# Chapter 1 -Introduction

## Multimedia and Multimedia System Overview

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 discrete (time-independent) medium. A multimedia system is any system which supports more than a single kind of media.

Multimedia is the integration among more than one media such that there should be at least two media: Continuous and Discrete with proper synchronization.

Multimedia is defined as the computer based interactive environment that incorporates text, images, graphics, sound, audio, animation, video and virtual reality. Fundamental feature of multimedia is interactivity. Text, pictures, animation, movies and sound -all these varied media are seamlessly blended, resulting in simple slide shows to dazzling, interactive presentations. Fundamental feature of multimedia is interactivity. Interactivity is the ability of the user to interact with an application. Examples include keyboard and mouse input, mouse rollovers, voice activation, and touch screen.

Main Properties of Multimedia System

The uses of term multimedia are not every arbitrary combination of media. The main properties of multimedia system are:

## Combination of media:

A simple text processing program with in corporate image is often called a multimedia application because two media are processed through one program. But one should talk multimedia only when both continuous and discrete media are utilized. So text processing program with incorporated images is not a multimedia application.

## Computer support integration:

Computer is idle tools for media combinations. The system should be capable of computer-controlled media processing. The system should be programmable by a system programmer or even a user.

## Communication systems:

Communication-capable multimedia systems must be approached. A reason for this is that most of today's computers are interconnected; considering multimedia functions from only the local processing viewpoint would be a restriction, if not a step back.

## Independence:

An important aspect of different media is their level of independence from each other. In general there is a request for independence of different media but multimedia may requires several level of independence. E.g. A computer controlled video recorder stores audio and video information's. There is inherently tight connection between two types of media. Both media are coupled together through common storage medium of tape. On the other hand for the purpose of presentation the combination of DAT (digital audio tape recorder) signals and computer available text satisfies the request for media independence.

## Multimedia Applications:

- ⌉ Advertisement , Education
- ⌉ Communication, Business
- ⌉ Entertainment

## Multimedia Tools:

- ｜Text Editing Tools
- ｜Drawing and Painting Tools
- ｜Image Editing Tools
- ｜Audio Editing Tools
- ｜Video Editing Tools
- ｜Animation and 3D Modeling Tools
- ｜OCR Tools
- ｜Voice Recognition Tools

## Usages of Multimedia Application:

- ｜Education
- ｜Training
- ｜Entertainment
- ｜Advertisement
- ｜Presentation
- ｜Business Communication
- ｜Web page Design

# Global structure of Multimedia System

Figure: Main topics in multimedia system with chapter number

- • Device domain
- • System domain
- • Application domain
- • Cross domain

## Device domain:

It deals with interaction between multimedia application and multimedia devices such as 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 (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 exits. 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.

# Representation Dimensions

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

## 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.

## 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 are used to represent media information in computer.

- ⌉ Text, character is coded in ASCII code
- ⌉ Graphics are coded according to CEPT or CAPTAIN video text standard.
- ⌉ Image can be coded as JPEG format
- ⌉ Audio video sequence can be coded in different TV standard format (PAL, NTSC, SECAM and stored in the computer in MPEG format)

## 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.

- ⌉ Output media: Paper, screen and speaker are the output media.
- ⌉ Input Media: Keyboard, mouse, camera, microphone are the input media.
- ⌉ Digital Media: Soft copy presentation.
- ⌉ Paper Media: Hard copy presentation.

## 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, Microfilm, printed documents, digital storage etc.

## 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.

## Information exchange medium:

Information exchange media includes all information carrier for transmission, i.e. all storage and transmission media. The central question is, which information carrier will be used for information exchange between different places? The answer is combine uses of storage and transmission media. E.g. Electronic mailing system

Information can flow through intermediate storage media, where the storage medium is transported outside of computer networks to the destination, through direct transmission using computer networks, or through combined usage of storage and transmission media.

# Traditional data streams characteristics:

In multimedia communication system data of discrete and continuous media are transmitted and information access takes place. This transmitted information is divided into small individual unit known as packets. A sequence of individual packets transmitted in a time dependent fashion is called a data stream. The data stream will be used as a synonym data flow.

