

 **Lecture 2**

History of Multimedia

- 1928 - debut of Steamboat Willie: first cartoon to use synchronized sound
- 1930s – technicolour introduced
- 1969 – Network technology introduced
 - ◀ Arpanet (Advanced Research Projects Agency NETwork) is created
 - ◀ First packet switching network and predecessor to Internet
 - ◀ Began talking about it in 1962
 - ◀ Objective: build a network to share information
- 1977: Apple dominated PC market
- 1991: Tim Berners-Lee debuts World Wide Web
- 1992: HTML debuts
- 1993: first graphical browser: Mosaic
- 1994: Rolling Stones' first live performance on Internet
- 1995: Toy Story: first feature length computer generated movie
- 1998: Google: Larry Page & Sergey Brins
- 1991: Napster: download and share mp3s

Top 3 Applications:

1. Entertainment
2. Publishing
3. Education/training
 - Education
 - E-learning became “real” not just substitute for lack of teachers
 - Learning facilitated on-line
 - All learning technology mediated in some way
 - Shopping & Retail
 - Traditional shopping replaced by on-line shopping
 - Shopping experience changes
 - Entertainment
 - Electronic games- more virtual reality and on-line
 - Media on demand
 - Communications
 - Internet telephone and video phone systems

Multimedia Features

1. Interactivity
 - User control over the application
 - Experience active rather than passive
2. Hyperactivity
 - Index/table of contents allows for “jumping”

- Sequential: you start at the beginning and move to the end
- Hyperlinking: an index allows for “jumping around” to different sections
- Computer based multimedia applications integrate the various components of media and allow interactivity and hyperlinking
- CD/DVD
 - Access time: view in an instant by inserting into drive
 - Cannot change content
- World Wide Web
 - Access time: may encounter slow connection speeds
 - Content can be changed
- Development Systems: systems used by multimedia developers to create applications
- User Systems: systems used to play back multimedia applications

Text

- Use of text in multimedia applications varies on the type of application and audience
- Change the look of your webpage by changing text attributes & design/layout/placement

Text Attributes

- Font type
 - Serif: tails, script, body paragraphs
 - Sans-Serif: no tails, block oriented, headings/titles
- Style
 - Regular, bold, italics
- Kerning
 - Spaces between characters
- Leading
 - Vertical space between lines of text
- Special Effects
 - Underline, shadow, super script, subscript
- Size
 - Points vs. Pixels

PIXEL (px)	POINT (pt)
<ul style="list-style-type: none"> • Smallest discrete component of an image or picture <u>on a monitor</u> • Pixels are a measurement for <u>text and images</u> on the web • If webpage expresses font sizes in pixels text will display more precisely the size you want on the screen 	<ul style="list-style-type: none"> • A linear unit measuring the size of <u>text</u> • Points are a <u>print</u> unit of measure • 72 pt = 1 inch, 36 pt = 0.5 inch • If webpage expresses font sizes in points text can be displayed much larger or smaller than you expect

Colour

- Hexadecimal code

- Represented as a number of 6 digits
- Made up of decimals (0-9) and letters (A-F)
 - #RRGGBB
 - 0-9 = darker colours, A-F = lighter colours (black = #000000, white = #FFFFFF)

Text Design Considerations

- Readability
- Visual appeal: position, layout, coordinate with graphics
- Mood creation: appropriate font attributes & layout, headings

C ontrast - avoid making 2 elements just similar

R epetition - repeat some aspect of design throughout entire design

A lignment - items are aligned; creates stronger cohesive unit

P roximity - group related items together

Lecture 3

What is digitization?

