

11. MULTIMEDIA TECHNOLOGIES



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8.1. Multimedia Technologies

8.1. Multimedia Technologies

8.2. Multimedia File Formats



Learning Objectives

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- Describe multimedia
- List the different types of media in multimedia
- Explain in detail the different types of media
- Describe a multimedia system

Multimedia Technologies (1)

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- What is Multimedia?
 - ▣ Multi = more than one
 - ▣ Media = a means of mass communication
- **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.

Multimedia Technologies (2)

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- Multimedia includes a combination of text, audio, still images, animation, video, and **interactivity** content forms.
- A ***multimedia application*** is an application which uses a collection of multiple media sources, such as:
 - ▣ text, graphics, images, sound/audio, animation, or video

Multimedia Technologies (3)



Text



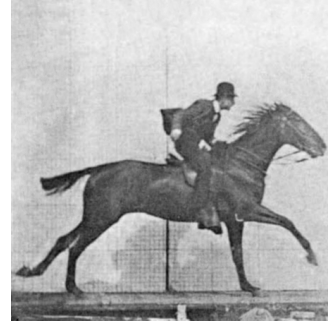
Audio



Images



Animation

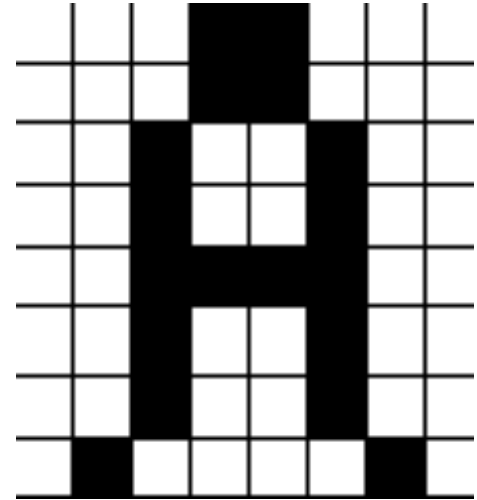


Video

Text (1)

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- When PC's were in their infancy running under *MS-DOS*, they only displayed text in one size and one color.
- Text on those early PC's was displayed using the ASCII charter set which was a series of 2 numbers that could be sent to the monitor. Each of those two digit numbers represented an alpha-numerical character.
- A text charter was 8 pixels high and 8 pixels wide.



Text (2)

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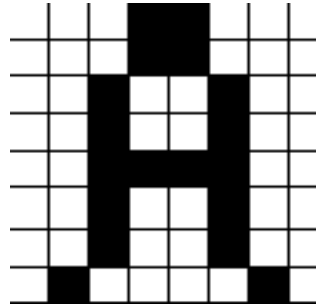
- Later with the use of color monitors which had multiple size modes which made it possible to display larger text (still using the ASCII system).
- Windows and other graphical operating systems used a font (a miniature picture) to paint text on the screen in graphical mode.



Images (1)

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- Turning on or off monitor pixels in graphics mode can create an alphanumeric character. The same process was used to create a picture in the earlier computers.



Images (2)

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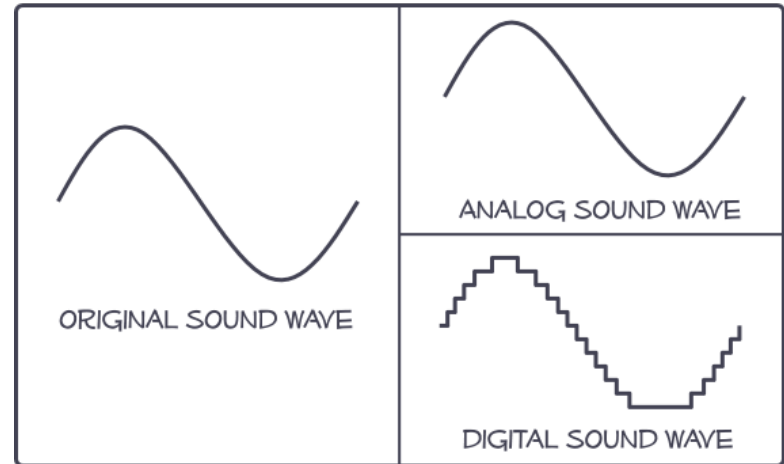
- Instead of turning off the colors, the black was dimmed to gray to create shades of colors
- There are many ways to mix colors to create an endless number of custom palettes.
- All computer colors are created by mixing **RED** **GREEN** and **BLUE**.



