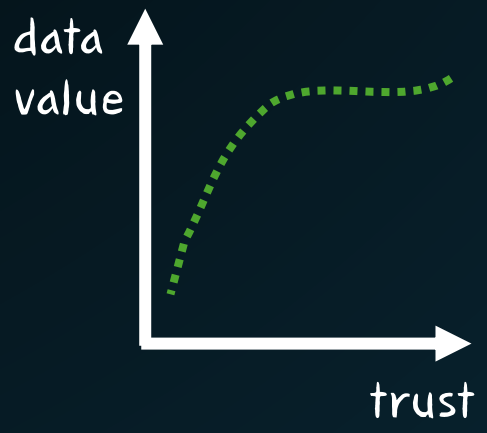
Data value increases with sharing



But risk also increases with uncontrolled sharing



However, risk decreases with trust



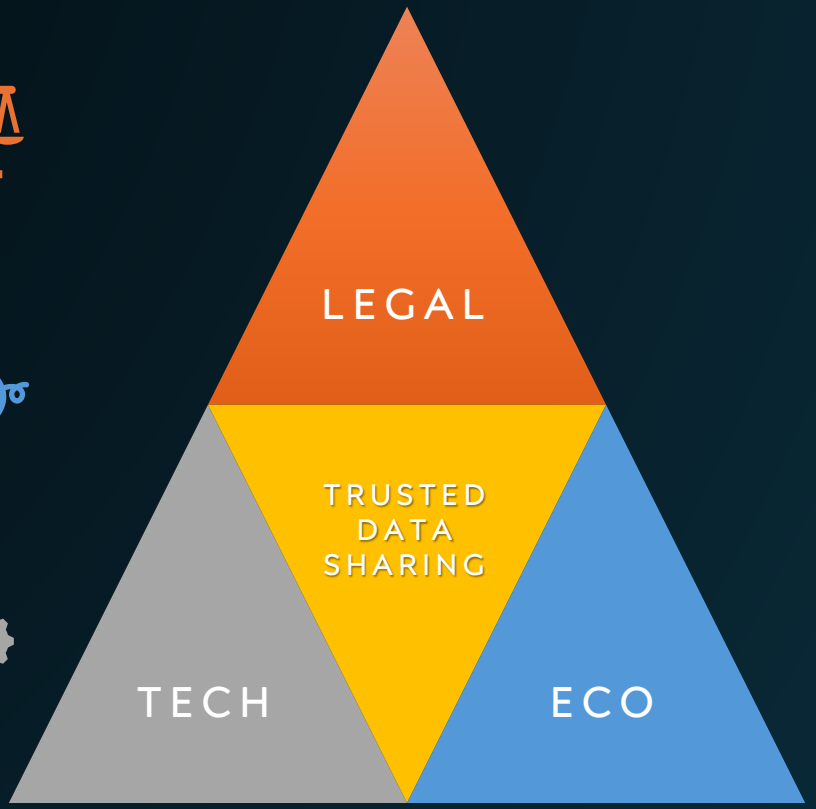
Based on trust, dataspaces enable a new **economy of data**

What? →The 3 dimensions of trusted data sharing

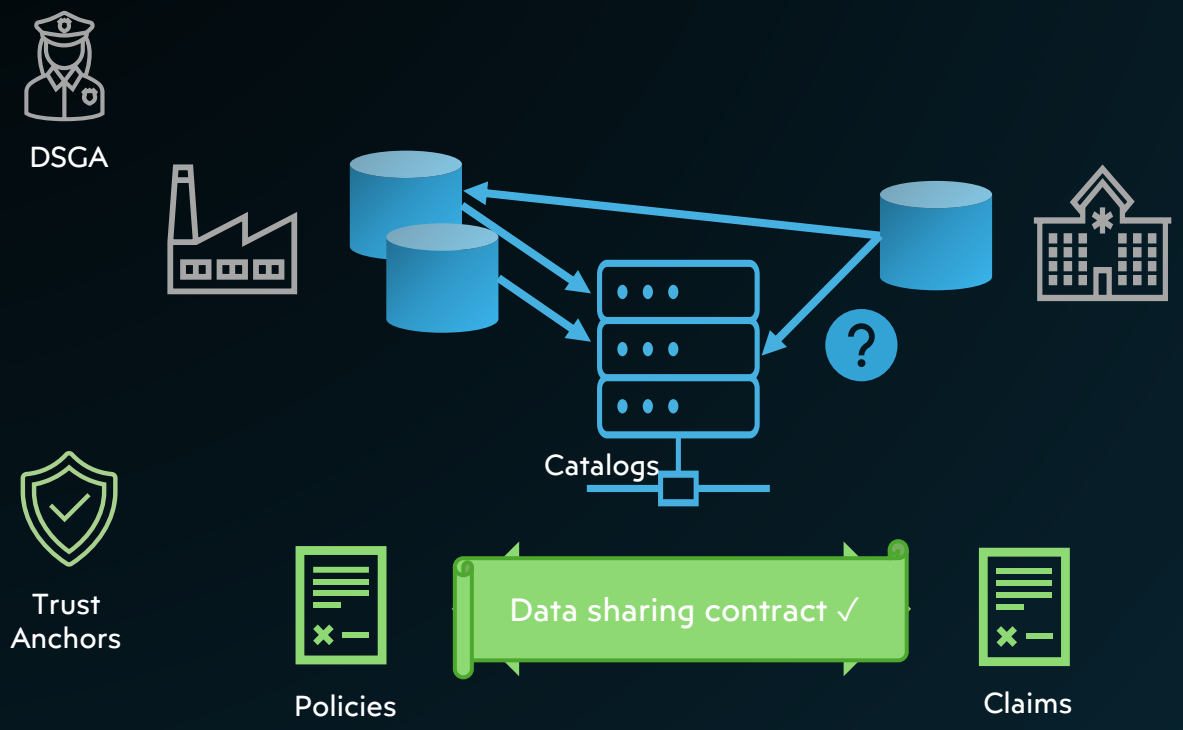
LEGAL / REGULATORY
Guarantee that participants are respecting all applicable laws and regulations in their jurisdictions.

ECONOMIC / OPERATIONAL
Support economic aspects of trusted data sharing, like data monetization, for instance.

TECHNICAL
Atomic building block, the simplest mechanism to establish trust between 2 participants.
Increases interop, robustness, scalability



How? →Key concepts



PARTICIPANTS
- Data providers
- Data users

DATA ASSETS
- Data description
- Sharing and usage policies
- Data assets discovery

TRUST FRAMEWORK
- Policies semantic models
- Reconciliation engines

How? → Implementations

CONNECTORS

- DISCOVER
- NEGOCIATE
- ORCHESTRATE

PRINCIPLES

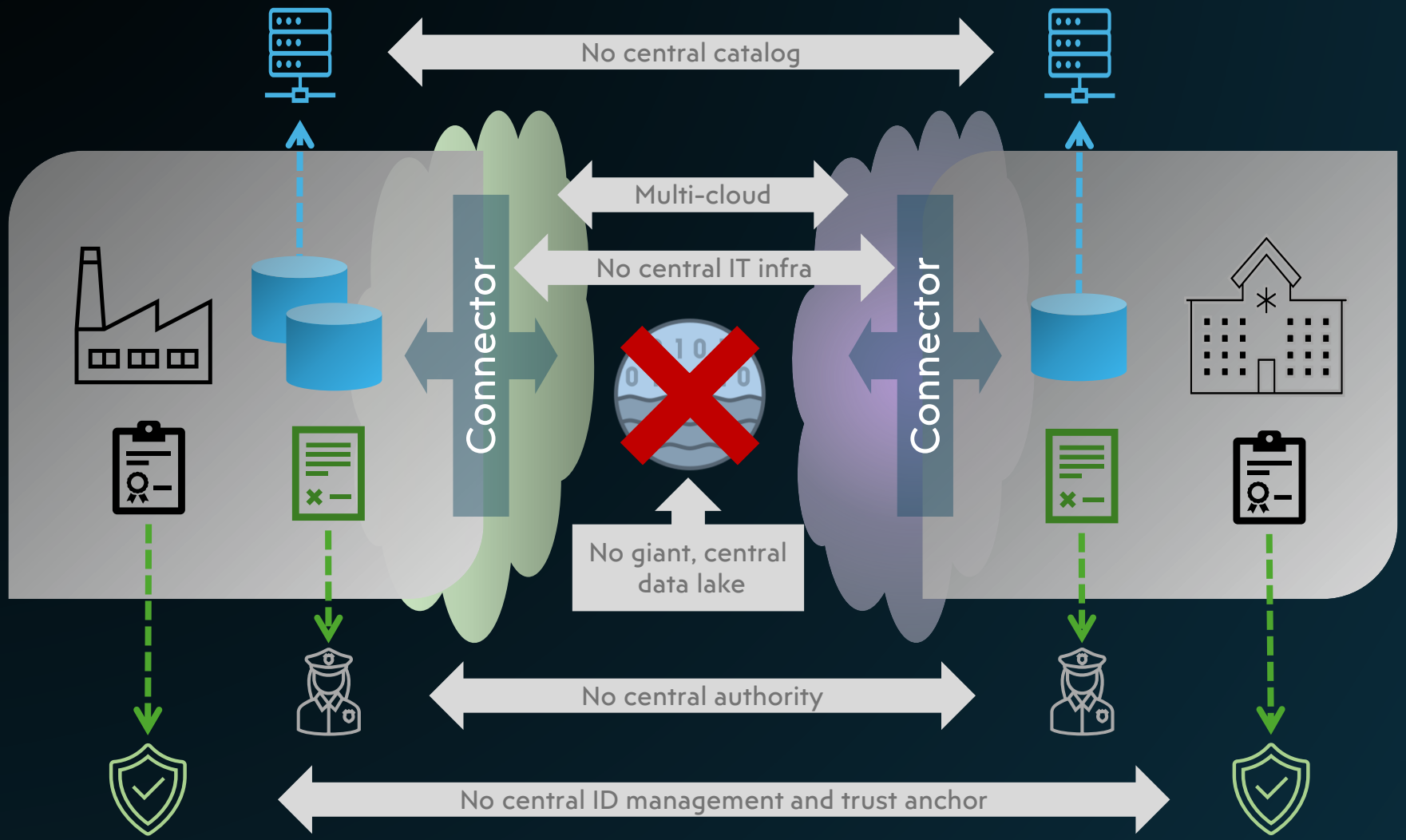
- OPEN SOURCE
- INTEROPERABLE
- DECENTRALIZED
- MULTI-CLOUD

IDSA / DSSC

- RULEBOOK
- REF. ARCH.
- BLUEPRINT
- SUPPORT

Eclipse
Dataspaces
Components

How? →Decentralization



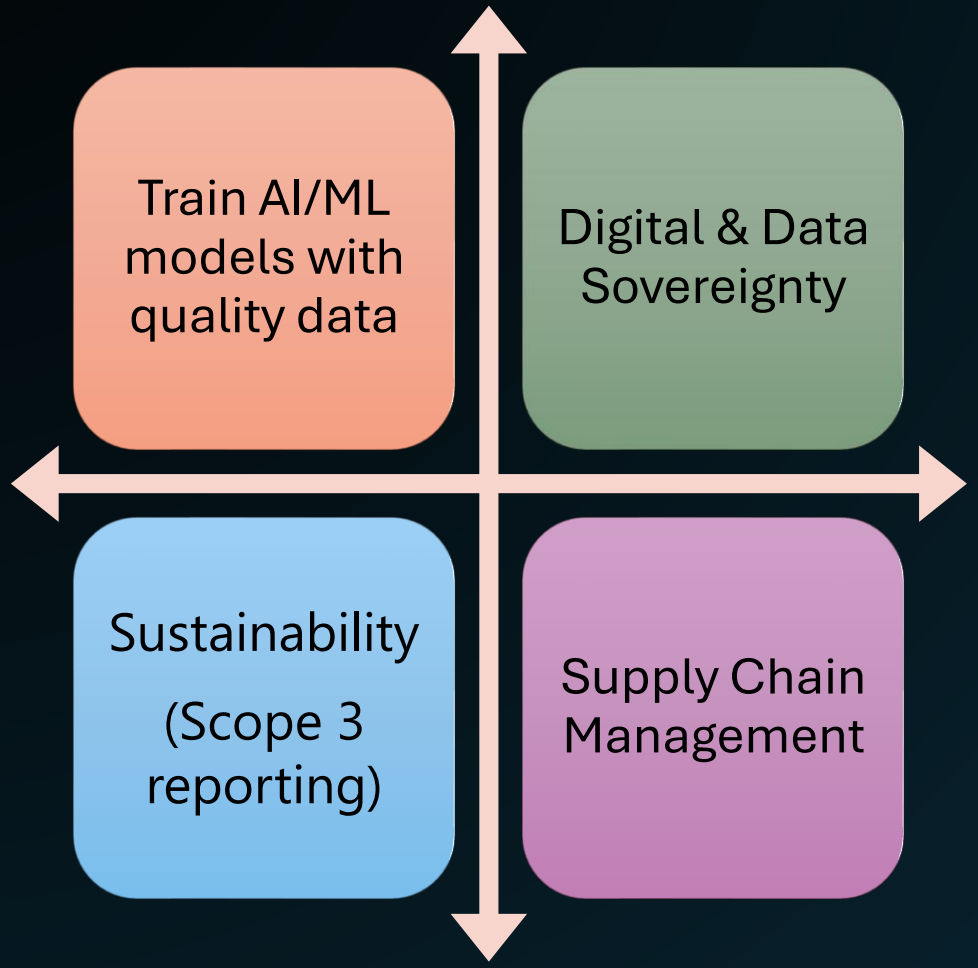
How? →Standards

ISO JTC 1 / SC38 / WG6	CEN CENELEC JTC 25	Eclipse Dataspace Working Group
20151: dataspaces 19941 : interop	WG2 : trusted data framework WG4: interop	Dataspaces protocols: DSP, DCP…

Which? →Industries

Our initial effort in manufacturing can be replicated for other industries

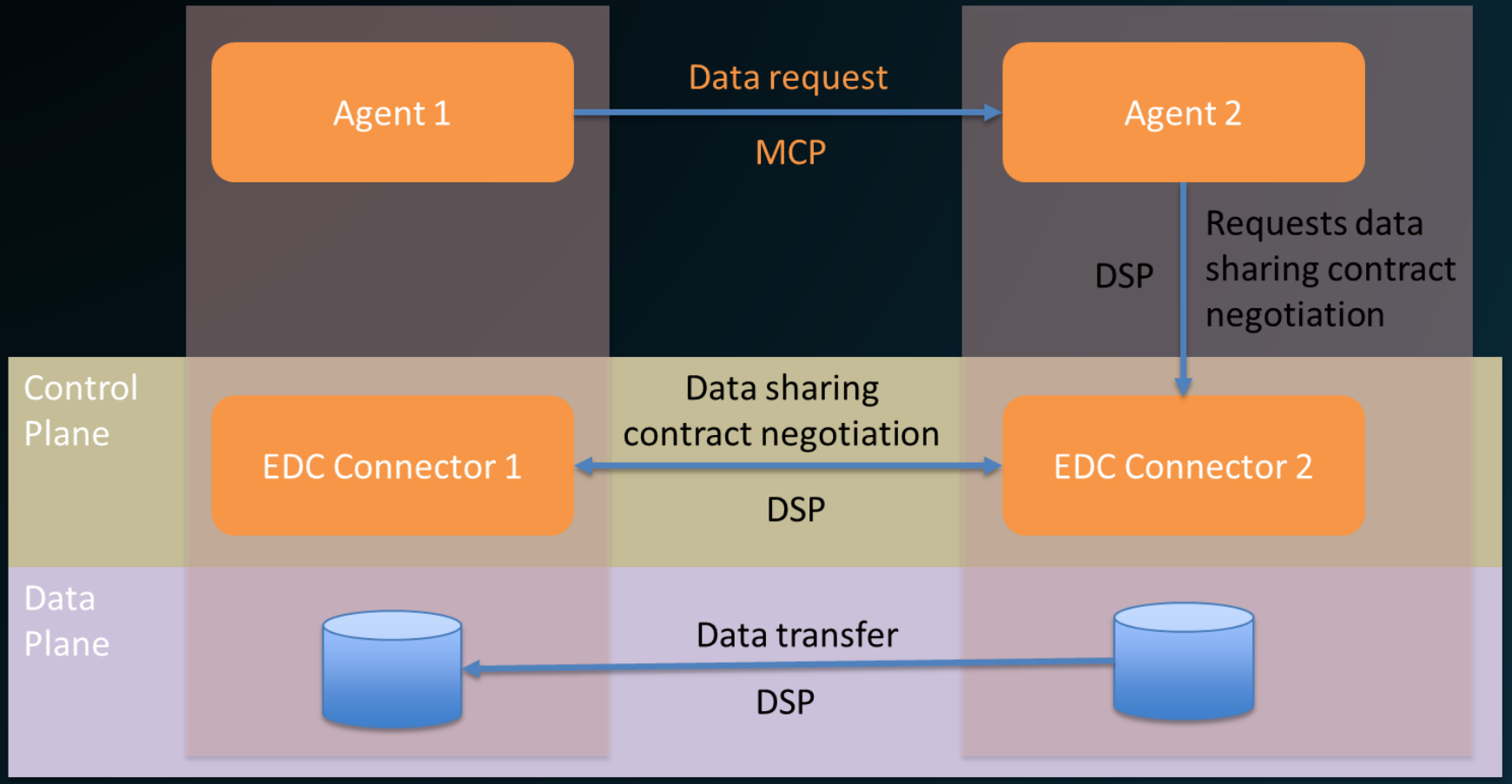
Which? →Use cases



Spain funding 80 dataspace projects (mostly Public Sector)

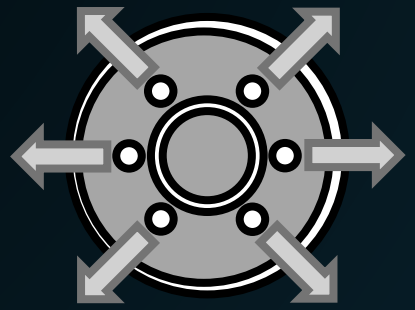
China funding ~100 dataspace projects

Which? →DSP for AI agents (MCP)



Key takeaways

Dataspaces enable a new **economy of data** by providing **trust contexts** to reduce risks associated with uncontrolled data sharing



Trust is established between dataspace participants through a flexible and powerful "*policies to claims reconciliation*" mechanism	**Decentralization** maximizes **autonomy** of dataspace participants, while increasing scalability and resiliency of the whole ecosystem	International **standards** and common protocols maximize **interoperability** (within and across dataspaces)

Want to know more?

[illegible]

[illegible]
[illegible]
[illegible]

[illegible]
[illegible]

[illegible]

[illegible]

Thank You!

Schedule | Day 1

Upcoming	
11:50 – 13:15	Industry Partner Presentations from Catena-X, Manufacturing-X, OPC Foundation and iShare trust framework
13:15 – 14:00	Lunch

Catena-X PoV
EDC Tech Summit

Catena-X Automotive Network e.V.

Weekday, March 7th, 2025

Catena-X is works via radical collaboration

The 1st trusted and multi-tier business collaboration network is LIVE!

Layer 1: Build & Standardize
Industry re-presentation

→ OEM / supplier / recycler / SME / research
→ Solution- / service provider / transfer org.

overall:
Global Industry Representation

Layer 2: Adopt, Scale & Govern
Global re-presentation

→ Local hubs (China, France, Spain, US, ..)
→ Regional alliances (e.g. Ouranos)
→ Productive Operations (e.g. Cofinity-X)

overall:
~ pot. 7,000 companies addressed

Layer 3: Transfer
X-Industry re-presentation

→ comparability & interoperability
→ re-use / synergies

selected industry Eco-Systems Partners

Temp. guidance-/ Collaboration Partner (when needed)

Trusted & Interoperable Data Exchange: **Governed by the industry**

Catena-X core values

4x architectural guardrails define our eco-system

Core Value #1

Trusted Digital Identities

Verified and unique company identities

Know for sure with whom you are dealing with in the digital world

Core Value #2

Interoperability

Open-source based standards / KITs.

No Lock-In. Choose the provider that fits you best to scale your business

Core Value #3

Self-Sovereignty

Decentral architecture and protocols

Stay in control over your data / IP and take Cyber-Security serious

Core Value #4

Industry Governance

One global operating model and framework

Rely on what's best for all not just one

We believe within our global automotive industry; we only can create a true multi-tier collaboration when we empower existing players and solution providers. We believe that trust in your partners and control over your data are decisive in a digital world.
Hence, we created an ecosystem from the industry for the industry

Catena-X certified partners portfolio

3 steps to value creation (04/2025)

Catena-X Qualified Advisors

8020 · abat · accenture · BearingPoint · Capgemini · CGI · codecentric · Cofinity-X · CONSILEON · ekan management · NEXUSCOGNITIVE Answers at scale · MATERNA · NOVATEC · NTT DATA · OPITZ CONSULTING · polygran · SIEMENS · SAP · SOVITY · SSC · T-Systems · VW · WITTE AUTOMOTIVE · MHP A PORSCHE COMPANY

Onboarding Journey

Final Step:
Business process integration (optional)

Trusted Sustainability
- Circularity: SAP
- Product Passport: SIEMENS, EVIDEN, circulor, DENSO, Data Space Solutions
- Product Carbon Footprint: SIEMENS, T-Systems, SUPPLYON, SAP, BASF, IBM

Resilient Supply Chains
- Demand & Capacity: SAP, CatX, Solutions, BMW
- Business Partner / Location Mgt.: Cofinity-X, aws, Cofinity-X, Data Space Solutions

Effective Quality / PLM Mgt.
- Quality: SAP
- Traceability: SIEMENS, SOVITY, Cofinity-X, GEC, Data Space Solutions, SAP

Step 3:
Get connected & ready for simple data exchange

Cofinity-X · T-Systems · polygran · aws · SUPPLYON · VW · Data Space Solutions · SOVITY · BOSCH · e2open

Alternative: Companies implement OSS EDC connector on their own (certification required)

Step 2:
Get registered and receive access & trust

Cofinity-X · polygran · T-Systems · NTT Communications

Step 1:
Get informed or co-create with us (optional)

Catena-X
www.catena-x.net

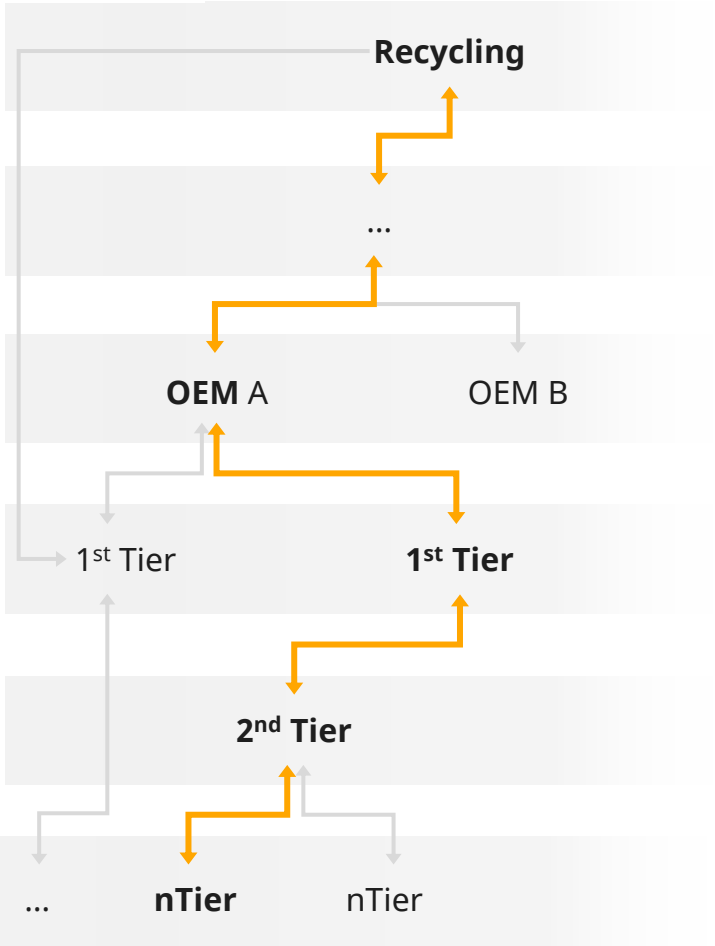
or via Hub Partners
AIAG · CM · GALIA · ODETTE · ANFAC · sernauto · VDA Verband der Automobilindustrie

Open Source Project (Tractus-X)
https://eclipse-tractusx.github.io/

Automotive Supply Chain is heterogeneous

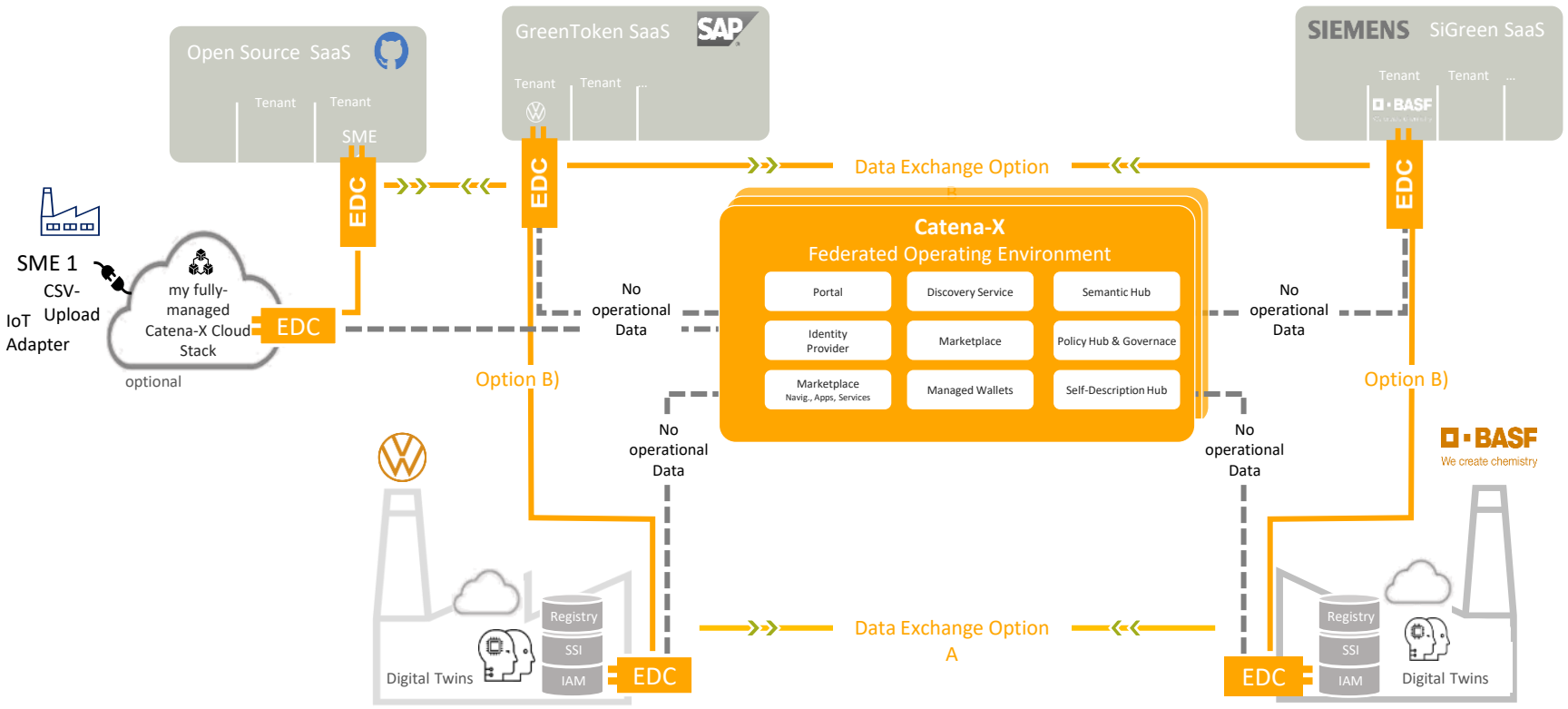
Automotive Value Chain

- Use Case X -



- Automotive Value chain depends heavily on Small-Midsize Enterprises (SME)
  - 30 % Large Enterprises (OEM, Tier 1)
  - 70 % SMEs
- Cross Industry beyond Automotive
  - Chemical, Semiconductors, discreet manufacturing
- Global Supply Chains
- Skills: Different levels of IT knowledge in Large Enterprise vs SME
- Participants care about supply chain use cases / solutions; they hardly ever care about technology

Data is being shared Peer-to-Peer without an intermediary



- **Data is only shared directly between partners**. No central data storage.
- **Data sovereignty** and a strong open source foundation is a key for trust.
- The EDC **integrates into the individual IT landscapes**.
- Roadmap: **Multiple** Core Service Providers

Challenges & Opportunities for Improvement

Current Market Observations

Wide range of usage patterns …

- FROM small companies with no IT department TO multi-national company groups with heterogenous data space access policies
- FROM infrequent data transfers TO high-volume, production relevant data transfers
- FROM few big services as Dataset TO data model instance-based Dataset definitions

Challenges

- Lower the entry barrier for getting started
- Resource consumption (memory allocation, boot-up times) and performance (catalog requests)
- Seamless integrations with other technologies (asset administration shell, streaming systems)
- Stable 360°-degree component to reduce need to operate multiple connectors
- Updates concerning Data Space Protocol (DSP) and DCP versions and multi-version support
- Impact of external developments / standards like EuDI in a global, operated solution
- Interoperability into multiple dataspaces on all levels
- Costs are a driving factor (no-cost low-end vs. highly scalable setups in high-end)

Recurring Conversations:

Onboarding
(Setup)

Operations
(Complexity)

Life-Cycle
(Stability)

Costs
(Time 2 Value)

Key Take-aways

1

Dataspaces like Catena-X provide Market Opportunities for targeted offers

(Different market segments demand different solutions)

2

Operational Complexity & Costs need to be significantly lowered

(Ease of Deployment, Ease of Use, Integration with other technologies)

3

It is a Network of Networks game driven by the individual industries

(Multi-region, multi-dataspace, multi-industries, multi-legislation, multi-versions, but based on common languages - use cases, contracts, legislative requirements)

Manufacturing-X

Thomas Hahn, Siemens Fellow

Motivation & Big Picture

International Manufacturing-X (IMX): Make Data Work

IMX will implement a federated, decentralized and collaborative data ecosystem for smart manufacturing. Open, global and cross-industry, following FAIR Data Principles.

Reorganize and increase flexibility and autonomy of industrial value chains and networks.

Resilience

Increase efficiency and enable data-driven solutions for GHG/CO2 balancing and circular economy.

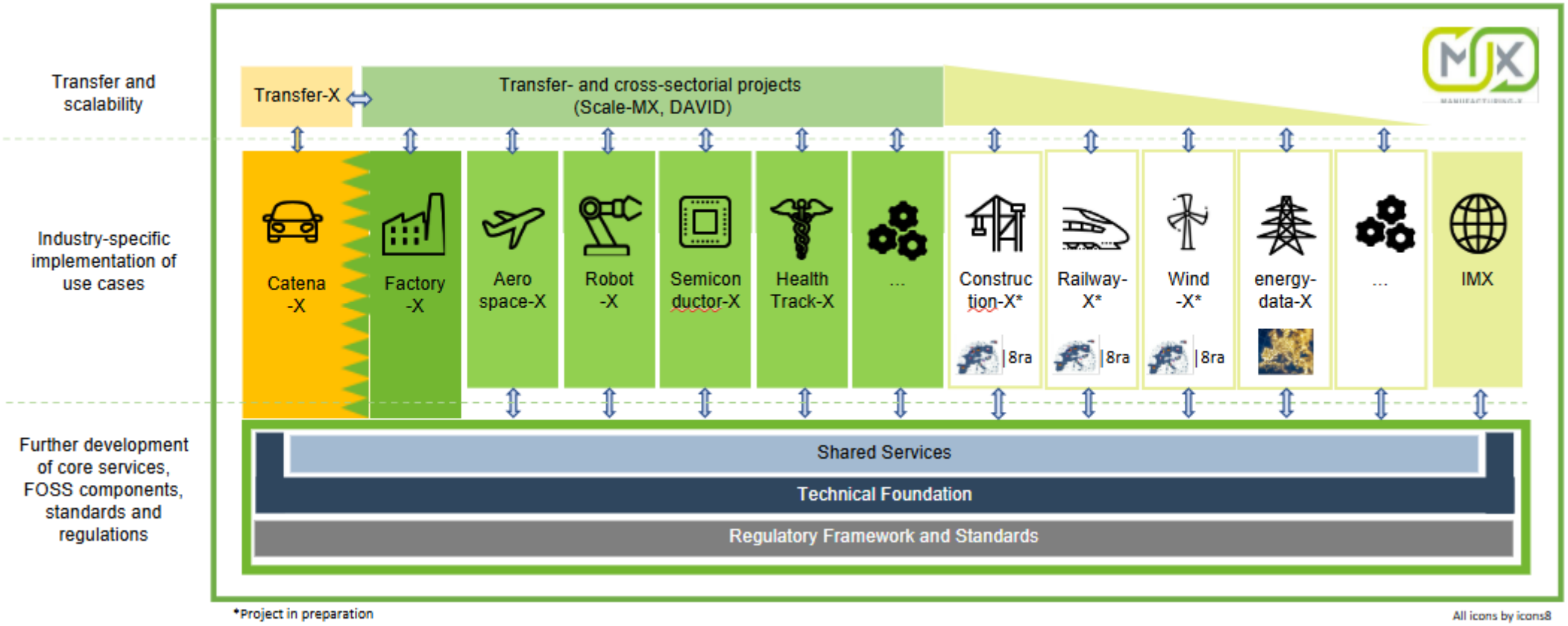
Sustainability

Accelerate digital innovations and enable new data-driven business models to create new value for manufacturing

Competitiveness

Projects

We serve diverse manufacturing verticals!



Technology

Foundational Framework for IMX

A common guideline for IMX activities and international stakeholders.

Strategic Goals

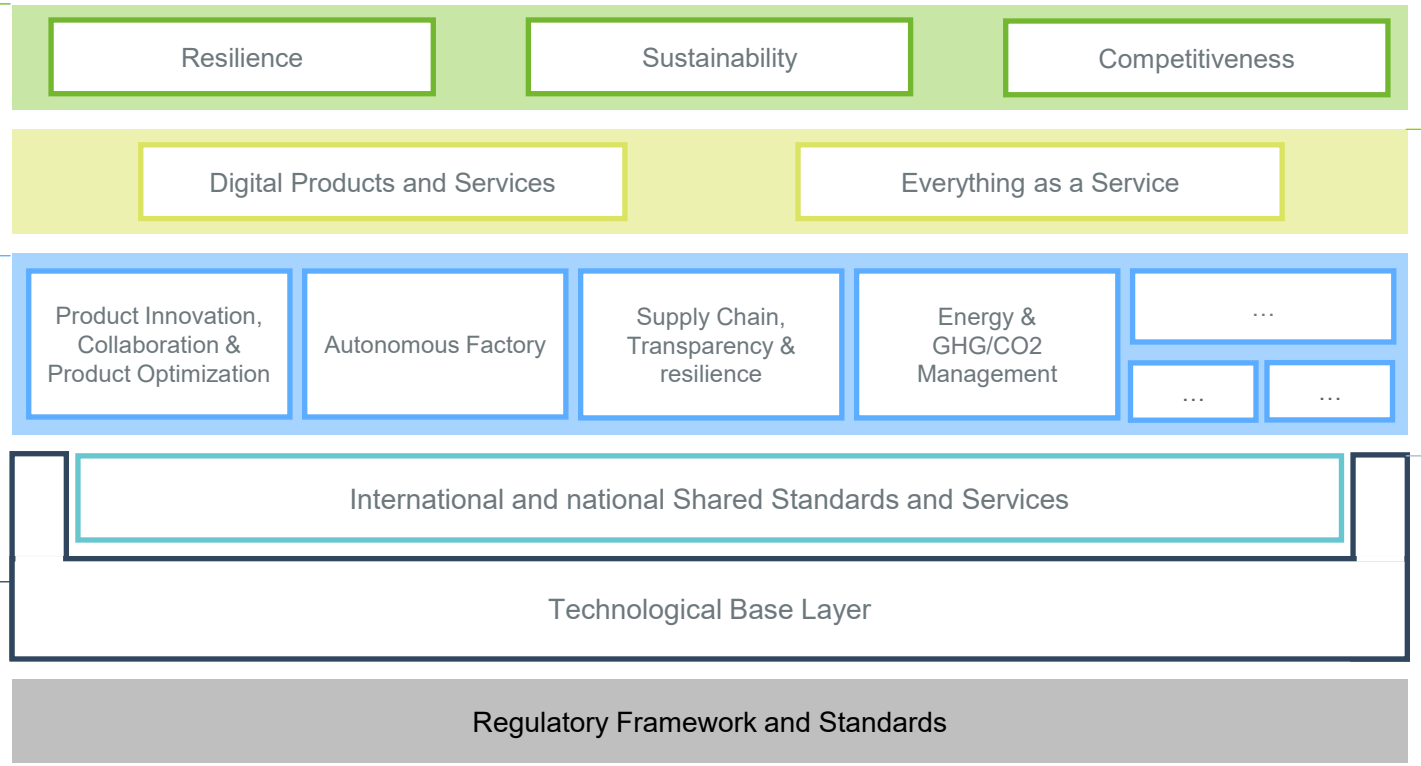
International Manufacturing-X develops the foundations for a resilient and competitive industry in a sustainable society.

Exemplary Cross-Industry Use Cases

International Manufacturing-X addresses cross-industry use cases based on a collaborative use of data with high economic and ecological impact.

Foundation

International Manufacturing-X defines global standards and runs a basic technical infrastructure to guarantee interoperability and sovereignty.



Business Models

International Manufacturing-X enables innovative business models based on a interoperable data-ecosystems

Capabilities

International Manufacturing-X enables development and deployment of fundamental services driving the federated data ecosystem.

Requirements

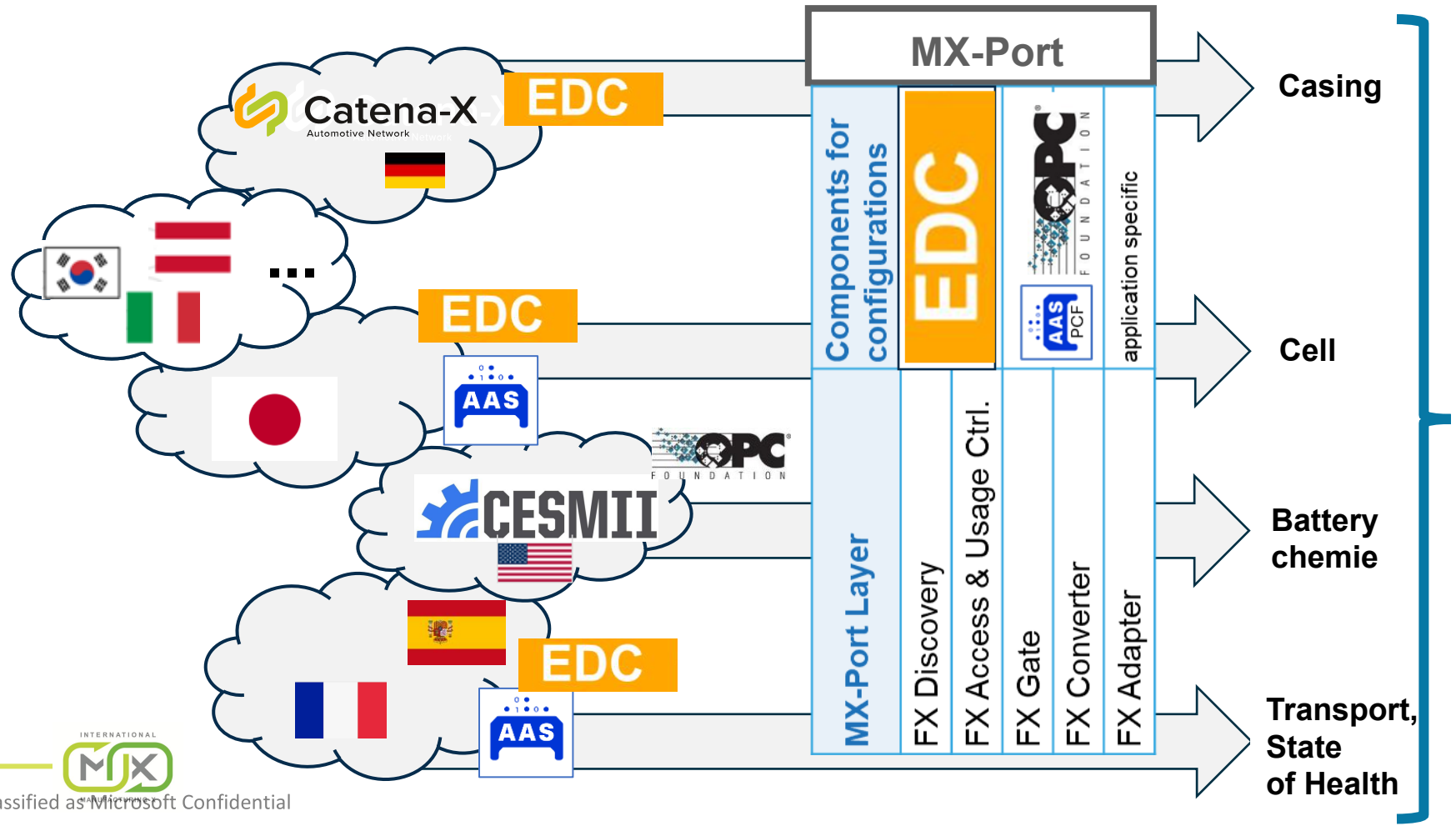
International Manufacturing-X builds on a common technical, organizational and legal framework and contributes to the future development in cooperation with international law.

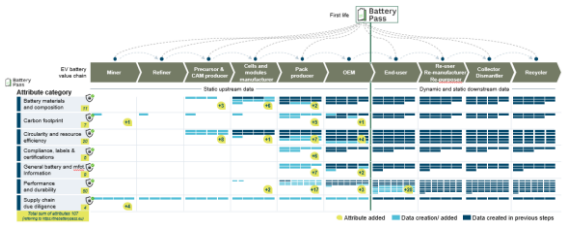
See IMX demonstrator hall 8, D28

Not only a concept. It`s a real implementation!

Realizing interoperable communication w/ MX-Port worldwide!

Example: Battery Passport

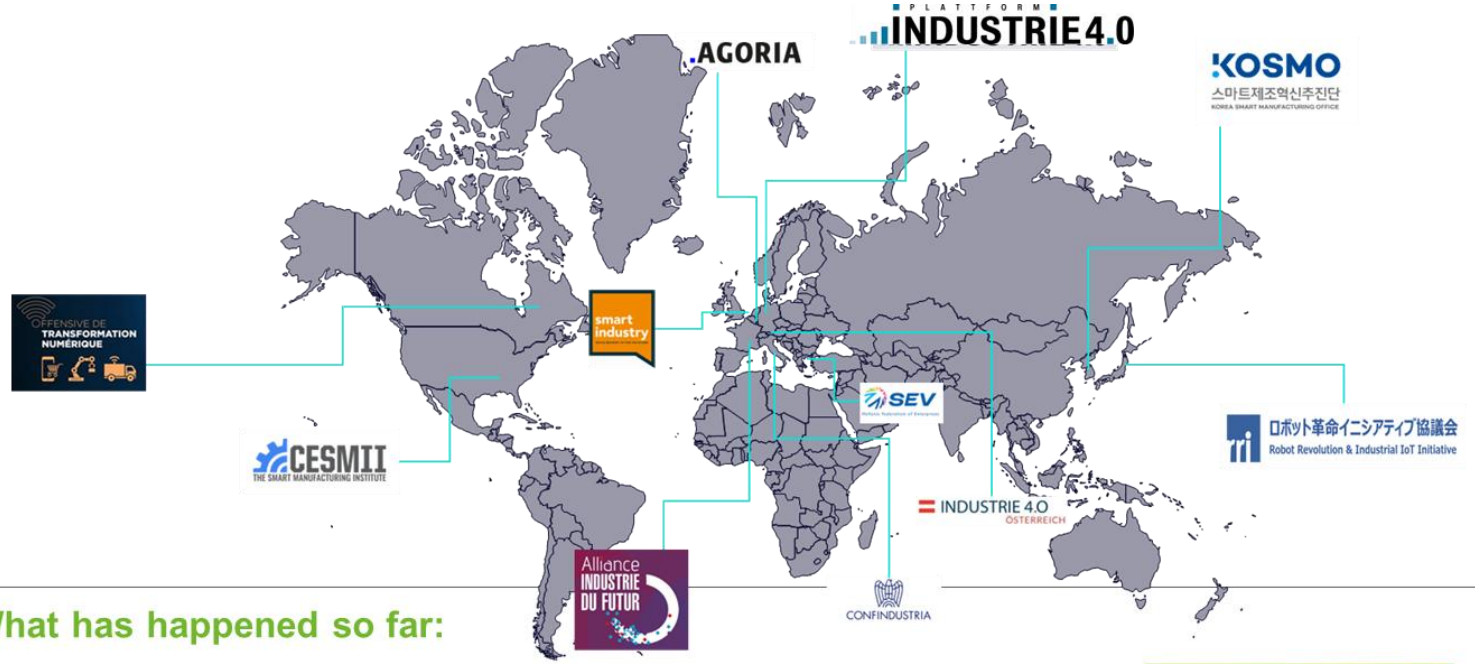




Source: Catena-X

Who?

