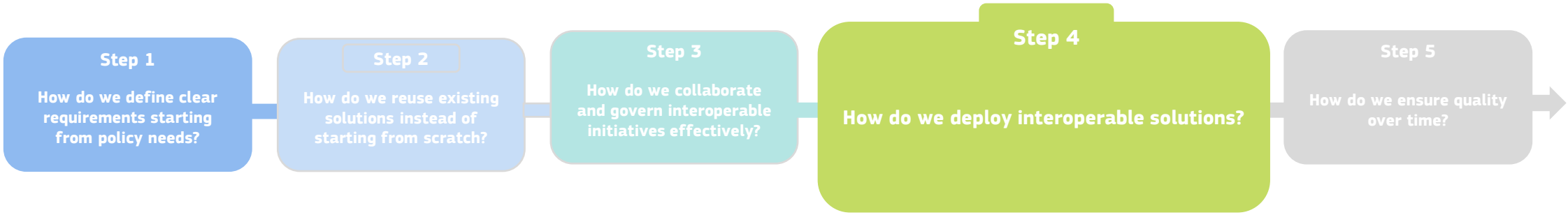
Seasonal School 2026 – Roadmap



Session 12 - Guidelines on sharing interoperability solutions

Session 13 - Building semantic interoperability: the SEMIC way

Session 14 - EIF Compliance Assessment with CAMSS: a practical introduction

Session 15 - GovTech and innovation in the public sector

interoperable europe

Step 4

How do we deploy interoperable solutions?

Building semantic interoperability: the SEMIC way

Georges Lobo
Jorge Sousa
Anastasia Sofou
Sander Van Dooren

Session 13

Interoperable Europe Academy
Seasonal School 2026

09-10 JUNE 2026

The layers of Interoperability

Semantic interoperability sits where policy concepts become data that machines can process.

Legal

Do we have compatible rights, obligations and legal effects?

Organisational

Do processes, responsibilities and services align?

Semantic

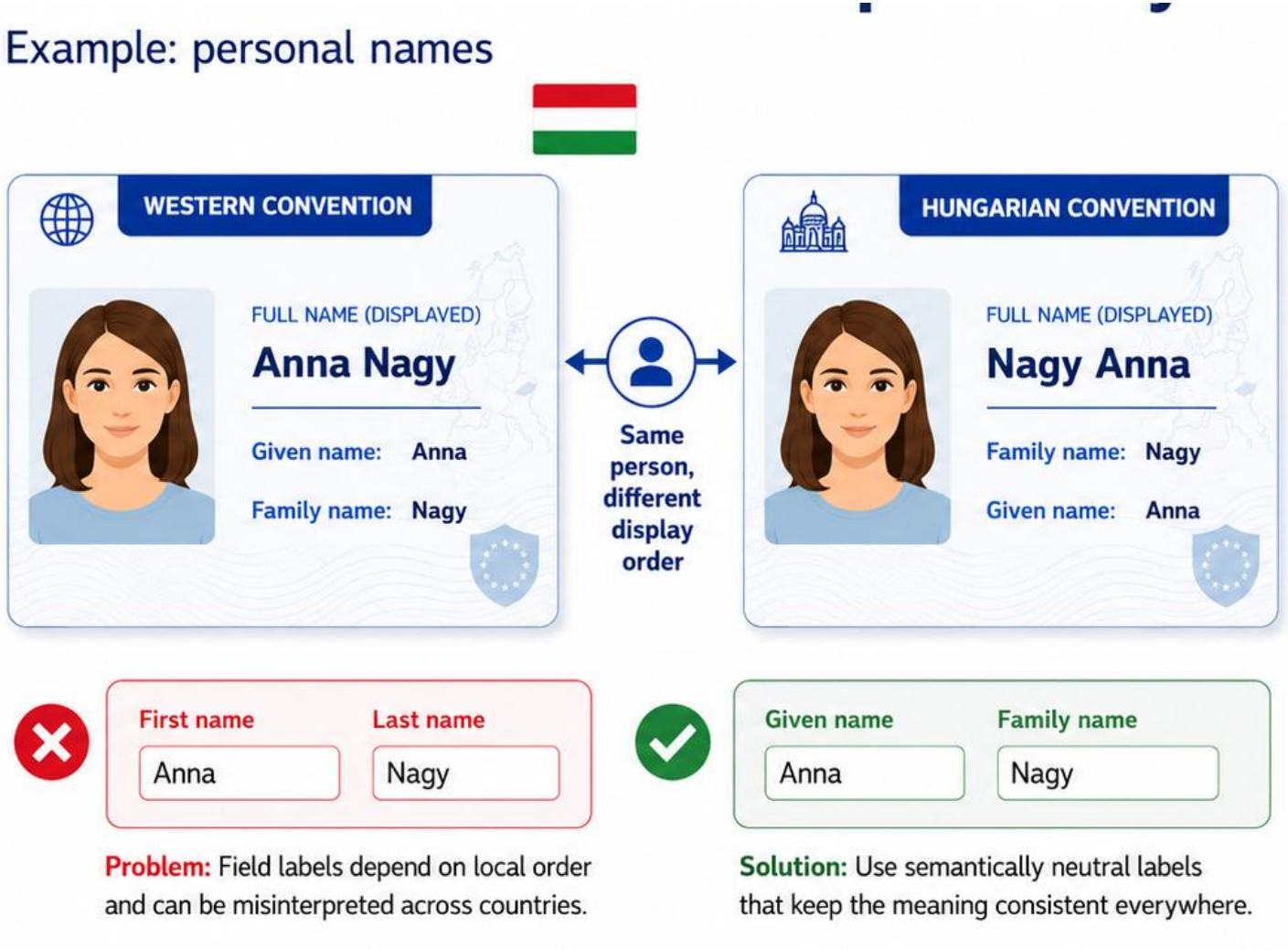
Do we mean the same thing by the data exchanged?

Technical

Can systems connect and exchange data trustfully?

Technical interoperability without semantic interoperability does not solve meaning of data.

What is Semantic Interoperability?



