

Multimedia Technology (IT-204-F)

Section A Introduction to multimedia

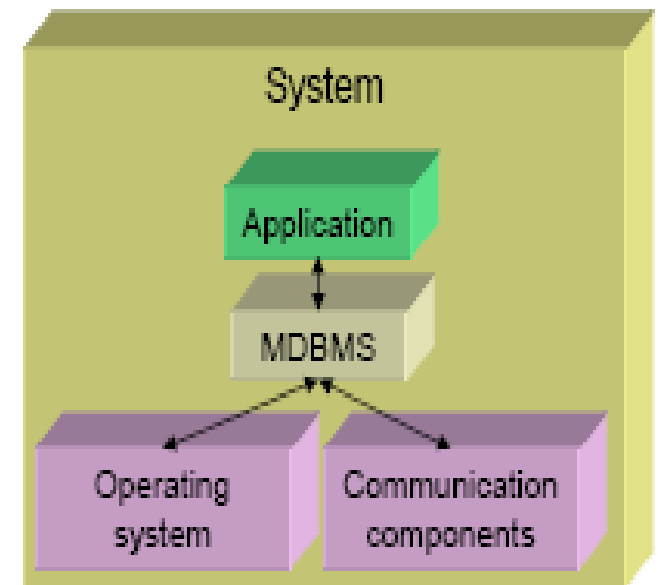
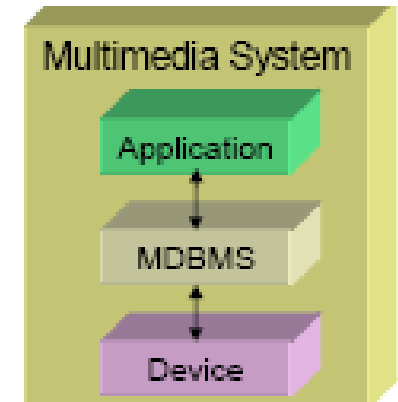
Lecture 7

Multimedia Database

Multimedia Database

- Multimedia Database Systems
- Multimedia Database
- Management System
- Data Structure
- Operations on Data
- Integration in a Database Model

- **Multimedia Database Management System**
- Main task of a Database Management System (DBMS) is to abstract from the details of:
 - Storage access
 - Storage management
- Location of the MDBMS:
 - Embedded between the application domain and the device domain
- *Integration into the system:*
 - Through operating system
 - Communication components



- *Persistence of data:*
- Data outlive processing programs and technologies, e.g. companies have to keep data in databases for several decades
- *Consistent view of data:*
- Synchronization protocols provide a consistent view of data in a multi-user system
- *Security of data:*
- Transaction concepts ensure security and integrity protection in case of system failure. Recovery of lost data.
- *Query and retrieval of data:*
- Query languages such as SQL (Structured Query Language) enable formulating database queries
- Each entry has its state information that can be retrieved correctly

- **Characteristics of MDBMS**
- *Corresponding storage media*
- Multimedia data must be stored and managed according to the specific characteristics of the available storage media
- *Descriptive search methods*
- Query of multimedia data should base on a descriptive and content-oriented search.
- *Device-independent interface*
- Hide details of device control, but offer information on specific characteristics of available storage media (read-only, write-once, write-many) *Format-independent interface*
- DBMS must hide internal storage format and offer conversions to formats requested by the applications (GIF, TIFF, JPEG,)
- This allows changing to new storage technologies without any impact on multimedia applications

- *View-specific and simultaneous data access*
- Allows consistent, multiple and simultaneous data access through different queries of several applications (e.g. shared editing)
Management of large amounts of data.
- DBMS must be capable of handling and managing large amounts of data. Need of appropriate referencing mechanisms.
- *Relational consistency of data management*
- Relations among data of one or different media must stay consistent corresponding to their specification. MMDBMS manages the following relations:
 - *Attribute Relation: supports different presentation (audio, video, image) of one object*
 - *Component Relation: includes all parts belonging to one data object*
 - *Substitution Relation: defines different kinds of presentation of the same information, e.g. equation as tables, graphs, animation*
 - *Synchronization Relation: describes temporal relations between data units, e.g. lip synchronization of audio and video*

- *Real-time data transfer*
- DBMS must perform read and write operations of continuous data in real-time.
- The data transfer of continuous data has a higher priority than other database management actions.
- Primitives of multimedia operating systems should be used to support the real time transfer of continuous data.
- *Long transactions*
- The transfer of large amounts of data will take a long time and must be done in a reliable fashion.