Initiatives Involved in Establishing the IMX Council – Growing!



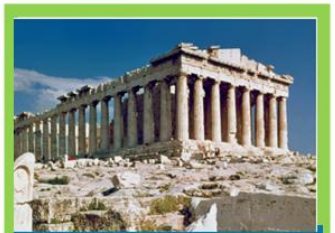
What has happened so far:

2023 July Initiation Brussels, Belgium

2023 October Inauguration Tokio, Japan

2024 February Kick-off Paris, France

2024 Novem. USA/ CESMII



2025 May Athens/ Greece

Many thanks!

OPC Foundation Cloud Initiative:
The new Cloud Reference Architecture

European Cloud Accelerator Technical Workshop, June 4th / 5th, 2025 in Milan, Italy

Stefan Hoppe
President & Executive Director OPC Foundation
stefan.hoppe@opcfoundation.org

Agenda

- Vision of Industrial Interoperability
- OPC Foundation Organization: Members, Board, Deliverables
- OPC UA: The Industrial Interoperability Standard
  - Modelling
  - Transport
  - Security
- OPC Foundation Initiatives for Cloud
- Collaborations - Updates
- Information & Offerings

Vision of Secure, Industrial, Semantic Interoperability

Wish: One harmonized solution for OT and IT

- Secure & reliable information exchange of static and dynamic data
  Independent from vendors, platforms, and domains
  Scaling from sensor to enterprise and beyond and independent from the life-cycle
- International
- Strong eco-system including open-source offerings and commercial tools
- Modern IPR policy

Solution:

OPC UA®

… exchange of

- **Live and Static Data & Information,**
- **Files,**
- **Alarms, Events,**
- **Historical Data**

The Organization:

OPC Foundation - The world largest ecosystem for cross-domain industrial interoperability

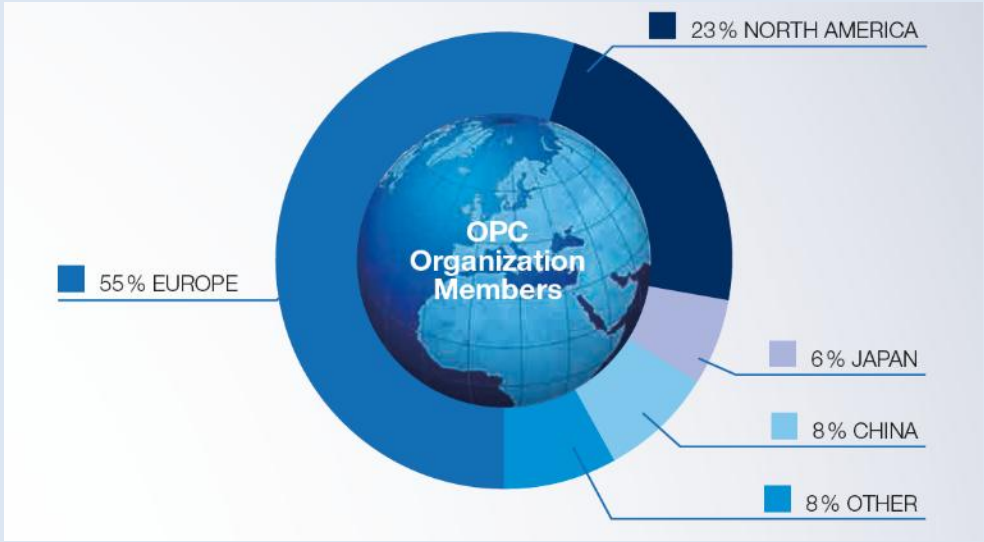
The OPC Foundation

https://opcfoundation.org

- Vision
  - Secure & reliable
  - Vendor, platform, and domain agnostic
  - Interoperability from sensor to enterprise and beyond
- Global Profile
  - Non-profit organization (founded 1995)
  - Companies from Automation & IT
  - Internationally recognized: OPC UA is IEC62541
- Deliverables
  - Specifications: openly available
  - Tools and code examples for faster, easier adoption
  - Certification: OPC Labs open to everyone
- Ecosystem with toolkits and education
- Modern IPR policy

Organizational Overview

Membership: 1017 (May 19 st, 2025)



Board of Directors 2025

Microsoft	Honeywell	Rockwell
SAP	Yokogawa	Schneider
Siemens	Mitsubishi	ABB
Beckhoff	Ascolab	VDMA
Huawei	AWS	Google Cloud

OPC Foundation: Numbers at a Glance

1017 Members

60% Europe
20% Americas
20% APAC

Budget 2025:

4.300.000 USD

In 2025 additional
1.400.000 USD for FLC

4 Regions
North America, Europe, China, Japan

4 Hubs
France, Singapore, India, Korea

150+ Working Groups

427+ Models free of charge in OPCF Cloud Library (Domain, AAS Catena-X)

350+ Specifications

15 Board Members

0 Employees

11 Contractors

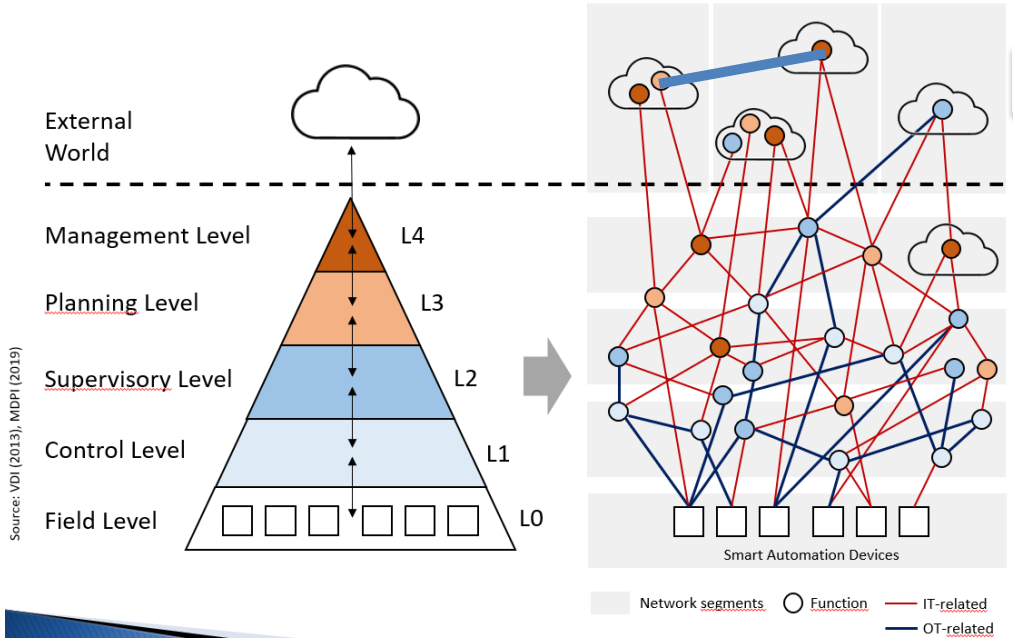
1100+ Volunteers

OPC UA is IEC62541 Standard
China standard GB/T 33863.x)
Local standard in Singapore, Korea, Russia …

17 Open Source Projects by OPCF
1900 Open Source Projects in total

10.365 Followers on LinkedIn

From Automation Pyramid to Information Network



Universal Industrial Network

OPC UA

OPC UA is not a protocol!

Instead it is a collection of technologies to ensure a secure exchange of standardized information from the sensor to the cloud (and back).

OPC UA over …
TCP, UDP, MQTT, … APL, SPE, 5G, TSN, …

- Challenge to transformation from an Automation Pyramid (with proprietary protocols between all layers) to an Information Network (providing standardized information exchanged secured end-to-end and be able to bypass layers)
- OPC UA is an open framework delivering end-to-end secured, standardized information exchange
  Openess is key: Open Specs, Open source (GitHub) and Open Labs for certification (without be paying member)
- OPCF defines with partners 170+ standardized information models for verikals like pumps, motors, robots, coffee machines
- OPC Foundation is the „Collaboration Organization“

OPC FOUNDATION

OPC Foundation Members – OT, IT, End-users & Enabler

The OPC Foundation is the place where OT and IT meet, talk together and make the (automation) world a better place!

OPC FOUNDATION

OPC UA in a simplified view – at a glance

Modelling

- Object Oriented
- For data and interfaces
- For devices and services
- Supported structured data
- Support type validation

Transport

- **2 Communication mechanism: Client/Server & Publisher/Subscriber**
- **Effective encoding: Binary, JSON**
- **Protocol agnostic: TCP, HTTPS, UDP, AMQP, MQTT, WebSocket**
- **REST interface & File transfer & OpenWebAPI**
- **Infrastructure agnostic & extendable: Ethernet, Ethernet APL, TSN, 5G, WiFi6**

Security

Security

- **Integrated by Design**
- **Proven by international experts**
- **End-to-End security**
- **Transport Encryption and Signing**
- **Authentication for applications and users**
- **Authorization on data points level**
- **Audit concepts integrated**

Extendable

- **Flexible information model**
- **Companion models**
- **Custom models**

Scalable

- **From field to cloud / cloud to cloud cloud to field / field to field**
- **Micro embedded to mainframe**
- **All industrial domains**
- **Multiple connectivity scenarios**
- **High speed, low bandwidth**

International

- **OPC UA is IEC62541 National standard in China (GB/T 33863.x) Singapore, Korea, …**
- **1017 members IT and OT worldwide**
- **International Leadership – elected annually**

Independent

- **Open standard, open source, open specs**
- **No proprietary technologies**
- **Multi vendor / Cross platform**
- **Multiple domains**
- **Modern IPR**

OPC UA Success Journey 2003 – 2025

2003

Start of OPC UA

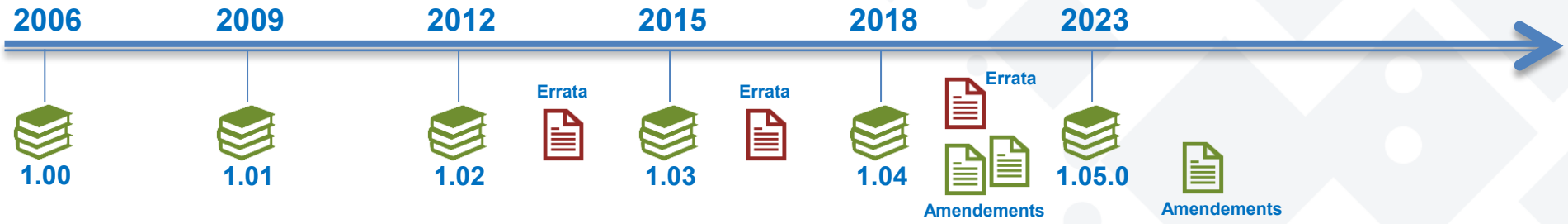
OPC UA

OPC Unified Architecture (OPC UA), comprising of 13 separate parts, is created by the OPC Foundation.
The first OPC UA working group meeting was held on November 3-7, 2003.
The original OPC specification is now referred to as "Classic OPC" or "OPC Classic".

- 2003 – 2006 OPC UA Core Specifications have been developed within 3 years
- 2006 Release of OPC UA v1.00
- 2023 Release of OPC UA v1.05

→ 2006 – 2025: 19 years of stability and backward compatibility

Timeline of OPC UA specifications



OPC UA:
Industrial Interoperability

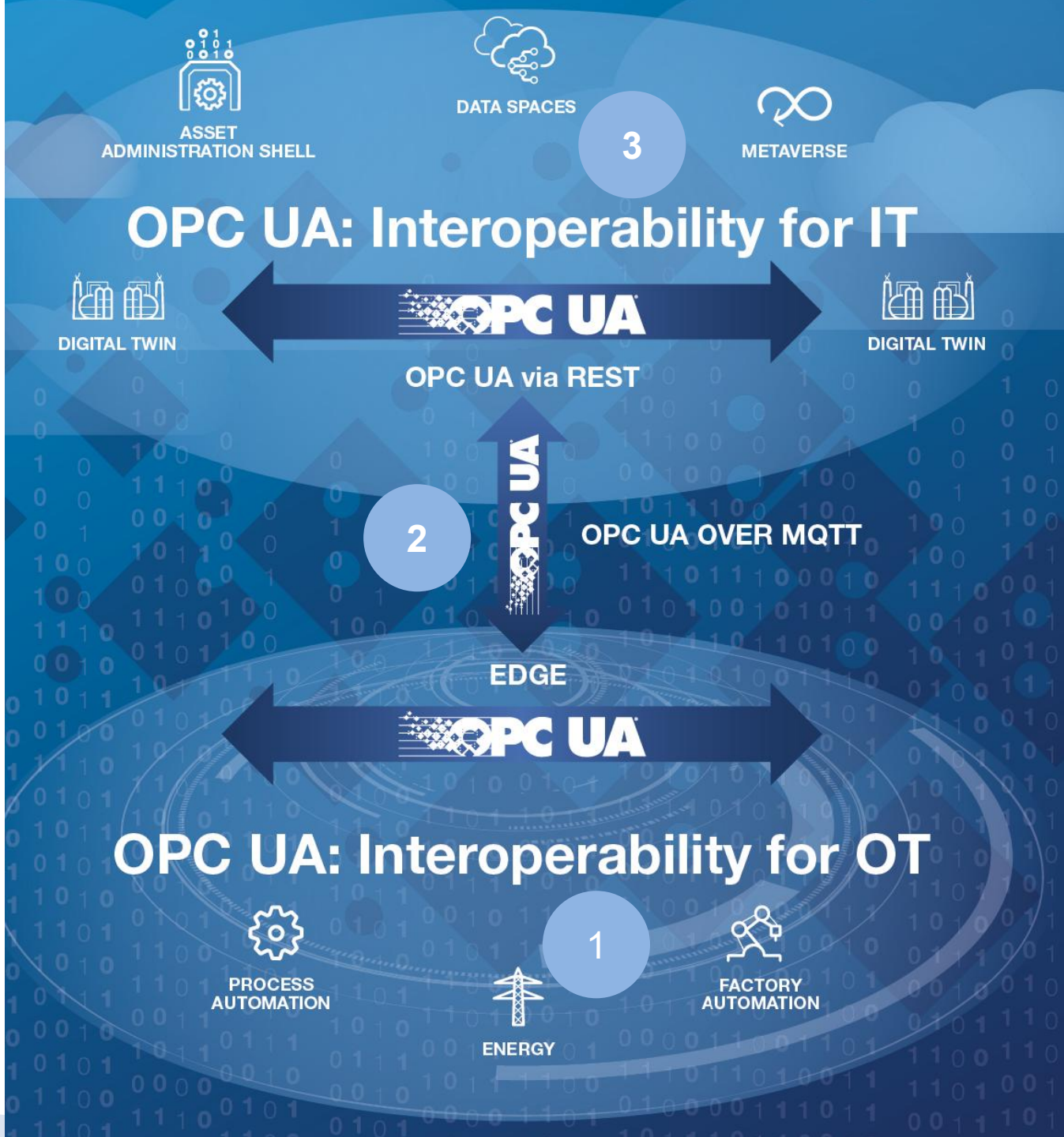
One harmonized solution designed from OT & IT for OT & IT

Including:

A. Rich modeling language
- complex data, inheritance

B. Flexible transport
- TCP/IP, UDP, MQTT
- File Transfer (since 2013)
- REST interface (since 2016)

C. Security
- for accessing information
- for transport of information
- onboarding
- infrastructure certificate management

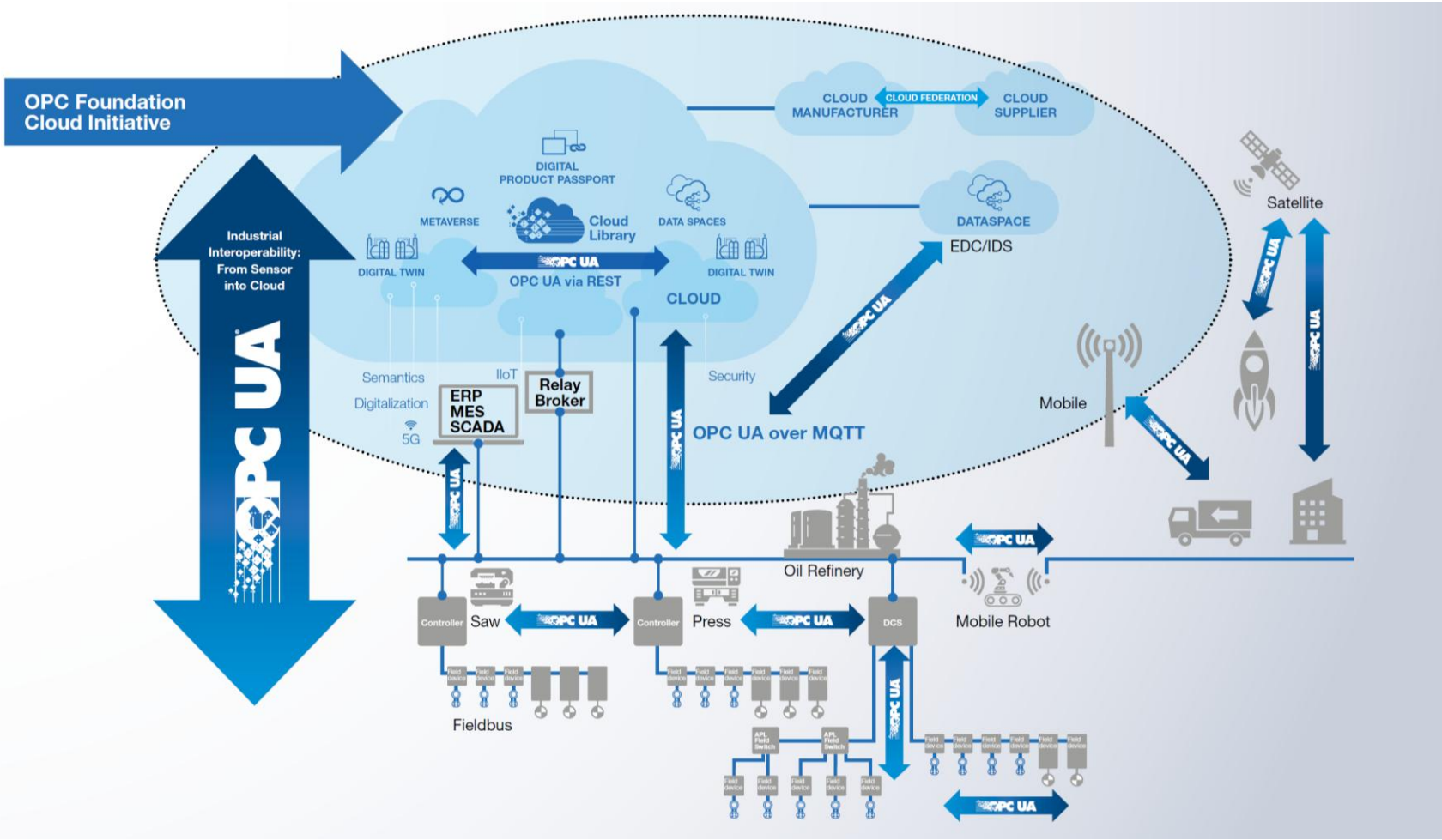


The OPC Foundation Cloud Initiative:

Vision: Accelerate the interoperability of IT and cloud applications through the OPC UA standard

OPC Foundation Cloud Initiative – Started 2024

Vision: Accelerate the interoperability of IT and cloud applications through the OPC UA standard.
Find more information www.opcfoundation.org/cloud

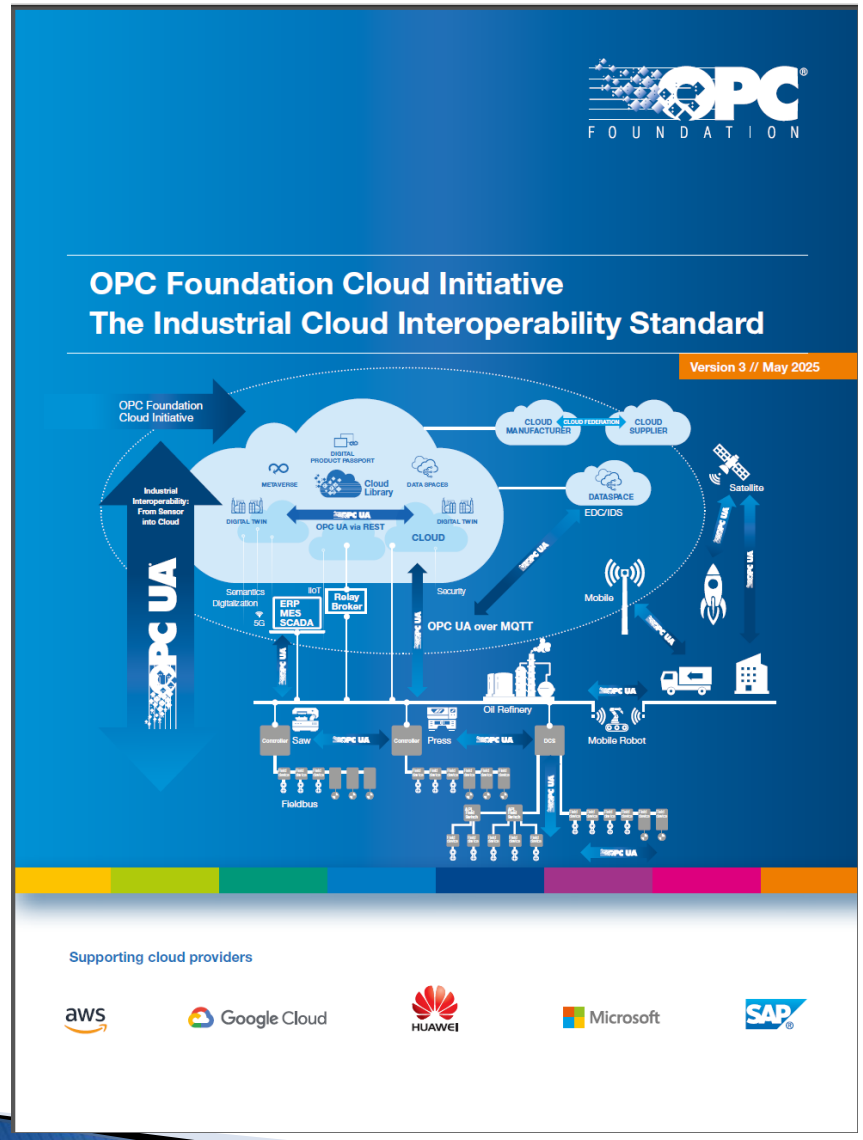


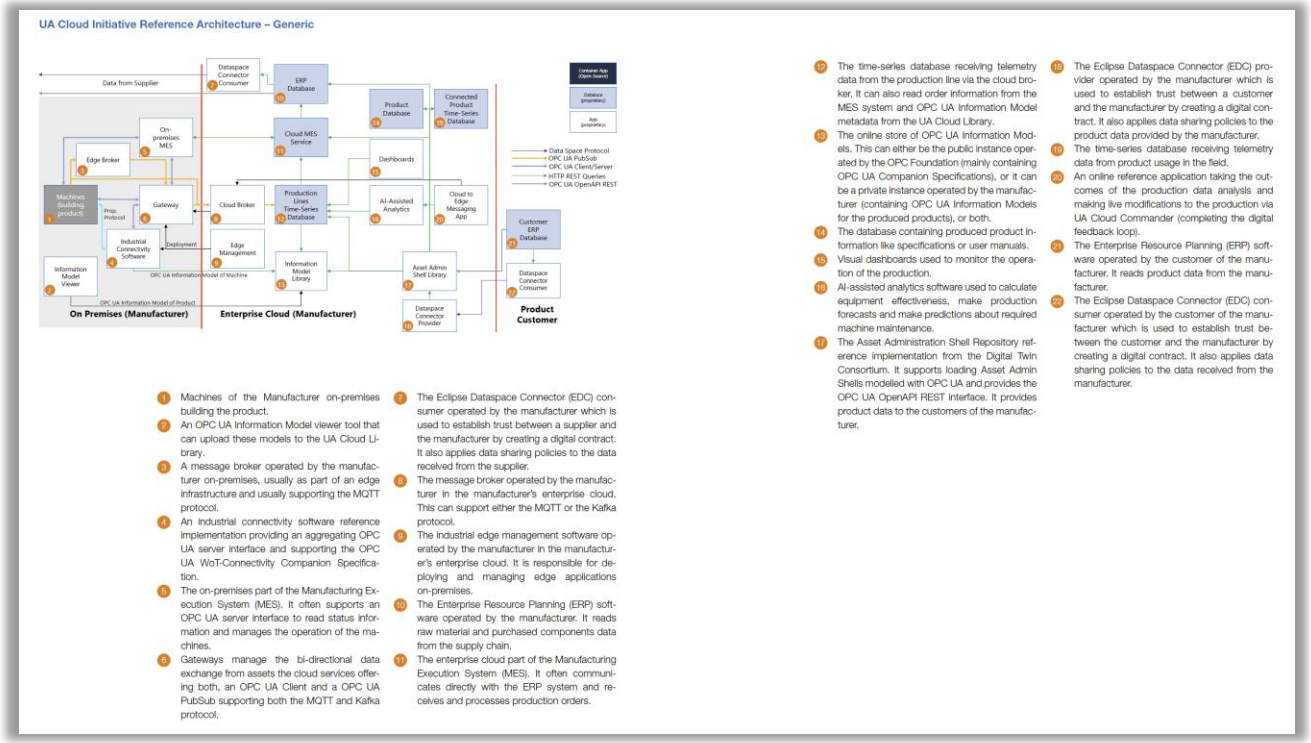
Working Groups

- OPC UA over MQTT
- OPC UA REST
- Cloud Library
- OPC UA for AI
- Metaverse
- WoT-Connectivity / Binding
- OPC UA & AAS: I4AAS
- Upcoming: Dataspaces (EDC)
- Digital Product Passport

- Cloud Marketing

OPC Foundation Cloud Initiative - Brochure





Download brochure here
[OPCF-Cloud-Initiative-Brochure.pdf]

OPC Foundation Cloud Initiative: Major goals

- Accelerate **interoperability of IT and cloud applications** using OPC UA, targeting data analytics using AI, industrial data spaces, digital product passports, industrial metaverse as well as digital twin applications.

- Semantic Data Models in the Cloud: Maintain **OPC UA Information Models** (Companion Specifications) in the cloud to utilize the context of data in cloud services.

- Create a **cloud reference architecture** to provide best practices, increase standardized data sharing and cloud-optimized profiles for the OPC UA standard, in line with global regulations such as the Data Act or the Cyber Resilience Act.

- Establish a new **Protected Identity** for OPC UA Cloud eXchange (UACX) – similar to OPC UA FX

- Establish a new **validation and certification program** for OPC UA Cloud interoperability as the leading cloud vendors Alibaba Cloud, AWS Cloud, Google Cloud, Huawei, Microsoft and SAP already support OPC UA to some extent, but no rules govern this support in the cloud to date.

OPC Foundation Cloud Reference Architecture

First time, cloud providers presented a consolidated overview of their commercial offerings

Nr.	Generic Name	aws	Google Cloud	HUAWEI	Microsoft	SAP
1	Machines (building product)			Machines of the Manufacturer		
2	Information Model Viewer			UA Cloud Viewer		
3	Edge Broker	Shopfloor Connectivity running on AWS IoT Greengrass / Amazon EKS Hybrid Nodes Greengrass	Manufacturing Connect	UA Edge Translator	Azure IoT Operations on Azure Local	SAP APM Device Connectivity
4	Industrial Connectivity Software			UA Edge Translator		SAP Production Connector
5	On-premises MES			On-premises MES		
6	Gateway	Shopfloor Connectivity running on AWS IoT Greengrass / Amazon EKS Hybrid Nodes	Manufacturing Connect	IOT Edge	Azure IoT Operations on Azure Local	SAP APM Device Connectivity
7	Dataspace Connector Consumer	Eclipse Dataspace Connector Consumer	Eclipse Dataspace Connector Consumer	EDS	Eclipse Dataspace Connector Consumer	SAP Integration Suite Dataspace Connector
8	Cloud Broker	AWS IoT Core / Amazon Managed Streaming for Apache Kafka	Pub Sub & Data Flow	IIoT	Azure Event Grid/Hubs	SAP Integration Suite – Advanced Event Mesh
9	Edge Management	AWS IoT Device Management / Amazon EKS	Manufacturing Connect (Cloud)	IOT Edge	Azure Arc	SAP Edge Lifecycle Managment
10	ERP Database			ERP Database	Dynamics 365 ERP	SAP S/4HANA
11	Cloud MES Service			Model Based Manufacturing	Dynamics 365 MES	SAP Digital Manufacturing
12	Production Lines Time-Series Database	Amazon TimeStream / Amazon Simple Storage Service (S3)	Cloud Storage & Big Table	GeminiDB	Azure Data Explorer	SAP Business Data Cloud

Supporting end-users

Boehringer Ingelheim · Continental CONTITECH · DANONE · equinor · L'ORÉAL OPERATIONS · Miele · Mondelēz International SNACKING MADE RIGHT · Renault Group · JTI · Tetra Pak PROTECTS WHAT'S GOOD™ · VOLKSWAGEN AKTIENGESELLSCHAFT

Supporting automation providers

ABB · BECKHOFF · Honeywell · MITSUBISHI ELECTRIC Changes for the Better · Rockwell Automation · Schneider Electric · SIEMENS · YOKOGAWA Co-Innovating tomorrow™

End users engage to gain insights and validate key concepts

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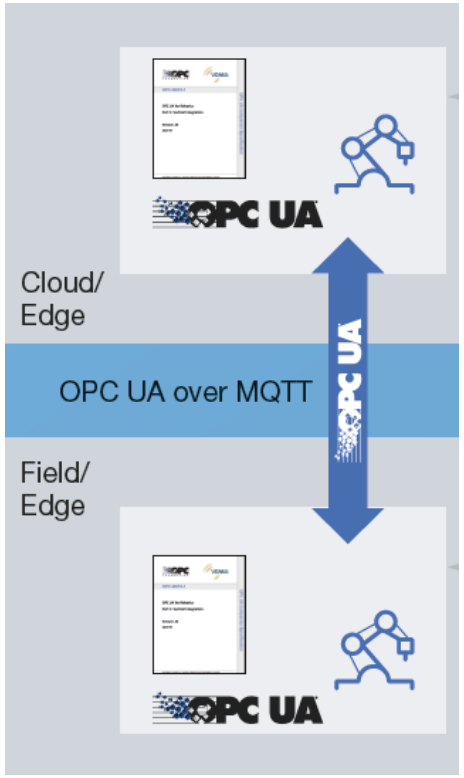
OPC Foundation Working Groups under Cloud Initiative

- OPC UA over MQTT
- OPC UA REST
- Cloud Library
- AI
- Metaverse
- WoT-Connectivity
- WoT-Binding
- I4AAS
- New: Dataspaces (EDC)
- New: Digital Product Passport/Battery Passport
- New: Cloud Marketing

Under Details on next slides

Digital Twin, Metaverse, DPP, AI powered by OPC UA

Digital Twin



Available as open source

Cooperation with Digital Twin Consortium

Metaverse

Available as open source Condition Monitoring

Cooperation with Digital Twin Consortium

Digital Product Passport

Example with Digital Battery Passport & Huawei battery

Available as open source

OPC UA for AI

Key use cases:

- Data analysis
- Next-generation User Interfaces
- Code generation and documentation

Join the OPC Foundation "OPC UA for AI" working group!

OPC FOUNDATION

Data Spaces – powered by OPC UA

INTERNATIONAL DATA SPACES ASSOCIATION

- A **data space** is a trusted digital environment where multiple organizations share and exchange data securely.
- It ensures participants **keep control over their data (sovereignty)** while enabling interoperability.
- Common standards and governance rules define how data is accessed and used.
- Data spaces are key enablers for building collaborative ecosystems across industries.

INTERNATIONAL DATA SPACES ASSOCIATION

OPC FOUNDATION

OPC UA connects assets to International Data Spaces

OPC Foundation and International Data Spaces Association are collaborating to connect the largest ecosystem for industrial interoperability to international data spaces

Scottsdale, AZ – March 26th, 2025 - The OPC Foundation, a global organization committed to advancing the development and adoption of industrial communication standards, is pleased to announce an expanded collaboration with the International Data Space Association (IDSA) aiming to enhance interoperability and data governance in the automation industry. The OPC Foundation connects the largest ecosystem for semantic interoperability in the automation world through OPC UA including over 150 semantic domain standards. This extensive framework ensures seamless communication and integration across various automation systems, fostering a more connected and efficient industrial

OPC FOUNDATION

Collaborations & Activities

SEMANTIC Interoperability: The key for the digitalization

Generic Device Models: Controller, Field Device, Process Device

- OPC 10000-100 – UA for Devices
- OPC 10020 – UA for Analyzer Devices
- OPC 30000 – UA for PLCs based on IEC 61131-3
- OPC 30001 – UA for IEC 61131-3 Function Blocks
- OPC 30010 – UA for AutoID Devices
- OPC 30081 – UA for Process Automation Devices (PA-DIM)
- OPC 30400 – UA for Cloud Library
- OPC 30500 – UA for Laboratory & Analytical Device Standard (LADS)*
- OPC UA for Analytical System Integration (CAISI)*
- OPC UA for Cloud Federation*
- OPC UA for Global Positioning*
- OPC UA for Non-destructive Evaluation
- OPC UA for Power Consumption Management*
- OPC UA for Secure Elements

Energy

- OPC 10040 – UA for IEC 61850 – Electrical Substation Automation (Release Candidate)
- OPC 30020 – UA for MDIS
- OPC UA for Wind Power Plants (IEC61400-25)*
- Power Consumption*
- OPC UA for Carbon Capture, Storage and Reporting*
- OPC UA for Solar PV Operations and Maintenance (SPOM)*

Building

- OPC 30030 – UA for BACNET (Release Candidate)

Miscellaneous

- OPC 30060 – UA for Tobacco Machines
- OPC 30200 – UA for Commercial Kitchen Equipment

Manufacturing Devices: Robots, Machines, Machine Tools

- OPC 30070-1 – UA for MTConnect, Part 1: Device Model
- OPC 40001-1 – UA for Machinery – Basic Building Blocks
- OPC 40001-2 – UA for Machinery – Process Values
- OPC 40001-3 – UA for Machinery – Job Management
- OPC 40001-100 – UA for Machinery – Result Transfer
- OPC 40010 – UA for Robotics
- OPC 40020 – UA for Cranes & Hoists
- OPC 40083 – UA for Plastics Rubber – General Types
- OPC 40077 – UA for Plastics Rubber – Injection Moulding Machines to MES
- OPC 40079 – UA for Plastics Rubber – Injection Moulding Machines to Robot
- OPC 40082-1…n – UA for Plastics Rubber – <device>
- OPC 40084-1….n – UA for Plastics Rubber – Extrusion
- OPC 40100 – UA for Machine Vision
- OPC 40200 – UA for Weighing Technology
- OPC 40210 – UA for Geometrical measuring Systems
- OPC 40223 – UA for Pumps and Vacuum Pumps
- OPC 40250 – UA for Compressed Air Systems
- OPC 40301 – UA for Flat Glass Processing
- OPC 40400 – UA for Powertrain*
- OPC 40444 – UA for Textile Testing Devices*
- OPC 40450 – UA for Joining Systems Base
- OPC 40451 – UA for Tightening Systems
- OPC 40501 – UA for Machine Tools
- OPC 40502 – UA for Computerized Numerical Control (CNC) Systems
- OPC 40530 – UA for Laser Systems
- OPC 40550 – UA for Woodworking Machinery
- OPC 40560 – OPC 40569 – UA for Mining
- OPC 40740 – UA for Process Air Extraction and Filtration Systems (PAEFS)*
- OPC UA for Cable Harness Manufacturing
- OPC UA for High Pressure Die Casting*
- OPC UA for Intralogistics Communication*
- OPC UA for Surface Technology*

Enterprise, Asset Mgmt, Packaging

- OPC 10030 – UA for ISA-S95
- OPC 10031-4 – UA for ISA-95 Job Control
- OPC 30050 – UA for PackML (OMAC)
- OPC 30260 – UA for OpenSCS Serialization Model
- OPC 30261 – UA for OPEN SCS – Job Order Profiles
- OPC 40600 – UA for Weihenstephan Standards
- OPC UA for Asset Administration Shell – AAS*
- OPC UA for Mimosa CCOM*

Engineering

- OPC 30040 – UA for AutomationML
- OPC 30250 – UA for DEXPI

Field Device Integration

- OPC 30080 – UA for Field Device Integration (FDI)
- OPC 30090 – UA for Field Device Tool (FDT)

Field Communication

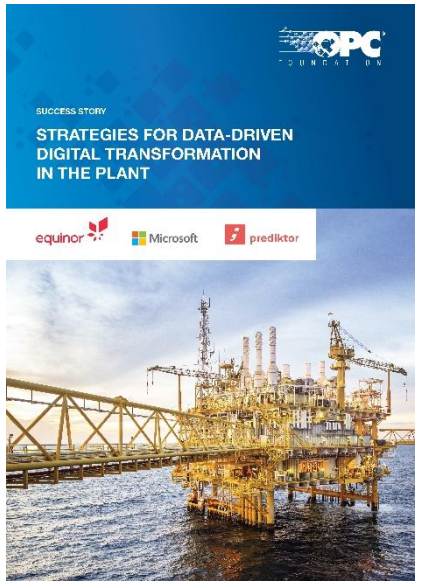
- OPC 30100 – UA for SERCOS Devices
- OPC 30110 – UA for POWERLINK
- OPC 30120 – UA for IO-Link Devices and IO-Link Masters
- OPC 30130 – UA for Control & Communication System Profile (for Machine) CSP + (CCLink)
- OPC 30140 – UA for PROFINET
- OPC 30141 – UA for PROFIenergy
- OPC 30142 – UA for PROFINET Remote IO
- OPC 30143 – UA for PROFI-Encoder
- OPC 30144 – UA for PROFINET-GSD
- OPC UA for CIP Devices*

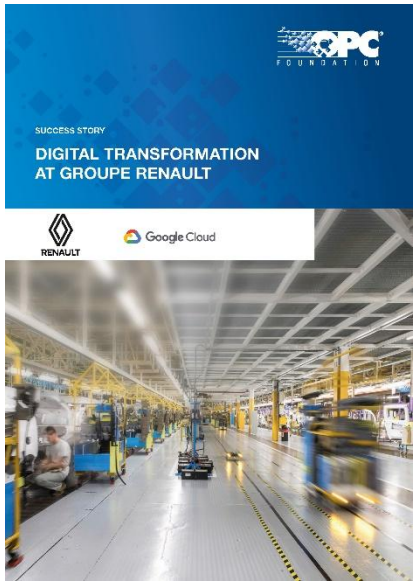
- **240+ groups with domain experts have defined the semantics for their verticals**
- **Largest eco-system for information models for the automation world**
- **Landing page with complete overview here: [www.opcfoundation.org -> About -> Working Groups-> List of Working Groups]**
- **Available free of charge**

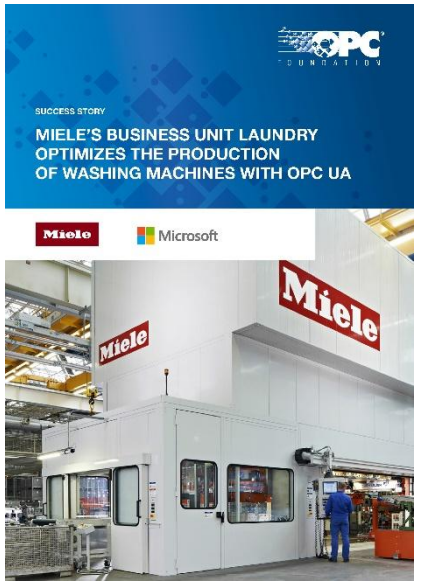
Offerings & Information

OPC UA success stories

- https://opcfoundation.org/resources/case-studies/

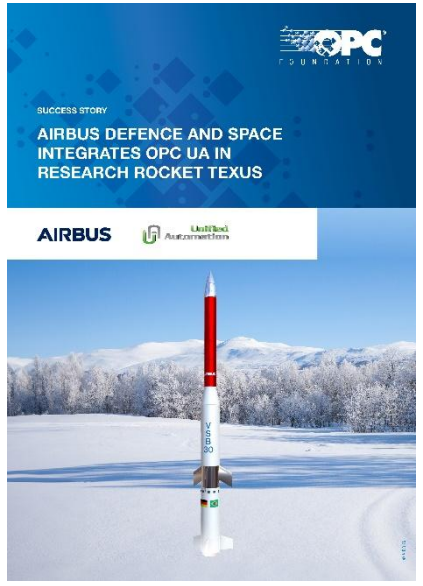






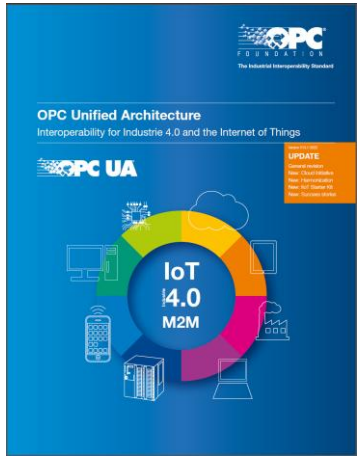
New Success Story:

Procter & Gamble
OPC UA delivers data for
115 brands of your daily life



OPC Foundation Information

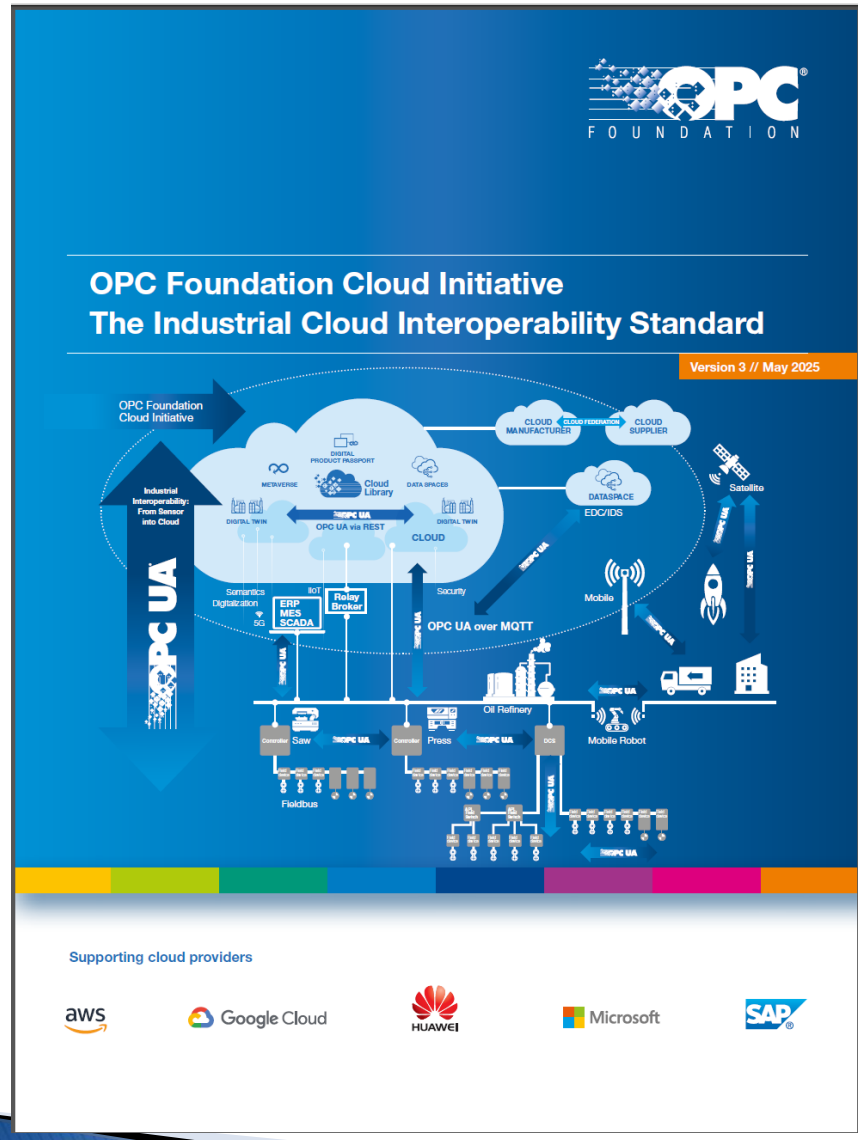
- Compliance: Self-testing tools (CTT) and official OPC Foundation Test Labs
- Open Source (GitHub) with major sponsors (ABB, Microsoft, SAP)
  https://opcfoundation.org/developer-tools/samples-and-tools-unified-architecture/net-stack-and-sample-applications/
- IIoT Starter Kit: easy quick start for OPC UA over MQTT
  https://github.com/OPCFoundation/UA-IIoT-StarterKit
- OPC UAcademic program: Free of charge lecture for professors
  https://opcfoundation.org/resources/opcuacademic/
- Success stories by end users
  Like equinor, Renault, Miele, Rosendahl, Procter & Gamble, etc
  https://opcfoundation.org/resources/case-studies/
- Podcast with interesting guests
  https://opcfoundation.org/resources/podcast/
- Marketplace
  https://opcfoundation.org/products/



OPC UA brochure on OPCF web

https://opcfoundation.org/resources/brochures/

Thank you for your attention – Q&A



Download brochure here
[OPCF-Cloud-Initiative-Brochure.pdf]

Stefan Hoppe
President & Executive Director
OPC Foundation
Stefan.hoppe@opcfoundation.org

INTERNATIONAL DATA SPACES ASSOCIATION

Dataspace Standardization – Overview

Sebastian Steinbuss

European Cloud Accelerator Technical Workshop – Milan

June 5, 2025

Why standardization matters

INTERNATIONAL DATA SPACES ASSOCIATION

- **Interoperability**: Connect seamlessly with partners across industries and regions.
- **Trust:** Ensure sovereign and secure data sharing with verified partners.
- **Scalability:** Grow your data sharing ecosystem without technical limitations.
- **Compliance**: Meet EU and global regulatory requirements.
- **Stability**: Avoid costly rework and secure long-term ROI

Dataspace Standardization

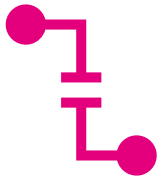
INTERNATIONAL DATA SPACES ASSOCIATION

Conceptual Standards

ISO/IEC 20151Dataspaces

CEN/CENELEC JTC25

Trusted Data Transactions

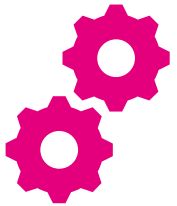


Technical Standards

IDSA Rulebook, RAM

Eclipse Dataspace Working Group (EDWG)

- Dataspace Protocol (DSP) Specification
- Dataspace Decentralized Claims Protocol (DCP) Specification



Interoperable Implementations

Ecosystem of OSS projects

- Eclipse Dataspace Components
- FiWare
- Other

Why ISO/IEC 20151 matters

Dataspace concepts and characteristics

INTERNATIONAL DATA SPACES ASSOCIATION

Provides a **clear definition** of what a data space is.