- **Same person, different naming conventions**
- **In many countries:** Anna Nagy = given name + family name
- **In Hungary:** Nagy Anna = family name + given name
- **Why it matters:**

→ Humans infer the convention from context

→ Systems may misread ‘first name” and ‘last name” across countries

→ This can break identification, matching, forms, certificates and cross-border data exchange

- **Semantic interoperability:**
- → Model the **meaning of the data**, not only its position in a string

Enabling semantic interoperability: Linked Data

Why identifiers matter for semantic interoperability

Without Linked Data (just strings)

"NagyAnna"

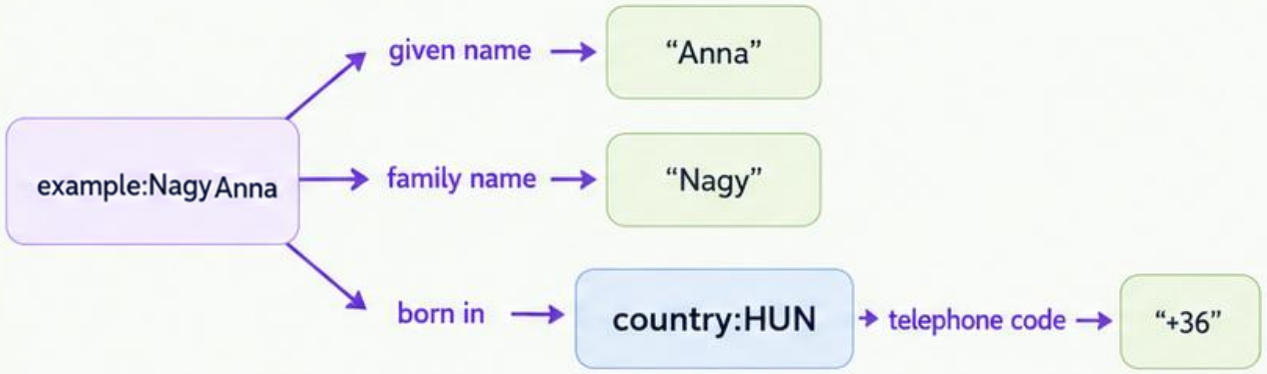
"Hungary"

"+36"

These are just strings.
Systems must guess what they mean.

Hard to link. Easy to get wrong.

With Linked Data (identifiers and links)

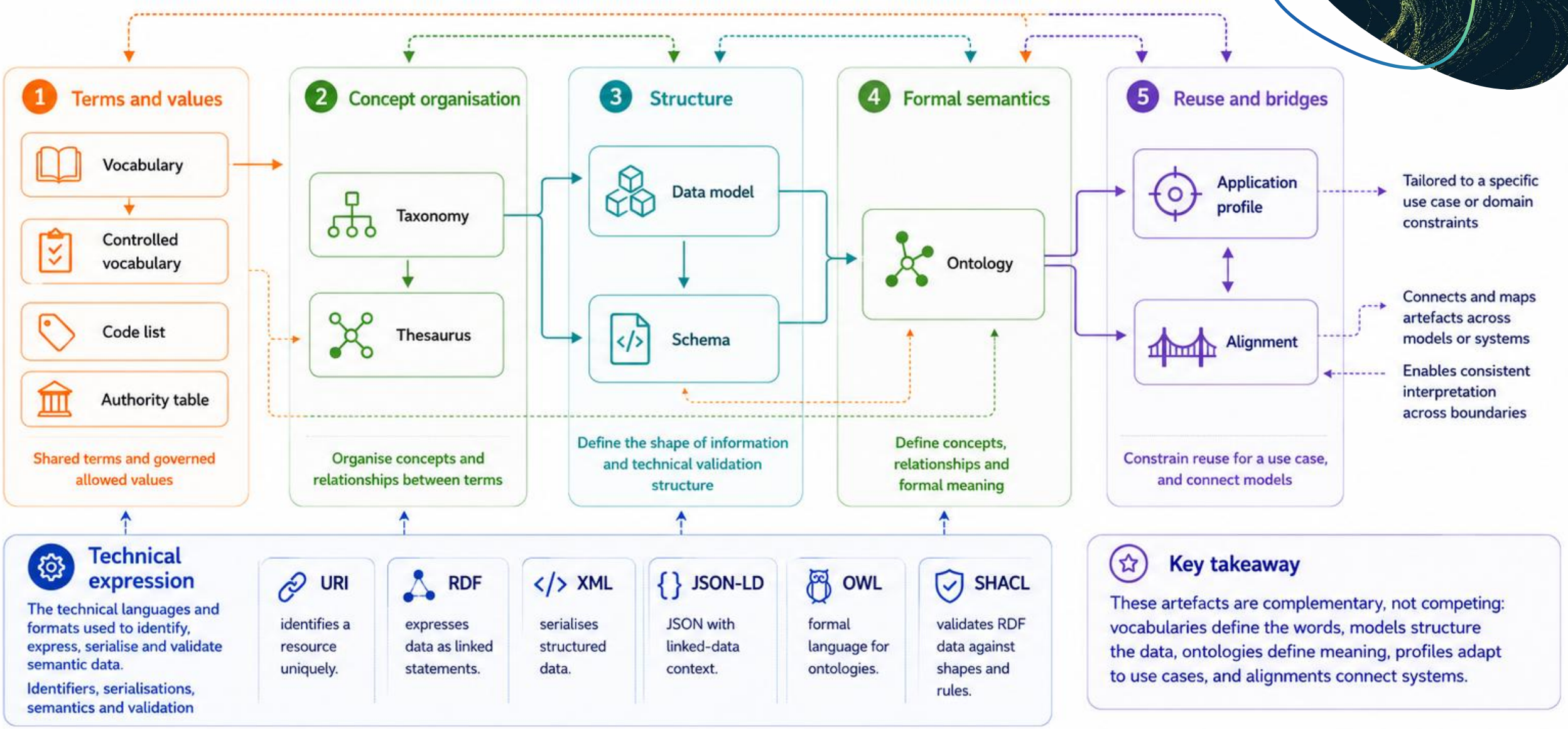


- We use identifiers for things.
- Meaning is explicit.
- Data can be reused and connected.

