Multimedia Computing

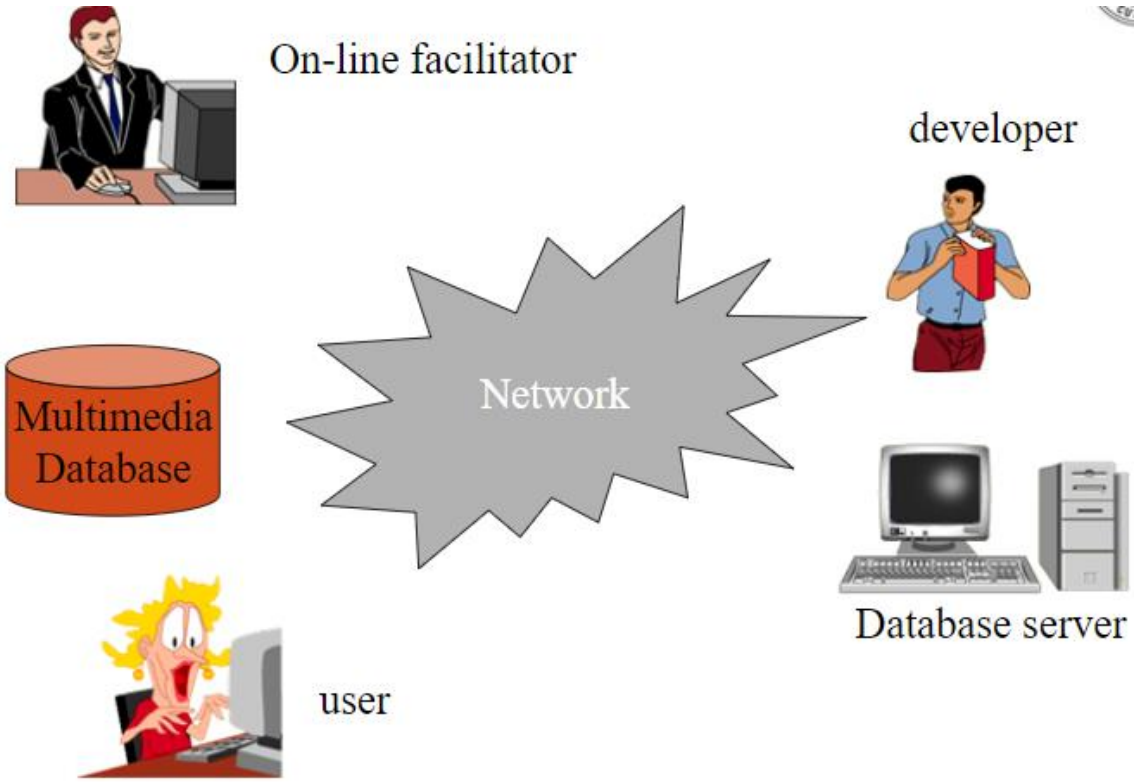
1 UNIT 1: INTRODUCTION (5 HRS.)

The word multi and media are combined to form the word multimedia. The word "multi" signifies "many." Multimedia is a type of medium that allows information to be easily transferred from one location to another. Multimedia is an interactive media and provides multiple ways to represent information to the user in a powerful manner. It provides an interaction between users and digital information. It is a medium of communication. Some of the sectors where multimedia's is used extensively are education, training, reference material, business presentations, advertising and documentaries.

1.1 DEFINITION OF MULTIMEDIA

By definition Multimedia is a combination of information having different transport signal characteristics and representation of information in an attractive and interactive manner with the use of a combination of text, audio, video, graphics and animation. In other words, we can say that Multimedia is the presentation of text, pictures, audio, and video with links and tools that allow the user to navigate, engage, create, and communicate using a computer.

Multimedia becomes interactive multimedia when a user is given the option of controlling the elements, such as text, drawings, still and moving images(videos) graphics, audio, animation, and any other media in which any type of information can be expressed, stored, communicated, and processed digitally. Multi and Media refers to many types of media (hardware/software) used for communication of information.



1.1.1 Objective of multimedia

- Data representation
- Data processing
- Data compression
- Data transmission
- Mobiles games
- Data security
- Human computer interaction

1.1.2 Hypermedia and Multimedia

• A **hypertext system**: meant to be read nonlinearly, by following links that point to other parts of the document, or to other documents

• **HyperMedia:** not constrained to be text-based, can include other media, e.g., graphics, images, and especially the continuous media – sound and video. - The World Wide Web (WWW) — the best example of a hypermedia application.

Multimedia means that computer information can be represented through audio, graphics, images, video, and animation in addition to traditional media.

1.1.3 Linear VS Non-Linear

A Multimedia Project is identified as Linear when:

- It is not interactive
- User have no control over the content that is being showed to them.

Example:

- A movie
- A non-interactive lecture / demo show

A Multimedia Project is identified as Non-Linear when:

- It is interactive
- Users have control over the content that is being showed to them.
- Users are given navigational control

Example:

- Games
- Interactive CD

1.2 MULTIMEDIA APPLICATION:

Multimedia applications can be subdivided into different categories:

- **Information Systems:** The major purpose of such systems is to provide information for one or several users. The requested information is typically stored in the databases

or media archives. Examples are electronic publishing, online galleries or weather information systems.

