

Lucerne University of
Applied Sciences and Arts

**HOCHSCHULE
LUZERN**

FH Zentralschweiz



Smart **IN**teroperability Architecture (SINA)

SINA Eco – Project Event

9 October 2024

Agenda

14:00	10'	Arrival of the guests	
14:10	15'	Welcome + introduction round	Christoph Imboden
14:25	15'	Datenräume im Energiesektor	Matthias Galus
14:40	15'	SINA – The project highlights	Eugen Rodel
14:55	20'	SINA – Technical aspects	Andreas Rumsch
15:15	20'	Break 🍷	
15:35	15'	SINA – Business aspects & use cases	Marco Kunz
15:50	15'	Demo data space	Edith Birrer
16:05	20'	P2P use case	Said Ahsaine
16:25	15'	Horizon WILSON – SINA extended – an overview	Eugen Rodel
16:40	20'	Discussion - The future of data spaces	Christoph Imboden
17:00	60'	Closing & Apéro 🍷 🍕	Christoph Imboden
18:00		End of event	



Datenräume im Energiesektor



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Energie BFE
Office fédéral de l'énergie OFEN
Ufficio federale dell'energia UFE
Swiss Federal Office of Energy SFOE

DATENRÄUME IM ENERGIESEKTOR AKTUELLE ENTWICKLUNGEN



© Dominique Udry



DATENRÄUME SCHWEIZ BUNDESRATSENTSCHEIDE 2022/2023

Förderung vertrauenswürdiger Datenräume und der digitalen Selbstbestimmung

Bern, 30.03.2022 - In der Schweiz soll das Potenzial von Daten besser ausgeschöpft werden. Dafür braucht es neue Datennutzungskonzepte, welche die Kontrolle über die eigenen Daten und damit die digitale Selbstbestimmung stärken. Der Bundesrat hat deshalb am 30. März 2022 verschiedene Massnahmen beschlossen, um in der Schweiz und im Ausland vertrauenswürdige Datenräume und die digitale Selbstbestimmung zu fördern.

Quelle: [Förderung vertrauenswürdiger Datenräume und der digitalen Selbstbestimmung \(admin.ch\)](#)

Bundesrat schafft Grundlagen für Schweizer Datenökosystem

Bern, 08.12.2023 - Das Potential von Daten soll in der Schweiz besser ausgeschöpft werden. Daten sollen auf vertrauenswürdige Art und Weise zugunsten der Gesellschaft, der Forschung und der Wirtschaft genutzt werden können. Eine bessere Mehrfachnutzung von Daten soll auch die Reaktionsfähigkeit der Schweiz in Krisen stärken. Darum soll ein sogenanntes Schweizer Datenökosystem entstehen. Der Bundesrat hat am 8. Dezember 2023 ein entsprechendes Massnahmenpaket verabschiedet und Aufträge erteilt.

Quelle: [Bundesrat schafft Grundlagen für Schweizer Datenökosystem \(admin.ch\)](#)



DATENRÄUME SCHWEIZ PRIORITÄTEN BUNDES RAT UND PARLAMENT

Das Potenzial von Daten besser erschliessen

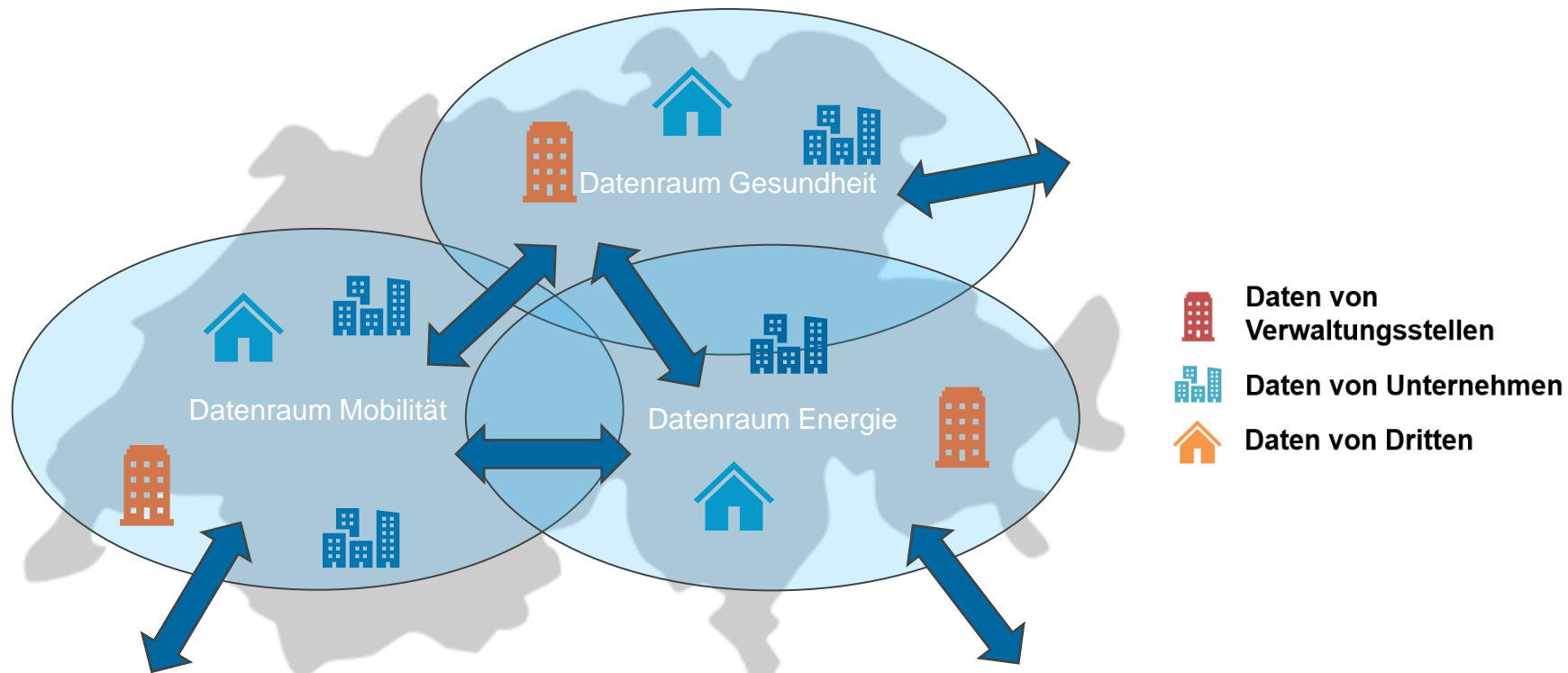
Neue Konzepte für die Mehrfachnutzung von Daten

Digitale Selbstbestimmung

Vertrauenswürdige und interoperable Datenräume



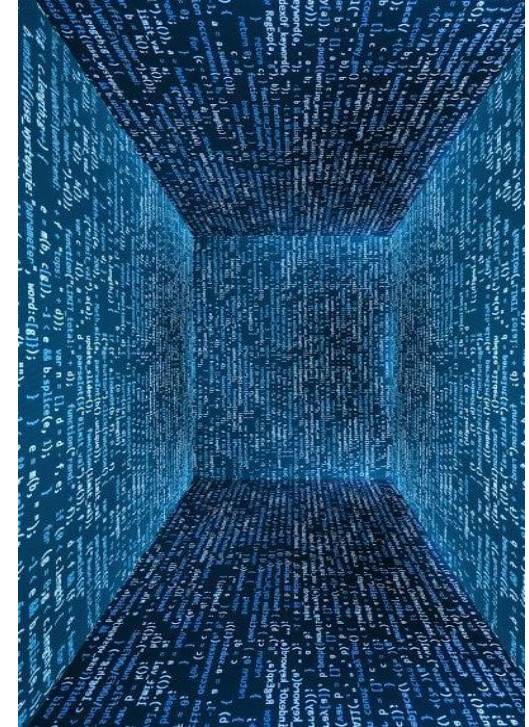
DAS DATENÖKOSystem DER SCHWEIZ AUFBAU UND VERNETZUNG





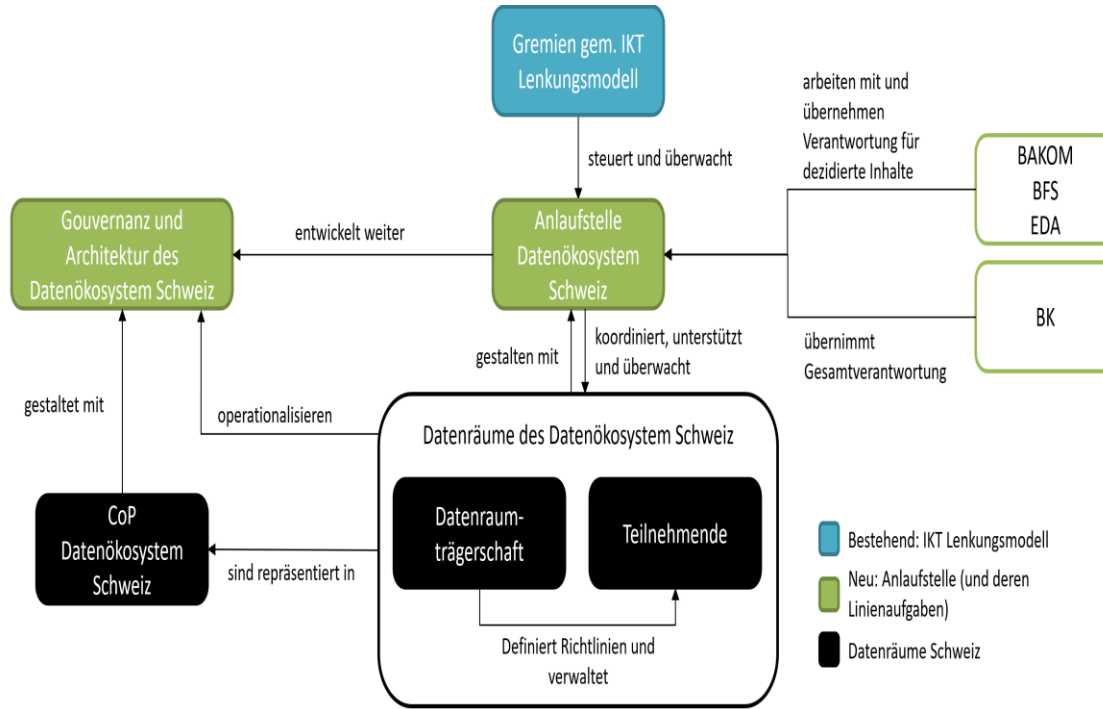
DATENÖKOSYSTEM SCHWEIZ VERSTÄNDNIS

- Bildet einen vertrauenswürdigen Rahmen für Datenräume,
- Daten sollen zur gesellschaftlichen Wohlfahrt, zum wirtschaftlichen Erfolg und wissenschaftlichen Fortschritt mehrfach genutzt werden können
- Akteure aus Wirtschaft, Wissenschaft, Verwaltung und Öffentlichkeit gestalten es gemeinsam
- Das Datenökosystem Schweiz ist interoperabel, international anschlussfähig und nachhaltig





ANLAUFSTELLE DATENÖKOSYSTEM SCHWEIZ UNTERSTÜTZUNG UND KOORDINATION



- Nationaler Akteur zur Koordination über Sektorengrenzen hinweg
- Bündelt Expertise und bietet Methodenkompetenz
- Unterstützt Lösungen zu Interoperabilität und Vertrauenswürdigkeit
- Vernetzung existierender Initiativen im Datenbereich
- Sektorübergreifende Projekte



ANLAUFSTELLE DATENÖKOSYSTEM SCHWEIZ ZIELE

1. Die Anlaufstelle unterstützt und koordiniert den Aufbau und Betrieb von Datenräumen.
2. Die Anlaufstelle stellt sicher, dass sich die Datenräume im Datenökosystem Schweiz in eine gemeinsame Richtung entwickeln. Sie sorgt für die Realisierung von Synergien.
3. Die Anlaufstelle fördert die nationale und internationale Anschlussfähigkeit bzw. Interoperabilität von Datenräumen und deren Vertrauenswürdigkeit.
4. Die Anlaufstelle setzt auf innovationsfördernde Massnahmen, um zur Weiterentwicklung des Datenökosystems beizutragen.