Audio (1)

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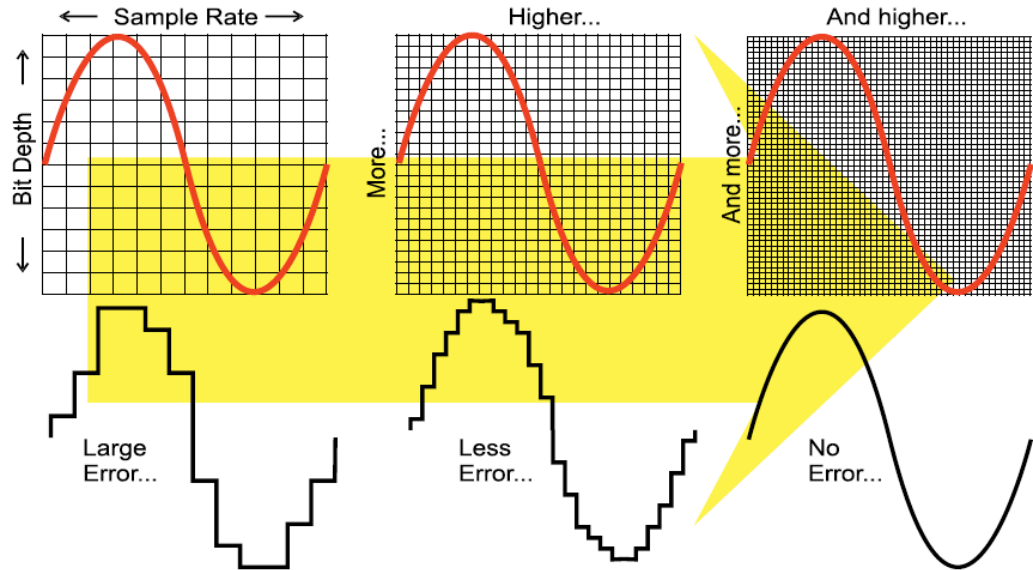
- Audio is the reproduction and transmission of sound stored in a digital format
 - ▣ This includes any physical or electronically stored sound
- Sound originates as an analog signal



Audio (2)