Helps organizations to differentiate between **true data spaces** and data lakes.

Supports **procurement clarity** by ensuring businesses know what they are engaging with.

Establishes a baseline for **interoperability** in and between data spaces.

Data space characteristics | ISO/IEC 20151

INTERNATIONAL DATA SPACES ASSOCIATION

- Maintain control
- Establish trust
- Discover data
- Negotiate data sharing contracts
- Orchestration of data sharing
- Observability of action
- Interoperability

Functional components

- Multi-level policies
- Semantic models
- Communication protocols
- Processes and Rules

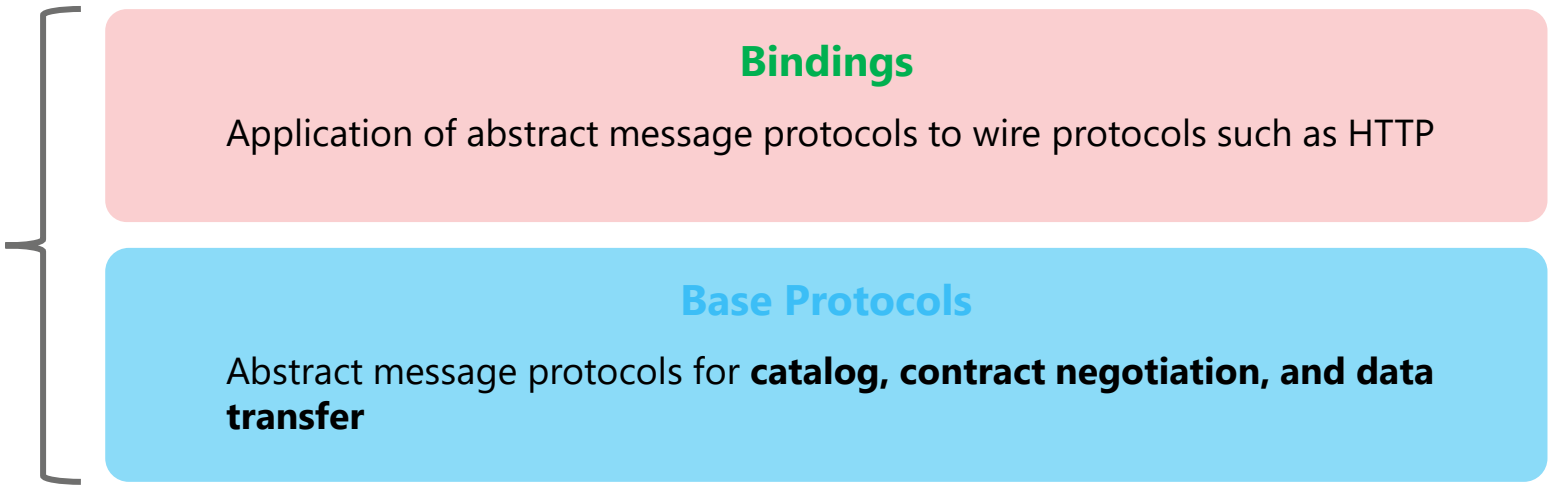
Overview Specifications under the Eclipse Dataspace Working Group

INTERNATIONAL DATA SPACES ASSOCIATION

Eclipse Conformity Assessment Policy and Credential Profile
Eclipse Data Rights Policy Profile

Eclipse Dataspace Decentralized Claims Protocol
(Planned PAS submission to ISO/IEC JTC1)

Dataspace Protocol
(Planned PAS submission to ISO/IEC JTC1)

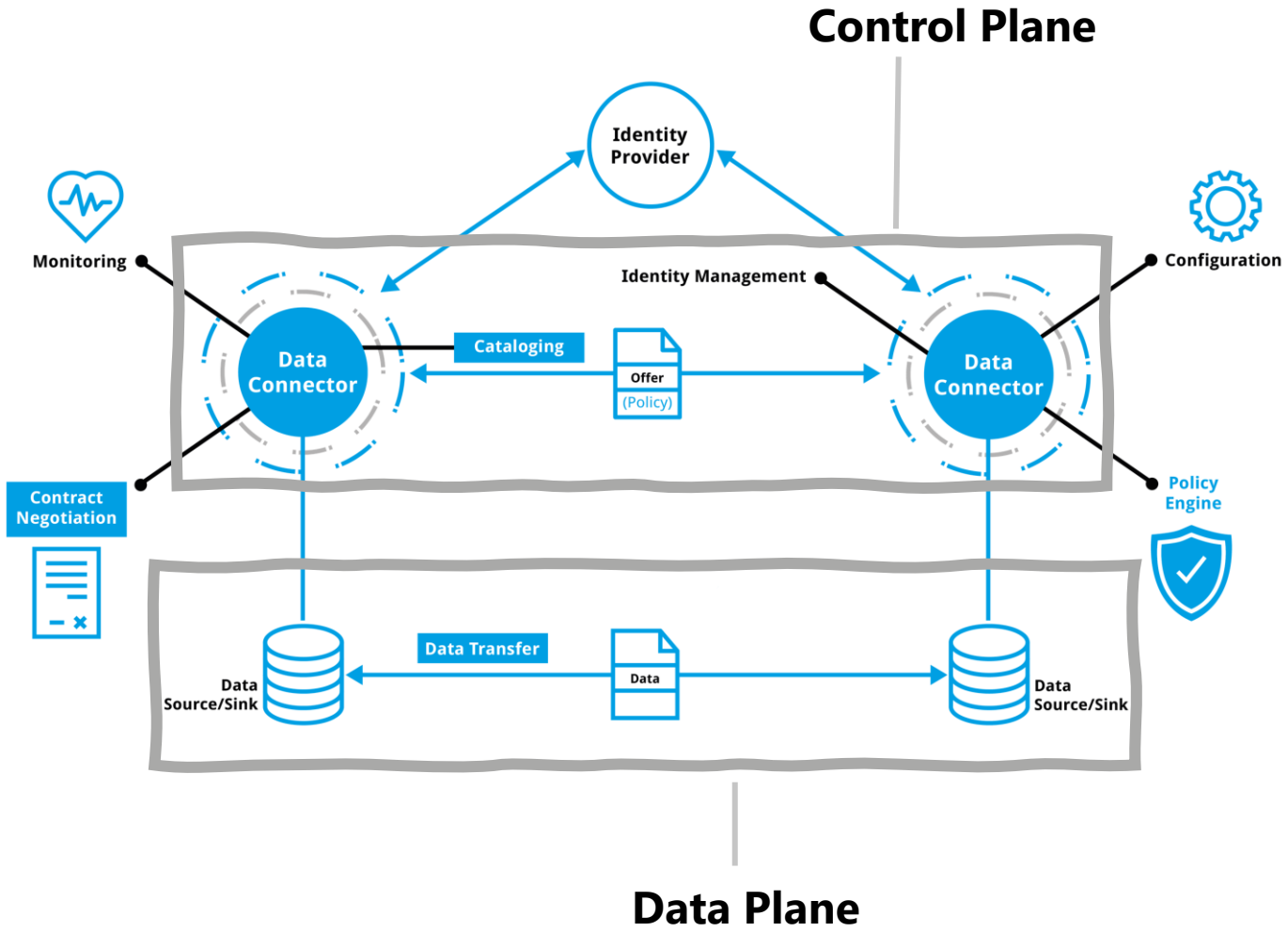


https://dataspace.eclipse.org/

https://www.eclipse.org/projects/efsp/

The need for Dataspace Protocol

Ensuring data space interoperability



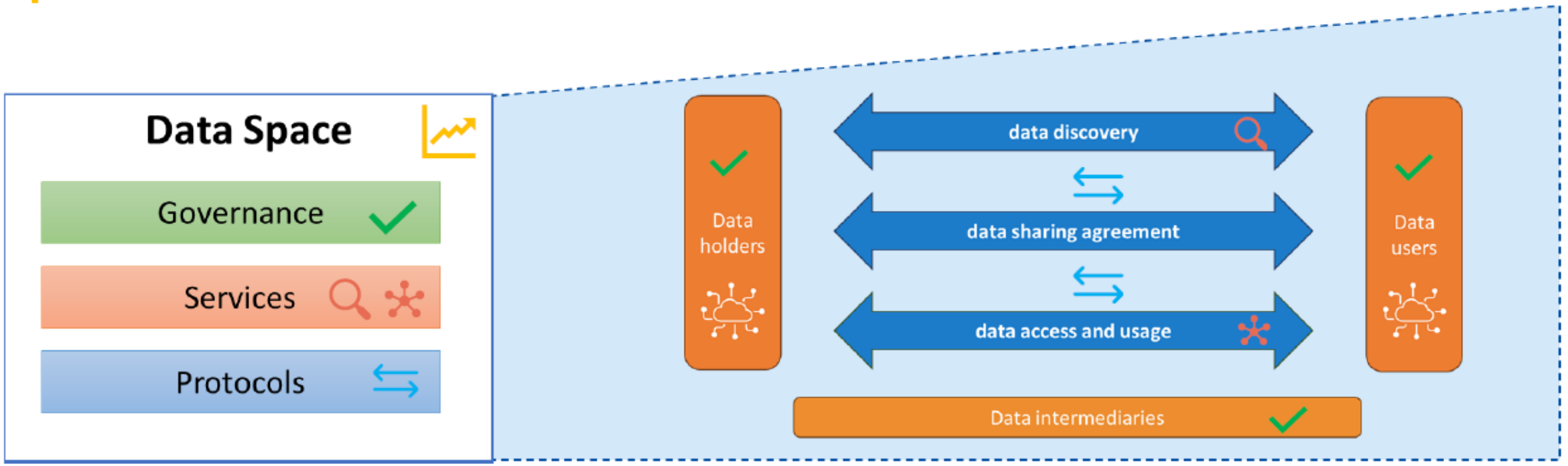
INTERNATIONAL DATA SPACES ASSOCIATION

Promotes seamless technical interoperability, while addressing certain aspects of semantic interoperability.

Enables standardized data exchange across different data space instances.

Provides flexibility and scalability through the separation of control plane and data plane.

Standardisation request
European Trusted Data Framework



Trusted Data Transaction standard

Data governance standard for data space participants

Maturity model for Common European Data Spaces

Data catalogue implementation framework

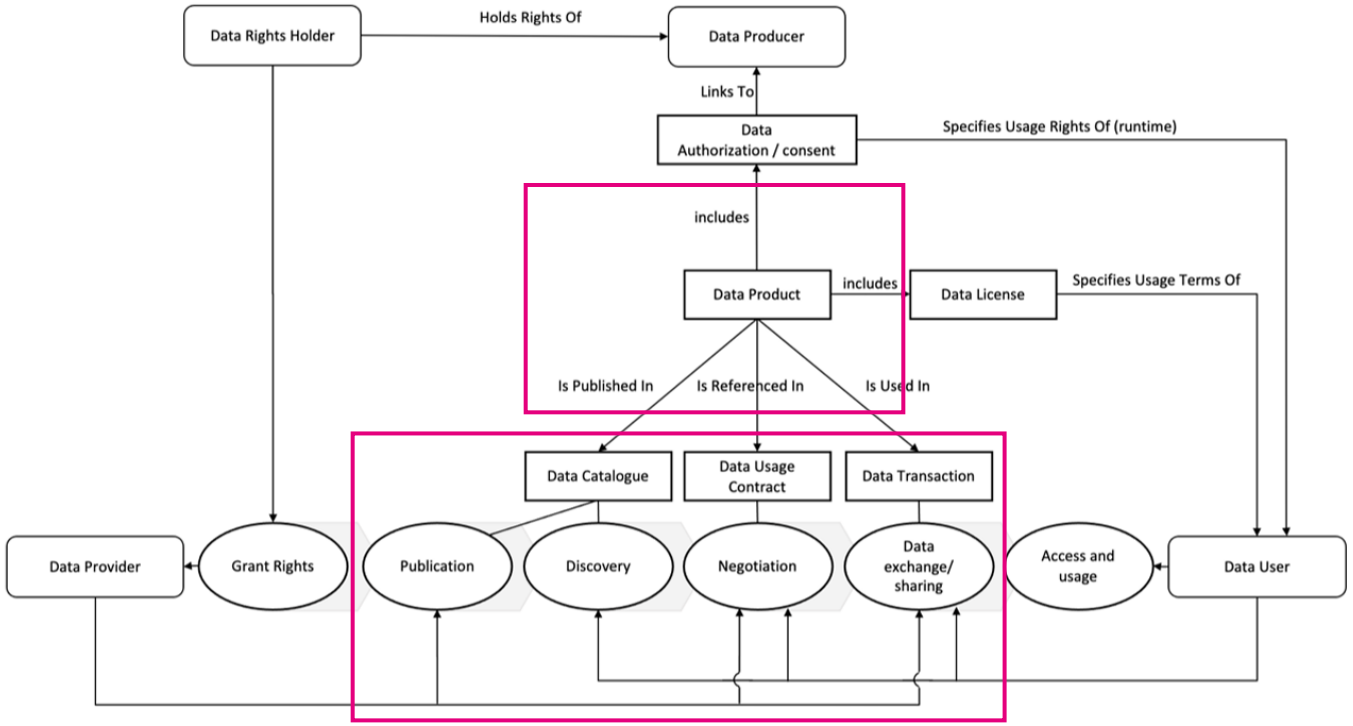
Semantic assets implementation framework

European Commission

Trusted Data Transaction

Part 1. Concepts and mechanisms published

INTERNATIONAL DATA SPACES ASSOCIATION



Modified from: https://www.cencenelec.eu/media/CEN-CENELEC/CWAs/RI/2024/cwa18125_2024.pdf

Started in March 2023, should terminate in summer 2025

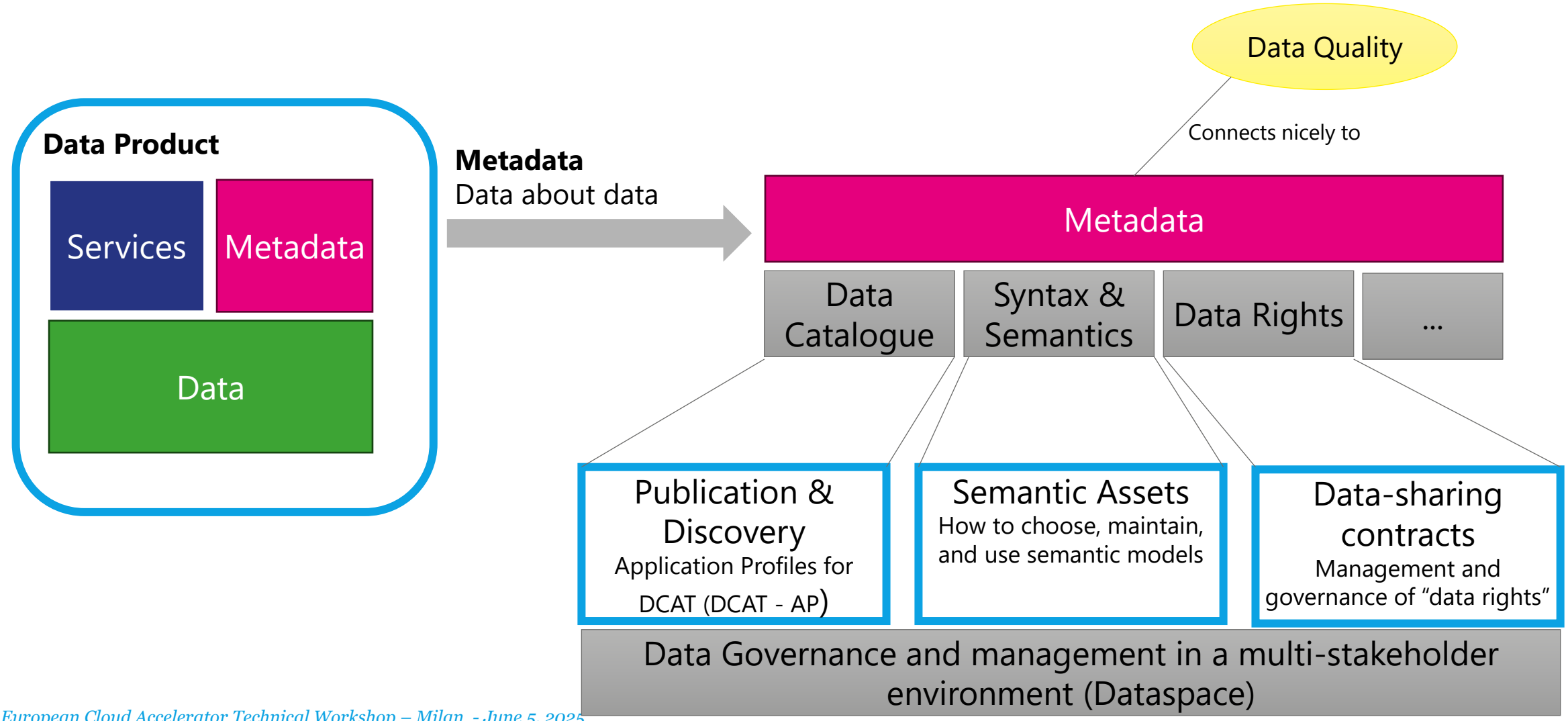
Part 1 Concepts, terminology, and mechanisms (published → hEN in JTC25)

Part 2 Trustworthiness (Enquiry stage at CWA → hEN in JTC25)

Part 3 Interoperability
(Homegrown hEN in JTC25, closely related to Dataspace Protocol)

Data Product in JTC 25 (under discussion)

INTERNATIONAL DATA SPACES ASSOCIATION



INTERNATIONAL DATA SPACES ASSOCIATION

What now to do?

There are standardization activities beyond the ones mentioned above, e.g.

Data Free Flow with Trust DFFT
IEEE P3800 Data Trading
Trusted Data Matrix

The activities need to be kept aligned

The Data Act and the subsequent standardization request make the work more time-critical

The continuous exchange with the implementing projects and solutions is mandatory.

Sebastian Steinbuss

INTERNATIONAL DATA SPACES ASSOCIATION

Learn more about the Data Space User Group

*Best suited for **data space users** looking for business opportunities, best practices and resources to make the most of participating in data spaces*

Become an IDSA Member

*Ideal for **data space makers** focused on building data spaces and offering products and services*

iSHARE Trust Framework

non-profit

The Trust Framework

For Data Rights

Architecting a strong foundation for trusted and decentralised data sharing in dataspaces

Trust in Dataspaces

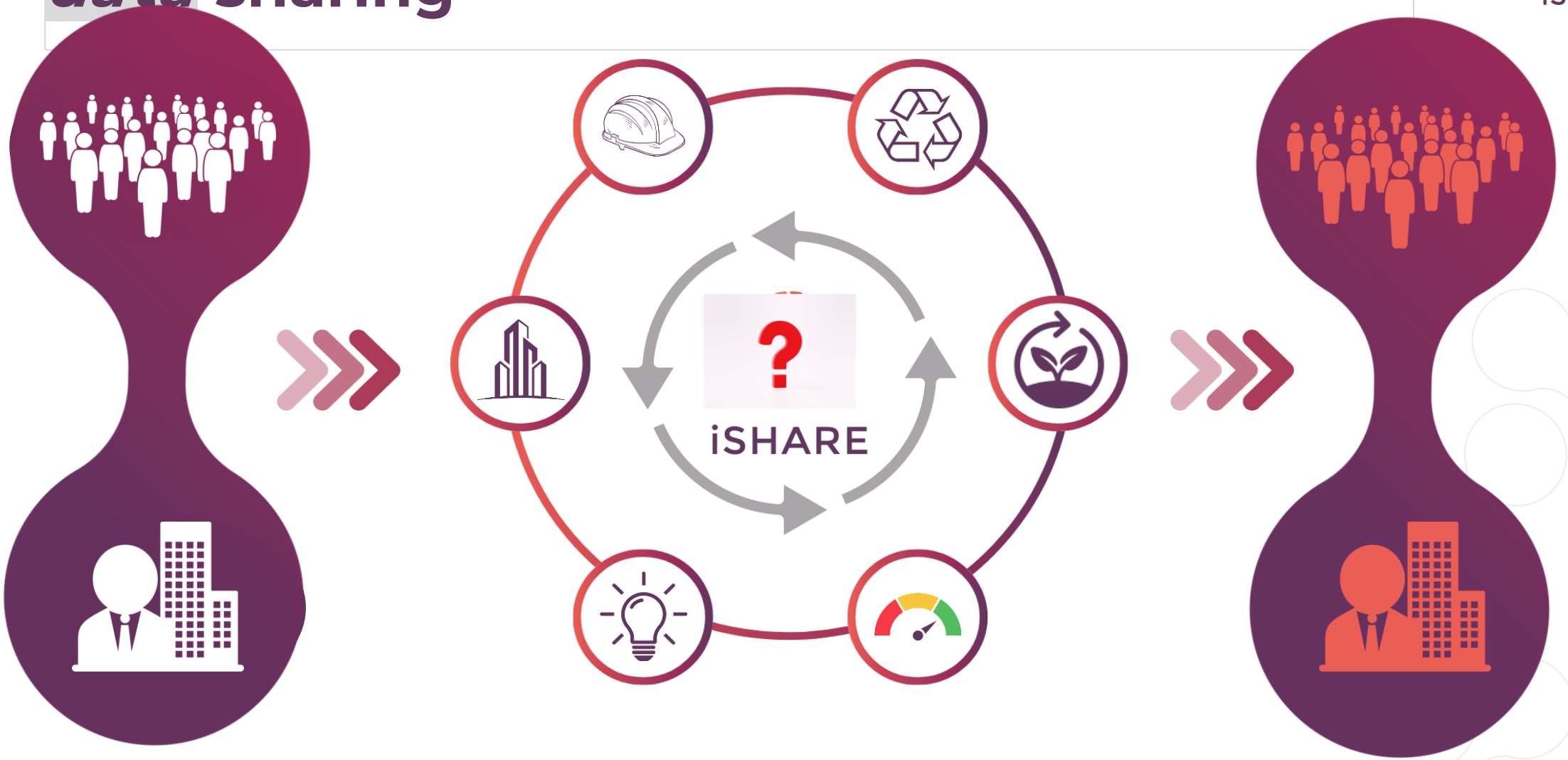
Rajiv Rajani
rajiv@ishare.eu

iSHARE

Every business is in **multiple domains** and **data spaces** by ***default***

iSHARE enabled seamless *sustainability data* sharing

iSHARE



iSHARE framework makes it possible for organizations to share data from source with any party including government agencies for climate agreement reporting while keeping control over what data is shared and what the data recipient can do with it.

Netherlands: Green Deal Data Space - energy reporting

iSHARE

Netherlands Enterprise Agency

https://green-deal-dataspace.nl/

Enabling the Climate agreement objectives:

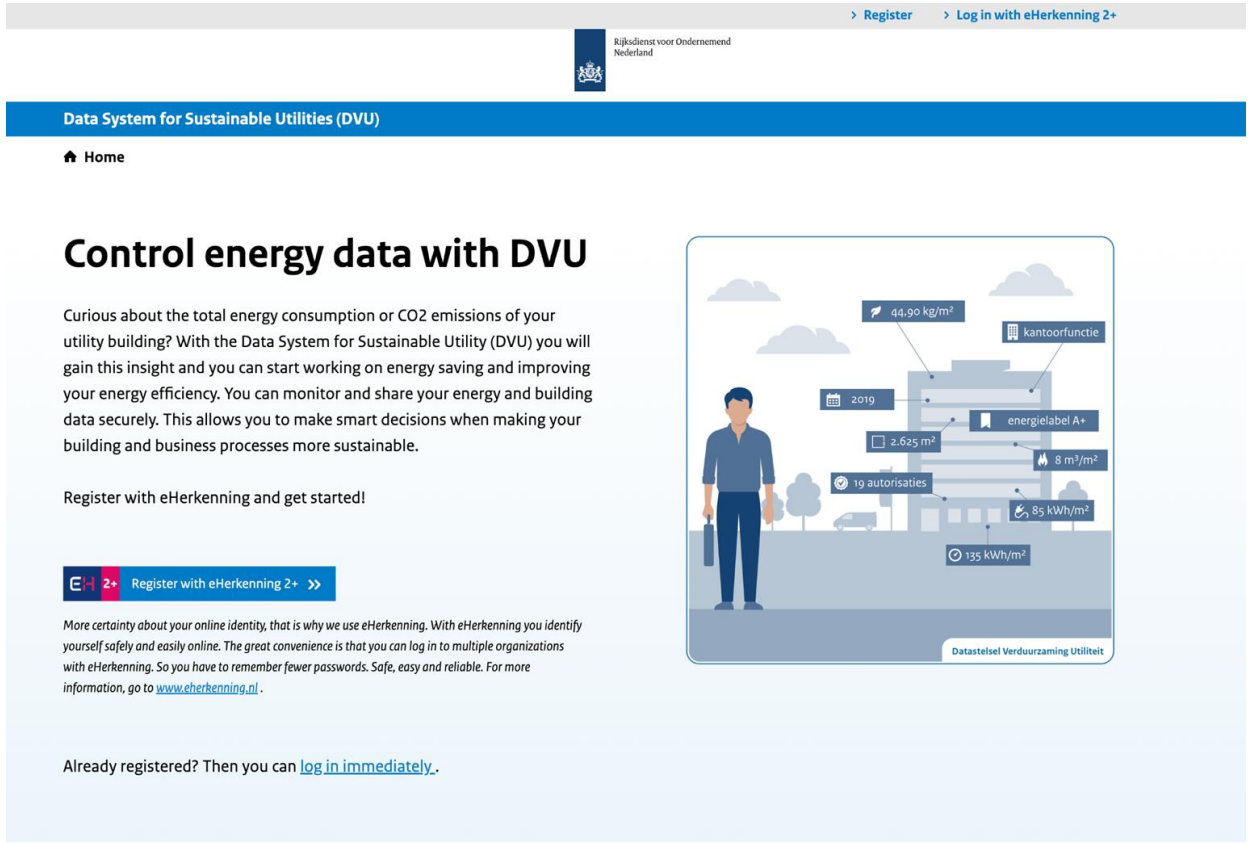
- **Controlling access** to sources of **1.181.074 buildings**
- Usable by over **1 mln users** with E-herkenning
- Driven by **businesses** needing this information

