Chapter 1

Multimedia

1.1 Introduction

Multi - many; much; multiple

Medium - a substance regarded as the means of transmission of a force or effect; a channel or system of communication, information, or entertainment

Medium

- *Means for distribution and presentation of information*
- *Classification based on perception (text, audio, video) is appropriate for defining multimedia*

Multimedia is a combination of text, graphics, sound, animation, and video that is delivered interactively to the user by electronic or digitally manipulated means.

Text:

- A broad term for something that contains words to express something.
- Text is the most basic element of multimedia.
- A good choice of words could help convey the intended message to the users (keywords).

Graphics:

- Two-dimensional figure or illustration.
- Could be produced manually (by drawing, painting, carving, etc.) or by computer graphics technology.
- Used in multimedia to show more clearly what a particular information is all about (diagrams, picture).

Audio:

- Produced by vibration, as perceived by the sense of hearing.
- In multimedia, audio could come in the form of speech, sound effects and also music score.

Animation:

- The illusion of motion created by the consecutive display of images of static elements.
- In multimedia, animation is used to further enhance/enriched the experience of the user to further understand the information conveyed to them.

Video:

- Is the technology of capturing, recording, processing, transmitting, and reconstructing moving pictures?
- Video is more towards photo realistic image sequence/live recording as in comparison to animation.
- Video also takes a lot of storage space. So, plan carefully before you are going to use it.

Multimedia is the media that uses multiple forms of information content and information processing (e.g. text, audio, graphics, animation, and video interactivity) to inform or entertain the user. *Multimedia* also refers to the use of electronic media to store and experience multimedia content. Multimedia is similar to traditional mixed media in fine art, but with a broader scope. The term "rich media" is synonymous for interactive multimedia.

Medium: An intervening substance through which something is transmitted or carried on.

Computer System Medium:

1. Text
2. Image
3. Sound
4. Video

Representation Dimension of media:

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

1. *Time independent (discrete):* Information is expressed only in its individual value. E.g. : text, image etc.

2. *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.

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.

Multimedia Building Blocks:

Any multimedia application consists any or all of the following components:

1. Text:

Text and symbols are very important for communication in any medium. With the recent explosion of the Internet and World Wide Web, text has become more the important than ever. Web is HTML (Hypertext Markup language) originally designed to display simple text documents on computer screens, with occasional graphic images thrown in as illustrations.

2. Audio:

Sound is perhaps the most element of multimedia. It can provide the listening pleasure of music, the startling accent of special effects or the ambience of a mood-setting background.

3. Images:

Images whether represented analog or digital plays a vital role in a multimedia. It is expressed in the form of still picture, painting or a photograph taken through a digital camera.

4. Animation:

Animation is the rapid display of a sequence of images of 2-D artwork or model positions in order to create an illusion of movement. It is an optical illusion of motion due to the phenomenon of persistence of vision, and can be created and demonstrated in a number of ways.

5. Video:

Digital video has supplanted analog video as the method of choice for making video for multimedia use. Video in multimedia is used to portray real time moving pictures in a multimedia project

Digital Representation:

Multimedia regards content and technologies dealing with a combination of different content forms/modalities, e.g. speech, audio, text, video, images, 3D models, etc.

Analog Signal:

An analog signal is any variable signal, continuous in both time and amplitude.

Digitization:

Digitization is the process of expressing analog data in digital form.

Analog data implies 'continuity' while digital data is concerned with discrete states, e.g. symbols, digits.

Interactive Multimedia:

When the user is given the option of controlling the elements.

Hyper Media:

A combination of hypertext, graphics, audio, video, (linked elements) and interactivity culminating in a complete non-linear computer-based experience.

Linear Vs Non-Linear:

Linear:

A multimedia project is defined as linear when:

- It is not interactive
- Users have no control over the content that is being showed to them.
- Example: A movie, A non-interactive lecture/demo show

Non-Linear:

A multimedia project is defined 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

1.2 The Media Aspect

Perception Media:

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 Media:

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 formats are used to represent media information in a computer.

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

Presentation Media:

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?* The answer is:

Output media:

Paper, screen and speaker are the output media.

