Multimedia Computing

CSC 319

BScCSIT 5th

Instructor:

Shiv Raj Pant

Text book:

1. *"Multimedia: Computing, Communications and Applications"*, Ralf Steinmetz and Klara Nahrstedt, Pearson Education Asia

Supplementary materials:

1. Lecture slides from the instructor (if possible!)

3. Syllabus and old question papers available online at : https://collegenote.net/ (Some notes and slides may also be found on this online source. These materials are not from the instructor(me). The instructor is not responsible for the content of the website. Please use the information (at your own risk) if you find it useful)

Syllabus:

Unit 1: Introduction

Unit 2: Sound /Audio System

Unit 3: Images and Graphics

Unit 4: Video and Animation

Unit 5: Data Compression

Unit 6: User Interfaces

Unit 7: Abstractions for programming

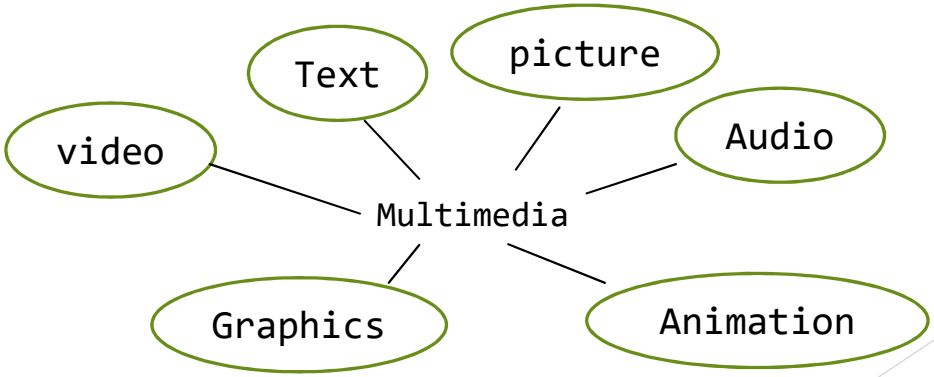
Unit 8: Multimedia Application

Unit 1

- Introduction
- Multimedia Applications
- Global Structure (components) of Multimedia
- Medium
- Multimedia System and Properties
- Characteristics of a Multimedia System
- Challenges for Multimedia Systems
- Components of a Multimedia System

What is multimedia ?

- Multimedia means representing information through audio and/or video in addition to text, image, graphics and animation.
- A variety of information in different areas (e.g. zoology, mathematics, genetics, engineering etc) can be presented better with multimedia than text alone.
- The integration of multimedia into computer can help more with additional advantage of computer power (e.g. fast processing and interactive presentation of huge amount of information.)
- Many areas of technology, business, entertainment etc have transformed because of the advancement in the multimedia. E.g. telecommunication, news publications, televisions, www etc. These areas offer more and more multimedia information.



Elements of Multimedia

1) ***Text***- All multimedia productions contain some amount of text. The text is usually represented as ASCII, Unicode etc

2) ***Image***- Image refers to the natural picture taken from camera and stored in digital form. Images can be presented in high-quality color format.

3) ***Graphics***- Graphics refers to the artfically-generated (usually with computer software) picture. Graphics make the multimedia application attractive. In many cases people do not like reading large amount of textual matter on the screen. Therefore, graphics are used more often than text to explain a concept, present background information etc.

3) ***Audio***- Audio includes use of speech, music and sound effects to represent information.

4) ***Video***- The term video refers to the moving picture, often accompanied by sound. A video is just a continuous series of still images that are displayed in a sequence. Video element of multimedia application gives a lot of information. Digital video is useful in multimedia application for showing real life objects. Video have highest performance demand on the computer memory and on the bandwidth if placed on the internet. Digital video files can be stored like any other files in the computer and the quality of the video can still be maintained. The digital video files can be transferred within a computer network. The digital video clips can be edited easily.

5) ***Animation***- Animation is essentially a computer-generated (artificial) video. Animation is very popular in multimedia application

Applications of Multimedia

- ***Multimedia in Business*** : Voice Mail, Electronic Mail, Employee Training, Presentation, records Management, Marketing and Advertising
- ***Multimedia in Entertainment***: Television, games
- ***Multimedia in Education-*** teaching/learning aids, demonstration, research
- ***Multimedia in Hospital***-real time monitoring of conditions of patients in audio/visual form. ECG, ultrasound etc. Multimedia displays are now extensively used during critical surgeries.
- ***Communication Technology***- E-Newspapers, e-magazines, Television

Some challenges/issues

- Multimedia applications require hardware and software to be adopted accordingly.
- Multimedia application requires handling of large amount of data (memory, processor)
- Because of memory-intensive and processor intensive nature of multimedia, real-time systems especially suffer challenge with multimedia because these systems have strict timing requirements and must work within time bound.
- Integration with traditional media (e.g. text) is also a challenge. Because application have to process different kinds of data.