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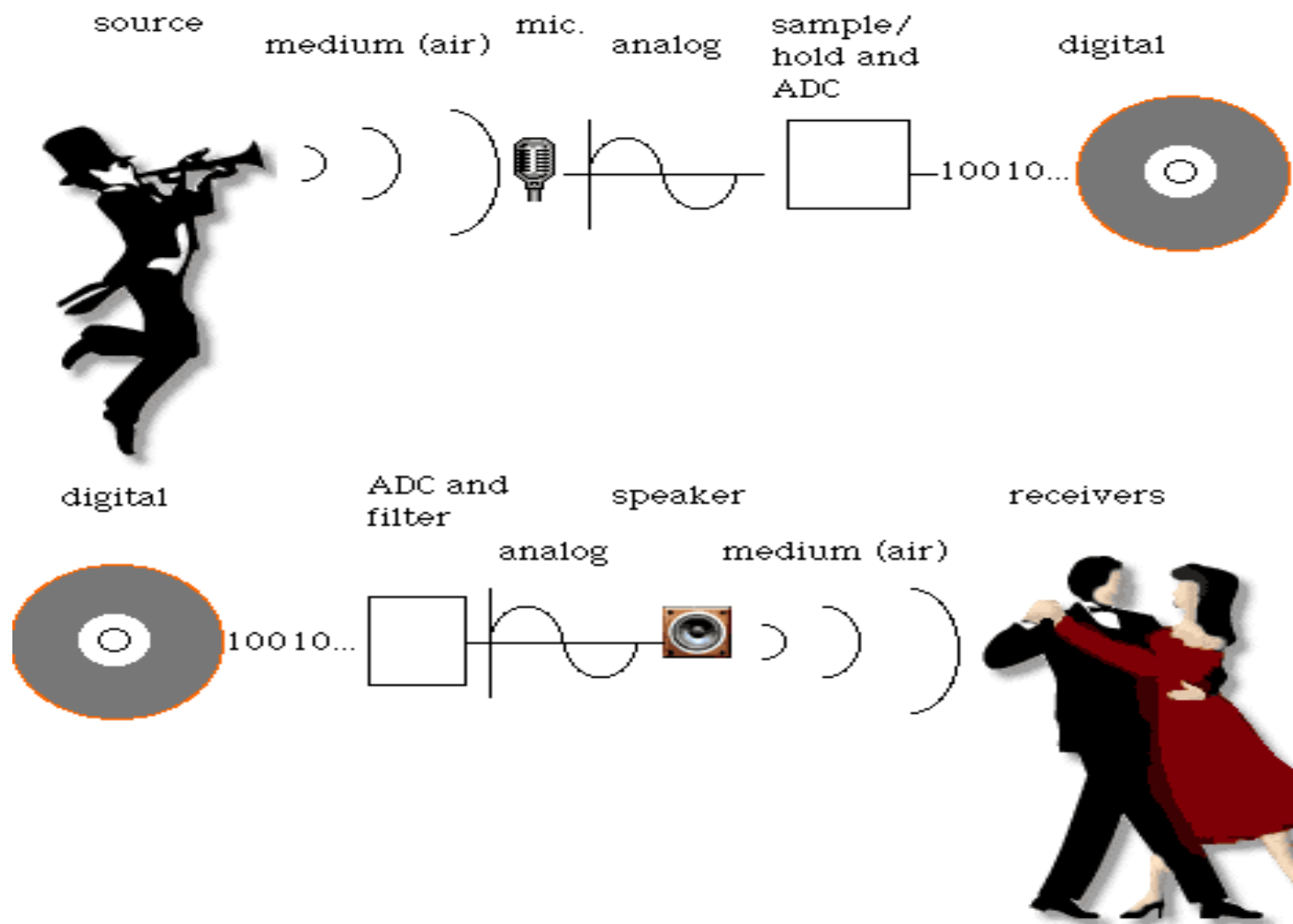
- Digital sound is sound that has been recorded and stored as a series of numerical values, rather than fluctuations in amplitude.



Audio (3)

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- Soundcards typically contain
 - ▣ an Analog-to-Digital Converter (ADC) for recording audio
 - ▣ a Digital-to-Analog Converter (DAC) for playing audio
- The operating system talks to the sound card to handle the recording and playback.



Animation/ Graphics (1)

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- Animation is a sequential series of still images that create an illusion of motion.



Animation/ Graphics (2)

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- Note the difference between animation and video.
- Video takes continuous motion and breaks it up into discrete frames.
- Animation starts with independent pictures and puts them together to form the illusion of continuous motion.

Animation/ Graphics (3)

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- 2D animation figures are created and/or edited on the computer using 2D bitmap graphics or created and edited using 2D vector graphics.
- 3D animations are digitally modeled and manipulated by an animator.

Animation (1)

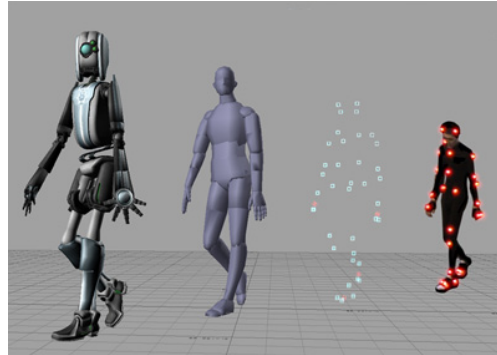
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- Computer animation is the process used for generating animated images by using computer graphics.
- The more general term computer generated imagery encompasses both static scenes and dynamic images, while computer animation only refers to moving images produced by exploiting the persistence of vision to make a series of images look animated.