Input media:

Keyboard, mouse, camera, microphone are the input media.

Storage Media:

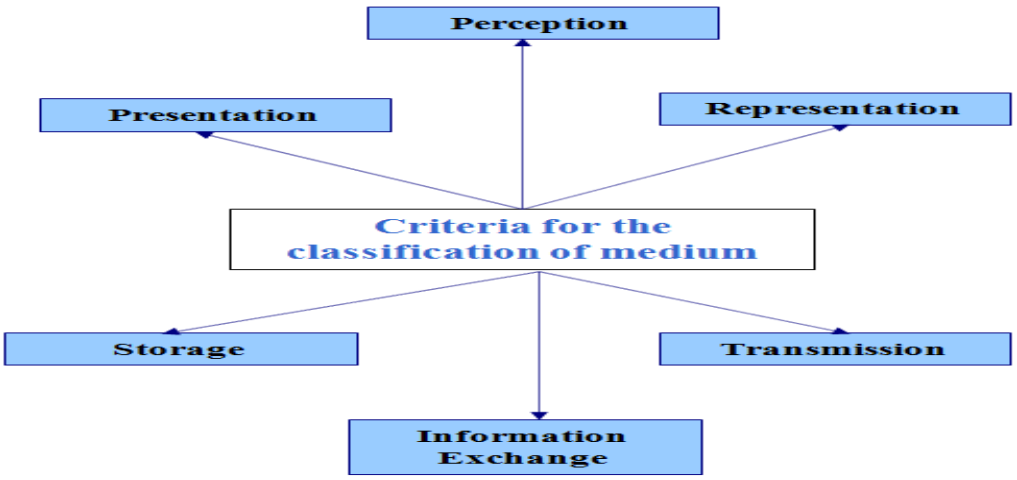
Storage media refer to the data carrier which enables storage of information. The central question is: *How will information be stored?* The answer is hard disk, CD-ROM, etc.

Transmission Media:

Transmission media are the different information carrier that enables continuous data transmission. The central question is: *Over what will the information be transmitted?* The answer is co-axial cable and fiber optics, as well as free air space transmission, which is used for wireless traffic.

Information Exchange Media:

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 combined uses of storage and transmission media. For example: Electronic Mailing System.



1.3 Main Properties of Multimedia

- **Combination of media:**
  - *Continuous and discrete.*

    A simple text processing program with incorporated images is often called a multimedia application because two media are processed through one

program. But one should talk about multimedia only when both continuous and discrete media are utilized.

- **Levels of media-independence:**
  - *Some media types (audio/video) may be tightly coupled, others may not.*

    In general, there is a request for independence of different media, but multimedia may require several levels of independence. On the one hand, a computer-controlled video recorder stores audio and video information, but there is an inherently tight connection the two types of media.
- **Computer supported integration:**
  - *Timing, spatial and semantic synchronization*

    A text processing program that supports text, table calculations and video clips does not satisfy the demand for integration if program supporting the connection between the data cannot be established. A high integration level is accomplished if changing the content of a table row causes corresponding video scene and text changes.

    Everything can be presented with video and sound that is presented with text and graphics today.
- **Communication capability:**

  Communication-capable multimedia systems must be approached. Multimedia information cannot only be created, processed, presented and stored, but also distributed above the single computer's boundary.

1.4 Media Concepts

Each medium defines:

Representation values

Representation space

Representation dimensions

Representation values - determine the information representation of different media

- Continuous representation values (e.g. electro-magnetic waves)

- Discrete representation values(e.g. text characters in digital form)

Representation space determines the surrounding where the media are presented.

- Visual representation space (e.g. paper, screen)
- Acoustic representation space (e.g. stereo)

Representation dimensions of a representation space are:

Spatial dimensions

Temporal dimensions

Spatial dimensions:

- two dimensional (2D graphics)
- three dimensional (holography)

Temporal dimensions:

Time independent (document) - Discrete media

Information consists of a sequence of individual elements without a time component.

Time dependent (movie) - Continuous media

Information is expressed not only by its individual value but also by its time of occurrence.

