



# ***Multimedia***

## ***Lecture: Multimedia data basic***

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# Multimedia Data:

The multimedia data includes:



Text and Static Data



Graphics



Images



Audio










Video

# **Multimedia Data Basics:**

Multimedia systems/applications have to deal with the:

- Generation of data,
- Manipulation of data,
- Storage of data,
- Presentation of data, and
- Communication of information/data

# Discrete vs. Continuous Media :

Continuous	 Natural Sound	 Video	 Synthetic Sound	 Animation
		 Still Images	 Text	 Graphics
Discrete	Captured (from real world)		Synthesized (by computer)	

## **Discrete vs. Continuous Media (cont.):**

- Continuous Media is time dependent Media such as video, animation and audio.
- Some media is time independent such as normal data, text, single images, and graphics.
- A majority of this data is large and the different media may need synchronization. The data will usually have temporal relationships as an integral property.
- For multimedia applications, all data must be in the form of digital information.

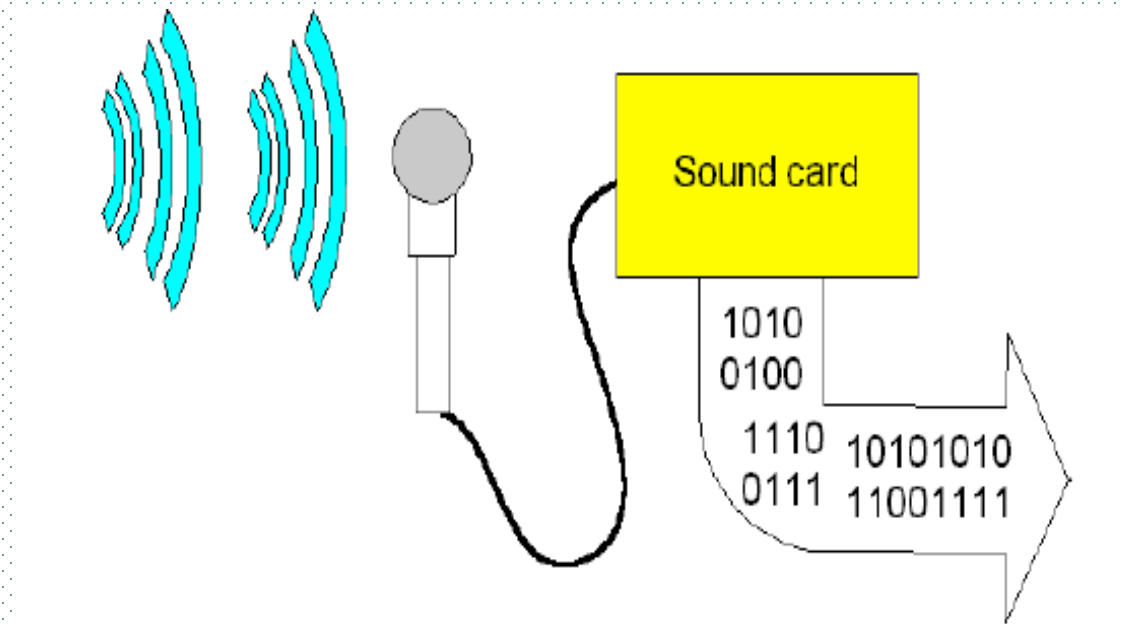
# Analog and Digital Signals

The world we sense is full of analog signals:

- Electrical sensors convert the medium they sense into electrical signals E.g. transducers, thermocouples (temperature sensor), microphones (acoustic sensor), cameras (Still and Video).
- Sound and Light signals are usually analog signals.
- Analog (continuous) signals must be converted or digitized for computer processing.
- Digital signals are discrete signals that computer can readily deal with.