Animation (2)

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- Given that images last for about one twenty-fifth of a second on the retina fast image replacement creates the illusion of movement.



Animation (3)

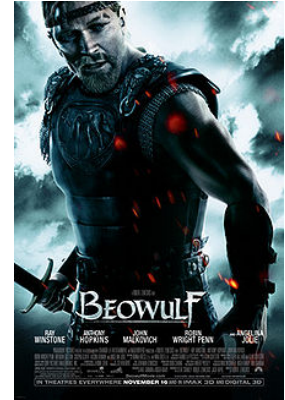
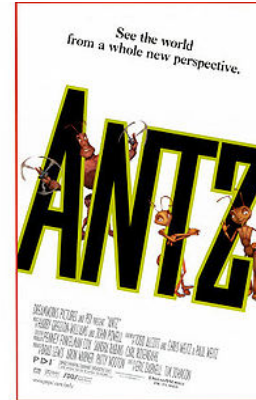
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Animation Film - Examples

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- Antz
- Shrek
- Bee Movie
- Beowulf



List of Animation Software

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- ❑ Adobe Flash
- ❑ Autodesk Maya
- ❑ cinema 4d
- ❑ 3ds max
- ❑ Poser
- ❑ Anim8or



Video

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- Unlike an animation that we can create from drawings or images, a video is created by a photographic process and converted or ported to a computer in sets of frames where each frame has data stored in every pixel.
- We measure the rate at which frames are displayed in Frames Per Second (FPS).
- Digital video can be copied with no degradation in quality.

Video (2)

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Multimedia categories (1)

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- Multimedia may be broadly divided into two categories.
 - ▣ Linear – No user control
 - ▣ Nonlinear – Interactive; user control

Multimedia categories (2)

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- **Linear Multimedia** is a type of multimedia that is designed to be presented in a sequential manner
 - ▣ It has a distinct beginning and end
 - ▣ The user does not control the process
- **Examples**
 - ▣ Newscasts, TV
 - ▣ Cinema



Multimedia categories (3)

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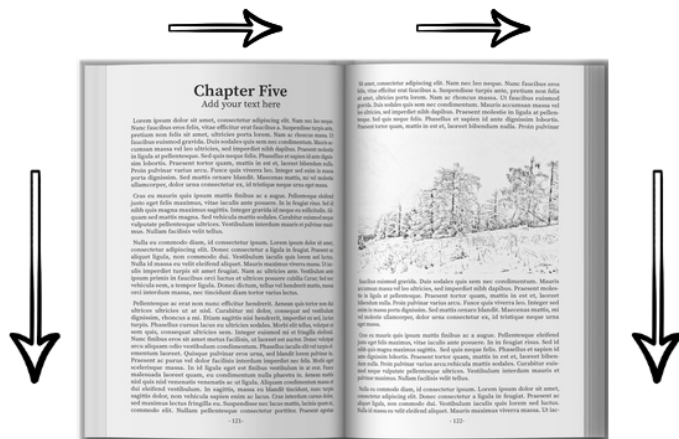
- **Nonlinear** content allows the user to control and interact with the media
 - Requires user participation/interaction
- Examples
 - YouTube – jump to a specific scene
 - Interactive learning content
 - Computer games
 - Websites



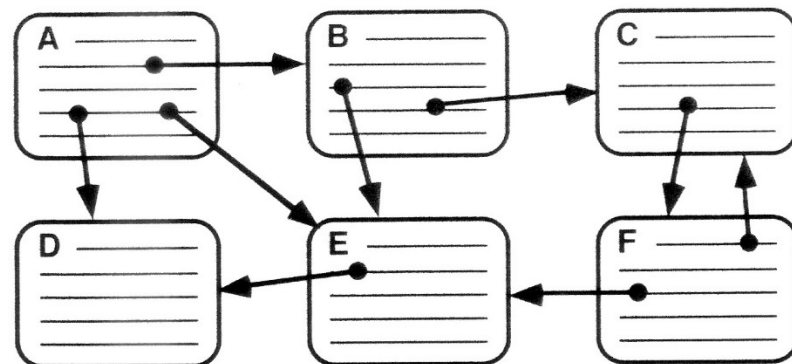
Linear/Nonlinear Example

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Linear (normal text)



