Urban models & semi-automatic instance mapping

Smart solution 8
Big open data platform

Impacts

EASES
integration of heterogeneous data sources

ENABLES
cities to take up smart solutions

GENERATES
complex queries in a user-friendly way

Barcelona

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What is it?

Creating a semantic urban model and semi-automatic instance mapping makes it possible to connect three domains of interest for smart cities: mobility, energy, and integrated infrastructures, and integrate heterogeneous data sources.

When data from different sources are mapped to a single urban model, the semantic layer makes it possible for users to browse and query the data through the ontology. The model makes a data schema transparent to the user/app, while the semantic layer translates automatically between the semantic queries and the actual API calls to the city platform. The exploration and query tool allows users to access to the data without the need to understand the data model nor manage the query language.

What did GrowSmarter do?

The Urban Model contains a generic high-level city model, to which energy, mobility, integrated infrastructures, and contamination monitoring verticals are added. This consist in defining the entities

GrowSmarter
Transforming cities for a smart, sustainable Europe
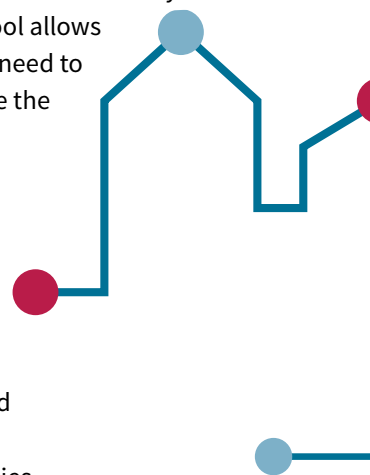
handled by these domains, the relationships between them, and the constraints that need to hold. Three different components have been created to implement this solution. A fourth one – the exploration and query tool – was adapted from a tool developed in a past project. The Urban Model contains a generic high-level city model, to which energy, mobility, and contamination monitoring, as well as relationships between concepts in the different domains are added. Three different components have been created to implement this solution:

- **City ontology:** A semantic model that represents several vertical domains and the relationships between them provides a single point of access to integrated heterogeneous data. Data is enriched by interconnections defined by the model.
- **Exploration and query tool:** Exploration, query, and visualization made user friendly. Exploration is keyword and graphical-based and queries are constructed in a graphical manner.
- **Semi-automatic mapping tool:** This tool aligns the semantic model (city ontology) with the specific city data schema in a semi-automatic fashion. Concretely, it recommends mappings to domain specialists, who can choose the correct ones using a collaborative tool. The core mapping tool is LogMap from Oxford. This process makes it easier to add new data sources or modify existing ones. These mappings are used by the Semantic access layer.
- **Semantic access layer:** This layer allows users to access data from different city platforms combined if their data sets have been included in the city platform.
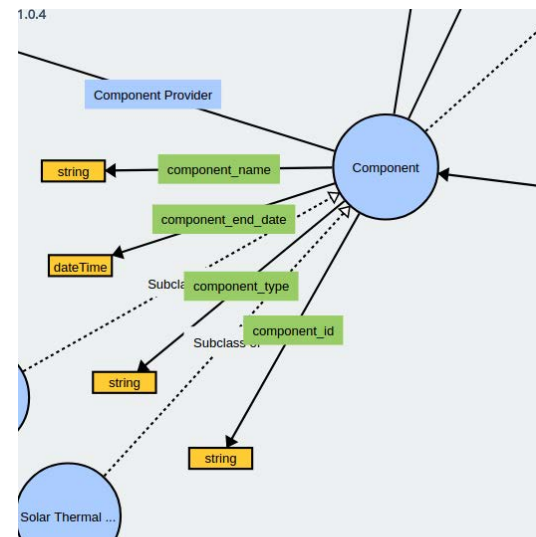
This is an enabling functionality for any measure and application that wants to easily cross data from different domains without having to know the underlying structure and of each individual data stream.

A lot of data is needed to make the semantic approach scalable.

Lessons learnt

With this enabling functionality, it is essential to understand the benefits of the system and to identify partners who can develop applications on top of the technology, stress the model and use data in complex manners. Extensive amounts of data is needed to make the case for such a labour intensive approach. If data either changes quickly, is highly heterogeneous, or a low-risk approach is needed instead of designing a massive database, semantic technologies are the right approach.

Upscaling & replication potential

The urban model may be re-used by any other city as is, although a domain specialist should help extend it with concepts that may not have been modelled. Additionally, a city re-using it should re-implement the Semantic access layer to adapt its own city platform and remap the data.

How did the measure work?

Technical feasibility ● ● ●

The urban model may be re-used by any other city when adapted to its own platform.

Economic feasibility ● ● ○

A solution based on a semantic model makes sense when integrating data from many heterogeneous sources, when data (and data schemas) change often, is incomplete, sparse, or otherwise dynamic; otherwise the effort involved in this large scale approach may not be justified.

Replication potential ● ● ●

A new semantic access layer needs to be implemented and the model may need to be extended.