- Refers to the process of translating a piece of information into bits
- Bits = binary digits
 - Fundamental units of information in a computer system ("0" and "1")
 - Electric signals translate into "bits" ("0" and "1")
- 1 Byte = 8 bits
 - x bits = # of digits, y values = # of combinations
 - ex: 2^4 (4 bit) = 16 values, \therefore x=4, y=16

Pixels

- an image is represented by a grid (array, matrix) of squares called pixels (Picture Elements)
- pixel = the smallest image component \therefore shows smallest detail
- arranged in columns and rows
- each pixel is given a numerical value that represents the corresponding colour

Colour Coding

- range of colours \square associated with number of bits
- if a pixel colour is represented by 1 bit only (0=black, 1=white) \square \therefore 1 bit allows for 2 colours
- Rule: more bits=more shades (colours)
- In true colour each pixel represents same colour shade

Colour Models

- Used for Web:

- Additive model (RGB)
 - Primary colours = red, green, blue
 - Adding light to black background (monitor) in order to obtain colour shades
- Used for Printing:
 - Subtractive model (CYMK)
 - Cyan, magenta, yellow
 - Ink when applied removes (“subtracts”) from a white background

RGB Code

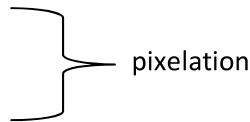
- Each pixel is represented by three values (R, G, B)
- Syntax
 - Each value ranges from 0-255
 - 0 = no colour, 255 = max amount
 - 256 colour shades = 1^8 bits
 - Need 3 bytes for true colour (8 bits = 1 byte)
 - RGB Code: <0-255,0-255,0-255> (black = <0,0,0>, white = <255,255,255>)
- The human eye can detect about 10 million colours

Types of Graphics

- Affects how the graphics are displayed on a computer screen:
 1. Quality
 2. File Size
 3. Time to display graphics

Bitmap Graphics

- Also known as RASTER graphics
- Made up of pixels
- Editing pixels = changing colour, shade and brightness
- If you start with a small image & make it larger by resizing...
 - squares become larger, edges more jagged
 - quality decreases
 - file size increases



Vector Graphics

- Image represented with lines and arcs that have a mathematical relationship which describes the drawing of the shape
- It doesn't matter what size the image is
- As the image is resized larger/smaller...
 - Edges still clean, crisp
 - No distortion going up/down in size
 - Quality is maintained
 - File size increases (if resized larger)

Graphic Software

1. Vector Based
 - Geared towards drawings
 - Greater control and precision
 - Display more accurately
 - Download faster
 - More details
 - Need a draw program (ex: Adobe Illustrator, Paint, etc.)
2. Bitmapped Based
 - Editing an image's pixels
 - Images from scanners, cameras, etc.
 - Need a paint program (ex: Photoshop)

What affects Image Quality?

- Resolution
 - Digital Camera
 - Describes the size of an image (width x height)
 - Higher resolution = larger image, better quality, bigger prints
 - Megapixel = how many millions of pixels you can capture in a photo with your digital camera
 - Monitor/Screen
 - Describes the dimensions of the pixels displayed on a screen
 - A resolution of 800 x 600 = 800 pixels wide x 600 pixels high
 - Monitor size does not matter
 - The higher the resolution, the smaller it appears

Image Resolution

- Controlled through graphics package
- Number of pixels per square inch
- Higher resolution = larger size
- dpi = ppi
- Web □ set resolution to **72 ppi**
- Laser printer □ set resolution to **300-600 ppi**
- High end image setters □ 1200-2400 ppi or higher

Image Bit-Depth

- Refers to the total number of colours in an image
- Amount of digital space used to record information about the colour of a pixel
- More bits you use = more info stored to describe the colour of a pixel, ∴ quality improves & larger file size

File Formats

- Universally supported files
 - universally supported by graphics industry (.jpg, .gif)

- Proprietary (aka: Native files)
 - bitmap or vector images used by specific graphic programs (original default formats, ex: .psd, .fla)
 - can save in both native and universal formats
 - Native □ preserves layering
 - Universal □ ability to save files in .jpg , .gif, etc.
- .GIF
 - Graphics Interchange Format
 - Bitmapped
- .JPG/.JPEG
 - Joint Photographic Experts Group
 - Bitmapped
 - Compact file

