

Multimedia Computing

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Aims of Module

To give students a broad grounding in issue surrounding multimedia, including the role of and design of multimedia Systems which incorporate digital audio, graphics and video, underlying concepts and representations of sound, pictures and video, data compression and transmission, integration of media, multimedia authoring, and delivery of multimedia.

Objectives of Module

Students should be able to:

- Understand the relevance and underlying infrastructure of the multimedia systems.
- Understand core multimedia technologies and standards (Digital Audio, Graphics, Video, VR, data transmission/compression)
- Be aware of factors involved in multimedia systems performance, integration and evaluation

Syllabus Outline

Topics in the module include the following:

1. Introduction: Multimedia applications and requirements (e.g., overview of multimedia systems, video-on-demand, interactive television, video conferencing, hypermedia courseware, groupware, World Wide Web, and digital libraries).

2. Audio/Video fundamentals including analog and digital representations, human perception, and audio/video equipment, applications.
 3. Audio and video compression including perceptual transform coders for images/video (e.g., JPEG, MPEG, H.263, etc.), scalable coders (e.g., pyramid coders), and perceptual audio encoders. Application and performance comparison of various coding algorithms including hardware/software trade-offs. Image and video processing applications and algorithms.
 4. Multimedia Programming Frameworks
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What is Multimedia?

Multimedia can have a many definitions these include:

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

A good general definition is:

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.

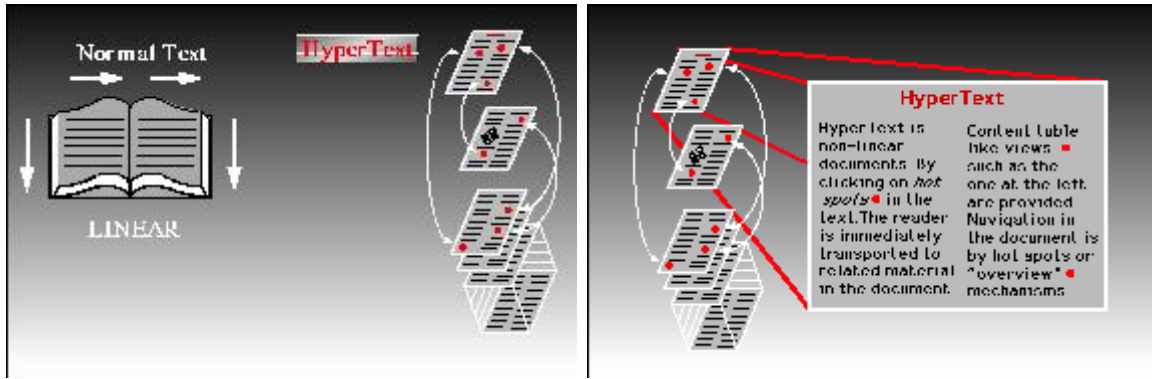
A ***Multimedia Application*** is an Application which uses a collection of multiple media sources e.g. text, graphics, images, sound/audio, animation and/or video.

Hypermedia can be considered as one of the multimedia applications.

What is HyperText and HyperMedia?

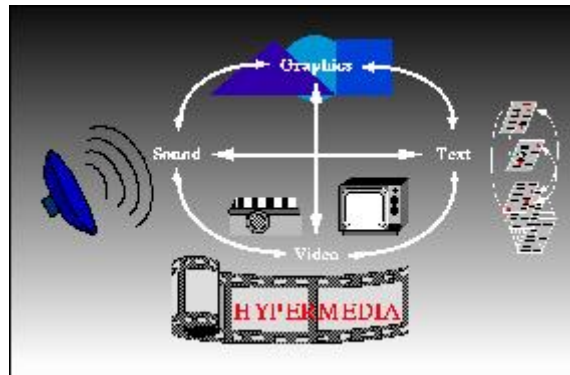
Hypertext is a text which contains links to other texts. The term was invented by Ted Nelson around 1965.

Hypertext is therefore usually non-linear (as indicated below).



Definition of Hypertext

HyperMedia is not constrained to be text-based. It can include other media, e.g., graphics, images, and especially the continuous media - sound and video. Apparently, Ted Nelson was also the first to use this term.



Definition of HyperMedia

The World Wide Web (WWW) is the best example of hypermedia applications.

A *Multimedia System* is a system capable of processing multimedia data and applications and it characterised by the processing, storage, generation, manipulation and rendition of Multimedia information.

Characteristics of a Multimedia System

A Multimedia system has four basic characteristics:

- Multimedia systems must be *computer controlled*.

- Multimedia systems are *integrated*.
- The information they handle must be represented *digitally*.
- The interface to the final presentation of media is usually *interactive*.

Challenges for Multimedia Systems

Supporting multimedia applications over a computer network renders the application *distributed*. This will involve many special computing. 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 for 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 be represented *digitally* so many initial source of data needs to be *digitise* -- translated from analog source to digital representation.

Components of a Multimedia System

Now let us consider the Components (Hardware and Software) required for a multimedia system:

Capture devices

-- Video Camera, Video Recorder, Audio Microphone, Keyboards, mice, graphics tablets, 3D input devices, tactile sensors, VR devices.
Digitizing/Sampling Hardware

Storage Devices

-- Hard disks, CD-ROMs, Jaz/Zip drives, DVD, *etc*

Note: Jaz a removable hard disk storage system sold by the Iomega company from 1996 to 2002.

Communication Networks

-- Ethernet, Token Ring, FDDI (Fiber Distributed Data Interface) (FDDI), (Asynchronous transfer mode) ATM, Intranets, Internets.

Computer Systems

-- Multimedia Desktop machines, Workstations, MPEG/VIDEO/DSP
Hardware

Display Devices

-- CD-quality speakers, HDTV, SVGA, Hi-Res monitors, Colour printers *etc*.

Multimedia Applications

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

Discrete vs Continuous Media

Multimedia systems deal with the generation, manipulation, storage, presentation, and communication of information in digital form. The data may be in a variety of formats: text, graphics, images, audio, video. A majority of this data is large and the different media may need synchronization- the data may have temporal relationships as an integral property. Some media is time independent or *static* or *discrete* media: normal data, text, single images, graphics are examples. Video, animation and audio are examples of *continuous* media.

Static or Discrete Media:

Some media is time **independent**: Normal data, text, single images, graphics are examples of static.

Continuous Media: Time **dependent** Media: Video, animation and audio are examples of Discrete.

Types of Data

The data may be in a variety of formats: text, graphics, images, audio, video.

Text and Static Data

The sources of this media are the keyboard, floppies, disks and tapes. Text files are usually stored and input character by character. Files may contain raw text or formatted text *e.g* HTML, Rich Text Format (RTF) or a program language source (C, Pascal, *etc.*). Even though to data medium does not include any temporal constraints there may be a natural implied sequence *e.g.* HTML format sequence, Sequence of C program statements. The basic storage of text is 1 byte per character (text or format character).