KARATINA UNIVERSITY

COM 429

MULTIMEDIA SYSTEMS

1. WHAT IS MULTIMEDIA?

Multimedia means that computer information can be represented through audio, video, and animation in addition to traditional media (i.e., text, graphics drawings, images).

Multimedia is the field concerned with the computer-controlled integration of text, graphics, drawings, still and moving images (Video), animation, audio, and any other media where every type of information can be represented, stored, transmitted and processed digitally.

A *Multimedia Application* is an Application which uses a collection of multiple media sources e.g. text, graphics, images, sound/audio, animation and/or 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.

Classification of Media:
1. The perception media
2. The representation Media
3. The Presentation Media
4. The storage media
5. The transmission media
6. The information Exchange media

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 format are used to represent media information in 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.
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 which information will be transmitted? The answer is co-axial cable, fiber optics as well as free air.

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 combine uses of storage and transmission media. E.g. Electronic mailing system.

Multimedia Systems

A *Multimedia System* is a system capable of processing multimedia data and applications.

A *Multimedia System* is characterised by the processing, storage, generation, manipulation and rendition of Multimedia information.

Multimedia systems have to deal with the
• Generation of data,
• Manipulation of data,
• Storage of data,
• Presentation of data, and
• Communication of information/data

Characteristics of a Multimedia System

A Multimedia system has the following basic characteristics:

- Multimedia systems must be *computer controlled*.
- Multimedia systems are *integrated*.
- The information they handle must be represented *digitally*.

Challenges for Multimedia Systems

Supporting multimedia applications over a computer network renders the application *distributed*. This will involve many special computing techniques and resources.

Multimedia systems may have to render a variety of media at the same instant -- a distinction from normal applications. There is a temporal relationship between many forms of media (*e.g.* Video and Audio. There 2 are forms of problems here

- Sequencing within the media -- *playing frames in correct order/time frame in video*
- *Synchronization* -- inter-media scheduling (*e.g.* Video and Audio). Lip synchronization is clearly important for humans to watch playback of video and audio and even animation and audio. Ever tried watching an out of (lip) sync film for a long time?

The key issues multimedia systems need to deal with here are:

- How to represent and store temporal information?
- How to strictly maintain the temporal relationships on play back/retrieval?
- What process are involved in the above?

Data has to represented *digitally* so many initial source of data needs to be *digitized*-- translated from analog source to digital representation. The will involve scanning (graphics, still images), sampling (audio/video) although digital cameras now exist for direct scene to digital capture of images and video.

The data is *large* several Mb easily for audio and video - therefore storage, transfer (bandwidth) and processing overheads are high. Data compression techniques very common.

Desirable Features for a Multimedia System

Given the above challenges the following feature a desirable (if not a prerequisite) for a Multimedia System:

Very High Processing Power

> -- needed to deal with large data processing and real time delivery of media. Special hardware common place.

Multimedia Capable File System

> -- needed to deliver real-time media -- *e.g.* Video/Audio Streaming. Special Hardware/Software needed *e.g* RAID(redundant array of independent disks) technology.

Data Representations/File Formats that support multimedia

-- Data representations/file formats should be easy to handle yet allow for compression/decompression in real-time.

Efficient and High I/O

-- input and output to the file subsystem needs to be efficient and fast. Needs to allow for real-time recording as well as playback of data. *e.g.* Direct to Disk recording systems.

Special Operating System

-- to allow access to file system and process data efficiently and quickly. Needs to support direct transfers to disk, real-time scheduling, fast interrupt processing, I/O streaming *etc.*

Storage and Memory

-- large storage units (of the order of 50 -100 Gb or more) and large memory (50 -100 Mb or more). Large Caches also required and frequently of Level 2 and 3 hierarchy for efficient management.

Network Support

-- Client-server systems common as distributed systems common.

Software Tools

-- user friendly tools needed to handle media, design and develop applications, deliver media.

Traditional data streams characteristics:
A sequence of individual packets transmitted in time dependent fashion is called 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 conform the field of computer communication and switching.

   i.   **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.

   ii.   **Synchronous Transmission mode:**
   The synchronous define the maximum end to end delay for each packet of the data stream. This upper bound will never be violated. 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 use d to synchronize the receiving station's internal clock. The end frame is used to indicate the end of packet.

iii.   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. Storage of packet at receiver is reduced.

Properties of Multimedia System:
The uses of term multimedia are not every arbitrary combination of media. Justify.
1. **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.

2. **Computer support integrated->** computer is idle tools for multimedia application

3. **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.
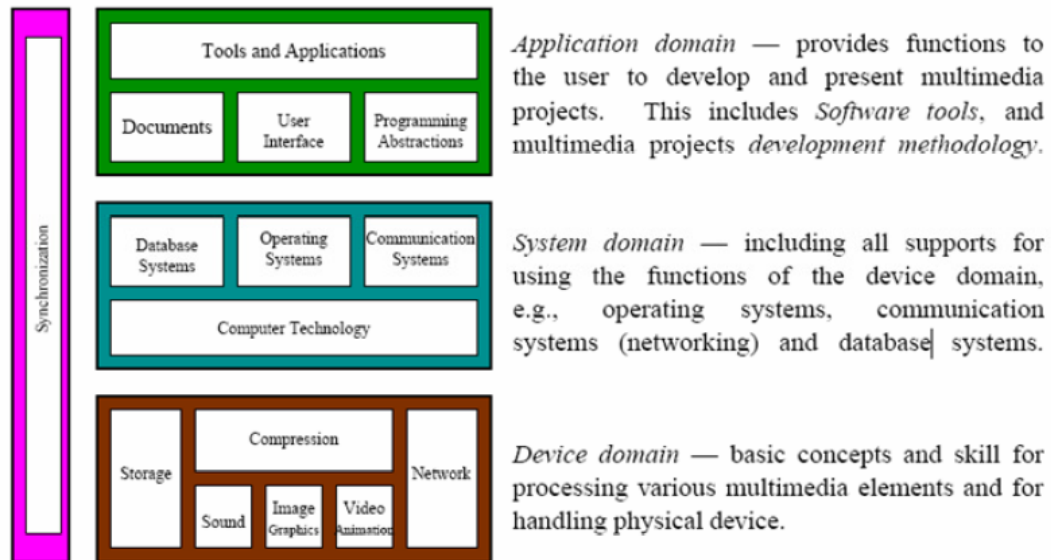
Global structure of Multimedia System:
1. Application domain
2. System domain
3. Device domain

Application domain: provides functions to the user to develop and present multimedia projects. This includes software tools, and multimedia projects development methodology.

System Domain: including all supports for using the function of the device domain, e.g. operating system, communication systems (networking) and database systems.

Device domain: basic concepts and skill for processing various multimedia elements and for handling physical device.

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Applications of Multimedia Systems

Examples of Multimedia Applications include:

- World Wide Web
- Hypermedia courseware
- Video conferencing
- Video-on-demand
- Interactive TV
- Groupware
- Home shopping
- Games
- Virtual reality
- Digital video editing and production systems
- Multimedia Database systems

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:

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.

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 encyclopaedia and almanacs. 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 are 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.

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.