

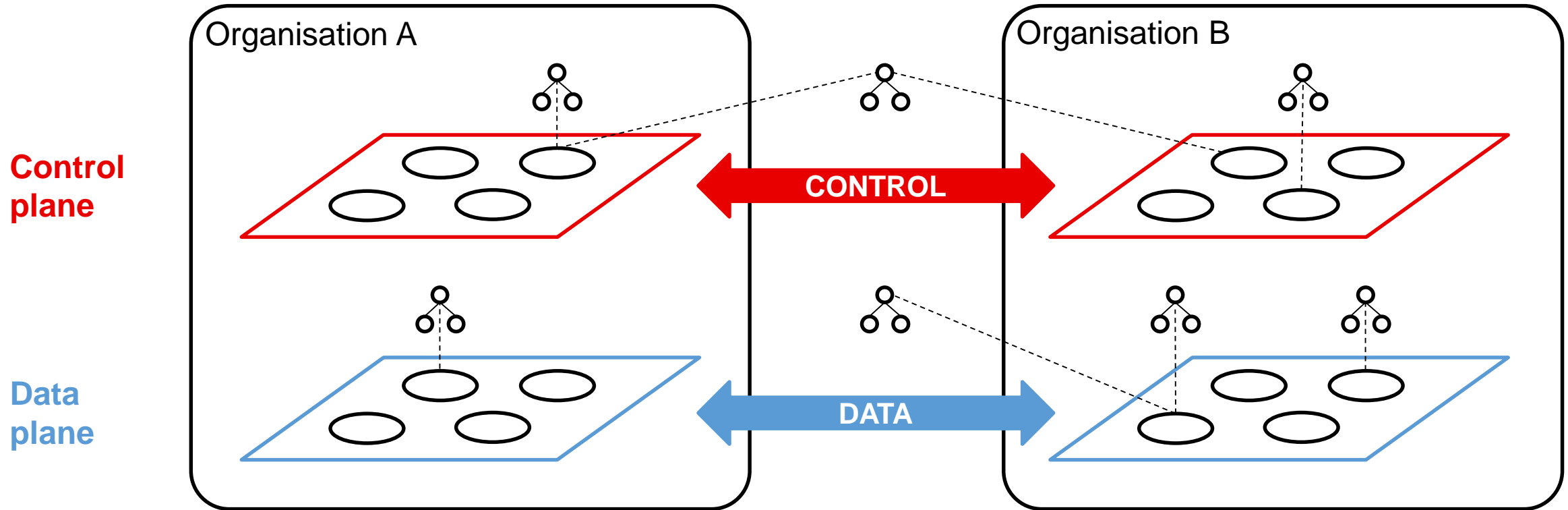


2nd AIOTI Workshop on Semantic Interoperability for Digital Twins

On the need for ontology hub interoperability

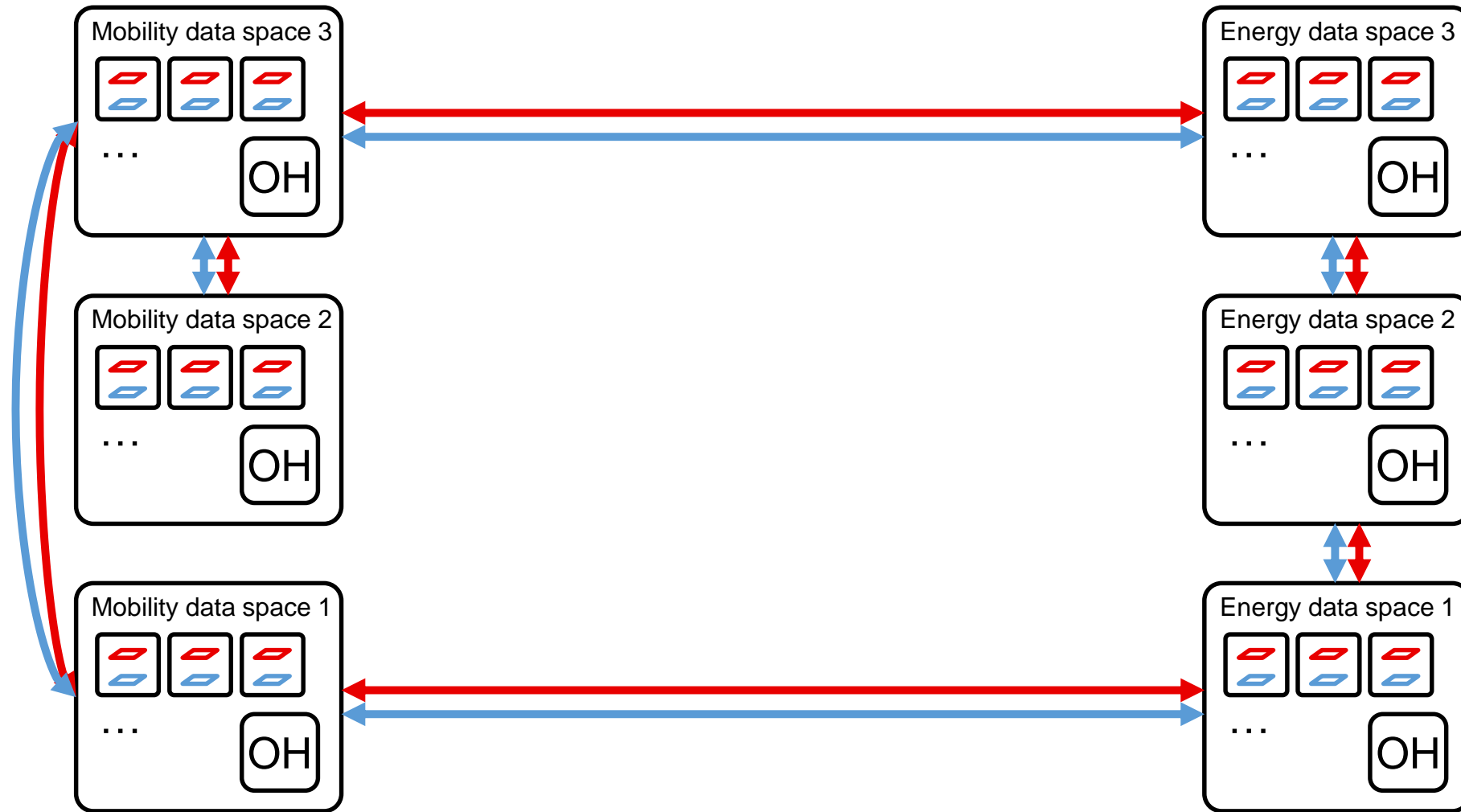
Raúl García-Castro