Global structure of multimedia system

- The global framework of a multimedia system includes different components at different levels working together.
- The figure shows the components(main fields) of multimedia system .
- The whole Multimedia system framework can be divided into three main domain levels:

1. *Device domain*: This level includes the basic or low-level (hardware level) concepts for representing and processing various multimedia elements and for handling physical device.

   For example,

   - basic concepts for processing audio/video data are based on digital signal processing.
   - Similarly, this level is concerned with low level representation of multimedia while transmitting over network. How to represent audio/video data on CD etc.

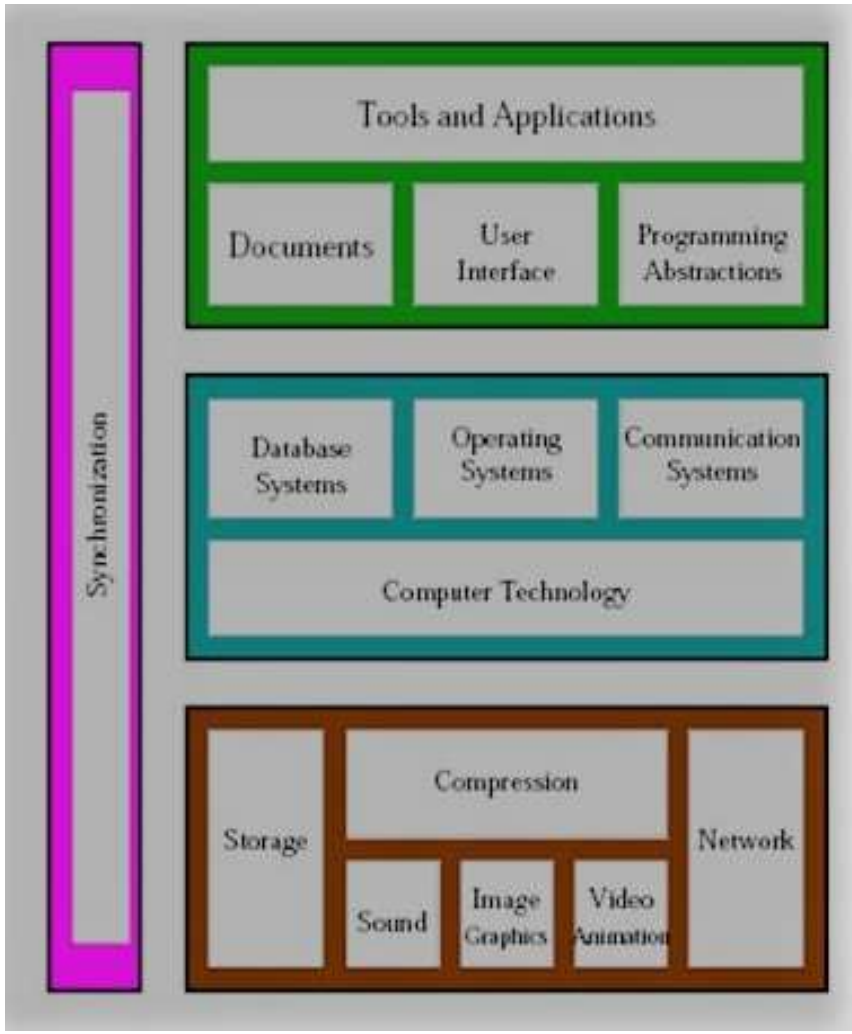


Fig: *The global structure of multimedia system.*

2. System domain:

- This level includes all supports for using the functions of device the device domain.
- The interface between the system domain and the device domain is specified by the computer technology.
- To utilizes the device domain, several system services are needed.
- There are three system services. These system services are mostly implemented in software.

i. **Operating system** : OS serves as an interface between H/W and other S/W. It provides an easy programming and computational environment. OS provides different services to operate the computer resources(processor, memory, I/O etc)

ii. **Database system**: provides structured management and access to large amount of data.

iii. **Communication system**: It is responsible for transmission of data with required reliability.