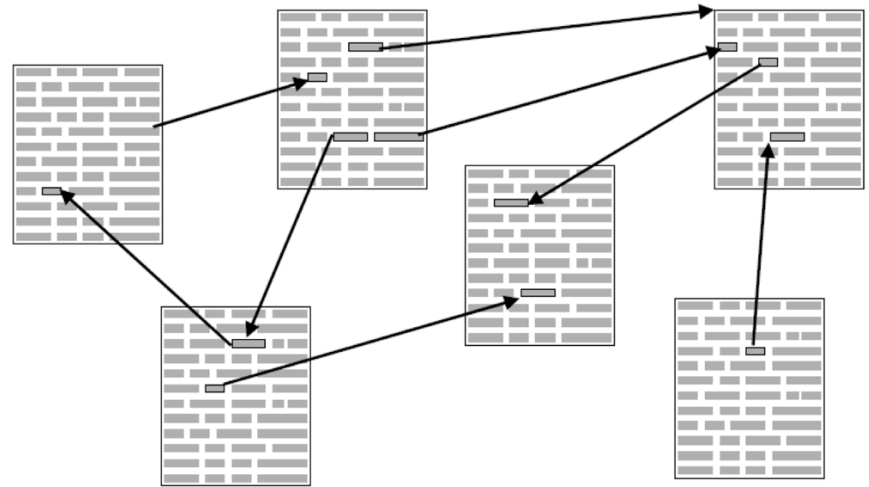
Nonlinear (hypertext)



Hypertext

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



Hypermedia

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- *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
- Ted Nelson was also the first to use this term
- The World Wide Web (WWW) is the best example of hypermedia applications

Multimedia Systems

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- A system capable of processing multimedia data and applications
- Characterized by the processing, storage, generation, manipulation and rendition of multimedia information

Components of Multimedia Systems (1)

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Components (hardware and software) required for a multimedia system:

□ **Capture devices**

- Video Camera, Video Recorder, microphone, Keyboards, mice, graphics tablets, 3D input devices, tactile sensors, VR devices, digitizing hardware



Components of Multimedia Systems (2)

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3D Input Devices

Components of Multimedia Systems (3)

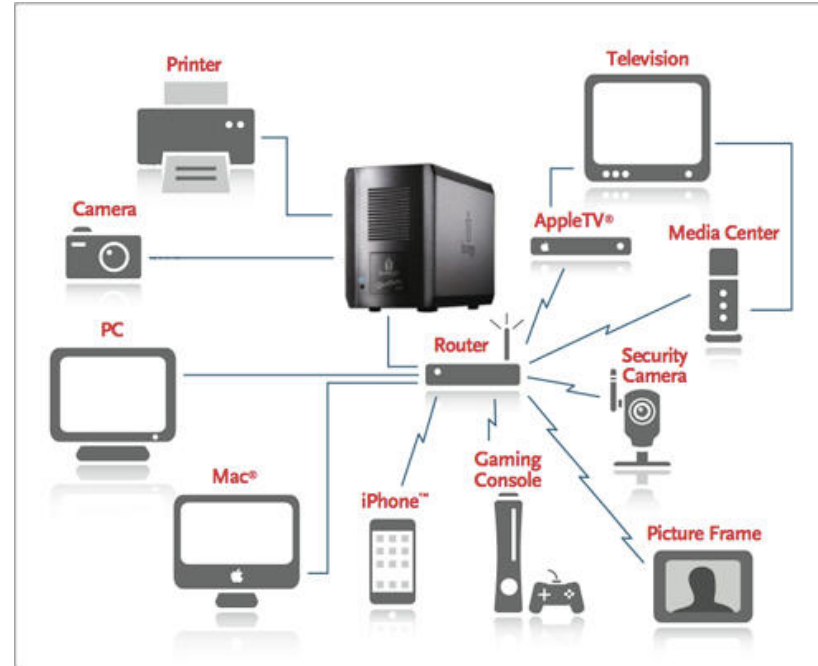
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□ Storage Devices