ANLAUFSTELLE DATENÖKOSYSTEM SCHWEIZ MONITORING

- Ab 2025 **Monitoring** mit **Datenräumen** des Datenökosystems Schweiz (oder deren Vorhaben)
- Die Übersicht **soll** Aufbau und **Weiterentwicklung** des **Datenökosystems Schweiz stärken**
- Erfassung «relevanter» **Datenräume** und **Vorhaben**
«**Relevant**» → Datenräume **profitieren** von den Arbeiten des **Datenökosystems Schweiz** oder **leisten Beitrag**
- Definition **weniger Kriterien** für **Entscheidung** zur Aufnahme im **Monitoring** («kein komplexes Regelwerk»)
- Erfassung **weiterer relevanter Informationen** (Steckbrief) zum Datenraum.





MONITORING DATENRÄUME STECKBRIEF

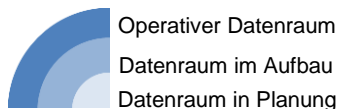
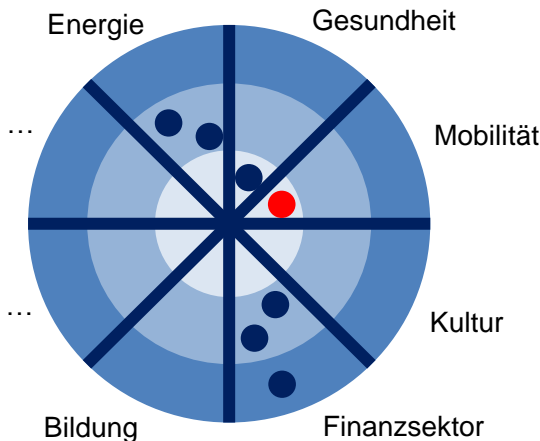
Folgende weiteren Informationen sollen in einem Steckbrief geführt werden:

- **Name** des Datenraums / Vorhabens
- **Status** der **Umsetzung** (Idee / Projekt / operativ / Skalierung)
- **Zweck** des Datenraums
- **Betroffene Sektoren** (Gruppierung entlang EU, eCH-Standard 0122 oder ähnlich)
- **Kontaktstelle** des Datenraums (Name, Email)
- **Datenraumträgerschaft** (Personen oder Organisationen)
- **Webpage** des Datenraums / Vorhabens (falls vorhanden)
- Genutzte **Building Blocks** sowie eingesetzte **technische Komponenten**
- **Beteiligte Organisationen** (ggf. summarisch)
- **Link** auf **Gouvernanz** und **Organisation** Datenraumträgerschaft (sofern vorhanden)
- **Link** auf **Architektur** (sofern vorhanden)
- Spezifische **Rechtsgrundlagen** (sofern vorhanden)
- Zentrale **umgesetzte Standards** (sofern vorhanden)





MONITORING DATENRÄUME MOCKUP



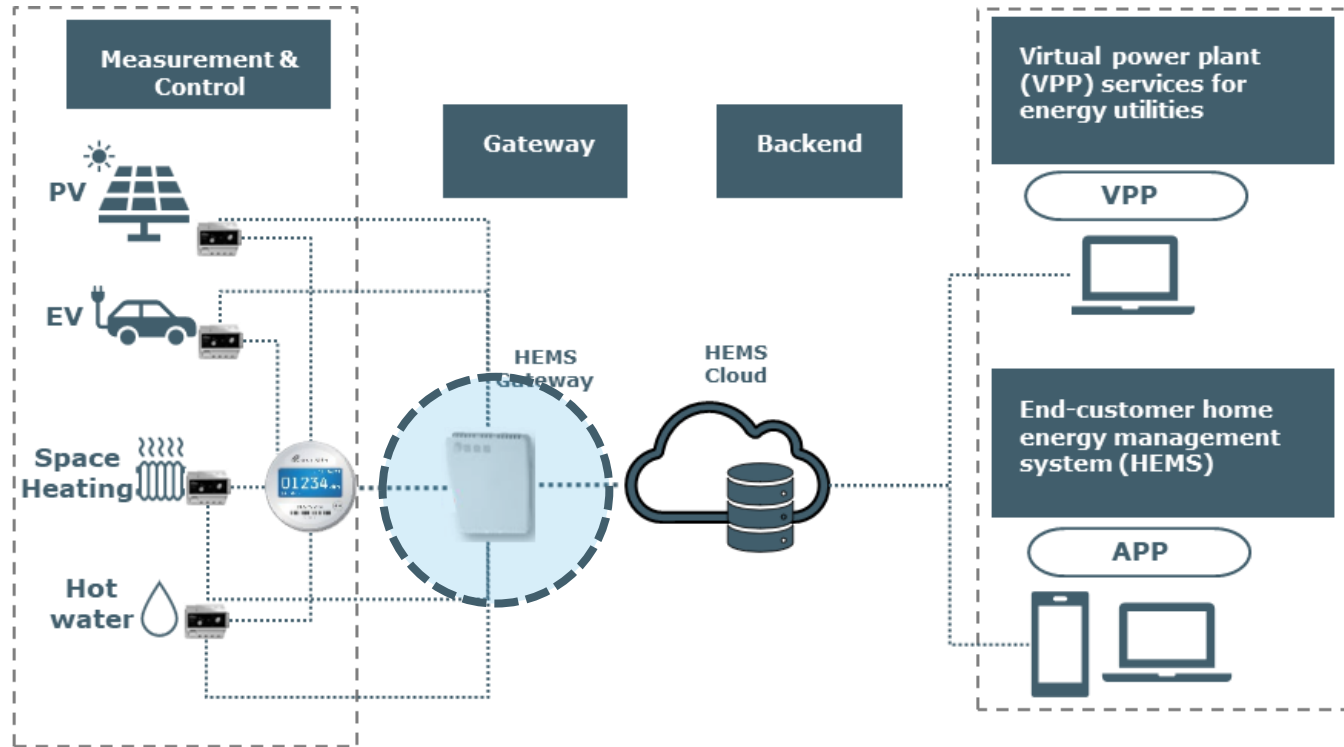
Mobilitätsdatenraum			
Status der Umsetzung	In Planung		
Zweck des Datenraums	Bereitstellung und optimale Nutzung von Mobilitätsdaten, damit: <ul style="list-style-type: none"> die Verkehrsinfrastruktur optimal geplant, betrieben und unterhalten werden kann die Mobilitätsangebote im Personenverkehr und die Angebote im Güterverkehr optimal geplant, betrieben und einfacher kombiniert werden können Infrastrukturen und Mobilitätsangebote besser ausgelastet werden können 		
Betroffene Sektoren	Mobilität		
Kontaktstelle	Bundesamt für Verkehr (BAV)		
Datenraumträgerschaft	Kompetenzzentrum Mobilitätsdaten KoMoDa (gemäss Gesetzesentwurf)		
Webpage	https://www.bav.admin.ch/bav/de/home/allgemeine-themen/modi.html		
Genutzte Building Blocks & Implementierungen	Building Block	Nutzung	Implementierung
	Datenmodelle	Ja	eCH
	Datenaustausch	Ja	
	Beschreibung von Daten, Services und Angeboten	Ja	I14Y (eCH-0200) Opendata.swiss (eCH-0200)
	...		
Beteiligte Organisationen	Bundesamt für Verkehr, SBB, Bernmobil, ...		
Gouvernanz & Organisation	Siehe Entwurf Gesetzestext		
Spezifische Rechtsgrundlagen	Gesetzesentwurf über die Mobilitätsdateninfrastruktur (LINK)		
Umgesetzte Standards	n.a.		





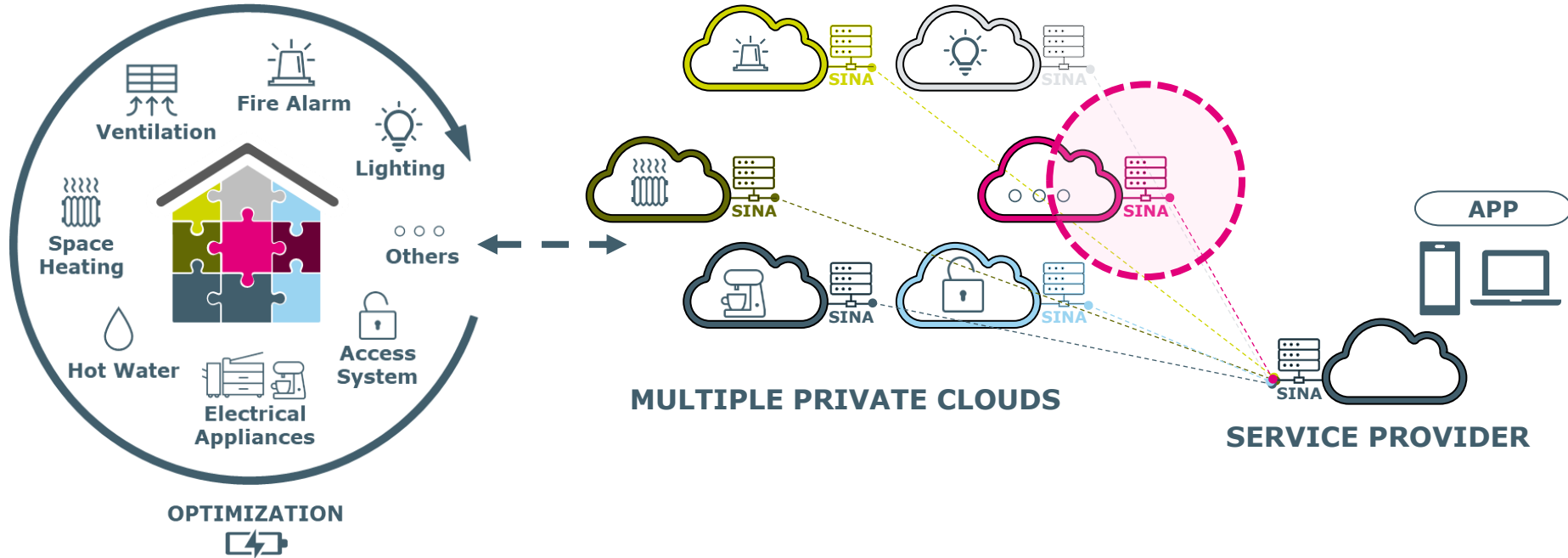
SINA - The project highlight

In the old days ...

