The Impact of Zoning Concept on Data-Flow Management within LBS System Components

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ABSTRACT

Typical Location Based Services (LBS) system is compound of a mobile device with positioning capability connected to a LBS service provider via wireless network. Thus, the efficiency of LBS System depends on each sub-element composing its architecture. One of the most important factors affecting LBS efficiency is the volume of data streamed from the server to the client. This problem has emerged as a consequence of customer demands for richer services such as videos and high-quality pictures. Therefore this paper discusses the impacts of transmitting huge size of information and services on: the mobile devices, wireless networks and the data server. In addition, it introduces a mechanism to improve the data flow based on the zoning concept in which data is organised in individual databases and then streamed gradually according to the end user’s new location. The outcome of the evaluation of this mechanism has shown better utilisation of the mobile device resources (memory and battery) as well as reducing the network and server consumption time.

Keywords: Data Management, Location Based Services, Mobile Handheld Computing, Wireless Network, Zone Based Update Mechanism, Zoning Concept

1. INTRODUCTION

Although mobile devices and wireless networks support high data transmission rates, there is still a problem in streaming data with high volume services such as Location Based Services LBS (Gartner, 2004). The size of such new services is huge compared to the text services (e.g. SMS) which are widely used nowadays. Therefore, there is a need to organise the flow of data to prevent any network congestion or delay which might occur as a result of flooding the network bandwidth (Almasri et al., 2009)

A good strategy to tackle this issue is establishing data management flow techniques mainly, associated with the server side of LBS system as it is the core of the entire system. This enables performing changes on one element of the system that will reflect on the performance of other elements of LBS, i.e. mobile devices and wireless networks.

LBS server contains the database which hosts the information to be streamed to the end users. It is essential that this database is
managed and accessed in an efficient way; otherwise unnecessary processing time and delay contribute to reducing the efficiency of the whole LBS system (Artem, 2002; Renault et al., 2005). Therefore, minimizing the amount of data to be transferred over the mobile network can significantly assist in maintaining the network Quality of Service (QoS) through minimizing delay and packet loss, which can directly enhance the utilisation of the Network bandwidth.

In addition, tackling the data-size issue has been made also to minimise the query processing time which could be problematic with both the volume of data and the number of users accessing the server at the same time.

In order to tackle the volume of data problem, a new mechanism for managing the data flow has been designed based on dividing the GIS database into a number of small geographical areas (micro-zones). This mechanism has been named Zone-based Update Mechanism (Almasri, 2008).

Managing the flow of data during its journey from the server to the client over the wireless network will contribute to improving the performance of the system (Gellersen, 1999). Figure 1 summarises the benefits of applying the new mechanism. As can be seen in the figure, the row on the top describes the impact of downloading huge information from the server database to the mobile end user, while the row in the middle describes the impact of downloading four micro-zones using the new mechanism.

Download large-sized geographical information engages the bandwidth of the wireless network for longer time. This has been calculated and described in the Evaluation section of this paper. Whereas downloading small pieces of information gradually gives the chance to the network to be free for other users and reduces the potential congestions. Moreover, keeping the LBS server as free as possible provides the ability to serve more users at the same time.

Mobile devices are still suffering from short battery life, small memory size, and low processor performance (Lee et al., 2005). Thus, the column on the right of the figure illustrates the impact of downloading data in both scenarios on the end user mobile device. It is obvious that the bigger the size of downloaded data the smaller the free memory space the users get.

Figure 1. Summary of the impact of zone-based update mechanism on LBS server, wireless networks and mobile devices (memory and battery)
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