- **Remote Representation:** By means of a remote representation system a user can take part in or monitor events at a remote location. Important examples are the distance conferencing or lecturing virtual reality or remote robotic agents.
- **Entertainment:** This major application area of multimedia technology is strongly oriented towards the audio and video data. Example entertainment applications are digital television, video on demand, distributed games or interactive television.
- **Multimedia in Marketing and Advertising**- By using multimedia marketing of new products can be greatly enhanced. Multimedia boost communication on an affordable cost opened the way for the marketing and advertising personnel.
- **Multimedia in Hospital**- Multimedia best use in hospitals is for real time monitoring of conditions of patients in critical illness or accident. The conditions are displayed continuously on a computer screen and can alert the doctor/nurse on duty if any changes are observed on the screen.

1.3 GLOBAL STRUCTURE OF MULTIMEDIA

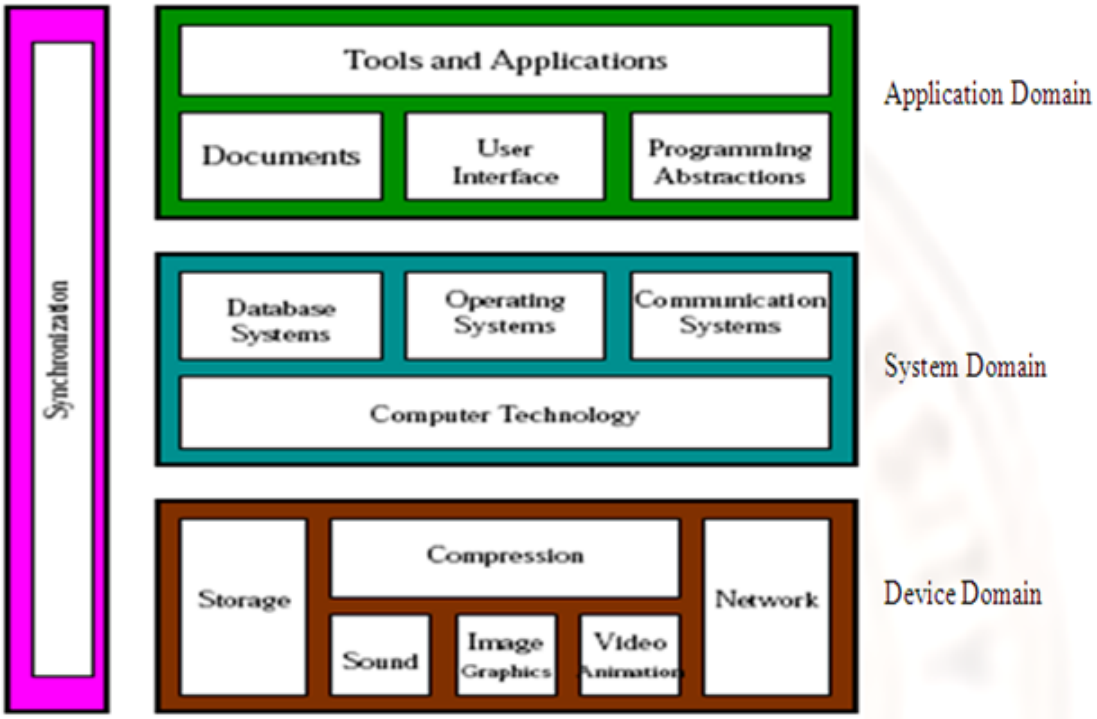


Figure: Global Structure

- **Device domain**:
  It deals with interaction between multimedia application and multimedia devices such as Accelerated Graphics Port (AGP) Card, Sound Card etc. Basic concepts for the processing of digital audio and video data are based on digital signal processing. Different methods for the processing of image, graphics and animation are described. The audio techniques section includes music, Musical Instrument Digital Interface (MIDI) and speech processing.

- **System Domain:**
  The interface between the device domain and the system domain is specified by the computer technology. To utilize the device domain, several system services are needed. Basically, three services exit. These services are mostly implemented in software. The operating system, serves as an interface between computer hardware/system and all other software components. It provides the user with a programming and computational environment, which should be easy to operate. The database system allows a structured access to data and a management of large databases. The communication system is responsible for data transmission according to the timing and reliability requirements of the networked multimedia.
- **Application domain:**
  Provides functions to the user to develop and present multimedia projects. This includes software tools, and multimedia projects development methodology. The services of the system domain are offered to the application domain through proper programming abstractions. Another topic embedded in the application domain is document handling.
- **Cross domain:**
  It turns out that, some aspects such as synchronization aspects, are difficult to locate in one or two components or domains. The reason is that synchronization, being the temporal relationship among various media, relates to many components across all domains.

1.4 MEDIUM, MULTIMEDIA SYSTEM AND PROPERTIES

Multimedia system is defined by computer controlled, integrated production, manipulation, presentation, storage and communication of independent information, which is encoded at least through a continuous and discrete media.