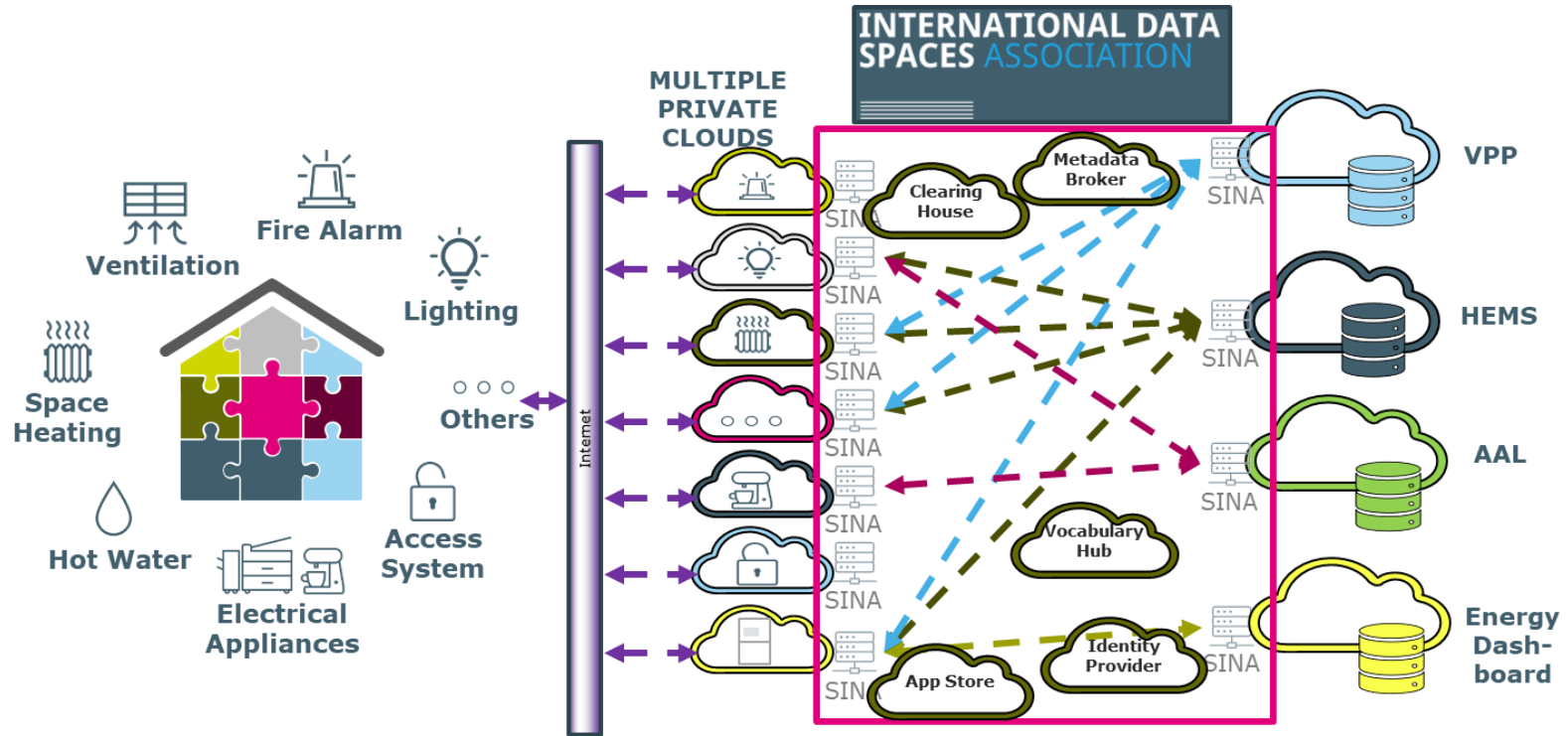


Need for additional decentralised communication infrastructure

The story behind SINA: Use existing infrastructure



The SINA data space



Starting Point, Goals & Aspects

Starting Point



- Decarbonization, transformation, data, convergence of systems
- Central role of data spaces for shaping data exchange between energy sectors

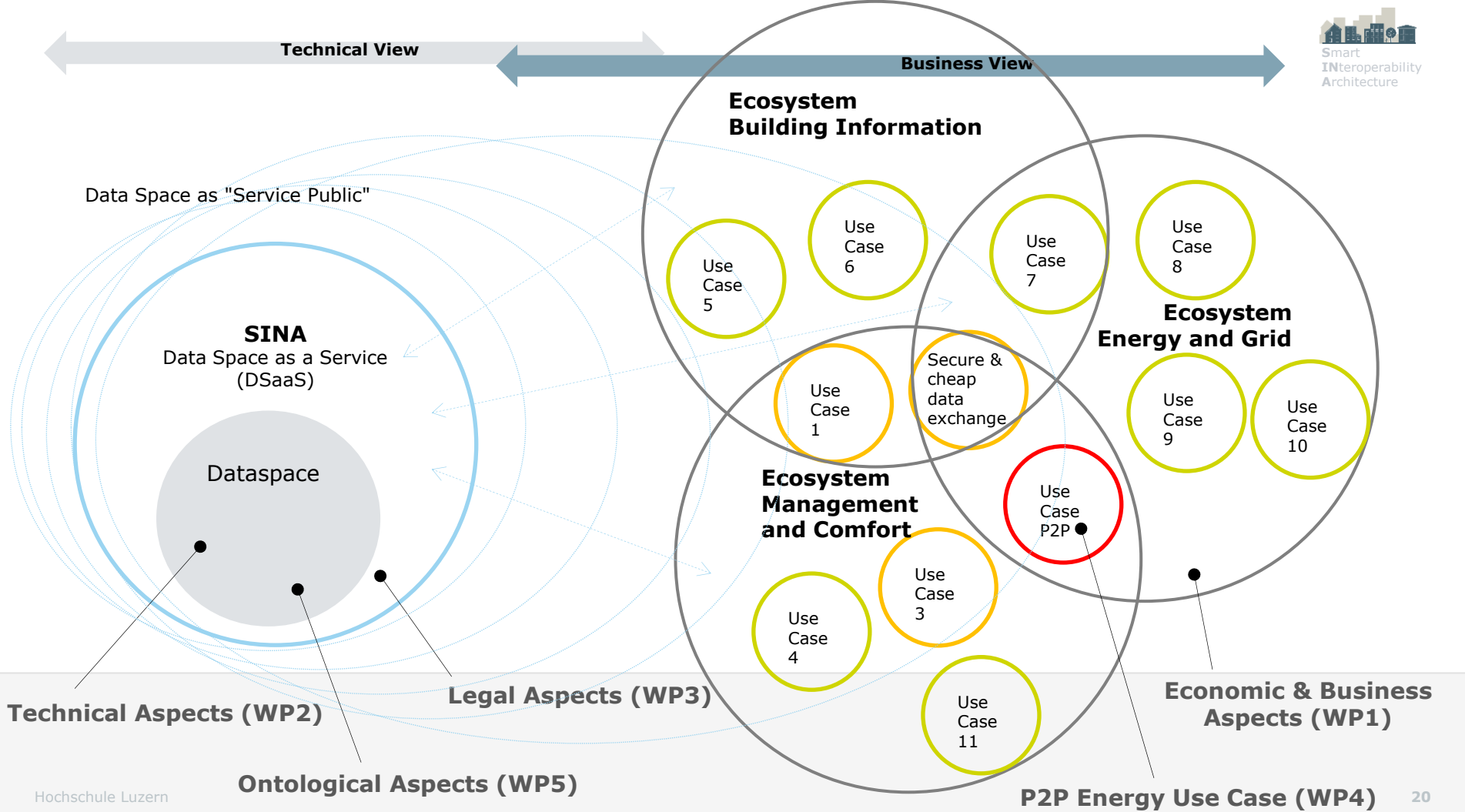
Goals



- Definitions of the economic & conceptual design of SINA
- Provision of a proof of concept

The project comprises studies on various aspects:

- technical
- ontological,
- legal (data law),
- economic & ecological,
- P2P energy data exchange,
- & organizational structure (organizational law).



The team

Project Management

Business Cases

HSLU T&A – IIT

Christoph Imboden
Eugen Rodel
Jekaterina Dmitrijeva
Marco Kunz
Markus Raschke

Core Conceptual Aspects

HSLU T&A - iHomeLab

Andreas Rumsch
Edith Birrer
Stefan Winterberger

Governance Model

HSLU I

Lynn Grau
Ursula Sury

P2P Energy Use Case

HSLU T&A - IGE

Olivier Steiger
Said Ahsaine

Protocols & Standards

CSEM

Yves Stauffer
Tomasz Gorecki

Our Supporters



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Department of the Environment, Transport, Energy and Communication
DETEC

Swiss Federal Office of Energy SFOE
Section Geoinformation & Digital Innovation

With the Support of



Co-financing

Allthisfuture AG / WWZ AG

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bonacasa AG

esolva AG

Intellitec AG Stans

Plutinsus, Wolfram Willuhn,

Privera AG

St.Gallisch-Appenzellische Kraftwerke AG

SIE SA, 1023 Crissier

Zug Estates AG

Zukunftsregion Argovia c/o Eniwa AG

Discussion partner

Open Energy Data Working Group


SmartGridready

Some other highlights

- The topics of SINA (data spaces, energy efficiency, legal aspects) are highly relevant
- Thanks to IDSA, we did not have to build our own data space
- the journey continues...
- thanks to ChatGPT we know what data spaces look like




Finally, it is here ...

 Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun Svizra


Department of the Environment, Transport, Energy and Communication
DETEC
Swiss Federal Office of Energy SFOE
Section Geoinformation & Digital Innovation

Report from 10 April 2024

Smart Interoperability Architecture (SINA): the Decentralized Data Space in the Building Industry



Quelle: HSLU 2024

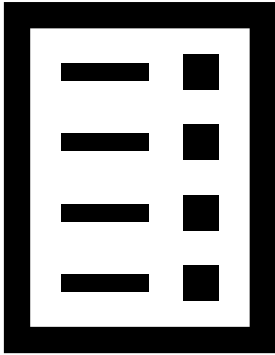
With the Support of  swissenergy

<https://www.hslu.ch/de-ch/hochschule-luzern/forschung/projekte/detail/?pid=6240>



SINA – Technical Aspects

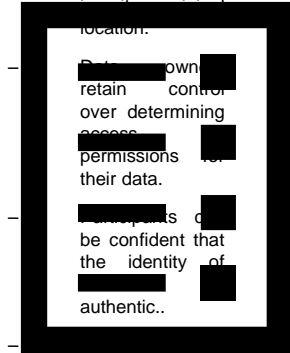
Requirements to SINA



- Data is not redundantly stored; it remains in its original location.
- Data owners retain control over determining access permissions for their data.
- Participants can be confident that the identity of others is authentic..
- There is no centralized entity managing the data.

IDSA Data Space Software

- Data is not redundantly stored; it remains at its original location.



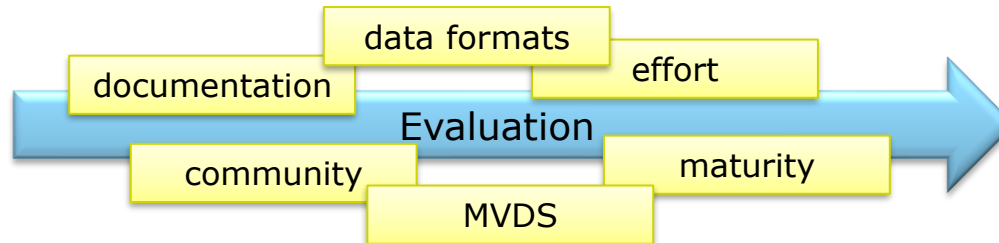
- centralized entity managing the data.