Graphics Software

- Illustration
 - Drawing program
 - Work with vector images
 - More flexibility with artwork that has to be resized (ex: create logos)
- Photo Image Editors
 - Paint programs
 - Work with bitmap images
 - Needed for working with photos, scans, or other “realistic” images
 - For the web or adding special effects to photos

Servers

- Advantages of a server:
 1. Connect: computer is on all the time and connected to the Internet
 2. Always Available: since it never gets turned off, your website will always be available
 3. Taken Care of: the people running the servers will take care of security and computer maintenance issues

Lecture 4

Image Optimization

- Optimization Techniques
 1. File Formats: choose .jpg or .gif
 2. Compression: compress the image data
 3. Colour resolution: number of colours used

File Format

- GIF Properties
 - Supports max of 8 bit colour scheme (good for clip art, not photos)

- Best for large areas of solid, flat colour
- Tiny file sizes in comparison with .jpg
- Summary: smaller file sizes but only 8 bit colour
- JPG Properties
 - Stores full colour information
 - Supports max of 24 bits per pixel (16.7 million colours)
 - Best for blends of colour, softer shadow effects, subtle changes in colour
 - Not for well defined lines or sharp contrast between colours □ distorts them
 - Summary: full colour scheme but larger file size

Compression

- To reduce file size □ choose a compression technique appropriate for the web
- Role of compression is to:
 - Reduce the redundancy of image data □ gives ability to store or transmit data in an efficient form
 - Compress as much as you can without compromising quality

Compression Techniques

- Lossless
 - Compress the original bits and bytes into less bits and bytes without losing any of the image's original information
 - When we reopen the file, all original info is still there
 - **No information is lost**
 - Gifs □ lossless compression
 - Does not get blurry or messy
 - Uses technique called "LZW" compression □ reduces file sizes of images by finding repeated patterns of pixels (ex: 12341234 turns into 11)
 - This compression maintains the image quality
- Lossy
 - When compression occurs, some of the original information is lost
 - Discards selected portions of image that are least missed or noticed
 - **Cannot get information back once it is discarded**
 - Quality degrades
 - JPGs □ lossy compression
 - Not all information from the original image is preserved □ not the same as the original; discards data
 - Degrades image quality each time you save
 - Compression is achieved by "forgetting" certain details about the image, which the JPG will try to fill in later when being displayed
 - **Human eye more sensitive to brightness details than to colour details**
 1. The quality of a JPG file is proportional to the file size
 2. A higher image quality setting has lower compression value, ∴ results in less data being distorted

Colour Resolution

- Colour resolution = bit depth

Dithering

- Definition: juxtaposing (placing side by side) pixels of two colours to create the illusion that a third colour is present (grainy look)
- Can lower download time
- Most common method of reducing colour range of images down to 256 (or fewer) colours seen in 8 bit .gif images
- If an image uses colour hues outside of browser-safe palette □ browser automatically dithers image into browser safe colours

Animation

- .gif allows for animation
- Don't need plug in for .gif animation (universal format)

Interlacing

- When the image is drawn in a series of passes rather than all at the same time (file size bigger)
- How images are downloaded to your screen

Transparency

- Allows the page background to display through the image
- Only formats that support transparency = GIF and PNG
- Transparent: every pixel in the image is either completely visible or completely see-through so that what's underneath the image shows through

PNG (Portable Network Graphics)

- Developed as a replacement for GIF due to legal issues resulting from GIF's use of the LZW compression scheme
- Lossless compression □ no discard
- Allows for image to have up to 48 bit colour
- Supports opacity and translucency

PNG-8

- Similar to GIF
- Only allows 8 bit colour
- One transparent colour
- Smaller than GIF counter parts

PNG-24

- Allows 24 bit colour

- Lossless ∴ JPG will be smaller
- Allows for transparency on each pixel

Advantages for PNG

- Lossless compression
- Smaller or same size as GIF
- Supports opacity and translucency

Disadvantages for PNG

- Older browsers may not support format
- No animation
- File size for 24 bit is bigger than JPG

