

Chapter 8

Optimizing Channel Utilization for Wireless Broadcast Databases

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ABSTRACT

A very large number of broadcast items affect the access time of mobile clients to retrieve data item of interest. This is due to high waiting time for mobile clients to find the desired data item over wireless channel. In this chapter, the authors propose a method to optimize query access time and hence minimize power consumption. The proposed method is divided into two stages: (1) The authors present analytical models and utilize the analytical models for both query access time over broadcast channel and on-demand channel; (2) they present a global index, an indexing scheme designed to assist data dissemination over multi broadcast channel. Several factors are taken into account, which include request arrival rate, service rate, number of request, size of data item, size of request, number of data item to retrieve, and bandwidth. Simulation models are developed to find out the performance of the analytical model. Finally, the authors compare the performance of the proposed method against the conventional approach.

INTRODUCTION

The development of wireless technology has led to mobile computing, a new era in data communication and processing (Barbara, 1999; Badrinath and Phatak; Imielinski and Viswanathan, 1994). With this technology, people can now access information anytime and anywhere using portable size wireless computer powered by battery (e.g. PDAs). These portable computers communicate with central stationary server via wireless channel. Mobile computing provides database applications with useful aspects of wireless technology, and mobile database is a subset of mobile computing that focuses on query to central database server.

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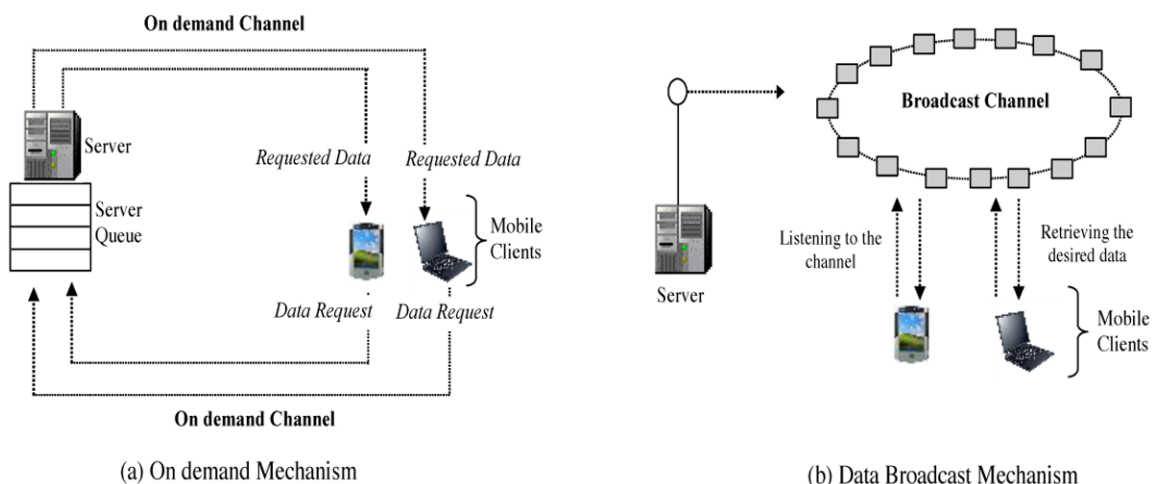
The main properties of mobile computing include mobility, severe power and storage restriction, frequency of disconnection is much greater than in a traditional network, bandwidth capacity and asymmetric communications costs. Radio wireless transmission usually requires approximately 10 times power as compared to the reception operation (Zaslavsky and Tari, 1998). Moreover, the life expectancy of a battery (e.g. nickel-cadmium, lithium ion) was estimated to increase the time of effective use by only another 15% in several years to come (Paulson, 2003). This is amplified with the fact that most applications involve read operations rather than write operations (Huang, Sistla and Wolfson, 1994). Thus, efficient query optimization and processing is definitely one of the main issues.

Broadcast mechanism refers to periodically transmit database items to mobile clients through one or more broadcast channels. Mobile clients filter their desired data on the fly. This strategy is known as an effective way to disseminate database information to a large set of mobile clients. In this way, mobile client enables to retrieve information without wasting power to transmit a request to the server. Other characteristics of data broadcasting includes scalability as it supports a large number of queries, query performance is not affected by the number of users in a cell as well as the request rate, and effective to a high-degree of overlap in user's request.

With the increase number of data items to be broadcast, the access time also increase accordingly as access to data item is sequential (Imielinski, Viswanathan, and Badrinath, 1997; Lee and Lo, 2003). This situation may cause some mobile clients to wait for a substantial amount of time before receiving desired data item. Consequently, the advantages of broadcast strategy will be eliminated. Alternatively, mobile client can send a request via point-to-point channel or on-demand channel to the server. The server processes the query and sends the result back to the client. This situation severely affects the query response time and power consumption of mobile clients, as it involves queuing and cannot scale over the capacity of the server or network. Thus, in this chapter we try to outperform the query access time over on-demand channel in any situation by optimizing the broadcast channel.

Figure 1 illustrates two mechanisms of mobile clients to obtain desired data. Figure 1 (a) is utilizing on-demand channel, while Figure 1 (b) is through broadcast channel. These two mechanisms are also referred as pull-based and push-based approach respectively (Aksoy et al, 1999).

Figure 1. The architecture of on-demand and data broadcast mechanism



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