Multimedia System

Lecture 1: Introduction to Multimedia

Dr. Reham Reda Mostafa

Mansoura University
Faculty of Computers and Information
Dept. of Information System

dr.reham2206@yahoo.com

25. September 2019

Outlines

- What is the multimedia
- Multimedia: Historical perspective
- Multimedia data
- Multimedia Systems
- Classification of Multimedia Systems

What is the multimedia?

- People who use the term "multimedia" may have quite different, even opposing, viewpoints.
  - **A PC vendor:** a PC that has sound capability, a DVD-ROM drive, and perhaps the superiority of multimedia-enabled microprocessors that understand additional multimedia instructions.

  - **A consumer entertainment vendor:** interactive cable TV with hundreds of digital channels available, or a cable TV-like service delivered over a high-speed Internet connection.

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

What is the multimedia? (con't)

- The term "multimedia" composed of two parts:
  - **Multi** (multus) : "numerous, multiple"
  - **Media** (medium): "middle, center" – agent (hardware and software) used for dissemination (distribute) and representation of information.

MULTI

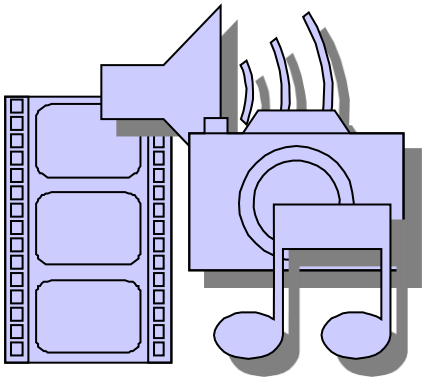
- Many or more than one

MEDIA

- Medium of Communication

What is the multimedia? (con't)

- In general, multimedia could be defined as the usage of multiple agents (text, audio, video, images) for disseminating and presenting information to audience (target user).
- In another word, "Multimedia" implies simultaneous use of more than one medium (audio, image, video, text, graphics …). Perhaps a better name is "Integrated media".