GIF or JPG???	
GIF	JPG
<ul style="list-style-type: none"> • Line art, logos, illustrations • 8 bit colour resolution max (256 colours) • Lossless compression • Supports dithering • Allows for transparency • Interlace process • animation 	<ul style="list-style-type: none"> • photos, computer game screenshots, movie stills • 24 bit colour resolution • Lossy compression • Does not support dithering • Does not support transparency • Progressive JPG • Not for animation

	GIF	JPG	PNG-8	PNG-24
Best For	Logos, cartoons, drawings	photographs	Logos, cartoons, drawings	Photographs that need transparency
Compression	Lossless	Lossy	Lossless	Lossless
Browsers	All	All	All	Not on IE
Transparency	One colour only	No	One colour only	Translucency
Animation	Yes	No	No	No
Dithering	Yes	No	Yes	No
Interlacing	Yes	No (progressive)	Yes	Yes
Shape of IMG		Rectangular		

 Lecture 5

Computer Network

- Network: a group of interconnected computers (connected by wires, wirelessly, or satellites)
- Network configurations: group of millions of computers around the world that are all connected to one another

The Internet

- Internet: a global system of interconnected networks that use the Standardized Internet Protocol Suite (TCP/IP) to serve billions of users worldwide
- A network of networks
- The Internet is hardware, not software
- The World Wide Web: software that runs on the Internet
- Uses TCP/IP
 - A standard protocol
 - Rules for the format and transmission of data

TCP

- At the sending end
 - Takes large chunk of data and breaks into small **packets**
- At the receiving end
 - Detects lost packets
 - Rearranges and reassembles the packets
- Packet: a small group of bytes consisting of...
 - Header (usually 64 bytes)
 - Destination, source
 - Body (512 bytes)
 - Actual message

IP

- IP = Internet Protocol
- Picks a route for a packet, stopping at routers which pick the next best machine/network to send the packet to
- If communication line is down/broken □ sends the message back to TCP and tries a different route
- All computers on the Internet need to be identifiable

IP Address

- Identifies each computer or device connected to the internet
- Consists of 4 numbers with dots between them
- Each number ranges from 1-255 (ex: 192.102.249.3)
- IP addresses are not geographical

Summary

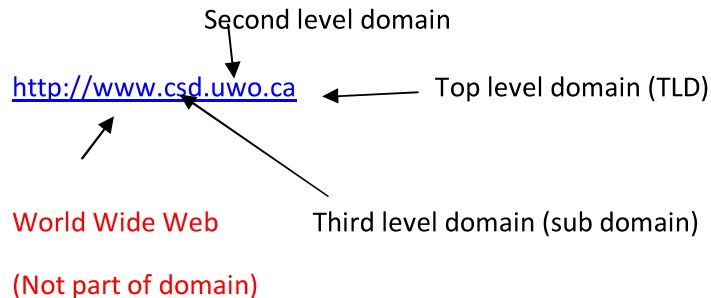
- TCP breaks webpage into packets of bytes
- TCP figures out IP address of where it wants to send the packets (destination)
- TCP figures out IP address of where the packet is coming from (source)
- Sends off each packet to first machine (IP address) on the route – does not re-plan route
- Packet stops at first machine, likely a router, then the router sends it to the next machine on the journey (IP address) and so on until it reaches the final IP address (destination)

Domain Name

- The text name corresponding to the numeric IP address of a computer on the Internet
- A DNS (Domain Name System) maps the domain name to the correct IP address so data can route to the correct computer

URL

- Uniform Resource Locator
- A web document address on a computer
- Established by Tim Berners-Lee



Sub Domains

- Used to organize your web server (just like folders and directories organize your computer)

Starting a Website

1. Choose a domain name
 - TLD identifies type of organization associated with the domain
 - Cost: you pay for securing the domain name on a per year basis

Suggestions:

- Keywords: pick a domain name with keywords in it
 - Be memorable: descriptive, memorable, and easy to spell
 - Avoid hyphens: use only if you don't have a choice
 - Buy ".com" first: default extension in most people's mind
 - Keep it short: people remember short names
 - Kill procrastination: register ASAP
 - Get creative: if first name is taken, add "e" or "i" or # in front of name
 - Know the rules of domain name
 - Test it out before buying
 - Buy up misspelled domains
2. Order Web Hosting
 - Web Hosting: the source that provides Internet users with online systems for storing information, images, video, or any content accessible via web

- Web Hosts: (Internet Service Provider- ISP) Companies that provide space on a server they own for use by their clients as well as providing Internet connectivity
- ISP provides user accounts for accessing Internet, email access, web space to host/hold your website

Lecture 6

Setting up a Website

1. Planning & Designing
 - Meeting with client □ info gathering, ask questions and listen
 - Define business requirements
 - Decide on colours, fonts, backgrounds, links
2. Implementation
 - Who will the maintainer be?
 - Straight HTML programming vs. Web page software?
 - Complexity
 - KISS principle
 - Effective design techniques- CRAP
 - Test in different browsers
 - Documentation
3. Publish
 - Web space
 - Use FTP software (File Transfer Protocol)
 - Upload once site is ready
 - *Back up your files*
4. Maintenance
 - Who is the maintainer? - training
 - Update frequently
 - Documentation
 - Backup your information

Designing for the Web

- Web Page
 - HTML
 - Computer instructions used to create web page
- Web Site
 - Collection of web pages created and maintained by an organization/individual
- Web Server
 - A computer that stores web pages and makes them available for people to see on the Internet
- Web Browser
 - HTML = hyper text mark-up language
 - Computer instructions read by browser
 - HTML tags: <square brackets>, <title> browser title bar

Lecture 7

Website Design & Searching

- HTML Tables & Dreamweaver
 - Tables are made up of rows and columns
 - Cell = where row meets columns
 - Can hold any kind of data
 - Nested table = table inside another table
 - Tables can be expressed in terms of percentage or pixels
 - Percentage = % of the browser, not entire screen
 - Pixels = resolution of screen
- Publishing your website
 - FTP software
- Marketing your Website
 - Try to make your website be in the first ten listed on search engine
- Directories
 - Not automated
 - Real people decide how to organize it
 - Drill down to category and subcategories

Search Engines

- How does a search engine work?
 - Part 1: finding all the data on the web and building a database
 - Part 2: given keywords from a searcher, returning the best/most appropriate pages
- 1. Building the database
 - Web crawlers or web spiders crawl the internet instantly
 - Index contains list of alphabetical list of words it finds, where within the page the word was and the links where it found the words (aka: keywords)
- 2. How does the search engine decide which pages to return to the searcher?
 - Uses index to decide which pages have the given keywords
 - Every engine uses slightly different algorithms to decide the order of displaying the returned pages
 - Google uses “page rank” algorithm

Search Engine Optimization

- Three components to look at when trying to make your site more visible:
 1. Text
 2. Links
 3. Popularity
- 1. Text Component:
 - Set of words or phrases

- Crucial you know what keywords that the users will type to find your products or services

Step 1: identify the crucial keywords

Step 2: put the keywords in the best locations

- Search engines also use the placement of keywords to weight the ranking of the webpage
2. Link Component:
 - Make sure your links are easy to navigate so that web spiders can search through your content easily and index all your content
 3. Popularity Component:
 - Link popularity: high quality links; remember Page Rank
 - Click through popularity: measures how many times your site is clicked on, a user returns, a user stays

History of Searching the Net

- First came Archie (short for achieves)
- Then came Gopher
- 1991: World Wide Web, Tim Berners-Lee

Lecture 8

Animation

- What is animation?
 - A sequence of images that create the illusion of movement when played in succession
- Why use animation?
 - Easier to show someone how something works then trying to explain it
 - Animation:
 - Indicated movement
 - Illustrates change over time
 - Visualize 3D objects
 - Attracts attention
- How does animation work?
 - Simulation of movement □ series of pictures that have objects in slightly different positions
 - Each drawing is called a frame (a snapshot of what's happening at a particular moment)
 - Frame rate: indicated the playback speed of the animation in frames per second