3. Application domain:

- Provides functions to the user to develop and present multimedia.
- Includes software tools, user interfaces and programming abstraction.
- Another component in the application domain is the document handling. A document contains structured information, represented in different media and are recorded or generated at the time of presentation.

4. cross-domain synchronization:

- Synchronization is temporal relationship among various media.
- It relates to many components across all domains.

An example of how different levels of multimedia system work:

Consider a video DVD.

Device domain: how to exactly represent data in the storage surface (coated with storage material) of DVD ?

System domain: we need operating system support to read/write binary data from/to dvd. This includes sector/track level control of dvd and control over the read/write head of dvd drive.

Application domain: This includes applications such as video players, video editors to control the multimedia by user application. This also includes organization of files and folders on dvd etc.

Medium

- In general, medium is a means for distribution and presentation of information.
- Examples of medium are text, graphics, speech and music.

Classification of media

1. *Perception medium*
2. *Representation medium*
3. *Presentation medium*
4. *Storage medium*
5. *Transmission medium*
6. *Information exchange medium*

1. *Perception medium*

- Perception media help humans to sense their environment.
- *How to humans perceive information in a computer environment ?*
- Perception of information occurs mostly through *seeing* and *hearing*
- For perception through seeing, the visual media such as text, image and video are used.
- For perception through hearing, the auditory media such as speech, noise, music are used.

2. *Representation medium*

- Representation medium is concerned with "how is the multimedia information represented(coded) in computer ?"
- Various formats are used to represent multimedia in computer.
- e.g.
  - Text is coded in ASCII, UNICODE, EBCDIC
  - Graphics is coded with GKS, CGI etc
  - Audio stream can be represented using a simple PCM (pulse coding method).
  - Image can be coded as JPEG
  - A combined audio/video sequence can be coded in TV standards such as NTSC, PAL, and SECAM

3. Presentation medium

- Presentation media refer to the tools and devices for the input and output of information.
- Here the question of concern is "*through which medium is information is delivered by the computer, or introduced in the computer*?"
- The media such as printer(paper), monitor, and speaker are used to deliver information by computer (called output media)
- The media such as keyboard, mouse, camera and microphone are used to introduce information to the computer (called input media)

4. Storage medium

- Storage medium enable storage of multimedia information.
- The storage of data is not limited to electronic mediums. e.g. paper is also a storage medium.
- Magnetic tapes, Hard disk, CD, DVD, Flash drives etc are examples of storage media.

5. Transmission medium

- The transmission medium is concerned with different information carriers, that enable data transmission.
- Information is transmitted over networks which are wired(copper cables, optical fiber) or wireless.

6. Information exchange medium

- The information exchange medium includes all information carriers for transmission. i.e. all storage and transmission media.
- The question here is *"which information carrier will be used for information exchange between different places?"*

Some terms:

Representation values and representation space

Time dependent vs time independent media

Discrete vs continuous media

Main properties of multimedia system

- A multimedia system distinguishes itself from other systems through several properties:

1. *Combination of the media* :
   - A multimedia system has the ability to process many types of media through one program.
   - Not every arbitrary combination of media can be called multimedia.
   - A true multimedia system should utilize both discrete and continuous media.
   - E.g. a text processing program with incorporated images is not a multimedia application

2. *Independence:*
   - An important aspect of multimedia is the level of independence among different media
   - Multimedia may require several levels of independence.
   - E.g. a video recorder records audio and video information where both media have inherently tight connection. But in a presentation, a combination of video and text information have more independence to each other.

3. Computer control and integration

- A multimedia system should be capable of computer –controlled media processing.
- Moreover, the system should be programmable by user.
- Simple input or output of different media through one system does not satisfy the requirement for a computer controlled solution.
- For a true computer control and integration the system should be able to include temporal, spatial and semantic synchronization.

E.g., a text processing program that supports text, table calculation and video clips is not true integration if it does not support the connection between different data.

A high integration level is achieved if some change in the table data causes a change in the video or text.

4. Communication capability

- Since today's computer systems are interconnected, multimedia must be communication capable.
- Communication-capable multimedia can be created, processed and distributed beyond single computer's boundary.

Based on above properties of multimedia system, let us redefine the term "multimedia".

A robust definition of multimedia

"A multimedia system is characterized by computer-controlled, integrated production, manipulation, presentation, storage and communication of independent information, which is encoded at least through a continuous (time-dependent) and a descrete (time-independent) medium.