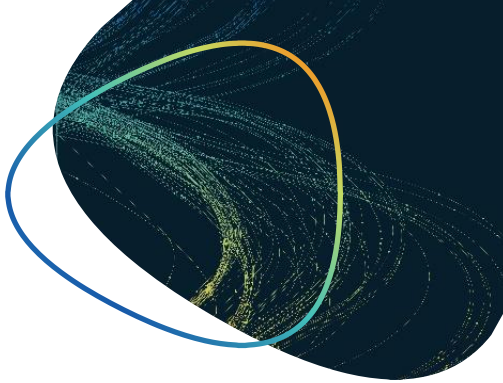
country:HUN is an authoritative concept: http://publications.europa.eu/resource/authority/country/HUN

URI identifies. HTTP URI can be looked up.

Building Blocks of Semantic Interoperability



Where semantics enter the public service lifecycle



Scenario: A citizen moves abroad

A citizen moving abroad applies for parental benefit in their new country. The system requests a birth certificate from the origin country. Data arrives with different field names and date formats. Without a semantic layer — a shared Core Vocabulary — the application fails or requires manual intervention.

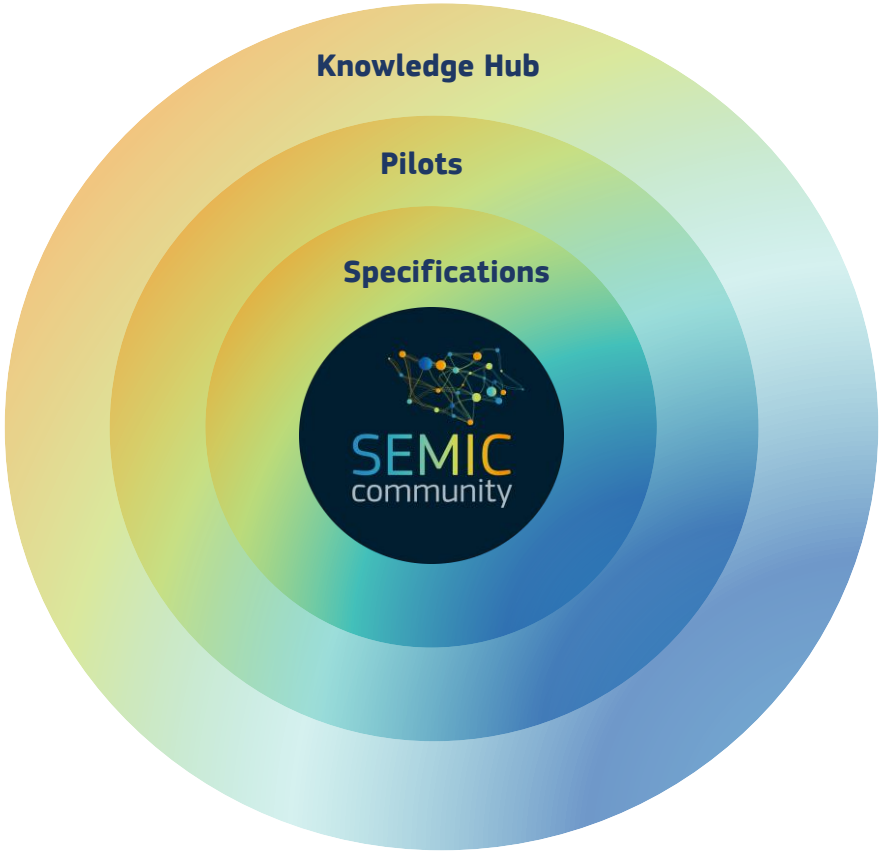
How can SEMIC help

The Core Person Vocabulary defines what a "person" is. The Core Criterion& Evidence Vocabulary defines what evidence is required. DCAT-AP describes the datasets. Together they make data self-describing and machine-readable across borders.

Semantic gaps cause friction; agreed models remove friction

SEMIC's Mission

- Promote Semantic Interoperability amongst the EU Member States
- Deliver pragmatic support to help build an Interoperable Europe.



01

Specifications

Publication and maintenance of open, free-to-reuse data models — Core Vocabularies and Application Profiles — with regular updates.

02

Pilots

Concrete solutions developed with public administrations to demonstrate and scale up interoperability maturity.

03

Knowledge Hub

Training materials, guidelines, webinars, events and the SEMIC Support Centre — for all profiles of users.