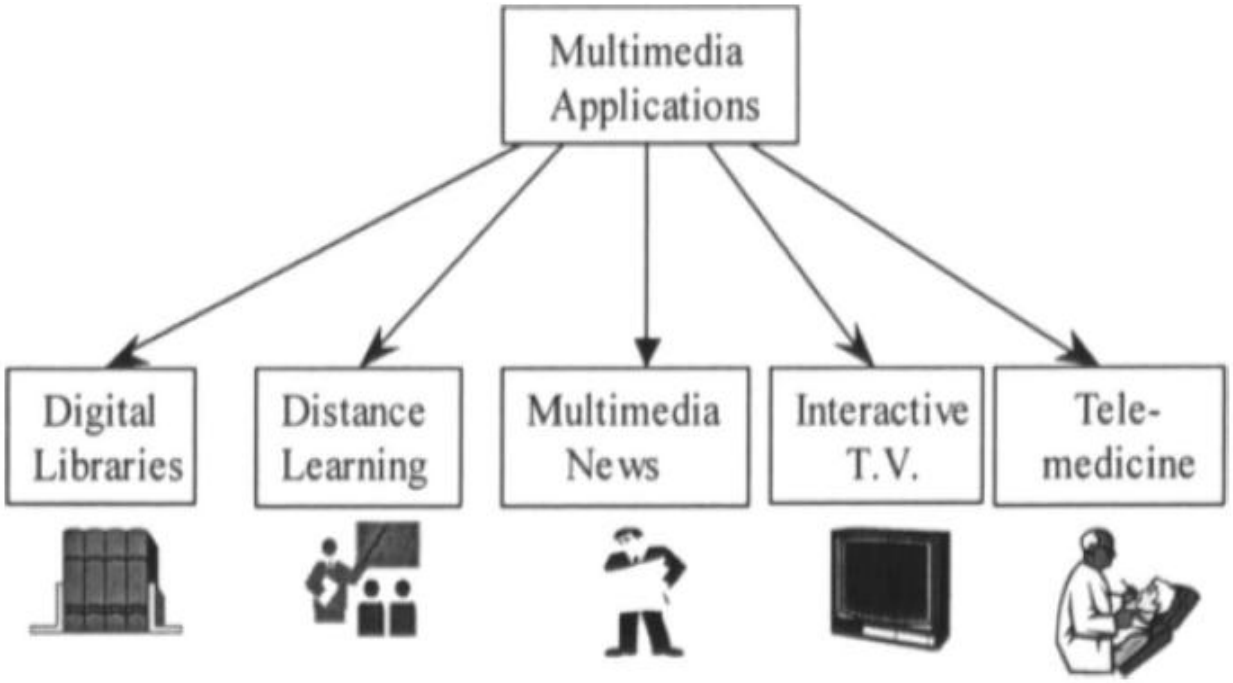


What is the multimedia? (con't)

- Multimedia ➔ it consists of all applications that involve a combined use of different kinds of media, such as text, audio, video, graphics, and animation.
  - A presentation that involves all these different media types can be termed a multimedia presentation.
  - Software that involves animations, sound, and text is called multimedia software.
  - Also, any system that incorporates different flavors of media can be termed as a multimedia system.

Multimedia Application

- The main reason for the multimedia system's popularity is its long list of potential applications that were not possible even two decades ago.
- A few examples are shown in following figure.



Multimedia Application (cont'd)

- 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. Examples of Multimedia Applications include:
  - World Wide Web,
  - Multimedia Authoring, e.g. Adobe/Macromedia Director,
  - Video-on-demand,
  - Interactive TV,
  - Computer Games,
  - Digital video editing and production systems,
  - Multimedia Database systems.

Multimedia In business

Business

- Business application for multimedia include presentation, Training, advertisement, video, conferencing and etc.
- Sales / Marketing Presentation
- Trade show production
- Staff Training Application
- Company Kiosk

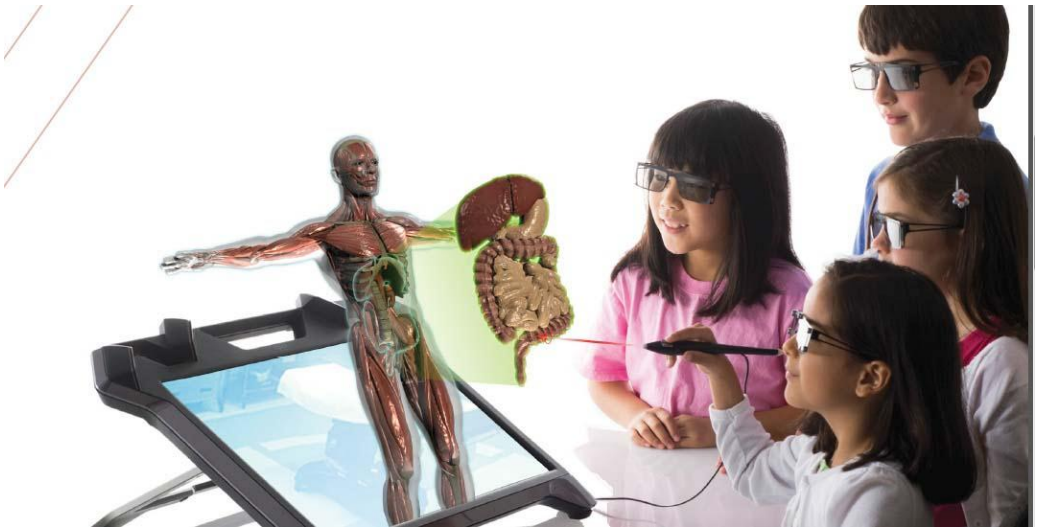
Multimedia In Education

Education

Courseware / Simulations

E-Learning / Distance Learning

Information Searching



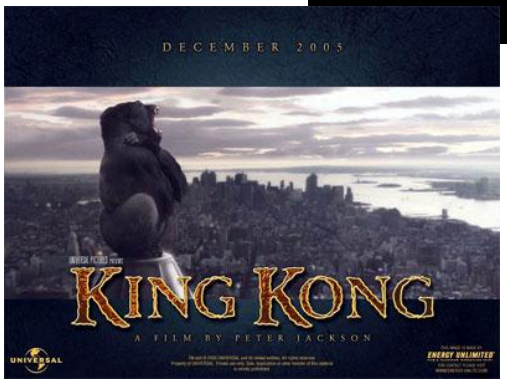
Multimedia In Entertainment

Entertainment

Games (Leisure / Educational)