1.5 Traditional Data Stream Characteristics

Distributed multimedia communication systems data of discrete and continuous media are broken into individual units (packets) and transmitted.

Data Stream

Sequence of individual packets that are transmitted in a time-dependent fashion.

Transmission of information carrying different media leads to data streams with varying features:

Asynchronous: -

Synchronous: -

Isochronous: -

Data Stream Characteristics

Asynchronous transmission mode: -

Provides for communication with no time restriction

Packets reach receiver as quickly as possible, e.g. protocols for email transmission

Synchronous transmission mode: -

Defines a maximum end-to-end delay for each packet of a data stream.

May require intermediate storage

E.g. audio connection established over a network.

Isochronous transmission mode: -

Defines a maximum and a minimum end-to-end delay for each packet of a data stream. Delay jitter of individual packets is bounded. E.g. transmission of video over a network.

Intermediate storage requirements reduced.

The Time Intervals Between a Complete Transmission of Consecutive Packets:

Strongly periodic data streams - constant time interval

Weakly periodic data streams - periodic function with finite period.

Aperiodic data streams - all other possibilities of transmission with respect to time interval.

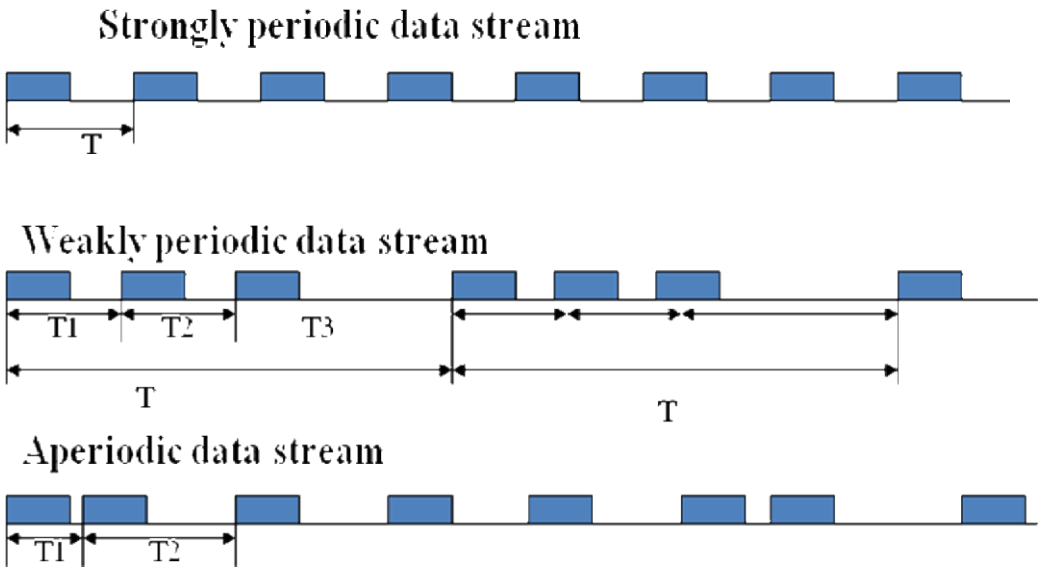


Figure: Classification based on time intervals

Data size - number of consecutive packets:

Strongly regular data streams - constant amount of data

Weakly regular data streams - varies periodically with time

Irregular data streams – the amount of data is neither constant nor changes according to a periodic function.