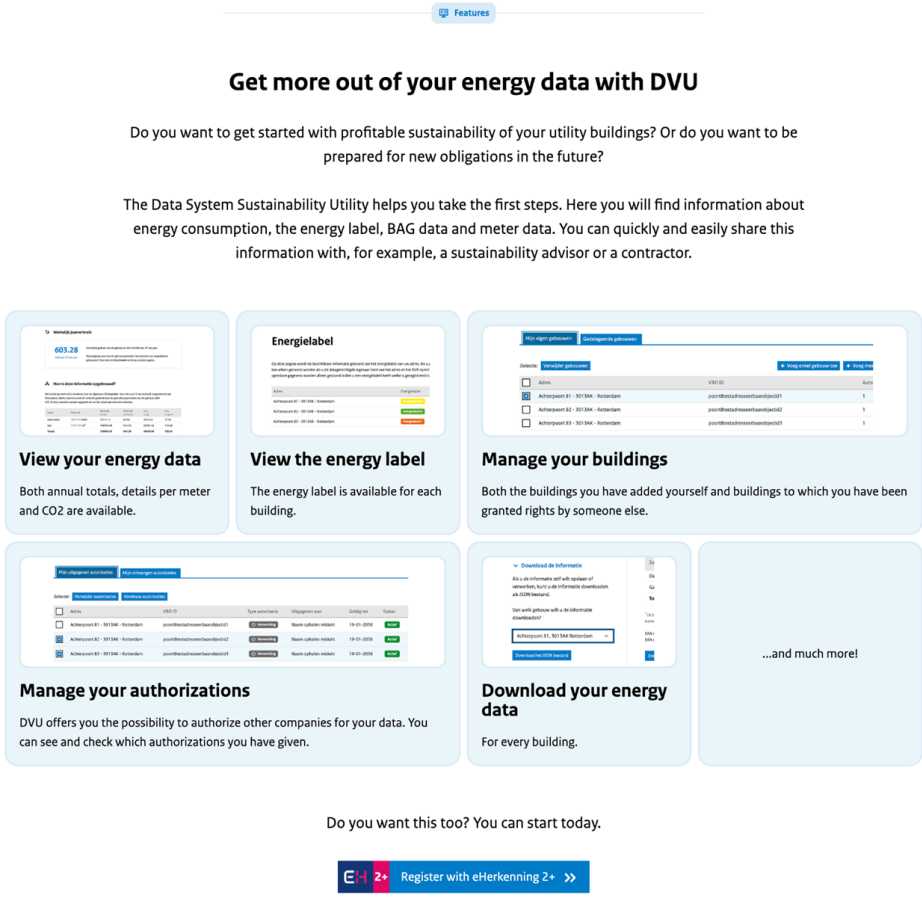
eHerkenning
eIDAS

+

iSHARE

Netherlands: Green Deal Data Space - energy reporting - Demo

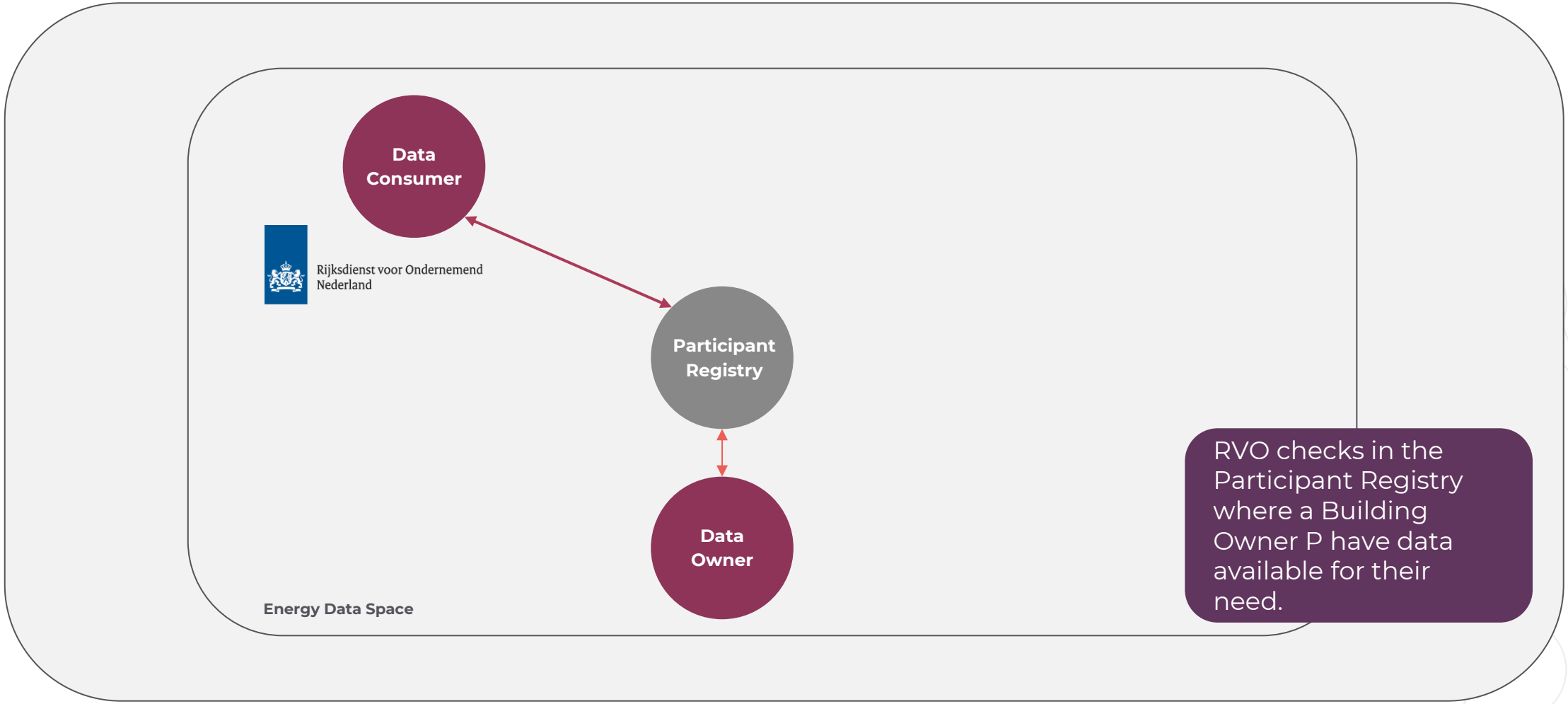




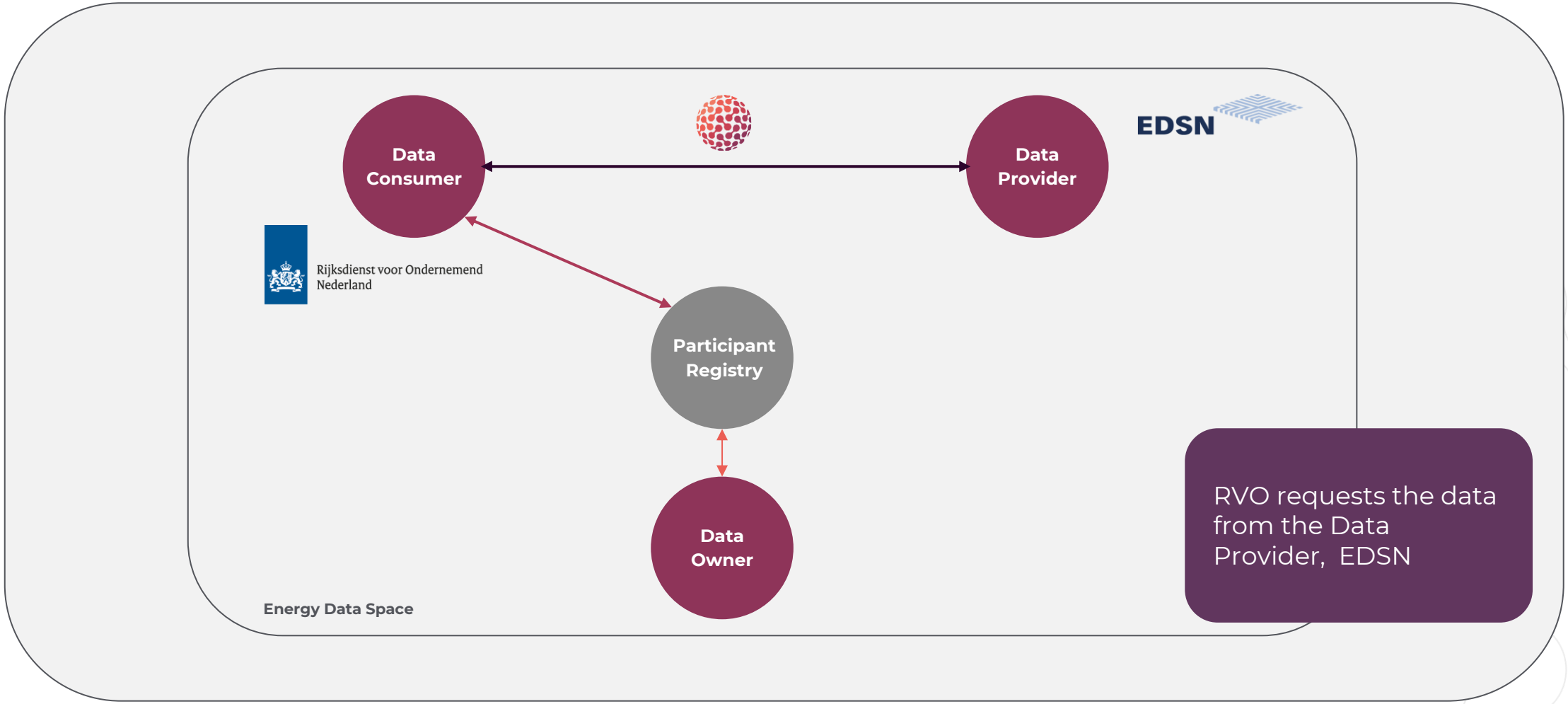
Demo

Slice view - energy data sharing

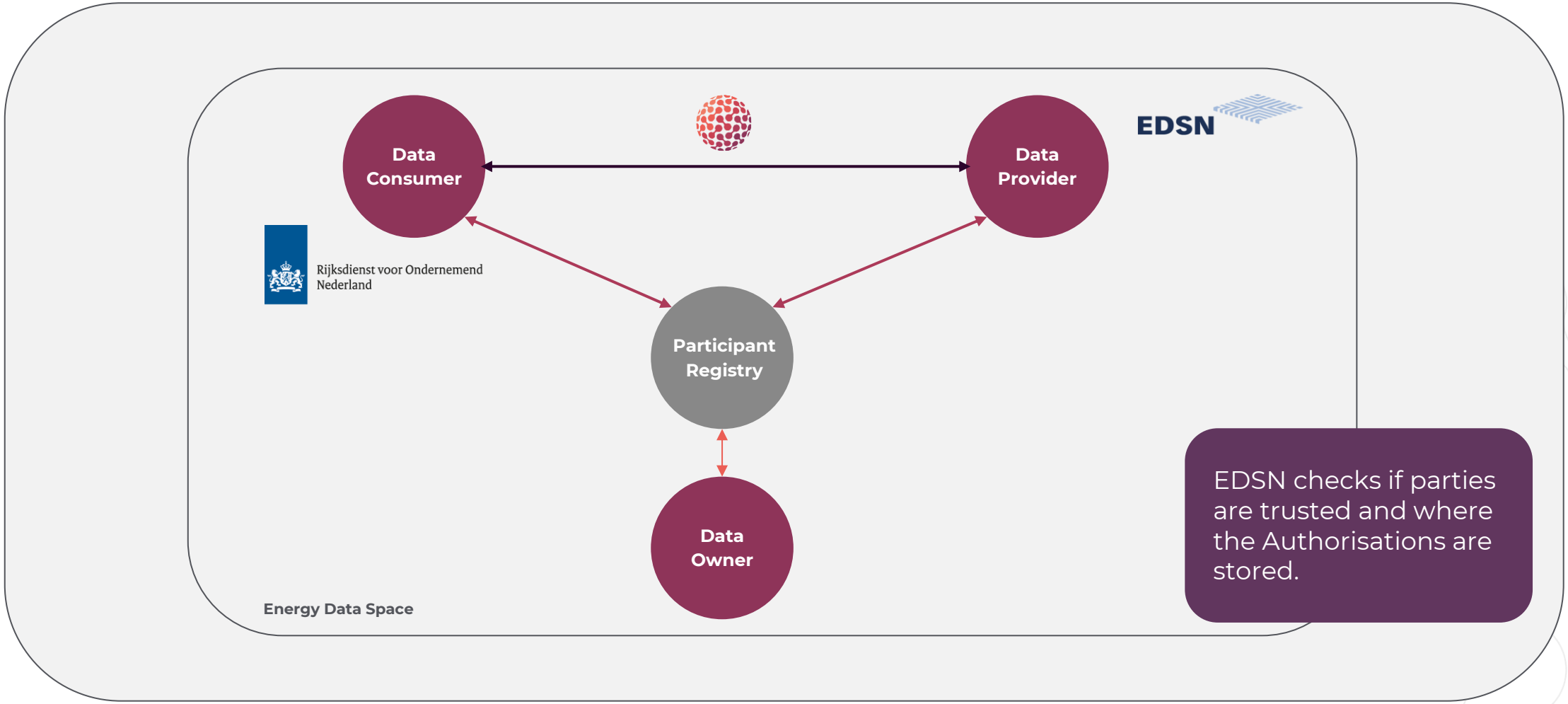
Slice view - energy data sharing



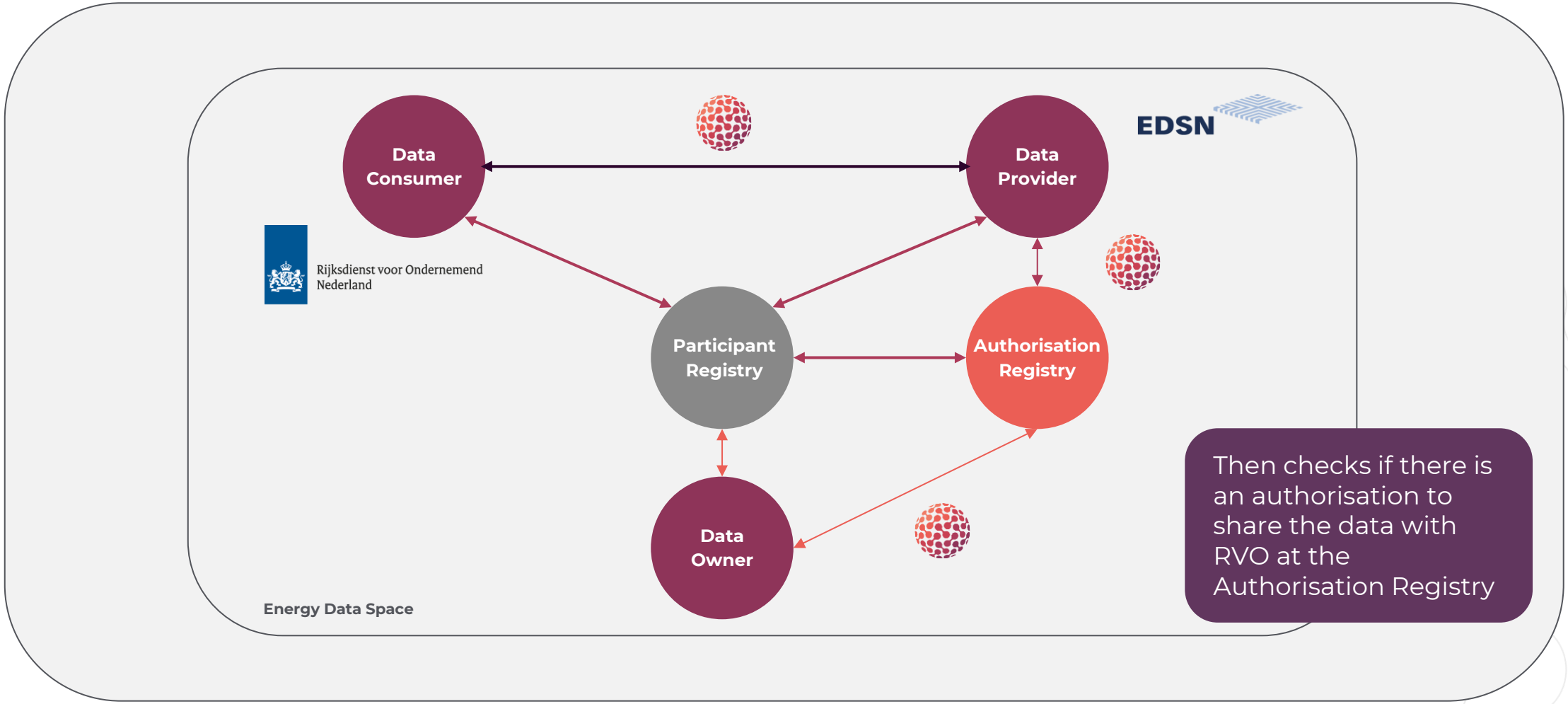
Slice view - energy data sharing



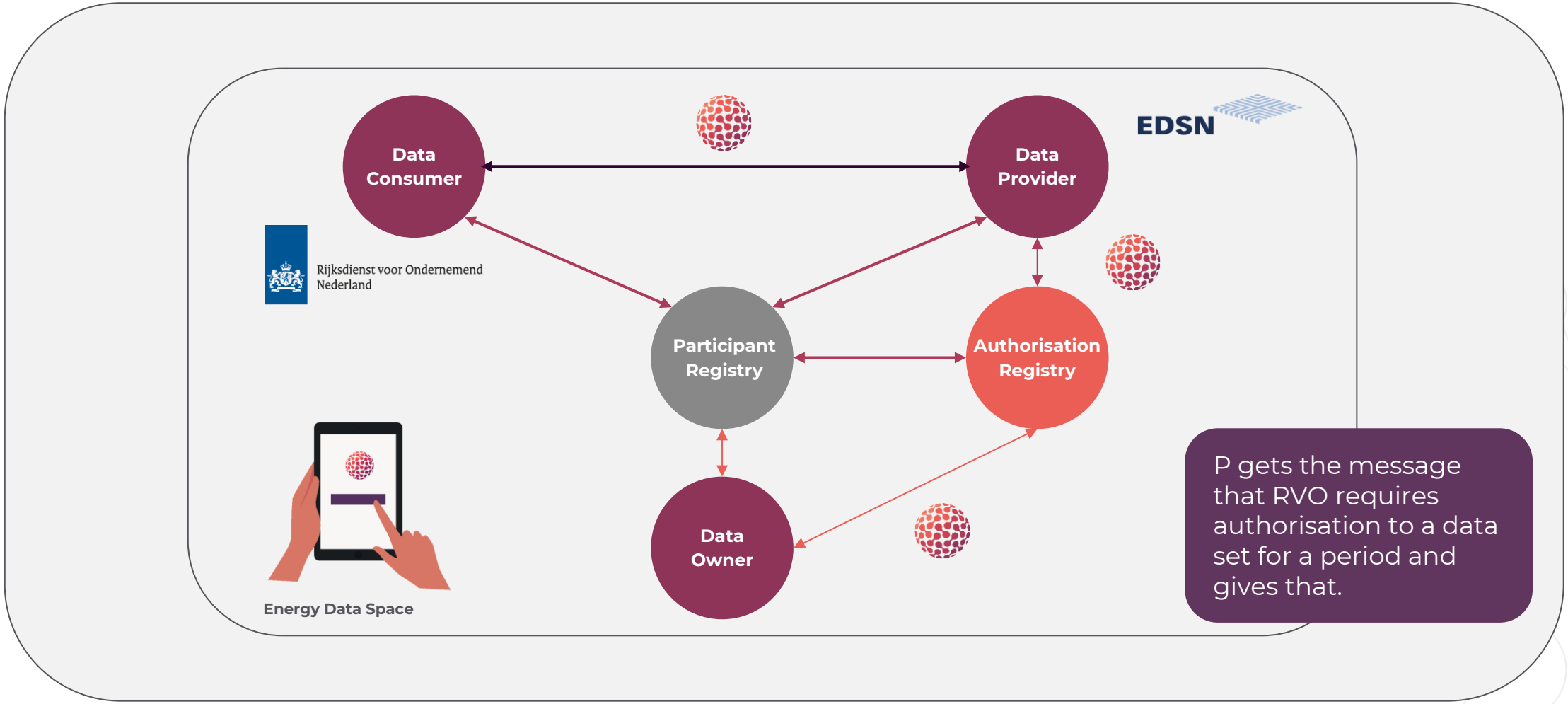
Slice view - energy data sharing



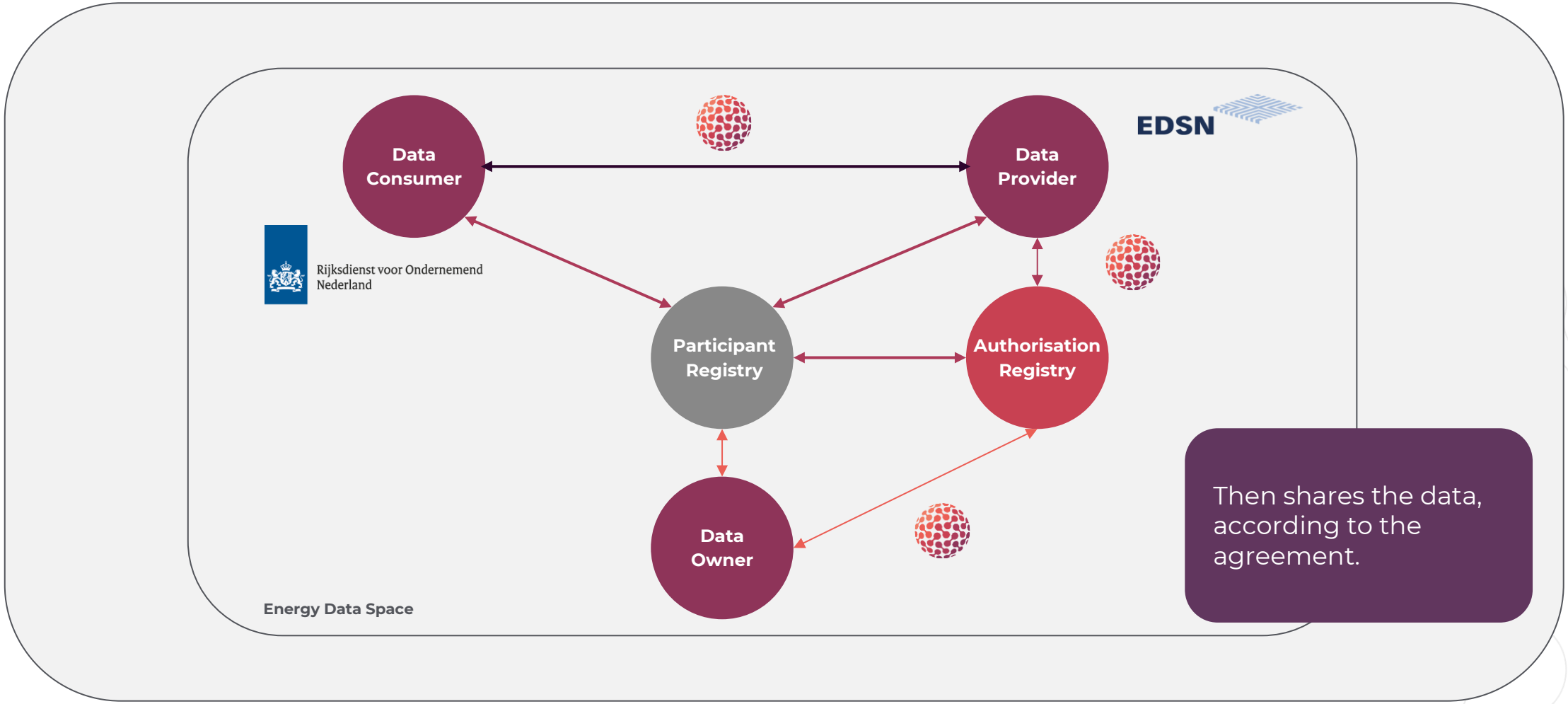
Slice view - energy data sharing



Slice view - energy data sharing

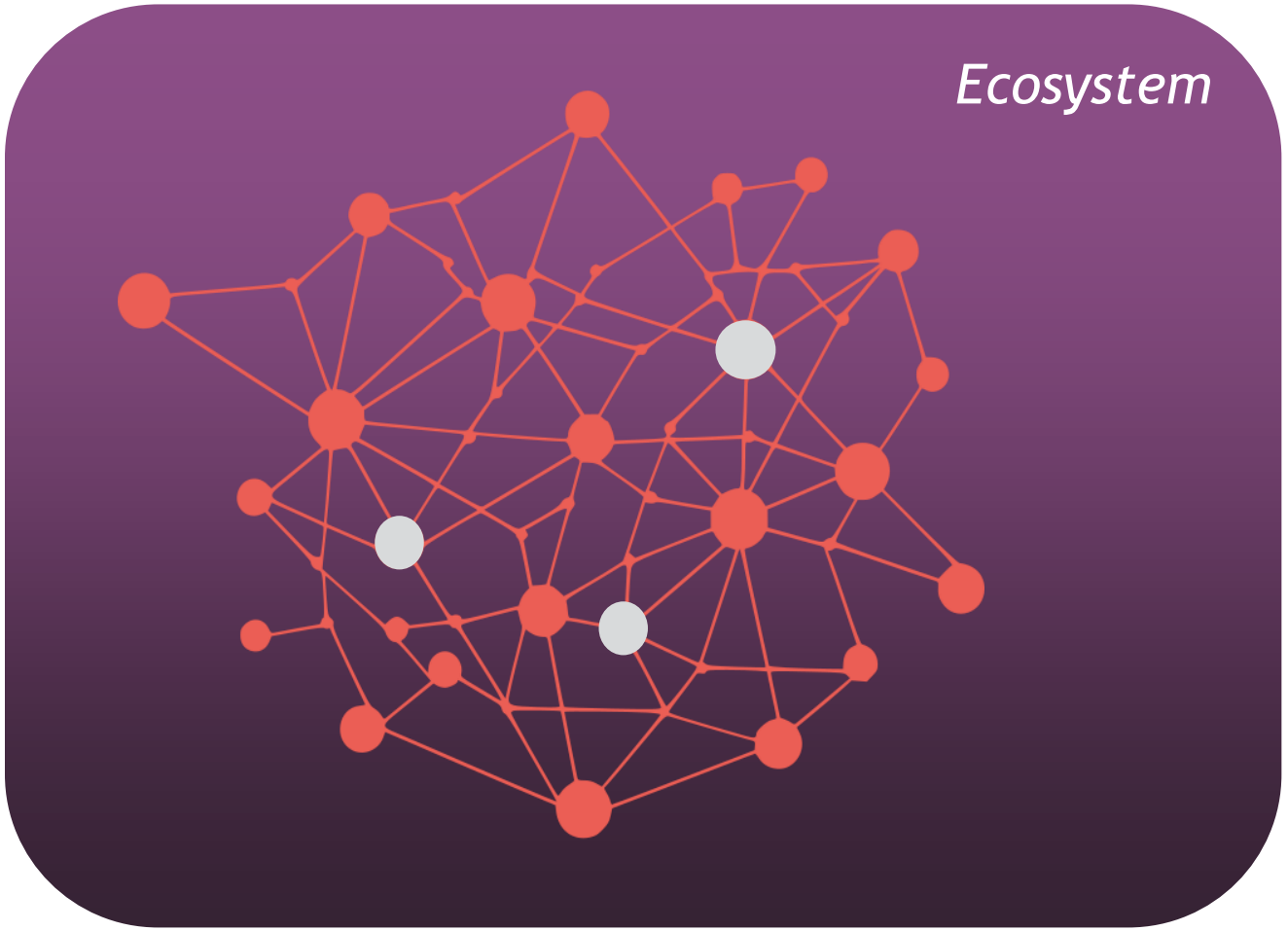


Slice view - energy data sharing



Framework enabling Decentralised Trusted Model

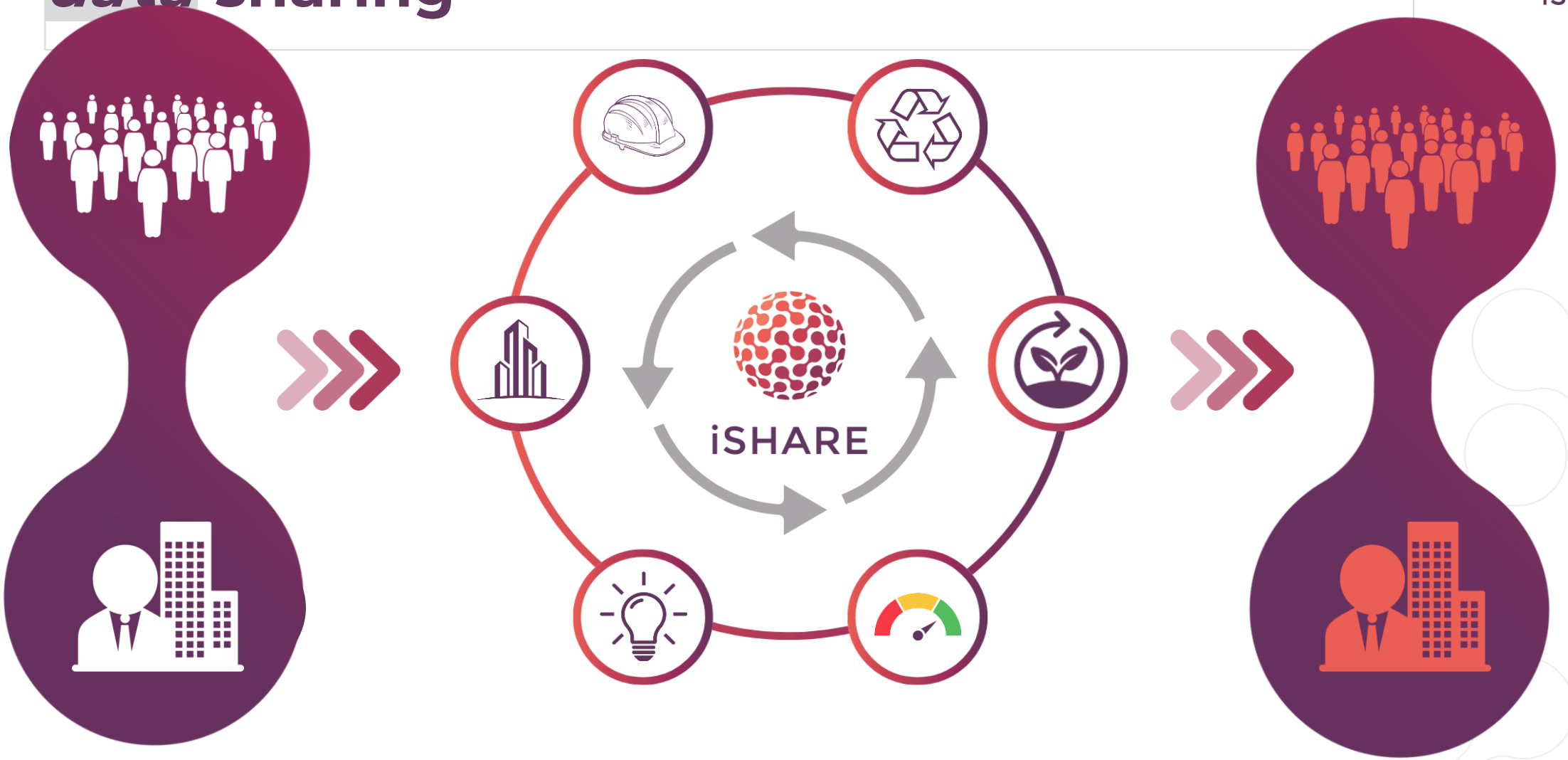
iSHARE



- Organisations
- Trust & Governance

iSHARE enabled seamless *sustainability data* sharing

iSHARE



iSHARE framework makes it possible for organizations to share data from source with any party including government agencies for climate agreement reporting while keeping control over what data is shared and what the data recipient can do with it.

iSHARE Framework for Data Rights

iSHARE

Your Data
Your Choice

Live since 2018

iSHARE

de facto harmonised standard for Data Rights, empowering Data Autonomy

https://framework.ishare.eu/

https://changes.ishare.eu/

iSHARE

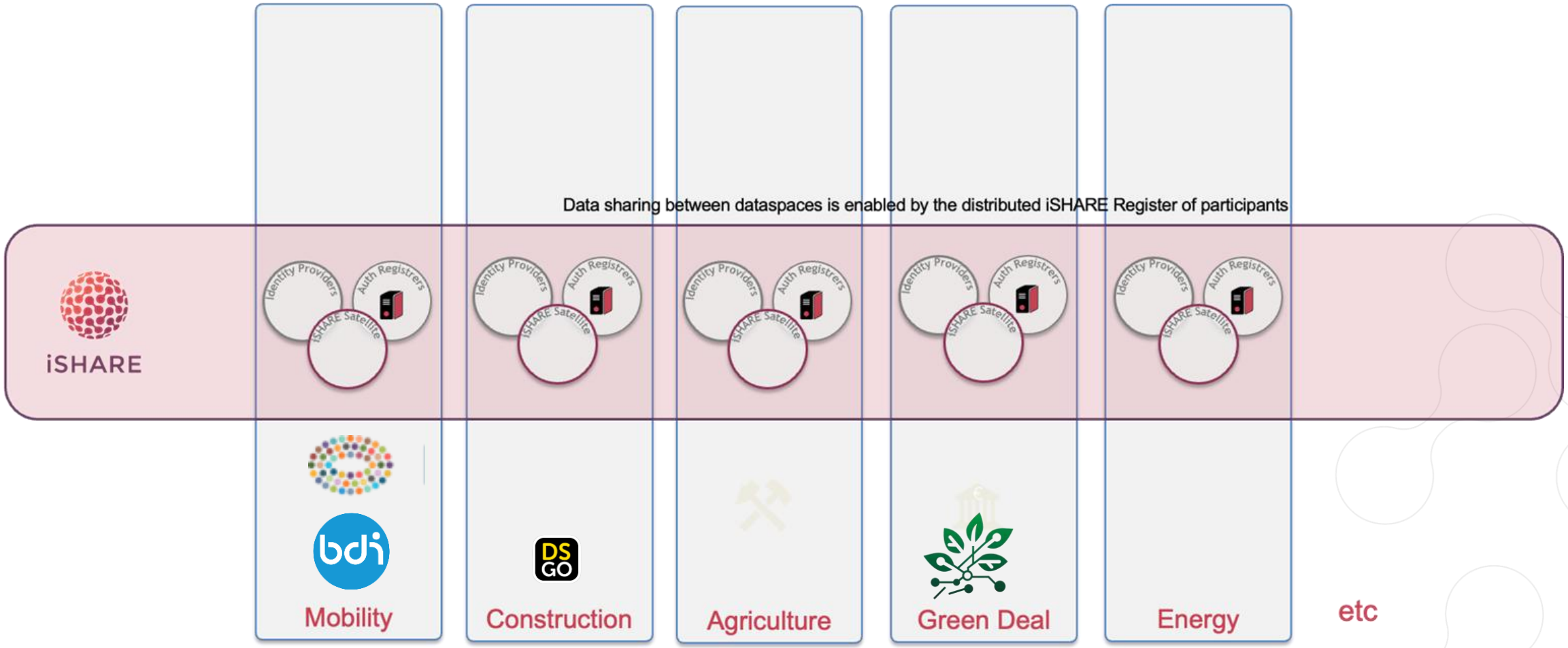
Proven and **in use** by **leading data spaces** and data sharing **initiatives**

Key standardised aspects

iSHARE

01	Organisation Identification	• building on eIDAS and others • One time issuing of credentials
02	Access Keys	• to Data Attributes • With detailed attestation requirements, access and usage policies
03	Usage Contracts	• per transaction • DGA compliant

Enabling people and businesses to get the most value out of their data across data spaces



Securely unlocking trusted data for AI

iSHARE

1. Enabling **controlled access to trusted sources** to any AI

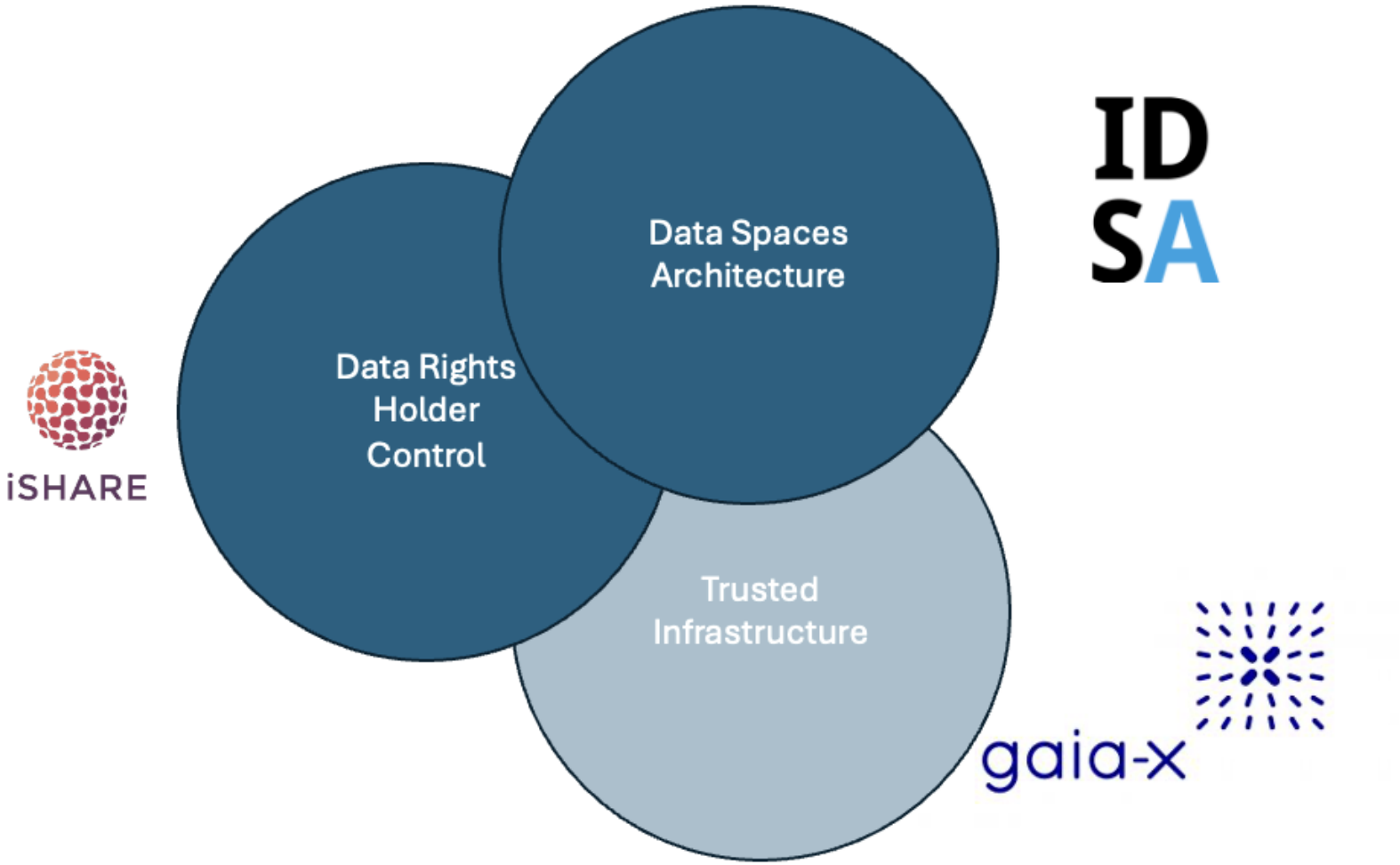
2. **Secured** in every transaction with purpose logging

1. Fully in line with **Data Governance Act**

1. **Legally covered** with every transaction

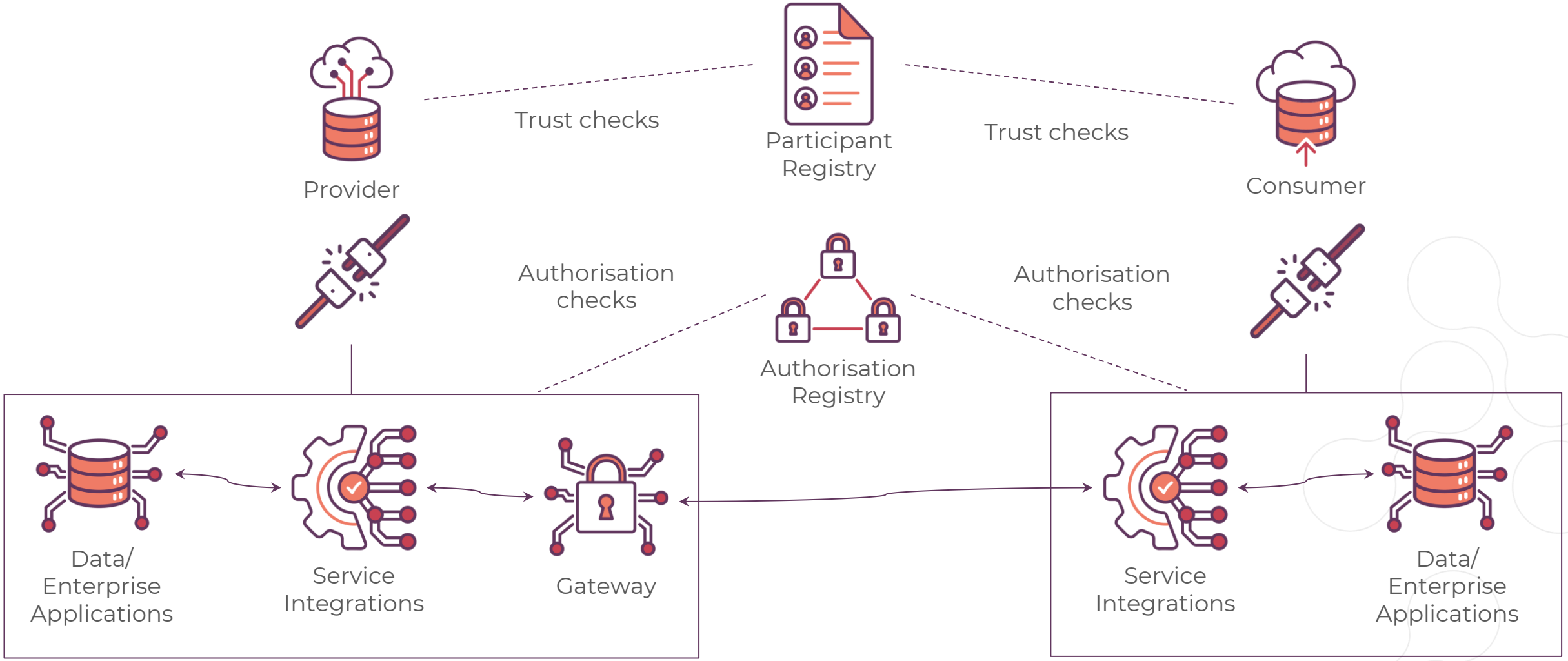
In perfect harmony with our peers

iSHARE

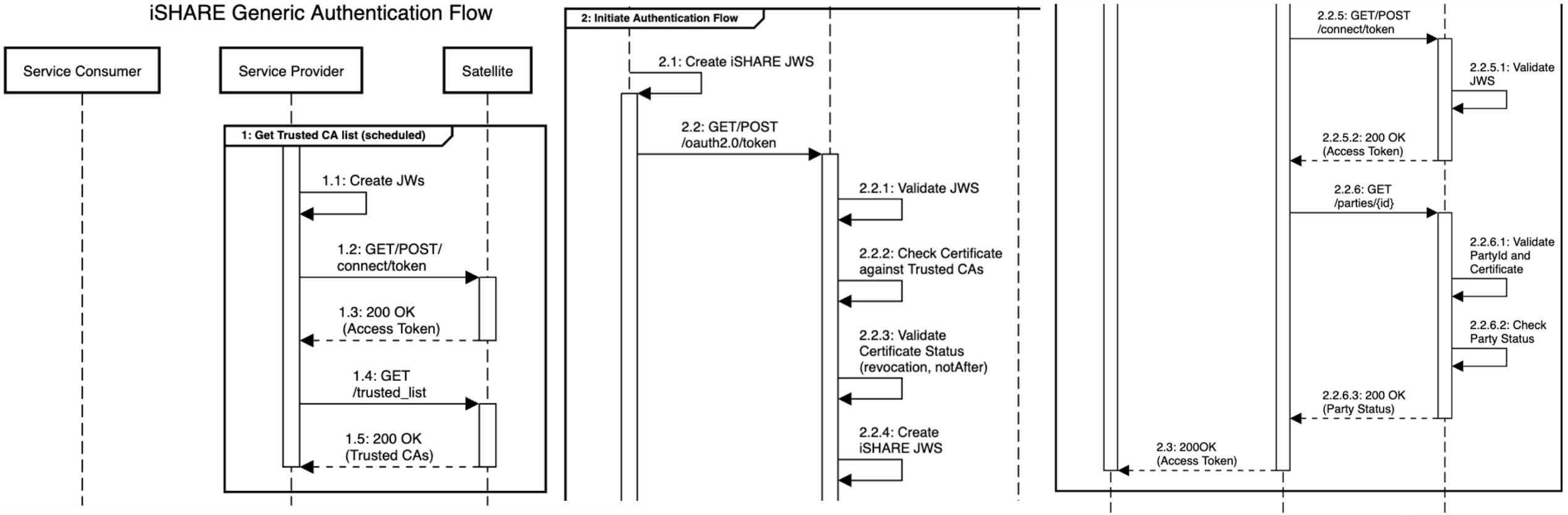


under the hood...

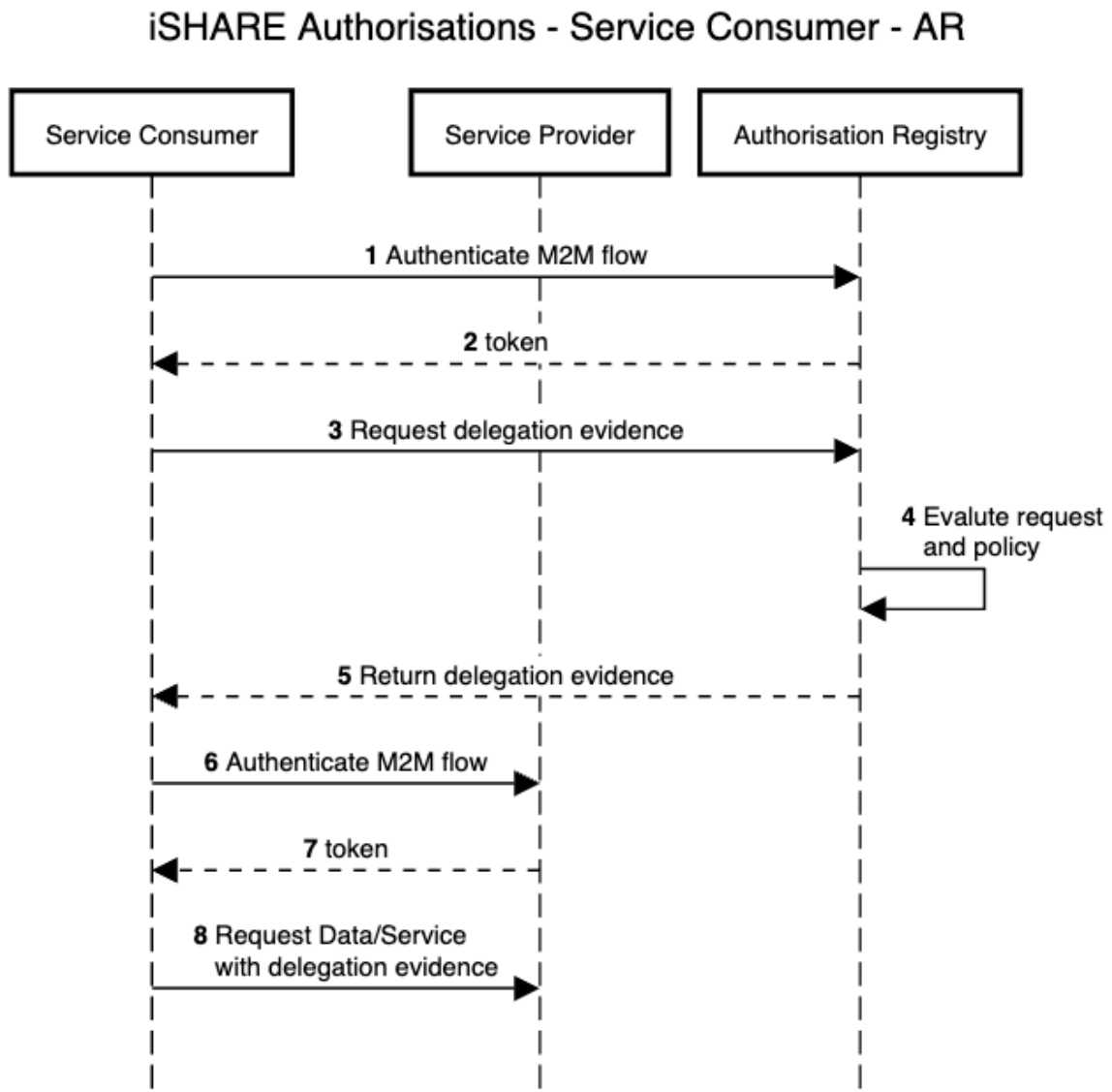
High level internal architecture

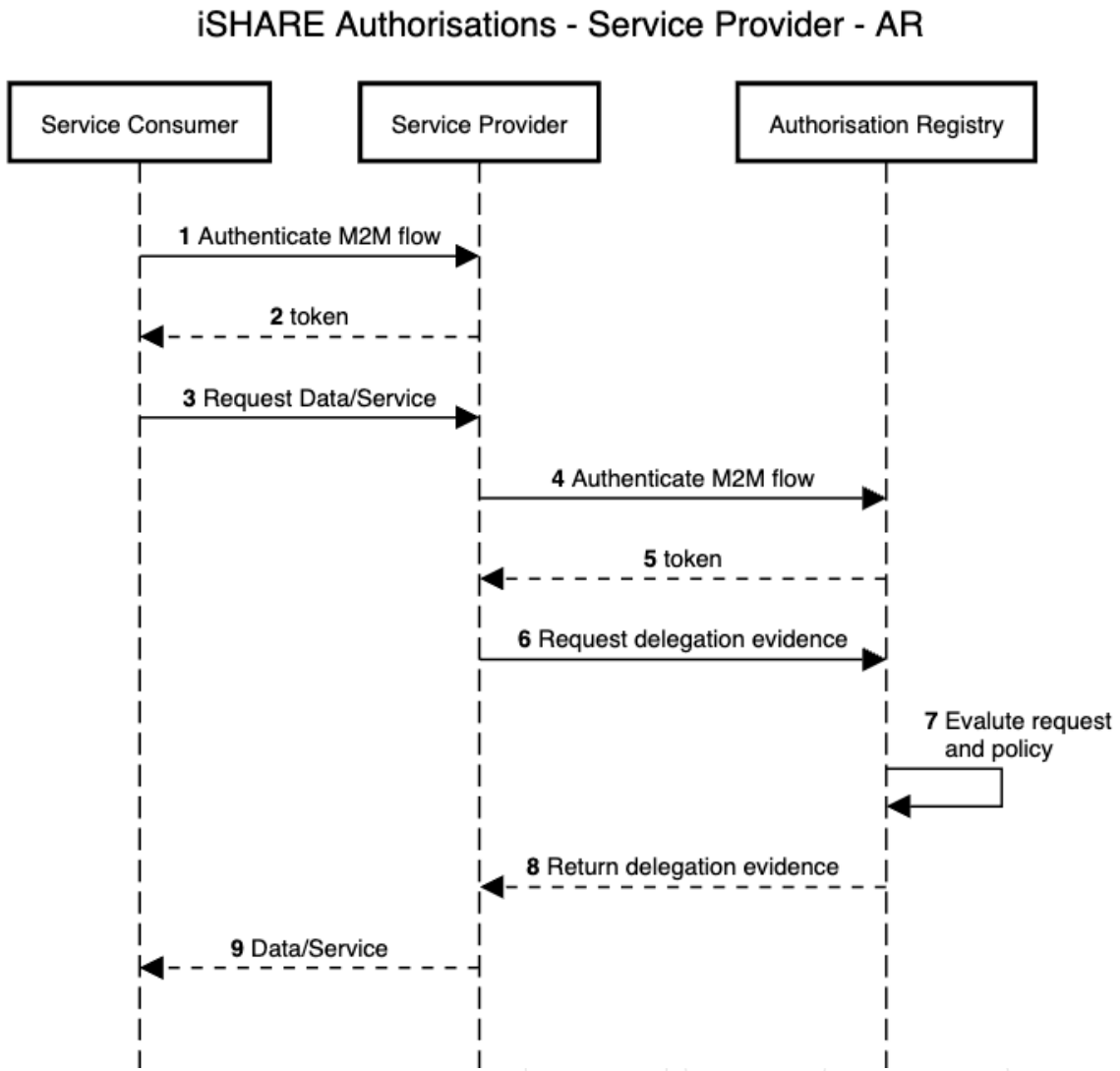


Authentication flow - M2M

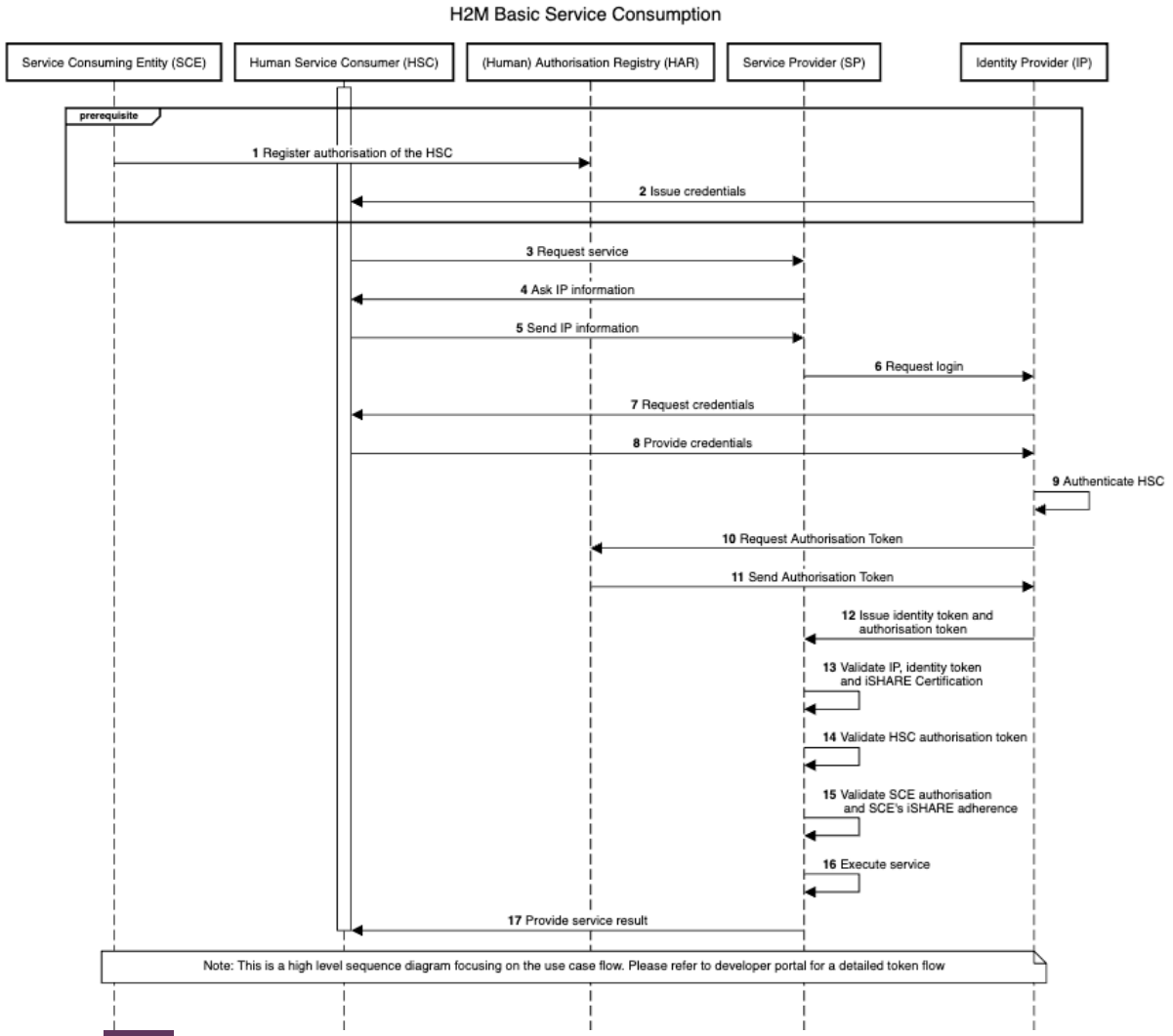


Authorisation flows - M2M

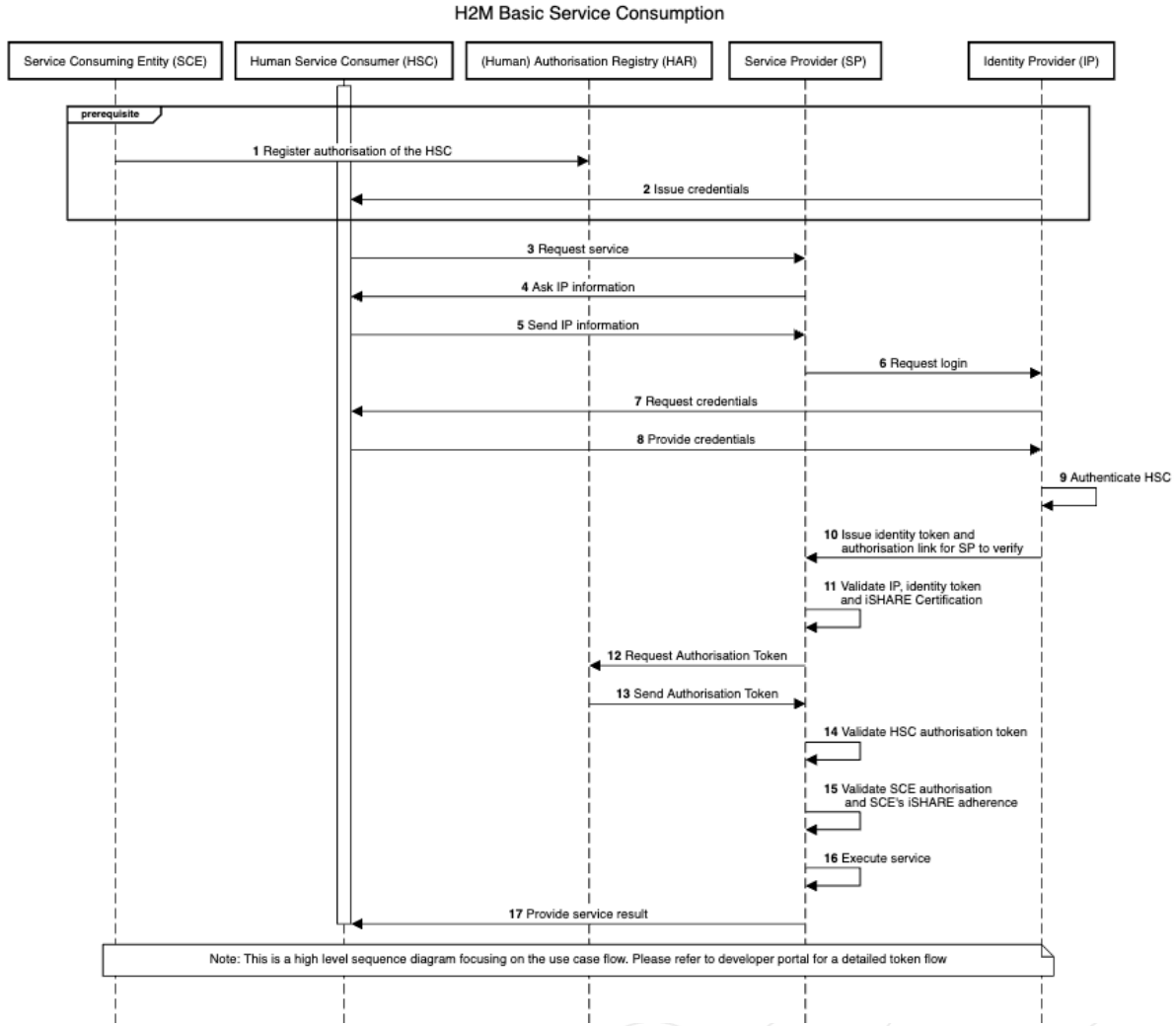




Authentication cum authorisation flow - H2M

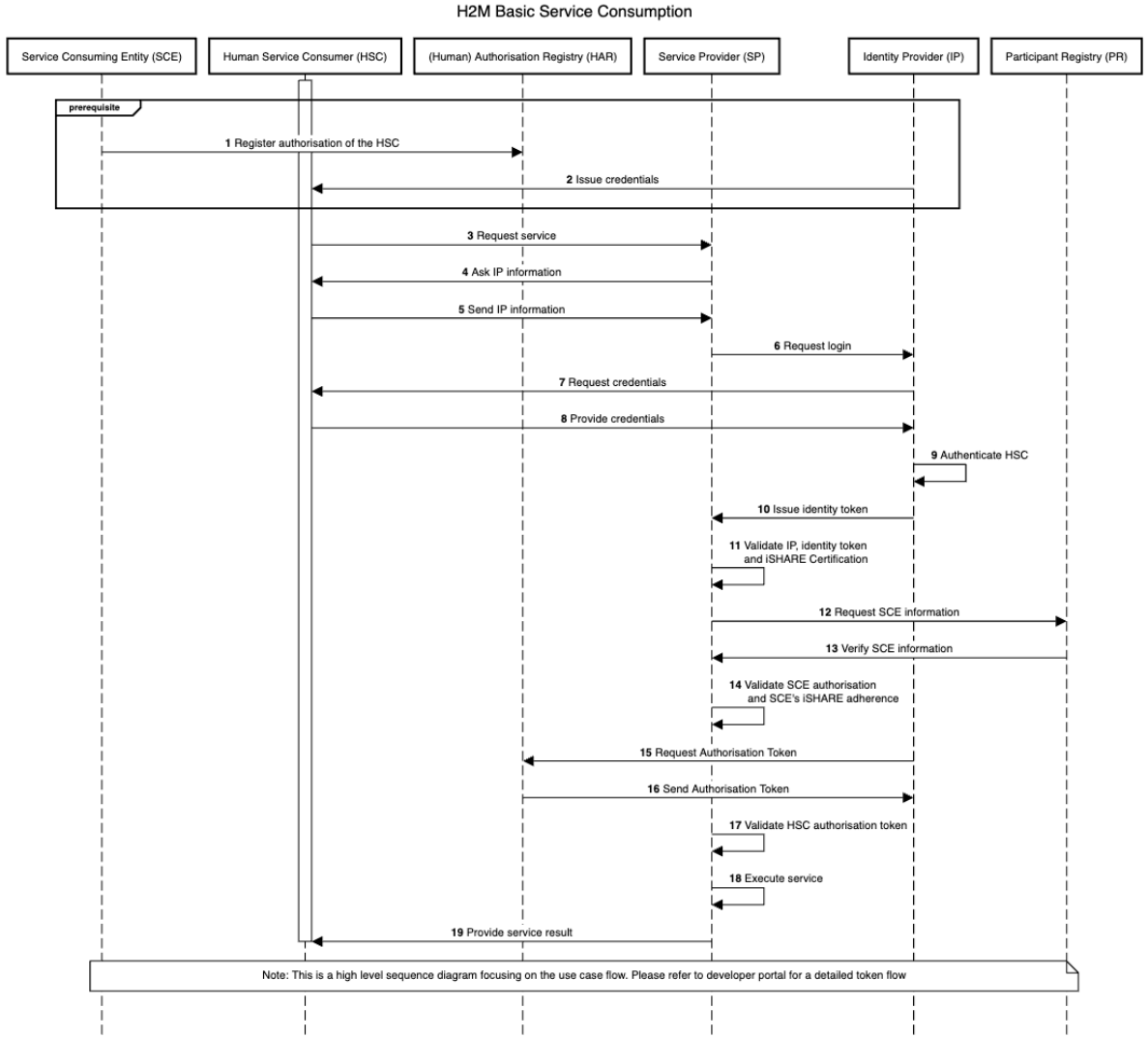


Authorization via Identity Provider Checking Authorization Registry (AR)