INTERNATIONAL DATA SPACES ASSOCIATION

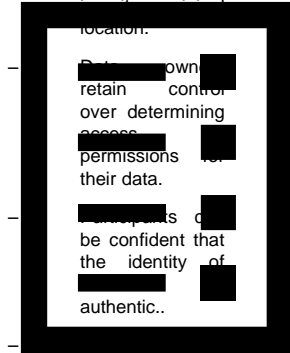


ECLIPSE[®]
FOUNDATION



IDSA Data Space Software

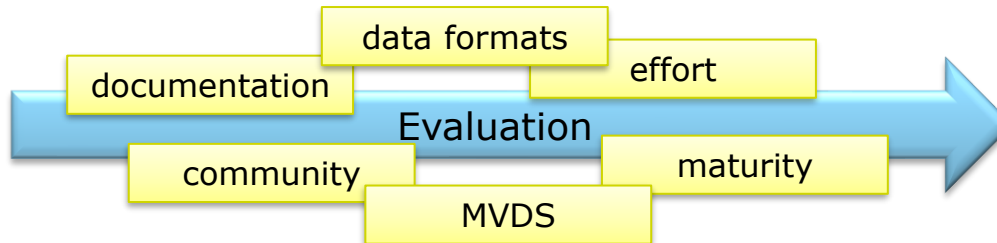
- Data is not redundantly stored; it remains at its original location.



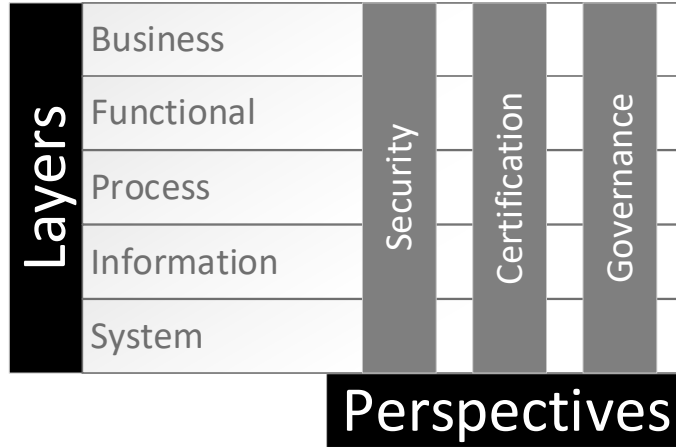
centralized entity managing the data.



INTERNATIONAL DATA
SPACES ASSOCIATION



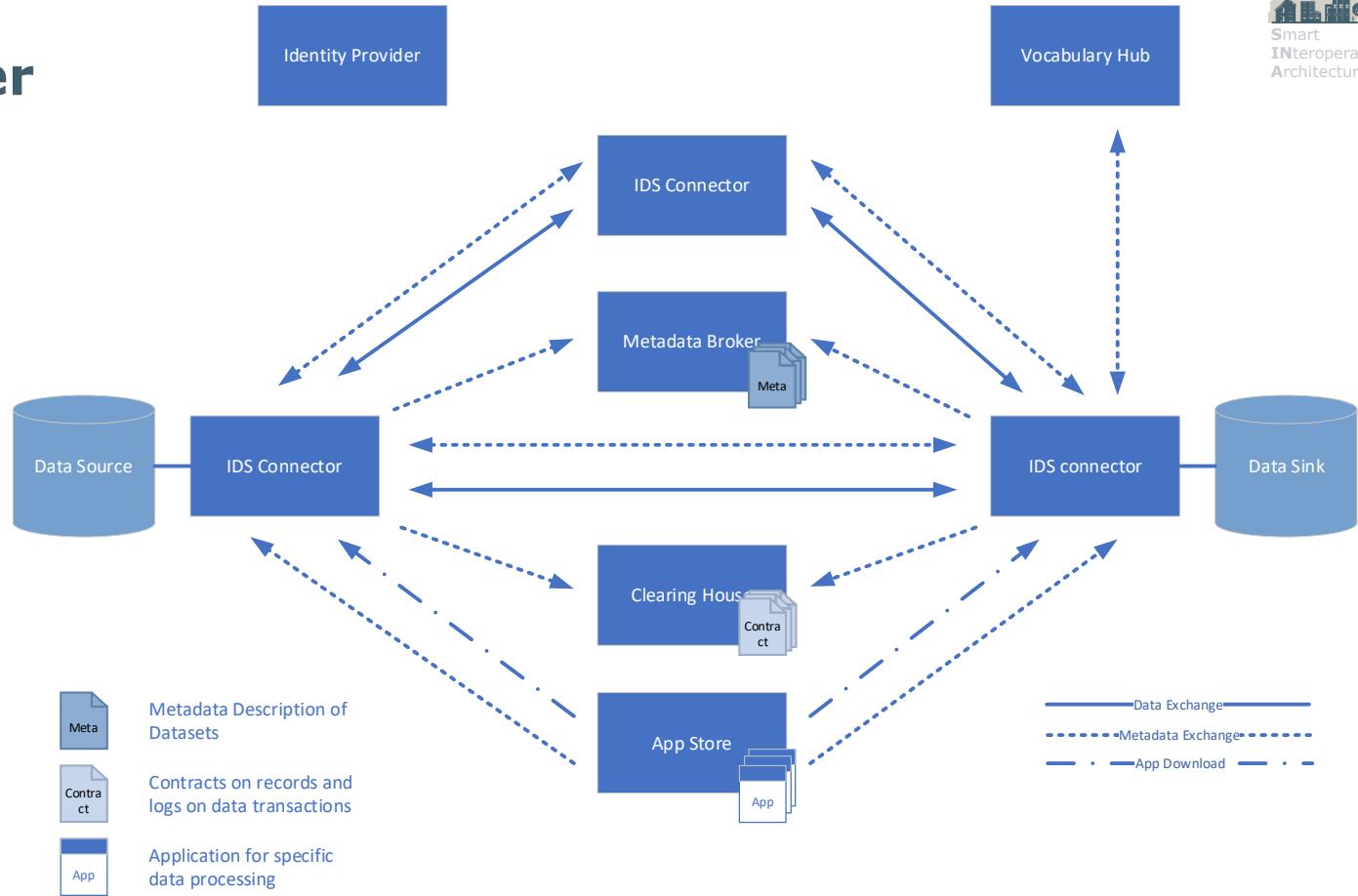
IDSA Reference Architecture Model



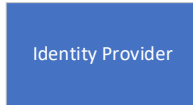
- Roles and their interactions
- Functional requirements
- Interactions between components
- Domain-independent language
- Technical core of Data Space

- Identify components, protect communication, control use of exchanged data
- Consistent certification of all components
- Data Space enable implementation of rules the participating organisations determine

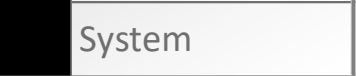
System Layer



Identity Provider

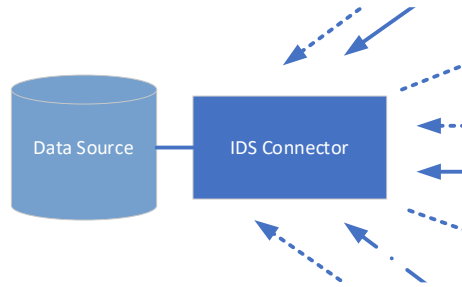


- Ensures identity and authenticity of connected components
- Manages certificates



System

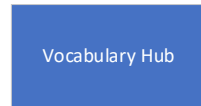
Connector



- Connects to data source via API
- Connects to other components in Data Space
 - Other connectors
 - Metadata Broker
 - Identity Provider
- Can run app in its context

System

Understanding Data

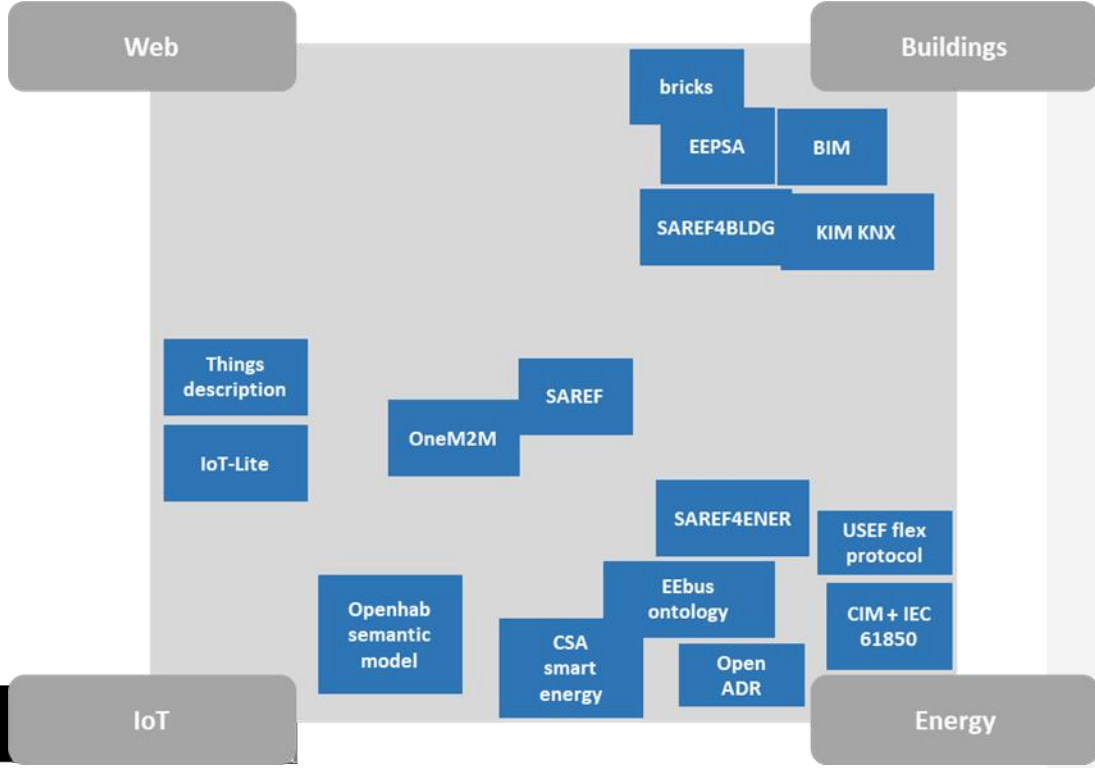


- Vocabulary Hub provides descriptions of the data for each data source (ontologies)
- No single data model required

System

Ontologies

Vocabulary Hub



- Ontologies for several domains available

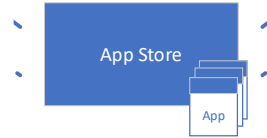
Ontologies

Vocabulary Hub

Ontology / Data model	Advantages	Drawbacks
CIM - IEC 61850	Widely used in industry Existing supporting tools	Not public Too specific for our purpose -> mostly focused on the grid
SAREF4ENER	Academic and institutional support Flexible and rich	Complex Lacks open-source implementations and example
EEBus ontology	Industry support with compatible products Few open-source implementation (although limited) Use cases are described precisely	Not many supported products Complex
OpenADR information model	Specific and practical Some compatible products	Limited in scope and functionalities Not so actively extended anymore

