Chapter IV
Data Dissemination in Mobile Environments

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ABSTRACT

Data dissemination today represents one of the cornerstones of network-based services and even more so for mobile environments. This becomes more important for large volumes of multimedia data such as video, which have the additional constraints of speedy, accurate, and isochronous delivery often to thousands of clients. In this chapter, we focus on video streaming with emphasis on the mobile environment, first outlining the related issues and then the most important of the existing proposals employing a simple but concise classification. New trends are included such as overlay and p2p network-based methods. The advantages and disadvantages for each proposal are also presented so that the reader can better appreciate their relative value.

INTRODUCTION

A well-established fact throughout history is that many social endeavors require dissemination of information to a large audience in a fast, reliable, and cost-effective way. For example, mass education could not have been possible without paper and typography. Therefore, the main factors for the success of any data dissemination effort are supporting technology and low cost.

The rapid evolution of computers and networks has allowed the creation of the Internet with a myriad of services, all based on rapid and low cost data dissemination. During recent years, we have witnessed a similar revolution in mobile devices, both in relation to their processing power as well as their respective network infrastructure. Typical representatives of such networks are the 802.11x for LANs and GSM for WANs.

In this context, it is not surprising that the main effort has been focusing on the dissemination of multimedia content–especially audio and video, since the popularity of such services is high, with RTP the de-facto protocol for multimedia data transfer on the Internet. Although both audio and video have strict requirements in terms of packet jitter (the variability of packet delays within the same packet stream), video additionally requires significant amount of bandwidth due to its data size. Moreover, a typical user requires multimedia to be played in real-time, (i.e., shortly after his request, instead of waiting for the complete file to be downloaded; this is commonly referred to as *multimedia streaming*.

In most cases, it is assumed that the item in demand is already stored at some server(s) from where the clients may request it. Nevertheless, if the item is popular and the client population very large, additional methods must be devised in order to avoid a possible drain of available resources. Simple additional services such as fast forward (FF) and rewind (RW) are difficult to support, let alone interactive video. Moreover, the case of asymmetric links (different upstream and downstream bandwidth) can introduce more problems. Also, if the item on demand is not previously stored but represents an ongoing event, many of the proposed techniques are not feasible.

In the case of mobile networks, the situation is further aggravated, since the probability of packet loss is higher and the variation in device capabilities is larger than in the case of desktop computers. Furthermore, ad-hoc networks are introduced, where it is straightforward to follow the bazaar model, under which a client may enter a wall mart and receive or even exchange videos in real time from other clients, such as specially targeted promotions, based on its profile. Such a model complicates the problem even further.

In this chapter, we are focusing on video streaming, since video is the most popular and demanding multimedia data type (Sripanidkulchai, Ganjam, Maggs, & Zhang, 2004). In the following sections, we are identifying the key issues, present metrics to measure the efficiency of some of the most important proposals and perform a comparative evaluation in order to provide an adequate guide to the appropriate solutions.

ISSUES

As stated earlier, streaming popular multimedia content with large size such as video has been a challenging problem, since a large client population demands the same item to be delivered and played out within a short period of time. This period should be smaller that the time t_w a client would be willing to wait after it made its request. Typically there are on average a constant number of requests over a long time period, which suggests that a single broadcast should suffice for each batch of requests. However, the capabilities of all entities involved (server, clients, and network) are finite and often of varying degree (e.g., effective available network and client bandwidth). Hence the issues and challenges involved can be summarized as follows:

- What should the broadcasting schedule of the server be so that the maximum number of clients' requests is satisfied without having them wait more than t_w?
- How can overall network bandwidth be minimized?
- How can the network infrastructure be minimally affected?