04

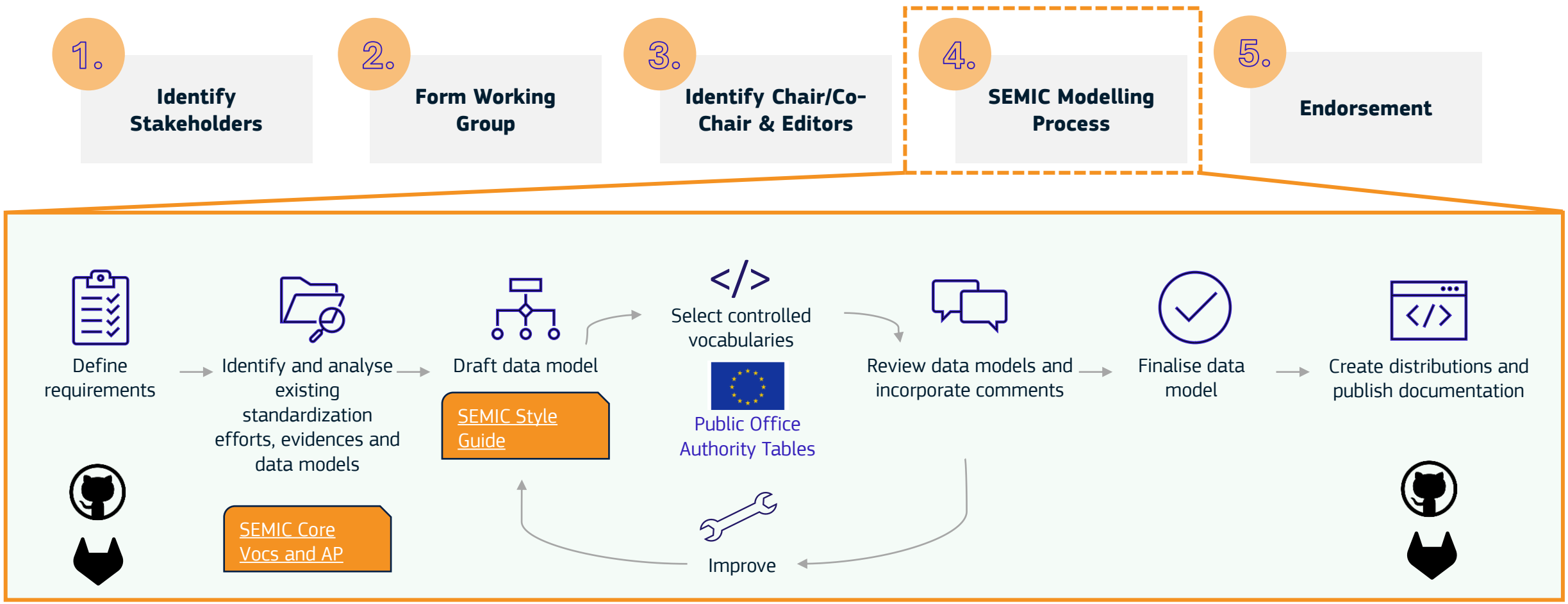
Toolkit

A European toolchain for generating, validating and publishing data specifications — Model2OWL, VocBench, SHACL testbed.

SEMIC 5-step process

SEMIC Overall Process

1. **Identify Stakeholders**
2. **Form Working Group**
3. **Identify Chair/Co-Chair & Editors**
4. **SEMIC Modelling Process**
5. **Endorsement**

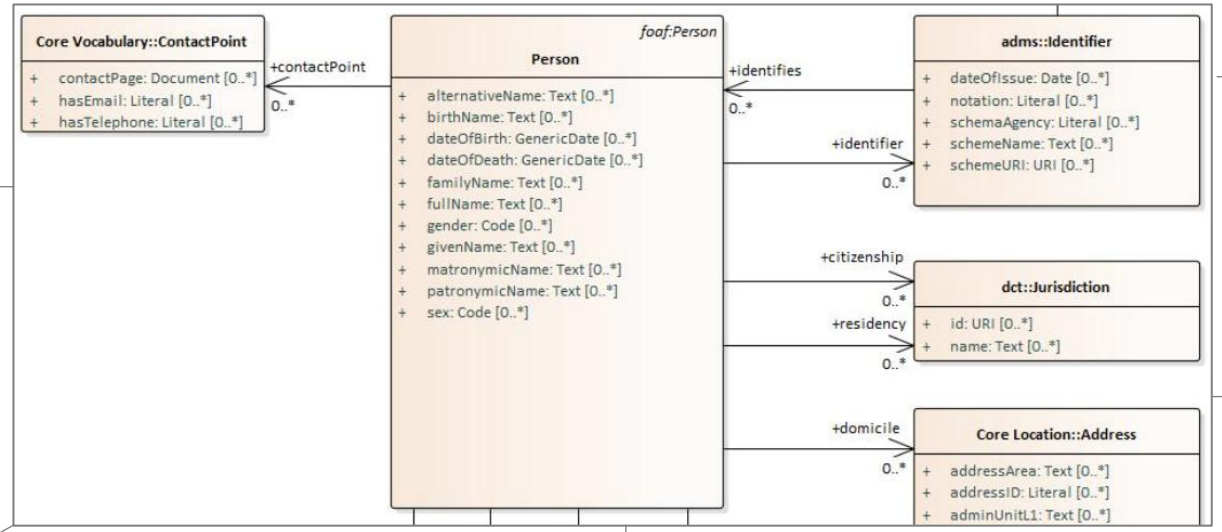


The resulted artefacts

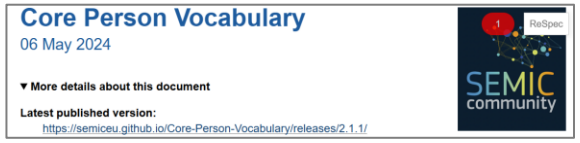
SEMIC Artefacts and Standards

Editor

UML



HTML
(W3C and WHATWG standard)



JSON-LD context

JSON-LD 1.1
A JSON-based Serialization for Linked Data
W3C Recommendation 16 July 2020

RDF Schema 1.1
W3C Recommendation 25 February 2014

XML Schema Part 1: Structures Second Edition
W3C Recommendation 28 October 2004

Shapes Constraint Language (SHACL)
W3C Recommendation 20 July 2017

SEMIC Specifications

They are aimed to enable interoperability by

- Making data **transparent** and **available**
- Supporting the **coherent** implementation of laws and policies
- Helping implement **cost efficiencies**
- Assisting **digitalisation** and **harmonisation of** processes

The SEMIC specifications are co-created on GitHub. Join the GitHub community here.

Core Vocabularies

Application Profiles

What is a Core Vocabulary?

A reusable, simplified, extensible data model capturing the fundamental characteristics of an entity – **the minimum set** of properties needed for cross-border interoperability.

Keyword: minimum — deliberately lean so it can be extended without losing interoperability.

Minimal

Only universally needed properties — local extensions add what is domain-specific.

Extensible

Designed to be built upon. Extensions stay compatible with the base.

Technology-agnostic

Same model published as RDF, XML, JSON-LD — you choose what fits your system.

Reduces friction

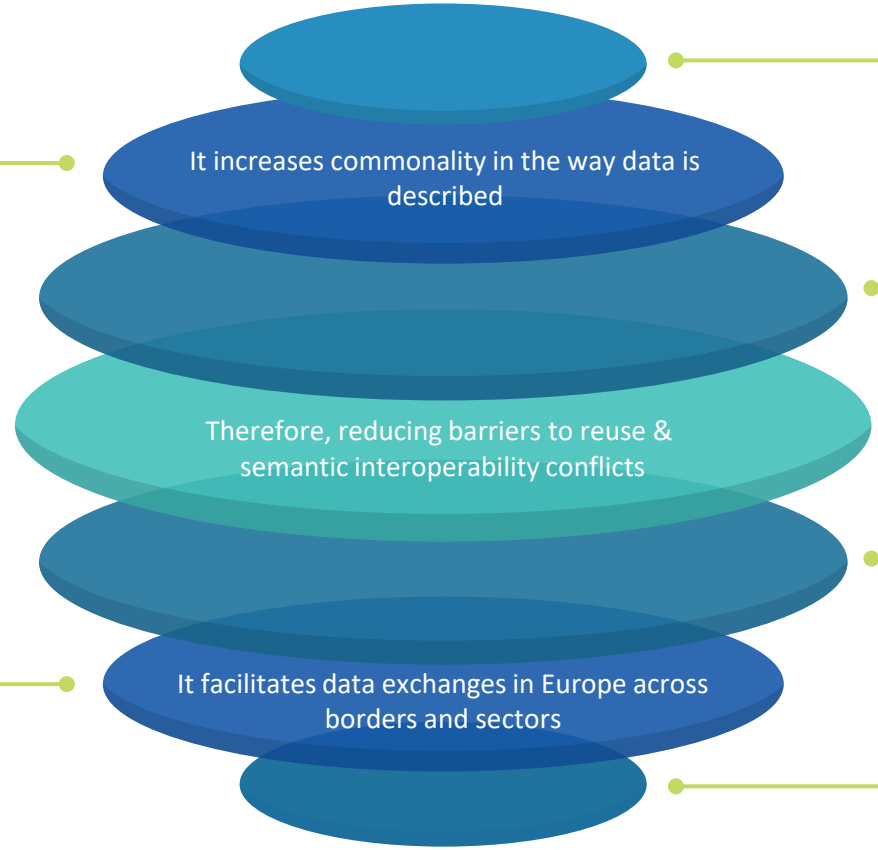
Fewer semantic conflicts, easier data exchange across borders and sectors.

