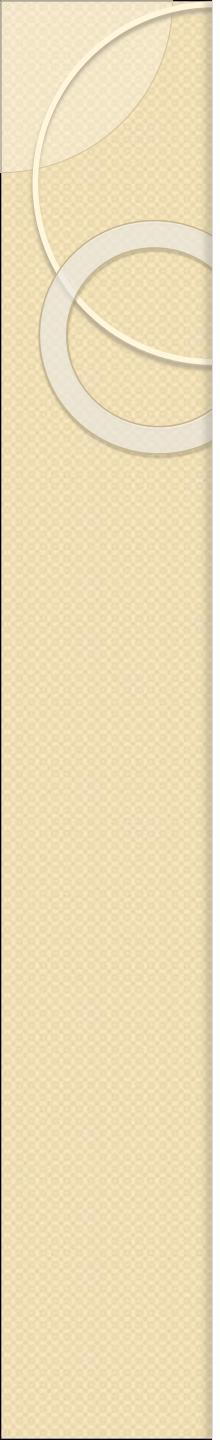




# Introduction to Multimedia Networking

Ary Shiddiqi

[ary.shiddiqi@if.its.ac.id](mailto:ary.shiddiqi@if.its.ac.id)



## ● Outline

- This chapter considers what multimedia is.
- It also supplies an overview of multimedia software tools, such as video editors and digital audio programs
- The supporting elements of multimedia, i.e. computer networks

# The term “multimedia”.

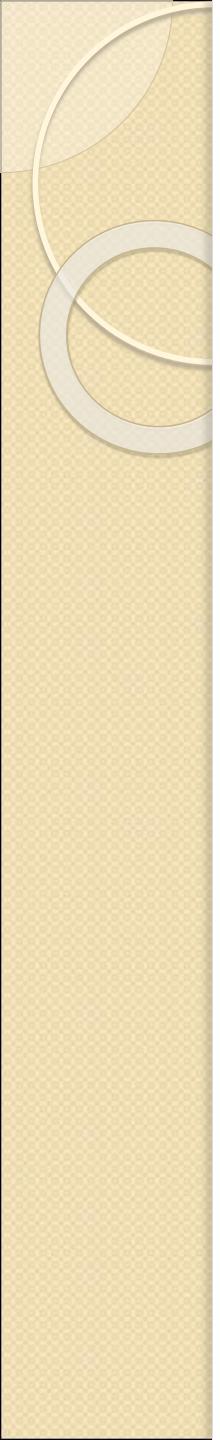
- applications that use multiple modalities, including text, images, drawings (graphics), animation, video, sound including speech, and **interactivity**.

# Multimedia and Computer Science

- Graphics, HCI, visualization, computer vision, data compression, graph theory, networking, database systems --- all have important contributions to make in multimedia at the present time.

# Components of Multimedia

- Multimedia involves multiple modalities of text, audio, images, drawings, animation, and video.
- Examples of how these modalities are put to use:
  1. Video teleconferencing.
  2. Distributed lectures for higher education.
  3. Tele-medicine.
  4. Co-operative work environments.

- 
5. Searching in (very) large video and image databases for target visual objects.
  6. "Augmented" reality: placing real-appearing computer graphics and video objects into scenes.
  7. Including audio cues for where video-conference participants are located.
  8. Building searchable features into new video, and enabling very high- to very low-bit-rate use of new, scalable multimedia products.

- 
9. Making multimedia components editable.
  10. Building "inverse-Hollywood" applications that can recreate the process by which a video was made.
  11. Using voice-recognition to build an interactive environment, say a kitchen-wall web browser.

# History of Multimedia:

1. **Newspaper:** perhaps the *first mass communication medium*, uses text, graphics, and images.
2. **Motion pictures:** conceived of in 1830's in order to observe motion too rapid for perception by the human eye.
3. **Wireless radio transmission:** Guglielmo Marconi, at Pontecchio, Italy, in 1895.
4. **Television:** the new medium for the 20th century, established video as a commonly available medium and has since changed the world of mass communications.

# History of Multimedia:

5. The **connection** between **computers** and ideas about **multimedia** covers what is actually only a short period:

- 1945 - Vannevar Bush wrote a landmark article describing what amounts to a hypermedia system called **Memex**.
- 1960 - Ted Nelson coined the term **hypertext**.
- 2000 - WWW size was estimated at over 1 billion pages.