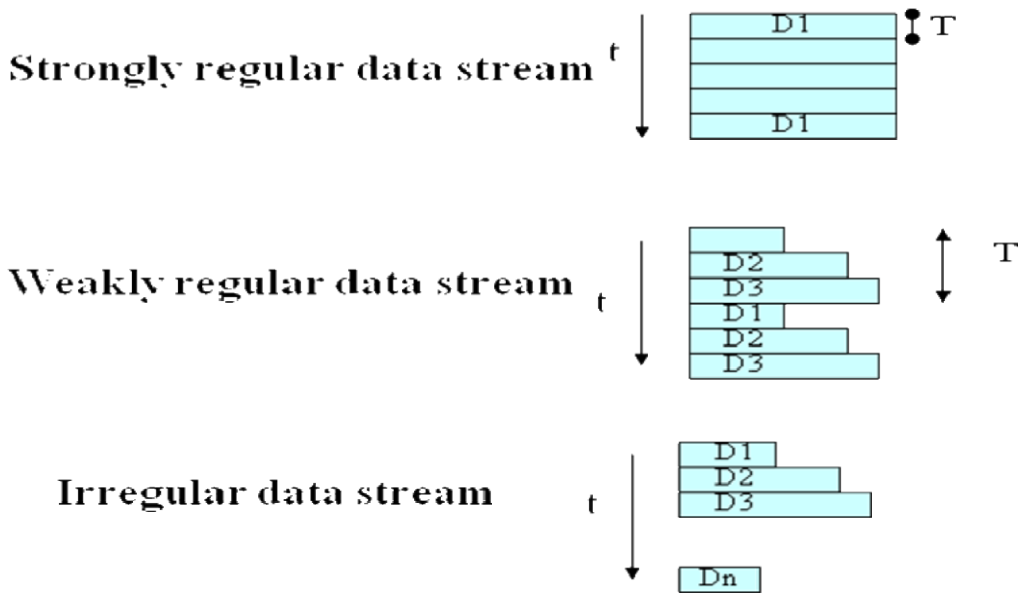


Figure: Classification based on packet size

Continuity (Contiguous Packets):

Continuous data streams – the packets are transmitted without intermediate gaps.

Discrete data streams – gaps exist among the packets.

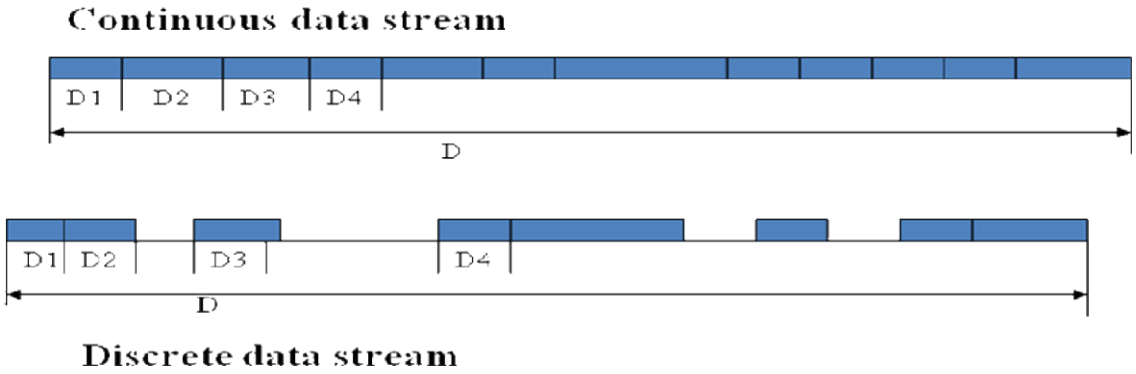


Figure: Classification based on continuity

1.6 Information Units

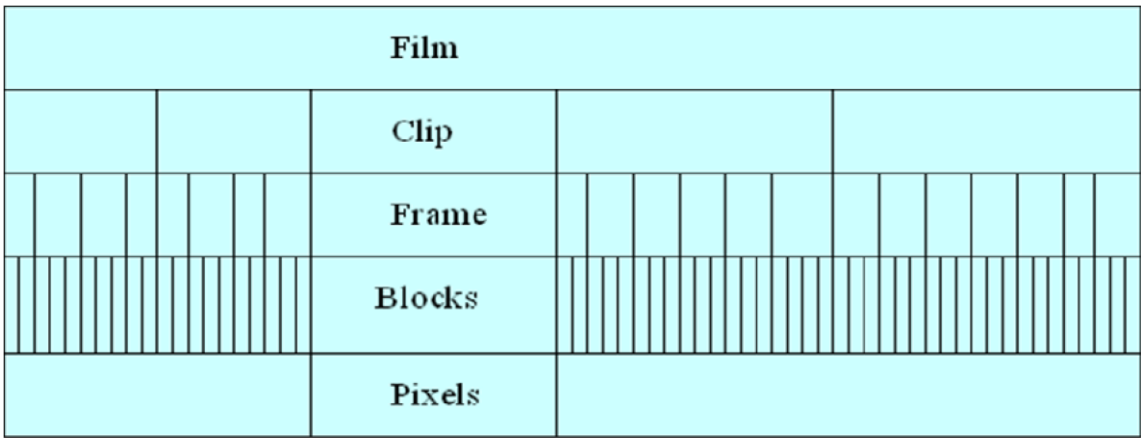
Continuous media consist of a time-dependent sequence of individual information units called Logical Data Units (LDU). A symphony consists of independent sentences a sentence consists of notes are sequences of samples