Reduces barriers to reuse · Facilitates data exchange across borders and sectors · Foundation for Application Profiles

SEMIC's Assets: Core Vocabularies

A reusable, simplified and extensible data model capturing fundamental characteristics of an entity.

Core Vocabularies can be used as basis for organisation to comply with developed legislation.



A person
His name, residence, nationality etc.

Core Person Vocabulary

A business
Its name, activity, address etc.

Core Business Vocabulary

A location
Its coordinates, latitude, longitude, address etc.

Core Location Vocabulary

A public service
Its type, service language, sector etc.

Core Public Service Vocabulary

A public organisation
Its name, purpose, opening hours etc.

Core Public Organisation Vocabulary

A public event
Its time, audience, location etc.

Core Public Event Vocabulary

Criteria and evidence
Its weight, bias, confidentiality etc.

Core Criterion and Core Evidence Vocabulary

From Core Vocabulary to Application Profile

The same conceptual foundation, applied to a specific context

Core Vocabulary

the grammar

WHAT IT DOES

Defines what a concept IS — its minimal, universal properties.

SCOPE

Technology-agnostic, domain-neutral, reusable everywhere.

CARDINALITY

No mandatory fields — intentionally open and flexible.

TYPICAL USERS

Anyone describing people, organisations, locations, services.

EXAMPLE

Core Person Vocabulary: givenName, familyName, birthDate, identifier.

extends & constrains

»

reuses & specialises

Application Profile

the style guide

WHAT IT DOES

Defines how data MUST be described — in this context.

SCOPE

Use-case specific, scoped to a domain or legal framework.

CARDINALITY

Specifies mandatory, recommended, and optional fields.

TYPICAL USERS

Portals, public services, registries needing data compliance.

EXAMPLE

DCAT-AP: a dataset MUST have a title, publisher, and access URL.

Core Vocabulary says what exists · Application Profile says how it must be described in this context

What is an Application Profile?

A specification that takes one or more vocabularies and adds **constraints, cardinality rules, and controlled vocabularies** to define exactly how data must be described in a specific context.

Metaphor: if Core Vocabulary is the grammar, an Application Profile is the style guide for a specific genre of writing.

Constrains

Specifies which properties are mandatory, optional, or forbidden — no ambiguity.

Context-specific

Scoped to a domain, legal framework, or use case — not meant to be universal.

Machine-checkable

Constraints expressed as SHACL shapes — compliance can be validated automatically.

Builds on CVs

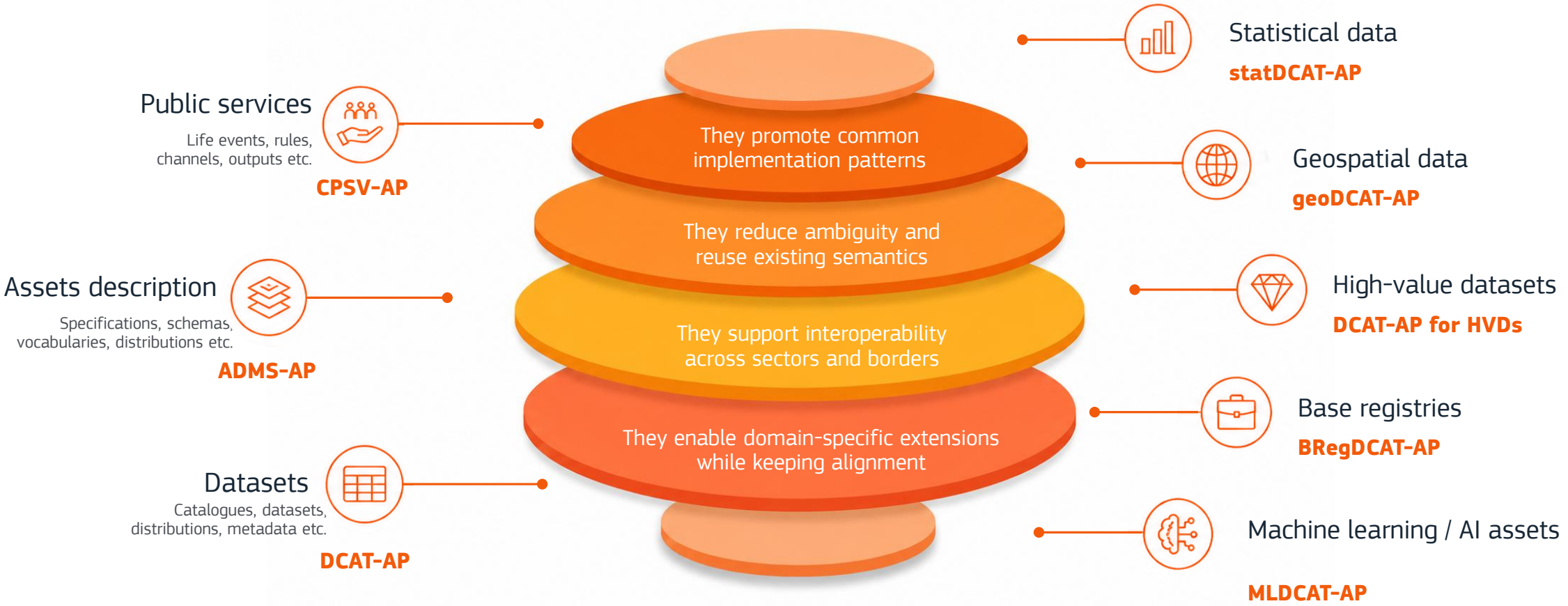
Reuses Core Vocabularies as the base — adds what is needed without reinventing.

