Chapter 4.1
A Taxonomy of Database Operations on Mobile Devices

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ABSTRACT

In this chapter, we present an extensive study of database operations on mobile devices which provides an understanding and direction for processing data locally on mobile devices. Generally, it is not efficient to download everything from the remote databases and display on a small screen. Also in a mobile environment, where users move when issuing queries to the servers, location has become a crucial aspect. Our taxonomy of database operations on mobile devices mainly consists of on-mobile join operations and on-mobile location dependent operations. For the on-mobile join operation, we include pre- and post-processing whereas for on-mobile location dependent operations, we focus on set operations arise from location-dependent queries.

INTRODUCTION

In these days, mobile technology has been increasingly in demand and is widely used to allow people to be connected wirelessly without having to worry about the distance barrier (Myers, 2003; Kapp, 2002). Mobile technologies can be seen as new resources for accomplishing various everyday activities that are carried out on the move. The direction of the mobile technology industry is beginning to emerge as more mobile users have been evolved. The emergence of this new technology provides the ability for users to access information anytime, anywhere (Lee, Zhu, & Hu, 2005; Seydim, Dunham, & Kumar, 2001). Quick and easy access of information at anytime anywhere is now becoming more and more popular.

People have tremendous capabilities for utilizing mobile devices in various innovative ways for various purposes. Mobile devices are capable to process and retrieve data from multiple remote databases (Lo, Mamoulis, Cheung, Ho, & Kalnis, 2003; Malladi & Davis, 2002). This allows mobile users who wish to collect data from different remote databases by sending queries to the servers and then be able to process the multiple information gathered from these sources locally on the mobile devices (Mamoulis, Kalnis, Bakiras, Li, 2003; Ozakar, Morvan, & Hameurlain, 2005). By processing the data locally, mobile users would have more control on to what they actually want as the final results of the query. They can therefore choose to query information from different servers and join them to be process locally according to their requirements. Also, by being able to obtain specific information over several different sites would help bring optimum results to mobile users queries. This is because different sites may give different insights on a particular thing and with this different insights being join together the return would be more complete. Also processing that is done locally would helps reduce communication cost which is cost of sending the query to and from the servers (Lee & Chen, 2002; Lo et al, 2003).

Example 1: A Japanese tourist while traveling to Malaysia wants to know the available vegetarian restaurants in Malaysia. He looks for restaurants recommended by both the Malaysian Tourist Office and Malaysian Vegetarian Community. First, using his wireless PDA, he would download information broadcast from the Malaysian Tourist Office. Then, he would download the information provided by the second organization mentioned previously. Once he obtains the two lists from the two information providers, he may perform an operation on his mobile device that joins the contents from the two relations that may not be collaborative to each other. This illustrates the importance of assembling information obtained from various non-collaborative sources in a mobile device.

This chapter proposes a framework of the various kinds of join queries for mobile devices for the benefits of the mobile users that may want to retrieve information from several different non-collaborative sites. Our query taxonomy concentrates on various database operations, including not only join, but as well as location-dependent information processing, which are performed on mobile devices.

The main difference between this chapter and other mobile query processing papers is that the query processing proposed here is carried out locally on mobile devices, and not in the server. Our approach is whereby the mobile users gather information from multiple servers and process them locally on a mobile device. This study is important, not only due to the need for local processing, but also due to reducing communication costs as well as giving the mobile users more control on what information they want to assemble. Frequent disconnections and low bandwidth also play a major motivation to our work which focuses on local processing.

The rest of this chapter is organized as follows. In the next section, we will briefly explain the background knowledge of mobile database technology, related work, as well as the issues and constraints imposed by mobile devices. We will then present a taxonomy of various database operations on mobile devices, including join operation in the client-side and describes how location-dependent affects information gathering processing scheme on mobile devices. Last but not least, we will discuss the future trend which includes the potential applications for database processing on mobile devices.

PRELIMINARIES

As the preliminary of our work, we will briefly discuss the general background of mobile database