Granularity of LDUs symphony, sentence, individual notes, grouped samples, individual samples film, clip, frame, raster, pixel *Duration of LDU:*

Open LDU - duration not known in advance

Closed LDU - predefined duration

Granularity of Logical Data Units



Applications of Multimedia

Multimedia finds its application in various areas including, but not limited to, advertisements, art, education, entertainment, engineering, medicine, mathematics, business, scientific research and spatial, temporal applications.

A few application areas of multimedia are listed below:

Creative industries

Creative industries use multimedia for a variety of purposes ranging from fine arts, to entertainment, to commercial art, to journalism, to media and software services provided for any of the industries listed below. An individual multimedia designer may cover the

spectrum throughout their career. Request for their skills range from technical, too analytical and too creative.

Commercial

Much of the electronic old and new media utilized by commercial artists is multimedia. Exciting presentations are used to grab and keep attention in advertising. Industrial, business to business, and interoffice communications are often developed by creative services firms for advanced multimedia presentations beyond simple slide shows to sell ideas or liven-up training. Commercial multimedia developers may be hired to design for governmental services and nonprofit services applications as well.

Entertainment and Fine Arts

In addition, multimedia is heavily used in the entertainment industry, especially to develop special effects in movies and animations. Multimedia games are a popular pastime and are software programs available either as CD-ROMs or online. Some video games also use multimedia features.

Multimedia applications that allow users to actively participate instead of just sitting by as passive recipients of information are called *Interactive Multimedia*.

Education

In Education, multimedia is used to produce computer-based training courses (popularly called CBTs) and reference books like encyclopedia and almanacs (directory). A CBT lets the user go through a series of presentations, text about a particular topic, and associated illustrations in various information formats.

Edutainment is an informal term used to describe combining education with entertainment, especially multimedia entertainment.

Engineering

Software engineers may use multimedia in Computer Simulations for anything from entertainment to training such as military or industrial training.

Multimedia for software interfaces is often done as collaboration between creative professionals and software engineers.

Industry

In the Industrial sector, multimedia is used as a way to help present information to shareholders, superiors and coworkers. Multimedia is also helpful for providing employee training, advertising and selling products all over the world via virtually unlimited web-based technologies.

Mathematical and Scientific Research

In Mathematical and Scientific Research, multimedia is mainly used for modeling and simulation. For example, a scientist can look at a molecular model of a particular substance and manipulate it to arrive at a new substance.

Representative research can be found in journals such as the Journal of Multimedia.

Medicine

In Medicine, doctors can get trained by looking at a virtual surgery or they can simulate how the human body is affected by diseases spread by viruses and bacteria and then develop techniques to prevent it.

Multimedia in Public Places

In hotels, railway stations, shopping malls, museums, and grocery stores, multimedia will become available at stand-alone terminals or kiosks to provide information and help. Such installation reduce demand on traditional information booths and personnel, add value, and they can work around the clock, even in the middle of the night, when live help is off duty.

A menu screen from a supermarket kiosk that provide services ranging from meal planning to coupons. Hotel kiosk list nearby restaurant, maps of the city, airline schedules, and provide guest services such as automated checkout.

Printers are often attached so users can walk away with a printed copy of the information.

Museum kiosk are not only used to guide patrons through the exhibits, but when installed at each exhibit, provide great added depth, allowing visitors to browser though richly detailed information specific to that display.