Core Vocabulary says what exists · Application Profile says how it must be described in this context

SEMIC's Assets: Application Profiles

Reusable semantic specifications that adapt and constrain existing models for specific use cases and domains.

Application Profiles



DCAT-AP

Supporting the discovery of/access to (open) data in a cross-border and cross-domain environment, by describing metadata to be harvested across a distributed network of portals.

In the form of an application profile of W3C DCAT, by

- expressing constraints and usages on DCAT properties and classes, and
- including additional properties and usages of controlled vocabularies

Domains of applications

Open data portals with an extension for statistics and geospatial data.

Base registries metadata descriptions

Data spaces

- MobilityDCAT-AP
- HealthDCAT-AP
- ...

Machine Learning with MLDCAT-AP

The DCAT-AP ecosystem – stackable and consistent

01

W3C DCAT → DCAT-AP

W3C DCAT (international standard) is the base. DCAT-AP adds EU-specific constraints anchored to the Open Data Directive.

02

Domain Extensions

GeoDCAT-AP (geospatial), StatDCAT-AP (statistics), HealthDCAT-AP (health), MobilityDCAT-AP (mobility), BRegDCAT-AP (registries), ML-DCAT-AP (AI / AI Act).

03

Key principle

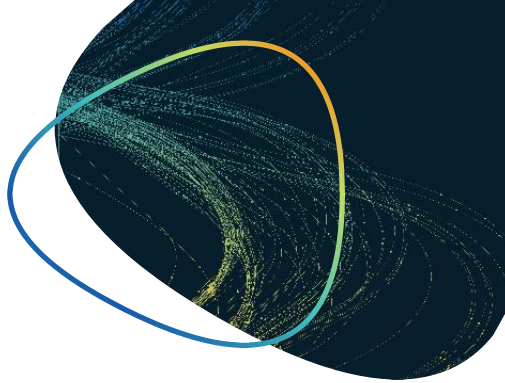
Every layer is stackable and consistent. Extending DCAT-AP does not break interoperability with the base or other extensions.

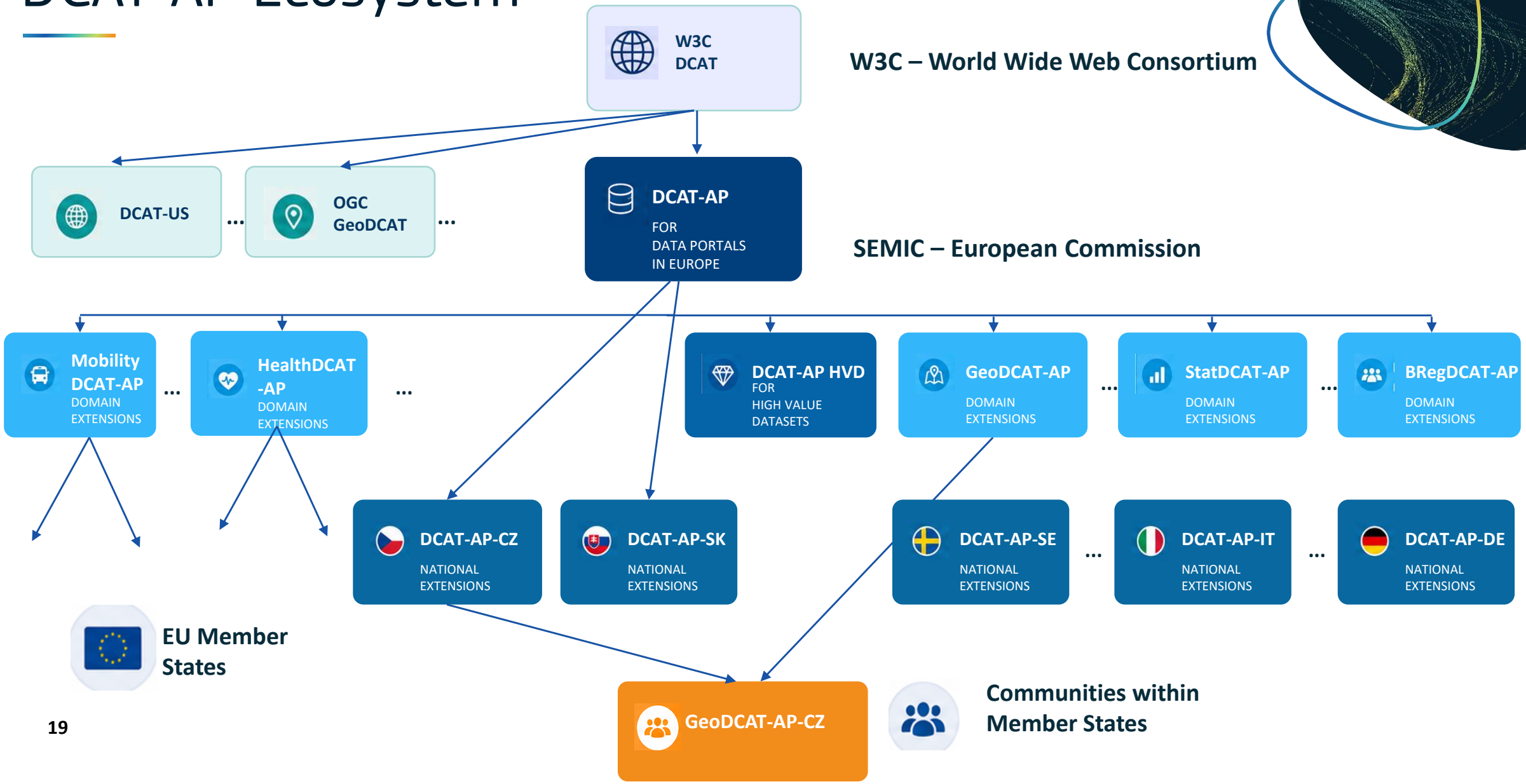
04

National Extensions

DCAT-AP-NO (Norway), DCAT-AP-SE (Sweden), DCAT-AP-IT (Italy), DCAT-AP-DE (Germany), DCAT-AP-CZ (Czech Republic) — and more.

