Advancement of Geoservices – Design and Prototype Implementation of Mobile Components and Interfaces for Geoservices

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Abstract

This paper describes the conceptual and functional aspects of a GIS client for mobile data acquisition. This includes research and prototype implementations on concepts of online access to spatial databases, manipulation of features and schemes and quality assurance.

This project is part of the joint research project »Advancement of Geoservices« which is funded by the German Ministry of Education and Research (BMBF).

1 Introduction

The aim of the project »Advancement of geoservices« is to show how the geosciences and other user communities can benefit from recent advancements in the fields of wireless communication technologies, Internet, client/server computing and information technology in general.

The use of mobile Internet technology, in combination with geospatial services, allows to shorten workflows in measuring campaigns and provides the user with real-time geospatial information in the field (see also [4]). The main advantages of this approach are:

- on site access to geospatial information in real-time
- mobile data acquisition with immediate update of remote databases
- in-situ quality management

Starting from the user scenario given in [2] the following user requirements are derived. Chapter 3 describes the functionality of the system which is needed to fulfill the user requirements. Chapter 4 covers some results of the market survey that has been carried out in the project. The conceptual architecture of the system is outlined in chapter 5.

2 User requirements

As shown in Figure 1, the user wants to access geospatial information sources in the field without prior downloading of the data. This offers the possibility to access information in real-time without the necessity to synchronize mobile and stationary data (i.e. data residing on a geo-spatial server). This allows for a great flexibility in the users work provided that wireless LAN hotspots, UMTS, GSM/GPRS or other communication technologies are available. This architecture also enables access to any information source provided by a geodata-infrastructure that might be of interest for the current application.

In this project, one of the main issues is the acquisition of spatial and non-spatial data by means of sensors and other measuring means. Therefore an interface is needed which allows the integration of position data from geodetic instruments like GPS receivers or total-stations. Often proprietary protocols are used in this area, which means an interoperable communication layer has to be established. Note also that analogue measurements and readings have to be integrated by means of a human interface. For this reason forms are needed to give a possibility to add attributive information to features.

This feature is closely associated with the quality assurance issue. This means, every transaction has to be checked against well-known quality parameters like consistency, completeness, correctness and accuracy. In addition to the above mentioned functionality, visualization and analysis of the data should also be possible for the user in the field (refer to [6]).

different application schemas described by any XML-Schema. For that reason, the client must be capable of downloading an application schema at runtime.

Another mandatory functionality is the acquisition of new measurements in the field. These measurements include position and several attributes of features specified by the established application schema. To assure that the collected data is conformant to the given application schema, forms have to be generated by means of the application schema. These forms (see e.g.[5]) stipulate which kind of attributes are mandatory, optional and which accuracy has to be achieved. Further information on the editor is given in [6].