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Centro de I+D+i en Inteligencia Artificial (AI.nnovation Space)
Universidad Politécnica de Madrid



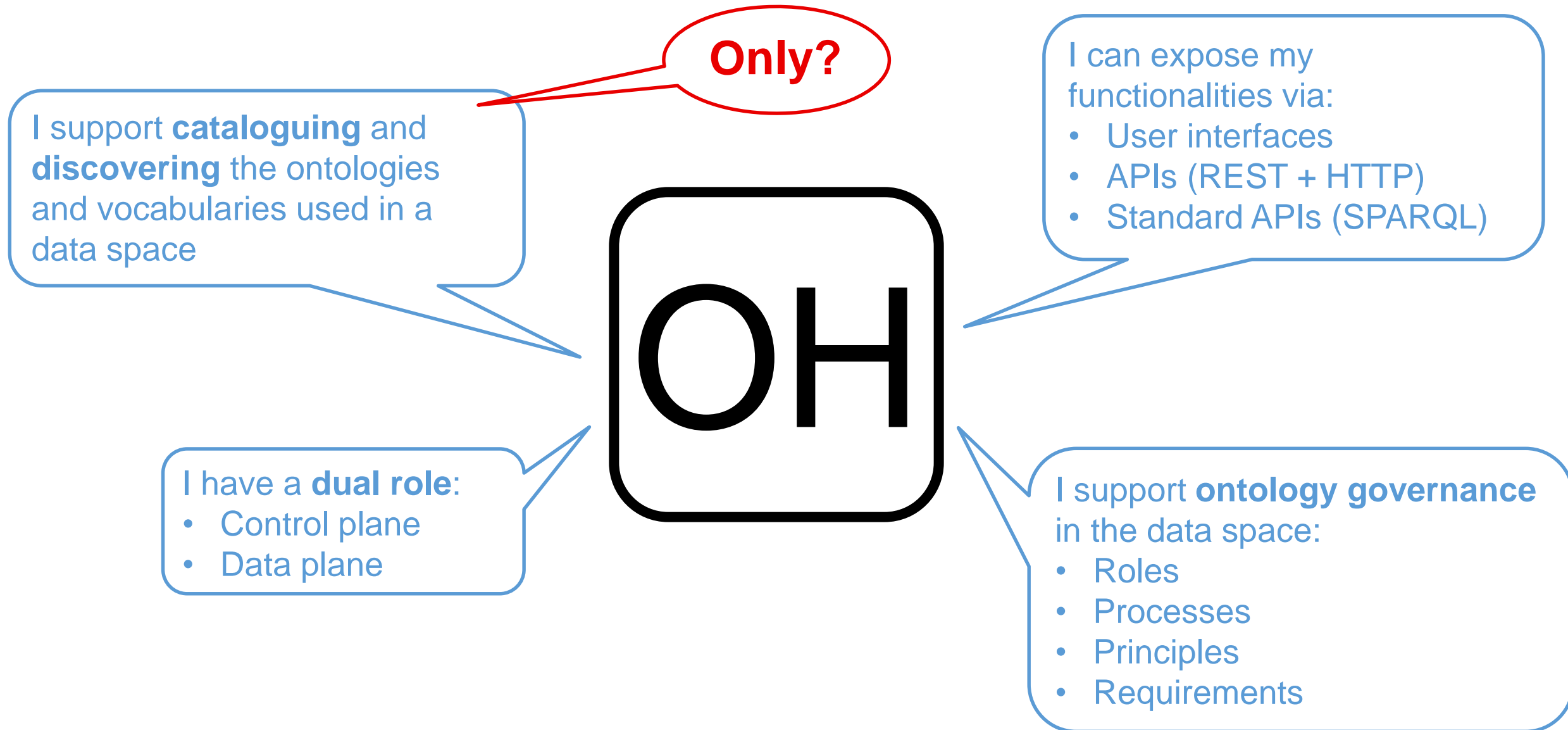
Which is the software component in charge of managing these ontologies?