Movies

Video on Demand



Multimedia In Public places

Public places

Information Kiosk

A product which is usually stationed at public places and allow the user to find information interactively and also other types of transaction.

Smart Cards, Security

Multimedia In Home

Home

Television
Satellite TV
SMS services (chats, voting, reality TV)

Multimedia System

- A system that involves generation, representation, storage, transmission, search and retrieval, and delivery of multimedia information
- There are **three processes** that are now inherent to multimedia systems:
  - ***Multimedia content creation or multimedia authoring***—This process involves digitizing media (audio, images, video) using capture devices and assembling/processing them using smart software and hardware.
  - ***Storage and compression***—Multimedia content created today has significant memory requirements and has to be engineered so as to minimize necessities for storage and distribution. The process mostly involves state-of-the-art compression algorithms and standards for audio, video, images, and graphics.
  - ***Distribution***—Distribution involves how multimedia content is distributed via various media, such as wired cables, optical networks, satellite, wireless networks, or any combination thereof, to specific platforms ranging from television, computers, personal digital assistants (PDAs), and so on.

Outlines

- What is the multimedia
- Multimedia: Historical perspective
- Multimedia data
- Multimedia Systems
- Classification of Multimedia Systems

History of Multimedia

Year	Events
prior industrial Revolution	Written Letters, Books, Poetry, Bulletin boards
Late 1890s	Radio was introduced
Early 1900s	Movie was introduced
1940s	Television was introduced
1960s	Concept of hypertext systems was developed
Early 1980s	Personal computer was introduced
1980-present	Several digital audio, image, and video coding standards have been developed.
1983	Internet is born, TCP/IP protocol was established. Audio CD was introduced.
1990	Tim Berners-Lee proposed the WWW. HTML was developed.
1993-present	Several Web browsers, hypertext languages were developed.
Mid 1990s	High Definition Television standard was established.

Outlines

- What is the multimedia
- History of Multimedia
- Multimedia data
- Multimedia Systems
- Classification of Multimedia Systems

Multimedia data

- *Multimedia information* can be defined as information that consists of one or more different media types.
- Today, multimedia information consists of
  - **text**
  - **audio**
  - **video**
  - **2D graphics**
  - **3D graphics**
- These are the media types that are used extensively today because of the availability of devices to capture them, as well as capabilities of authoring software applications to combine them to produce a variety of informational and entertaining content.

Inherent Qualities of Multimedia Data

- There are certain inherent qualities generic to all media, which, in turn, define its multimedia nature. These qualities are as follows:
  - ***Digital***—Multimedia information is always digital. In fact, it is the digital nature of the information that allows it to be combined together to produce rich content. Whether it is digital images, video, audio, or text, the underlying representation of the information is always bits and bytes.
  - ***Voluminous***—The size of the data resulting from combining video, audio, and images together is understandably large and voluminous. This causes problems when such high volume data has to be stored, searched, and, worse, when it has to be transmitted over bandwidths.
    - The storage and transmission bandwidth limitations require that the data be compressed.