System

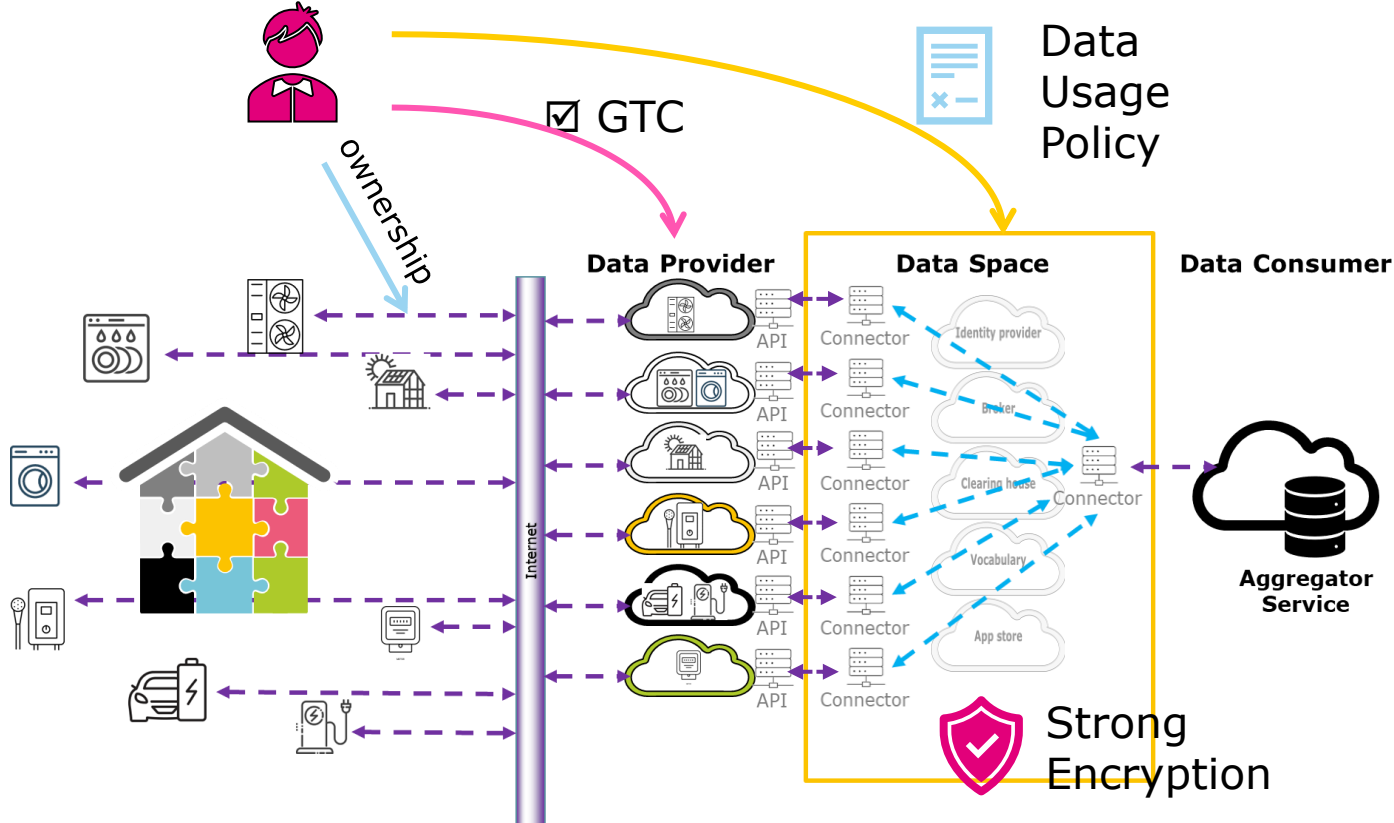
App Store



- App Store provides certified apps
- Apps are server apps, not to compare to smartphone apps
- Apps run in the context of a connector
- Apps can guarantee that data they get never leaves the app