DCAT-AP Ecosystem





CPSV-AP

The **Core Public Service Vocabulary** is:

- A simplified, reusable and extensible data model;
- that captures the fundamental characteristics of a public service.

It aims to be:

- Technology-independent and generic
- the common denominator of existing national, regional and local public service models
- a lingua franca that will enable the seamless exchange of services and information across different e-Government systems

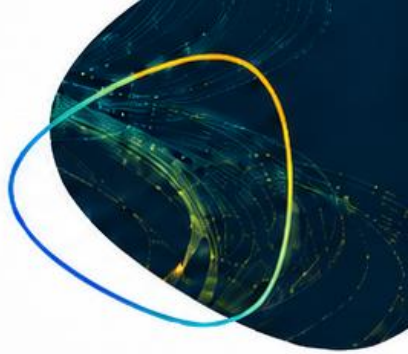
Increase findability of public services

Building user-centric catalogues of services

Managing portfolios of public services

Publishing descriptions of life and business events

CPSV-AP Ecosystem



SEMIC CPSV

SEMIC – European Commission

CPSV-AP
FOR PUBLIC SERVICES IN EUROPE

SEMIC – European Commission

- Belgium – Flemish Citizen Profile — REGIONAL PROFILE
- Spain — IMPLEMENTATION
- Italy — IMPLEMENTATION
- Greece — IMPLEMENTATION
- Ireland — IMPLEMENTATION
- Finland — IMPLEMENTATION
- Estonia — IMPLEMENTATION
- Slovakia — IMPLEMENTATION
- Portugal — IMPLEMENTATION
- Netherlands — IMPLEMENTATION
- Norway — IMPLEMENTATION

EU Member States

Communities within Member States

The SEMIC guidelines toolkit

Three instruments that keep 15+ specifications coherent across dozens of contributors

SEMIC Style Guide

Specification editors

DEFINES

Modelling principles, reuse rules, validation & publication conventions

SCOPE

Scoped to SEMIC — not a general ontology engineering guide

ENSURES

Coherence and quality across all SEMIC assets

Core Vocabularies Handbook

Implementers & adopters

GUIDANCE

How to use and extend Core Vocabularies in your context

ENSURES

Extensions remain compatible with the base model

PRESERVES

Cross-border interoperability as implementations scale

DCAT-AP Extension Guidelines

Domain communities

FOR

Communities creating Application Profiles based on DCAT-AP

ENSURES

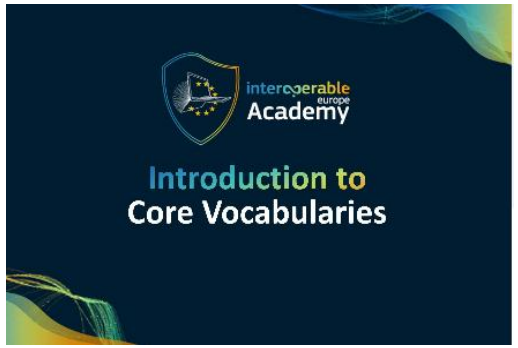
New extensions stay consistent with the base and each other

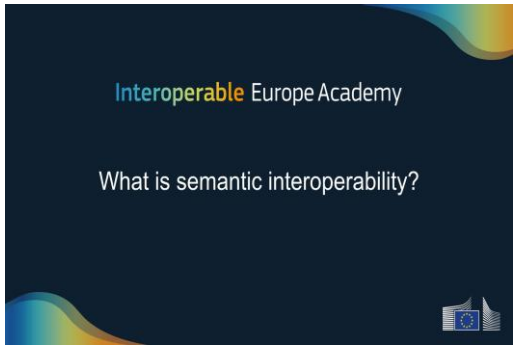
SUPPORTS

Growing ecosystem — no fragmentation across profiles

Not bureaucratic documents — the shared infrastructure that keeps 15+ specifications coherent across dozens of contributors from different Member States and organisations.