Inherent Qualities of Multimedia Data (cont'd)

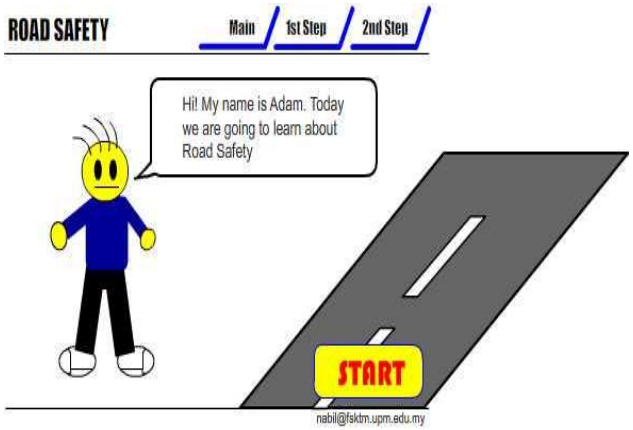
- There are certain inherent qualities generic to all media, which, in turn, define its multimedia nature. These qualities are as follows:
  - ***Interactive***—Multimedia content can be interacted with from a high-level application point of view, such as choosing a video to watch or a set of images to browse down to a low level, where you can click on areas of an image causing an action to be taken. For example, on a Web site consisting of hyperlinked text, images, or video, you can read, jump to different Web sites, or browse video in any order you want.
  - ***Real-time and synchronization***—When transmitting content involving different media types, real-time requirements and resulting synchronization issues play a crucial role in the system's architecture and design. Real-time needs imply that there can be only a very small and bounded delay while transmitting information to the end client. Synchronization imposes time-respected rendering of the media, which might be self-contained or interdependent.

Different Media Types Used Today

- **Text**
  - Text has been commonly used to express information not just today but from the early days.
    - Literature, news, and information being archived today and accessed by browsing on the Internet include a large amount of text.
  - The representation and writing of text information has evolved from simple text to more meaningful and easy-to-read *formatted* text, using a variety of fonts.
  - Today, hypertext is commonly used in digital documents, allowing nonlinear access to information.

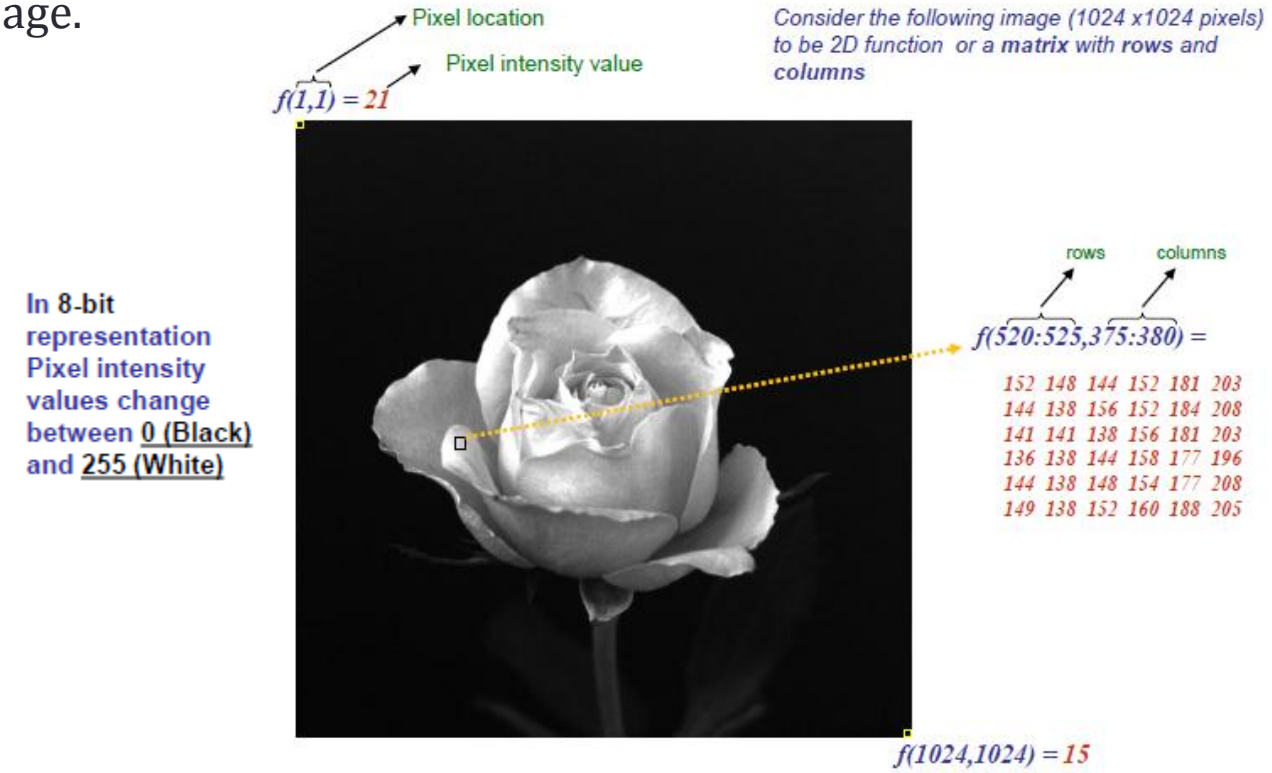
Different Media Types Used Today (cont'd)