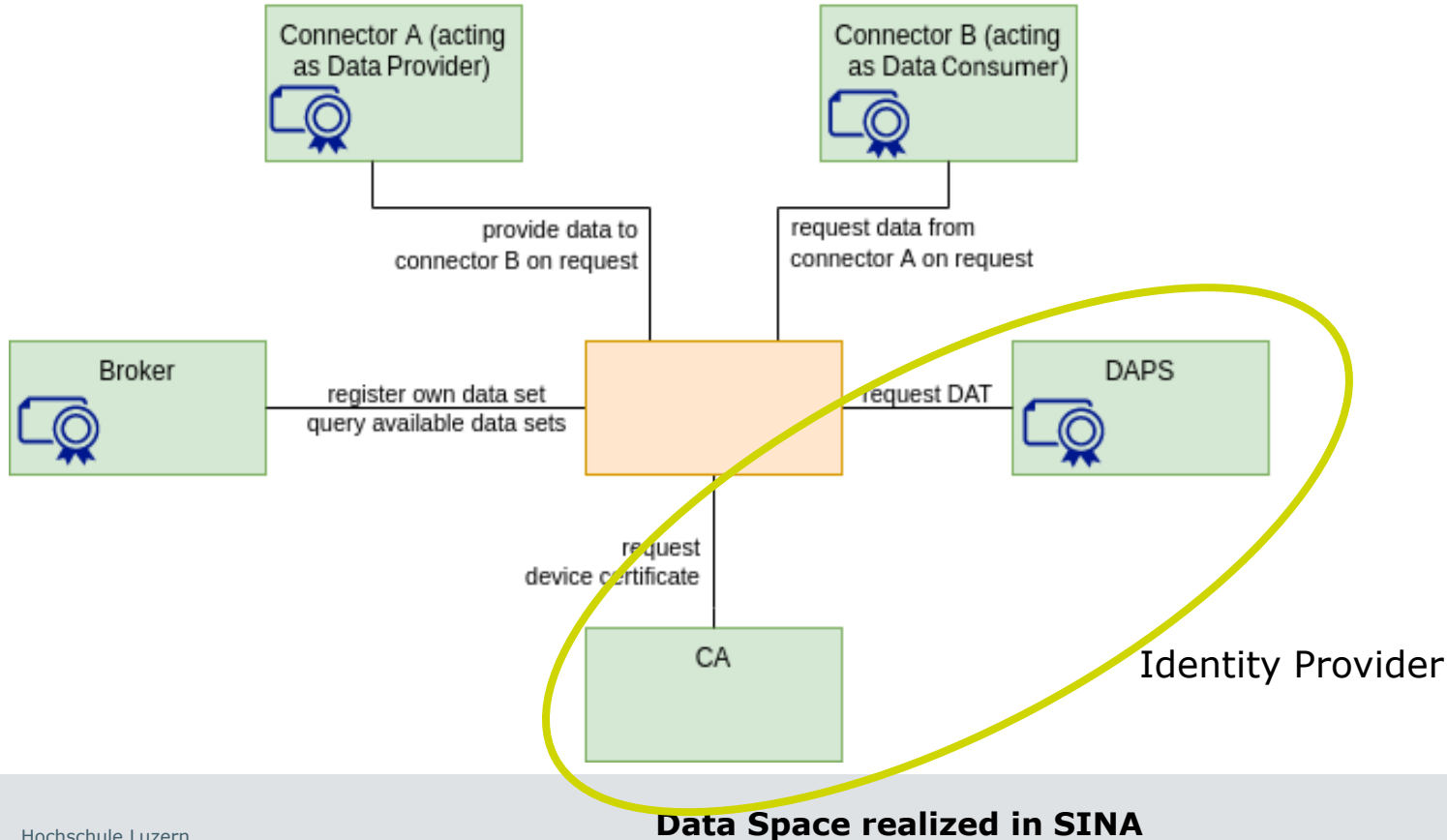
System

Data Security, Data Sovereignty, Trust

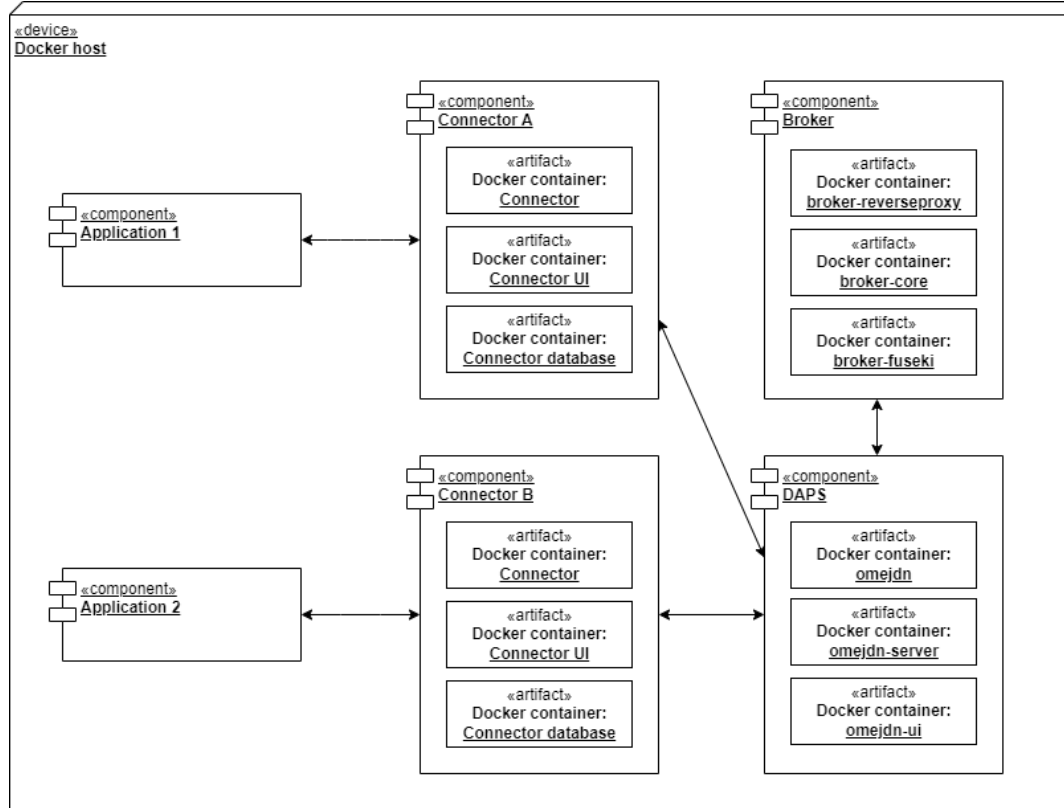


All the components contribute to security, sovereignty and trust

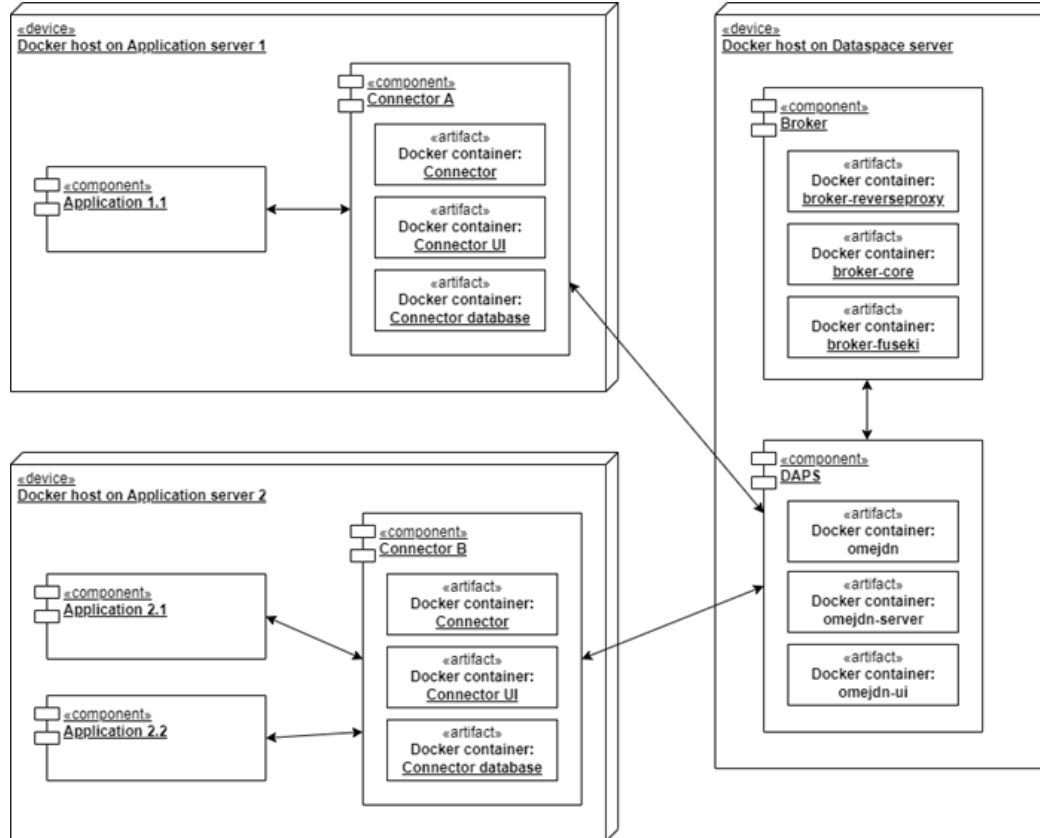
Minimum Viable Data Space



Minimum Viable Data Space



Real Data Space

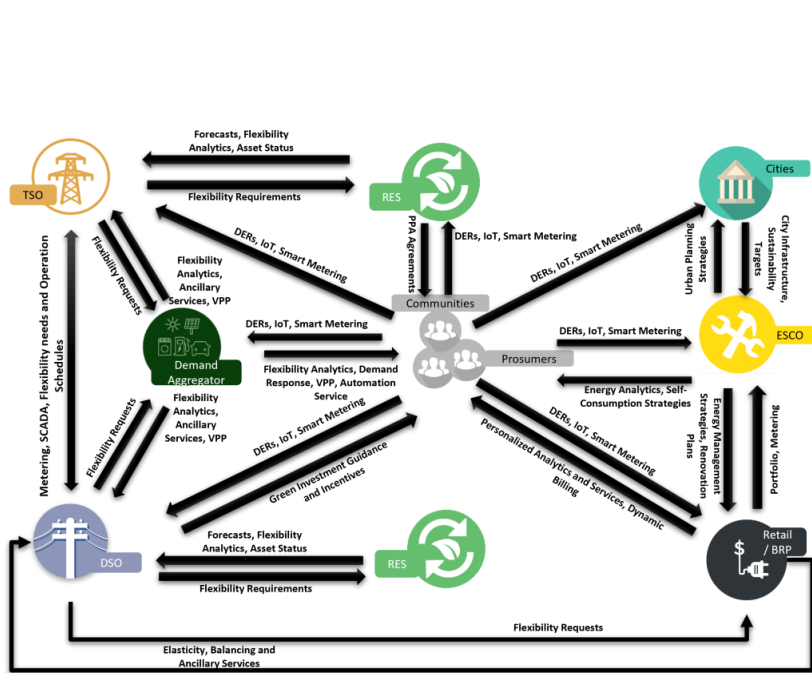


Components can run on different machines



SINA – Business aspects & use cases

Economic and Ecological Aspects



(Retrieved from <https://energydataspaces.eu/>)

Data exchange between different actors is getting more and more crucial in a future system

An open infrastructure for data exchange, based on agreements, rules, and standards is needed

Data spaces can enable new innovative data-driven business models

Data spaces have potential benefits for the economy and the environment

Cost of data handling and how a data space environment can reduce it

Costs	SINA
Data Transfer Costs	- A targeted selection of the data to be received by the data consumer can reduce the data volume and thus costs
Data Processing Costs	- Reduced data processing can occur if certain data is only processed by one data customer and the outcomes are made available to other stakeholders via the data space
Storage Costs	- The amount of stored data is reduced because the same data is not stored in multiple locations
Data Governance and Compliance Costs	- Data governance and compliance are provided by the data space framework and should lower these costs - Access control to data is provided by the data space framework
Data Integration Costs	- Stakeholders only have to adapt and maintain one interface

Economic and Ecological Aspects

“... use case: how the technology can be applied to solve a business problem.” (Netland et al. 2023)

Frontiers

by requiring a good business case, organizations that bring in new technologies via limited pilot projects often find that these experiments go nowhere.

Throughout their experiments can successfully assess, pilot, and implement novel technologies, we studied how H&M introduced drone technology into its warehouse operations. We describe the research in more detail in our paper, *Journal of Operations Management* article, “Dropping Technologies and the Use Case: A Multi-Year Study of Amazon.” The company’s experience demonstrates that a use case can be developed into a meaningful business case with a credible approach and fit for key partners.

H&M may be the world’s largest furniture company, but it suffers from the same pain points as every other retailer: locating inventory, knowing when you have it in stock when, and where it is located. In critical, but human error still impacts a company that moves hundreds of thousands of items every day. Every time a customer asks a product to be located in stock, a potential sale is lost – as well as future sales. The customer is disappointed enough with the company.

Converting inventory transactions about shop items as well. Use of H&M’s digital centers in Germany and in two several operations dedicated to bring customers through regular manual inventory checks. Using turnkeys or leaders to count inventory in various scenarios, and generally, customer work that is prone to human error. The promising technology that H&M thought might help solve the problem was drones – something that already experimented with in unobstructed flight

at a flow of its warehouse problems. In Thailand, a warehouse employee had purchased a consumer drone and showed it to the warehouse’s photogrammetry on high-tech in Germany and Germany. H&M had talked about various products, including professional consumer drones and hobby drones. But they all required too much time, maintenance, and management while introducing new safety risks – and their performance was poor compared with human-led tasks.

The Breakthrough

In Asia, employees in the corporate range their development function H&M realized that the problem wasn’t simply with the technology but was also with the company’s process, an uncoordinated approach to testing drones. H&M decided to connect, coordinate, and directly manage the drone solution as part of its global Development Innovation Network (DIN).

The early pilots of the autonomous drones were more promising. By late 2018, H&M’s store warehouses in Springfield, Massachusetts, had successfully incorporated eight of the drones into its operations. The stores, which required no human intervention, flew at night to check the locations of all products that have moved during the day. On Sundays, the drones flew to all unobstructed, providing precise information about the warehouse’s stock status directly to the H&M’s warehouse management system. The business case looked good for the high-use locations that had no night-time work restrictions. But would it work elsewhere, too?

To assess the potential business case for fully autonomous drones in other H&M locations, the DIN studied what types of

ideal pilots. The unit’s highest view is critical for reaching emerging technologies and to right technology solutions with the best use case in the appropriate location.

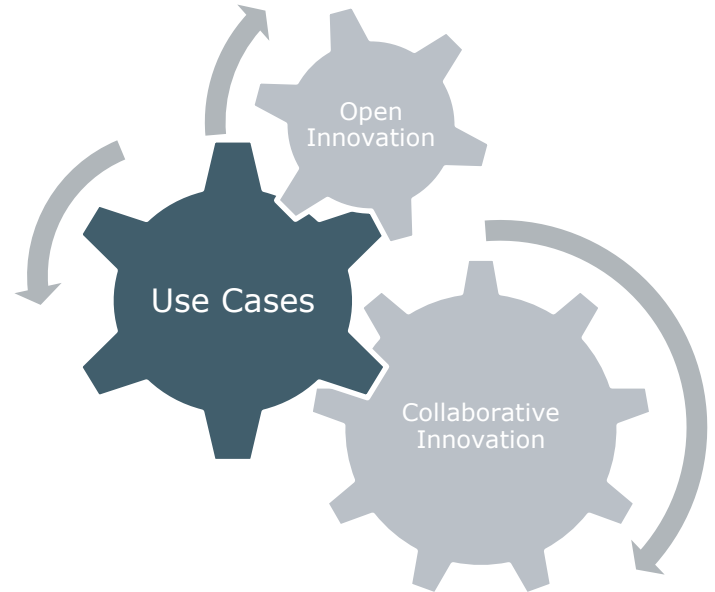
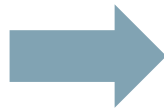
The leading and strong retailer’s leaders decided to strategically test three strong technologies in Asia. One of them was discarded after the initial pilot because it did not appear to reduce labor costs. This left H&M with a semi-autonomous solution from a French warehouse management specialist and an autonomous solution from local drone startup, Flyt.

H&M tested both drones in parallel at multiple warehouse locations, following a three-step approach: exploration of various kinds of use cases, pilots, and deployment. The DIN was responsible for the first two steps.

The pilot tests gave H&M the opportunity to identify the benefits and drawbacks of the drones under the various boundary conditions of the technology in later, fit-for-specific use cases. The semi-autonomous drones were found to be technologically fit for pilots, but the expense of manual setup and administration outweighed other cost advantages. After more extensive testing identified a pilot for other business cases, the semi-autonomous option was discarded.