Authorization via Identity Provider Providing an Authorization Link to the Service Provider

Authentication cum authorisation flow - H2M (continued)



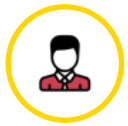
Authorization via Authorization Registry Verifying Service Consumer getting details from Participant Registry before Authorization Check

In summary iSHARE enables

iSHARE

Seamless data exchange

Machine-to-Machine (M2M)
- Communication between machines, without interference by a human



Human-to-Machine (H2M)
- Communication between a human and (a) machine(s). Requires a user interface

Decentralised (IAUM)

Flexible authorizations
- Coarse-grained: broad authorization
- Fine-grained: specific authorization
- Flexibility on where to store authorizations

Reuse of existing identities (decentralised IAM)
- Identities can be spread out and recognised, i.e. portable, across multiple independent systems

Empower Data Rights Holders

Access & Usage tokens
- Issued as evidence that a party(SC) is allowed to access data and what it can do with the data(data licenses)

Organisations in control
- Parties can modify or withdraw access rights to their data or services, whenever they wish

ISO and EU Standardisation and regulations

Standardisation - ISO, CEN/CENELEC
Regulations - Data Act, Data Governance Act

iSHARE

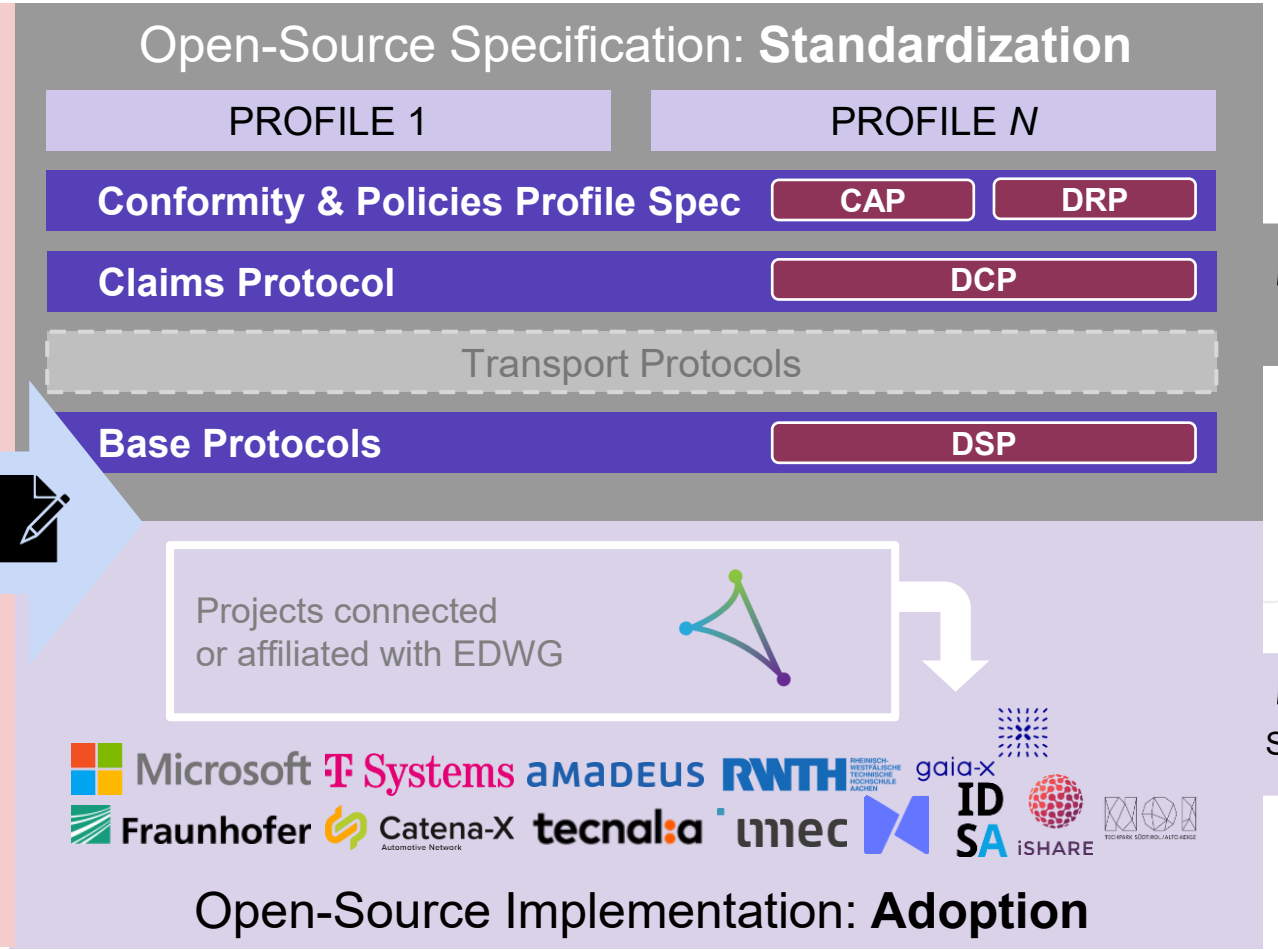
Data Act Chapter VIII

Interoperability - Article 33

- Automatic access & transmission
- Open formats & vocabularies
- Find, access & use
- Smart contracts

Interoperability - Article 36

- Consistency
- Safe termination/interruption
- Robustness & access control



ISO

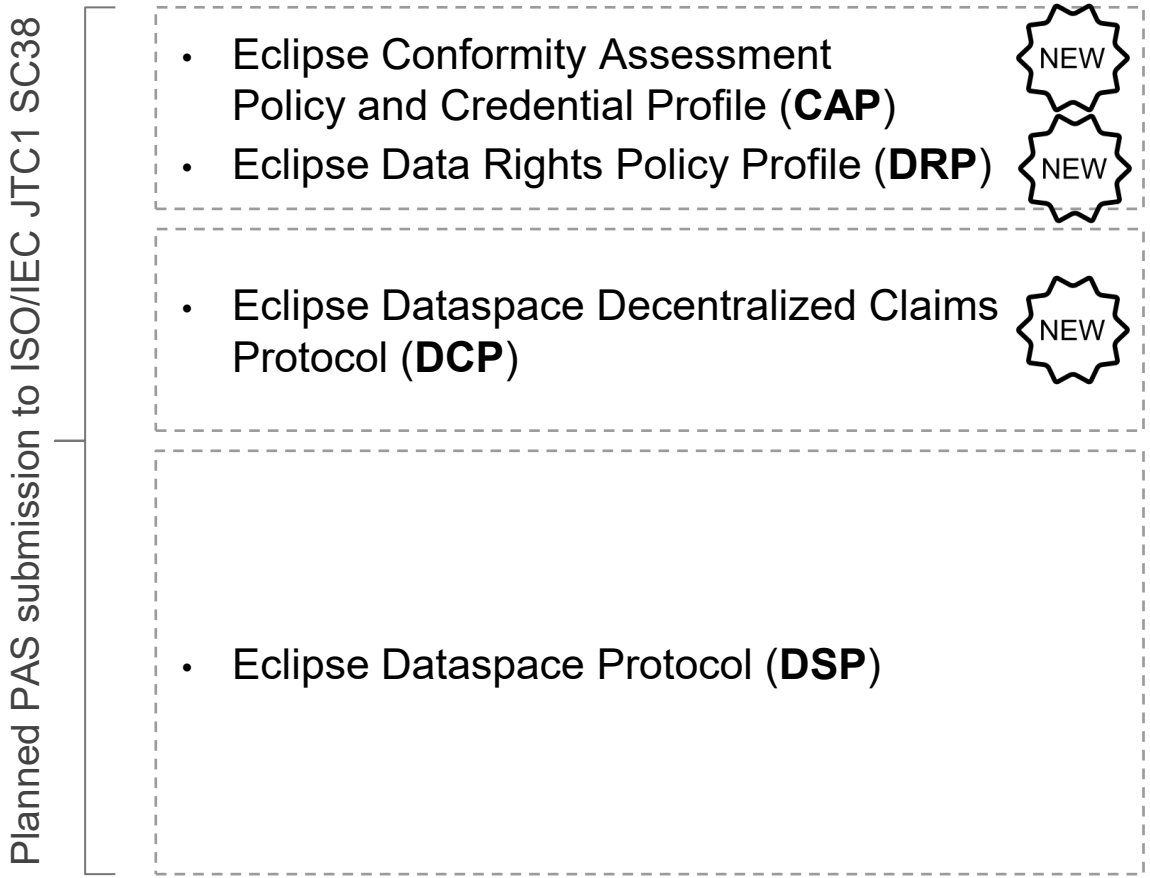
CEN

CENELEC

European Commission

Open

Overview Current Specifications under EDWG



Policy and Credential Profiles
Define an ODRL policy model, subject format for verifiable credentials, and semantics associated with the former

Claims Protocols
Message protocols for proving the identity of, and claims about, dataspace participants

Bindings
Application of abstract message protocols to wire protocols such as HTTP

Base Protocols
Abstract message protocols for catalog, contract negotiation, and data transfer

Getting started and further reading

iSHARE

framework.ishare.eu

dev.ishare.eu

template.ishare.eu

iSHARE

Schedule | Day 1

Upcoming	
14:00 – 14:40	Industrial Data Sharing – Erich Barnstedt
14:40 – 14:50	Break

Digital product passports (DPP) as part of European broader regulatory

European Green Deal

EU Plan: climate-neutral by 2050, safeguard biodiversity, establish a circular economy and eliminate pollution, while boosting the competitiveness of the European industry

agreed

Ecodesign for Sustainable Product Regulation (ESPR)

- Proposed in Mar 2022, as central part to the Commission's strategy for eco-friendly and circular products
- Aims to promote environmental sustainability across a broader range of products

Requires **digital product passports based** on harmonized European Standards (hEN)

Entered into force

Battery Regulation

- Entered into force in Aug 2023 replacing the EU Battery Directive
- Provides a legal framework aiming to promote sustainability, circularity, safety and transparency

Mandates a **battery passport** for all EV, LMT, and industrial (>2kWh) batteries starting Feb 2027

Proposal

End-of-Life Vehicle Regulation

- Proposed in Jul 2023
- Will replace the End-of-life Vehicle Directive
- Governs the entire vehicle lifecycle, from design to end-of-life treatment

Mandates a **circularity vehicle passport**

Most product groups require a DPP and are affected by JTC 24

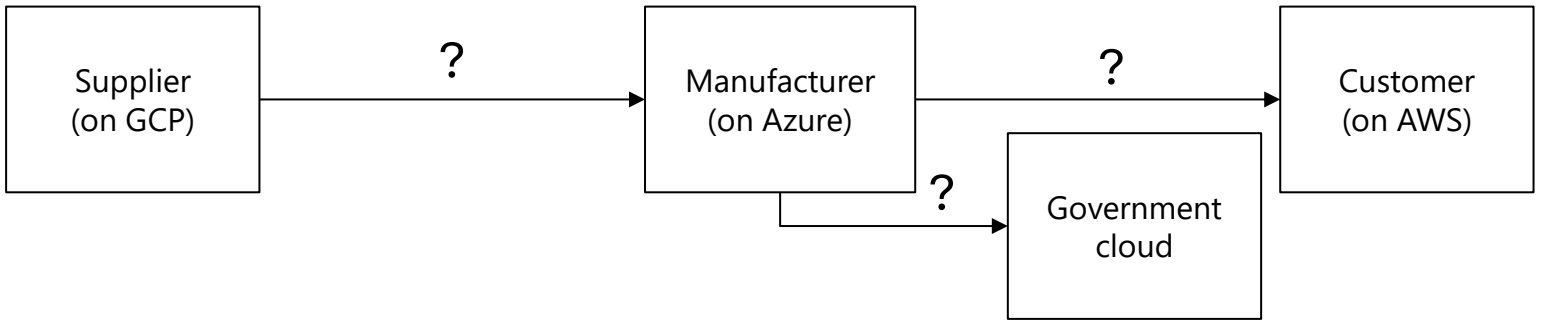
Main Regulations
ESPR
Batteries (Traction and industry)
Toys
Detergents
Construction Materials
Critical Raw Materials

Iron & steel
Aluminium
Textile, notably garments and footwear
Furniture, including mattresses
Tyres
Detergents
Paints
Lubricants
Chemicals
Energy related products
ICT products and other electronics

DPP for Building Resilient Manufacturing Supply Chains

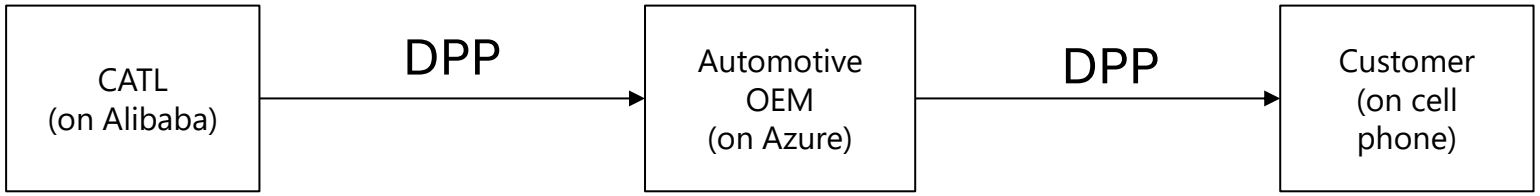
Or: How to provide scalable product data, cross-platform

- Supplier needs to verify component / raw materials are within spec
- ESG Reporting: Supplier needs to report hazards of materials provided
- Manufacturer needs to digitally verify data from supplier on-the-fly during production planning
- Manufacturer needs to calculate carbon footprint of product manufactured (PCF)
- From 2027: Manufacturer needs to produce digital description of product to European Commission



Example: Battery in EV

- CATL delivers battery to Automotive OEM with (machine-readable) Digital Battery Passport, it includes battery PCF.
- OEM installs the battery in their EV and uses PCF for total EV PCF calculation to be entered into DPP.
- OEM creates DPP for EV, accessible via QR code sticker on car for customer to read.
- Customer buys EV and scans QR code with their cell phone, gets directed to human-readable version of DPP.



Microsoft

Example: Data in Battery DPP (“Battery Passport”)

- Digital Nameplate (serial number, manufacturer address, year of manufacturing)
- Materials used, which ones are hazardous and where they came from
- Product Carbon Footprint (PCF – Scope 1, 2 & 3 emissions, calculation method, CO2 equivalence)
- Remaining Useful Lifetime: Number of charging cycles, cell condition
- Owner info: Current owner, contact information

The Key to Reducing Costs: Data Interoperability

We need…

1. A common **Interface** (Analogy: A Book)
2. A common **Data Format** (Analogy: The Latin Alphabet)
3. A common **Data Model** (Analogy: The English Language)
4. Common **Semantics** (Analogy: The Plot and Characters from the Novel)

Only when all 4 things are present can we truly understand each other!

Digital Product Passport and Digital Battery Passport
powered by AAS, EDC & OPC UA

DPP with an IEC standardized interface & data format/model/semantics

Interface: OpenAPI-compatible (AAS/OPC UA REST and DS Protocol)

Data Format: OPC UA Nodeset file

Data Model: OPC UA Modelling Language

Semantics: I4AAS Companion Spec & Asset Admin Shell Submodel Templates

The Industrial Interoperability Standard
Since 1996
>1000 members
IEC standard since 2012 – IEC 62541
Microsoft supports OPC UA since 2016 & contributed over 6M lines of open-source code

Interoperability

to remove on-prem data silos

Vendor, Protocol, Platform and OS Independent

Open Source on GitHub (>4.5M source lines contributed by Microsoft)

Scalable from sensor to Cloud, Services Oriented Architecture (SOA)

Owned by a Non-Profit (OPC Foundation)

>100M installed base and exponential growth

Data Modelling

to avoid data conversion cost

Discoverable, supports complex data types

Graph support, preserves source context

Vendor extendable

Domain-specific Companion Specifications:

- Discrete: MTConnect, Robotics, …
- Process: NOA, OPAF, PA-DIM, MDIS, …
- Energy: IEC61850, …

Security

to mitigate cybersecurity threats

Secure Design from group-up

Based on open security standards

Auditing, Authentication & Encryption

Evolves as security technologies evolve

Vendors can choose level of security

Acceptable by IT departments

Reviewed by international experts

Leveraging IEC Standard OPC UA Building Blocks for the DPP & DBP

- Details of the Asset Administration Shell Spec Part 1
  - OPC UA Information Model for AAS is defined in section 7.7
  - I4AAS OPC UA Companion Spec v1, IDTA-OPCF Joint Working Group developing a new version!

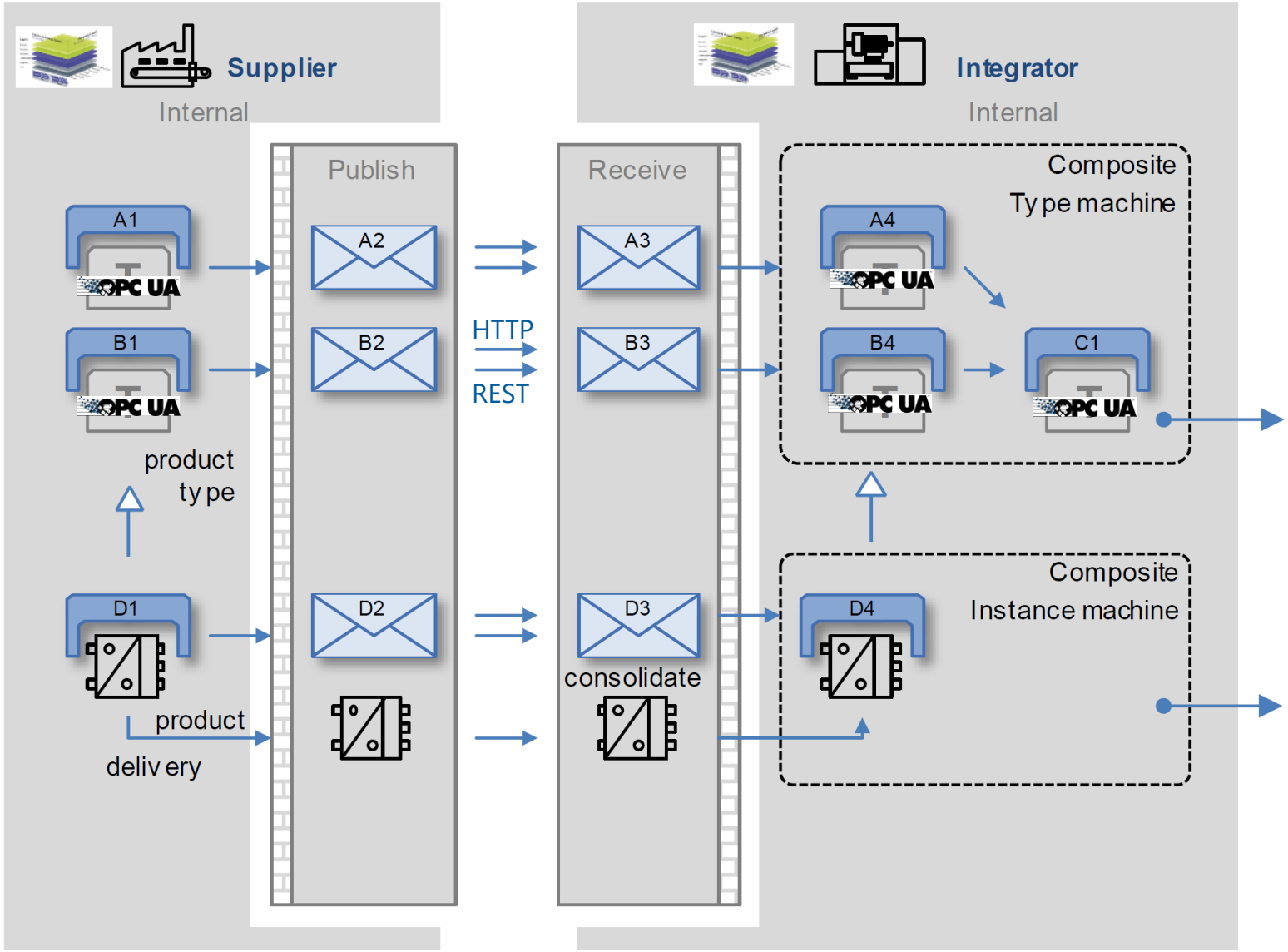
- OPC UA REST Interface
  - An OpenAPI-compatible Interface for OPC UA Servers

- Rich Ecosystem of free & professional OPC UA modelling tools
  1. CESMII's Smart Manufacturing Profile Designer
  2. Siemens OPC UA Modeling Editor (SiOME)
  3. Beckhoff TwinCAT 3 OPC UA Nodeset Editor
  4. Unified Automation UaModeler
  5. Beeond EdgeXStudio
  6. Free OPC UA Modeler
  7. ProSys OPC UA Modeler
  8. IBH OPC UA Editor
  9. OOI Address Space Model Designer (OOI ASMD)
  10. … and many more open-source projects…

IEC 63278 - Asset Administration Shell (AAS)

- Vendor-neutral **Asset Data Sharing Service**

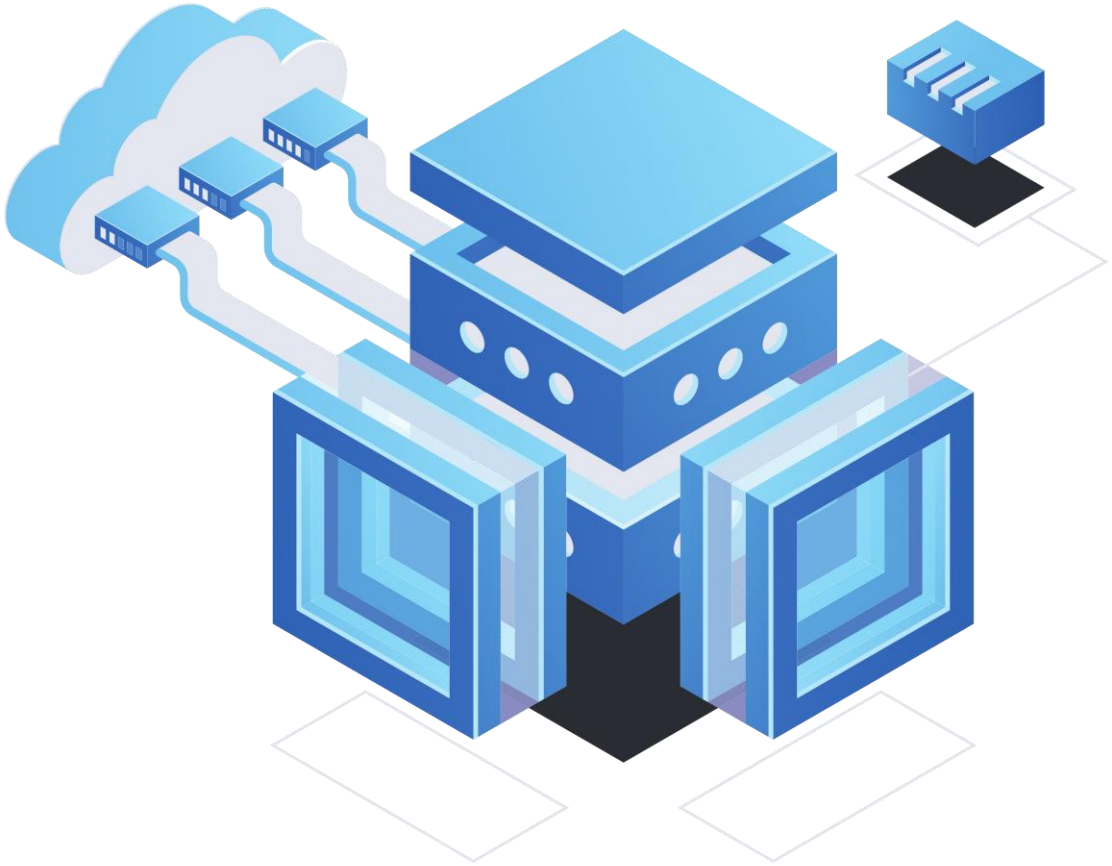
- It's a shell (container)
- Cross-Platform
- Covers full lifecycle of the Asset
- **Contains OPC UA Info Model**
- Open-Source implementation
- HTTP REST interface



Leveraging IEC Standard AAS Building Blocks for the DPP & DBP

- AAS Submodel Templates
  - Semantic descriptions for a range of asset types
  - Can be automatically converted to OPC UA nodesets
- AAS REST Interface
  - An OpenAPI-compatible interface for AAS Repositories/Registries

Dataspace Connectors



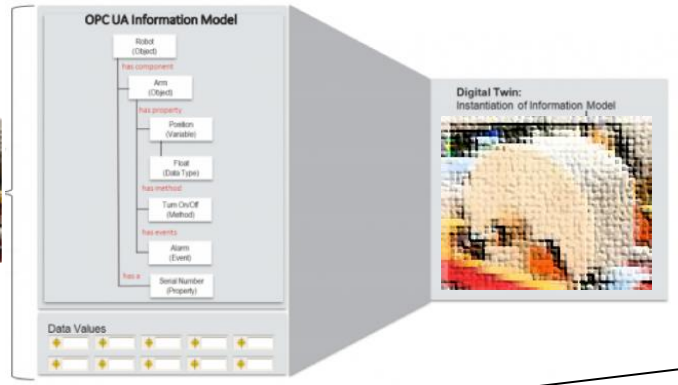
One example is the Eclipse Dataspace Connector, an **open-source framework** hosted by the Eclipse Foundation for building **secure, globally-scalable data-sharing services**. EDC provides highly customizable components for creating control planes, decentralized identity systems, and federated data catalogs. **Backed by leading companies and cloud providers**, EDC gives developers the tools they need to deliver innovative solutions for data exchange networks. Other projects are targeting dataspace connectivity issues, e.g. Data4Industry.

Next step: Integration and testing of Dataspace Connectors.

eclipse-edc.github.io

Use Case: Combining Ecosystems – OPC UA & AAS implementing EU Digital Product Passport Together with OPCF/DTC/CESMII/Manufacturing USA

Physical Manufactured Product

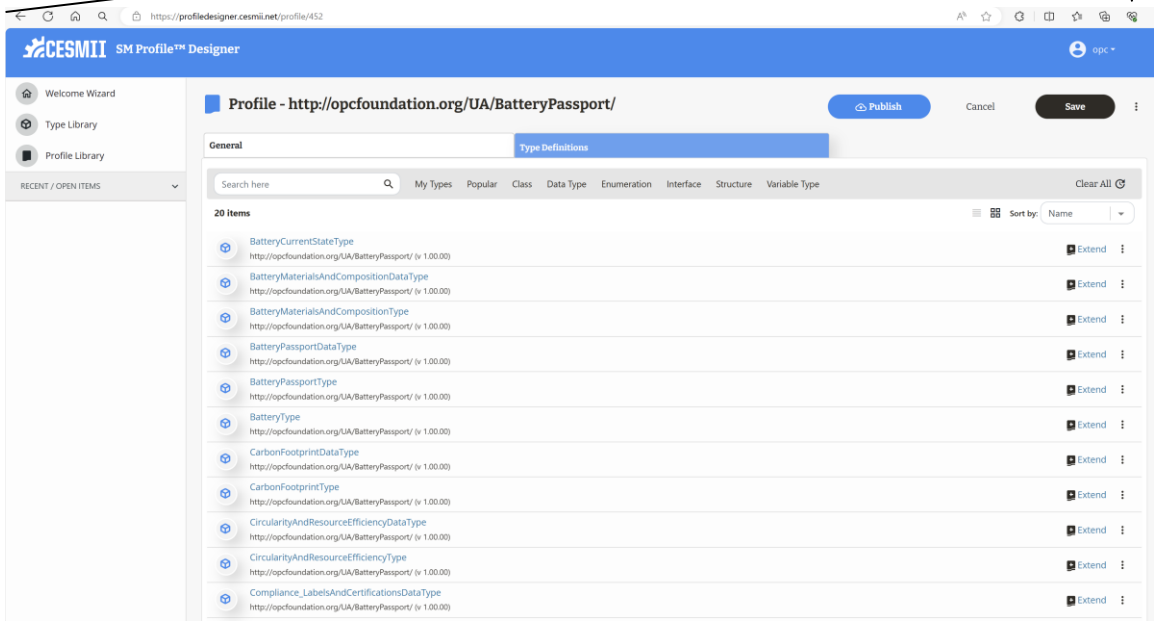


Create

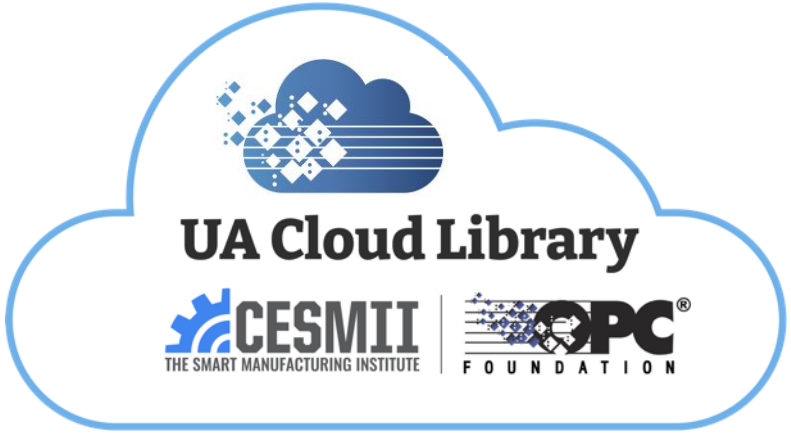
Embed

Store

AAS Repository



Load



profiledesigner.cesmii.net (free online OPC UA editor)

65/1120/NP

NEW WORK ITEM PROPOSAL (NP)

PROPOSER:	DATE OF PROPOSAL:
Secretariat	**2025-02-21**
DATE OF CIRCULATION:	**CLOSING DATE FOR VOTING:**
2025-02-28	**2025-05-23**

IEC TC 65 : INDUSTRIAL-PROCESS MEASUREMENT, CONTROL AND AUTOMATION

SECRETARIAT:	SECRETARY:
France	Mr Didier GIARRATANO
NEED FOR IEC COORDINATION:	HORIZONTAL FUNCTION(S):
SC 3D,SC 41	

ASPECTS CONCERNED:

Digital content,Information security and data privacy

TITLE OF PROPOSAL:

Industrial Automation Product Data

☒ STANDARD	☐ TECHNICAL SPECIFICATION	☐ PUBLICLY AVAILABLE SPECIFICATION

PROPOSED PROJECT NUMBER:

SCOPE
(AS DEFINED IN ISO/IEC DIRECTIVES, PART 2, 14):

The document contains Industrial Automation Product Data as information models and interfaces with defined semantics for digital use for industrial manufactured products, small and big assemblies and manufacturing systems.

It supports the entire lifecycle and supply chain. Specifically, the data covers lifecycle stages from planning, designing, producing, using, maintaining, repairing, and disposing.

Industrial Automation Product Data with standardized digital information supports industrial digital twins and circular economy, as well as carbon footprint aggregation with the relevant environmental impact factors.

The following standards are leveraged as a baseline: IEC 63283-2 Smart manufacturing - Part 2: Use cases and IEC 63278-4 Asset Administration Shell for industrial applications - Part 4: Applications of Asset Administration Shell. In addition, the IEC 62264 Enterprise-control system integration series is used to define IEC CDD properties with their semantics.

The Industrial Automation Product Data standard defines the semantic of properties in sufficient detail for the general usage e.g. for digital product passports and production systems. The standard specifies how the data are created, collected, used and maintained along the supply chain.

Clas

New Working Group in IEC TC65

TARGET DATE(S)	FOR FIRST CD: 2025-12-31	FOR PUBLICATION: 2027-12-31	
ESTIMATED NUMBER OF MEETINGS:	FREQUENCY OF MEETINGS:	DATE OF FIRST MEETING:	PLACE OF FIRST MEETING:
40	20 per year	2025-06-18	web

RELEVANT DOCUMENTS TO BE CONSIDERED:

IEC 61360 Common data dictionary

IEC 63278-1 Asset Administration Shell for industrial applications - Part 1: Asset Administration Shell structure

IEC 62541-5 OPC Unified Architecture - Part 5: Information Model

IEC 62541-6 OPC Unified Architecture - Part 6: Mapping

IEC 62541-14 OPC Unified Architecture - Part 14: PubSub

RELATION TO AND IMPACT ON EXISTING WORK:

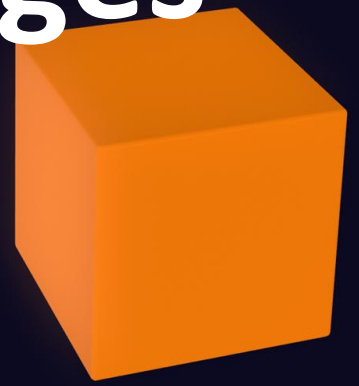
Standards for the DPP developed in CEN/CLC/JTC 24.

Schedule | Day 1

Upcoming	
15:00 – 17:00	Partner Presentations from Aruba and Opiquad
19:30	Dinner at Duo Milan Bistro


opiquad
R-INNOVAZIONE DIGITALE

Challenges



- The need for **cloud infrastructure (more pervasive and widespread)** is growing.
- **The technology gap between large and local cloud service providers (CSPs) is widening.**
- **Local providers are steadily losing market share (and expertise).**
- **Market's need for edge and tailor made solutions.**

Opportunities

A Different Approach: open, distributed and federated.

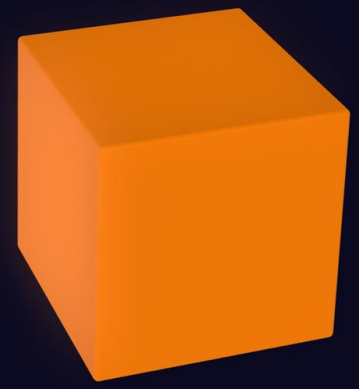
Allow local CSPs to exploit EDGE customer vicinity.

Foster the development of open source solutions.

Wide geographic distribution (e.g. Edge infrastructures).

Integration between large and small CSPs.

A new federated technological paradigm



ICX & CEM

INTERCLOUD EXCHANGE FOUNDATION

- Adoption of the main models of verifiable credentials existing in the European landscape.
- Technological Consensus Room on orchestration and federation systems.
- Development of an override system to create the so-called "Cloud Continuum".
- Training for businesses and people through a collaboration with educational institutions in the field of «cloud continuum technologies» according to the principles of the European Declaration on Digital Rights and Principles

CEM COMPUTING EXCHANGE MARKET

- The "Cloud continuum exchange» marketplace.
- A place where operators share resources for a Wholesale Only market.
- Interconnection and Interoperability between IaaS, PaaS and SaaS guaranteed through integrated Agents.

Core

Fulcrum Core is an Open Source software integrated into one **Core Gateway** that CSPs can connect to based on their technological choices.

ICX develops the code and acts as a public open co-repository, with **CISPE**, for the Fulcrum Core.

With time more technologies will be integrated and any proposal will be tested in the **Fulcrum Framework** with the collaboration of the **CEM** and the Foundation's technical committee.

The Fulcrum Core has been released with Apache 2.0 Licensing.

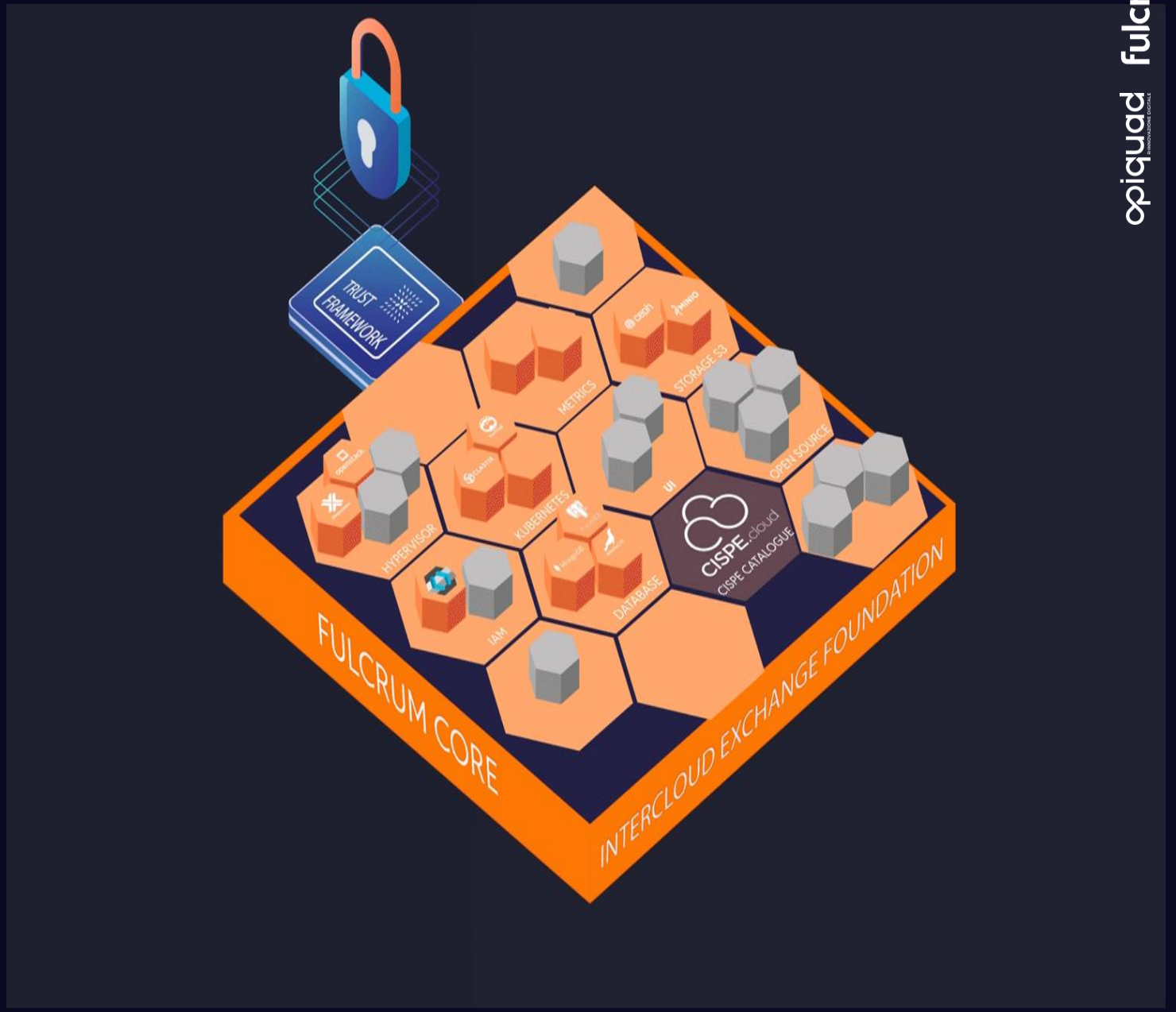
Framework

CEM is the enabler of the Fulcrum Framework.

This is where CSPs, MSPs, ISPs, IXPs and carriers will exchange networking resources, computing capacity and services with each other.

CEM will provide an onboarding system, observability, metering, APIs and billing for the resources and services exchange between Service Providers.