2-D Animation

- Cell animation (also called traditional animation, classical animation, hand-drawn animation, frame by frame animation)
 - Animator must draw every single frame by hand
 - Snow white = first full length animated cell based movie (1937)

- Path based animation
 - Pick:
 - a starting point
 - an ending point
 - a path for the object to follow
 - a computer generates all frames in between (called **Tweening**) so the artist doesn't have to draw the intermediate frames
 - if the motion appears too slow, you can speed up the motion by:
 - reducing the number of frames
 - increasing the frame rate
- The more FPS the more believable the movement will be
- The more FPS the bigger the final version of the movie will be

Special Effects Animation

- Morphing
 - A process of blending together two images into a series of images
 - Useful for showing how image might change over time
 - Morphing done in 2D but usually in 3D because subjects chosen
- Warping
 - Distorts a single image
- Virtual Reality
 - Creates environment where user becomes part of the experience

Flash

- A multimedia authoring and playback system
- Launched by macromedia in 1996
- Bought by Adobe in 2005
- Flash became popular for its animated graphics

Lecture 9

What is video?

- A sequence of still images (photographs) that create the illusion of movement when played in succession

Video History

- Digital video adheres to standards to TV Broadcasting
- TV Broadcasting began in US in 1939
- **Standard broadcasting for Britain = PAL**
- Experiments with high definition started in 1940s & 50s but wasn't adopted until 1996
- Before 1996, all TV was broadcast using interlaced display and fields

How Did Original TV Display Work?

- Eyes can see phosphor dots on screen
- An electron beam (gun) activates the dots, gun scans through the dots horizontally
- A complete scan is when the gun starts at the top left and scans several times horizontally until it gets to the bottom right
- Scan only draws every other line then starts back at the top and scans the even lines
 - Two passes – each pass is called a field
 - Process is called interlaced display

Sampling and Quantizing of Motion

- Sampling process: each frame is sampled into a discrete sample \square becomes a pixel
- Remember:
 - More samples = better quality, bigger file size
- Quantizing process: each pixel gets assigned a colour, 2 colours, or 16 million colours

NTSC Standards

- The frame size of the NTSC standard DV frame is 720 pixels x 480 pixels
 - Frame aspect ratio is 4:3
 - Pixels are distorted (not square) because 720:480 is usually 3:2 ratio, \therefore must change the pixel aspect ratio
- High definition for NTSC
 - 1440 x 1080
 - 1280 x 720
 - Frame aspect ratio is 16:9
 - 1440:1080 = ratio is 1:333 (pixels not square)
 - 1280:720 = ratio is 16:9 (pixels are square)

Displaying Digital Video

- Can display video on computer, TV, DVD
- Not all digital video must conform to NTSC standards. Digital video that will primarily be played on a computer does not have to conform, but digital video that will be used in DVD playback needs to conform
- On a computer:
 - Digital video displayed on a computer is still very tied to analog TV standards
 - Sixes = 320 x 240, 640 x 480 (both 4:3 ratio)

Capturing the Video

- Analogue Camcorder
 - Must convert to digital before putting it on the computer to edit \square need a video capture card to convert analogue video into digital
- Digital Video Camcorder
 - No need to convert
 - Most DV camcorders do a little bit of compression right inside the camera. DV25 is the most common DV compression used by today's camcorders

Colour Compression

- RGB is commonly used for still images
- For video the model is YUV (YIQ) or Ycbc
 - Y = luminance (brightness)
 - UV = CbCr = chrominance (colour/hue)

Format Comparison	
Format	Lines of Resolution
VHS, VHS-C (Beta)- Analogue Camcorder	240
8mm	240
Hi 8mm	400
Most older TVs (before 1995)	480
Digital Video Recorders- Mini DV	480
High Definition TV and High Definition	720 or 1080