- ▣ Hard disks, SSDs, network attached storage (NAS)

□ Communication Networks

- ▣ High-bandwidth networks



Components of Multimedia Systems (4)

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- ❑ **Computer Systems** — Multimedia desktop machines, MPEG/VIDEO/DSP Hardware
- ❑ **Output Devices** — 5.1 surround sound, HDTV, Hi-resolution monitors, etc.

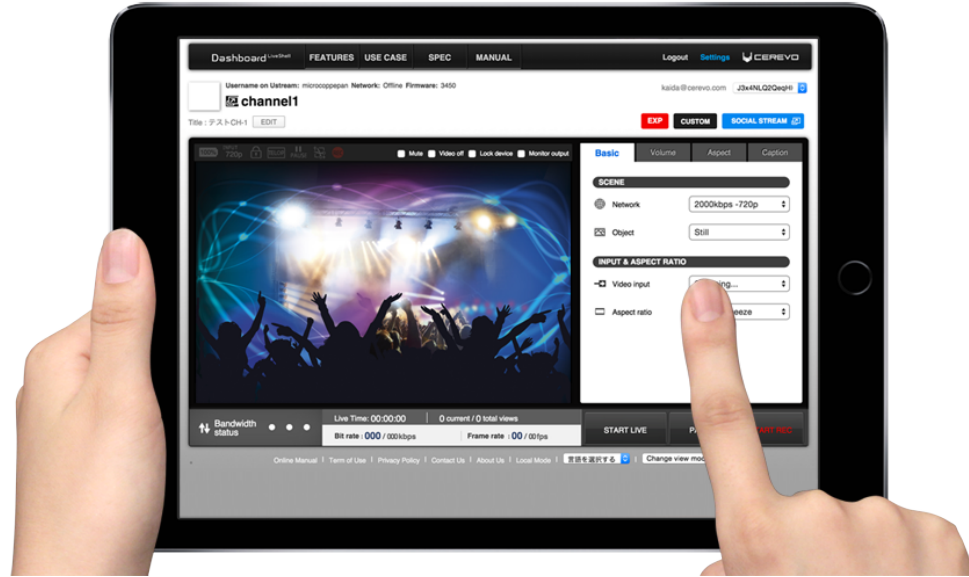


Modern Multimedia Systems (1)

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□ Tablets

- ▣ A computing device
- ▣ Has multiples inputs
- ▣ Has multiple outputs
- ▣ Has storage
- ▣ Connects to Wifi



Modern Multimedia Systems (2)

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- Smart TV: The all-in-one multimedia system?



Applications of Multimedia

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- World Wide Web
- Video conferencing
- Video-on-demand
- Interactive TV
- Digital Transmission
- Groupware
- Webcasting
- Home shopping
- Games
- Virtual reality
- Digital video editing and production systems

Multimedia Technologies Summary

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- Multimedia is integrating various forms of digital media
 - ▣ includes a combination of text, audio, still images, animation, video, and interactive content forms
- Text is miniature pictures, called fonts
- Audio is digitally stored sound
- Animation is a sequence of existing images or frames and assembled to show motion
- Video take continuous motion and splits it into individual frames
- A multimedia system is a system capable of processing multimedia data and applications

8.2. Multimedia File Formats

8.1. Multimedia Technologies

8.2. Multimedia File Formats

Learning Objectives

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- List common image file formats
- Describe how audio files are stored
- List common audio file formats
- Describe the different components of video files
- List common video file formats

