

Data spaces and OPC UA

Ilkka Niskanen
Advanced Data Spaces
Senior Scientist, PhD

07/05/2026 VTT – beyond the obvious



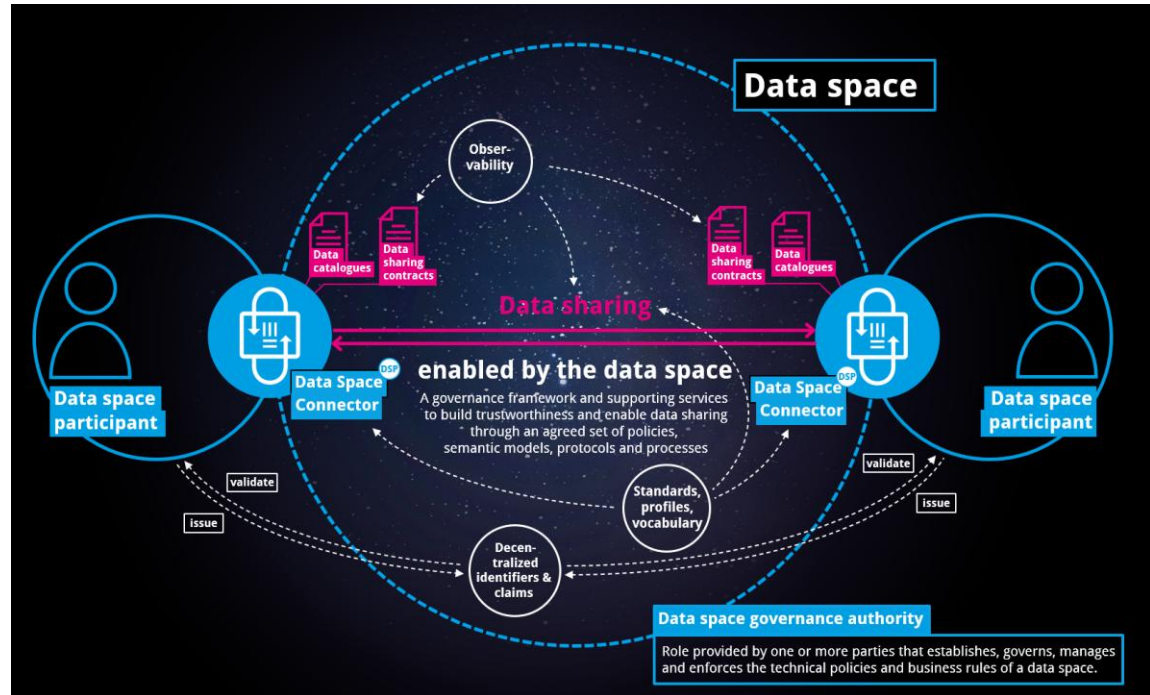
Data spaces – overview

- A novel approach for secure, cross-organizational data sharing
- Designed to build trust while preserving data sovereignty of each participant
 - Participants commit to common rules, policies, and contractual agreements
- Provides standardized building blocks for:
 - Identity and access management
 - Data product definitions and metadata models
 - Data discovery, contract negotiation, and data provisioning
- Promotes decentralized and federated architectures
 - No single point of failure
 - No vendor lock-in



Data spaces – overview

- Does not replace existing data exchange solutions (e.g. REST APIs, OPC UA, MQTT)
 - Introduces a trust and governance layer on top to enable interoperability and trust across organizations



Data spaces – overview

- Some of the most prominent data spaces include
 - Catena-X (catena-x.net)
 - Trusted and collaborative data ecosystem for the automotive industry
 - 186 members, competing car manufacturers participate: BMW, VW, Ford, Volvo...
 - SCSN (smart-connected.nl/en)
 - Smart connected supplier network for data sharing of supply chains in the manufacturing industry
 - Several hundred manufacturing companies are connected in the SCSN network