Firewire vs. USB

- To get digital video off of you camera onto your computer you must use either
 - Firewire (i.link (sony) IEEE1394) – peer to peer technology
 - USB cord

Video Editing Software

1. Import capture card, images and sound into project
2. Arrange the material on the timeline
 - Trim clips as needed
 - Might remove/trim some sound and add music, etc.
3. Apply transitions, special effects, some common ones:
 - Straight cut = put two clips right against each other with no transition
 - Dissolve = fade from one clip to the next
 - Adding titles, credits, captions

Lecture 10

Editing a Video

- Before digital video
 - Copy from one tape to another
 - Load up takes on a machine to copy
 - Loss of quality after each copy made
- Now
 - can easily move clips around
 - no loss of quality
 - slight compression occurs in the camcorder when video is captured

Data Rate

- Amount of video processed per second
- Average data rate = file size/length

Compression Strategies

1. Lower frame size of the video
2. Lower frame rate of the video
3. Pick a codec that does higher compression

Codec

- A codec is a piece of code that compresses the video or audio as it is created (exported from the editing software) and then decompresses the video or audio when displayed to the user □ also stands for coder/decoder
- There are lots of coders, you have to use the same one to decompress that was used to compress the video
- Most common coders are:
 - Sorenson Spark
 - H.264
 - DIV-X

Compression Strategies Cont'd

4. Pick a codec that does higher compression
5. Lower the picture quality of the video
6. Lower the colour depth
7. Play with the audio

Compression Concepts

- Spatial Compression
 - Compresses each frame individually
 - Uses same techniques as JPG compression
 - Codecs that do spatial compression □ animation, planar RGB
- Temporal Compression
 - Only saves info on selected frames (called keyframes)
 - All other frames just have differences from the previous keyframe
 - Good when the difference between current frame and keyframe is small
- Lossy vs. Lossless Compression
 - Depending on the codec
 - Lossless □ looks for large blocks of pixels that are the same
 - RLE (run length encoding)
 - Lossy □ lowers video quality but gets better file size & data rate

Terms You Need to Know

- Container file format

- A file format that stores both the data (the frames) and how to play the data (which codec to use)
- Some common containers are:
 - o .avi – sometimes has uncompressed video
 - o .mov
 - o .fla
 - o .mkv – newest & open source, allows you to store unlimited audio & video
- Digital Media Player
 - A piece of software that will play multimedia files (audio or video)
 - Most players play a variety of formats
 - Examples: Windows Media Player, Quicktime, iTunes, Real Player
- Video on the Web
 - 3 main ways to get video/audio (media) from a website onto your computer so you can view it
 - o Download
 - o Progressive download
 - o Streaming – media that is constantly received by and displaced to an end user while being delivered by a streaming provider
 - Media is either streamed or not streamed

Download

- A click begins the download, after some portion of the file has been downloaded the video will start to play
- The player calculates the speed of the download and guesses when to start playing it
- Data that is sent is permanently stored on the end machine
- Disadvantages: interrupts while watching video if played too early
- Advantages: get to start watching movie earlier than true download

Streaming

- In true streaming the file is never permanently saved to the user's computer, media begins to play as soon as it gets a packet
- Disadvantages: requires server to be streaming server
- Advantages: fastest □ reduces waiting time for users
- Drawback: congestions may cause the media to stall if download process can't keep up with the playback, doesn't take up disk shortage, live playback, great for long videos
- Need a special server using a Real Time Streaming Protocol
- In order to do streaming video, you need two things
 1. A streaming web server
 2. A video that has been converted to be streamed
- Unicast: each user gets their own stream of video, the server has to send out a lot of data if several users are watching at once
- Multicast: send the same stream to a bunch of users but then they lose their ability to pause, rewind, etc.