Let's call it ontology hub: **OH**

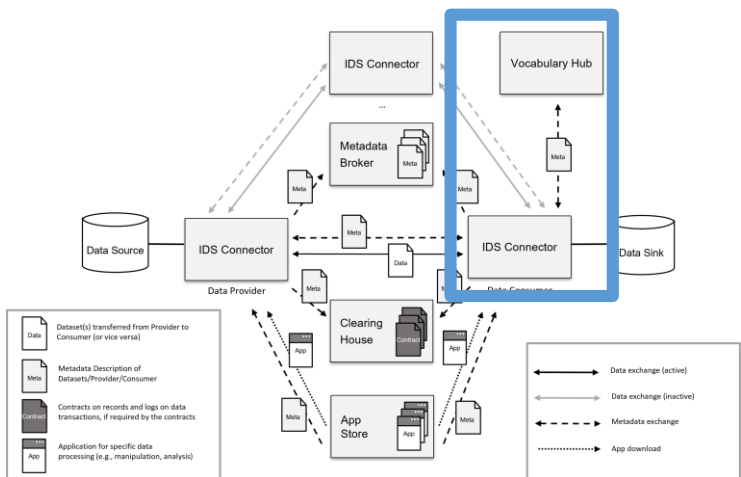


How far are we from ontology hub interoperability?

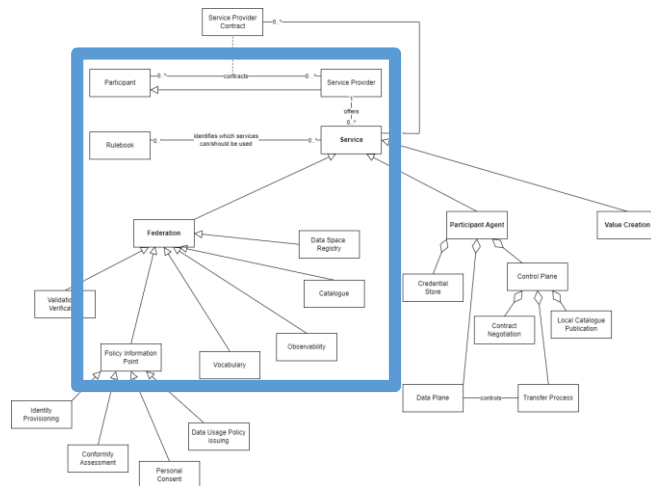
Which are the challenges?