- **Text (cont'd)**
  - Linear multimedia applications active content progresses without any navigation control for the viewer such as a cinema presentation or movie.
  - Non-linear multimedia applications offers user interactivity, such as selection buttons or hyperlinks, to control progress as used with a computer game or used in self-paced computer based training.
    - Non-linear content is also known as hypermedia content.



Different Media Types Used Today (cont'd)

- **Image**
  - Images consist of a set of units called pixels organized in the form of a two-dimensional array. The two dimensions specify the width and height of the images. Each pixel has bit depth, which defines how many bits are used to represent an image.



Different Media Types Used Today (cont'd)

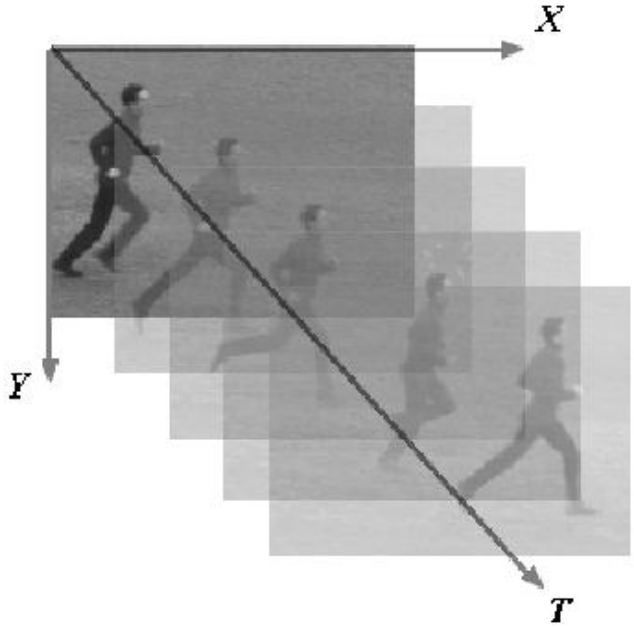
- **Image (cont'd)**
  - There are various kinds of images, which can be characterized into groups depending on the following:
    - ***Bit depth***—Bit depth represents the number of bits assigned to each pixel. Accordingly, images are categorized by the bit depth as binary images where every pixel is represented by one bit *or* gray-level images where every pixel is represented by a number of bits (typically 8) or color images, where each pixel is represented by three color channels.
    - ***Formats***—Formats are application-specific, for example, faxes are also images that have a format different from digital photographs.
    - ***Dimensionality***—Images can be enjoyed singularly or combined in a variety of ways. Stereo images are commonly used for depth-perception effects. Images can also be stitched together to form panoramas.

