

# 1

## Introduction to Multimedia Systems

---

**Multimedia** - Department of Computing, Imperial College  
Professor GZ Yang ! <http://www.doc.ic.ac.uk/~gzy>

### What is Multimedia

“Face it. Butlers cannot be blind. Secretaries cannot be deaf. But somehow we take it for granted that computers can be both.” This is a quote by Nicholas Negroponte who wrote the popular book Being Digital. The purpose of this course is exactly to deal with this problem.

Before we go on, it is important to define the term *media*. It refers to the *storage, transmission, interchange, presentation, representation* and *perception* of different information types (data types) such as text, graphics, voice, audio and video, where

*Storage* - refers to the type of physical means to store data, such as magnetic tape, hard disk, optical disk, DVDs, CD-ROMs, etc.

*Transmission* - refers to the type of physical means of transmitting data, such as coaxial cable, twisted pair, fibre, etc.

*Interchange* - refers to the means of interchanging data; this can be by storage media, transmission media, or a combination of both.

*Presentation* - is used to describe the type of physical means to reproduce information to the user or to acquire information from the user; for example, speakers, video windows, immersive environment etc.

*Representation* - is related to how information is described in an abstract form for use within an electronic system. For example, to present text to the user, the text can be coded in raster graphics, in graphics primitives or in simple ASCII characters. Thus the presentation can be the same but with different representations. Other examples of representation media are ASN.1 and SGML.

*Perception* - is used to describe the nature of information as perceived by the user; for example speech, music and film.

We use the term *multimedia* to denote the property of handling a variety of representation media in an integrated manner. The more means of transmission used and the greater the interactivity, the more ‘multimedia’ a system is.

### Challenges in Multimedia

The development of multimedia technology is to provide a digital experience that closely resembles that of the physical world. Biological forms provide what are, perhaps, the most sophisticated multimedia systems.

*Visual* - Each eye has 127m rods and cones with 1m nerve fibres connected to the brain. Neurons can fire every millisecond. Eye-brain link data transmission rate is about 1 Gbit/sec.

- Aural* - Each ear has 23,500 hairs in the cochlea, around 30,000 nerve fibres to the brain. They transmit approximately 30 Mbit to the brain if all were firing. In practice, data rate is around 100 Kbit/sec. Human has a hearing range of 20Hz - 20 kHz, whale 2Hz - 20 kHz, dolphin 20Hz - 200 kHz, and bat 16Hz - 200 kHz.
- Tactile* - A human has approximately 5 million (compared with 127m on eyes) sensors on the skin sensing at about a few Mbit/sec. Finger tips have nerve endings 1mm apart.
- Sense* - Human can detect around 10,000 different smells at about a few Kbit/sec. Maximum range for smell: Human -1m, Dog -100 m, Moth -5 km, Elephant -3 km. The tongue can only sense four tastes sweet, sour (H<sup>+</sup> hydrogen ions), salt (Na<sup>+</sup> sodium ions), and bitter. A few tens of bits/sec are sent to the brain. A snake can taste its way around.

### What's the Current Status of Digital Communication

|                                 |                             |
|---------------------------------|-----------------------------|
| • <b>GSM phone data channel</b> | <b>8kb/s</b>                |
| • <b>Group 3 fax</b>            | <b>9.6kb/s</b>              |
| • <b>PSTN modem</b>             | <b>28.8, 33.6, 56 kb/s</b>  |
| • <b>ISDN modem</b>             | <b>64 kb/s, per channel</b> |
| • <b>ISDN - 30</b>              | <b>2 mb/s</b>               |
| • <b>Ethernet</b>               | <b>10/100 mb/s</b>          |
| • <b>ATM</b>                    | <b>100 mb/s</b>             |
| • <b>CD-ROM (single speed)</b>  | <b>150 kbyte/s</b>          |
| • <b>DVD</b>                    | <b>&gt; 1 Mbit/s</b>        |
| • <b>Hard disc</b>              | <b>3 Mbyte/s</b>            |

### What is this Course all About

This course does NOT teach you

- how to write HTML, JAVA, FLASH, PHP4, ASP, and construct web pages
- how to install a multimedia computer
- how to edit video clips, create vector and bitmap graphics
- how to create digital animations

It is, however, mainly concerned with both theoretical and practical foundations of multimedia systems in terms of

#### ***Content representation and understanding***

- Signals in the Digital Domain
- Image and Data Compression
- Colour Spaces
- Compression and Multimedia Standards
- Sound and Audio
- Motion Picture Processing

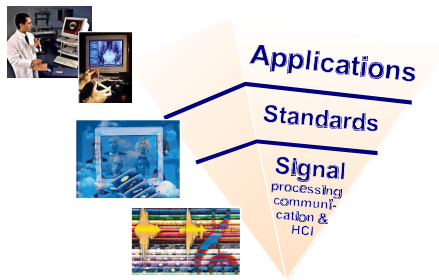
### **Communication and delivery**

- Distributed Processing and Multimedia
- Videotelephony & videoconferencing
- MPEG-Communication Packetisation
- Offline Delivery: LD/CD/DVD
- Online Delivery: QoS
- Video on Demand (VoD)

### **Interaction**

- Human Computer Interaction
- Media Immersion - Integrated Media Systems
- Interactivity via WWW

### **Levels of Learning**



This lecture provides both theoretical foundations and practical applications/standards for multimedia systems. It consists of 20 lectures, 10 tutorials, 1 assessed course work, plus a 2-hour examination. Detailed course notes are available at the beginning of each lecture, but they can also be downloaded at <http://www.doc.ic.ac.uk/~gzy>. Lecture slides, stored both in HTML and PDF formats, can also be found at the above web site. The HTML format is good for online browsing, whereas PDF format is good for printing. It is highly recommended to print out the lecture slides before you come to the lecture.

### **References**

- Digital Video and Audio Compression, by Stephen J. Solari, McGraw Hill Text, 1997.
- Digital Multimedia, by Nigel Chapman and Jenny Chapman, Wiley, 2000.
- Multimedia Communications, by Fred Halsall, Addison-Wesley, 2001.
- Emerging Multimedia Computer Communication Technologies, Chwan-Ha Wu and J. David Irwin Prentice-Hall, 1998
- Open Distributed Processing and Multimedia, Gordon Blair and Jean-Bernard Stefani, Addison Wesley, 1998
- The Death of Distance : How the Communications Revolution Will Change Our Lives, by Frances Cairncross, Harvard Business School Pr.