

Content Management (A Multimedia DBMSs Architecture)

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ABSTRACT

Multimedia data are forms of media content such as texts, sounds, images, graphics, video and animation thus managing these kinds of sophisticated data because of its large size and bandwidth consumption requires some current technologies and smart applications. Traditional database cannot handle multimedia data because of its difficult requirements thus there is a need for multimedia database system that can store and handle media data. Though it is very important for computers to search, process and store these kind of data but managing them required a key content-based search. The architecture of multimedia DBMS should be well structured and enlarged to fit in these type of data. However, the semantics nature and complexity of these data type makes searching and retrieval of multimedia content highly demanding. Because of the highly application areas and significance uses of multimedia data to the users, we propose a multimedia database management system architecture that is capable of searching different types of multimedia content and also support natural language. The architecture works in layers and can search all types of multimedia data.

Keywords: *Multimedia, Metadata, Database management system (DBMS), Multimedia Database (MMDB), Multimedia database management system (MMDBMS).*

Introduction

Most of these recent applications such as fire sensor, office automation, theft sensor, simulator and conferencing apps require the use of multimedia data such as images, texts, graphics, sounds, and videos. To make them feasible and effective, there must be a provision for the content search of these data types. Often times, the unavailability of these usually resulted to the use of hard copies by the users. This happens when for example a police command keeps a physical images or documents as witness when there is a crime hearing. Current technology allows us to store the images in the computer. Nevertheless, the moment content-based search is not feasible to search for these data types, the system may not be useful. Content search for multimedia data is usually very complicated though taken for granted and just few research have been made on this. The difficulty lies in the complex nature of the semantics and the contents associated with any media data. In alphanumeric data, there is restriction in the semantics but in multimedia, we have an almost unbounded semantics. Many research proposals have been carried out to stretch database management system to manage multimedia data in the early seventy centuries.

To design an architecture for multimedia database can be so complicated though there is no particular architecture that can be said as perfect for multimedia data. Although database architecture has some similar features with multimedia architecture, the system and users view are different and use some of the database operations such as storage structure, query optimizer, query modules etc. Database management system has made it possible to create, analyze, store and send big files over the internet but recently researchers have begun to think about multimedia database system capable of storing, processing and retrieving multimedia data. This paper tends to discuss and analyze what multimedia database management system can do.

Literature Review

Krishnan (2013) developed a tested multimedia application for primary school students' with dyslexia. The results show the application is capable of lessening the reading miscues. The intervention of multimedia plays a significant role in the reading capacity and attainment scores of dyslexic students. Arjen (1999) conducted a research on content and multimedia database management systems where he based his research on multimedia architectures such as three schema architecture and the multi-model DBMS architecture. Donald and Kinsley (1997) conducted a research on multimedia database management requirements and issues. The author stated that for multimedia to serve its purpose, it must meet some special requirements.

Samir (1991) conducted a research on multimedia database (content & structure) where he classified multimedia database into two, linked multimedia database and embedded multimedia database. Yu and Teri (2011) conducted a research on multimedia database applications where contents, issues and application areas of multimedia database system is discussed. Vincent and Klause (2005) conducted a research on architecture of multimedia database management system supporting content search where he used a parser to interpret media descriptions matching them with queries.

Statement of the Problem

The introduction of multimedia database management system is to help solve the problems and setbacks encounter using traditional database management system for multimedia data as follows:

- Multimedia Data Storage Capacity
- Information Retrieval Capabilities
- Multimedia Data Management System
- Media Integration, Composition and Presentation
- Query Languages

Aims and Objectives

The purpose of multimedia database management system architecture is to provide a suitable framework or architecture for using and managing multimedia database information.

Objectives are:

- To create a framework that support various multimedia data types such as static media, dynamic media and dimensional media.
- To enable data creation & definition, data access, data independence, data integrity etc. for traditional database management system.
- To enable multimedia data structure and semantics creation to ease programmer's work of creating complicated files.

Multimedia Databases

A Multimedia database (MMDB) is a database that contains one or more related media data types such as pictures, videos, texts and graphic displays such as animations. A Multimedia Database Management System (MMDBMS) is an application using in managing multimedia database. It provide support for creation of data, data query, data access and data modifications.