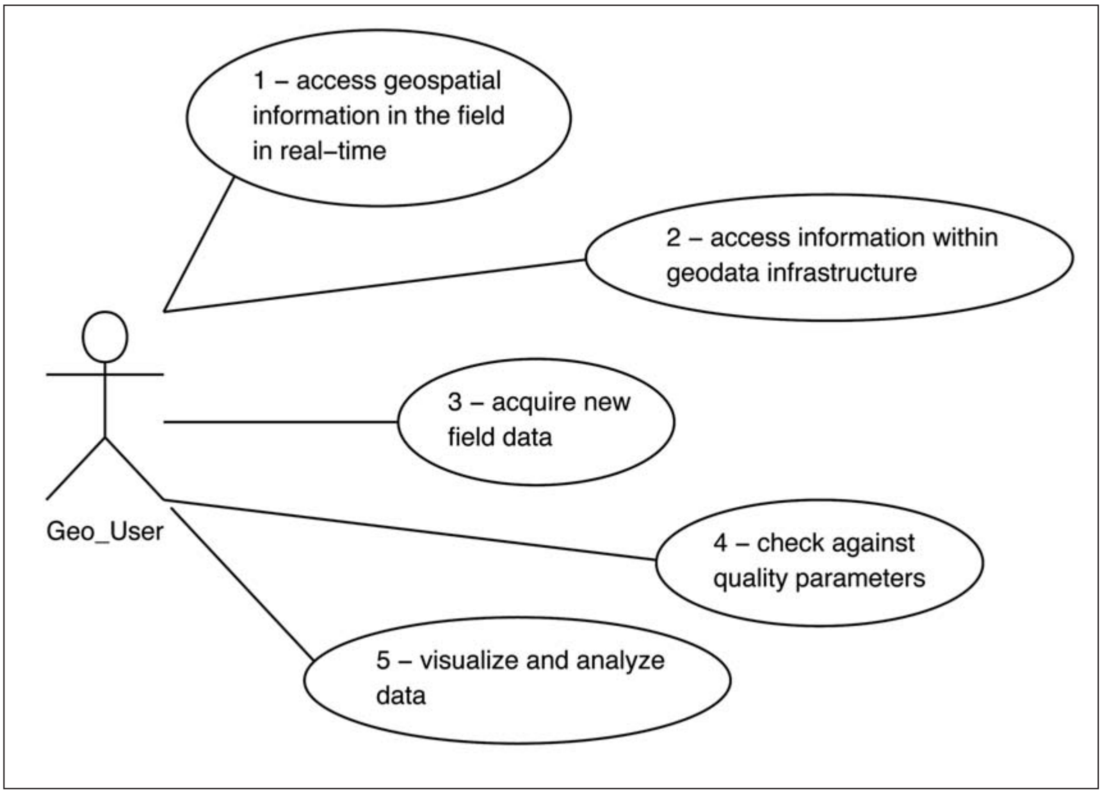

Figure 1: User requirements.

3 Components of the system

The client being developed is connected to the server by means of standardized protocols.

In this case, WFS/HTTP [3] is used to access and update vector data sources. Beyond that, additional services providing multidimensional data are being developed in [1]. In both cases, GML will be used as encoding standard for spatial information.

Regarding ISO 19109 – »Rules for application schema« in conjunction with ISO 19107 – »spatial schema«, the application schema should be open for different spatial domains. This means the system should be able to use

4 Market survey

In this part of the project, a survey identified the current state-of-technology in computer hardware, sensor hardware (i.e. PDAs, GPS receivers, total stations) and communication fields. The main issues looked at, among others, were interfaces (i.e. cable, wireless, Åc) and protocols (standard or proprietary) implemented by these equipment. In short the survey has shown that a remarkable trend towards wireless applications can be recognized. This trend fits very well with the needs of mobile or field workers who may need to create their own personal networks (i.e. via Bluetooth) where, for example, a PDA, laptop, GPS, and total station (i.e. data acquisition equipment) are connected to one another wirelessly and, at the same time, enabling the user to roam or move freely during data acquisition. It is also interesting to note that many laptops, tablet devices and digital assistants support current communication interfaces such as WLAN 802.11x, Bluetooth or both. Also many public hotspots have been and are still being installed in cities. At the time of writing, in Germany UMTS is in the testing phase. However, despite the technological advancements toward wireless, the cable technology (i.e. serial interfacing) will still exist in order to complement wireless technology.

5 Architecture

The architecture of the overall system is shown in Figure 2. It shows the main components of the server developed by the University of Vechta. Currently two clients are planned to be connected to these services. The first one is the virtual reality client of the University of Karlsruhe. The second is the data acquisition client developed together by AGIS (University of the Bundeswehr Munich) and EML (European Media Laboratory).

The core functionality like establishing data connections to services, transfer of data schemas and data manipulation is carried out by AGIS. In addition, an interoperable communication layer based on XML is investigated to communicate with sensor instruments. The data acquisition process is supported by methods of quality assurance.