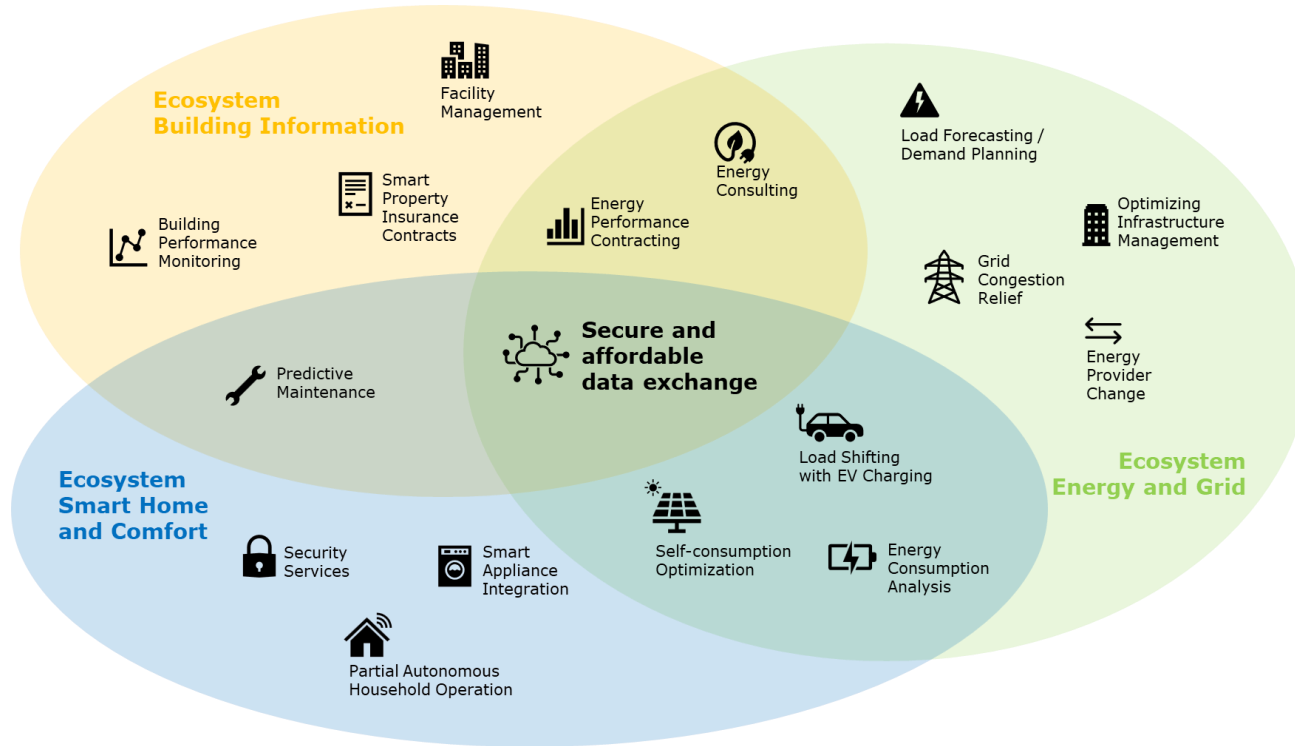
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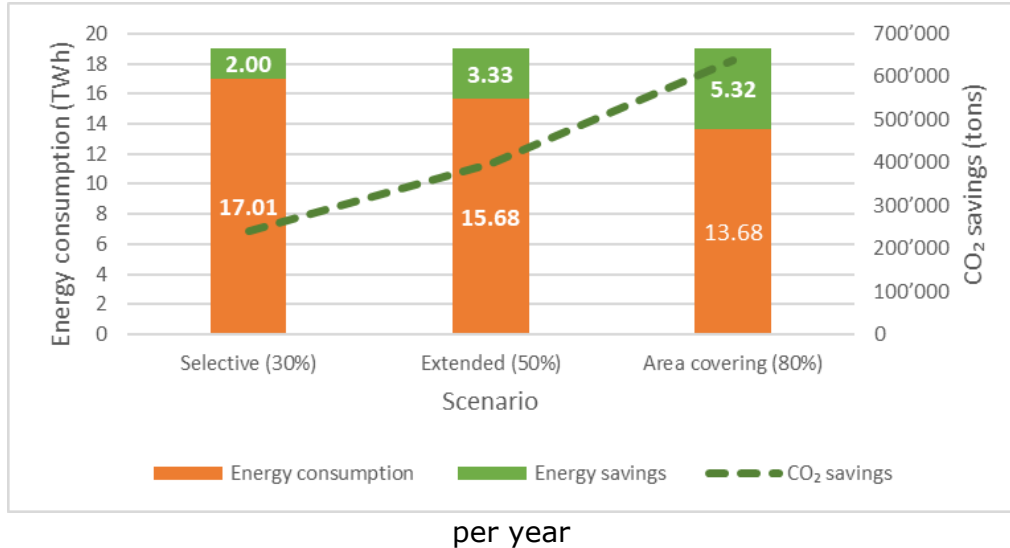


A specific setting in which **two or more participants** use a data space to **create value** (business, societal or environmental) **from data sharing**

Overview – Ecosystems of use cases



Energy and CO2 savings due to HEMS



	3.9 million households (100%)	3.12 million households (80%)	1.95 million households (50%)	1.17 million households (30%)	1 household
Consumption households	19 TWh	15.2 TWh	9.5 TWh	5.7 TWh	4872 kWh
Consumption equivalent CO ₂	2.28 Mton	1.82 Mton	1.14 Mton	0.68 Mton	585 kg
Savings HEMS (30%)	6.65 TWh	5.32 TWh	3.33 TWh	2.0 TWh	1705 kWh
Savings equivalent CO ₂	0.8 Mton	0.64 Mton	0.4 Mton	0.24 Mton	205 kg

... with 30% adaption 2 TWh of energy or 240,000 tons of CO₂ can be saved annually in Switzerland

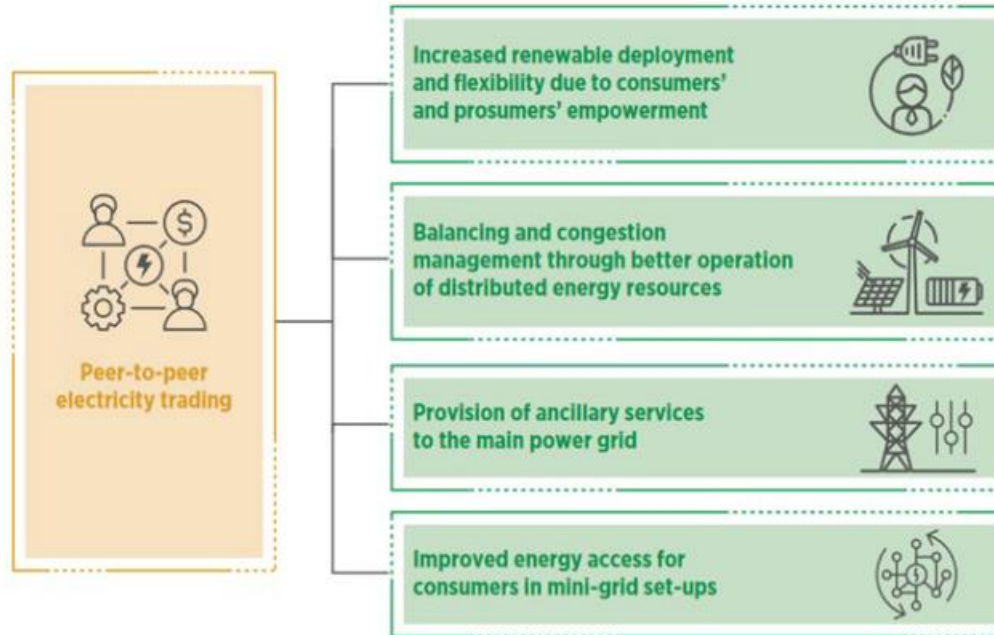
Demo data space



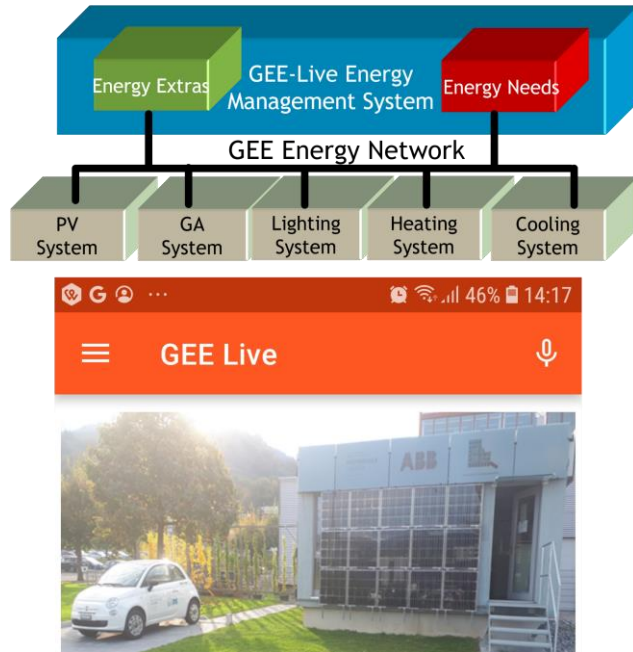


P2P Energy Trading Platform as POC

Benefits of a P2P Energy Trading Platform



P2P Energy Trading Platform as PoC



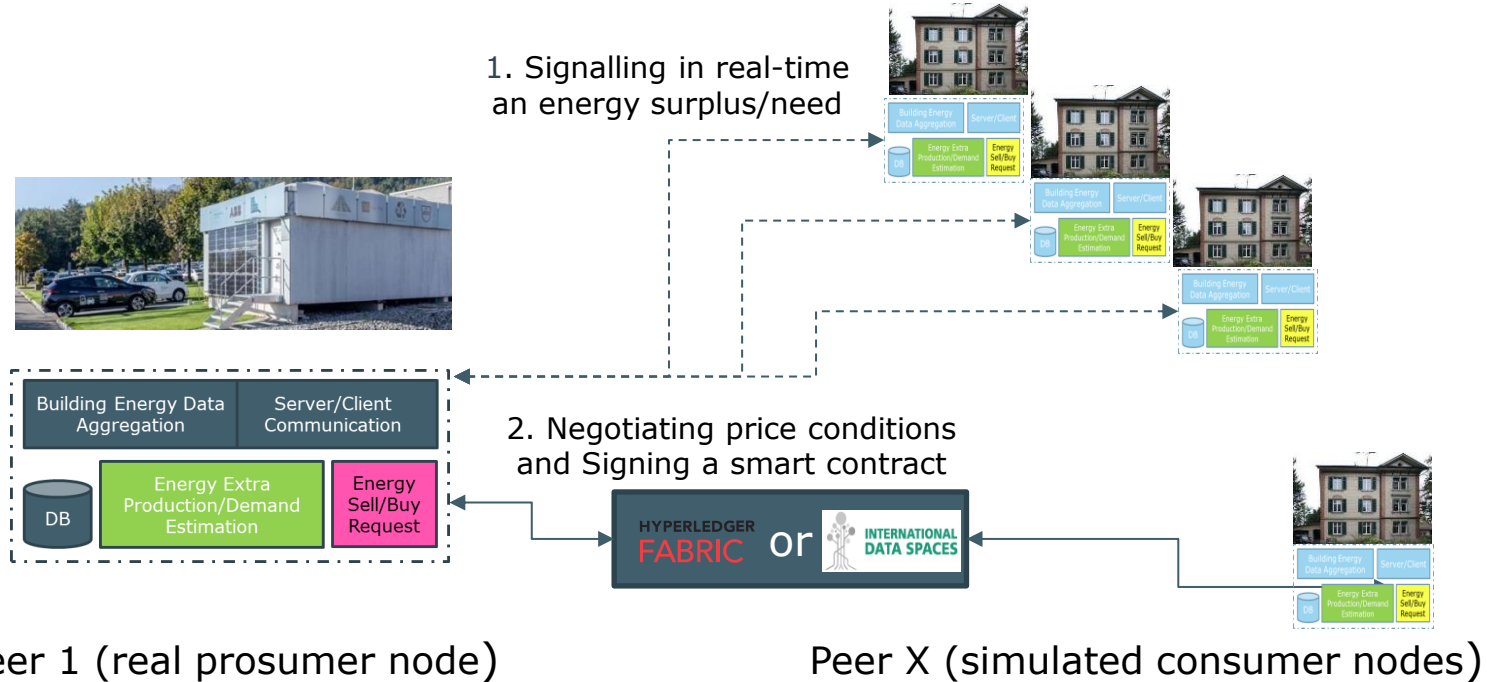
This PoC draft is prototyping how energy data can be aggregated, analyzed and exchanged in a local energy area network consisting of many buildings.

GEE-Live and its PV systems are providing the P2P platform with instant real energy production data.

P2P platform integrates secure IP-based protocols as well as sample smart contracting mechanisms based on a DLT – Distributed Ledger Technology.

P2P platform can be run on premise or in a cloud.

