



Semantic Interoperability in Transport Domain

9th IT Combined Meeting

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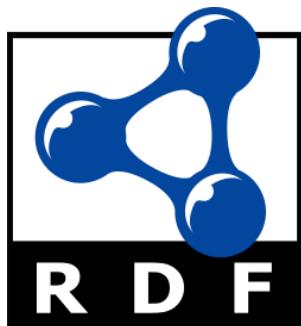
Marco Comerio, CEF
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- What is Semantic Interoperability?
 - From Interoperability to Semantic Interoperability
- European Interoperability Framework
 - Principles and types of interoperability
- Semantic Interoperability in Market
- Multimodal Travel Information Services
 - Barriers, key enablers, regulations and challenges

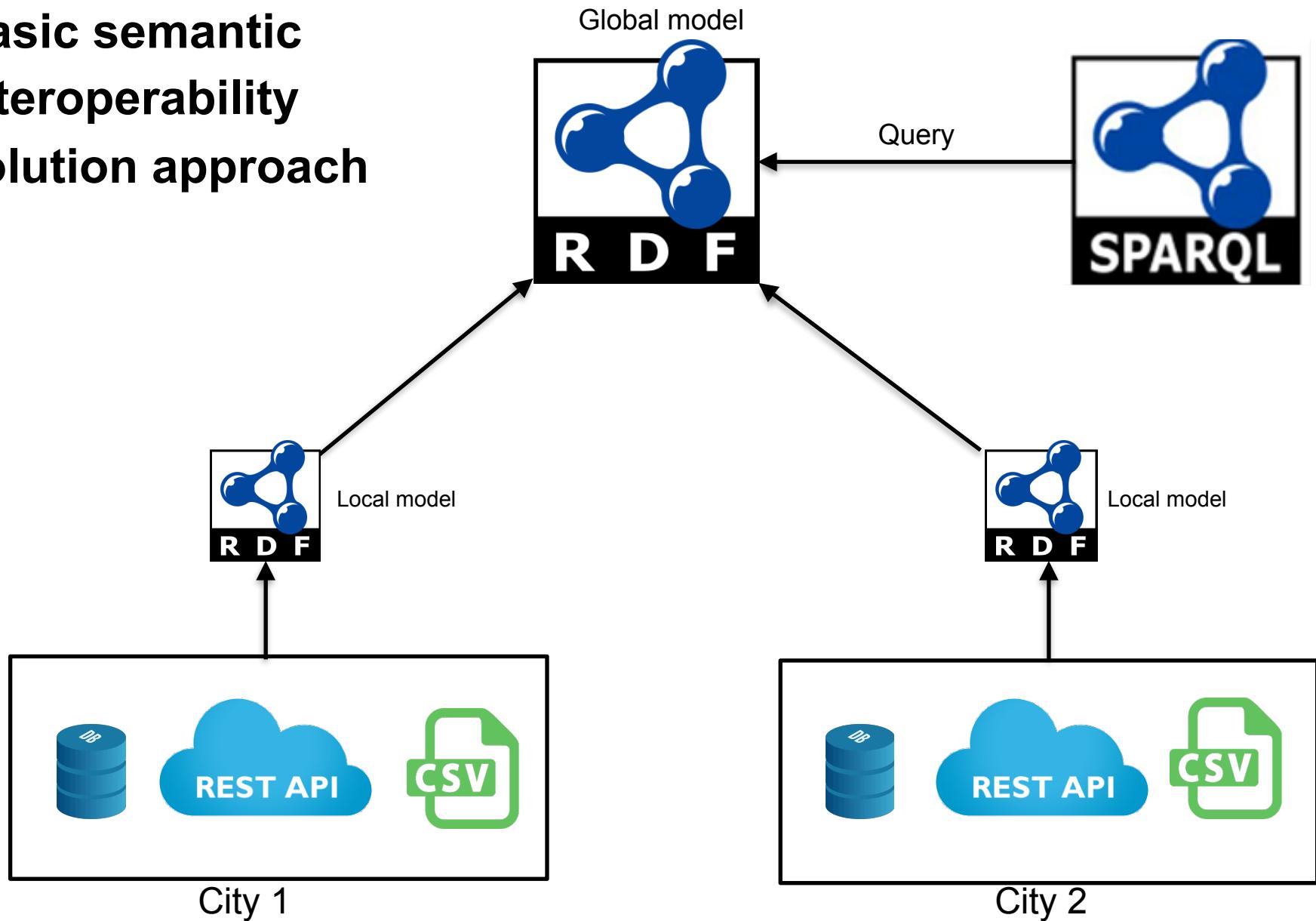
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- Two systems are **syntactic interoperable** if they are able to communicate to each other.
 - Syntactic Interoperability is usually solved by creating ad hoc "adapters" that convert/translate the exchanged information between different formats.
- Two systems are **semantically interoperable** if they are interoperable and if their information exchange is based on the *meaning* of the exchanged information.
 - Semantic Interoperability is usually solved by
 - creating a common and shared model of the "meaning" of the exchanged information
 - creating "interpreters" that transform the exchanged information from each of the non-interoperable format to the shared model.