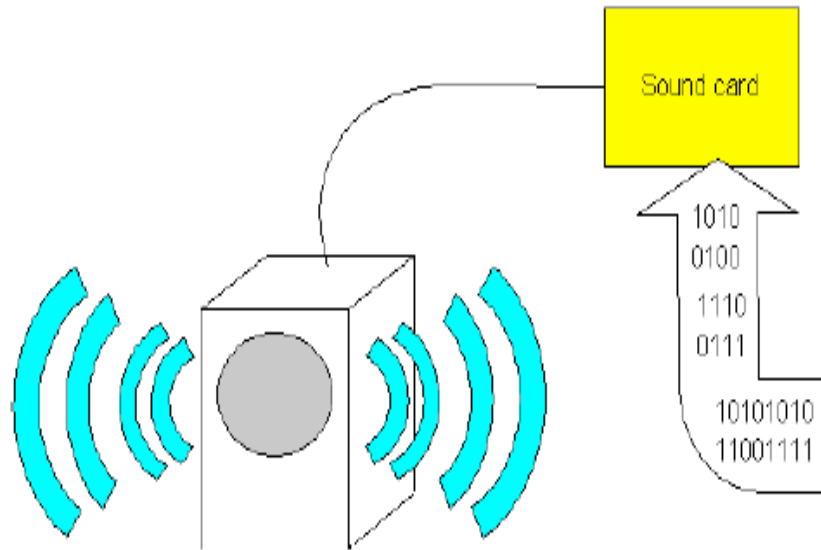
# Analog-to-Digital Converter (ADC)

Special hardware devices: Analog-to-Digital converters take analog signals from analog sensor (e.g. microphone) and digitally sample data.



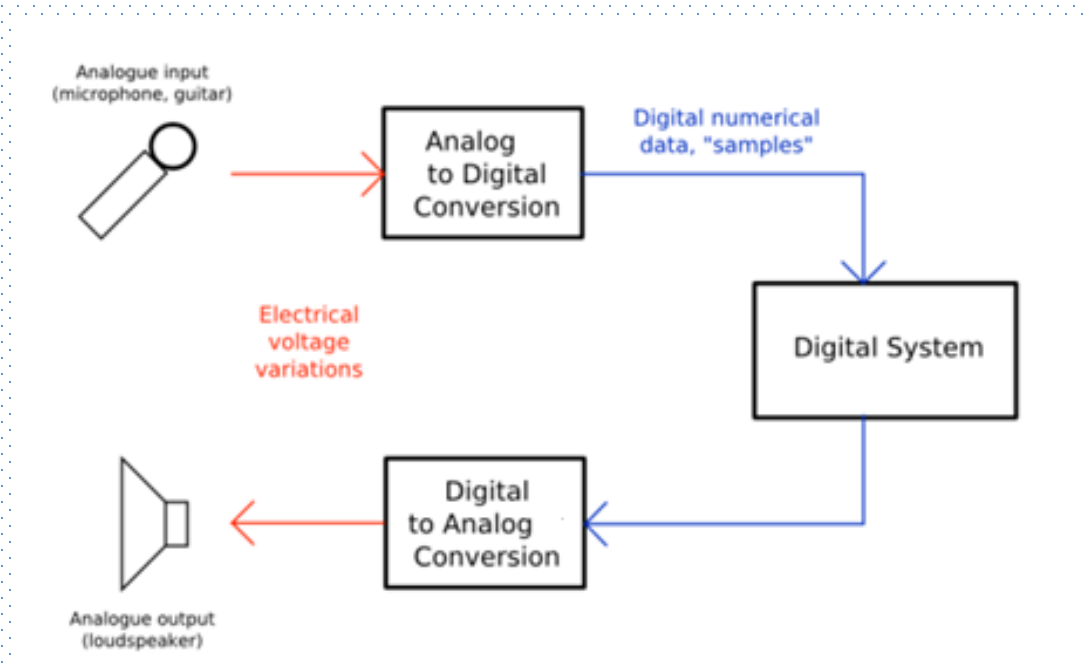
# Digital-to-Analog Converter (DAC)

A converse operation to Analog-to-Digital, Takes digital signal, possible after modification by computer (e.g. volume change, equalization) and outputs an analog signal that may be played by analog output device (e.g. loudspeaker, RGB monitor/display).