Different Media Types Used Today (cont'd)

- **Image (cont'd)**
  - panoramas

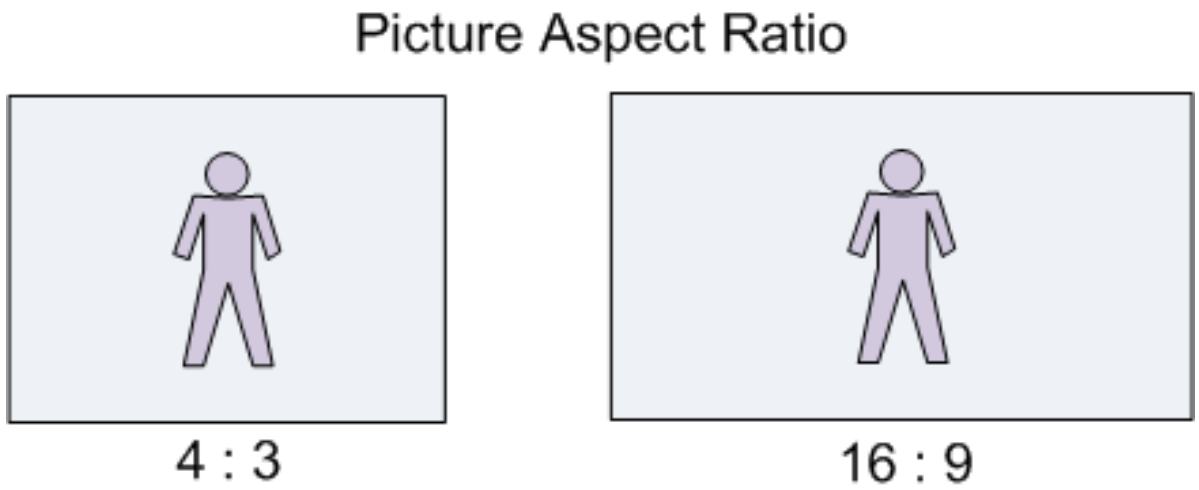
Different Media Types Used Today (cont'd)

- **Video**
  - Video is represented as a sequence of images. Each image in the sequence typically has the same properties of width, height, and pixel depth.
    - Additionally, there is one more temporal parameter known as frames per second or fps. This parameter describes how fast the images need to be shown per second for the user to perceive continuous motion.



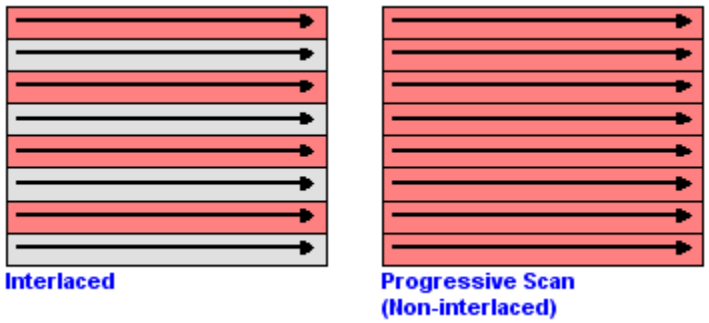
Different Media Types Used Today (cont'd)

- **Video (cont'd)**
  - Apart from this basic definition, video can be classified depending on the following:
    - ***Aspect ratio***—A common aspect ratio for video is 4:3, which defines the ratio of the width to height.
      - Today, however, we have a variety of different aspect ratios for high definition, cinemascope, and so on.



Different Media Types Used Today (cont'd)

- **Video (cont'd)**
  - Apart from this basic definition, video can be classified depending on the following:
    - ***Scanning format***—Scanning helps convert the frames of video into a one-dimensional signal for broadcast.
      - Interlaced scanning format was invented to make television work in the middle of the last century.
      - Digital display devices can support progressive scanning and provide better quality for visual information.



Different Media Types Used Today (cont'd)

- **2D Graphics**
  - 2D graphical elements have become commonplace in multimedia presentations to enhance the message to be conveyed.
  - A 2D graphic element is represented by 2D vector coordinates and normally has properties such as a fill color, boundary thickness, and so on.
  - Additionally, 2D graphical elements are effectively used to create 2D animations to better illustrate information.

Different Media Types Used Today (cont'd)

- **3D Graphics**
  - 3D graphics are primarily used today for high-end content in movies, computer games, and advertising. Like 2D graphics, 3D graphics largely make use of vector coordinate spaces.
  - 3D graphics concepts and practices have advanced considerably as a science but, until recently, were not a commonplace media type.
  - This is now changing with affordable consumer-level software, scanning devices, and powerful graphics cards now becoming available.

