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Chapter III

Indexing and Clustering of Wireless Broadcast Data

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Abstract

This chapter describes some data management issues that are necessary for wireless data broadcasting. The major topics we include in this chapter are (a) broadcast data indexing and (b) broadcast data clustering. Mobile clients can access the wireless data in an energy-efficient way with the index on the broadcast channel, and the well-clustered broadcast data enables mobile clients to access the wireless data in a short latency.

Introduction

With the recent proliferation of mobile communication technology and portable computing devices, clients can move around without interruption of their information computing (Badrinath & Imielinski, 1994; Imielinski, Viswanathan, & Badrinath, 1994). We call this

computing environment the mobile computing environment (in short, the mobile environment). Some major characteristics of mobile environments are as follows:

- (1) The clients can move around.
- (2) The bandwidth for wireless communication is physically limited.
- (3) The usage of energy is restricted because clients use battery-powered portable computers.
- (4) The wireless communication is less reliable than the wireline one.
- (5) Mobile clients are frequently disconnected from the server in voluntary and involuntary ways.
- (6) Portable devices are vulnerable to physical damage, for example, crash, theft, electromagnetic interference, and so on.

Owing to the characteristics mentioned above, the data-broadcasting approach is widely used for various applications in mobile computing environments (Barbara, 1999; Imielinski et al., 1994). In contrast to peer-to-peer communication, the broadcasting approach enables clients just to receive the data sent from the server without sending requests to the server. Some useful characteristics of data broadcasting in mobile computing environments are as follows:

- **Energy efficiency:** In wireless communications, the amount of energy consumption for sending data is much bigger than that of data receiving. For example, in the case of the *Hobbit* chip (Argade et al., 1993), the former is about one thousand times bigger than the latter. In this respect, the data-broadcasting approach is very energy-efficient because the clients receive data via broadcast channel without sending data (i.e., requests) to the server.
- **Bandwidth efficiency:** Different from wireline networks, the bandwidth of wireless networks is physically limited. Thus, we have to focus on the efficient utilization of communication bandwidth. In the data-broadcasting approach, many mobile clients share a single channel (i.e., broadcasting channel). Therefore, data broadcasting is said to be bandwidth efficient.
- **Scalability:** In peer-to-peer communication, we have to establish a channel (or more channels) for each client. However, the broadcasting approach uses only one single channel irrespective of the number of mobile clients. So, when using the broadcasting approach, we are free to add mobile clients to a server without additional channel allocation.

In this chapter, we consider data management issues that are necessary for wireless data broadcasting. The major topics we include in this chapter are (a) *broadcast data indexing* and (b) *broadcast data clustering*.

The rest of the chapter is organized as follows. The section entitled “Background” describes the background and some measures for wireless data broadcasting. In the section entitled “Broadcast Data Indexing,” we introduce the indexing problem of wireless broadcast data and explain some indexing methods. In “Broadcast Data Clus-

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