VTT approach in a nutshell

- Strong expertise with comprehensive project portfolio
 - Technical, governance, business and legal capabilities
 - Sandbox environment for data spaces as a co-creation with partners (Data Innovation Lab)
 - Certified data space components
 - Use case clinic, ecosystem orchestration, data productisation
- Data-space specific knowledge complemented with domain-specific capabilities
 - A dedicated team focusing on data spaces
 - VTT has domain-specific teams focusing on most industries: manufacturing, agriculture, energy, smart cities, mobility, health



www.vttresearch.com/en/ourservices/data-spaces

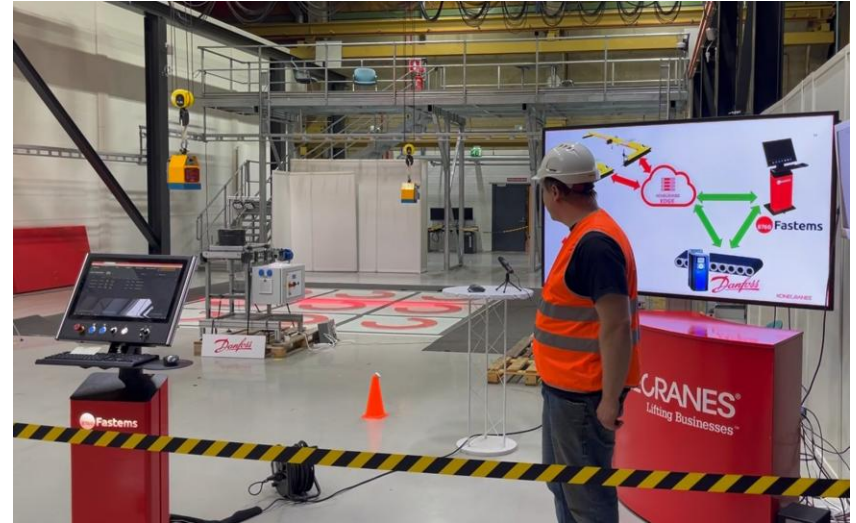
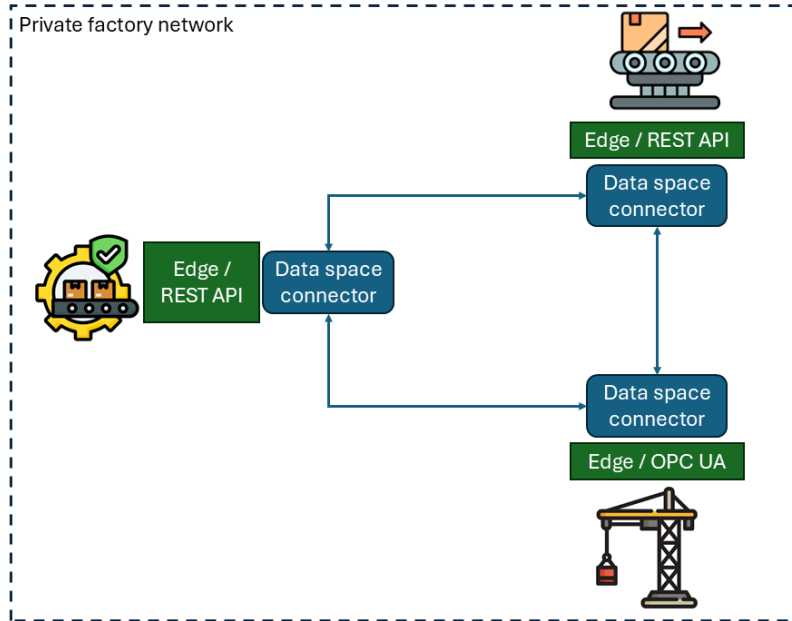
Integrating OPC UA with data spaces

- To enable OPC UA and data space integration, an OPC UA-compatible data space connector is required
 - Can provide additional trust and interoperability, especially for cross-organizational OPC UA data exchange
 - Potential added value include:
 - OPC UA-based data products can be easily discovered by other data-space participants
 - Selective disclosure of OPC UA data in accordance with the data space trust framework and data-sharing policies
 - Data providers can define purpose, usage duration, and constraints for data entities hosted on their OPC UA servers
 - Machine-readable agreements enable machine-to-machine negotiation and support the establishment of digital contracts

Case examples - InDEx

- InDEx (Industrial Data Excellence) project coordinated by DIMECC
- Case: Smart Factory with VTT, Konecranes, Danfoss, Fastems
 - **Challenge**
 - Securely exchanging data between manufacturing machines that use heterogeneous interfaces and communication protocols
 - **Solution**
 - An OPC UA-compatible data space connector deployed on edge devices responsible for controlling and monitoring the machines
 - The connector enables trusted, interoperable data exchange across organizational and technical boundaries
 - **Results**
 - The solution was tested and demonstrated at the Konecranes factory premises in Hyvinkää
 - Production machines communicated via the deployed connectors using the established data space