Image File Formats

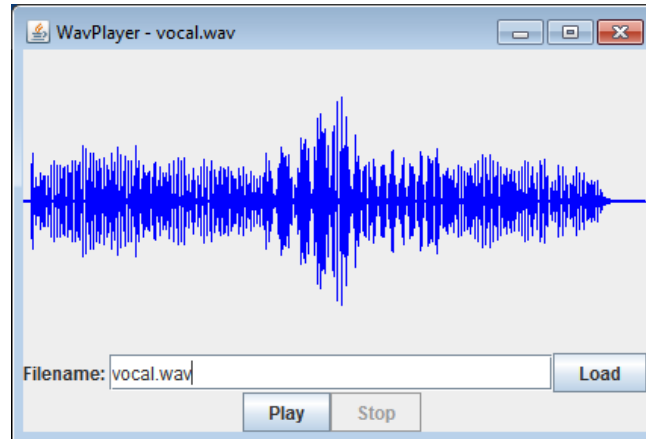
45

- Image file formats are standardized means of organizing and storing digital images.
 - Image files are composed of either pixel or vector (geometric) data that are rasterized to pixels when displayed (with few exceptions) in a vector graphic display.
- JPEG
 - Exif
 - TIFF
 - RAW
 - PNG
 - GIF
 - BMP
 - WEBP

Audio File Formats (1)

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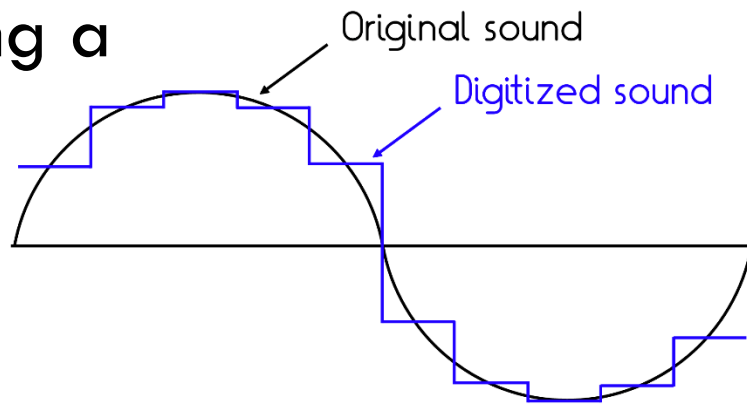
- An audio file format is a method for storing audio data on a computer system.
- The analog signal is converted using a sampling method.



Audio File Formats (2)

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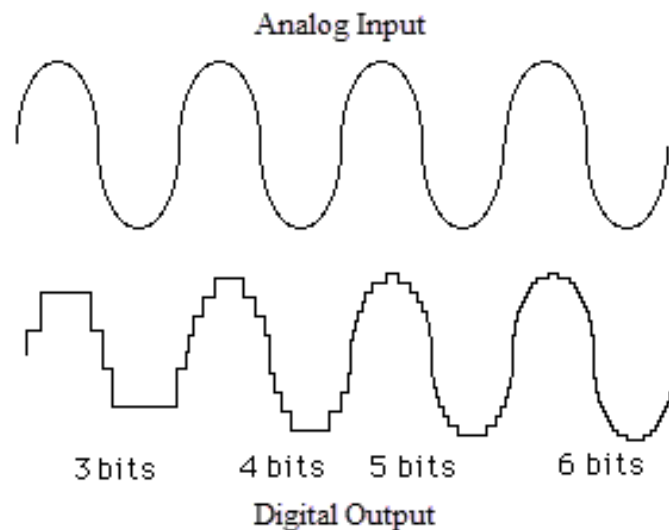
- It can be a raw bitstream, but it is usually a container format or an audio data format with defined storage layer.
- The audio is compressed using a lossless or lossy file format.



Audio File Formats (3)

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- The general approach towards storing digital audio is to sample the audio voltage at certain levels to reconstruct the waveform in a digital format
- The higher the sample rate, the higher the resolution or number of bits



Audio File Formats (4)

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Lossless

- Preserves the original audio
 - ▣ WAV, FLAC, AIFF
 - ▣ If compressed:
50-60% reduction in file size