# Hypermedia and Multimedia

- A **hypertext** system: meant to be read nonlinearly, by following links that point to other parts of the document, or to other documents
- **HyperMedia:** not constrained to be text-based, can include other media, e.g., graphics, images, and especially the continuous media | sound and video.
  - The World Wide Web (WWW) | the best example of a hypermedia application.
- **Multimedia** means that computer information can be represented through audio, graphics, images, video, and animation in addition to traditional media.

# SMIL (Synchronized Multimedia Integration Language)

- SMIL: pronounced "smile" -- a particular application of XML (globally predefined DTD) that allows for specification of interaction among any media types and user input, in a temporally scripted manner.

# SMIL

- **Purpose of SMIL:** it is also desirable to be able to publish multimedia presentations using a markup language.
- A multimedia markup language needs to enable scheduling and synchronization of different multimedia elements, and define their interactivity with the user.
- SMIL 2.0 is specified in XML using a modularization approach similar to the one used in xhtml:

# SMIL

- Basic elements of SMIL as shown in the following example:

```
<!DOCTYPE smil PUBLIC "-//W3C//DTD SMIL 2.0"  
"http://www.w3.org/2001/SMIL20/SMIL20.dtd">  
<smil xmlns="http://www.w3.org/2001/SMIL20/Language">  
  <head> <meta name="Author" content="Some Professor" />  
  </head> <body> <par id="MakingOfABook">  
    <seq> <video src="authorview.mpg" />  
        
    </seq>  
    <audio src="authorview.wav" />  
    <text src="http://www.cs.sfu.ca/mmbook/" />  
  </par> </body> </smil>
```

# **Overview of Multimedia Software Tools**

- software tools available for carrying out tasks in multimedia are:
  1. Music Sequencing and Notation
  2. Digital Audio
  3. Graphics and Image Editing
  4. Video Editing
  5. Animation
  6. Multimedia Authoring

# I. Music Sequencing and Notation

- **Cakewalk:** now called Pro Audio.
  - The term sequencer comes from older devices that stored sequences of notes ("events", in MIDI [**Musical Instrument Digital Interface**]).
  - It is also possible to insert WAV files and Windows MCI commands (for animation and video) into music tracks (MCI is a ubiquitous component of the Windows API.)
- **Cubase:** another sequencing/editing program, with capabilities similar to those of Cakewalk. It includes some digital audio editing tools.
- **Macromedia Soundedit:** mature program for creating audio for multimedia projects and the web that integrates well with other Macromedia products such as Flash and Director.

## 2.Digital Audio

- tools deal with accessing and editing the actual sampled sounds that make up audio:
- **Adobe Audition** (formerly **Cool Edit**) is a powerful, popular digital audio toolkit that emulate a professional audio studio, including multitrack productions and sound file editing, along with digital signal processing effects.
- **Sound Forge** Like Audition, Sound Forge is a sophisticated PC-based program for editing WAV files.
- **Pro Tools:** a high-end integrated audio production and editing environment . It offers MIDI creation and manipulation; powerful audio mixing, recording, and editing software.

# 3. Graphics and Image Editing

- **Adobe Illustrator:** a powerful publishing tool from Adobe. Uses vector graphics; graphics can be exported to Web.
- **Adobe Photoshop:** the standard in a graphics, image processing and manipulation tool.
  - Allows layers of images, graphics, and text that can be separately manipulated for maximum flexibility.
  - Filter factory permits creation of sophisticated lighting-effects filters
- **Macromedia Fireworks:** software for making graphics specifically for the web.
- **Macromedia Freehand:** a text and web graphics editing tool that supports many bitmap formats such as GIF, PNG, and JPEG.

## 4. Video Editing

- **Adobe Premiere:** an intuitive, simple video editing tool for nonlinear editing, i.e., putting video clips into any order:
  - Video and audio are arranged in "tracks".
  - Provides a large number of video and audio tracks, superimpositions and virtual clips.
  - A large library of built-in transitions, filters and motions for clips => effective multimedia productions with little effort.
- **Adobe After Effects:** a powerful video editing tool that enables users to add and change existing movies. Can add many effects: lighting, shadows, motion blurring; layers.

