Terminal-Centric Location Services in the IP Multimedia Subsystem

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Abstract

Location-based services in 3G and beyond networks depend on high-accuracy location data. Today’s 2G and 3G access networks determine user location in a network-centric manner. The accuracy of these location mechanisms depends on the radio infrastructure near the user’s geographical position and is typically limited to hundreds or thousands of meters. This precision is inadequate for typical location-based services like city maps or route planners.

In this paper we present a terminal-centric location enabler that integrates seamlessly with the existing IP Multimedia Subsystem presence architecture and interoperates with network-centric location mechanisms. We argue that the optimal accuracy is achieved by determining the location on the user terminal, which can be equipped with location sources like Global Positioning System (GPS) receivers. In consequence, the user terminal should be used as the primary source for location information. We extend the existing and well-known concept of presence by defining location as a type of presence information that is of interest to users. Terminal-based triggers and filters reduce the amount of traffic on the radio interface and enable scalable location architecture.
This paper describes the system architecture for a terminal-based location service enabler in the 3G IP Multimedia Subsystem (IMS).

1 Introduction

Location Based Services (LBS) are services that require information about the physical position of a user in order to provide ‘added-value’ to services in a 3rd generation (3G) network. Location data may be plain geographical coordinates, access point cell ids, civil location in form of postal addresses or more abstract definitions like ‘in the office’, ‘at home’. Example services are a map showing the user’s current location or triggering a switch of the user profile when entering a specified area.

Service enablers, defined to expose network functionality to external service providers, are becoming the cornerstones of modern service architectures defined by the Parlay Group, the Open Mobile Alliance (OMA) or in the IP Multimedia Subsystem (IMS). A Location Service Enabler is a functional entity in the network enabling value-added services to query the current position of a user or to request a trigger when a specified area is entered or left.

Many mobile and fixed network operators have already started to migrate their telecommunication networks towards an All-IP infrastructure where voice loses its dominancy and becomes just one among many services. The IP Multimedia Subsystem (IMS) [1], standardized by the 3rd Generation Partnership Project (3GPP), is the most promising candidate for replacing legacy, voice-dedicated mobile networks with an All-IP technology. As opposed to traditional IP-based networks, the IMS guarantees end-to-end Quality of Service (QoS) in the network. The IMS creates an infrastructure that enables the fast deployment of new IP-based services and flexible billing while still maintaining compatibility with existing applications. The 3GPP IMS location specifications [2] adopt a network-centric location mechanism based on the Gateway Mobile Location Centre (GMLC) as primary location source for LBS.

The accuracy of this network-centric positioning mechanism is dynamic. Depending on the radio infrastructure near the user’s geographical location the GMLC typically positions a user within an area of several thousand square meters in urban area to several square kilometers in rural area. This accuracy is not satisfactory for many LBS. High investments are required to implement network-centric location mechanism enhancements like Network Assisted GPS (A-GPS) or Idle Period Downlink- Observed Time Difference Of Arrival (IPDL-OTDOA).