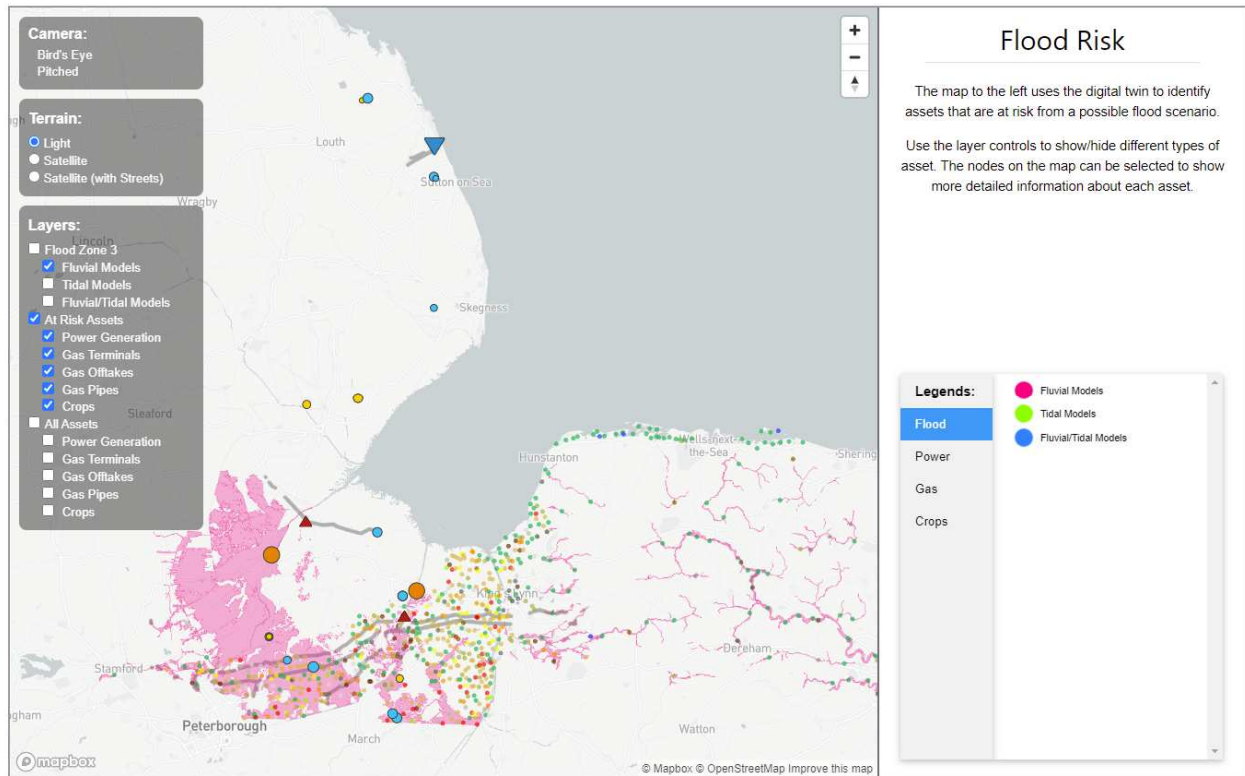


Universal Digital Twin to boost resilience of critical infrastructure assets at risk from flooding



Infrastructure assets at risk from fluvial floods

THE CHALLENGE

Floods are devastating and endanger both human lives as well as critical infrastructure assets such as the gas grid, electricity power network, etc. With the recent trends in global climate change, floods are more likely to occur in the future. Hence, it is imperative to account for and make allowances for climate change in flood risk assessments and resilience planning.

In order to improve this accountability and boost critical infrastructure resilience, accessing transient data from multiple domains (e.g. gas grid, land use, geospatial, weather) is crucial. Furthermore, such data tends to be heterogeneous (collected by different organisation and in terms of formats) and spans across multiple sources leading to data and information silos. This problem is worsened with the lack of consistent vocabulary across different disciplines or domains.