- *Relation between the operating system and MDBMS:*
- The operating system provides the management interface for MDBMS to all local devices.
- The MDBMS provides an abstraction of the stored data and their equivalent devices, as is the case in DBMS without multimedia.
- The communication system provides for MDBMS abstractions for communication with entities at remote computers.
- Operating system and communication system can unify all the different abstractions and offer them.

- **Data Structure**

- Data can be stored in databases as Unstructured (unformatted): data are presented in a unit where content cannot be retrieved by accessing any structural detail

Example: “Mr. Penguin is a student in the seventh term.”

- Structured form (formatted): data are stored in variables, field or attributes with corresponding values

Example: o.student.surname = “mustername”

o.student.name = “hermann”

o.student.age = 41

- **Data Types**
- Multimedia data can be stored in databases as raw, registering and descriptive data types:
- *Raw Data: represent the unformatted information content, e.g. letters, pixel, values*
- *Registering data: necessary for correct interpretation and identification of the data; usually concealed in the header. For example: format-description (GIF, TIFF, JPEG, ASCII, EBCDIC, ...), compressed/uncompressed data, etc.*
- *Descriptive data: information about content and structure of the multimedia data to make use easier and faster, e.g. semantic search*

- **Data Types - Examples**
- *Text*
- Characters represent raw data
- Registering data describe the coding (e.g., ASCII)
- Descriptive data may include information for layout and logical structuring of the text, or keywords *Image*
- Pixels represent raw data
- Registering data include the height and width of the picture
- Descriptive data are individual lines, surfaces and subjects

- **Data Types - Examples**
- *Video sequence*
- Pixel matrices represent the raw data
- Registering data provides, in addition to other information, the number of images per second
- Descriptive data provide a scene description, e.g. "Jan's birthday party"
- *Audio sequence*
- The digital sample values created by a simple PCM coding represent the raw data
- Registering data represent the properties of the audio coding
- Descriptive data represent the content of the audio

- **Operations on Data**
- An MDBMS must offer, for all data types, corresponding operations for:
 - archival and
 - retrieval
 - The media related operations will be handled as part or extension of query languages,
e.g. SQL
- Different classes of operations are needed:
 - input
 - output
 - modification
 - deletion
 - comparison
 - evaluation

- *Input (insert / record) operation:*
- Data will be written to the database. The raw and registering data are always needed, descriptive data can be attached later

- *Output (play) operation:*

Read the raw data from the database according to the registering data

- *Modification:*

Changing of raw, registering and descriptive data.
Modification can also be understood as a data conversion from one format to another

- *Deletion operation:*

Remove an entry from the database. The consistency of the data must be preserved

- *Comparison:*
- Many queries to the MDBMS consist of a search and retrieval of the stored data
- Queries are based on comparison information
- Individual patterns in the particular medium are compared with the stored raw data → not successful enough → *Pattern matching, search in descriptive data, etc.*
- *Evaluation:*
- Generation of the corresponding descriptive data from the raw and registering data

- **Integration in a Database Model**
- Design of multimedia database systems base on two different kinds of DBMS:
- *ERDBMS (Extensible Relational Database Management System):*
 - Definition of additional, application-dependent data types as domains for attributes
 - Definition of new functions to control behavior of and access to the data
 - Embedding new types and functions into existing RDMBS
- *OODBMS (Object-Oriented Database Management System):*
 - Different media are represented by classes, whose instance variables include the data as internal state
 - Class hierarchy allows object relations, offers well information navigation and flexible presentation possibilities

- **Relational Database Model**
- *Type 1 Relational Model*
- Value of a certain attribute can be fixed over the particular set of the corresponding attribute types, e.g. the frame rate of the video can be fixed In the example, the videos from the exercise devices 1 and 2 will play at the fixed rate defined by the type 1 specification
- *Type 2 Relational Model*
- A variable number of entries can be defined through the type 2 relational model. In the example, the individual disciplines of each admitted student are identified through their admission numbers
- *Type 3 Relational Model*
- Additionally, an entry can simultaneously belong to several relations. In the example, a video entry of a student can be assigned to the relation "athletics" as well as to the relation "analysis"

- **Object-oriented Database Model**
- In *object-oriented databases...*
- classes with objects are defined
- objects can be put in relations via a class hierarchy
- a semantic specialization of classes and objects can follow

Example

Main class: sports institute

Subclass: athletics, swimming

Objects: students

- *Advantage:*
- These system offer good information navigation and flexible presentation possibility
- *Disadvantage*
- Query operations are incompletely supported

Scope of Research

- Dynamic Storage