## 4. Video Editing

- **Final Cut Pro:** a video editing tool by Apple; Macintosh only.
- **CyberLink PowerDirector:** PowerDirector produced by CyberLink Corp.
  - is by far the most popular nonlinear video editing software.
  - It provides a rich selection of audio and video features and special effects
  - easy to use.
  - It supports all modern video formats (AVCHD 2.0, 4K Ultra HD, and 3D video)
  - It supports 64-bit video processing
  - it is not as “programmable” as Premiere.

# 5.Animation

- **Multimedia APIs:**
- **Java3D:** API used by Java to construct and render 3D graphics, similar to the way in which the Java Media Framework is used for handling media files.
  1. Provides a basic set of object primitives (cube, splines, etc.) for building scenes.
  2. It is an abstraction layer built on top of OpenGL or DirectX (the user can select which).
- **DirectX :**Windows API that supports video, images, audio and 3-D animation
- **OpenGL:** the highly portable, most popular 3-D API.

# 5. Animation

- **Animation Software (Rendering Tools):**
- **3D Studio Max:** rendering tool that includes a number of very high-end professional tools for character animation, game development, and visual effects production.
- **Softimage XSI:** a powerful modeling, animation, and rendering package used for animation and special effects in films and games.
- **Maya:** competing product to Softimage; as well, it is a complete modeling package.
- **RenderMan:** rendering package created by Pixar.

# 5. Animation

- **GIF Animation Packages :**
  - simpler approach to animation, allows very quick development of effective small animations for the web.
  - GIFs can contain several images, and looping through them creates a simple animation.
  - Linux also provides some simple animation tools, such as **animate**.

# 6. Multimedia Authoring

- Tools that provide the capability for creating a complete multimedia presentation, including interactive user control, are called **authoring** programs.
- **Macromedia Flash:** allows users to create interactive movies by using the score metaphor, i.e., a timeline arranged in parallel event sequences.
- **Macromedia Director:** uses a movie metaphor to create interactive presentations. It is very powerful and includes a built in scripting language, **Lingo**, that allows creation of complex interactive movies.

# 6. Multimedia Authoring

- **Authorware:** a mature, well-supported authoring product based on the **Iconic/Flow-control** metaphor.
- **Quest:** similar to Authorware in many ways, uses a type of flowcharting metaphor. However, the flowchart nodes can encapsulate information in a more abstract way (called **frames**) than simply subroutine levels.

# The implications of the growing multimedia contents

**Table 1.1** The rapid deployment of last-mile broadband access has made Internet usage even more popular

Services/Networks	Data rates
POTS	28.8–56 kbps
ISDN	64–128 kbps
ADSL	1.544–8.448 Mbps (downlink) 16–640 kbps (uplink)
VDSL	12.96–55.2 Mbps
CATV	20–40 Mbps
OC-N/STS-N	$N \times 51.84$ Mbps
Ethernet	10 Mbps
Fast Ethernet	100 Mbps
Gigabit Ethernet	1000 Mbps
FDDI	100 Mbps
802.11b	1, 2, 5.5, and 11 Mbps
802.11a/g	6–54 Mbps