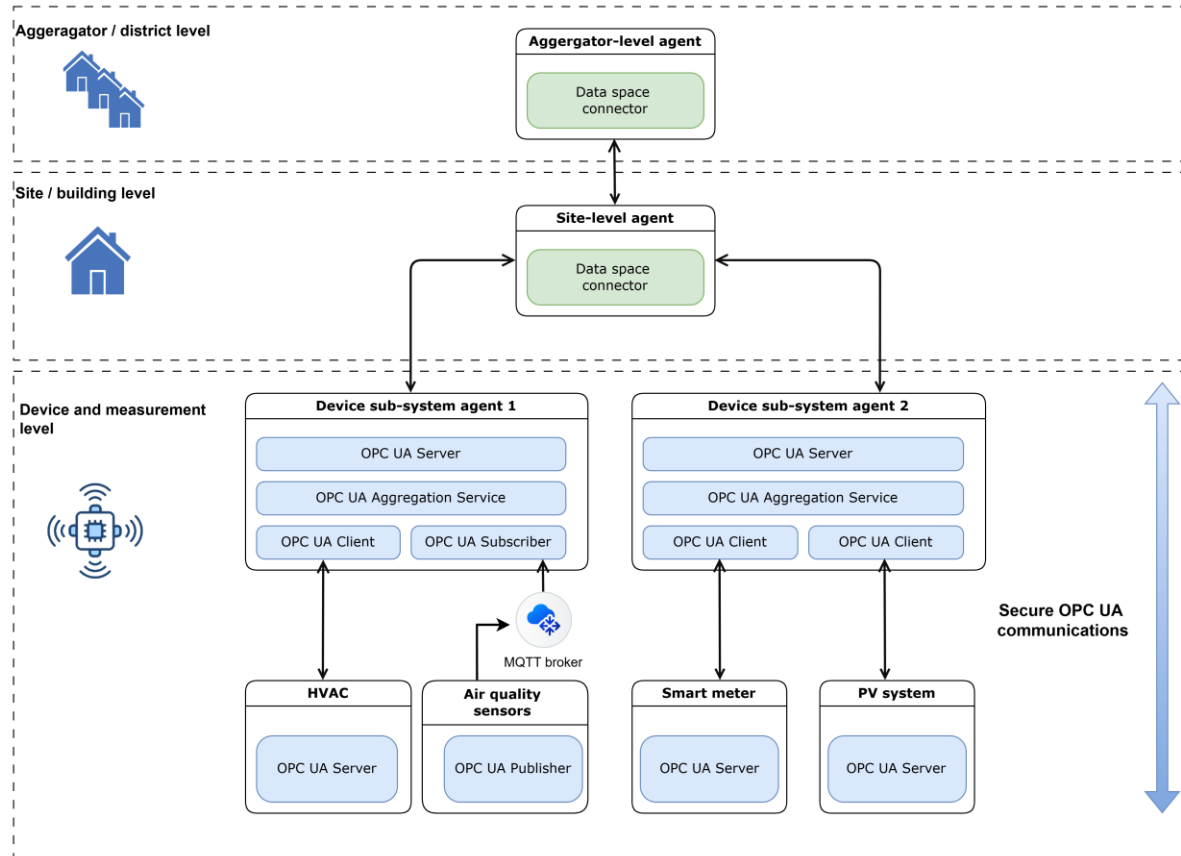
Case examples - InDEx



Case examples - CIASEM

- CIASEM – Collaborative Intelligent Agents for Smart Energy Management
 - Develops an automated multi-agent system that enables collaborative energy flexibility between energy users, distributors and market actors
 - Role of the OPC UA-compatible data space connector in CIASEM
 - Agents, as participants in data spaces, can retrieve OPC UA data directly from devices and sensors deployed within a building.
 - The retrieved OPC UA data is transformed into shareable data products with clearly defined usage policies.
 - Through data space mechanisms, agents can share these data products to enable interoperability and cross-agent collaboration (e.g., between site-level agents and energy flexibility aggregators).

Case examples - CIASEM



bey⁰nd

the obvious

Ilkka Niskanen
ilkka.niskanen@vtt.fi