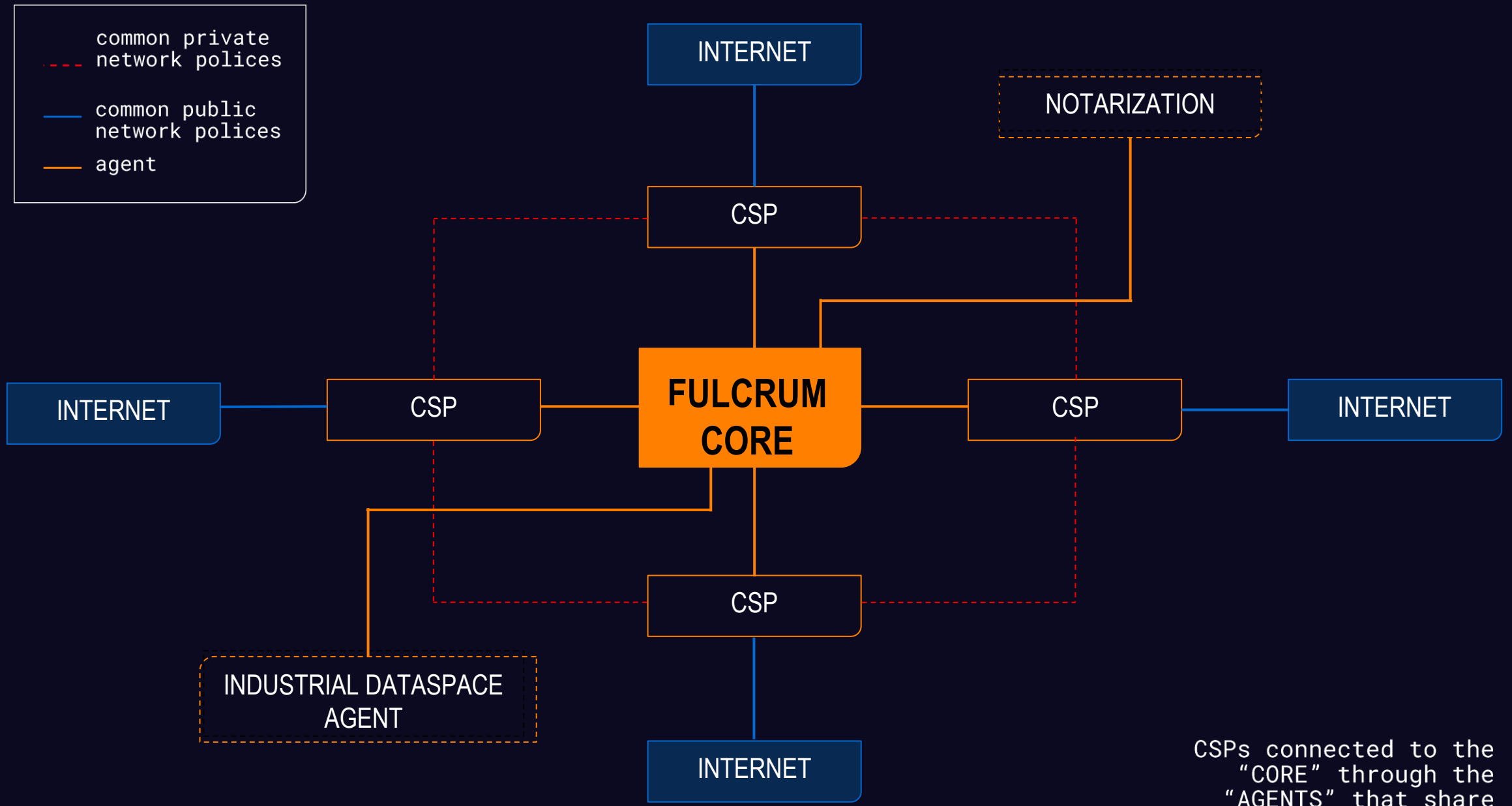
CEM will test all open source platforms requested by the ICX to verify capabilities, networking behavior, security and interoperability and provide the foundation's technical committee with the results for further evaluations.



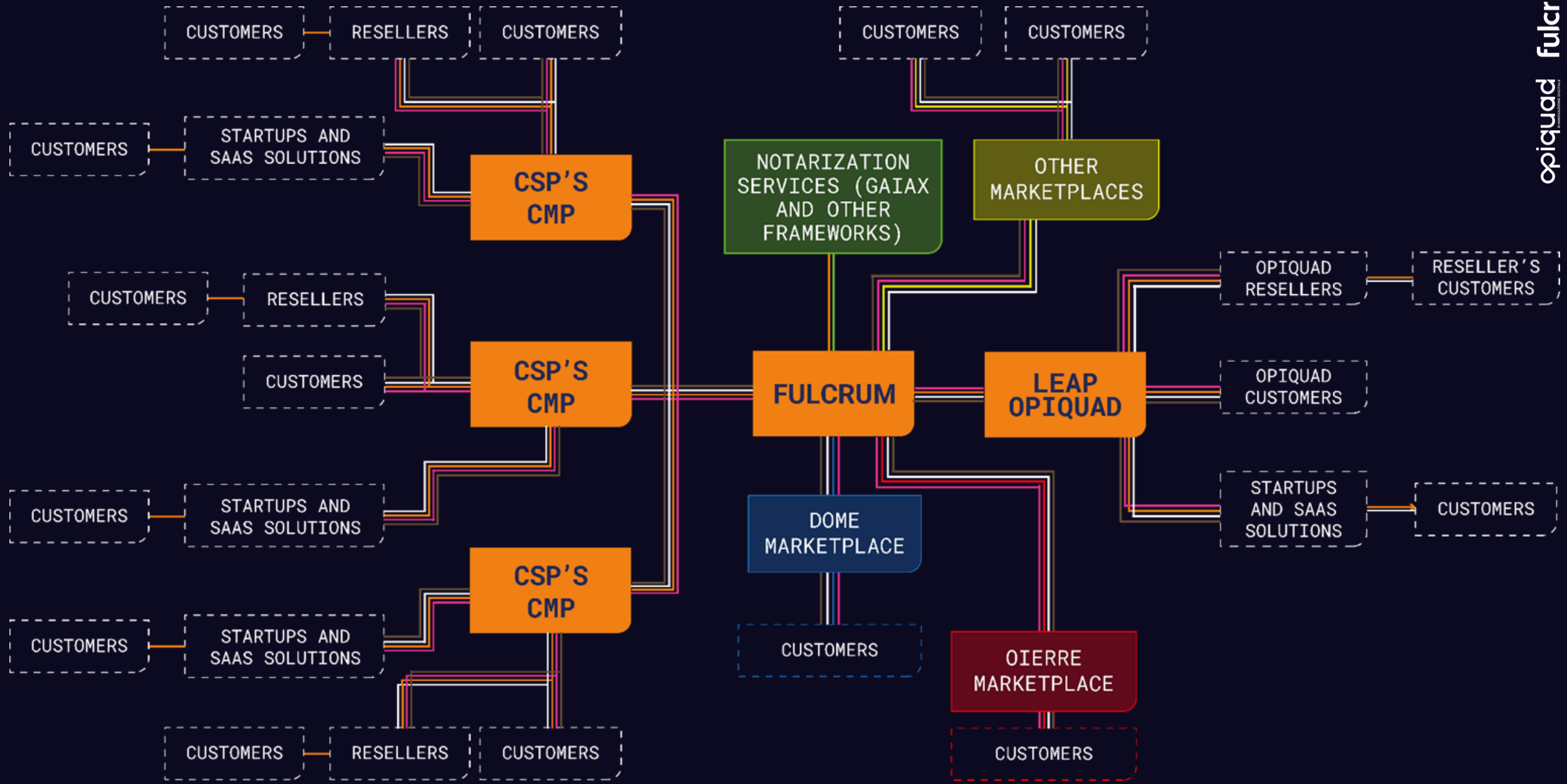
Ecosystem

The Fulcrum Digital Ecosystem is comprised of all marketplaces, applications and CMPs that are enabled by the Fulcrum Core and Framework

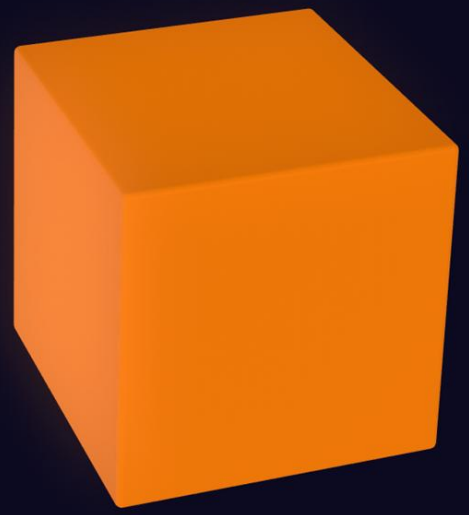
A new federated channel distribution paradigm



CSPs connected to the "CORE" through the "AGENTS" that share the FULCRUM FRAMEWORK



Thank you!



fulcrumproject.org

fulcrum

opiquad fulcrum

Agenda | Day 2

Day 2, June 5	
10:00 – 10:10	Day 1 Recap and Day 2 Objectives – Babak Jahromi
10:10 – 13:00	Technical Deep Dive (Break halfway) – Jim Marino, Erich Barnstedt, Paul Latzelsperger, Paul Yao
13:00 – 14:00	Lunch
14:00 – 15:00	Project Deliverables/commitments and timelines – Jim Marino, Erich Barnstedt
15:00 – 15:30	Partner asks and Wrap up – Babak Jahromi

Eclipse Dataspace Connector

A live demo using AAS and OPC UA

Technical Deep Dive – Profile Designer & NodeSets
powered by AAS, C-Labs, CESMII & OPC UA

What is CESMII?

- Collaborative (*)
- Ecosystems for
- Smart
- Manufacturing
- Innovation
- Institute

- US Department of Energy funded
- Situated on Campus of University of California, Los Angeles (UCLA)
- https://www.cesmii.org/

(*) Previously:
Clean Energy Smart Manufacturing Innovation Institute

CESMII Profile Designer

- Open Source Project
  - Created by CESMII
  - Donated to OPC Foundation

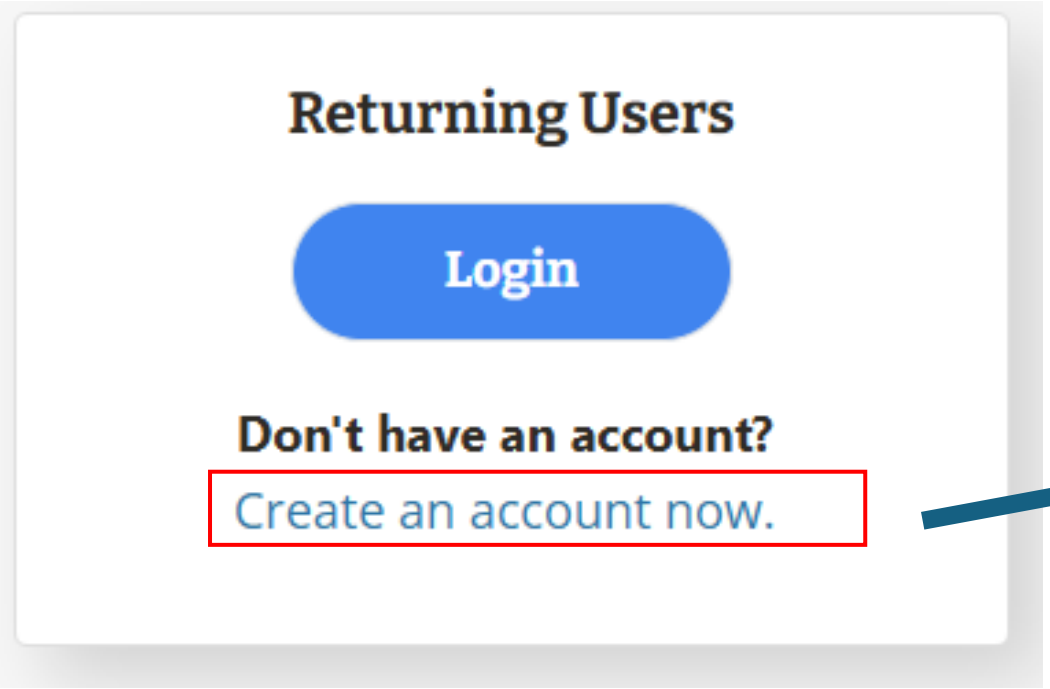
- OPC / UA NodeSets (a.k.a. CESMII “Profiles”)
  - Create
  - Edit
  - Upload
  - Download

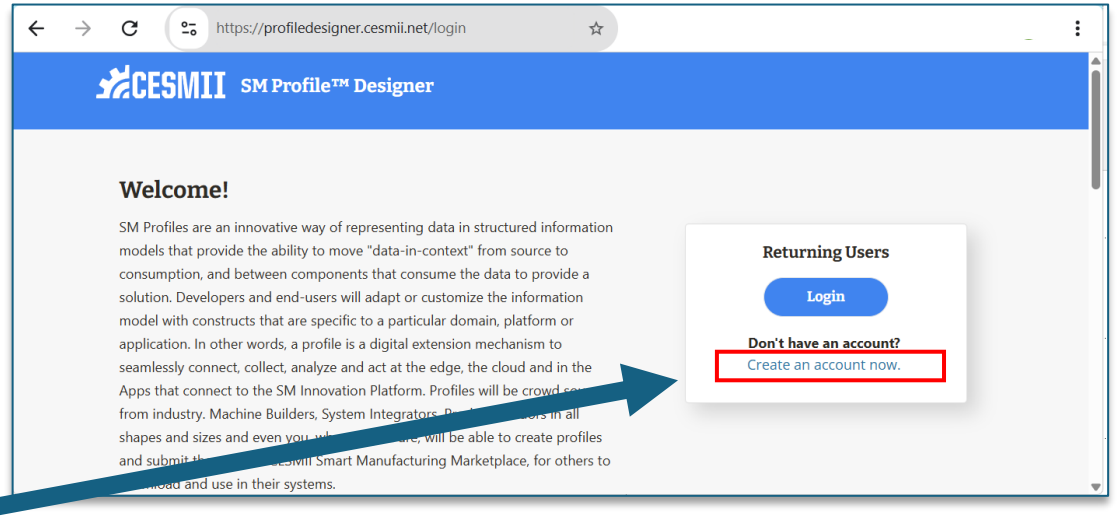
- Access “Cloud-Library” (OPC UA reference NodeSets)

- https://profiledesigner.cesmii.net

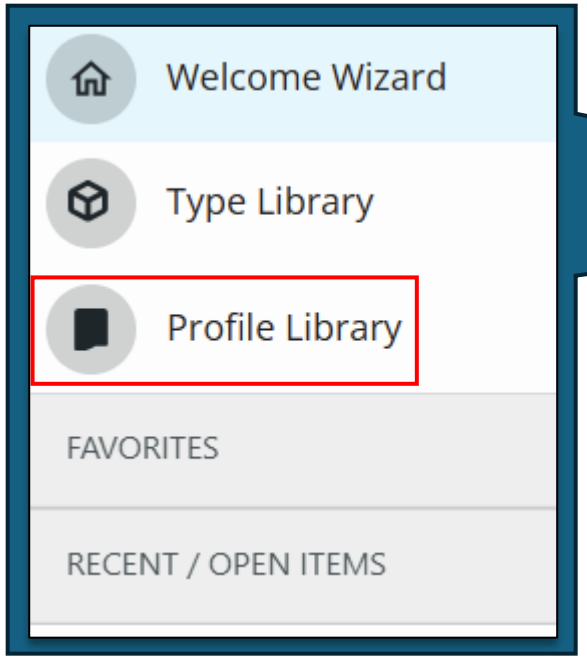
CESMII Profile Designer

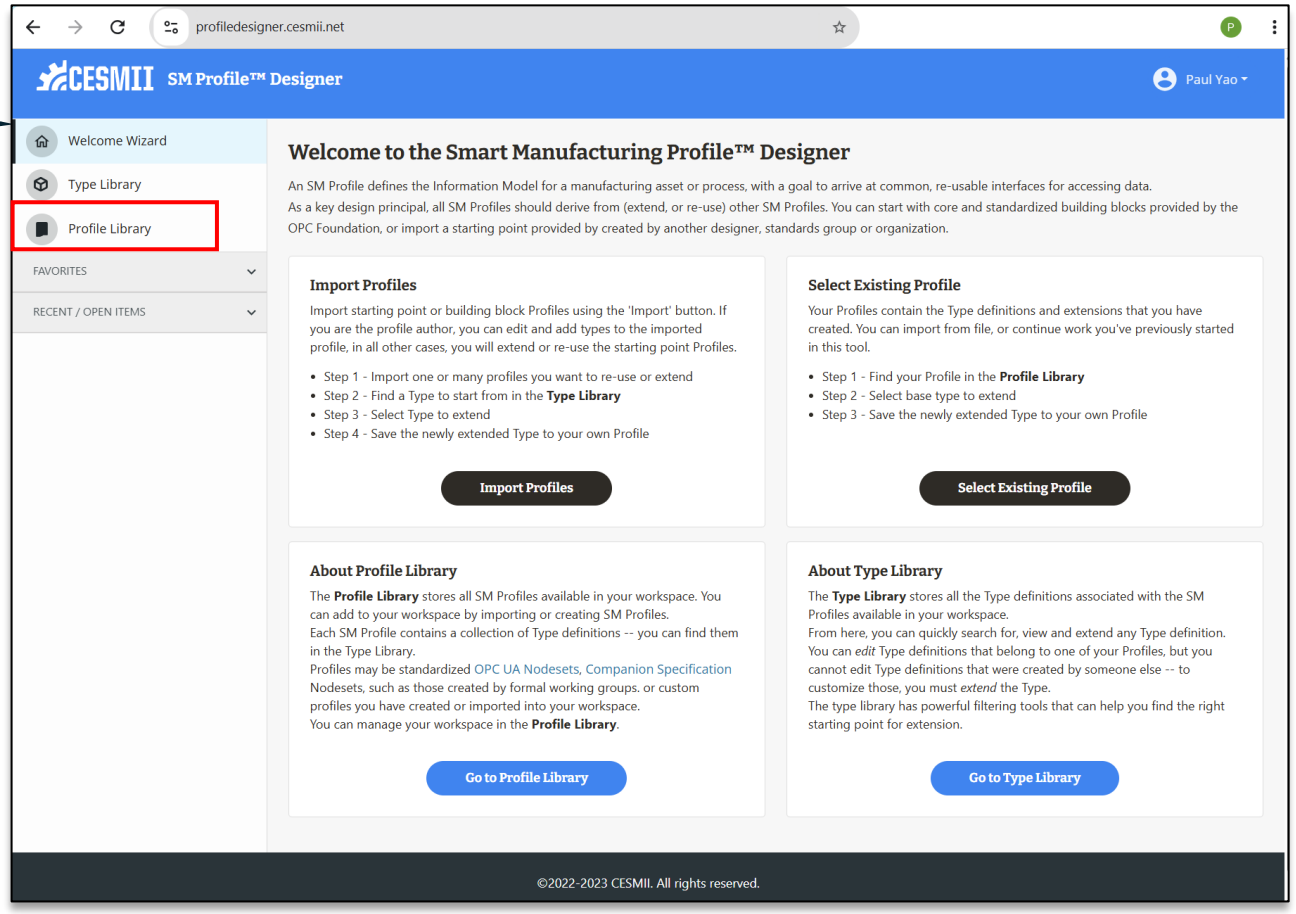
- To do
  - Navigate to https://profiledesigner.cesmii.net
  - Create a free account





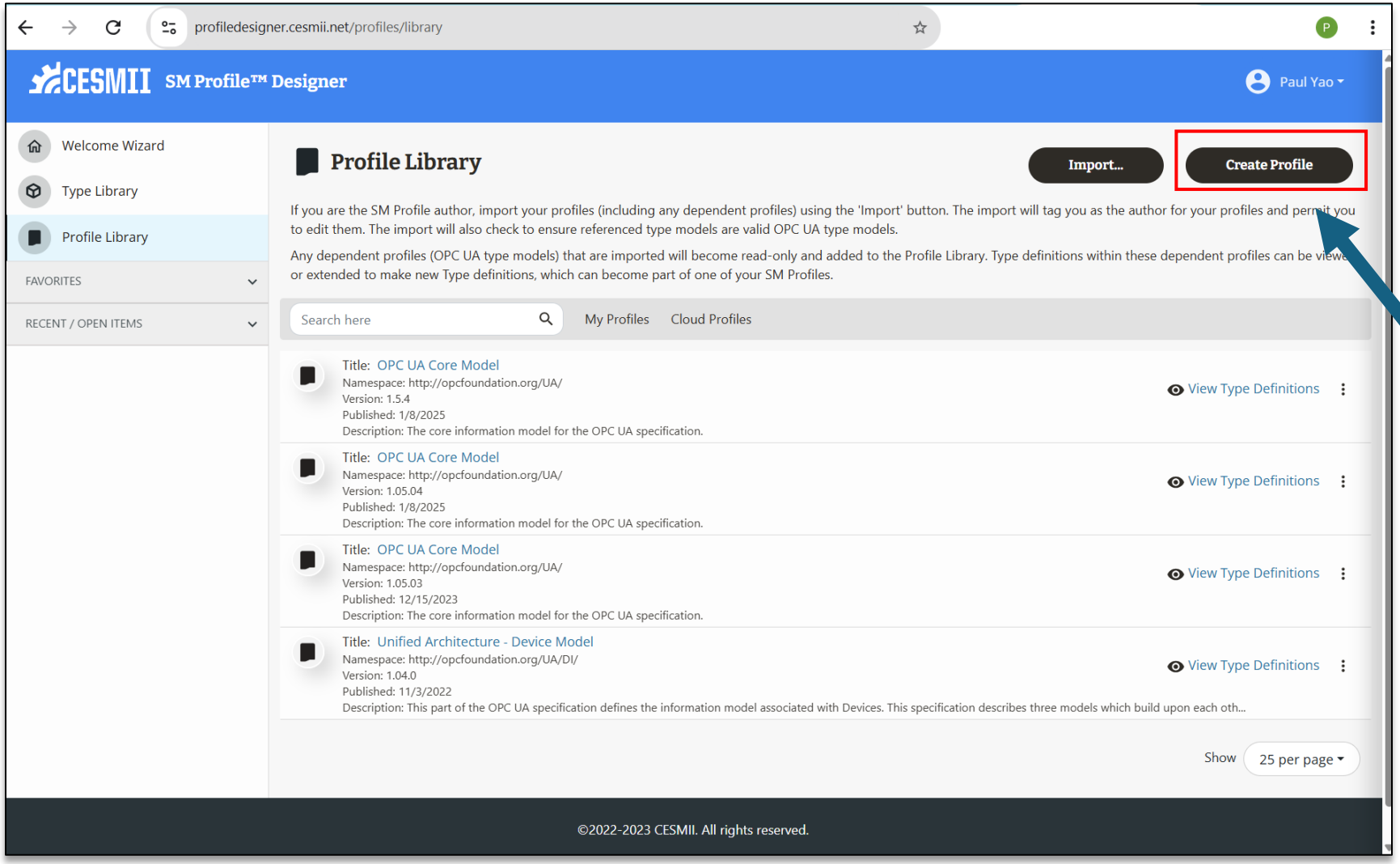
CESMII Profile Designer



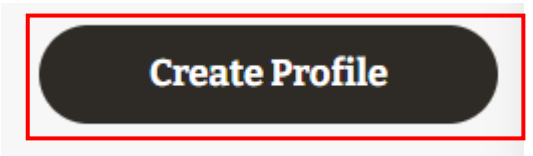


- To Do:
  - Login
  - Open Profile Library

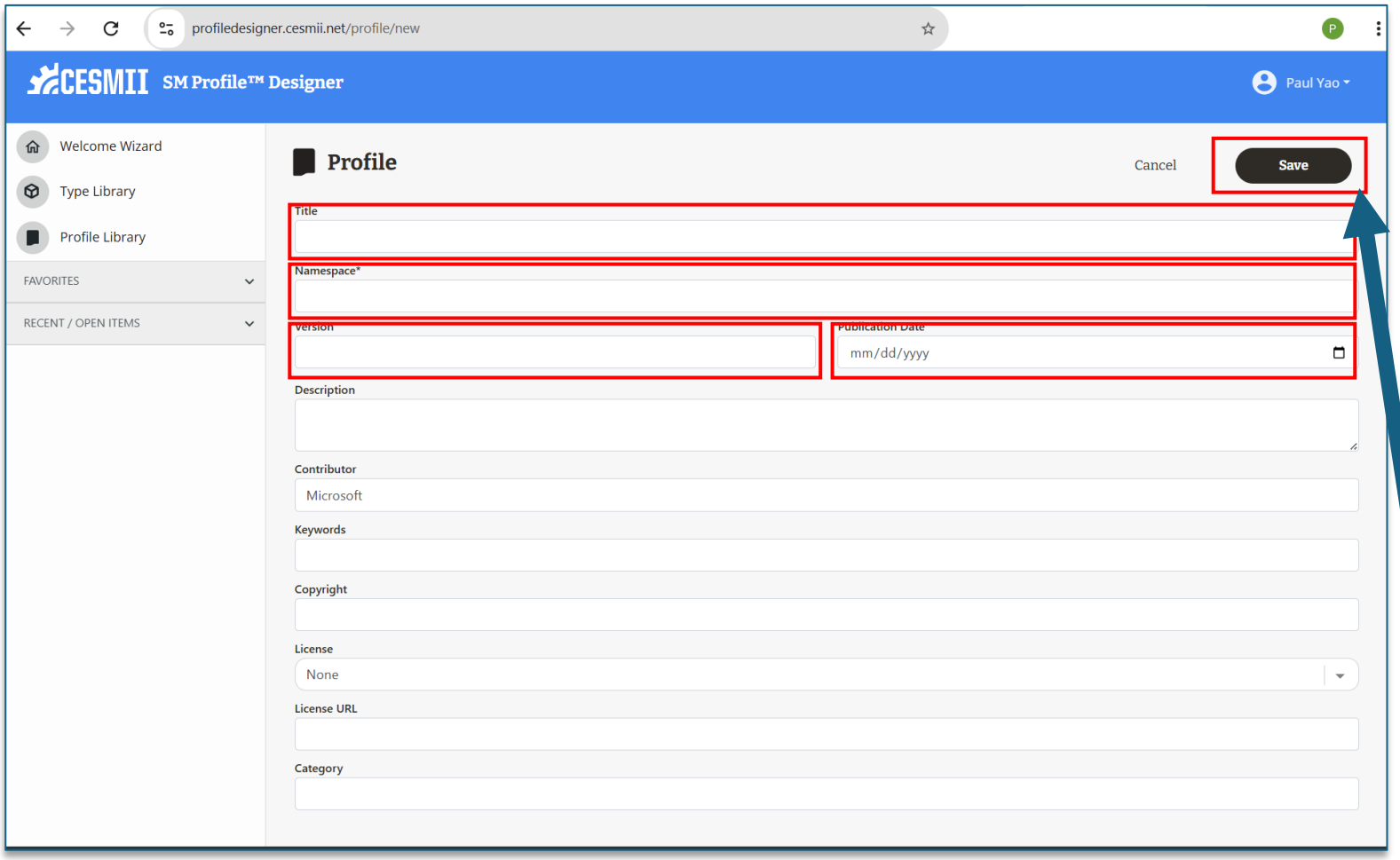
CESMII Profile Designer



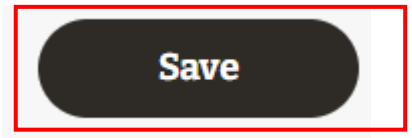
- To Do:
  - Create a profile.



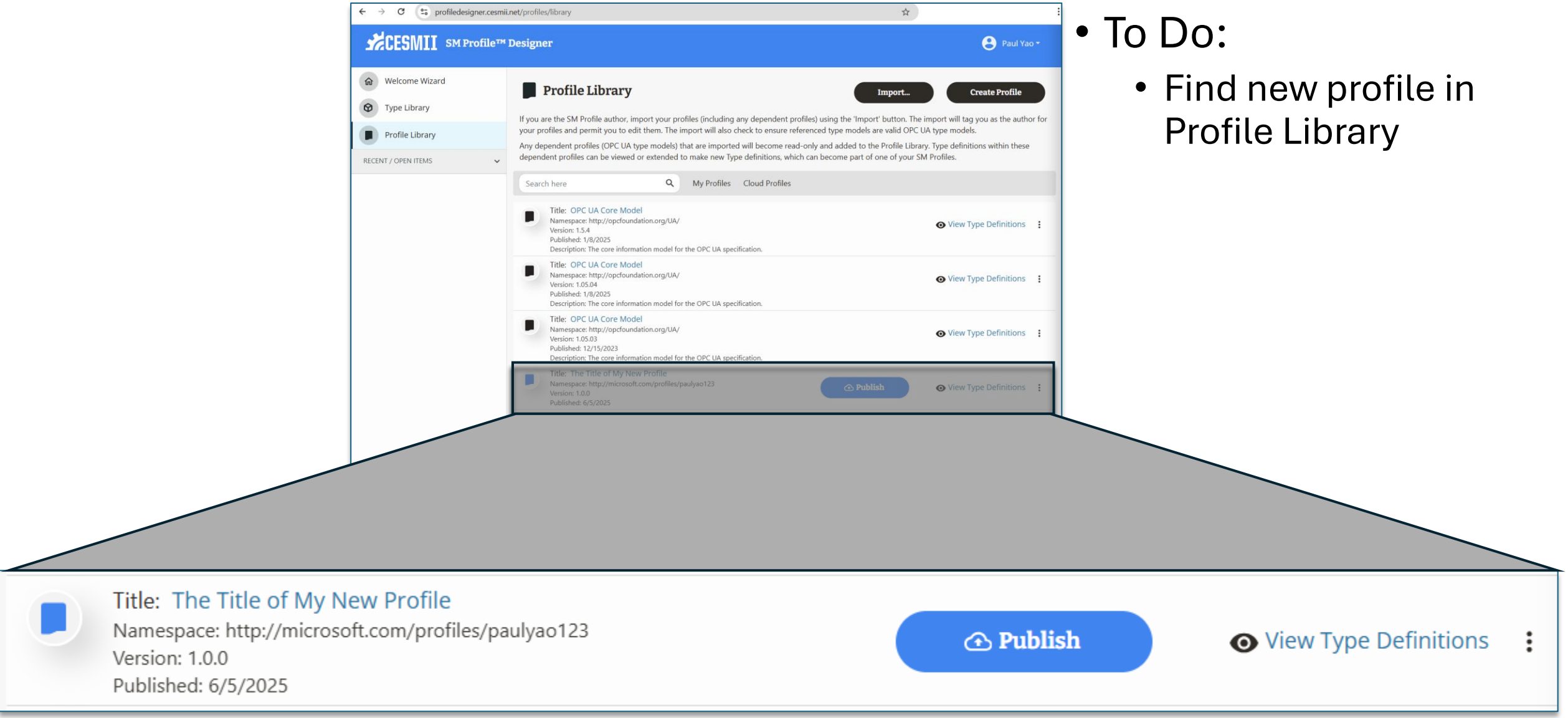
CESMII Profile Designer



- To Do:
  - Enter friendly name (Title).
- Fill required fields:
  - Namespace (Url)
    - http://www.1.com
  - Version:
    - xx.xx.xx
  - Pub Date:
    - June 1, 2025
- Save



CESMII Profile Designer



- To Do:
  - Find new profile in Profile Library

CESMII Profile Designer – NodeSet Identifier

- Namespace:
  - Unique identifier for a NodeSet (“Profile”).
- Version:
  - <Maj>.<Min>.<Rev>
- Publication Date

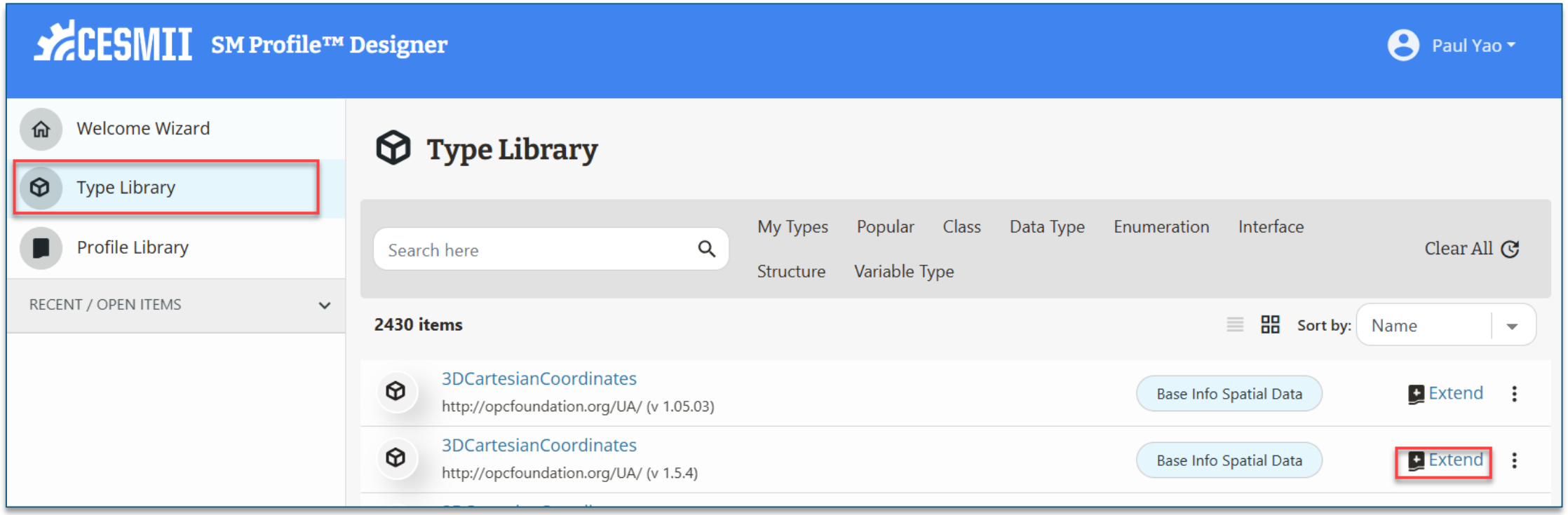
Namespace	Version	Pub Date	Notes
http://opcfoundation.org/UA	1.05.04	1/8/2025	Core Model
http://opcfoundation.org/UA/DI	1.04.0	11/3/2022	Device Model
http://microsoft.com/profiles/paulyao123	1.0.0	6/5/2025	My own profile

CESMII Profile Designer – Adding Items

- In Type Library, find similar existing type
- Click Extend
  - Create new name
  - Add new attributes
  - Edit existing attributes
- Add to your profile
  - Select profile
  - Save

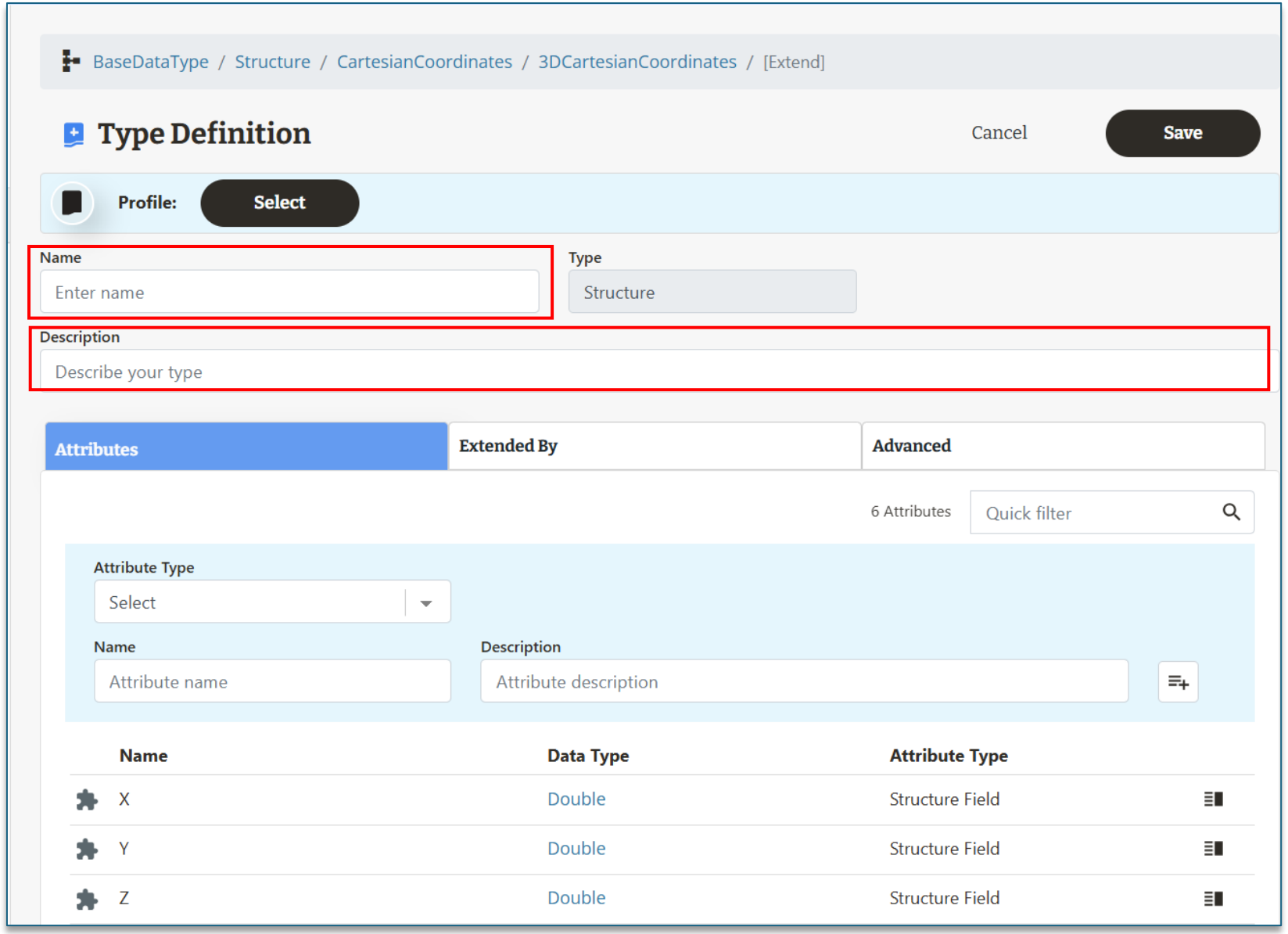
CESMII Profile Designer – Adding Items

- To Do
  - Select Type Library
  - Find similar existing item
  - Click **+Extend**



