Open Middleware Architecture for the LBS Domain

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ABSTRACT

The combination of position fixing mechanisms with location-dependent, geographical information can offer truly customized personal communication services through the mobile phone or other types of devices. Prompted by the avalanche of technology advances in the aforementioned areas, in this article we present a generic framework for delivering location-based services (LBS). The framework is capable of providing the full functionality required for delivering LBS, starting from the specification of the service, and covering issues like the deployment and maintenance of services, the service invocation and the final delivery of the produced results to the calling user. The main focus of the article is on the technical specification, the design, and the functionality of the framework. However, with the purpose of assessing the proposed architecture, a prototype implementation based on the discussed specifications was built and its performance was evaluated using a series of pilot services.

Keywords: communications infrastructure; IS performance evaluation; middleware; systems implementation; wireless networks; wireless technology

INTRODUCTION

The mobile communications market experienced an unprecedented boom in recent years. New handheld devices with increased capabilities are introduced, while mobile operators are striving to gain a significant portion of the market by delivering new state-of-the-art value added network services that can fully utilize the given technology. Location-based services (LBS) is just one such category of services in which both manufacturers and mobile operators have invested a lot (Kaasinen, 2003). However, delivering new services requires developing means and tools that
will assist in their creation, provision and maintenance.

This article presents an extensible cross-platform framework, which facilitates the provision of LBS services with minimum effort from all involved sides (e.g., service provider, mobile operator, etc.) and with no change to the wireless Internet infrastructure. Moreover, the framework is based on open standards so that it can accommodate future evolved technologies and be fitted in future telecommunication infrastructures.

The rest of the article is structured as follows. The second section lists the requirements for a service-provisioning platform. The third section provides an overview of the platform and of the involved technologies. The fourth section dives deeper in the architecture of the system. The article concludes with the performance evaluation of the proposed platform, followed by the conclusions.

**LBS PROVISIONING PLATFORMS REQUIREMENTS**

The development of a provisioning platform, which would cover all aspects of LBS provisioning, is a primary goal of all vendors involved in the world of LBS software systems. The set of requirements and desired characteristics for such platform includes:

- Means for supporting the service creation process without the need for special programming skills.
- Support for service deployment and operation through automatic procedures, which do not require special IT personnel or programming skills.
- Service provisioning through a variety of access protocols so that the service is accessible from different networks.
- Portability over different operating systems and hardware platforms, so that integration to different infrastructures is possible.
- Reusability: The same platform may host a number of different services, with different requirements and functionality. The introduction of new services should not require changes to the platform and changes to the platform should not affect the execution of existing or future services.
- Access to the system should be possible through a variety of devices, using different transport protocols.
- Independence from underlying positioning and GIS technologies: The platform should not bind to any specific networking technologies. GSM/GPRS and WLAN interfaces should be treated in a unified way, while the introduction of UMTS and 3G networks will not require changes to either services or the platform. This also applies to the GIS interface, which should be open enough so that integration with different implementations is possible.
- Security: Interfaces with external entities have to be secure and privacy should be maintained. These characteristics will make the user feel safer and as a result more receptive to using the platform.
- Roaming across different infrastructures. Both indoors and outdoors environments should be supported.
- Scalability: Possibility of hosting large number of services, each capable of serving numerous concurrent requests, is sure to enhance the marketing potential of the platform.

Currently, to the best of our knowledge, no integrated platform that covers all these
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