Media are divided into two types in respect to time in their representation space:

Time independent (discrete) Information is expressed only in its individual value, without a time component. E.g.: text, image, graphics, etc.

Time dependent (continuous) Information is expressed not only it's individual value, but also by the time of its occurrences. E.g.: sound and video.

Classification of Media

Medium is defined as means for distribution and presentation of information. Examples of a medium are text, graphics, speech, and music. Media can be classified with respect to different criteria. We classify media according to perception, representation, presentation, storage, transmission, and information exchange.

It can be categorized as following sections:

- The perception media
- The representation Media
- The presentation Media
- The storage media
- The transmission media
- The information Exchange media

1. **Perception Medium:** Perception media help human to sense their environment. The central question is how human perceive information in a computer environment. The answer is through seeing and hearing.
   Seeing: For the perception of information through seeing the usual such as text, image and video are used
   Hearing: For the perception of information through hearing media such as music, noise and speech are used.
2. **Representation medium:** Representation media are defined by internal computer representation of information. The central question is how the computer information is coded? The answer is that various format is used to represent media information in computer.
3. **Presentation medium:** Presentation media refer to the tools and devices for the input and output of the information. The central question is, through which the information is delivered by the computer and is introduced to the computer.
4. **Storage medium:** Storage Media refer to the data carrier which enables storage of information. The central question is, how will information be stored? The answer is hard disk, CD-ROM, Floppy, Micro- film, printed documents, digital storage etc.
5. **Transmission medium:** Transmission Media are the different information carrier that enables continuous data transmission. The central question is, over which information will be transmitted? Information is transmitted over network either by using wired or wireless connection. Wired connection can be twisted pair, coaxial cable, optical fiber cable etc. Wireless connection can be satellite connection or radio link connections etc.
6. **Information exchange medium:** Information exchange media includes all information carrier for transmission, i.e. all storage and transmission media.

A Multimedia system has four basic properties:

1. Multimedia systems must be **computer controlled**.
2. Multimedia systems are **integrated**.
3. The information they handle must be **represented digitally**.
4. The interface to the final presentation of media is usually **interactive**.

1.5 CHALLENGES FOR MULTIMEDIA SYSTEMS

Some of the challenges for multimedia system are:

- Continuous media types such as video need a lot of space to store and very high bandwidth to transmit.
- They also have tight timing constraints.
- Automatically analysing, indexing and organizing information in audio, image and video is much harder than from text.
- Multimedia involves many different research areas and needs more complex and more efficient algorithms and hardware platforms.
- Distributed Network
- Temporal relationship between data

    - Render different data at same time- continuous data
    - Sequencing within the media
    - Synchronisation – inter medium scheduling
- Data representation – digitally- analog – digital conversion, sampling etc.
- Large data requirements- bandwidth, storage, compression.

1.6 COMPONENTS OF A MULTIMEDIA SYSTEM

Following are the common components of multimedia:

- **Text**- All multimedia productions contain some amount of text. The text can have various types of fonts and sizes to suit the profession presentation of the multimedia software.
    - **Hypermedia:** Hypermedia, the term derived from hypertext, extends the notion of the hypertext link to include the links among any set of multimedia objects, including the sound, motion video, and virtual reality. It may also suggest a higher level of user/network interactivity than the interactivity already implicit in the hypertext. The World Wide Web (www) is a classic example of hypermedia.

- **Graphics**- 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. There are two types of Graphics:
    - **Bitmap images**- Bitmap images are real images that can be captured from devices such as digital cameras or scanners. Generally, bitmap images are not editable. Bitmap images require a large amount of memory.
    - **Vector Graphics**- Vector graphics are drawn on the computer and only require a small amount of memory. These graphics are editable.

- **Audio**- A multimedia application may require the use of speech, music and sound effects. These are called audio or sound element of multimedia. Speech is also a perfect way for teaching. Audio are of analog and digital types. Analog audio or sound refers to the original sound signal. Computer stores the sound in digital form. Therefore, the sound used in multimedia application is digital audio.

- **Video**- The term video refers to the moving picture, accompanied by sound such as a picture in television. Video element of multimedia application gives a lot of information in small duration of time. 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.

- **Animation**- Animation is a process of making a static image look like it is moving. An animation is just a continuous series of still images that are displayed in a sequence. The animation can be used effectively for attracting attention. Animation also makes a presentation light and attractive. Animation is very popular in multimedia application.

References:

- Multimedia: Computing, Communications and Applications", Ralf Steinmetz and Klara Nahrstedt, Pearson Education Asia

- “Multimedia Communications, Applications, Networks, protocols ad Standards”, Fred Halsall, Pearson Education Asia
- “Multimedia Systems”, John F. Koegel Buford, Pearson Education Asia

Assignments:

1. Describe the data stream characteristics for continuous media.
2. Define Multimedia and explain how media can be classified.
3. Define Multimedia. Explain the characteristics of multimedia.
4. What do you mean by medium? Define different types of medium.
5. What is multimedia? With suitable example, discuss the definition and properties of a multimedia system.

A Gentle Advice: *Please go through your text books and reference books for detail study!!! Thank you all.*