Outlines

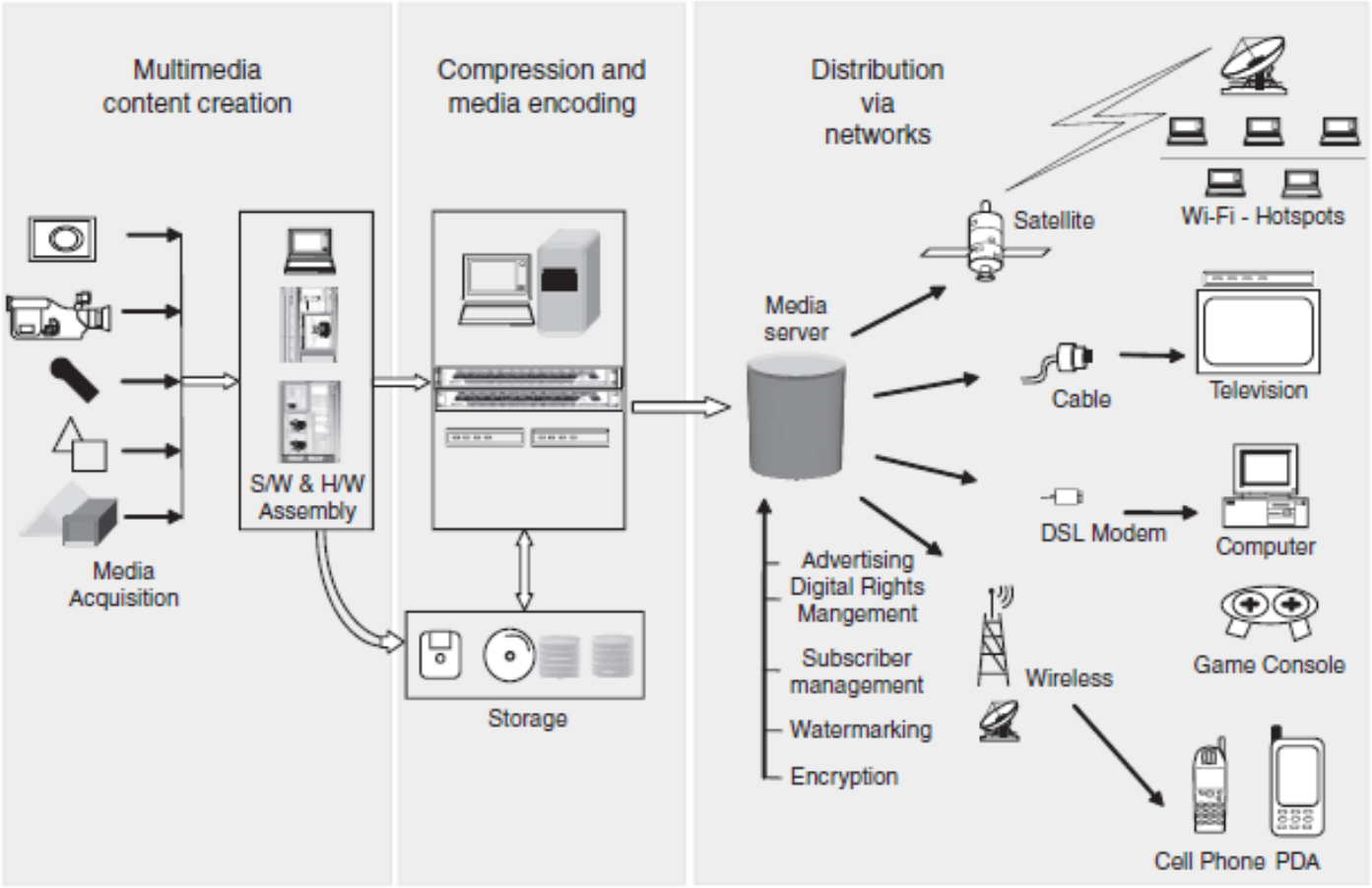
- What is the multimedia
- Multimedia: Historical perspective
- Multimedia data
- Multimedia Systems
- Classification of Multimedia Systems

Multimedia Systems

- A multimedia system is a system that takes care of all content creation, storage, and distribution issues to various platforms.
- Multimedia systems can be logically grouped into three parts whose primary functionalities are
  1) content production,
  2) compression and storage, and
  3) distribution to various end users and platforms.