- Systems are **semantically interoperable** when they are able to “*understand the meaning*” of the information they exchange.
 - *Semantic Web technologies* are a possible technical solution to Semantic Interoperability.
 - *Semantic Web technologies* have been adopted in domains like: pharma industry, government, media and publishing, etc.



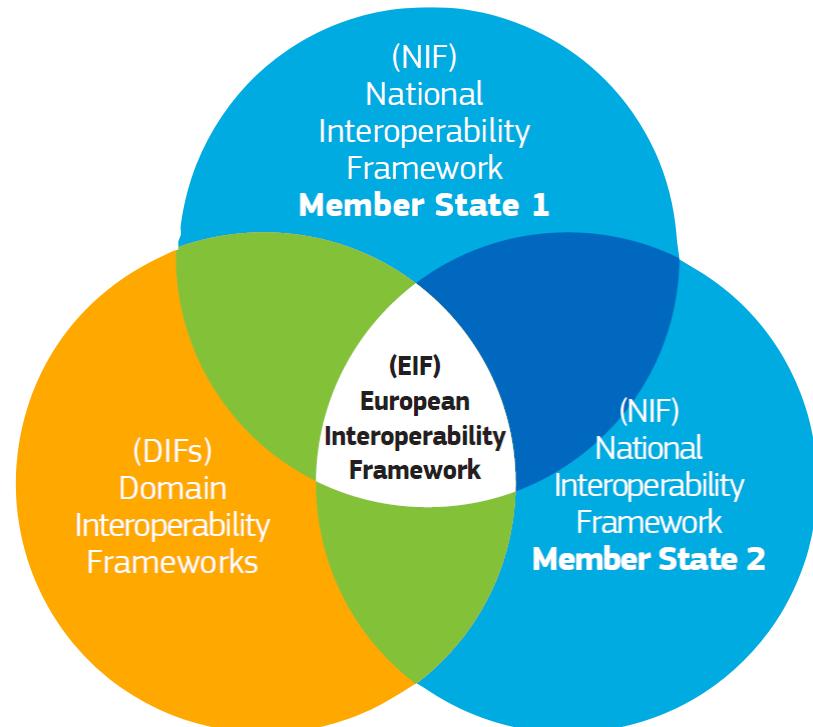
Basic semantic interoperability solution approach



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- The EIF defines a set of **recommendations and guidelines for eGovernment services** so that public administrations, enterprises and citizens can **interact across borders, in a pan-European context**. The main goals of the framework are:
 - Support the European Union's strategy of providing user-centred eServices by facilitating the interoperability of services and systems between public administrations, as well as between administrations and the public (citizens and enterprises), at a pan-European level.
 - To supplement national interoperability frameworks in areas that cannot be adequately addressed by a purely national approach.
 - To help achieve interoperability both within and across different policy areas, notably in the context of the IDABC programme and any other relevant Community programmes and initiatives.

