IDEA GROUP PUBLISHING
701 E. Chocolate Avenue, Hershey PA 17033-1117, USA
Tel: 717/533-8845; Fax 717/533-8661; URL-http://www.idea-group.com
ITB7309

## Chapter VIII

# QoS-Aware Digital Video Retrieval Application

Tadeusz Czachorski, Polish Academy of Sciences, Poland
Stanislaw Jedrus, Polish Academy of Sciences, Poland
Maciej Zakrzewicz, Poznan University of Technology, Poland
Janusz Gozdecki, AGH University of Technology, Poland
Piotr Pacyna, AGH University of Technology, Poland
Zdzislaw Papir, AGH University of Technology, Poland

Delivering high quality video content to customers is now expected to be one of the driving forces for the evolution of the Internet as it can be deployed in many niches of the emerging e-market. This chapter presents an originally developed Video Retrieval application with its unique features including a flexible user interface based on HTTP browser for content querying and browsing, support for both unicast and multicast addressing and a user-oriented control of QoS of video streaming in Integrated Services IP networks. The remaining part of the chapter is devoted to some selected methods of information systems' modelling requested for the prediction of a system performance and an influence of different control mechanisms on quality of service perceived by end users.

## DIGITAL VIDEO RETRIEVAL AND STREAMING

The global Internet is absorbing video. You do not have to be in a hurry any more to get home for the evening TV news. You do not have to record any more sport competitions you are interested in. All important political, sport and entertainment events are on the Net. More and more regular movies can be downloaded from the Net as well.

Digital video storage, retrieval and delivery to customers was the only logical way for the Internet evolution as multimedia broadband services' experts convince us (Cahners In-Stat Group [CISG], 2000; Riley & Richardson, 1997; and Minoli, 1995). This statement is a straighforward consequence of the stunning, however still controversial, success of the digital sound format MP3.

CISG (2000) examined that streaming media is taking off and will drive the market for servers delivering multimedia content from the edges of the Internet to high populations of potential customers. CISG (2000) also found that new technologies will make it possible for servers to greatly increase the number of simultaneously delivered streams. CISG (2000)

This chapter appears in the book, Multimedia Networking: Technology, Management and Applications by Syed Mahbubur Rahman.

suggests as well that streaming media has the potential to make all Web sites more eye-catching to consumers and, therefore, to keep them at a site and attract new consumers.

Servers and software for digital media retrieving and streaming are sophisticated database systems tuned for the management of high-quality graphical or video content.

Traditional database systems were used to store and manage alphanumeric data types. Databases that additionally contain images, text, audio and video are called *multimedia databases* (Khoshafian & Baker, 1996).

Video is a sequence of images, a recorded real-life event usually recorded with a video camera. In contrast to image data, video is time-dependent. *Time-dependency* means that the data has a meaningful interpretation only if presented with respect to a constantly progressing time scale. Video data items are described with a set of attributes like width and height of each frame (in pixels), compression/file format, compression quality, frame/bit rates, video duration and color depth (bits/pixel).

Video inherits all image content-based features, like keywords, color histograms, object shapes, etc., but it also adds same specific features like object motion (spatiotemporal object movement), camera motion and representative frames (Flickner et al., 1995).

DBMS should provide a set of video manipulation methods, like:

- export/import to/from external data sources,
- cut (create a subset of the original video),
- real-time playback and recording: play forward, play backward, fast forward, set working point, remove working point, jump to working point.

The multimedia data types show drastically higher storage requirements as compared to traditional alphanumeric data types. A single multimedia data item consumes kilobytes (simple JPEG-compressed images) to gigabytes (high-definition television) of memory, and usually data compression methods are employed to reduce the data size. This also implies the requirement for high data transfer rates in case of time-dependent continuous media.

The requirement to store and manage multimedia information in a database significantly influences DBMS implementation (Aberer & Klas, 1992; Adjeroh & Nwosu, 1997; Khoshafian & Baker, 1996). The most interesting topics of DBMS technology, which are important for multimedia databases, include data storage, transaction and query processing, and data protection.

The Video Retrieval Service is a derivative of a Video-on-Demand, which is defined in ATMF specification as an asymmetrical service that transfers digital, compressed and encoded video and audio information from a server (typically a video server) to a client (typically a set-top Terminal-STT). At the consumers' set-top terminal, the streams are reassembled, uncompressed, decoded and presented on a display (ATM Forum, 1996a, p. 6).

In Video-on-Demand service, the user has a predetermined level of control over the selection of the video content as well as the time of viewing. It offers the functionality of a home VCR, including select/cancel, start, stop, pause (with or without frame freeze), fast forward and reverse. More advanced implementation may enable scanning forward or reverse, setting and resetting memory markers, showing counters, jumping to different indexes. The Video-on-Demand service ensures synchronization of the audio and video streams as well as time base recovery. It is likely to be used for entertainment and educational/training purposes allowing subscribers to access a library of programs (e.g., movies) collected in a digital repository.

Depending on the implementation, the user may have various levels of control over the video playback startup time and service type. It is assumed that the Video-on-Demand will allow for the individual treatment of a user. It means that the user will be provided with means