Types of Multimedia Databases

- **Linked Multimedia Database:** In linked multimedia database, the database is structure into metadata and they are linked to the actual data such as video, audio, image and graphics. These data may be stored in CD ROM, DVD and Hard disc or maybe online.
- **Embedded Multimedia Database:** In embedded multimedia database, the multimedia data is embedded inside the database itself in a binary form. The retrieval of data is very easy here of the decreased access time but occupies large storage capacity.

Contents OF Multimedia Database

- **Static media (SM):** the static media consist of constant, time independent and non-reciprocally objects such as graphic and image objects.

- Dynamic media (DM): the dynamic media consist of continuous, moving, time dependent and mutually objects such as video, audio and animations.
- Dimensional media (DmM): The dimensional media consist of 3 dimensional objects in height, weight and depth such as 3D game, 9D movies and virtual reality.
- Multimedia Database (MMDB) also consist of media data (Md), media format data (MFd), media keyword data (MKd) and media feature data (MFd).

Requirements of Multimedia Database

- Data independence
- Integration
- Concurrency control
- Privacy
- Query support
- Persistence
- Recovery

Multimedia database system must support the following data:

- TEXT AND FORMATTED DATA (TFd)
- AUDIO AND MUSIC DATA (AMd)
- IMAGE DATA (Id)
- FULL-MOTION VIDEO DATABASE SYSTEM (FMVds)

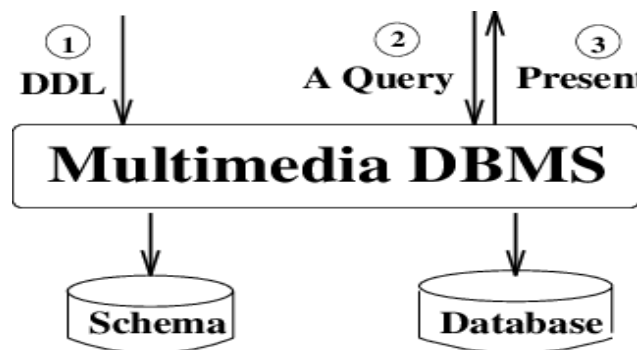


Fig 1: Functional Requirements of Multimedia DBMS (Source: Google, 2020)

Issues and Challenges of Multimedia Database

- Conversion problem: Multimedia data has various data and media formats and representation thus converting from one formats to another i.e JPEG, GIF,DOC, PPT, AVI etc is very difficult.
- Large Storage problem: Multimedia system usually contain large amount of data such as games, videos etc thus large storage capacity is a necessity.

- Time problem: In processing multimedia data, a lot of time and bandwidth is consumed.
- Integration problem: The problem of integrating one or more models together is very difficult in multimedia. That is, a relational database model best handle texts/numbers while object-oriented database model best handle animation/videos thus bringing them together is limited.

Application Areas

- Educational Institution: It is applied in training, online learning and digital libraries.
- Entertainment industry: It is used in creating music database, video on demand and interactive television show.
- Healthcare Centers: It is used in hospitals for managing health information and for medical imaging system.
- Manufacturing Industry: for distributed digital manufacturing
- E-Commerce: for creating online market stores and transactional databases.
- Geographic Information Systems: for capturing, storing, analyzing and managing of all kind of geographical or spatial data.

Multimedia DBMS Architecture

A Multimedia database management system combine both traditional database support and multimedia database support for managing of data structures. Designing a multimedia database is divided into three components which are data abstraction, query processing and retrieval engine. Data abstraction helps to manage the content related metadata that is used for digital representation of the objects. The query processing helps to will compile query specifications using language such as structural query language (SQL). The retrieval engine helps in query analysis and evaluation. It serves as interface between multimedia contents and users. The multimedia system employed two concept of operation which are maintenance and retrieval.

In maintenance, objects are added, sorted and deleted. In retrieval, the users communicate with the content. The interface between the DBMS and user consist of normal data structure with some manipulative languages and new amplified with some new ideas. DDL will require a command that will instruct DBMS which schema of multimedia data types be treated an active objects. The information will be directed to the data abstraction component which will then gather metadata relating to these objects. The retrieval engine will ensured a correlation and flow with the users and provide commands that will differentiate the start and end query session of any information needed.

Multimedia systems can be grouped into three:

- Standalone Multimedia System (SaMS): It comprises of storage subsystem such as a database and device storage where various multimedia data are stored.

- Networked Multimedia System (NMS): It comprises of various sub-networked system.
- Server Multimedia System (SMS): It comprises of both networked subsystem and storage subsystem.