The graphical user interface is being developed by EML. This includes functions for presentation and user interaction. Besides that, support for other user interface components is planned. This means that the user should be able to control a measurement instrument (e.g. trigger it to fire measurements) from the user interface and should be able to enter

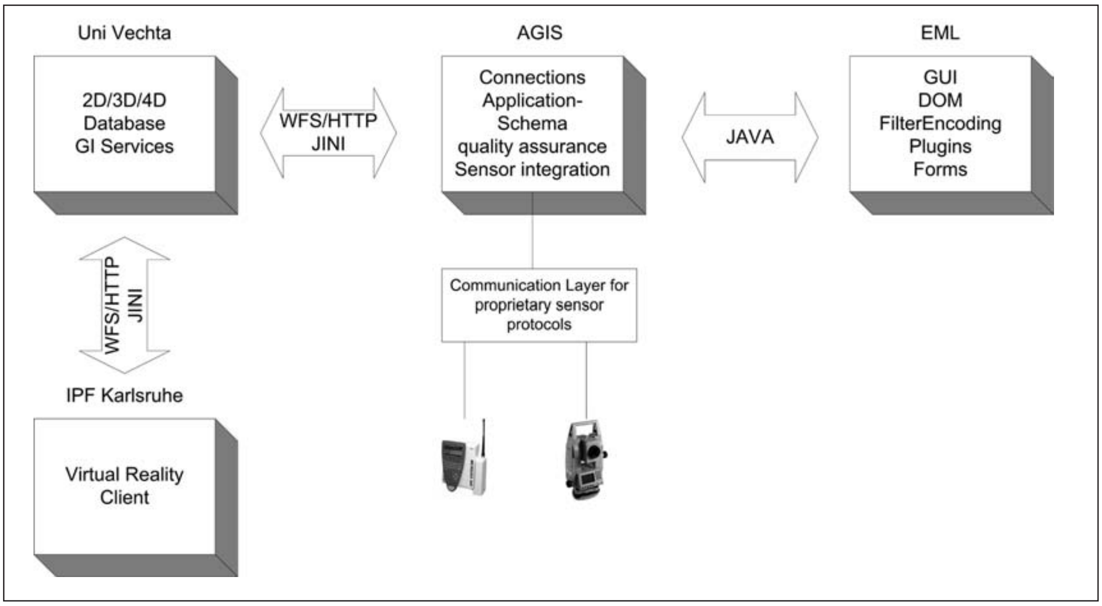

Figure 2: architecture of the system.

attribute information in dynamic generated user forms.

6 Conclusion

In this paper, some use cases for the usage of a mobile client have been outlined. Accorting to the scenario given in [2], some concepts of the architecture for the mobile client have been described. Furthermore the functionality of the mobile client carried out by the project partners EML and AGIS has been outlined.
At this time, the feasibility of the concepts is verified by means of prototype implementation.

7 References

[1] Breunig, Martin; Bär, Wolfgang; Thomsen, Andreas: Services for geoscientific applications based on a 3D geodatabase kernel. In: GEOTECHNOLOGIEN »Science Report« No. 4. Potsdam: Koordinierungsbüro GEOTECHNOLOGIEN, 2004

[2] Wiesel, Joachim; Staub, Guido; Brand Stephanie; Hering Coelho, Alexandre: Augmented Reality GIS Client. In: GEOTECHNOLOGIEN »Science Report« No. 4. Potsdam: Koordinierungsbüro GEOTECHNOLOGIEN, 2004

[3] Open GIS Consortium: Web Feature Service Implementation Specification. URL: http://www.opengis.org/specs/?page=specs (2004): Open GIS Consortium, 2002

[4] Open GIS Consortium: OpenGIS Location Services (OpenLS): Core Services [Parts 1-5]. URL: http://www.opengis.org/specs/?page=specs (2004): Open GIS Consortium, 2004

[5] W3C: XFORMS 1.0 W3C Recommendation. URL: http://www.w3.org/TR/xforms/ (2004): W3C Consortium, 2004

[6] Häußler, Jochen; Merdes, Matthias, Zipf, Alexander: A Graphical Editor for Geodata in Mobile Environments. In: GEOTECHNOLOGIEN »Science Report« No. 4. Potsdam: Koordinierungsbüro GEOTECHNOLOGIEN, 2004