Multimedia Systems (cont'd)

- A typical end-to-end multimedia system today has been graphically depicted in following Figure.



Multimedia Systems (cont'd)

- The **content creation section** shows a variety of different instruments, which capture different media types in a digital format.
- These include digital cameras, camcorders or video cameras, sound recording devices, scanners to scan images, and 3D graphical objects.
- Once the individual media elements are in their digital representations, they may be further combined to create coherent, interactive presentations using software (S/W) applications and hardware (H/W) elements.
- This content can be stored to disk, or in the case of real-time applications, the content can be sent directly to the end user via digital networks.

Multimedia Systems (cont'd)

- The **second section** deals with the compression of multimedia content. This entails the use of various compression technologies to compress video, audio, graphics, and so on. Shown in the Figure are hardware and software elements, such as media encoders and storage devices.
- The **last section** deals with media distribution across a variety of low-bandwidth and high-bandwidth networks. This ranges from cellular, to wireless networks, to cable, to digital subscriber line (DSL), to satellite networks.
- Distribution normally follows standards protocols, which are responsible for collating and reliably sending information to end receivers. The commonly used end receivers are computers, televisions, set-top boxes, cell phones, or even more application- or entertainment-specific items, such as video game consoles.

Outlines

- What is the multimedia
- Multimedia: Historical perspective
- Multimedia data
- Multimedia Systems
- Classification of Multimedia Systems

Classification of Multimedia System

- Depending on the application, multimedia systems can be classified in a variety of ways, such as interaction style, the number of users interacting, when the content is live, and so on. A few common classifications are discussed in the following list:
  - ***Static versus dynamic***—This differentiation, although rarely used, refers to cases when the multimedia data remains the same within a certain finite time, for example, one slide of a Microsoft PowerPoint presentation or one HTML Web page. Compare this with the dynamic case when the data is changing, for example watching a video.
  - ***Real-time versus orchestrated***—This is a more common classification. Orchestrated refers to cases when there is no real-time requirement. For example, compressing content on a DVD and distributing it has no real-time requirement.

Classification of Multimedia System (cont'd)

- A few common classifications are discussed in the following list:
  - ***Linear versus nonlinear***—Here, the method of interaction with the multimedia data is used to differentiate the system. In a linear system, you would proceed linearly through the information, for example reading an eBook or watching a video. However, if you want to interact with the data in a nonlinear fashion, you would have to make use of links that map one part of the data to another. A well-known example of this is hypertext. You could extend this analogy from text to other media types—images, video, and audio. The term hypermedia generalizes the concept of accessing media nonlinearly.

Classification of Multimedia System (cont'd)

- A few common classifications are discussed in the following list:
  - ***Person-to-machine versus person-to-person***—In this case, the classification is based on whether the end user is interacting with a machine or with another person. For example, playing a CD-ROM game is a simple person to- machine experience. However, videoconferencing is a person-to-person experience.
  - ***Single user, peer-to-peer, peer-to-multipeer, and broadcast***—Here, the manner of information distribution is used as a means to classify a multimedia system. You might have a single-user scenario such as browsing the Web, or it could be a peer-to-peer scenario when the information is exchanged from one person/computer to another, for example two friends instant messaging over the Internet. A peer-to-multipeer scenario extends the paradigm to sending messages to a limited set of intended viewers such as in a chat room.

Classification of Multimedia System (cont'd)

- A few common classifications are discussed in the following list:
  - ***Single user, peer-to-peer, peer-to-multipeer, and broadcast***
    - Broadcasting is the most general-purpose scenario, where information is sent not to any specific listener(s) but available to all those who want to listen, such as television and radio broadcasts.

Thank You