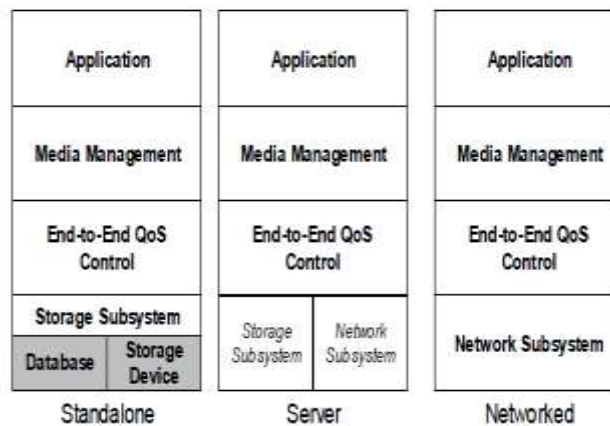


Fig 2: Layered Architecture (Source: Google, 2020)

- LAYER 1: The layer 1 consist of network subsystem and storage subsystem which provide services that are the central part of the multimedia system.
- LAYER 2: It ensured quality connection between the source data and point of delivery.
- LAYER 3: We referred here to management zone where data streaming and other synchronizing activities are carried out.
- LAYER 4: This is the communication interface that allow various users to interface with the media data.

In Layered MMDBMS architecture, the layer consist of two portion which is a portion for managing unformatted data such as (audio, video and images) and another portion for managing (text and numeric) unformatted data. The architecture is decomposed in order to allow database layer and data composition to be distributed in a multiple server system of a multimedia environment. The database management system manage the media files, the moment the local controller send a request command, the specified database will be accessed and data will be passed on. In this architecture, the database manager of each system are independent of each other and they are enjoined to a multiprocessor system.

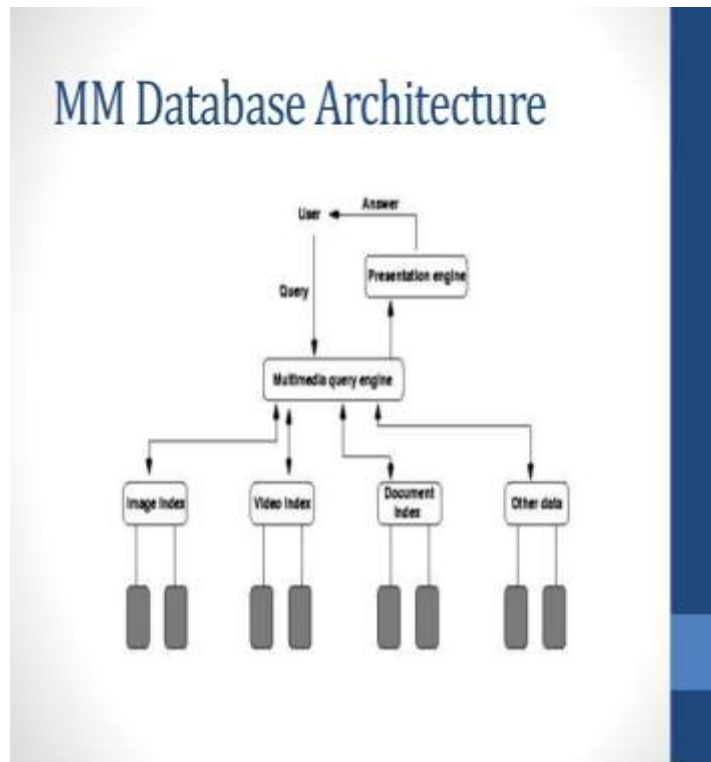


Fig 3: Flowchart of How It Works (Source: Google, 2015)

Conclusion

This paper gives a brief introduction of multimedia, multimedia database, multimedia database management system and how multimedia data are retrieved from the database. Some various components, contents and challenges faced by multimedia system are also discussed. There are many challenges that occur while designing, implementing, managing and even retrieving data from a multimedia system so as its application in many fields are also outlined. Unlike the traditional database, multimedia database requires heavy bandwidth and storage capacity, so there is a need for the database to be stretched to accommodate this type of data. Managing a multimedia database requires some special features beyond normal traditional database such as storing of metadata in catalog in traditional database which in multimedia, the application not only store but think about the content to be stored. Thus, multimedia database management system also manage metadata of the data content.

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