- Accessibility
- Multilingualism
- Security
- Privacy
- Subsidiarity
- Open Standards
- Open Software



Types of Interoperability

Organizational Interoperability	Defining business goals, modeling business processes and bringing about the collaboration of administrations that wish to exchange information and may have different internal structures and processes.
Technical Interoperability	Covers technical issues of linking computer systems and services. It includes key aspects such as open interfaces, interconnection services, data integration and middleware...
Semantic Interoperability	It ensures that the precise meaning of exchanged information is understandable by any other application that was not initially developed for this purpose . Semantic interoperability enables systems to combine received information with other information resources and to process it in a meaningful manner.

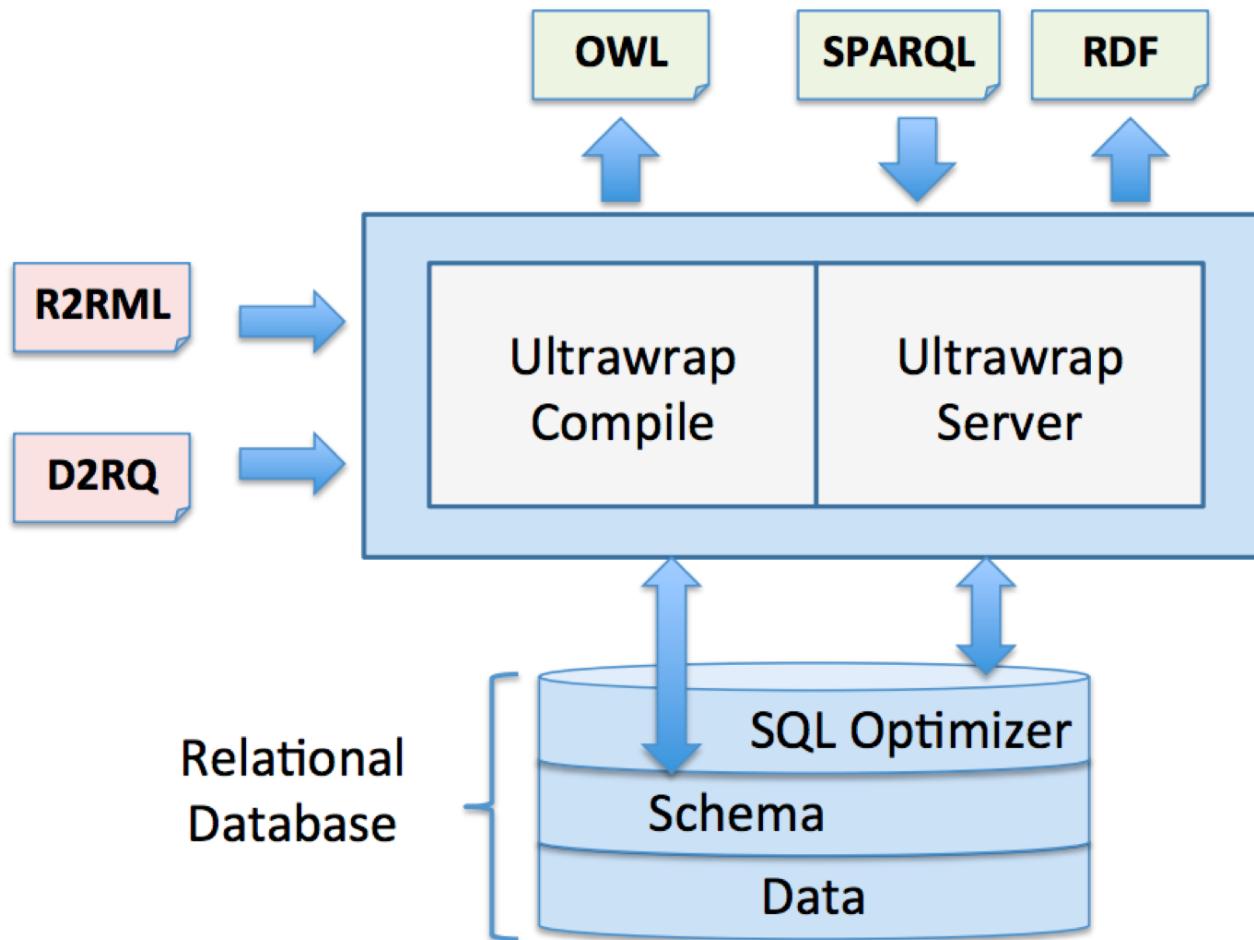
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- Industry solutions: Denodo, SOFIA2, TopBraid, Stardog
- Research solutions: Ultrawap - Capsenta, GraphDB
- Open Source: Camel
- Transport Domain: Linked Connections, Railway core ontology, Public transportation ontology or Transit ontology and Linked GTFS