P2P essential operations (in Backend)

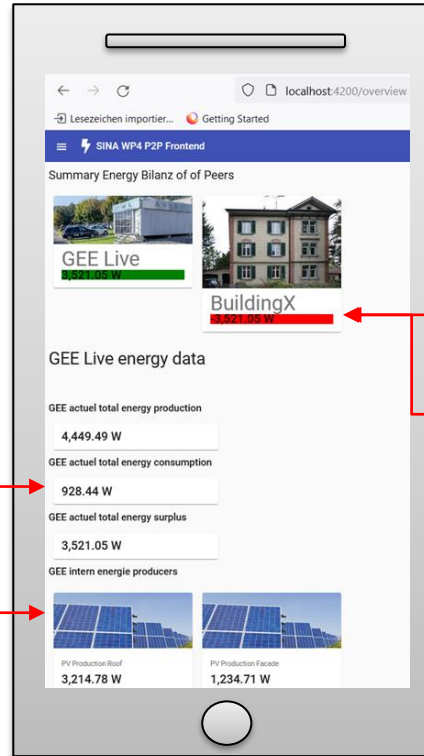
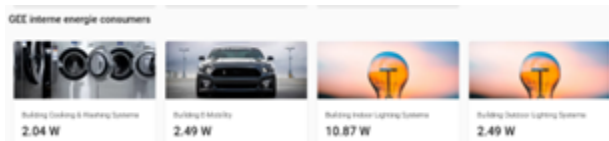


Using IDS connectors for P2P energy network could standardize energy exchange interfaces

P2P instant overviews (in Frontend)

Communication via secure MQTT, HTTPs, etc. protocols

GEE instant energy consumption



P2P energy data exchanges via secured stream sockets



Intercept energy messages of a virtual neighbor building with its instant energy needs

Summary – P2P Energy Trading Platform

- Within this PoC a functioning P2P energy trading platform with an elementary HEMS enabling estimation of the energy consumptions and productions of GEE-Live is built and tested.
- The PoC framework integrates several secure communication protocols for accessing real-time as well as historical energy consumption and production data of GEE-Live.
- External energy data exchanges between the HEMS of the buildings participating in the P2P network are managed by means of stream sockets to ensure a reliable way for the participants to broadcast their energy needs or surpluses within the network.
- An initial DLT test environment based on Hyperledger Fabric is successfully set up.

However

- Deployment and running smart contracts in Hyperledger remain a challenging task.
- An IDS smart contract framework may be an alternative. This has not been tested.



Horizon WILSON (SINA extended)

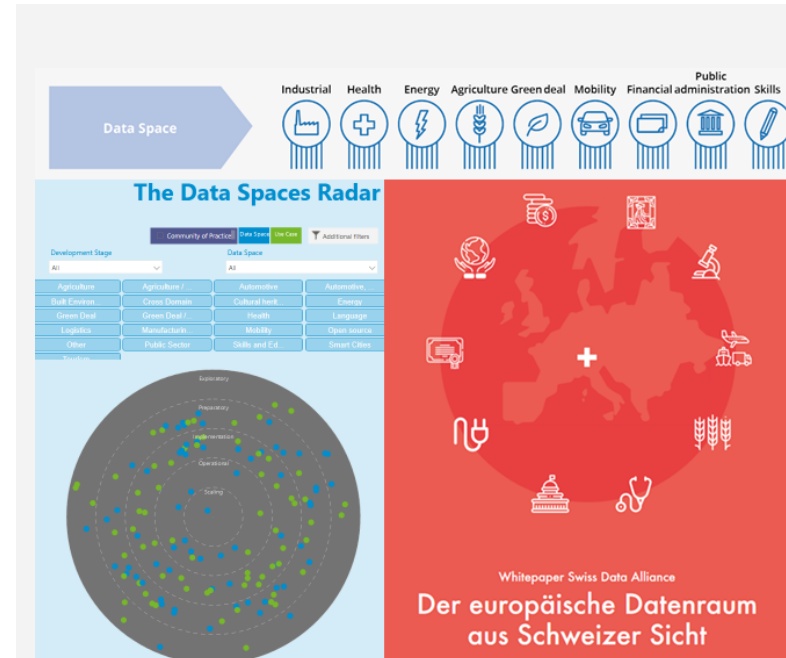
Trends

Initiatives and research on data spaces are very strongly supported in the EU.

"Future" issues such as legal agreements, data ownership, data sovereignty, trust and security are already considered in data spaces

A trustworthy non-profit organization that sets up and operates the data spaces in Switzerland is needed

It is important to pursue further projects for practical implementation

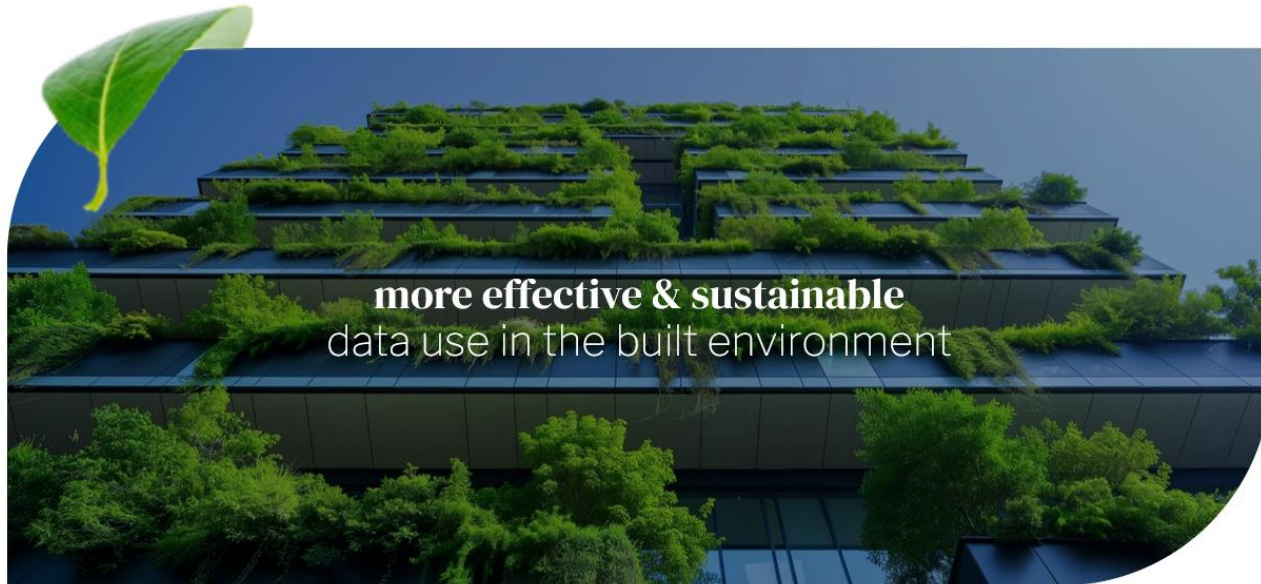




WILSON

An Overview

Distributed data modelling and federated digital
t**W**inning for **L**ifecycle data-driven **S**ustainable
Operation**N** and management of buildings and
districts



HORIZON-CL5-2023-D4-02-01: Innovative uses of lifecycle data for the management of buildings and buildings portfolios (Built4People Partnership)



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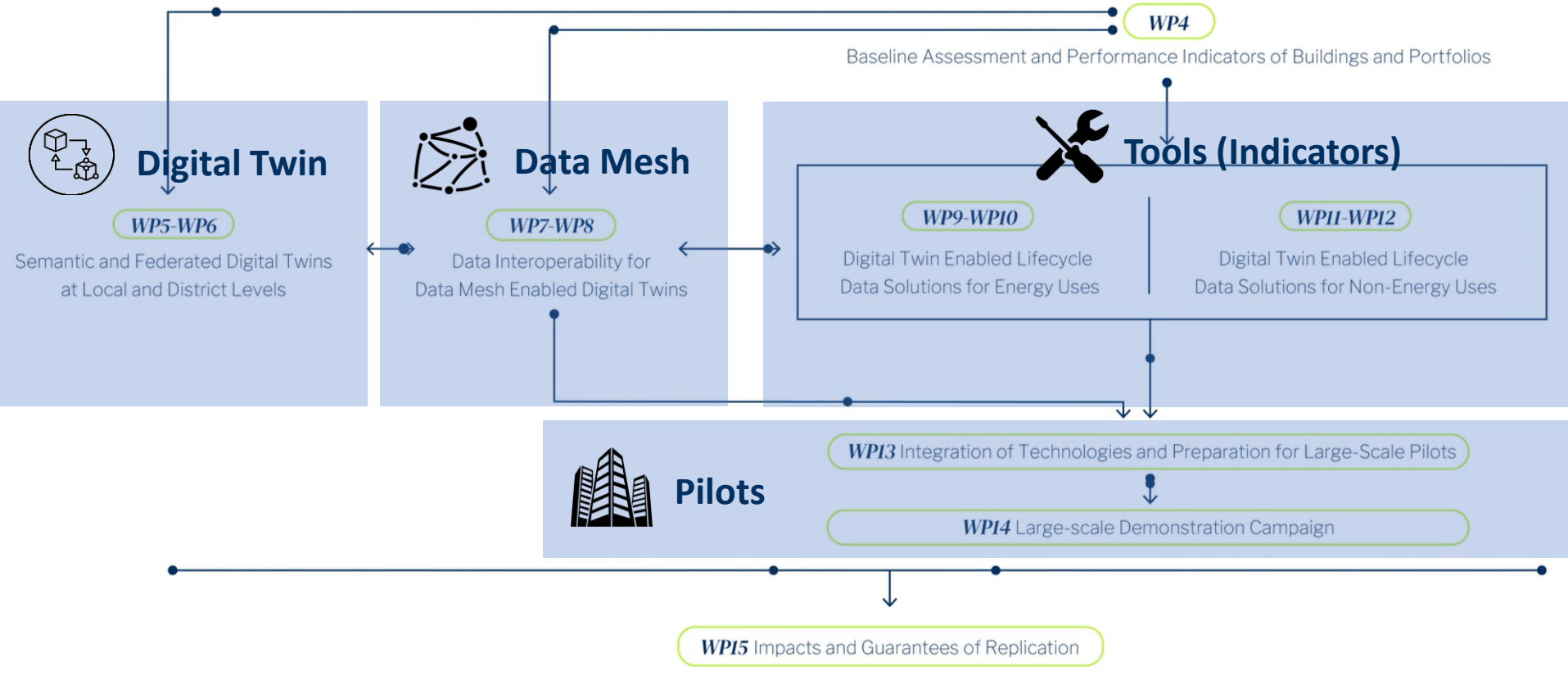
HSLU Lucerne University
of Applied Sciences
and Arts



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the European Union

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Data and interoperability		INN1) District digital twins: federation and data mesh INN2) Personalised Building Data Hubs (PDHs) INN3) P2P data and services marketplace
Planning and management INN4) Semantic-aware analytics energy management tools INN5) CIMBA: predictive maintenance	Environmental performance INN6) HIBOU: biodiversity in the built environment INN7) LOD-L: semantic renovation for material passports	Building diagnostics INN8) Risk and resilience of buildings INN9) BIM-enabled Smart Readiness Indicator calculator

Innovations



Use Cases



Pilots



- Data-driven network asset management
- Boost of green energy investments by market actors

Future projects ...

Data spaces & Energy

- BIM-based processes and digital twins for facilitating and optimising circular energy renovation (HORIZON)
- Innovative, Community-Integrated PV systems (Horizon)
- Lifecycle data in buildings (Innovationscheck -> Innosuisse)

Data spaces & Agriculture

- Eat data – from farm to fork (HORIZON)

Data spaces & Industrial & Manufacturing

- Sustainability reports for manufacturing companies (Innosuisse)





Discussion- The future of data spaces