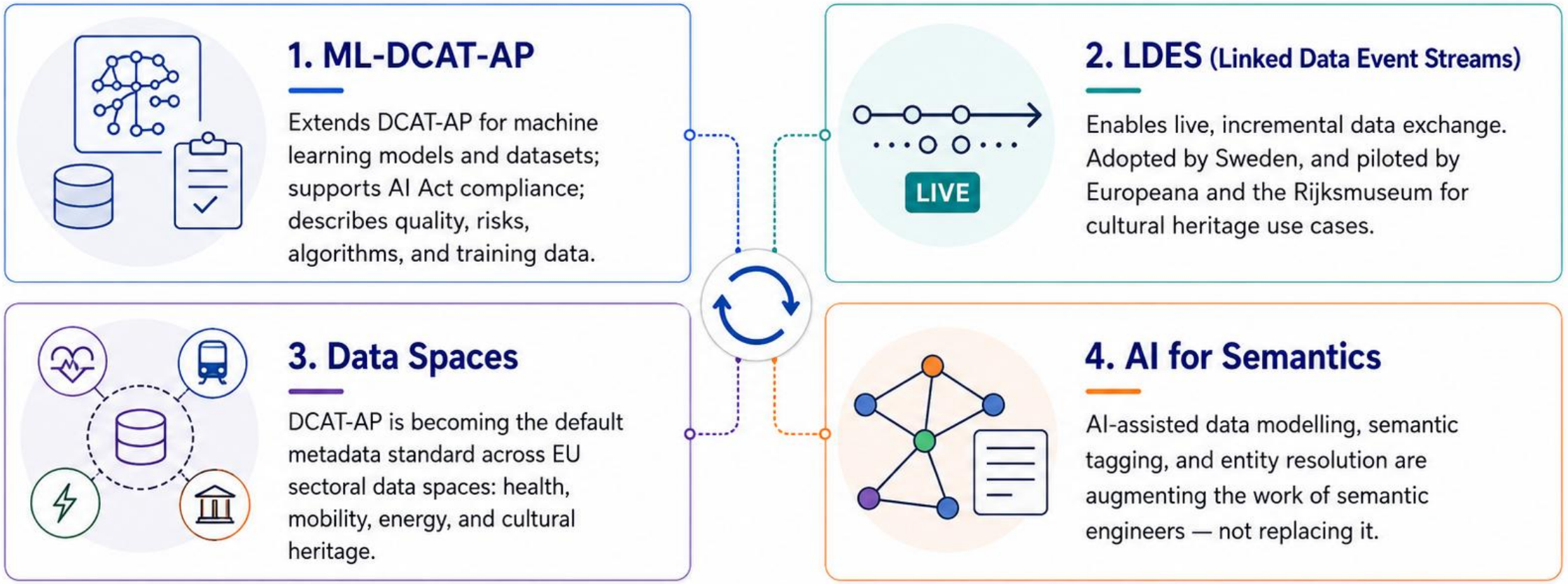
Courses on Semantic Interoperability





AI, Data Spaces and next frontier

How semantic interoperability is evolving with AI, live data and sectoral ecosystems



Key message

The same approach — agreed semantics, open co-creation, and community governance — can be applied to new challenges in AI and data spaces.

Main Takeaways

Semantic interoperability is a precondition

Without agreed meaning, digital public services fail at the border. Semantics enables everything else.

SEMIC provides reusable building blocks

Core Vocabularies define the common denominator. Application Profiles add context-specific rules. No starting from scratch.

The ecosystem is layered and stackable

W3C DCAT to DCAT-AP to domain extensions to national extensions. Each layer adds constraints without breaking the one below.

Guidelines keep the ecosystem coherent

Style Guide, Handbook, extension rules — what allows 15+ specifications to stay consistent across contributors over time.

The methodology is open and iterative

GitHub, public reviews, working groups. Specifications evolve through community-driven maintenance cycles.

The same approach scales to new challenges

ML-DCAT-AP, LDES, data spaces, AI-assisted modelling — same foundation, growing application domains.

Join us

SEMIC on the Interoperable Europe Portal

Interoperable Europe | LinkedIn

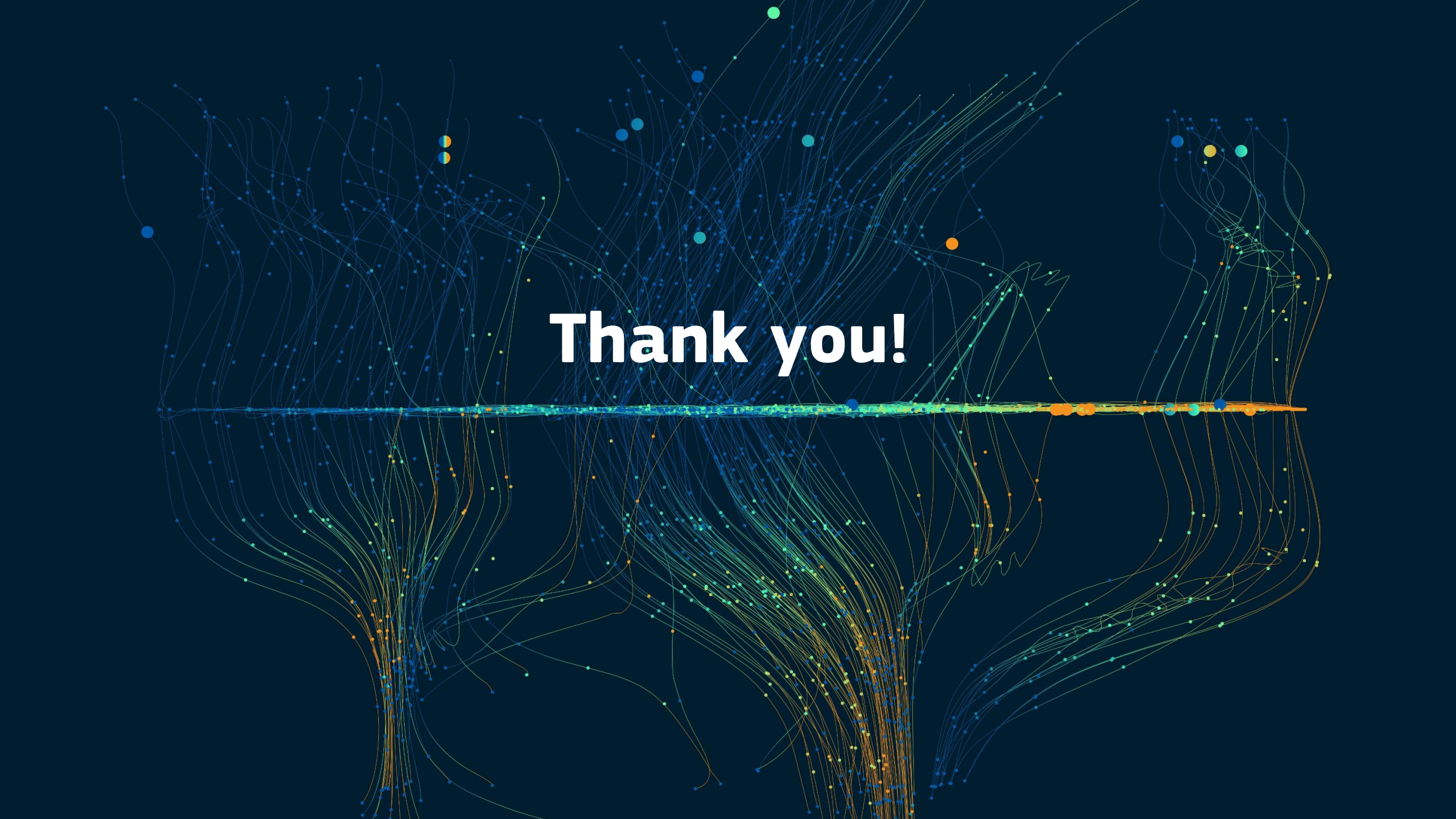
Interoperable Europe | YouTube

(@InteroperableEU) | X

DIGIT-SEMIC-TEAM@ec.europa.eu

Subscribe to the SEMIC mailing list: https://ec.europa.eu/eusurvey/runner/SEMICmailinglist

Need support or interested in a pilot? Please contact: DIGIT-SEMIC-TEAM@ec.europa.eu


Thank you!