Data Broadcasting with Data Item Locality and Client Mobility

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1. Introduction

Existing broadcasting techniques prepare a data broadcast by appending individual information items together, and send the data broadcast to a common channel from which all the mobile clients download. These techniques, however, fail to elaborate on how to construct the network perimeter within which to send their broadcasts. It is conceivable that these techniques use one of the following approaches: 1. a single broadcast for the entire network is prepared (*one-for-all*), 2. an individual broadcast for each wireless cell is prepared (*one-for-each*).

In this paper, we explore the performance of both approaches via simulations. Particularly when the data items have *locality*, i.e., the increased likelihood of being requested at certain geographical areas, we suspect that these approaches have little use. For example, the traffic on a busy intersection might be requested very frequently within 10 miles of that intersection, and is of very little interest to those travelling 100 miles from that area. Hence, with a broadcast protocol that does not consider locality of data items, many clients will receive irrelevant data items.

2. Comparison of Existing Techniques

Using ns-2, we simulate the one-for-all and the one-for-each approach and measure their performance by the following metrics:

- Access Time (AT): AT measures the average time a client has to wait between successive downloads from the broadcast for the same data item.
- Tuning Time (TT): TT measures the average time a client actively spends listening for the data items.
- Network Load (NL): NL measures the number of packets that the network carries.

The one-for-each approach outperforms the one-for-all approach in all three metrics with a large margin when simple item locality is present.

3. Clustered Broadcasting

Motivated by the results of our simulation, we propose the clustered broadcasting approach that seeks a balance between sending the same broadcast to the entire network and sending an individual broadcast to each cell. Our goal is to minimize the network bandwidth use, yet achieve an acceptable level of quality of service. We note that many wireless cells are very small and may not differentiate much in terms of data locality. This is particularly true for adjacent cells. We propose to group these adjacent cells and prepare a common broadcast for the group.

We examine the performance of the clustered broadcasting in the context of wide area networks. We compare clustered broadcasting with the one-for-each broadcasting approach since the one-for-all approach proved to be inferior in the previous simulation. We also trace additional transmitted packets generated due to the movement of the mobile hosts. Additionally, we model and measure the effects of client mobility

The simulations demonstrate that clustered broadcasting technique has low Access and Tuning Times, and generates the fewest network packets for stationary and mobile clients alike.

4. Conclusions

In this paper, we discussed the shortcomings of the existing broadcasting protocols in specifying the boundaries of the broadcasts. We demonstrated that when item locality is present, the one-for-all and the one-for-each approaches fail to conserve the network bandwidth. Our proposed broadcasting approach, the clustered broadcasting technique, observes the network topology and item locality in constructing the broadcast boundaries. We predict that any actual data broadcasting implementation will use some form of the clustered broadcasting approach. We are currently working on deriving a cost measure and a heuristic to determine the composition of the clusters.

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