Towards a Global Spatial Data Infrastructure Using Web Services

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SUMMARY

Location-based Services (LBS) are services that utilize their ability of location-awareness to simplify user interactions and adapt to the location-specific context. Unfortunately, current LBS applications do not provide the degree of adaptivity and interoperability required for mobile environments in a global scale. Therefore, a global spatial data infrastructure (GSDI) is mandatory that is flexible enough and accessible via open, interoperable standards for data formats, interfaces, and protocols.

In this paper, we investigate how to setup a GSDI - we call our approach the *Sema*ntic *Lo*cation *N*etwork (*SEMALON*) - based on open Web Service standards and we describe how Web Service Description can be enriched with location information to allow for service discovery with respect to spatial criteria and how LBS applications can be dynamically composed during runtime. Primary focus is put on smooth integration, i.e., without the need for changing the standards.

Another major issue in SEMALON is location semantics. Currently location information is mostly represented by geographic coordinates, i.e., values describing latitude, longitude, and altitude in some coordinate systems. Unfortunately, there are many cases where geo-coordinates are not sufficient and more meaningful location descriptions are demanded, e.g., the building or room where a user is located. In SEMALON, ontologies can be used to define objects and relations between objects. However, it will be difficult to get any ontology globally accepted and finally, various ontologies will be required to suit the multiplicity of applications. Thus, multiple application-specific ontologies can coexist in our approach while ontology translation allows for adaptive service composition and semantic interoperability.

We implemented an example chain of Web Services comprising position sensing, semantic location determination, content delivery, and accounting. Different or new services can be easily integrated according to environmental dynamics. This achieves a high degree of adaptivity. Our prototype implementation for the Science and Technology Park Berlin-Adlershof allows for dynamic switching from GPS positioning to in-house WLAN positioning. It also integrates support for stationary or mobile objects which may provide further descriptive content (text, pictures, graphics, and videos). Because of its fully distributed architecture, its open Web Services foundation, its adaptivity, and its multi ontology support, our SEMALON approach seams promising as a basic GSDI and gives valuable insight for further developments.