A Domain Ontology for Wastewater and Stormwater Network

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Introduction

One crucial aspect of urban development lies in the efficient management of underground wastewater and stormwater networks ensuring public health and safety. The challenge arises from the network being buried underground [Wang et al., 2022] where:

1. different data types [Bel-Ghaddar et al., 2021]
2. inaccurate and inconsistent data [Aitken et al., 2021]
3. fragmented work processes and infrastructure data [Halfawy, 2010]

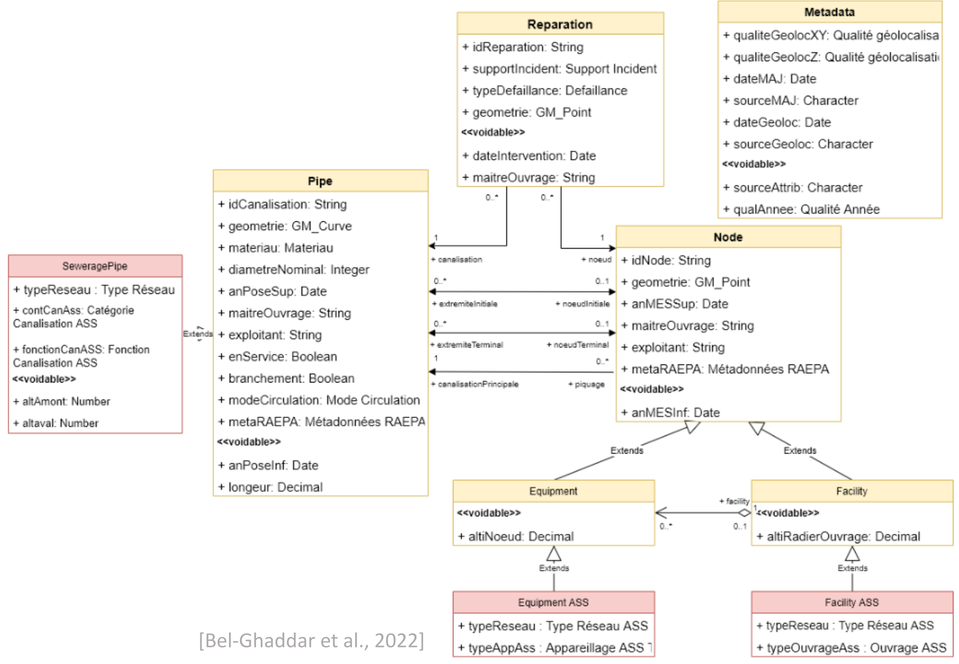
Goal

a common language and shared conceptualization of the domain that enhances consistency and interoperability in managing the networks

*"An **ontology** is a formal, explicit specification of a shared conceptualization"*

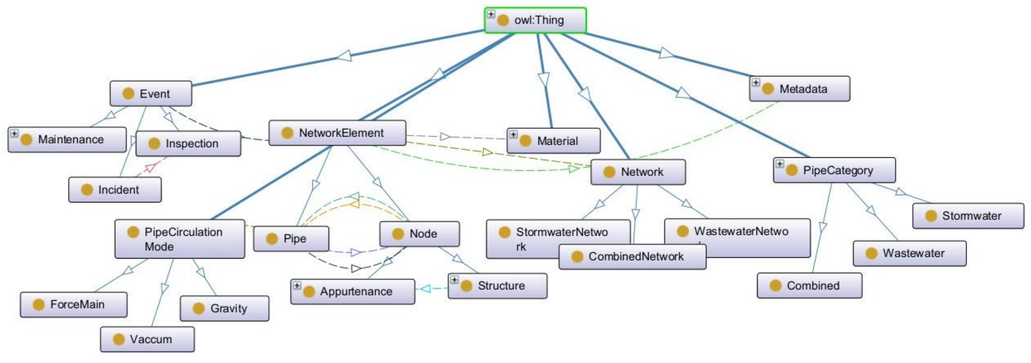
[Guarino et al., 2009]

RAEPA Geostandard



[Bel-Ghaddar et al., 2022]

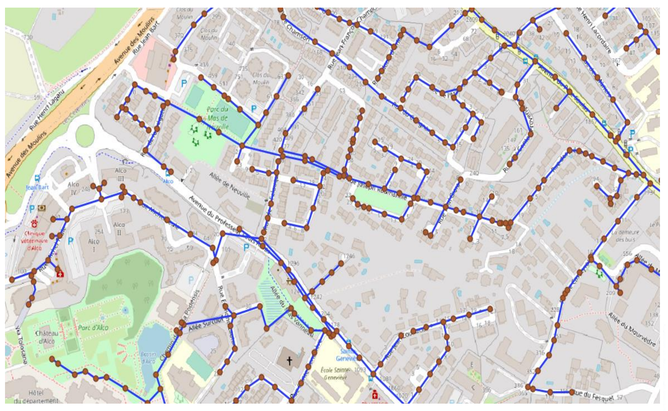
Ontology in Protége



Ontology evaluation is to verify the correctness of the ontology as a knowledge base for future applications and to assess whether the developed ontology meets the proposed requirements through reasoners such as HermiT and SPARQL queries.

3M Open Data

Montpellier Méditerranée Métropole



Accessed in July 3rd2023

Stormwater Data	Wastewater Data
3M data	3M data
47955 Manholes	50015 Manholes
48765 Pipelines	51013 Pipelines

Instances

Development Methodology

Simple Knowledge Methodology

[Noy et al., 2001]

1 Define scope & domain

- ❑ ***domain*** is wastewater and stormwater networks
- ❑ ***scope*** of the ontology, list of competency questions (CQs)

[Gruninger, 1995]

2 Reuse existing ontology

- ❑ surface water [Raskin and Pan, 2005] or wastewater treatment [Ceccaroni et al., 2000] ontology available only
- ❑ geostandards such as COVADIS and INSPIRE

3 List important terms

- ❑ list of terminology from CQs
- ❑ translated terms from used in COVADIS French to English

4 Define classes & hierarchy

- ❑ combination of the top-down and bottom-up approach
- ❑ progressing to generalizing and specializing

5 Define properties

- ❑ object properties
- ❑ data properties
- ❑ annotation properties

6 Define constraints

- ❑ domain & range
- ❑ existential quantification

7 Create instances

- ❑ Montpellier Mediterranean Metropole (3M) data

Conclusion

We've established a domain ontology for wastewater and stormwater networks. It presents a common language and structure that enhances consistency and interoperability in managing data within these networks.

Our future work is centered on leveraging the ontology for enhanced reasoning and inference capabilities. The ontology will be instrumental in detecting inconsistencies, ensuring that the information remains accurate and reliable.

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