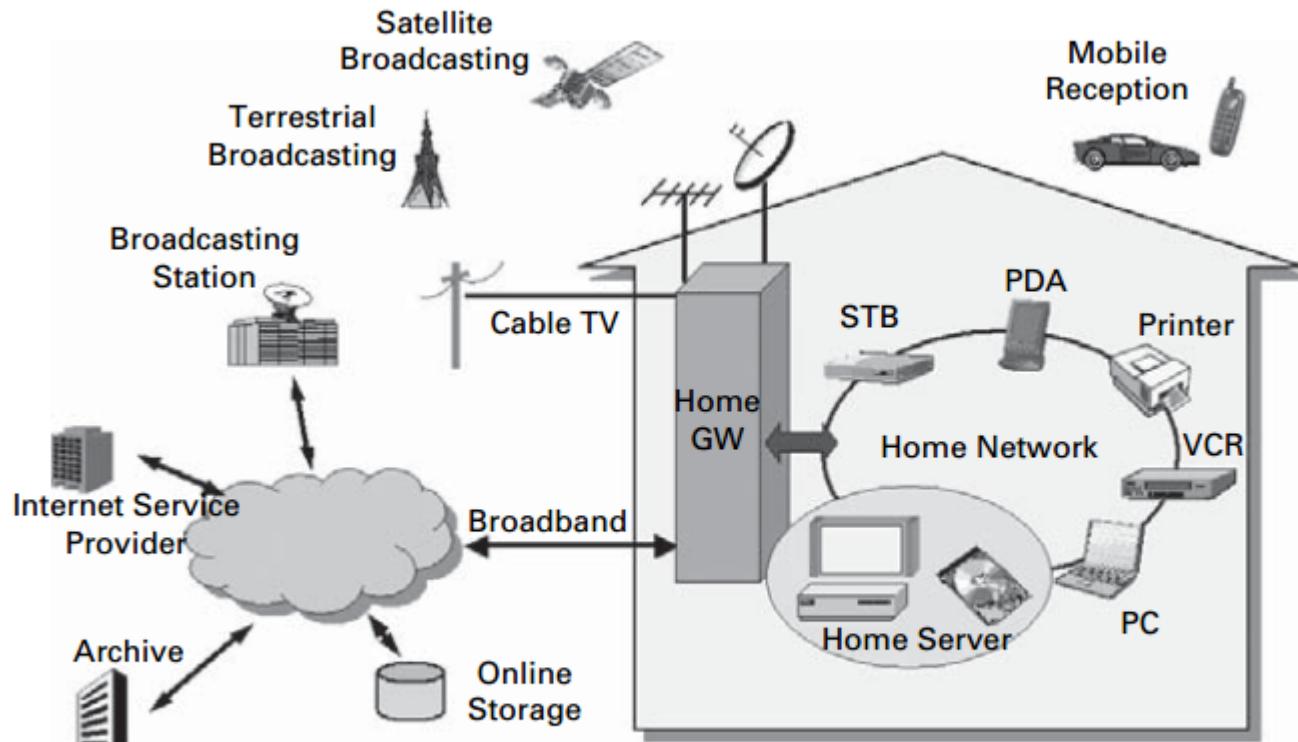
# Paradigm shift of digital media delivery

- Traditional analog TV and radio broadcasting is gradually being replaced by digital broadcasting
- The use of IP-based Internet is growing rapidly for many purposes, e.g. voice over IP (VoIP) replacing public-switched telephone networks (PSTN)
- The connecting integration and content sharing using LAN and WLAN
- People now spend more time on the Internet browsing, watching video or movie by means of on-demand services, etc.
- These indicate that consumer preferences are changing from traditional TV or radio broadcasts to on-demand information request