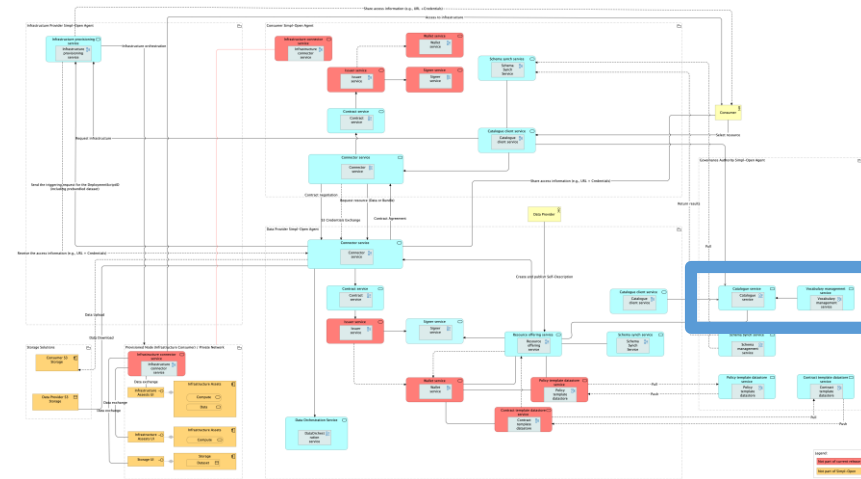
Ontology hubs in data space architectures



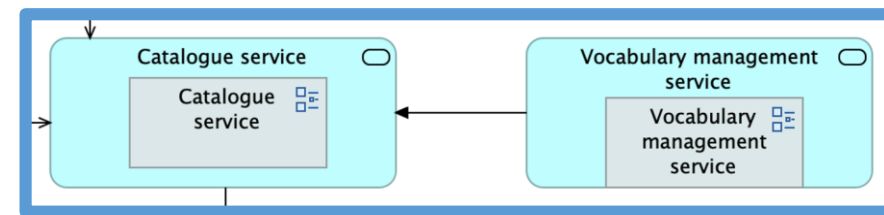
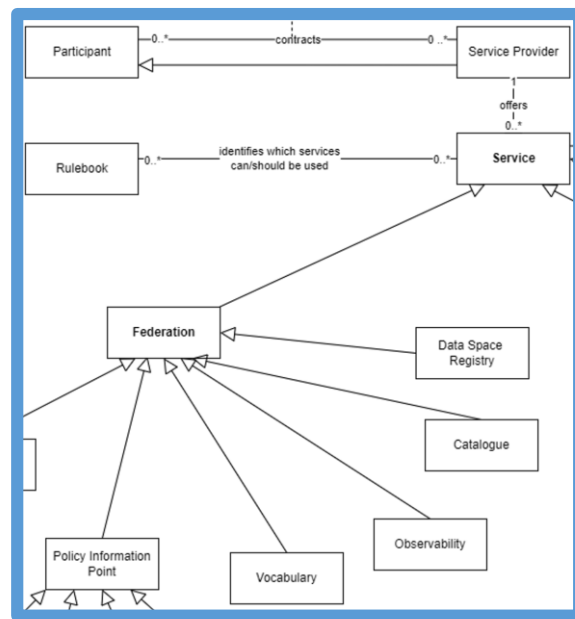
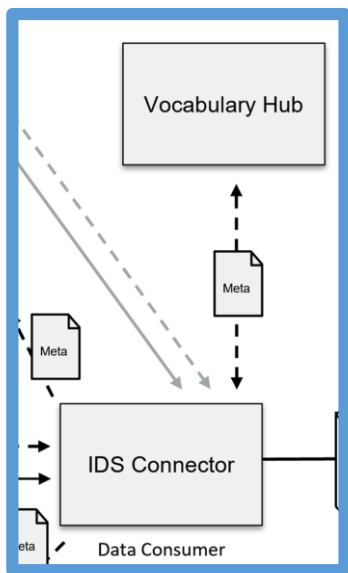
Vocabulary hub @ IDSA-RAM 4



Vocabulary service @ DSSC Blueprint 2.0



Vocabulary management service @ Simpl Open by March 2026





LOV



OntoPortal



ShowVoc

VocolReg

...



OBO Foundry



*Portal (Agro, Bio...)

...



PIONERA ontology hub



Poolparty Thesaurus Manager



Semantic Treehouse

...