# Analog-to-Digital-to-Analog

Begins at the conversion from the analog input and ends at the conversion from the output of the processing system to the analog output as shown:



# Multimedia Data: Input and format

Note that text and graphics (and some images) are mainly generated directly by computer/device (e.g. drawing/painting programs) and do not require digitizing:

They are generated directly in some (usually binary) format.

- Printed text and some handwritten text can be scanned via Optical Character Recognition.
- Handwritten text could also be digitized by electronic pen sensing.
- Printed images/graphics can be scanned directly to image formats.

# Text and Static Data

- Source: keyboard, speech input, optical character recognition, data stored on disk.
- Stored and input character by character:
  - Storage of text is 1 byte per char / more bytes for Unicode.
  - For other forms of data (e.g. Spreadsheet files). May store format as text (with formatting), others may use binary encoding.
- Format: Raw text or formatted text e.g HTML, Rich Text Format (RTF), Word or a program language source (Java, Python, MATLAB etc.)
- Not temporal - BUT may have natural implied sequence e.g. HTML format sequence, Sequence of C program statements.
- Size Not significant with respect to other Multimedia data.

# Graphics

- Constructed by the composition of primitive objects such as lines, polygons, circles, curves and arcs.
- Input: Graphics are usually generated by a graphics editor program (e.g. Illustrator) or automatically by a program (e.g. Postscript).
- Graphics are usually editable or revisable (unlike Images).
- Graphics input devices: keyboard (for text and cursor control), mouse, and trackball or graphics tablet.
- Graphics standards : OpenGL, PHIGS, GKS
- Graphics files usually store the primitive assembly
- Do not take up a very high storage overhead.

# Images

- Still pictures which (uncompressed) are represented as a bitmap (a grid of pixels).
- Input: digitally scanned photographs/pictures or direct from a digital camera.
- Input: May also be generated by programs “similar” to graphics or animation programs.
- Stored at 1 bit per pixel (Black and White), 8 Bits per pixel (Grey Scale, Color Map) or 24 Bits per pixel (True Color).
- Size: a  $512 \times 512$  Grey scale image takes up 1/4 MB, a  $512 \times 512$  24 bit image takes 3/4 MB with no compression.
- This overhead soon increases with image size – modern high digital camera 10+Megapixels  $\approx$  29MB uncompressed!
- Compression is commonly applied.

# Audio

- Audio signals are continuous analog signals.
- Input: microphones and then digitized and stored.
- Compact Disk (CD) Quality Audio requires 16-bit sampling at 44.1 KHz Even higher audiophile rates (e.g. 24-bit, 96 KHz).
- 1 Minute of Mono CD quality (uncompressed) audio requires 5 MB.
- 1 Minute of Stereo CD quality (uncompressed) audio requires 10 MB.
- Usually compressed (E.g. MP3, AAC, Flac, Ogg Vorbis).

# Video

- Input: Analog Video is usually captured by a video camera and then digitized.
- Raw video can be regarded as being a series of single images. There are typically 25, 30 or 50 frames per second.
- E.g. A  $512 \times 512$  size monochrome video images take  $25 \times 0.25 = 6.25\text{MB}$  for a second to store uncompressed.
- Typical PAL digital video ( $720 \times 576$  pixels per color frame)  $\approx 1.24 \times 25 = 31\text{MB}$  for a second to store uncompressed.
- High Definition video on Blu-ray (up to  $1920 \times 1080 = 2$  Megapixels per frame)  $\approx 6.2 \times 25 = 155\text{MB}$  for a second to store uncompressed. (There are higher possible frame rates!)
- Digital video clearly needs to be compressed for most times.

# Summary

- Multimedia Data Basics.
- Discrete vs. Continuous Media.
- ADC and DAC.
- Multimedia Data and Format.
- Introduction to multimedia data:
  - ☐ Text and Static Data
  - ☐ Graphics
  - ☐ Images
  - ☐ Audio
  - ☐ Video