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Chapter VII

A Layered Multimedia Presentation Database for Distance Learning

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Multimedia presentations are suitable for instruction delivery. In a distance learning environment, multimedia presentations are lecture materials to be broadcasted among a number of workstations connected by networks. In order to manage these course materials efficiently, a multimedia database management system (MDBMS) is essentially important. We propose a MDBMS, which has five layers. Attributes of elements in each layer as well as database operations are discussed. The system supports storage sharing and object reuse. The system is implemented on Windows '98 with the support from a conventional database management system. Also, we present an instruction-on-demand system, which is an application of the underlying MDBMS. The instruction-on-demand system is used in the realization of several computer science-related courses in our university.

INTRODUCTION

Multimedia computing and networking change the way that people interact with computers. In line with the new multimedia hardware technologies, as well as well-engineered multimedia software, multimedia computers with the assist of Internet change our society to a distanceless and colorful global community. Yet, in spite of these fantasies gradually being realized, there still exist many technique problems to be solved. This chapter summarizes state of the art research topics in multimedia database and addresses the problems from the perspective of multimedia applications. Theoretical details are dropped from the discussion not because of the lack of their importance but due to the avoiding of tediousness. A list of carefully selected references serves as suggested readings for those who are participating with the research of this new territory.

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

In order to support the production of multimedia applications, the management of multimedia resources (e.g., video clips, pictures, sound files) is important. For instance, multimedia presentations can be designed as building blocks, which can be reused. To facilitate multimedia application design, many articles indicate the need of a multimedia database (Chen, Wu & Shen, 1994; Paul et al., 1994; Rody & Karmouch, 1995; Yoshitaka et al., 1994; Johnson, 1999; Kaji & Uehara, 2000; and Ozsu, 1999). A multimedia database is different from a traditional relational database in that the former is object-oriented while the latter relies on entity relations. Moreover, a multimedia database needs to support binary resource types of large and variable sizes. Due to the amount of binary information that needs to be processed, the performance requirement of a multimedia database is high. Clustering and indexing mechanisms that support multimedia databases are thus important.

The discussion of research issues in multimedia database management systems can be found in Paul et al. (1994), Johnson (1999), Kaji and Uehara (2000), and Ozsu (1999). A distributed database supporting the development of multimedia applications is introduced in Chen, Wu and Shen (1994). A mechanism for formal specification and modeling of multimedia object composition is found in Little and Ghafoor (1990). The work discussed in Little and Ghafoor (1990), also considers the temporal properties of multimedia resources. A database system for video objects is discussed in Lin, Chang and Lee (1994). A content-based querying mechanism for retrieving images is given in Yoshitaka et al. (1994). Layered multimedia data modeling (Schloss & Wynblatt, 1995) suggests a mechanism to manage multimedia data.

In addition to the general discussion on multimedia database management systems (MDBMSs), other articles take a similar approach to ours. The work discussed in [5] proposes a multimedia data model and a database to support hypermedia presentations and the management of video objects. Its specialized video server with an incremental retrieval method supports VCR-like functions for heterogeneous video clips. The design of multimedia DBMS is from scratch, which is similar to our approach. The system also supports object composition/decomposition. However, no specific reuse mechanism is emphasized in the discussion. Only an object-oriented data model was proposed. The system also provides a global data-sharing mechanism, including a video tool and an image collaboration tool, which are integrated with a distributed environment.

A multimedia database for news-on-demand applications is proposed in Ozsu et al. (1995). The database follows international standards, such as SGML (Standard Generalized Mark-Up Language) and HyTime (Hypermedia/Time-Based Structural Language). Its Visual Query Interface supports presentation, navigation and querying. A multimedia-type system, especially useful for structured text and presentation information, is also proposed. This database takes an object-oriented approach, which is also used by us. Similar to their standardization approach, we follow standard multimedia file formats by Microsoft, which are used worldwide. The work discussed in Ozsu et al. (1995) has a multimedia-type system, which provides a limited object composition mechanism. However, similar to the work discussed in Chen et al. (1995), no explicit reuse mechanism is provided.

The research in Chen, Wu and Shen (1994) uses an object-oriented approach to design a client-server database environment and a multimedia class library to support multimedia applications. Its graphical object editor based on OCPN (Object Composition Petri Net) allows scheduling and composing of multimedia objects. The implementation uses the Raima Data Manager/Object Manager (a database system) for its storage model, which is similar to our early approach. However, we redesign the system from scratch later due to some reasons for extension.