Ontology hub functionalities according to its role

As an ontology catalog

- **Ontology metadata management**
- **Ontology metadata visualization**
- **Ontology versioning**
- **Ontology discovery**

As an ontology publisher

- **Ontology management**
- **Ontology publication** (best practices, FAIR)

As an ontology usage tool

- **Ontology artifact management**
- **Ontology artifact publication** (examples, SHACL shapes, JSON-LD contexts, etc.)
- **Ontology services** (reuse, evaluation, data integration, reasoning, etc.)

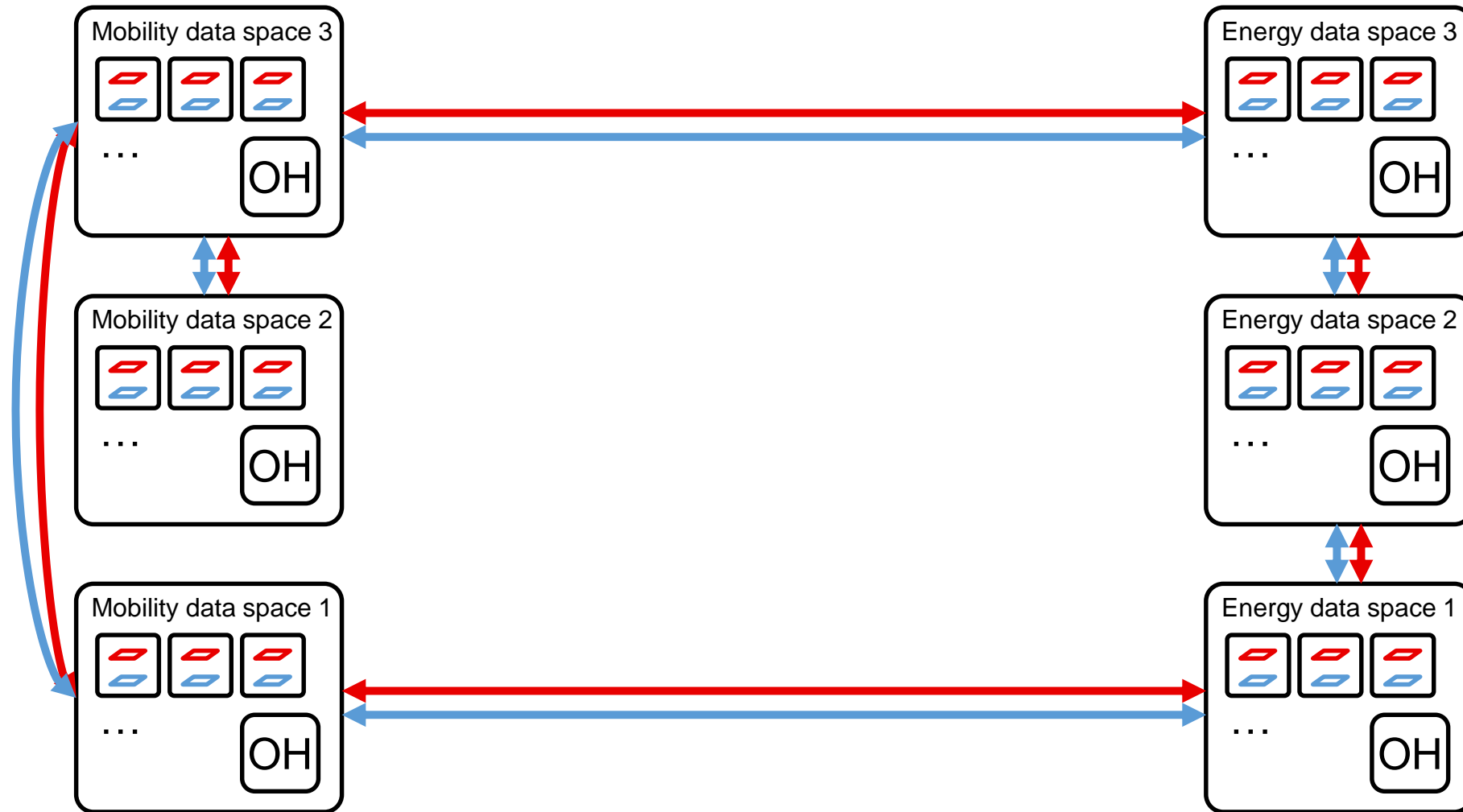
As an ontology development tool

- **Ontology development artifacts management** (requirements, conceptualization, tests, etc.)
- **Ontology development services** (edition, specification, reuse, testing, etc.)
- **Collaborative development**
- **User management**
- **Integration with ontology development infrastructure**