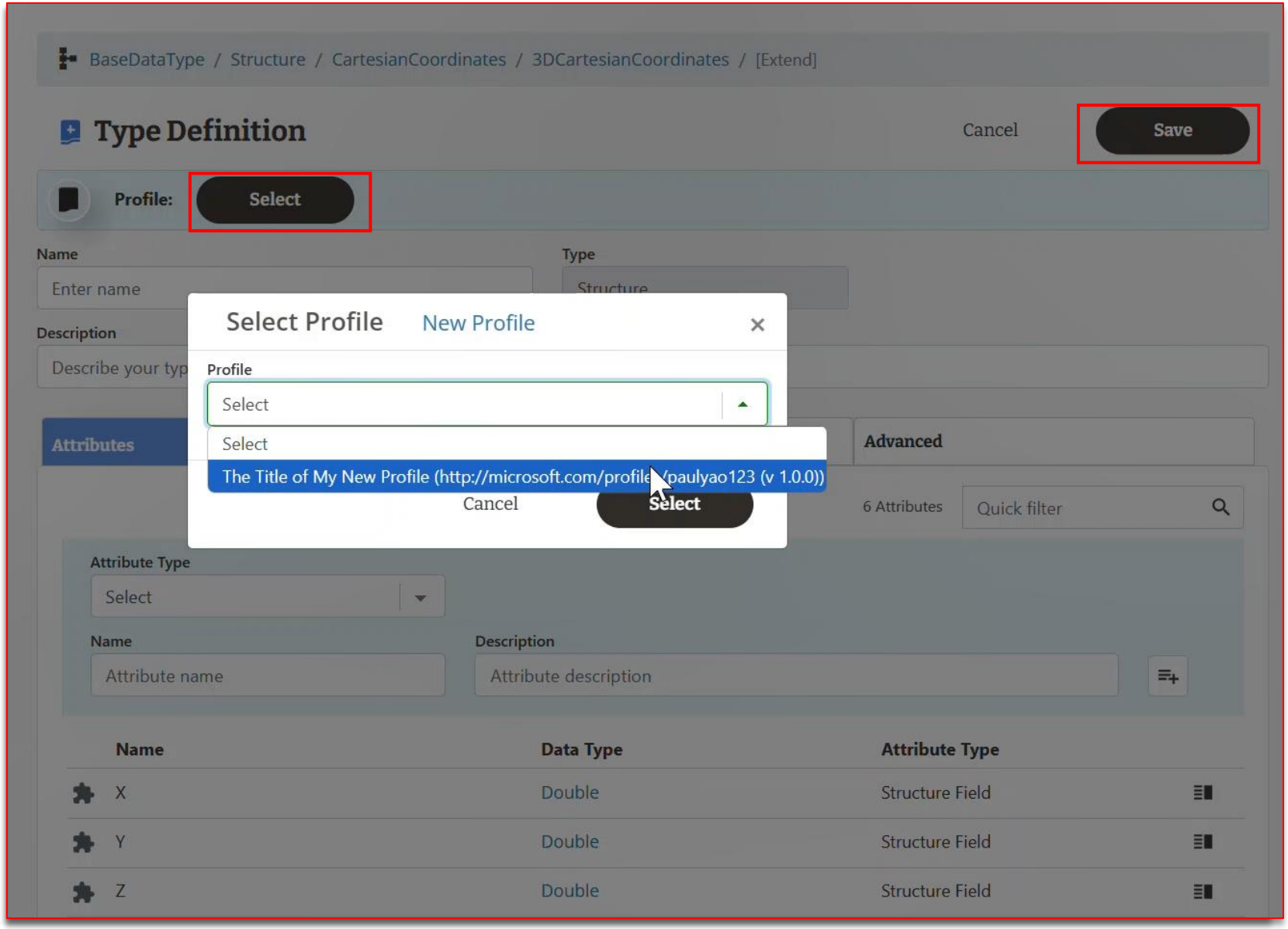
CESMII Profile Designer – Adding Items

- To Do
  - Enter name
  - Enter description
  - Select profile
  - Save

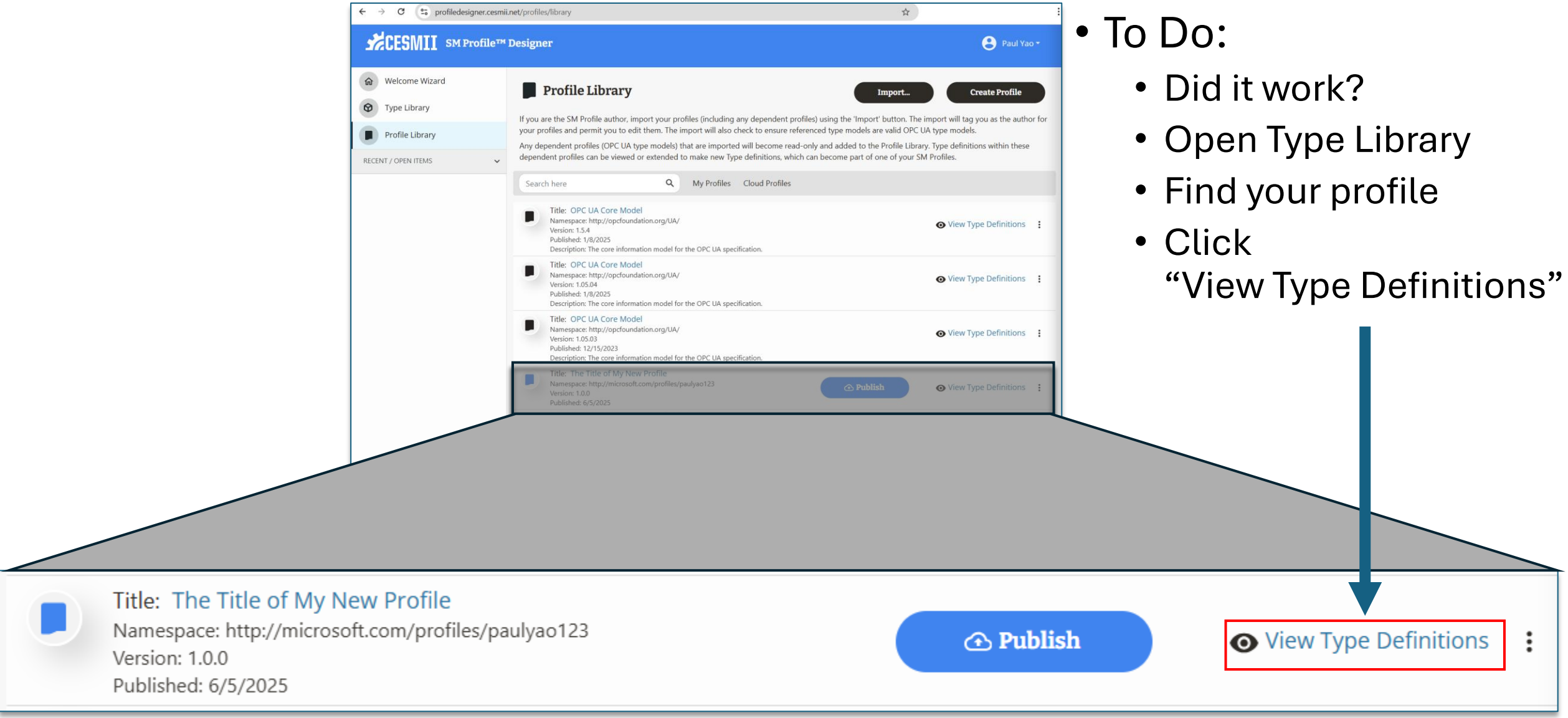


CESMII Profile Designer – Adding Items

- To Do
  - Enter name
  - Enter description
  - Select profile
  - Save



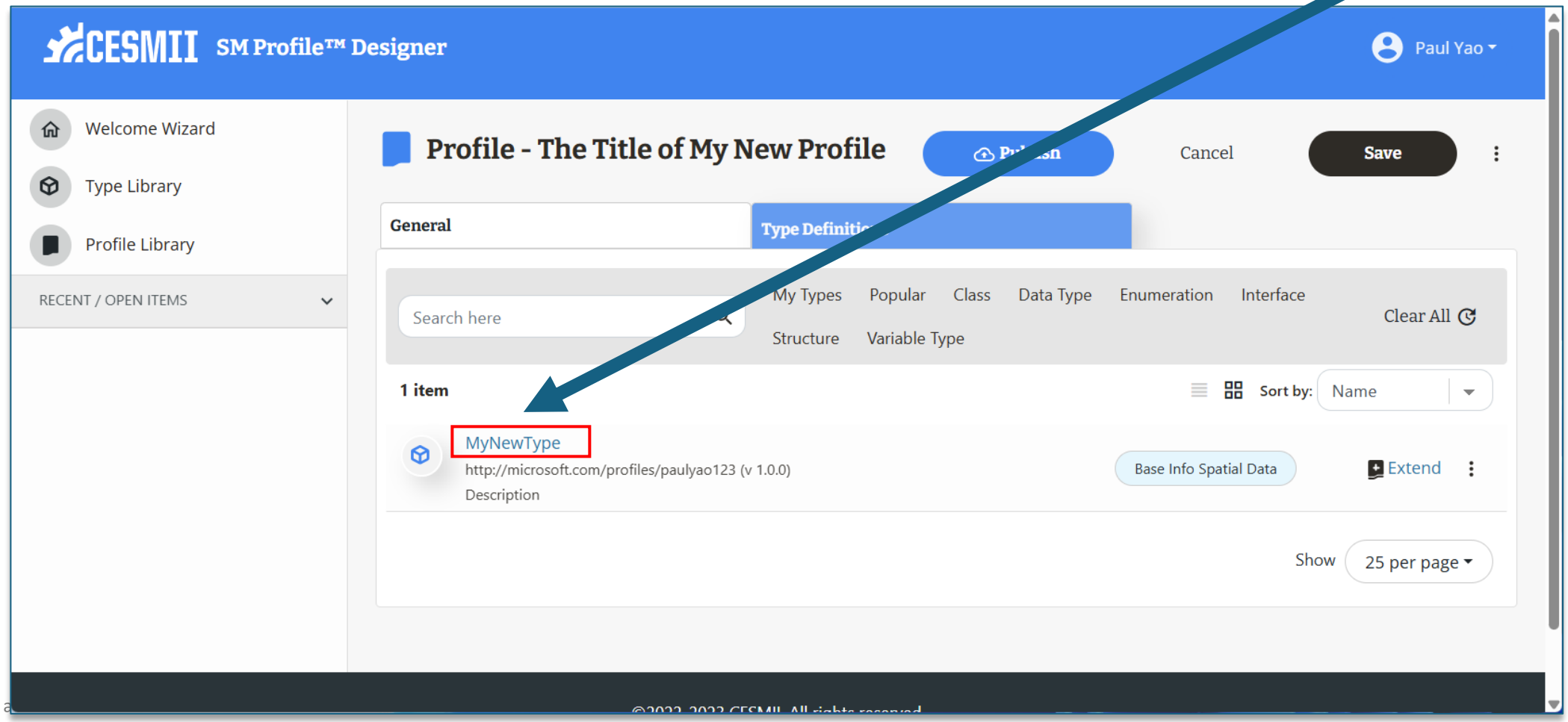
CESMII Profile Designer



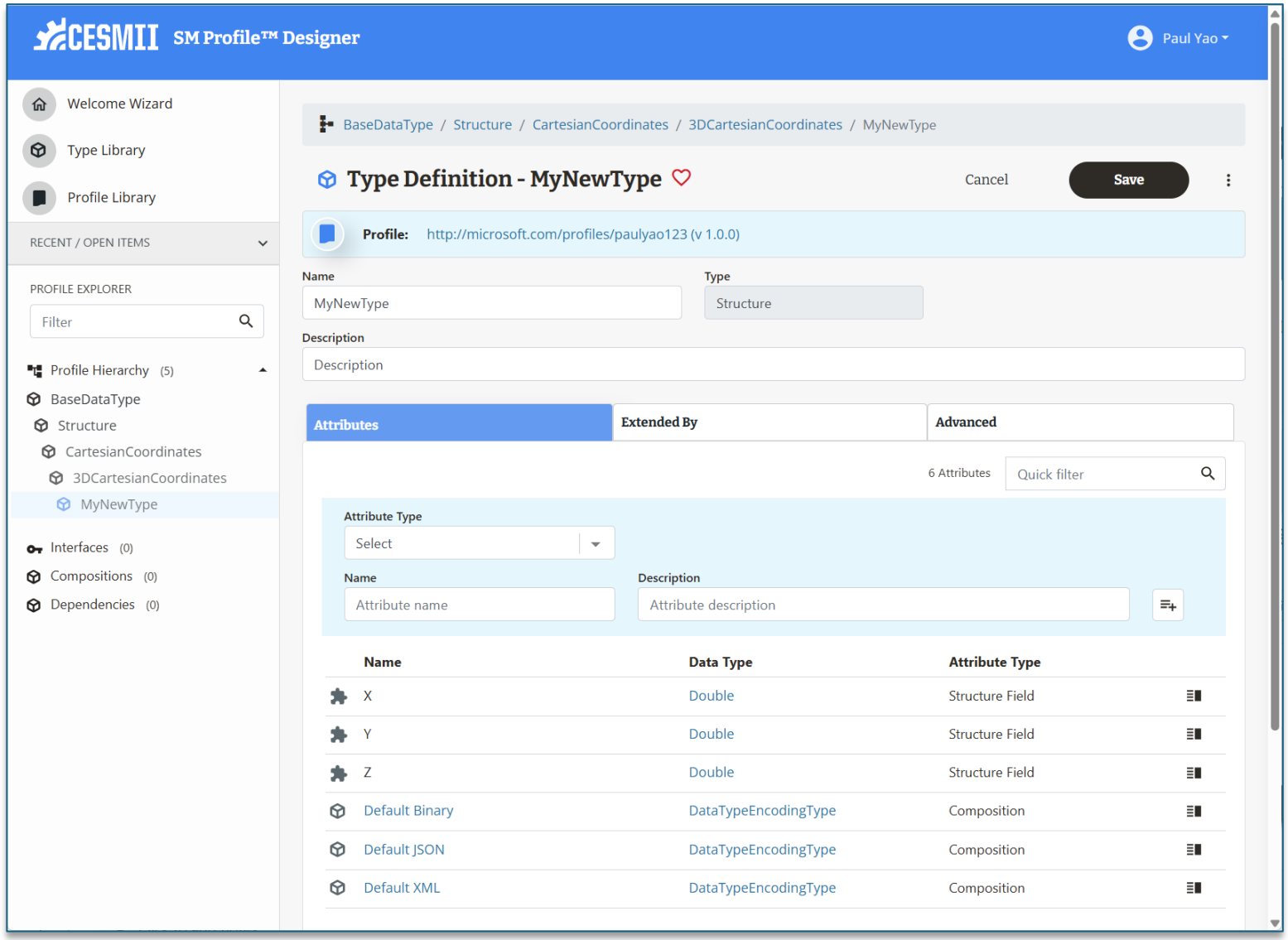
- To Do:
  - Did it work?
  - Open Type Library
  - Find your profile
  - Click “View Type Definitions”

CESMII Profile Designer – View Type Definitions

- To Do:
  - Click type name

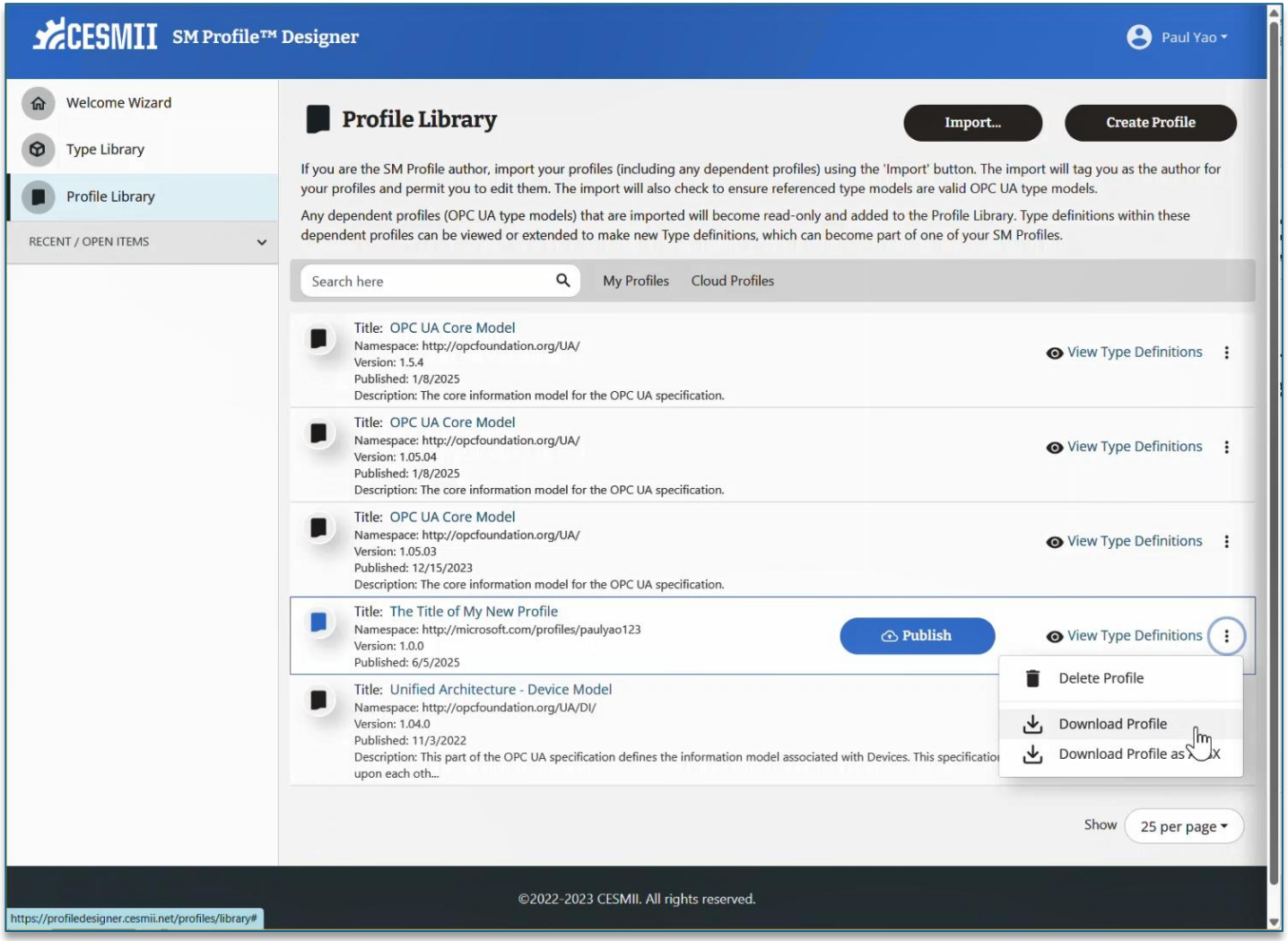


CESMII Profile Designer – View Type Definitions



- To Do:
  - View types
  - Add items
  - Delete items
  - Edit items

CESMII Profile Designer – Viewing NodeSet File



- To Do:
  - Open Profile Library
  - Locate Profile (NodeSet)
  - Click ⋮ for item menu
  - On menu, select “Download Profile”
  - Enter download file name

CESMII Profile Designer – Viewing NodeSet File

- To Do:
  - Open download file

```
<?xml version="1.0" encoding="utf-8"?>
<UANodeSet xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
           LastModified="2025-06-05T05:28:00.520612Z" xmlns="http://opcfoundation.org/UA/2011/03/UANodeSet.xsd">
  <NamespaceUris>
    <Uri>http://microsoft.com/profiles/paulyao123</Uri>
  </NamespaceUris>
  <Models>
    <Model ModelUri="http://microsoft.com/profiles/paulyao123" Version="1.0.0" PublicationDate="2025-06-05T00:00:00Z">
      <RequiredModel ModelUri="http://opcfoundation.org/UA/" Version="1.5.4" PublicationDate="2025-01-08T00:00:00Z" />
    </Model>
  </Models>
  <Aliases>
    <Alias Alias="3DCartesianCoordinates">i=18810</Alias>
    <Alias Alias="HasSubtype">i=45</Alias>
  </Aliases>
  <UADataType NodeId="ns=1;g=c437115d-b6bf-4549-8072-35b117e1f047" BrowseName="1:MyNewType">
    <DisplayName>MyNewType</DisplayName>
    <Description>Description</Description>
    <Category>Base Info Spatial Data</Category>
    <References>
      <Reference ReferenceType="HasSubtype" IsForward="false">3DCartesianCoordinates</Reference>
    </References>
  </UADataType>
</UANodeSet>
```

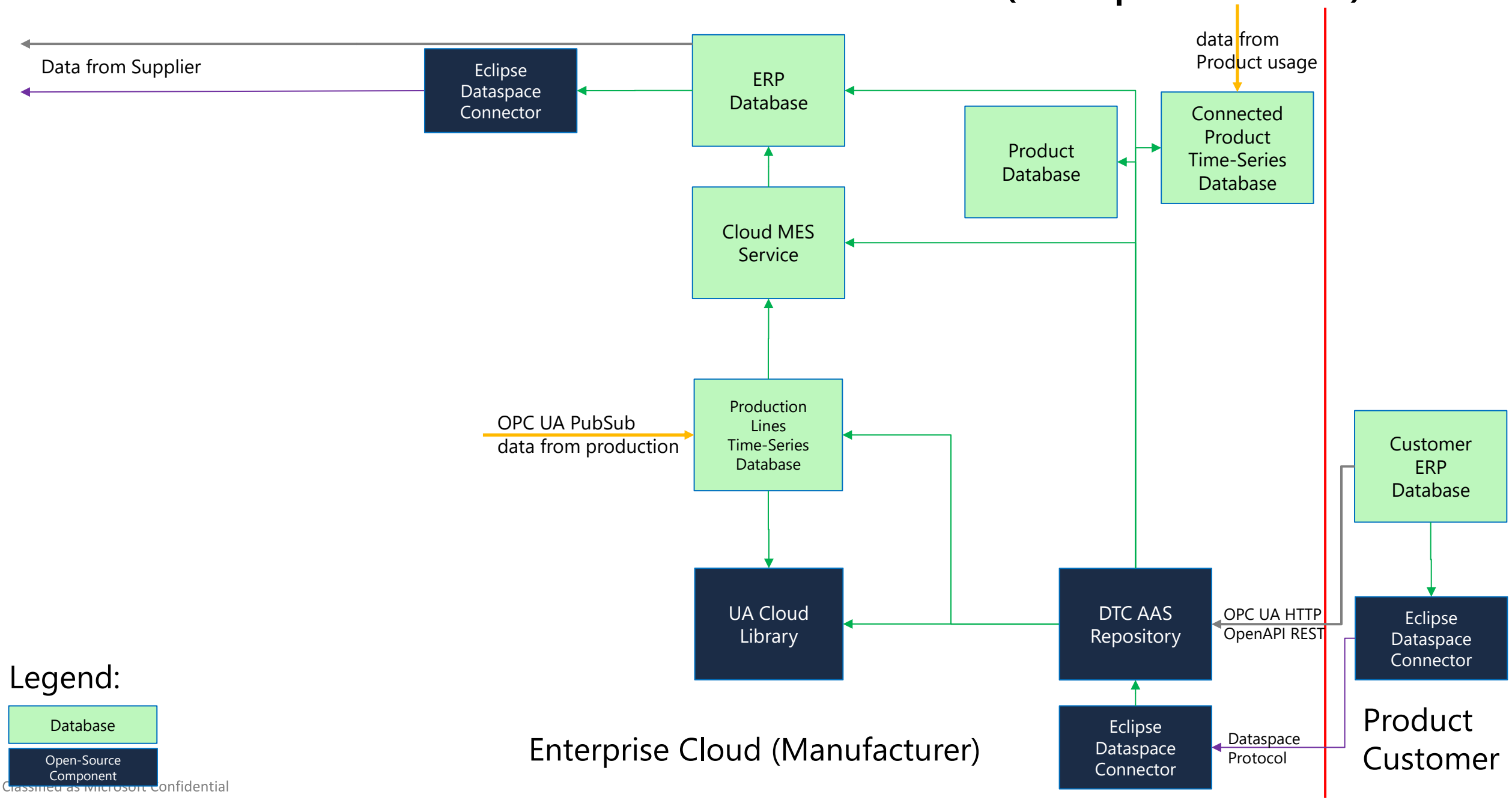
IT and OT

Common Goals:

- Managing people & technology
- Maximize output
- Minimize disruptions

- Information Technology (IT)
  - Knowledge workers
  - Computers
  - Output = documents, reports, spreadsheets
  - Disruptions = new user, lost passwords, request backlog
- Operations Technology (OT)
  - Knowledge workers + Factory workers
  - Computers + production line equipment
  - Output = documents, reports, spreadsheets + manufactured items / raw materials / production waste
  - Disruptions = (IT disruptions) + human safety + unscheduled downtime + input shortage + output storage
- OT Example:
  - Manufacturing Bottled Water: https://www.youtube.com/watch?v=BI0TbsISb4k

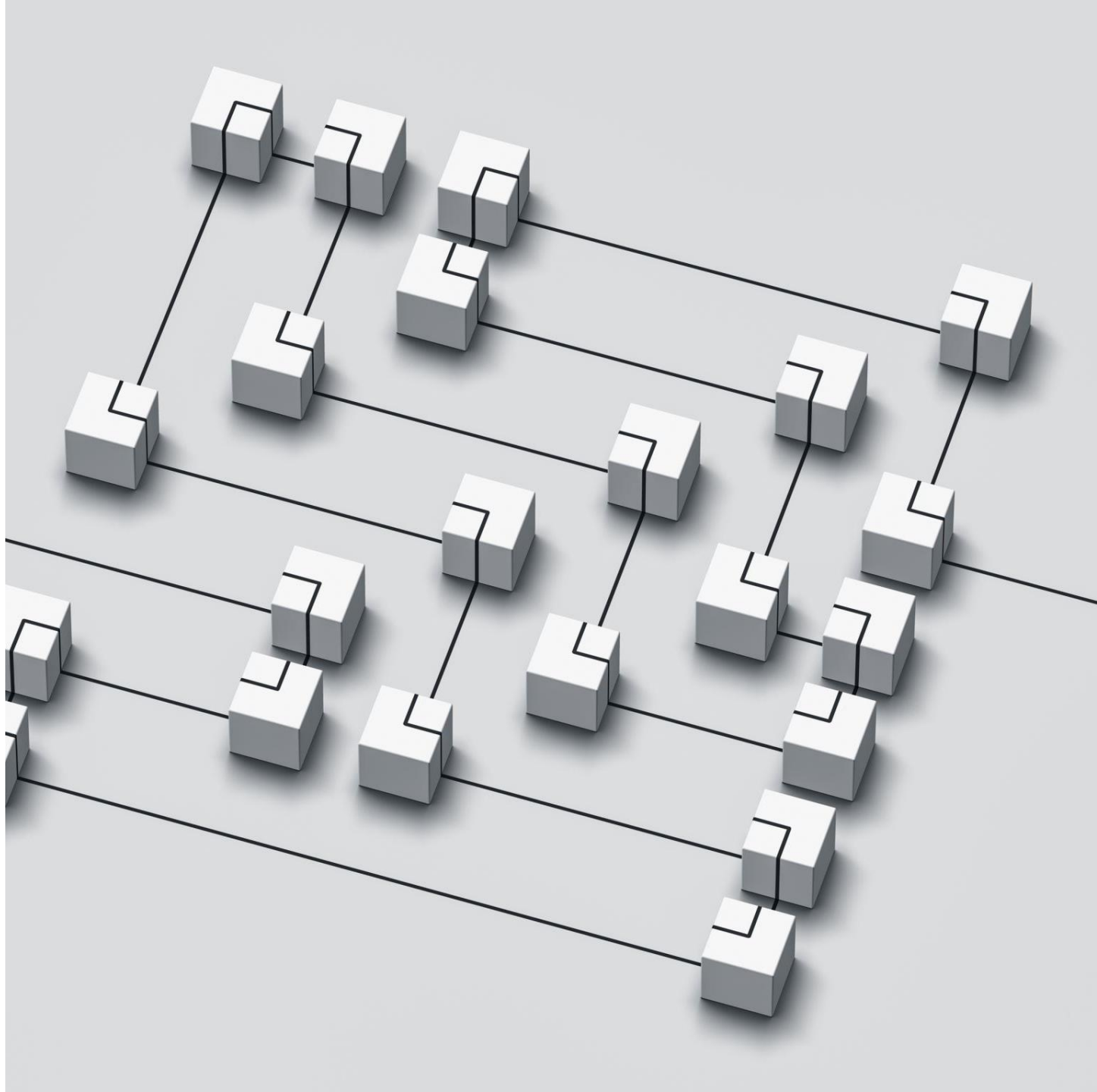
OPC Foundation Cloud Initiative Reference Architecture (Dataspace-relevant)



“Putting it all together” demo:

A sample EDC application sharing industrial data in Asset Administration Shell format

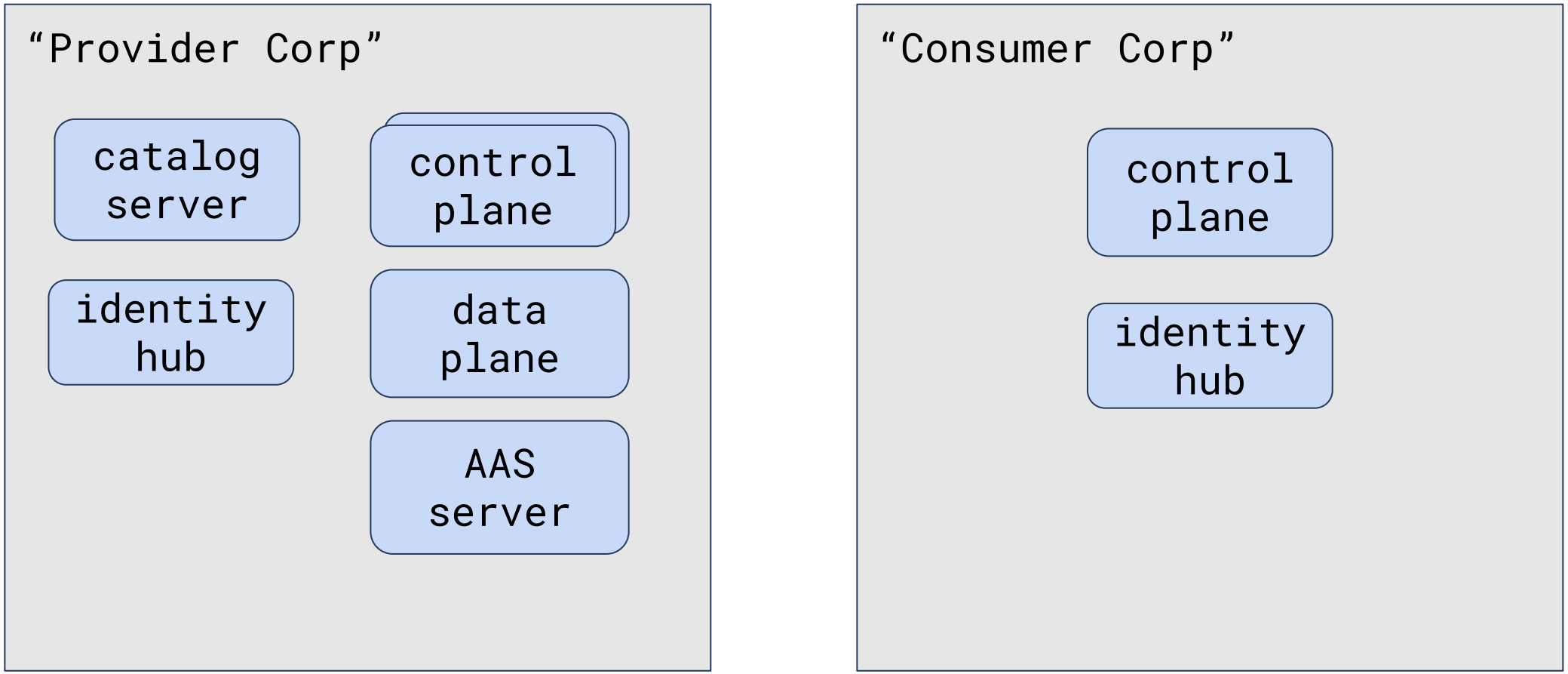
Paul Latzelsperger
Metaform

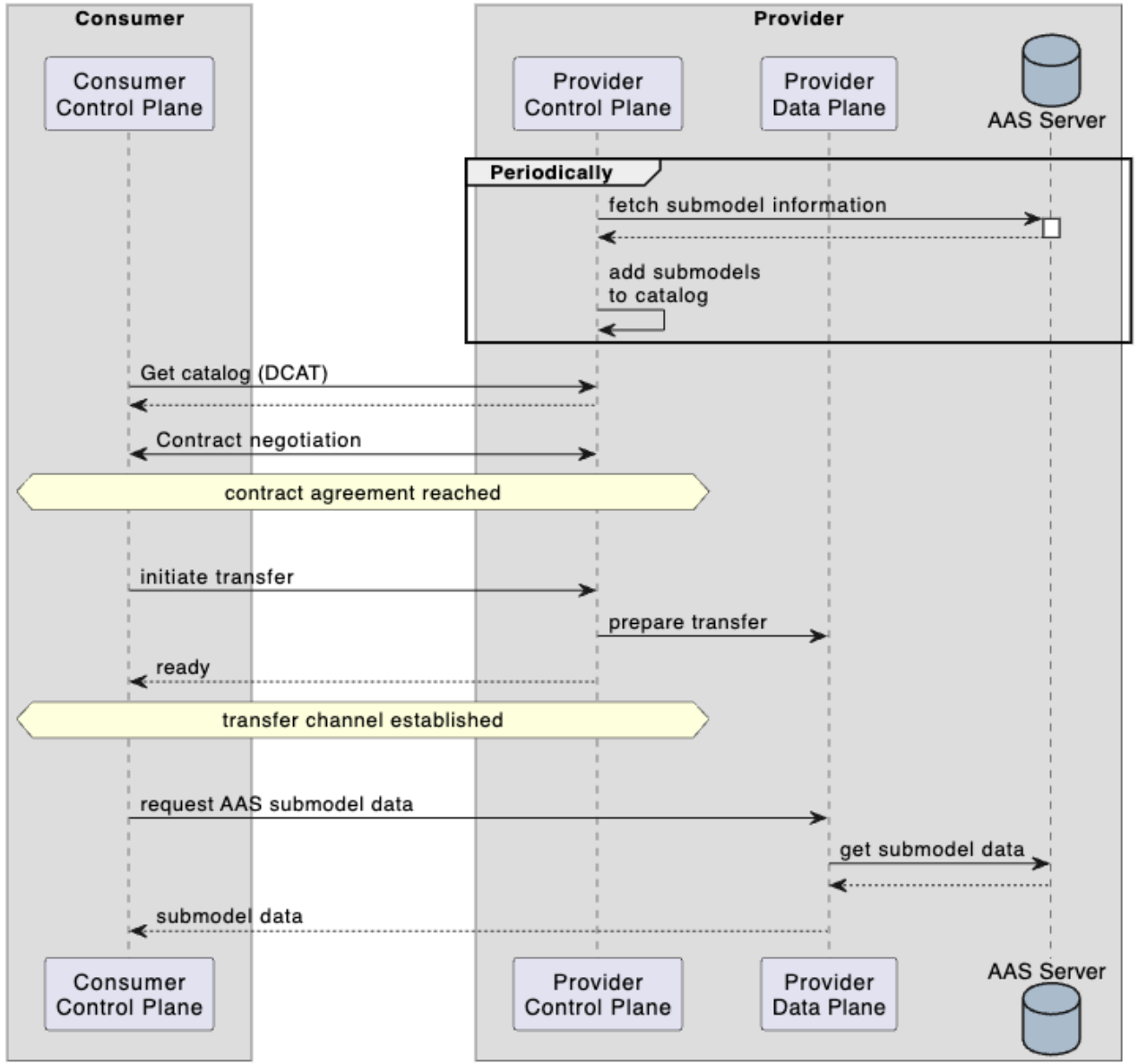


Introducing Minimum Viable Dataspace (MVD)

- EDC's one-click sample dataspace (https://github.com/eclipse-edc/MinimumViableDataspace)
- Utilizes most components and concepts
- Deployable to Kubernetes or runnable directly from within IntelliJ
- Intended for demonstration purposes

Live-Demo: the scenario





- Provider lists AAS submodel data in its catalog
- Consumer: requests data catalog from Provider
- Provider checks whether Consumer has appropriate access rights (DCP)*
- Consumer picks a submodel, starts contract negotiation
- Consumer and Provider agree on terms -> contract agreement
- Consumer initiates transfer
- Provider hands over to its data plane
- Consumer transfers data through HTTP/REST

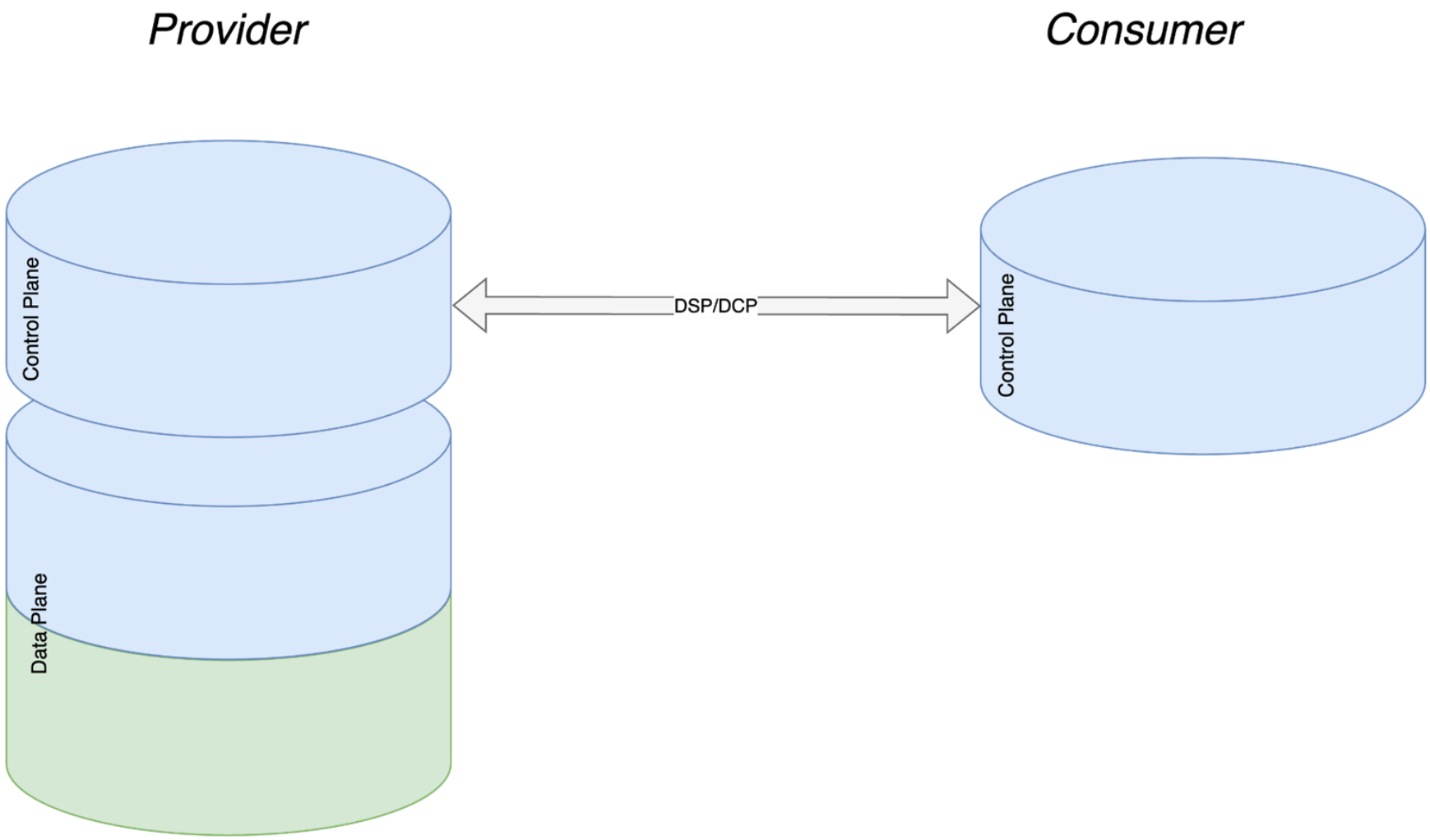
*not shown here

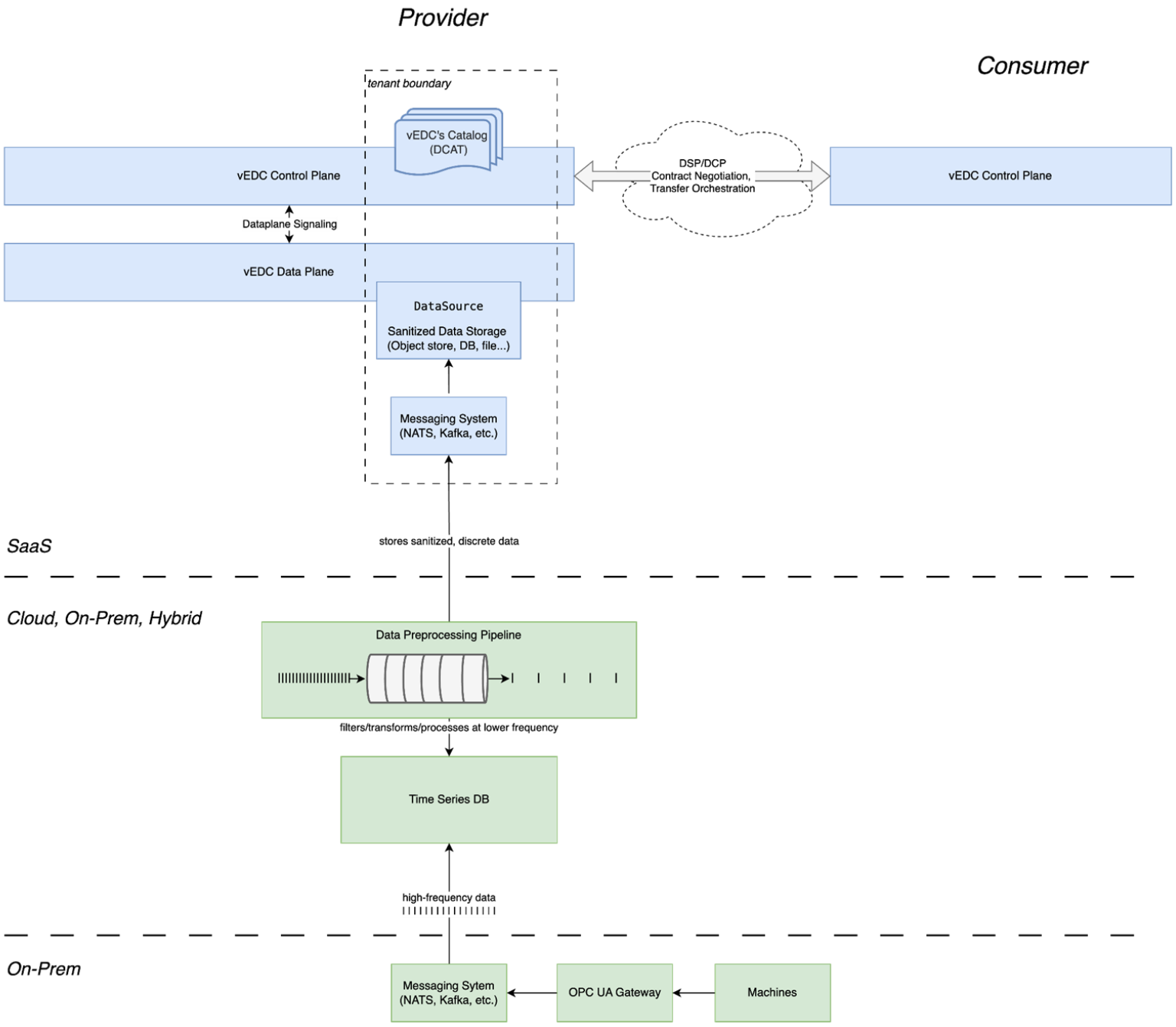
(lean back and enjoy)

EDC Dataplane Architecture

Proposal with OPC UA / AAS

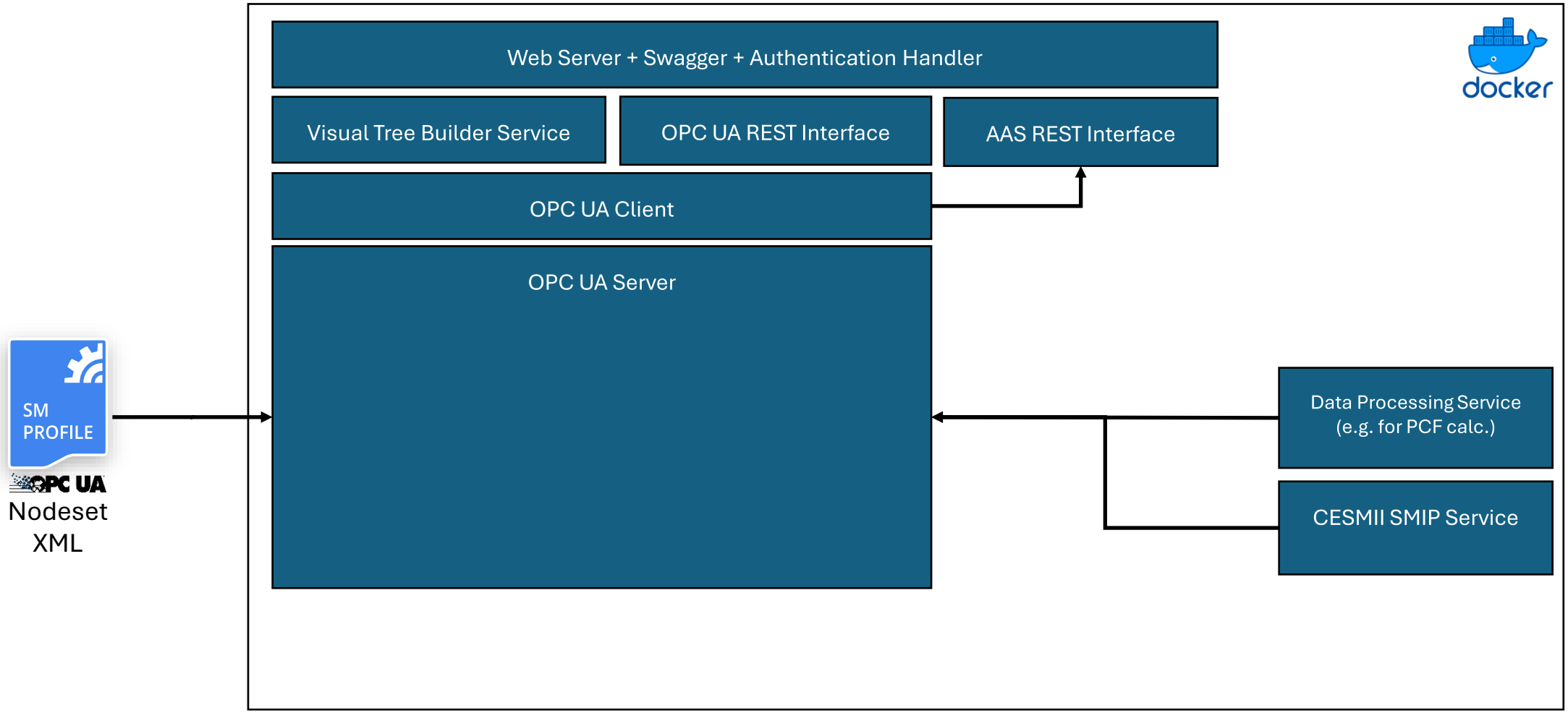
Data Plane: Overview





(detailed view)

DTC’s AAS Repository - System Architecture



github.com/digitaltwinconsortium/AAS-Repository

digital twin™ CONSORTIUM

Data Plane Architecture - Key Takeaways

- High-frequency data ingest happens on premises
- Processing pipeline filters/transforms/sanitizes data into consumable data items
- Data items are stored on e.g. SQL, Blob Storage,…
- EDC's data plane transfers those data items over REST, AAS API…

- The data plane consists of **on-premises** and an **cloud-based** parts
- Cloud-based components are a "multi-tenant" SaaS solution

EU Cloud Accelerator Day 2

Technical Workshop

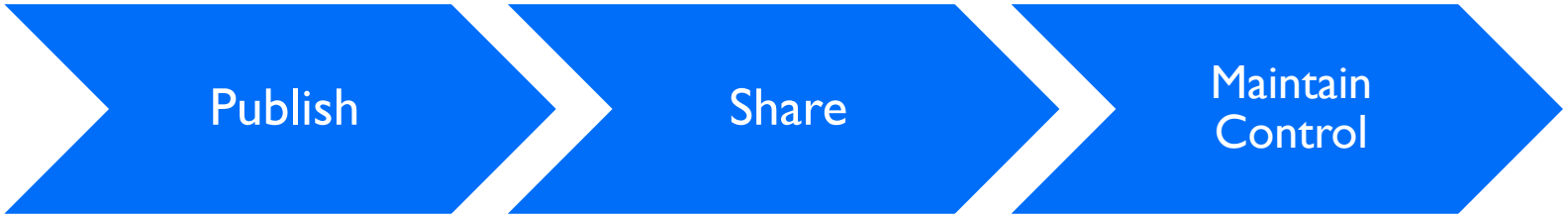
Milan , June 2025

Dataspaces

(A Very Quick) Technical Overview

What is a Dataspace?

A set of technical services that facilitate trusted data sharing between two or more organizations



Dataspace

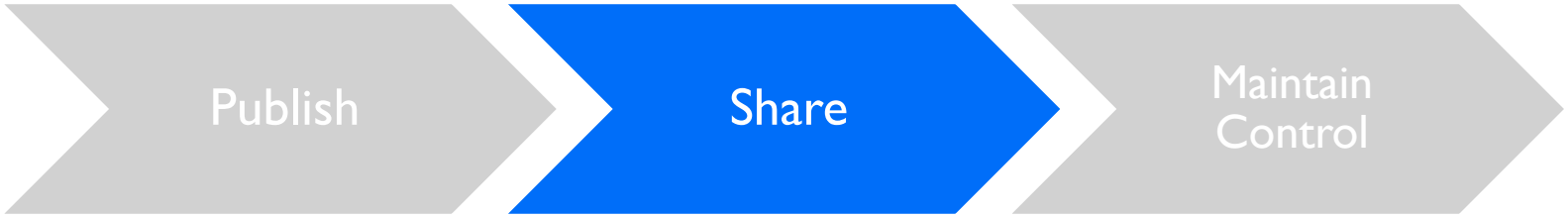
A set of technical services that facilitate trusted interoperable data sharing between two or more organizations

Data is made available to select participants with associated usage policies. Data can be files, APIs, streams, etc.