Video on Multimedia Applications

- Source: quality is tied to colour, resolution, fps, compression, format, frame size
- Appropriateness: if the quality of the video is going to be bad (because of required compression) perhaps images or animations should be used instead
- Playback systems: will the user have the required playback software?
- User controls: let the user have ability to pause/stop/loop/control volume

Lecture 11

What is sound?

- Sounds are pressure waves of air
- Visualize a sound as a series of recurring waves called a wave form
- Voice muscles vibrate and cause the air to move □ thus cause sound (a series of waves)

The NYQUIST Limit

- This rule says you must take at least two samples for every cycle of the wave. If you take less than two samples, you will get a completely different sound wave.
- Sample rate = number of samples we take per second of audio or number of times per second the wave form is measured

Typical Sample Rates

- Voice only (telephone quality) = 8 KHz
- AM radio quality = 11.025 KHz
- FM radio quality = 22 KHz
- CD quality music= 44.1 KHz

How does the sound wave get converted to be stored on our computer?

- Computers have a sound card which samples (sets the number of samples and quantizes) the sound wave from a microphone
- Sound log has an analog-digital converter (ADC) for recording, and a digital-to-analog converter (DAC) for playing audio

Sound Editing

- Rearrange the waveform
 - Cut, copy, drag, trim parts of the waveform
 - Overlap two or more pieces of audio
 - find words you want to edit out and cut them from the waveform
- Modify the volume
 - Use amplify, fade-in, fade-out, envelop, normalize
- Noise Reduction
 - Hiss reduction – noise within a given frequency range

- Noise reduction/removal – software examines the audio and finds unusual differences from waveform and removes them. Need a longer piece of audio than for HISS reduction □ software had to analyze the audio to generate stats on what is unusual
- Special effects
 - Adding echo, changing the pitch of a portion
- Down sample and reduce the bit depth (i.e. compress)

Sound Compression

- reduce the number of samples (sample rate)
- reduce the bit depth (sample size)
- reduce the channels
- compress using the appropriate codec

Audio Compression

- file formats that use lossless codecs/compression
 - there are a few but not very common
- common file formats that are uncompressed
 - .wav (very common, 44KHz, 16 bit)
 - .aiff
 - .cdda (Red Book) – standard for CDs, 44 KHz, 16 bit/sample, 2 channels
 - Note: .wma and .mp4 are lossy and allow for built-in lockdowns

<u>Audio File Formats</u>			
Audio Format	File Extension	Advantages	Disadvantages
Advanced Audio Compression	.aac	<ul style="list-style-type: none"> • Good sound quality • Used on iTunes 	<ul style="list-style-type: none"> • Copy protected • Limited to approval devices
Audio Interchange Format	.aif/aiff	<ul style="list-style-type: none"> • Excellent sound quality • Supported without a plug-in 	<ul style="list-style-type: none"> • Uncompressed; large files
MP3	.mp3	<ul style="list-style-type: none"> • Good sound quality even though compressed • Can be streamed over web 	<ul style="list-style-type: none"> • Requires stand-alone player or browser plug-in
Real Audio	.ra/.rx	<ul style="list-style-type: none"> • High compression • Very small files • Can be streamed over web 	<ul style="list-style-type: none"> • Sound quality not great • Requires a player or plug-in
Wave	.wav	<ul style="list-style-type: none"> • Good sound quality • Supported without a plug-in 	<ul style="list-style-type: none"> • Uncompressed; large files

Windows	.wma	<ul style="list-style-type: none">• Good sound quality even though compressed• Used on music download sites	<ul style="list-style-type: none">• Files can be copy protected• Requires windows media player 9 or higher
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MIDI Sound

- Does look at sound waves, it looks at the notes – great for instruments but not for human voice
- MIDI deals with music and synthesized sound, it does not handle voices or noise well
- No sampling or quantizing when storing
- MIDI files hold information about music or sound □ how long you were holding it, note being held, how hard note was pressed
- Staff view: working with notes on a sheet of music
- Advantages: small file sizes, easy to edit and change
- Disadvantages: doesn't work for voice, can't incorporate into website easily