As a data space component

- **Control plane services** (asset description, extend asset description, asset metadata validation, etc.)
- **Data plane services** (dataset description, extend dataset description, dataset validation, dataset integration, knowledge graph creation, dataset annotation, reasoning, etc.)
- **Governance services** (traceability, provenance, privacy)
- **User and role management**
- **Integration with data space components** (mainly with the connector)

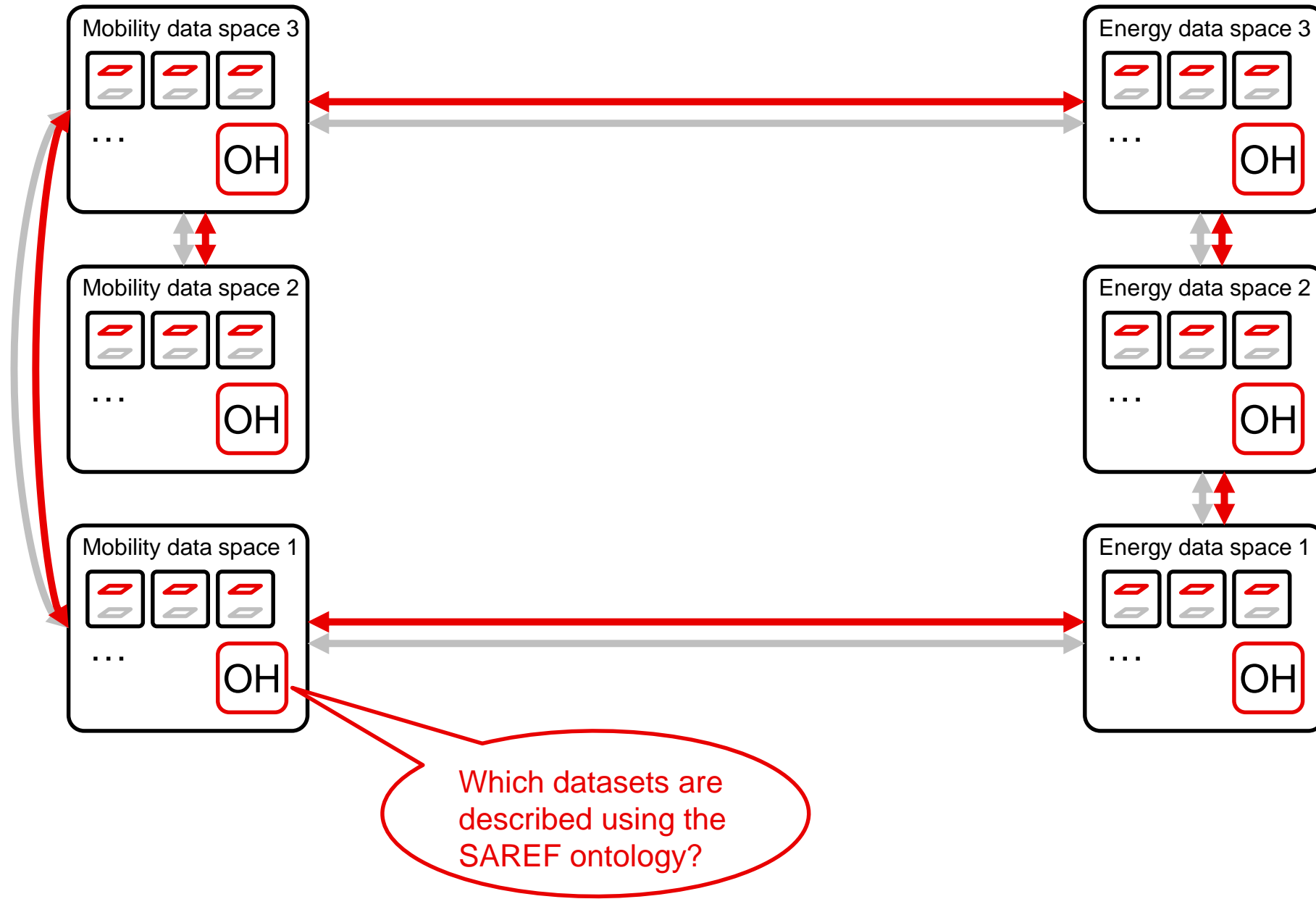
Back to... Inter-data space inter-operability

