A semantically aware user interface design for GIS applications through cloud based microservices

Abdelrhman Rayis
Keele University
Keele, Staffordshire, UK
a.rayis@keele.ac.uk

This research aims to establish a smart data integration framework that will aid in a better understanding of the meaning of spatial objects and relationships on the spatial web by creating semantic web ontologies and microservices, building on a data-driven agile development approach for geospatial applications. The research will contribute to semantic spatial web and data mining techniques, big geospatial data analytics and semantic-based data distribution methods.

GIS, Microservices, Native-Cloud, Human-Computer Interaction, Semantic Web, Ontologies

1. INTRODUCTION

Geospatial data has become a key driver of business success and the growth of modern applications. According to a recent forecast (Markets and Markets, 2021), the global geospatial solutions market has grown tremendously and is projected to reach USD 502.6 billion by 2024 from an estimated USD 239.1 billion in 2019. This increasing demand has put a lot of strain on GIS developers to handle Geospatial Interoperability with a range of limitations in resource discovery in their projects across a wide range of diverse teams (Allan et al., 2020).

2. MOTIVATION AND AIMS

Cloud computing has evolved as a dominant trend for gaining access to computer resources of geospatial data across a wide range of domains and applications, including resource mapping, transportation, and logistics. This research aims to provide a methodology to combat the problem of semantic spatial integration by employing empirical methodology to evaluate the efficacy of the proposed container-driven approach. This approach will improve the development experience of native cloud applications that incorporate the microservice architecture by investigating the concept of Map as-a-service (MaaS) and using a native cloud-based geospatial approach. Maps may be distributed as cloud-native microservices or micromaps using the MaaS technique. This technique will be used as a framework for the geographic data integration approaches in the research. Based on a holistic approach, the research will focus on how the problem components interrelate and communicate to work within the context of the larger domain. Various methodologies will be used to develop a resilient approach for spatial data integration that leverages microservices architecture and holistic semantic methods. The following goals have been defined.

1. Study of smart data integration approaches to efficiently design and develop GIS-based systems. By investigating and establishing an ontological framework for semantic spatial data integration in GISs using a graph-based approach to efficiently store, integrate, and distribute data.

2. Define user experience design strategies to enhance the usability and development of spatial data infrastructure (SDI) systems by using a microfrontend (micromaps) approach in map-based applications and SDIs to compact map availability in the event of system failure or maintenance. In addition, system design guidelines will be developed for SDIs that are implemented in a decentralised environment. The guidelines will be extended for quality control processes to ensure the integrity and security of using geographical data in decentralised SDIs. Finally, as part of the research, we focus on analysing historical spatial data patterns using a smart data integration technique to aid in forecasting future user behaviour.

3. RESEARCH QUESTIONS

How can a semantic aware UI approach improve spatial data interoperability in the development of cloud-native Geographic Information systems (GISs)?

The spatial data integration strategy utilised in today’s applications lacks the power of holistic spatial integration in the content of GISs (Allan et al., 2020). Semantic web technologies are introduced to solve the interoperability issue for data from different sources (Yu, et al., 2018). Our research will focus on
how the components interrelate and communicate to work within the context of a larger domain by developing a resilient approach for spatial data integration that leverages microservices architecture and holistic semantic methods. The understanding that the issue is best treated from a different point of view as viewed in Figure 1, such as designing the application using a smart spatial data integration approach, is one of the foundations of this research.

Figure 1: Research area of focus

4. CURRENT WORK AND FUTURE PLANS

We started demonstrating the research aims and objectives by designing a smart spatial integration approach utilizing Smart Energy Network Demonstrator (SEND) data. This proof-of-concept application uses spatial data history patterns of weather and SEND data. This strategy has several advantages, including providing insights into resource use for Keele University by integrating meteorological and SEND IoT data and identifying social aspects. By collecting and monitoring data, open-source Spatial Data infrastructure (SDI) solutions can help in the interoperability challenges between different spatial resources (Morteza Omidipoor, 2020), such as a break hour of building energy use to assist in estimating future expenses. This technique will also aid stakeholders in anticipating and comprehending client behaviour, resulting in a better overall resource management experience.

5. CONCLUSIONS

Although having this clear workflow for geospatial data discovery in the spatial web, we need additional conceptualizations and numerical representations of spatial information that require a richer abstract ontology to match the complexity of the spatial and temporal information. The focus should be shifted to building a flexible and advanced integration framework of spatial data (Dominique Bonte, 2018). This can be done by conducting research to discover new models in holistic methods of integrating Big Geospatial Data for current applications that will be more formalized and well defined for testing and deploying data standards and specifications (AlYadumi, et al., 2021).

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