Chapter 7

Conclusions

In this thesis, we have presented the dissemination-based approach to design the access methods in a broadcast system. This broadcasting is an effective way of data dissemination mechanism for both power conservation at the client and the conservation of network bandwidth. In our thesis, we emphasize and showed how broadcasting can be efficiently used in low bandwidth wireless networks. In this chapter, we summarize the specific contributions of the thesis. We then conclude with a discussion of the various directions to extend this work and the opportunities for future research in the area of mobile computing.

7.1 Thesis Contribution

In our thesis, we study the access methods for broadcast data in wireless mobile computing and their performance evaluation in terms of access and tuning time. The specific contributions of the thesis are as follows:
To carry out fresh search for data or use the previous search result entirely depends upon the availability of location information in the form of cache at the client. To use this cache, users are classified into two categories: user in-system and the new user. User in-system carry out the access of desired data using the previous offset value whereas new user starts from the scratch.

Apart from the performance metrics, the robustness is also very crucial issue in an error-prone mobile environment. The proposed modified progression method, which tolerates the access failures, is based upon the $EPR$ scheme. In this method, update if any can be identified at two stages. We analytically demonstrated that the proposed algorithm lead to significant improvement in the battery life of the client.

Performance benefits of filtering the variant and invariant bits of a version number over the traditional updates in the real-time system are also discussed. These two types of bits keep track of the update of broadcast data. The proposed continuous algorithms with or without disconnection designed for real-time applications are based upon the caching of the offset value (at the user in-system).

In an error-prone environment, access time escalates with the increase in the number of access failures and the size of broadcast. The size of the broadcast is pruned by removing the redundant version number from the non-replicated and data buckets. The cumulative effect due to access failure is thus results in minimizing the access time.
We propose the algorithms to reduce the power consumption by minimizing the average probe of index probes for the skewed data. For this, a computationally less expensive criterion is designed to structure the imbalanced index tree. A factor known as adjustment factor is also explored to further reduce the cost by transforming the skewed data into a pure skewed one. A simple formula for attaining the average cost of index probes is also obtained for the highly skewed data.

7.2 Future Work

The area of data dissemination and push-based systems in general is still in infancy and this work just touches the tip of the iceberg. Although the volume of work in this area has been large during the recent future, many challenges still remain. We point some of the new opportunities for further research.

- Epsilon-Broadcast Mode

Instead of broadcasting an entire page (or item) in each broadcast cycle, a server can broadcast just an update of the page (i.e., broadcast only the epsilon pages). Alternatively, the server send an invalidation notification to the clients about a change in the content of the page, on receipt of which the clients who have cached that page can access it by the on-demand mode [BI94]. How can this idea be used as an effective alternative to the broadcasting and the on-demand mode of data dissemination? Can epsilon broadcasting be used along with the broadcasting and the on-demand modes to improve the performance of the whole system?
Hybrid Broadcasting

In this thesis, we dealt with broadcasting using either temporal addresses or multicast addresses in isolation. Technically, the address of a bucket on a network can be an element of the Cartesian product:

\[ \text{TIME} \times \text{MULTICAST} \]

where TIME is the domain of temporal addresses and MULTICAST is the domain of multicast addresses. For example, Microsoft stock quotes may be broadcast at 10:25 A.M. on multicast address 255.6.3.3. An interesting research issue is to look at hybrid schemes where a combination of multicast and temporal addresses is used for broadcasting.

Implementation

The Dataman Research Group at Rutgers University has implemented broadcasting using multicast addresses. Broadcasting using temporal addresses is yet to be implemented. This implementation will be especially interesting, as epsilon tuning, the setup time, synchronization etc., can be empirically determined. These communication issues depend upon the type of network and the type of client used in the implementation.

Bandwidth Utilization

A comprehensive study that analyzes the best way to divide the bandwidth between all the options (data broadcast, indexes, invalidation reports) is required. The study in [AFZ97] is a good step towards understanding the trade-offs, but sufficient work is still required in this direction.
Multiplexing of Indices and Signature

To avoid any false search, whether the signature technique can be used to detect the existence of desired record in the broadcast channel well in advance.

As we can find, the amount of research in mobile computing in the last few years have been overwhelming. However, some problems remain open for research. Clearly there is a need of better protocols in the real-time systems to shape the ideal broadcast. Finally, we conclude with the opinion that still there are various issues that need to be addressed in the area of mobile computing.