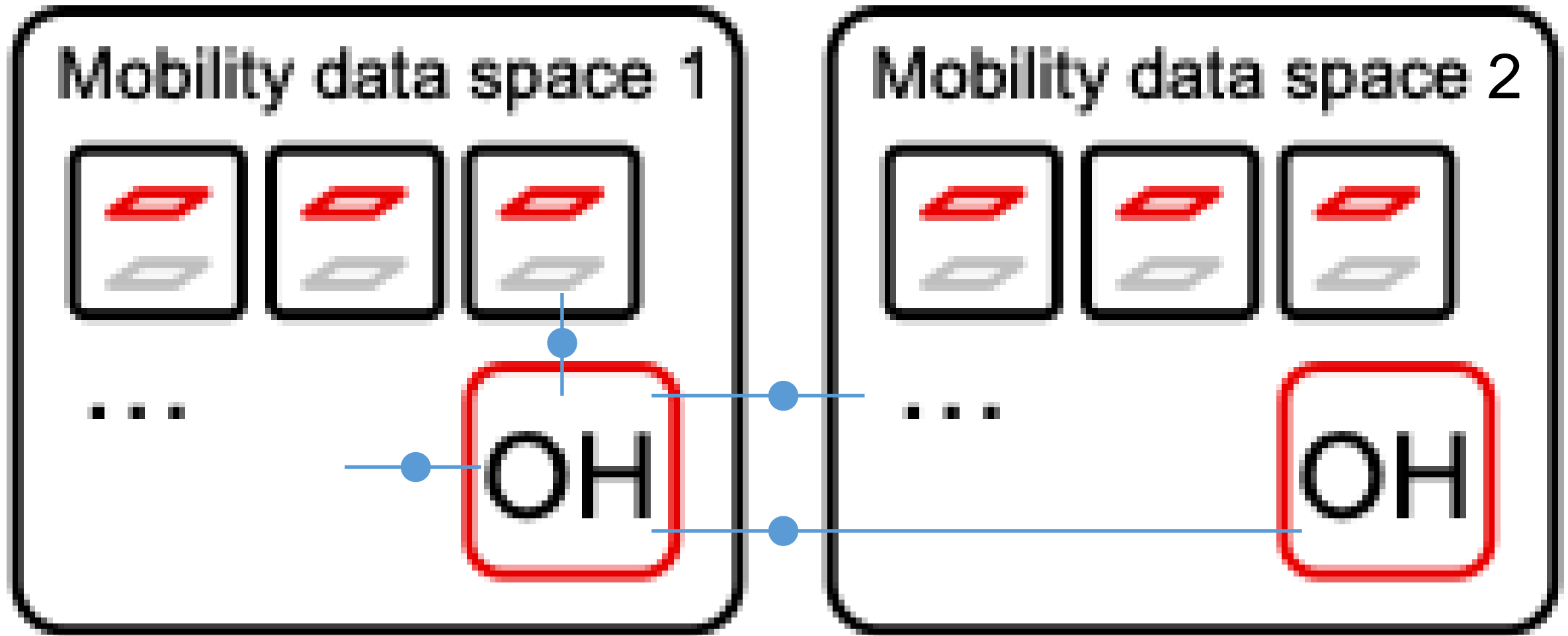


As an ontology catalog	As an ontology publisher	As an ontology usage tool	As an ontology development tool
<ul style="list-style-type: none"> • Ontology metadata management • Ontology versioning • Ontology metadata visualization • Ontology discovery 	<ul style="list-style-type: none"> • Ontology management • Ontology publication (just practice, FAIR) 	<ul style="list-style-type: none"> • Ontology artifact management • Ontology artifact publication (templates, SHACL, shapes, _JSON-LD contexts, etc.) • Ontology services (reus, evaluation, data integration, reasoning, etc.) 	<ul style="list-style-type: none"> • Ontology development artifacts management (incubators, ontologies, tests, etc.) • Ontology development services (adapters, verification, reuse, testing, etc.) • Collaborative development • User management • Integration with ontology development infrastructure
As a data space component			
<ul style="list-style-type: none"> • Control plane services (asset description, extend asset description, asset metadata validation, etc.) • Data plane services (dataset description, extend dataset description, dataset validation, dataset integration, knowledge graph creation, dataset annotation, reasoning, etc.) • Governance services (traceability, provenance, privacy) • User and role management • Integration with data space components (mainly with the connector) 			