# Implications

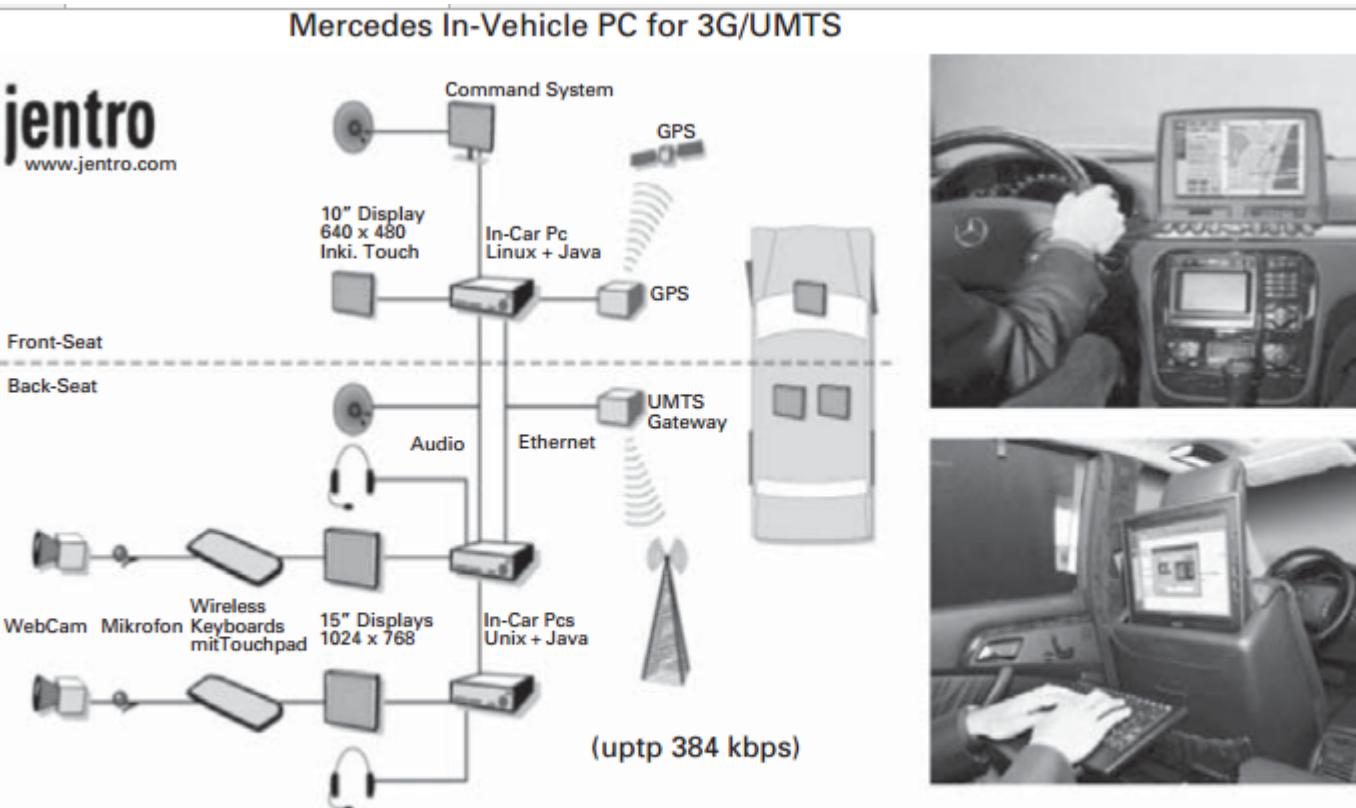
- More interactive multimedia services are taking advantage of bidirectional communication media using IP networks, as evidenced by the rapidly growing use of video blogs and media podcasting.
- It can be predicted that soon Internet-based multimedia content will no longer be produced by traditional large-capital-based media and TV stations
- Everyone can have a media station that produces multimedia content whenever and wherever they want, as long as they have media-capturing devices with Internet access

# The dawn on IoT



**Figure 1.4** Interactive multimedia services take advantage of the bidirectional communication media of IP networks.

# Autonomous Vehicle



**Figure 1.7** An example of new vehicles equipped with 3G mobile access provided by Jentro

# Increasing bandwidth requirements

**Table 1.3** The bandwidth requirement of raw digital data without compression

Source	Bandwidth (Hz)	Sampling rate (Hz)	Bits per sample	Bitrate
Telephone voice	200–3400	8000 samples/s	12	96 kbps
Wideband speech	50–7000	16 000	14	224 kbps
Wideband audio (2 channels)	20–20 000	44 100 samples/s	16 per channel	1.412 Mbps (2 channels)
B/W documents		300 dpi (dots per inch)	1	90 kb per inch <sup>2</sup>
Color image		512×512	24	6.3 Mb per image
CCIR-601 (NTSC)		720×576×25 (DVD)	24	248.8 Mbps
CCIR-601 (PAL)		720×576×25	24	248.8 Mbps
Source input format (SIF)		352×240×30 (VCD)	12	30 Mbps
Common intermediate format (CIF)		352×288×30	12	37 Mbps
Quarter CIF (QCIF)		176×144×7.5	12	2.3 Mbps
High definition DVD		1920×1080×30	24	1492 Mbps

# The four major components

- There are four major components that have to be carefully dealt with to allow the successful dissemination of multimedia data from one end to the other
  - data compression (source encoding)
  - quality of service (QoS) issues
  - the integration of wired and wireless heterogeneous networking systems
  - interoperability of multimedia-networked contents and digital rights management

# References

- Ze-Nian Li and Mark. S. Drew, “Fundamentals of Multimedia”, Prentice-Hall, 2003. ISBN 0130618721
- Jenq-Neng Hwang, “Multimedia Networking From Theory to Practice”, Cambridge, 2013. ISBN 9780521882040.