- ✓ **Publish parts defect notifications to partners**
- ✓ **Offer manufacturing data to partners that can only be used for calculating carbon footprint**
- ✓ **Offer LLM data that can only be used for specific use cases**

Dataspace

A set of technical services that facilitate trusted interoperable data sharing between two or more organizations



Securely share data using interoperable standards and existing technologies

- ✓ **W3C Verified Credentials establish trust and limit access**
- ✓ **Automated or workflow-based approval**
- ✓ **Uses existing wire protocols and technologies for data transfers (HTTP, streaming, object storage)**
- ✓ **Data sharing is decentralized and not subject to central brokers or single points of failure**
- ✓ **Cloud-agnostic**

Dataspace

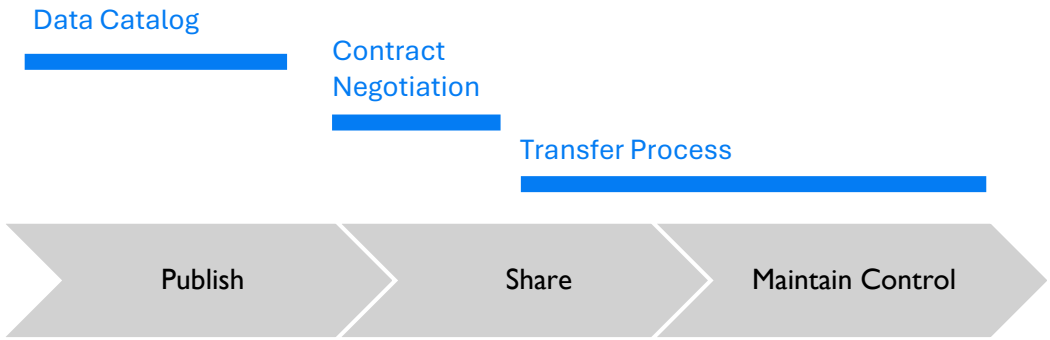
A set of technical services that facilitate trusted interoperable data sharing between two or more organizations

Maintain control of data transfers

- ✓ **Policy compliance monitoring**
- ✓ **Shutoff in case of policy violations**
- ✓ **Auditing**

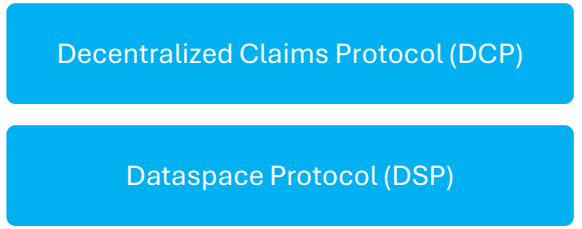
Dataspace Protocol Specification (DSP)

- Orchestration for data sharing
- Defines three things
  - Data catalogs with offers (policies)
  - Contract negotiation
    - Determines access
  - Transfer process
    - Manage data transfer
    - Ongoing compliance checks
- Based on state machines
  - Simple, reliable, fault tolerant



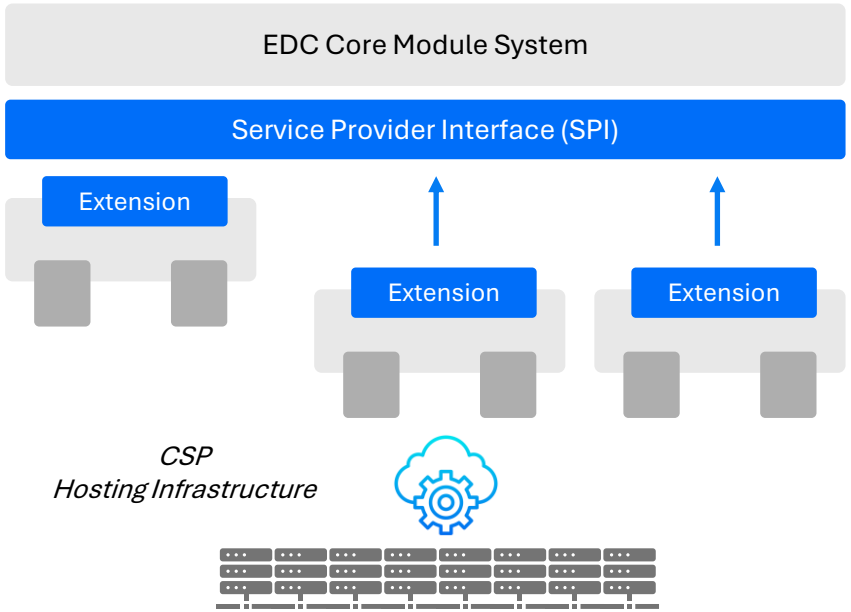
Decentralized Claims Protocol (DCP)

- Organizational credential issuance and presentation for machine-to-machine interactions
- How do you trust another party?
  - Only share data with select partners
  - *Based on verifiable credentials*
- How do you maintain control over your data?
  - Restrict data to geographic regions
  - Restrict data to use cases
  - *Mapping of policies to credentials*
- How do you do this without a central identity provider?
  - Each participant remains in control of their identity and credentials
  - No need for a centralized identity provider like OAuth2
  - *Defines an overlay to DSP*

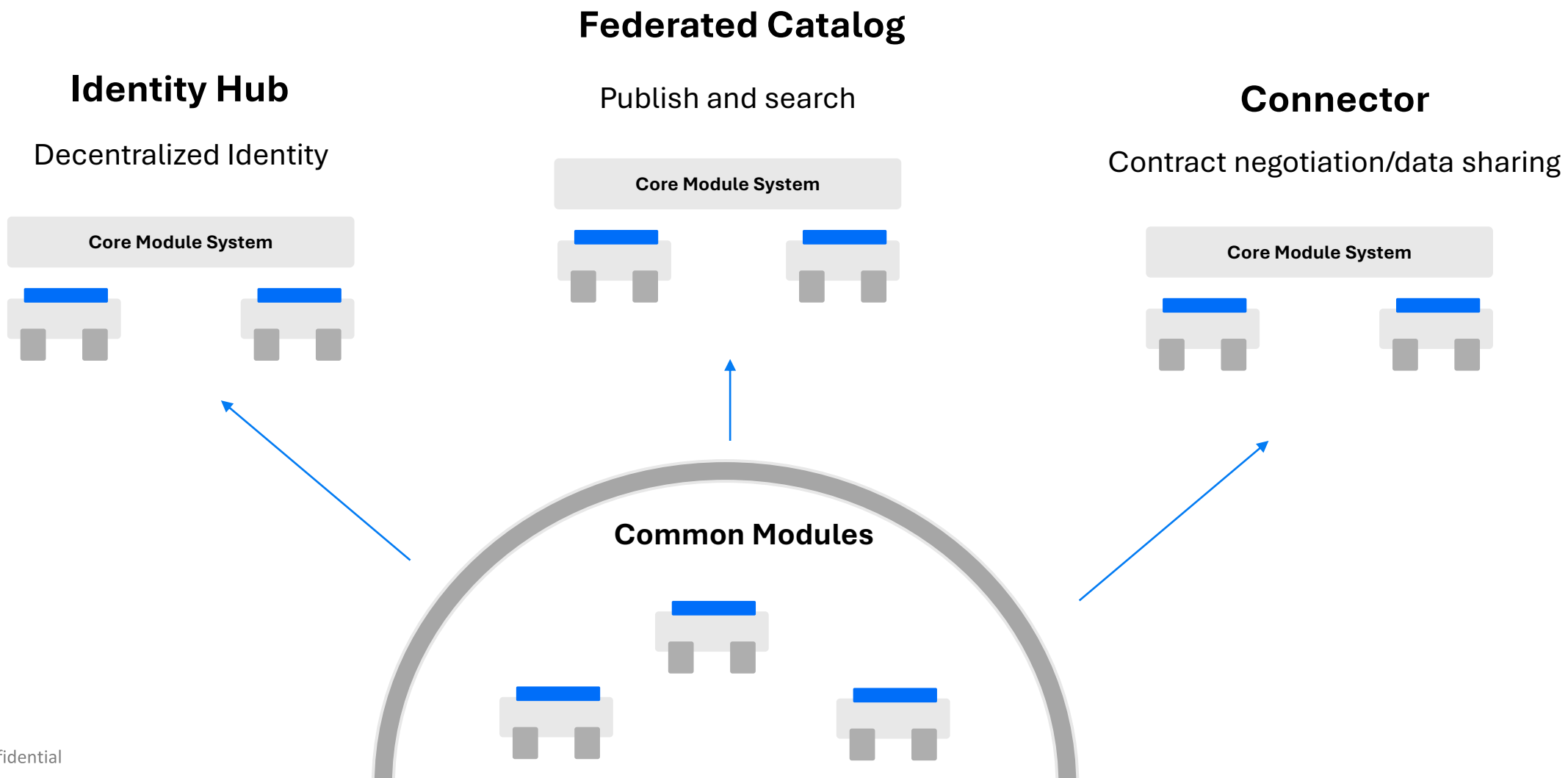


EDC – Eclipse Dataspace Components

- 100% open-source governed by the Eclipse Foundation
  - Vendor-neutral with transparent (meritocratic) rules
- Architected as an extensible framework
  - All capabilities are implemented as extensions
- Cloud-agnostic, abstracts infrastructure for data control and transmission
- Enables pooling and federation of cloud resources
  - Use existing APIs, technologies, and infrastructure for data transfer

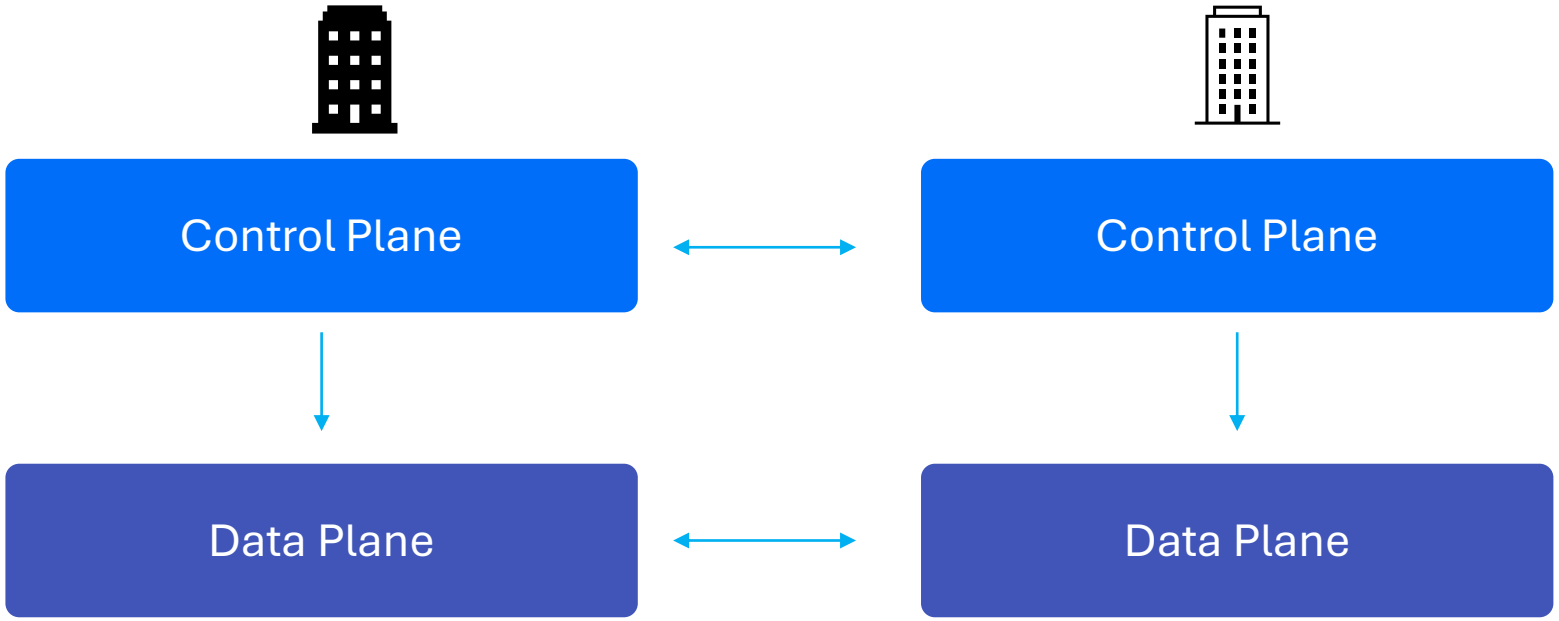


EDC: Dataspace Components



Control Plane and Data Plane

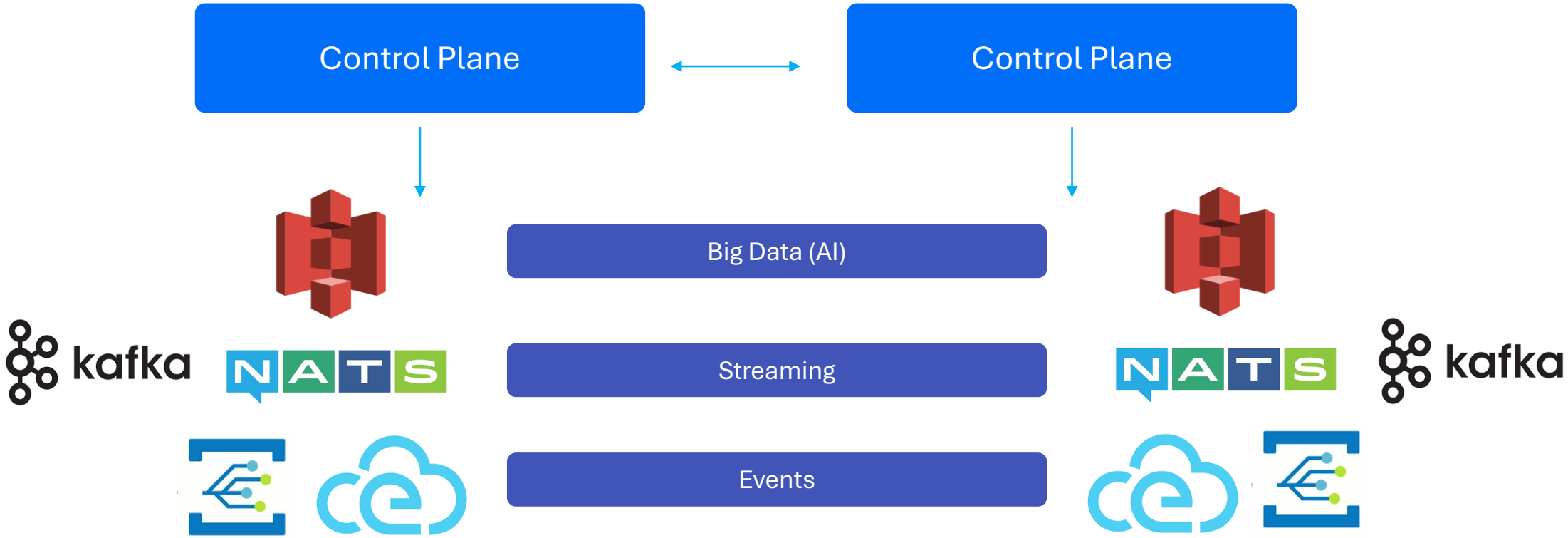
- The Connector is divided into two logical subsystems, a **control plane** and a **data plane**



- Verification
- Contract negotiation
- Oversee policy enforcement

- Manages provisioning
- Moves bits
- Big Data
- Streaming
- Events

Leveraging Existing Infrastructure



Data Sharing as a Service

Technical Overview

Create hosted dataspaces-as-a-service:

To enable complex supply chains to meet new regulatory requirements

- Facilitate B2B supply chain data sharing projects to address one of their biggest challenges – scaling to 1M+ participant companies
- Empower small firms to participate in the supply chains where regulatory mandated requirements will force them to provide data (i.e. digital product passports, IoT device owners' data, sustainability reporting…)

To create economic opportunity for European cloud providers

- Deploy hosted services solutions that meet the market demand created by regulatory and business requirements (e.g. Catena-X)
- Build services consumption business based on trusted, industrial data exchange

To build open solutions

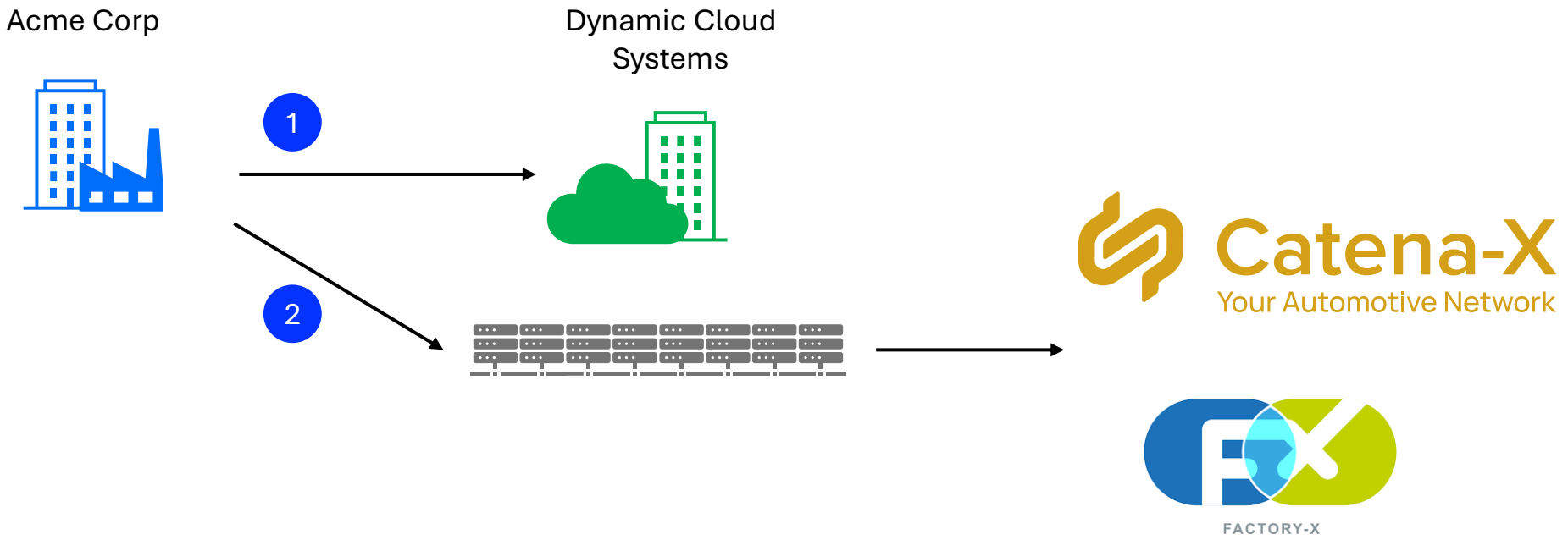
- Open-source software
- Open standards
- Platform-independent
- Multi-cloud / Federated cloud

Dataspace Architecture Vision

- Enable companies to easily participate in dataspaces with minimal technical knowledge
- Enable cloud service providers to leverage their capabilities and services to offer data sharing solutions to these companies
  - Automated service offerings with easy onboarding
  - Leverage in-house or federated infrastructure

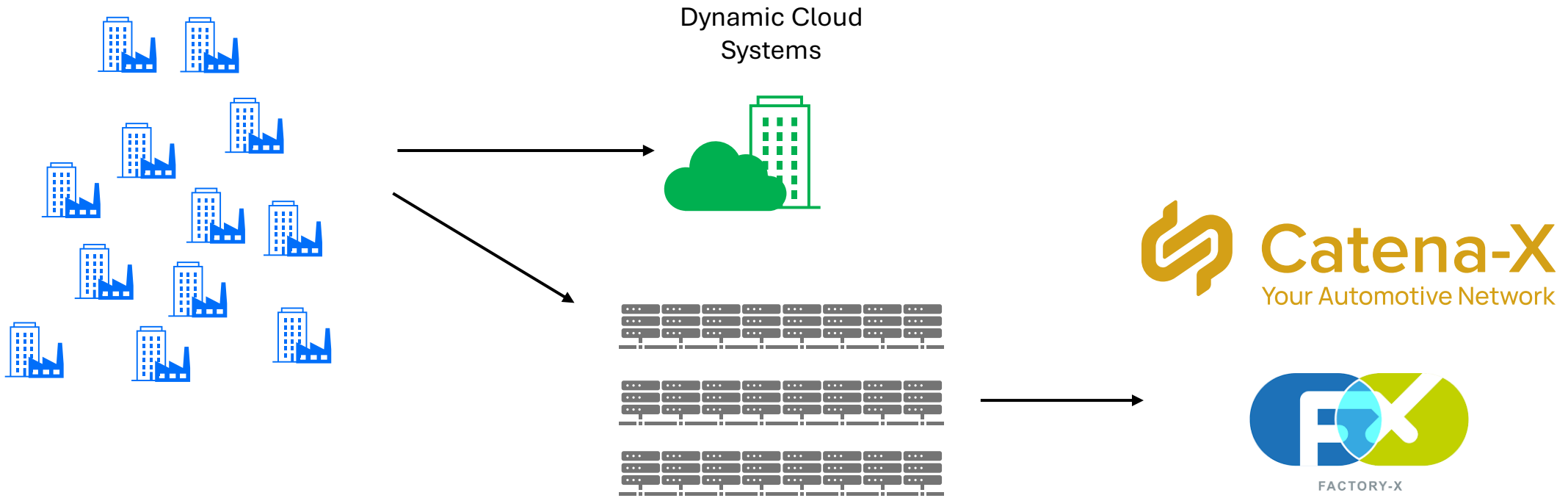
Blue Sky Scenario

- Acme Corp signs up for Connector services to Catena-X and Factory-X with Dynamic Cloud Systems, a CSP
- Dynamic Cloud Systems provisions a tenant and Acme is connected



Blue Sky Scenario

- Dynamic Cloud's service is a success. Many more customers sign up, maxing DCS's capacity.
- With the help of federated provisioning services offered by CISPE members, DCS can incorporate additional infrastructure for tenant allocation



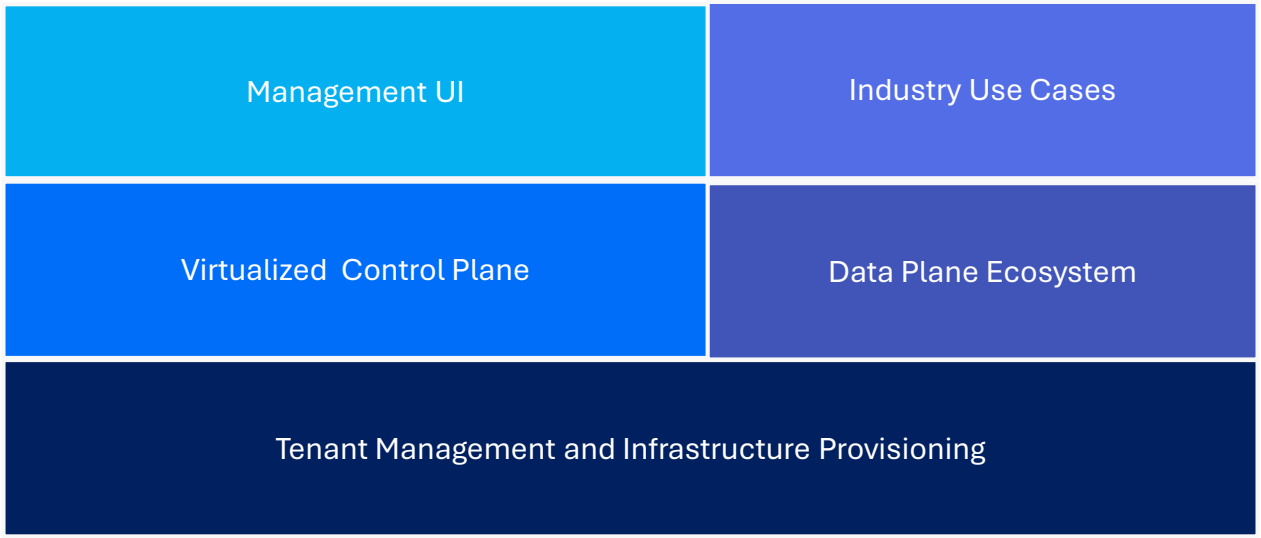
What are the Gaps?

- **Workload automation**
  - Limited operational automation
  - No tenant management or resource orchestration
- **Workload efficiency**
  - EDC is designed for single-tenant deployments
  - EDC is not cost-effective to run in an environment that requires high-density processing
  - EDC does not support multiple dataspace operation (one dataspace per deployment)
- **Scalable industrial data transfer**
  - No widely available industry-specific data planes
  - Cost-effective, high-performance data planes

Industrial Dataspace Ecosystem

EDC as a Service

Use Case Enablement



Workload Efficiency
Cost-effective hosted service for sovereign data sharing

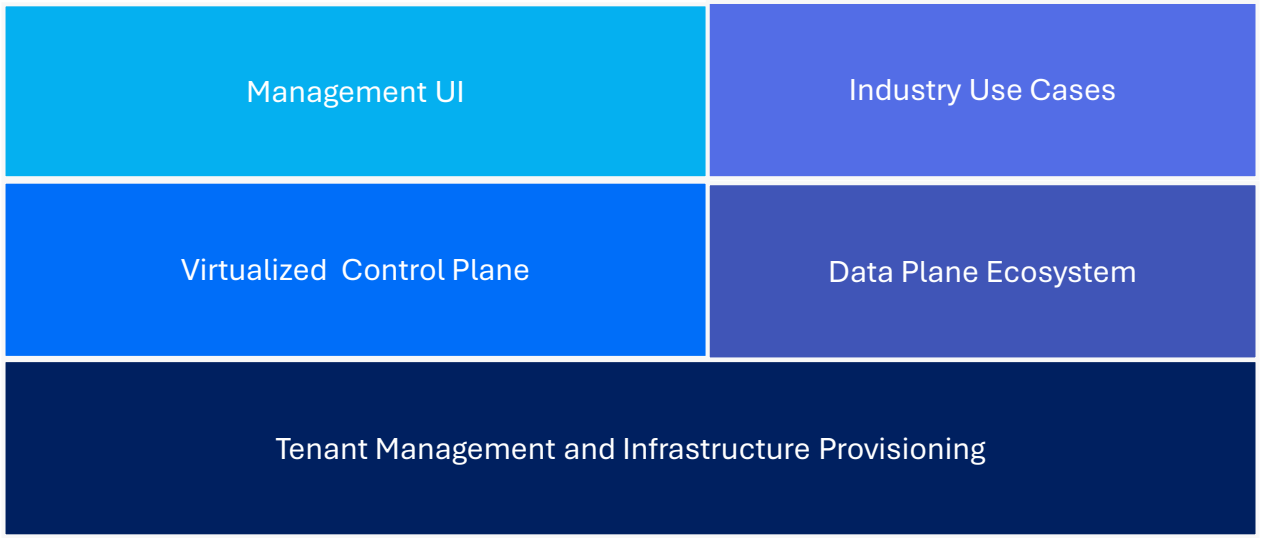
Scalable Industrial Data Transfer
Core data plane technologies

Workload Automation
Deploy and manage resources to a single cloud or federated environments

Thinking about where you can get involved

EDC as a Service

Use Case Enablement



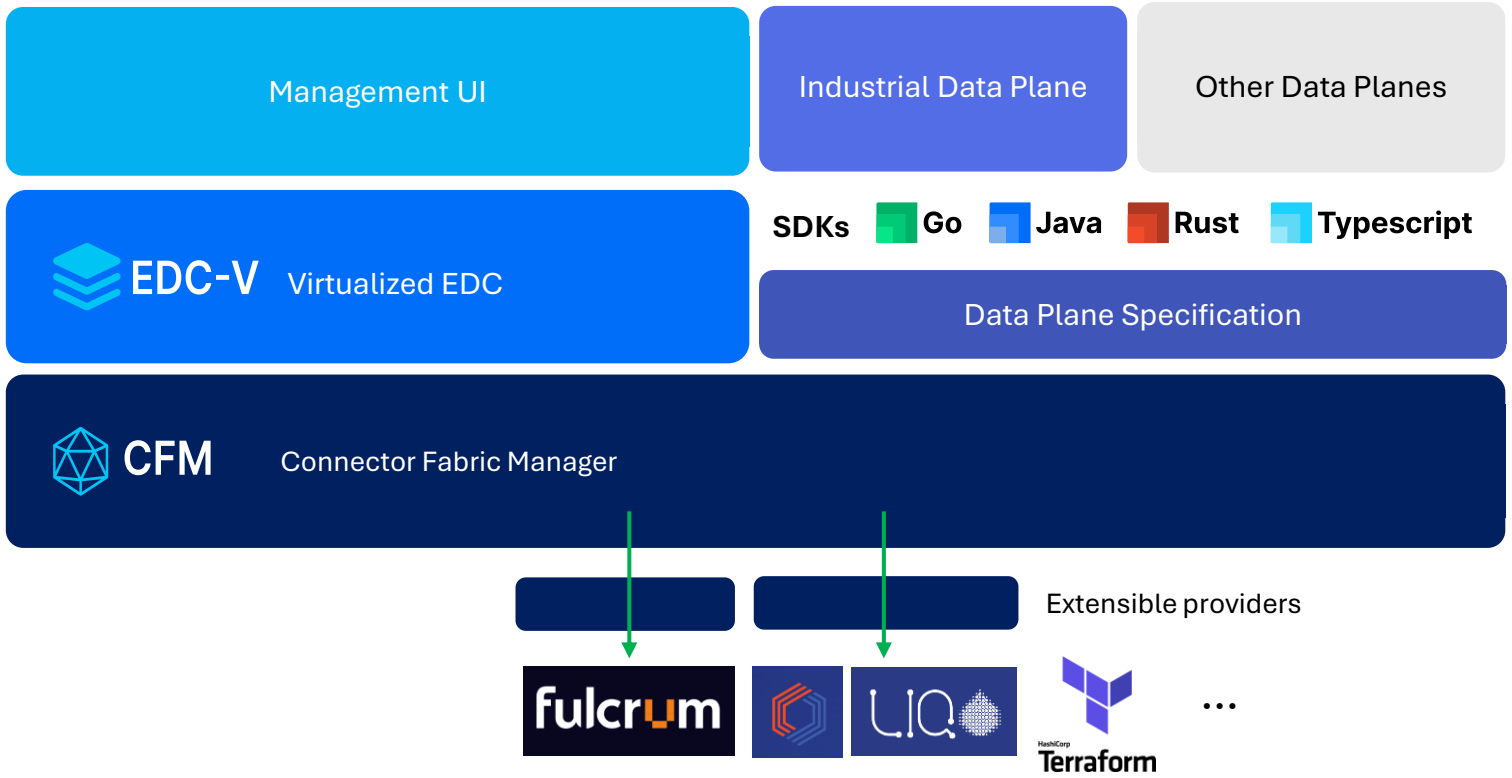
Workload Efficiency
- Requirements
- Development
- Testing
- UI design and development

Scalable Industrial Data Transfer
- Industrial data requirements
- App enablement
- Development
- Testing
- Custom data planes

Workload Automation
- Requirements
- Development
- Testing
- Technology integrations

The Industrial Dataspace Ecosystem

Cost-effective hosted control plane



Multi-language ecosystem for building data planes that serve diverse use cases

Extensible orchestration framework that integrates with multiple providers to support federated and targeted deployment and management

Project Deliverables

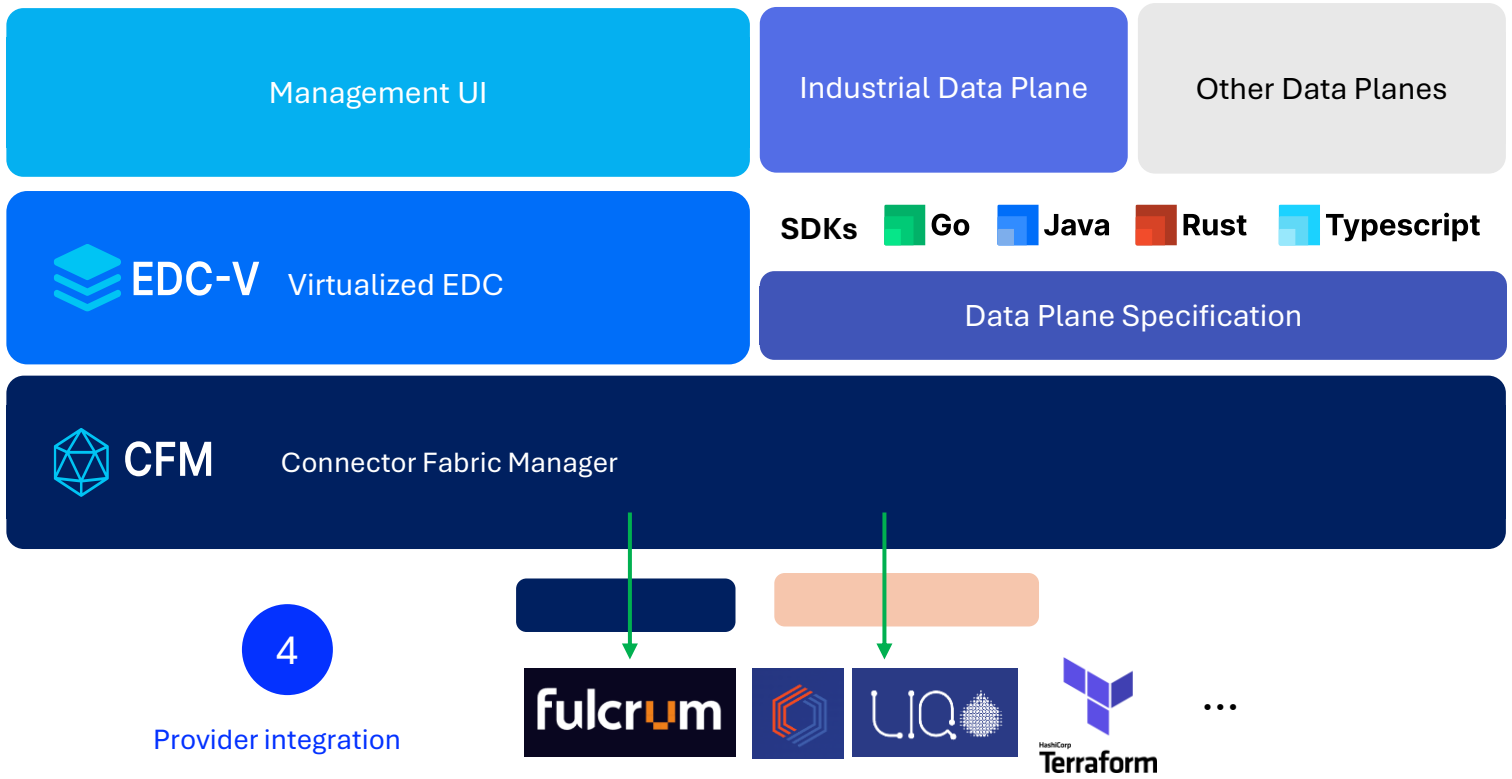
1 Management Portal (Need volunteers!)

2 EDC-as-a-Service

3 Infra & provisioning

4 Provider integration

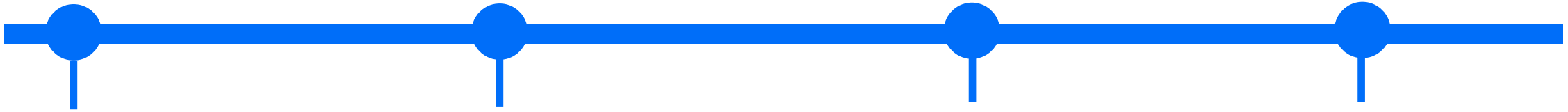
5 Industrial use-cases, data integration, and transfer



Project Governance

- Development work to happen at an open-source foundation
  - Governance framework and IP protections
  - Neutral environment independent from vendor control
  - Project infrastructure
    - Source control, CI tools, etc.
- Divided into multiple, independent projects
  - Easier for project governance and management
- Eclipse Foundation is a logical choice
  - Open for discussion
  - Battle-tested governance and IP regime
  - Strong presence in dataspaces and industrial open source
    - Eclipse Dataspace Working Group
    - Dataspace specifications (DSP and DCP)
    - EDC
    - Tractus-X
    - Other industrial projects

roject Timeline



Tech Summit
June 4-5

Demo
- ✓ Industrial data plane demo
- ✓ MVD starter kit
- ✓ Initial open-source code

Partner engagement

Early July

Partner Integration Demos
Participation with CISPE July Demo

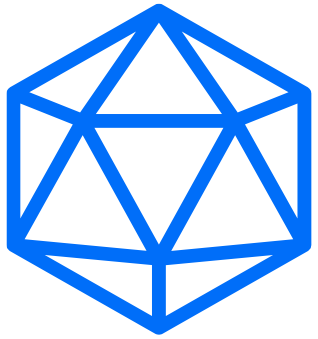
July-August

M1 Release
- EDC-V
- CFM
- Industrial Data Plane

Foundation Setup
Transfer projects to an open-source foundation (Eclipse)

October

M2 Release
- EDC-V
- CFM
- Industrial Data Plane



CFM

Workload Automation

Tenant Manager and Orchestration Framework

Components

- Tenant Manager
  - Manages tenants and assigns them to a cell (cluster)
    - Assignment and migration happen through the movement of configuration data to a cell
    - Does not involve EDC deployment
  - Cells are individually responsible for scaling until they reach a limit
- Provision Manager
  - Responsible for provisioning tenants *and* infrastructure
  - Stateful workflow system
  - May delegate to multiple provisioning technologies
    - Manages reliable processing and state
    - Extensible providers
- EDC Operator
  - K8S operator that configures a cluster to run EDC-V services

Whiteboard Session

CFM Connector Fabric Manager

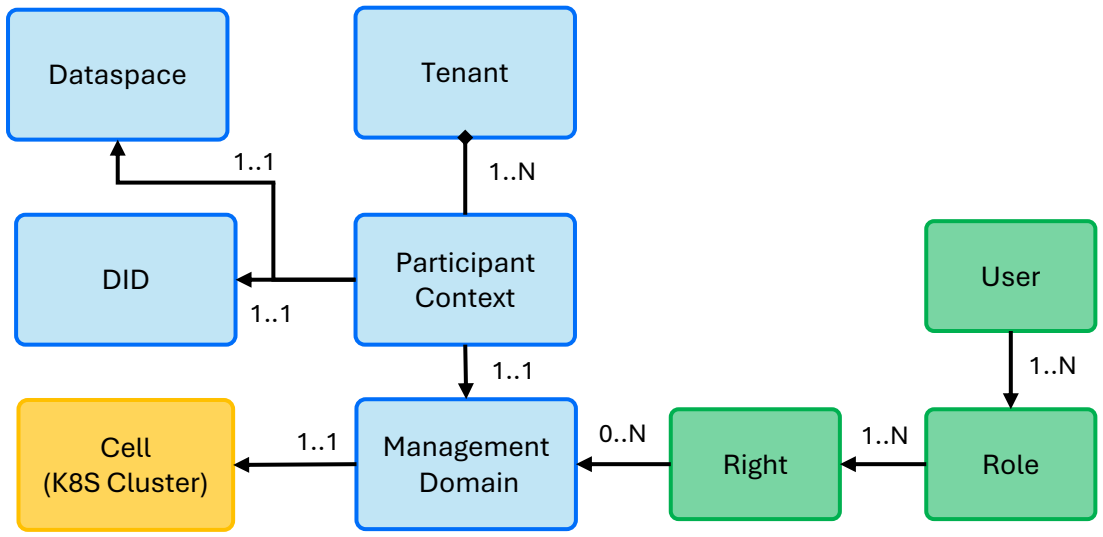
Tenant Manager

Provision Manager

Whiteboard Session

CFM Connector Fabric Manager

Tenant Manager

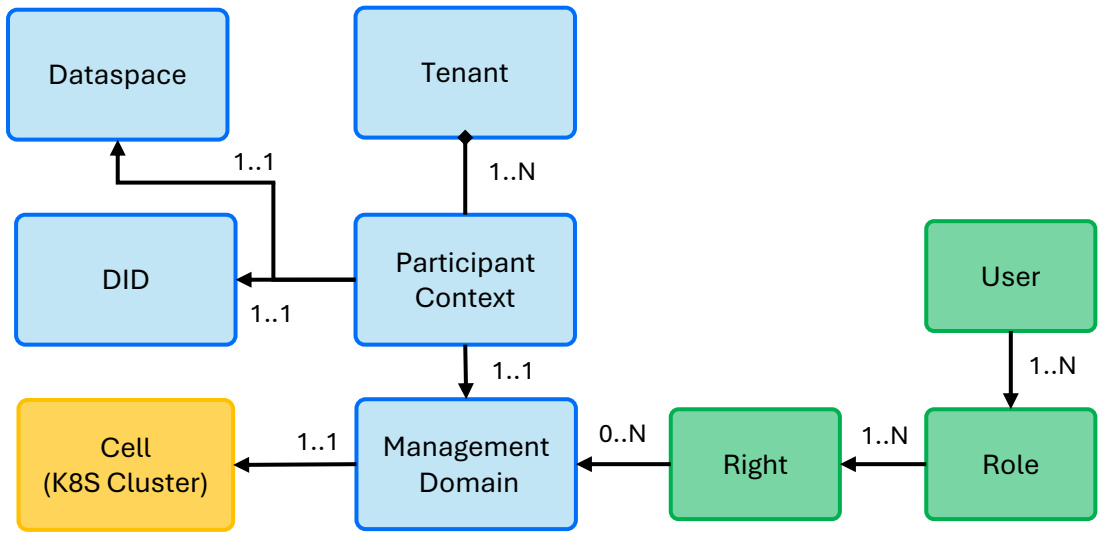


Provision Manager

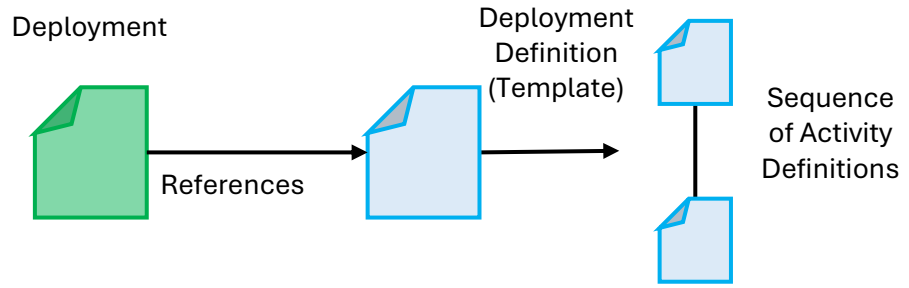
Whiteboard Session

CFM Connector Fabric Manager

Tenant Manager



Provision Manager



Stateful reliable queuing system (pluggable)

Workload Efficiency

EDC Virtualization

EDC-V

Virtualization vs Optimization

- Dramatically improve EDC overhead through *virtualization,* not *optimization*
  - Don’t try and optimize a runtime-per-tenant model
  - Only minimal gains to be had
  - Per-tenant runtime optimization will introduce exponentially more operational complexity
    - K8S namespaces not a sufficient isolation mechanism
    - Runtime passivation requires complex scheduling
    - Failover, resiliency, backups, and migrations are difficult to manage
- *EDC Virtualization* is the ability for a runtime to process requests for multiple tenants and multiple dataspace contexts
  - Tenant 1 in Dataspace A
  - Tenant 2 in Dataspace B

How: The EDC Platform

- The EDC is like a car platform
  - Swap out modules to enable virtualization
- Introduce a "*virtualization container*" in EDC
  - Dataspace context
  - Participant context
  - No tenant context – the CFM handles that
- Each instance dynamically processes requests for these contexts
- Message-based state machines
  - Naturally creates compute efficiency
  - Requires reliable stateful queuing
- Dynamic policy engine
  - Load and evaluate Common Expression Language (CEL)
- **This is additive to the existing EDC architecture, not a rewrite**
  - Different "configurations" for single-tenant vs. multi-tenant use cases
  - Do you want a sedan, hatchback, or SUV?

How Virtualization Simplifies the Problem

- Migration and fail-over
  - Move/replicate database data and route traffic
- Scale-out
  - Cross tenant: add more cells
  - Tenant: isolate heavy-use tenants to specific cells with more nodes
- Performance
  - Not a function of runtime startup, but rehydrating context during request processing
- Overhead
  - JVM overhead (memory usage such as class metadata, garbage collection, etc.) and service dependencies (database, vault, etc.) are amortized across tenants
- Efficiency
  - Use of message queues for work processing (state-machines) will result in a more efficient (and compact) compute distribution

Schedule | Day 2

Upcoming	
13:00 – 14:00	Lunch
14:00 – 15:00	Project Deliverables/commitments and timelines – Jim Marino, Erich Barnstedt

Thank you