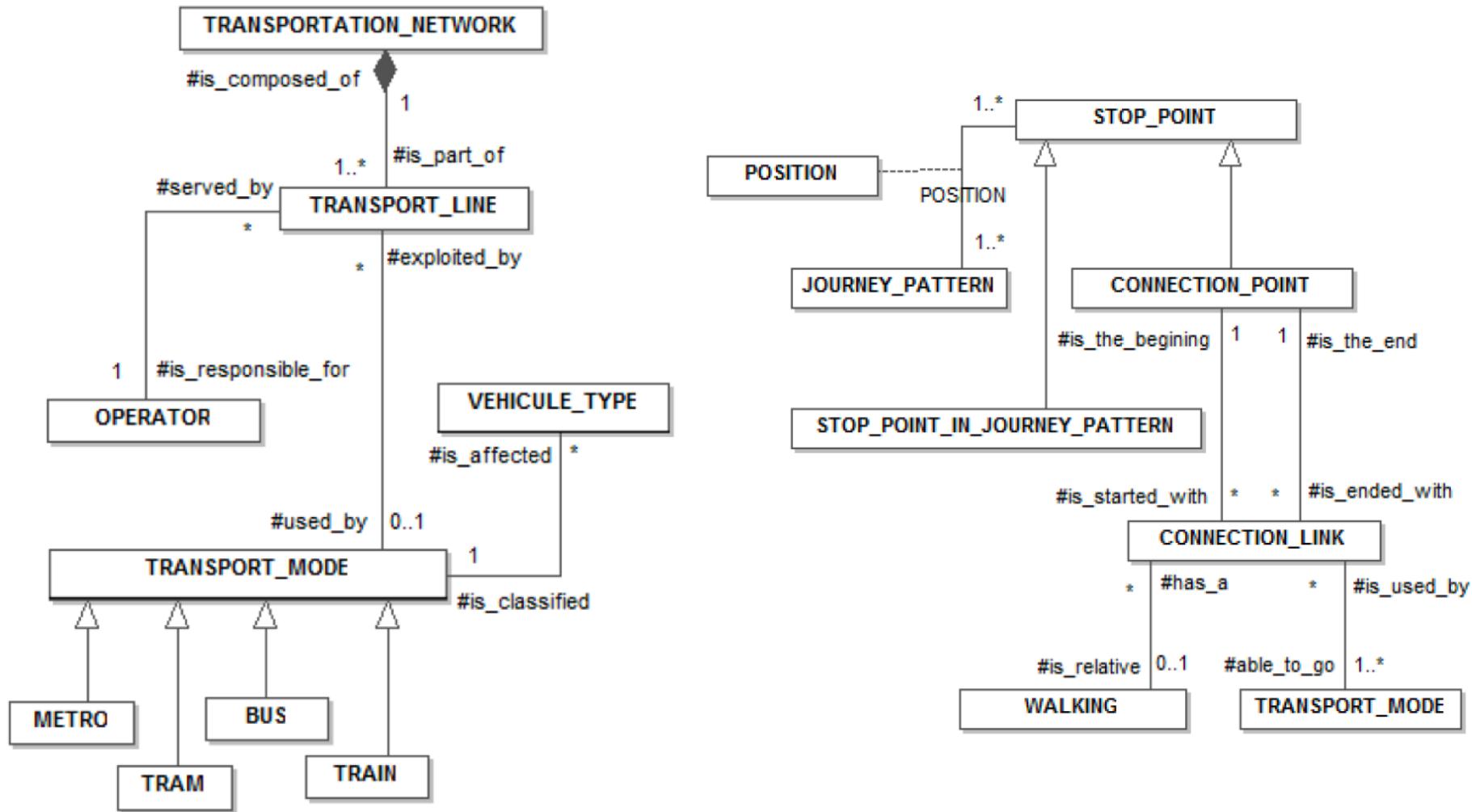
Denodo



Ultrawrap - Capsenta



Public transportation ontology



Linked Connections

A connection

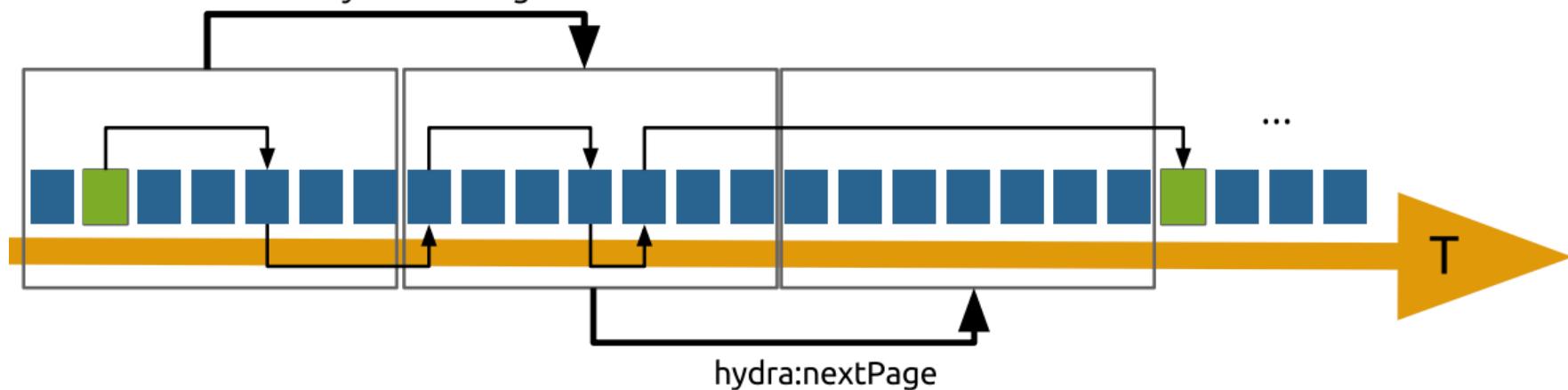
departureStop
departureTime

arrivalStop
arrivalTime

...extra info...
headsign
trip
route



hydra:nextPage



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The EU-report on The Provision of EU-wide Multimodal Travel Information Services highlighted the following **barriers of comprehensive travel information services** in the EU:

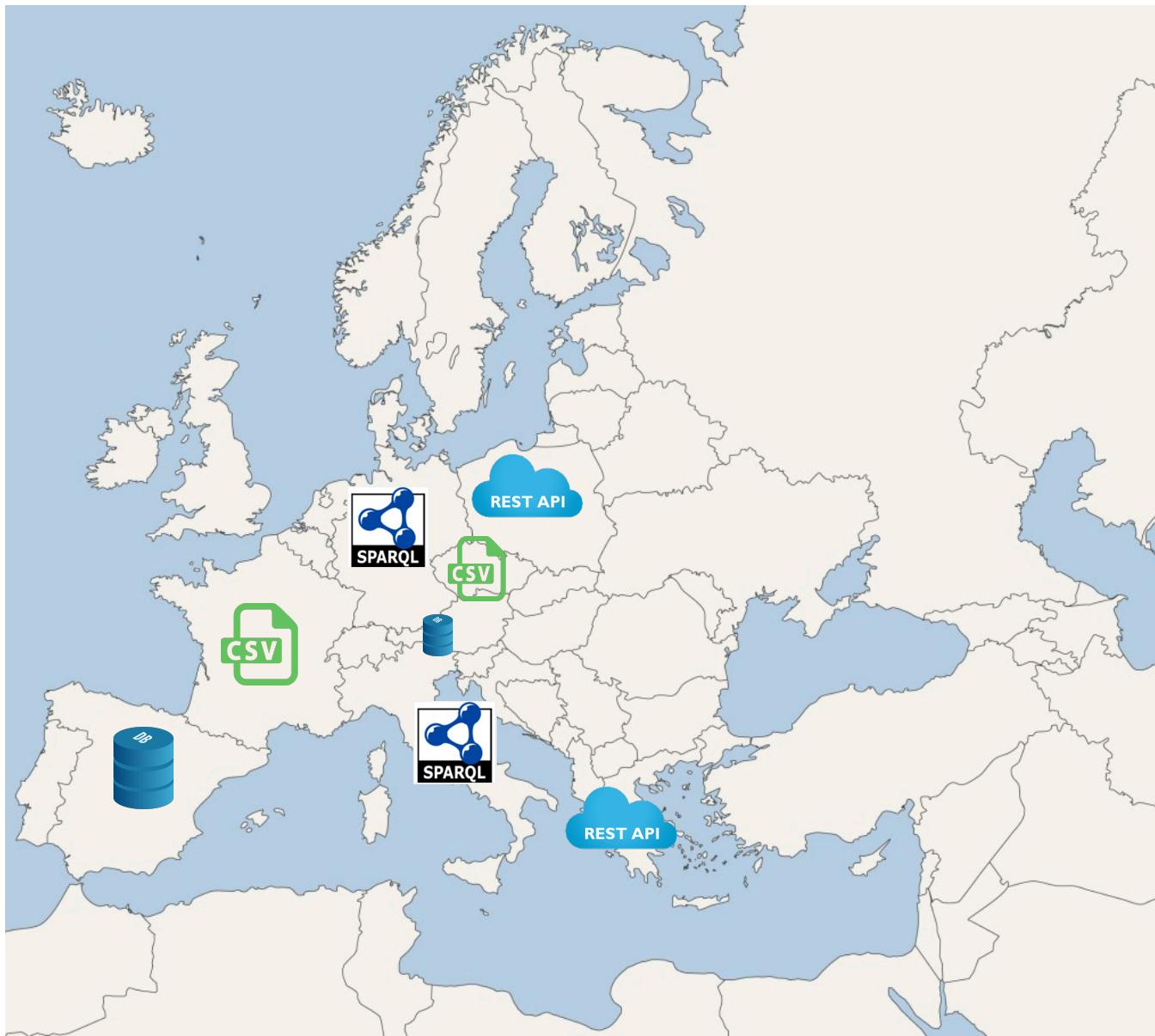
- insufficient **accessibility** of travel and traffic data
- the lack of travel and traffic **data interoperability**
- lack of travel information **service interoperability**
- insufficient travel and traffic **data quality**

The EU-report reveals that the key enablers to address these barriers are:

- ensuring that users have access to the right scope of data and information with the appropriate data sharing mechanism
- **making travel and traffic data interoperable with a common set of data exchange standards**
- **improving the interoperability of travel information services and supporting distributed journey planning**
- improving the quality of multimodal travel information services with a basic data quality framework

- On 31 May 2017, the EU delivered a new EU regulation with regard to the provision of EU-wide multimodal travel information services.
- The regulation establishes the specifications necessary to ensure the **accessibility, exchange and update of static and dynamic transportation data** for the provision of multimodal information services in the European Union.

*“In order to facilitate the **easy exchange and re-use of these data** for the provision of comprehensive travel information services, corresponding metadata and information on the quality of the data will be accessible to users through a **national or common access point.**”*





- Member States may choose to continue using national public transport data standards at the Member State level.
- To ensure EU-wide interoperability and the continuity of services, the specified EU standards must be used at the national access point level.
- Member States may use **translation and conversion methods** to adhere to the European standardization requirements.



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