Pick one

Federated discovery

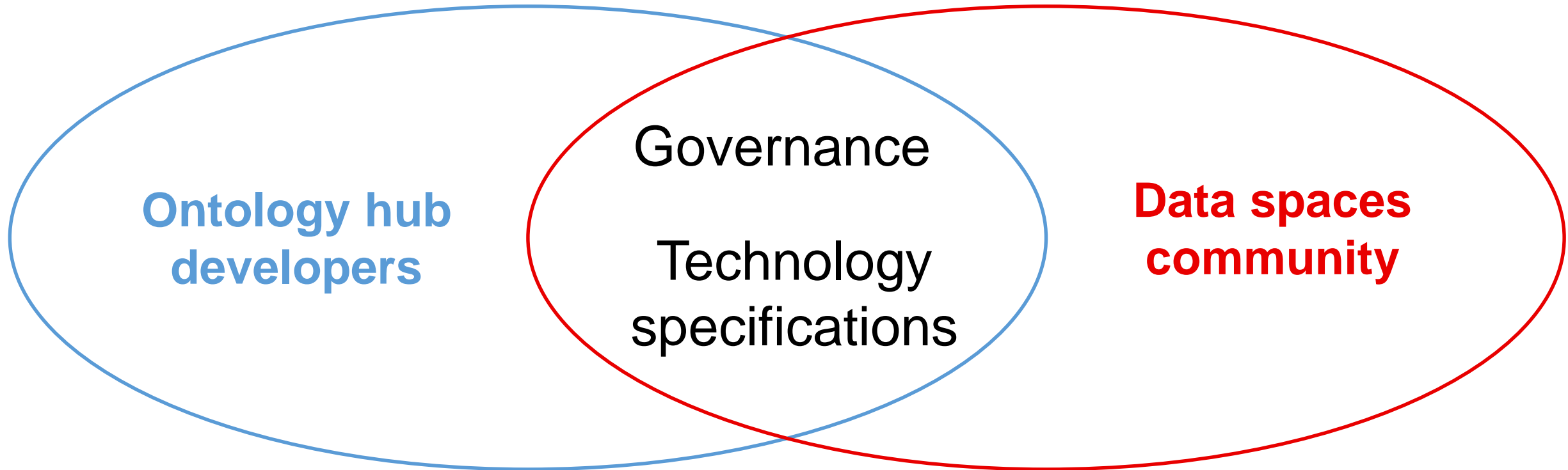




Challenges for ontology hub interoperability

<ul style="list-style-type: none"> • Policies for access control or usage of ontologies not here yet 	<ul style="list-style-type: none"> • Ontologies are openly available in general 	Policy
<p>Depends on functionality</p> <ul style="list-style-type: none"> • Coupled with data space governance • Need behaviour specifications • Need common APIs 	<p>Depends on functionality</p> <ul style="list-style-type: none"> • Heterogeneity in behaviour (normal operation + errors) • Heterogeneity in APIs (ad-hoc, SPARQL, etc.) 	Behavioural
<ul style="list-style-type: none"> • DCAT as backbone • Need standard metadata for describing ontologies 	<ul style="list-style-type: none"> • Heterogeneity in ontology metadata (voaf, MOD, etc.) 	Semantic
<ul style="list-style-type: none"> • Asset metadata in RDF (Turtle, JSON-LD, etc.) 	<ul style="list-style-type: none"> • Ontology metadata in RDF 	Syntactic
<ul style="list-style-type: none"> • Web protocols (HTTP+REST) • Trust mechanisms (security, identity, etc.) 	<ul style="list-style-type: none"> • Web protocols (HTTP+REST) • Ontologies are openly available in general 	Transport
DATA SPACES	ONTOLOGY HUBS	

Need agreement and consensus



Call for Action for the Dataspaces

Community

01

Define a roadmap for interoperable ontology hubs

Identifying and prioritizing the most relevant interoperability points

02

Define a strategy for reaching agreements

For every facet (currently semantic and behavioural are the most challenging)

03

Embrace interoperability testing

Specify and implement mechanisms for interoperability testing and assurance

Questions

This work has received funding from the PIONERA project (Enhancing interoperability in data spaces through artificial intelligence), a project funded in the context of the call for Technological Products and Services for Data Spaces of the Ministry for Digital Transformation and Public Administration within the framework of the PRTR funded by the European Union (NextGenerationEU).