Transmission of information carrying different media leads to data stream with very different features. The attributes of synchronous, asynchronous and isochronous data transmission conforms the field of computer communication and switching. Transmission of the data packets takes place in any of the following transmission modes:

## Asynchronous Transmission mode:

- ⌉ The asynchronous transmission mode provides for communication with no timely restriction.
- ⌉ Packets reach the receivers as fast as possible.
- ⌉ All information of discrete media can be transmitted as asynchronous data stream.
- ⌉ If an asynchronous mode is chosen for transmission of continuous media, additional technique most be applied to provide the time restriction.
- ⌉ E.g.: Ethernet, protocol of worldwide internet for e-mail transmission.
- ⌉ No time bound (E.g. postal service)
- ⌉ E.g. mail system.

## Synchronous Transmission mode:

- ⏋ The synchronous transmission mode defines the maximum end to end delay for each packet of the data stream.
- ⏋ This upper bound will never be violated. (E.g. Ping operation)
- ⏋ Moreover, a packet can reach the receiver at any arbitrary earlier time.
- ⏋ So most of the time the receiver has to hold the packet temporarily
- ⏋ A packet has a start frame and the end frame.
- ⏋ Start frame is used to tell the receiving station that a new packet of characters is arriving and used to synchronize the receiving station's internal clock.
- ⏋ The end frame is used to indicate the end of packet.

## Isochronous Transmission mode:

- ⏋ Isochronous transmission Mode defines maximum end to end delay as well as minimum end to end delay.
- ⏋ This means the delay jitter for individual packet is bounded.
- ⏋ Isochronous transmission mode minimizes the overhead of the receiver.
- ⏋ Upper time bound + lower time bound (E.g. TV systems)
- ⏋ Data will reach destination in between these upper and lower bound time.
- ⏋ Less storage buffer at receiver is needed than the synchronous transmission mode.

# Data stream characteristics for continuous media

Characteristics for continuous media can be classified according to: Time interval between a complete transmission of consecutive packets (a)Periodic (b)Weakly periodic (c)Aperiodic

## Variation in amount of consecutive packet amount

(a)Regular (b)Weakly regular (c)Irregular Contiguous packets (a)Continuous (b)Discrete

## Time interval based characteristics:

**(1) Strongly periodic data stream transmission:**

Time interval between two consecutive packets is constant. E.g. PCM-coded speech used in traditional telephone switching systems. It is also called strongly periodic.

**(2) Weakly periodic data stream transmission:**

Time interval between the consecutive packets is of periodic nature. Duration of time interval between two consecutive packets can be described by using a periodic function with finite period. But, time interval between two consecutive packets is not constant.

**(3) Aperiodic data stream transmission:**

Sequence of the time interval between packets is neither strongly nor weakly periodic. e.g. Cooperative application with shared Window.

## Packet Amount based characteristics:

**Strongly regular data stream:**

Data size of all the packets is constant. Amount of the data stays constant during the life time of a data stream. E.g. Uncompressed digital data transmission, video stream taken from a camera in Uncompressed form, and the audio stream from an audio CD.

**Weakly regular data stream:**

Data size of the packets changes periodically (with time). E.g. compressed video stream

**Irregular data stream:**

Data size of the packets is neither constant nor changing periodically according to a periodic function. Transmission and processing is more complicated.

## Contiguous packets based characteristics:

It characterizes continuity, or connection between consecutive packets. Is consecutive packets transmitted directly one after another, or is there a gap between the packets.

Continuous data stream: D1 D2 D3 D4 …….. Dn

t

Packets are transmitted without intermediate gaps. Also called connected information transfer. It allows maximum data throughput. E.g. B-channel of ISDN with 64 Kb audio data transmission

Gap exists among the packets. Also called unconnected data stream. Duration of the gap may vary.

# Information Units

Continuous media consists of a time dependent sequence of individual information units. Such an information unit is called a LDU (logical data unit). With respect to time there can be Closed LDU and Open LDU.

## Closed LDU

- ⎤ Predefined duration is present.
- ⎤ E.g. data stream characteristics of audio samples in the computer.

## Open LDU

- ⎤ Duration is not known in advance.
- ⎤ E.g. Data stream sent from camera/ microphone to computer.

The most general names and best-known information units are the symphony and the movie. LDU is the whole symphony, individual sentences, individual notes, grouped samples of 1/75 second duration or just individual samples.

An example is an uncompressed video sequence consisting of individual video clips which presents a specific scene. Such a scene is comprised of a sequence of image. An image can be divided into group of pixels. Each pixel consist luminance and chrominance values. The image is therefore not the only possible LDU of a video sequence. A scene or a pixel also can be an LDU.

# 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.