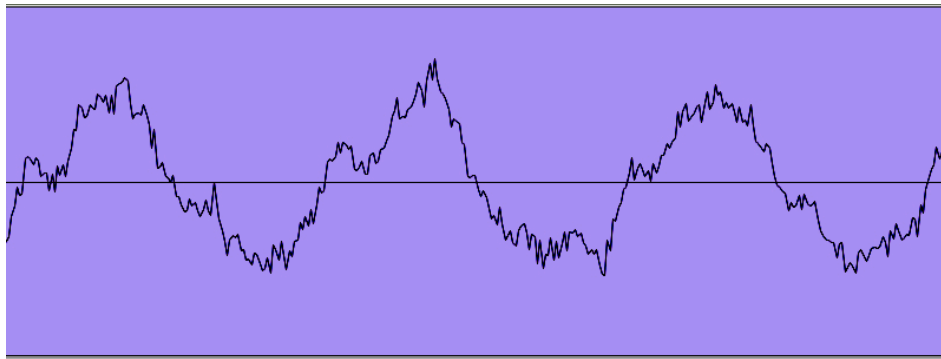
Lossy

- Simplifies the data; removes sound ranges humans cannot hear
 - ▣ MP3, AAC
 - ▣ 75-95% reduction in file size

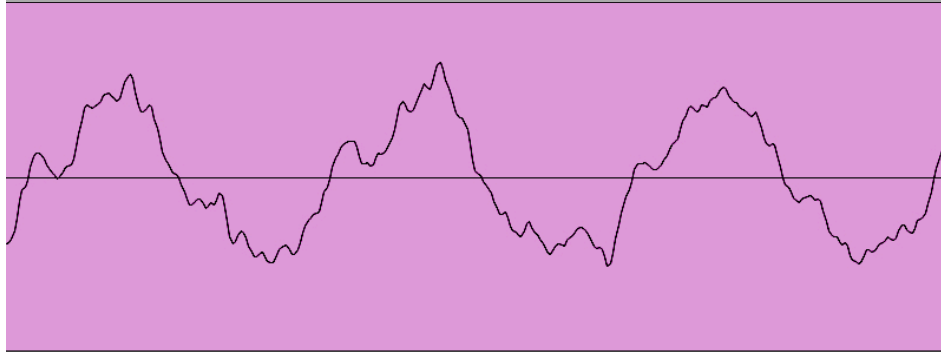
Audio File Formats (5)

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Lossless



Lossy



Audio File Formats (6)

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- ❑ Waveform Audio File Format (WAV)
- ❑ MPEG-1 /2 Audio Layer III (MP3)
- ❑ MPEG-4 Part 14 (MP4)
- ❑ Au file format (AU)
- ❑ Windows Media Audio (WMA)
- ❑ The Adaptive Multi-Rate (AMR or AMR-NB)
- ❑ Advanced Audio Coding (AAC)
- ❑ Red Book is the standard for audio CDs



Video File Formats (1)

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- The Video Files category includes a wide range of video formats, which use different codecs to encode and compress video data
- Two main parts
 - ▣ Video Codec
 - ▣ Video Container



Video File Formats (2)

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Video Codec

- It is the COmpressor and DECompressor algorithm of the video

Video Container

- The holder of the video file and components
 - ▣ Video file
 - ▣ Audio file
 - ▣ Subtitles

Video File Formats (3)

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Video Codecs

- H.264/MPEG-4 AVC
 - ▣ QuickTime
 - ▣ DivX
- Microsoft
 - ▣ WMV, WMA, ASF

Video Containers

- MP4
- MKV
- OGG
- AVI
- MOV/QT

Other formats

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- ❑ Real Video
- ❑ Shockwave
- ❑ Flash Video (FLV, F4V)
- ❑ 3GP, 3G2



Multimedia File Formats Summary

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- Common image files are JPEG, PNG, BMP, and WEBP
- Audio files are stored in a format using a sampling method to convert analog data to digital
 - ▣ Audio files are stored in a lossless or lossy format
 - ▣ Common types are WAV, MP3,
- Video files contain two parts, the codec and container
 - ▣ The codec is the *compression* and *decompression* method
 - Common codecs are H.264/MPEG-4 AVC and WMV
 - ▣ The container packages the components of the video
 - Common types are MP4, MKV, OGG, and AVI