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Chapter X

Broadcasting Approaches for VoD Services

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A VoD system is typically implemented by a client-server architecture supported by certain transport networks such as telecom, CATV, or satellite networks. The simplest scheme is to dedicate a channel to each client. Many VCR-like functions may be provided (e.g., forward, rewind, pause, search, etc.). Since video is an isochronous medium, the video server has to reserve a sufficient amount of network bandwidth and I/O bandwidth for each video stream before committing to a client's request. Apparently, such systems may easily run out of channels because the growth of the number of channels can never keep up with the growth of the number of clients. To solve this problem, many schemes have been proposed to resolve the bandwidth problem. In this chapter, we review two kinds of broadcasting schemes. The first one is the batching scheme, in which a set of viewers arriving close in time will be collected and grouped together. Then the video server will serve them altogether with one channel. The second one is the periodic broadcasting approach. The server uses multiple dedicated channels to cooperatively broadcast one video. Each channel is responsible for broadcasting some portion of the video. Each client follows some reception rule to grab data from appropriate channels so as to play the whole video continuously. The server's broadcasting activity is independent of the arrivals of requests. Such an approach is more appropriate for popular or "hot" videos that may interest many viewers during a certain period of time.

This chapter appears in the book, Distributed Multimedia Databases: Techniques and Applications by Timothy K. Shih.

INTRODUCTION

Why VoD?

Video has become one of the most important media in our lives. On average, each household has 1.4 television sets in the U.S. (Agnew and Kellerman, 1996). With the availability of networks, people may also wish to be able to access videos instantly at the touch their fingertips. Unlike synchronous TV, viewers do not have to watch the same program at the same time. Videos can be requested in an *on-demand* fashion.

With the advancement of broadband networking technology, computing technology, and storage technology, *VoD (video-on-demand) services* have become possible. All these three factors are critical to the success of VoD services. Offering VoD services is likely to be popular at local residential areas, and viable in metropolitan areas in the near future.

Bandwidth Concerns of VoD Services

A VoD system is typically implemented by a client-server architecture supported by certain transport networks such as telecom, CATV, or satellite networks (Chang, Coggins, Pitt, and Skellern, 1994; Hodges, Manon, and Jr , 1993; Sincoskie, 1991). The simplest scheme is to dedicate a channel to each client (Deloddere, Verbiest, and Verhille, 1994; Little and Venkatesh, 1994). Many VCR-like functions may be provided (e.g., replay, forward, rewind, pause, search, etc.). The video server has to reserve a sufficient amount of network bandwidth and I/O bandwidth for each video stream before committing to a client's request (Gao, and Towsley, 1999). Buffering spaces at the client sides may also be necessary to support these functions. Apparently, such systems may easily run out of channels because the growth of the number of channels can never keep up with the growth of the number of clients. This results in tremendous demand for communication bandwidths on the system.

Storage Concerns of VoD Services

Another important problem is storage. Given an extremely large data size, the major challenge to handle multimedia data is to support very high disk I/O bandwidth for video retrieval. One solution is to use *disk arrays* to provide high disk bandwidth at the video server side. In fact, it is highly desirable to use disk striping in a disk array to handle the storage and retrieval of video data. Disk striping is done by dividing the video data into blocks according to their presentation order (i.e., time sequence), and then storing these blocks into different disks so better load balancing on disks can be achieved. Also, accessing can be started earlier, and multiple video streams can be supported.

Multi-resolution coding can be used to support scalable video. A video is coded in such a way that a subset of the full video bit stream can be decoded to create low quality/resolution videos (Chang and Zakhor, 1994a, 1994b; Chiueh and Katz, 1993). This can offer viewers a "preview" of the video. Then the remaining video streams can be made up to the viewers, if possible, which can give a higher quality/resolution. Another motivation is supporting multi-layer resolutions from a video server is desired by the broadcasting industry since a video provider (such as a VoD company) may want to provide different customers with different levels of service. In addition, multiple resolution encoding is useful when clients have different hardware platforms.