THE SOLUTION

- Universal Digital Twin – A dynamic knowledge-graph approach

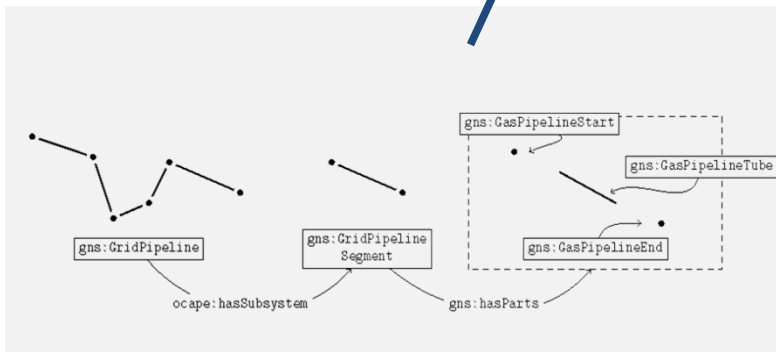
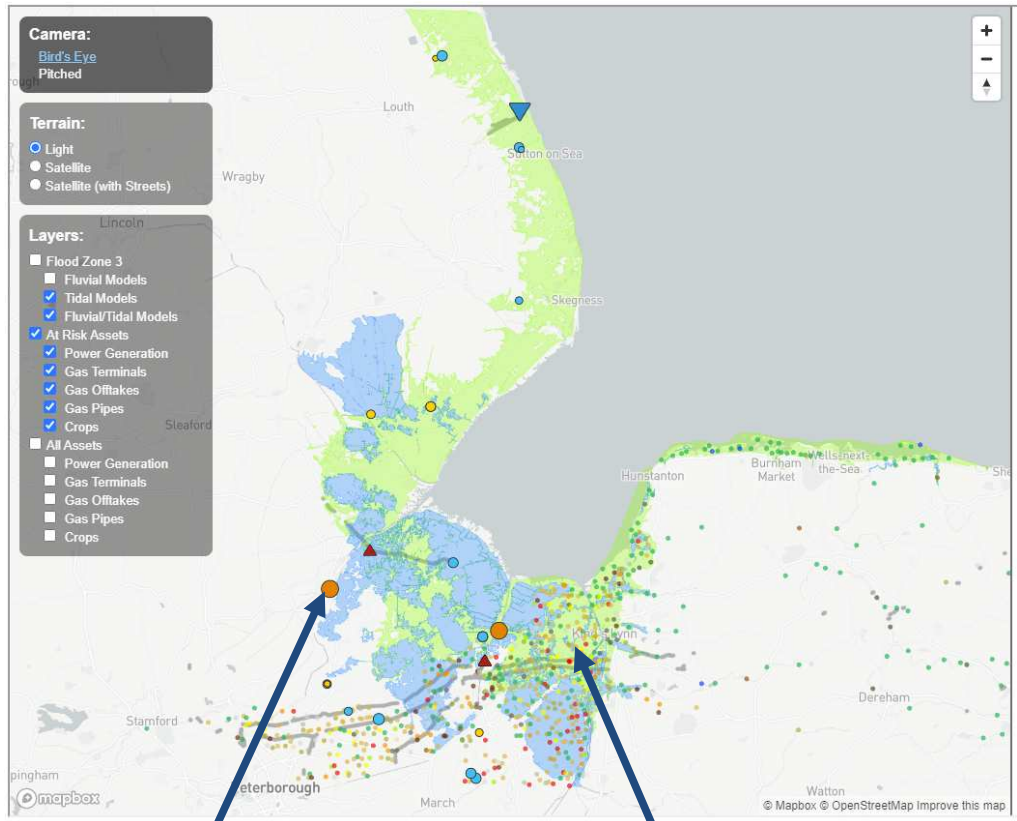
OVERVIEW

The main goal of the Universal Digital Twin is to represent a dynamic world model that is scalable, modular and distributed by-design. The Universal Digital Twin is based on a dynamic Knowledge Graph approach and exploits the connected nature of the underlying data and information, while taking into account the contextual relevance.

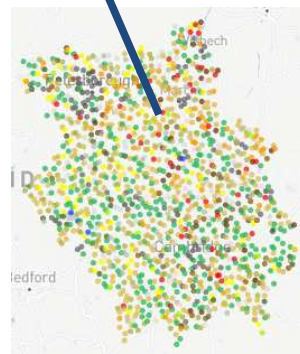
The Universal Digital Twin was used to describe the “base world” for the UK digital twin using infrastructure data from domains such as power systems, gas grid, land use, etc. Ontologies were developed to describe and link data consistently in the knowledge graph. The Universal Digital Twin ensures that all data can be queried through a uniform interface, thus enabling the breaking down of the silos.

Here, we are interested in assessing the risks of flooding to critical infrastructure such as the gas grid, power systems, etc. It is possible to assess the effects from flooding using geospatial queries on the knowledge graph.

User Story



Gas grid/network



Land use

Infrastructure assets at risk from tidal floods

RESULTS

The Universal Digital Twin enables the users to work out the cascade dependencies between infrastructure assets from flood risks. As the dynamic knowledge graph approach is scalable and supports cross-domain interoperability, the assessment can be extended to include knock-on effects on domains such as telecoms, water supply, roads, traffic patterns, food supply chain and emergency service response.

The Universal Digital Twin is dynamic and comprises the autonomous agent ecosystem which makes it possible to understand the risks, identify the most important assets and evaluate resilience measures including a variety of flood defence options in real time.

APPLICATION AREAS

- Resilience and risk assessment
- City planning

PRODUCTS USED

- Technical Services team