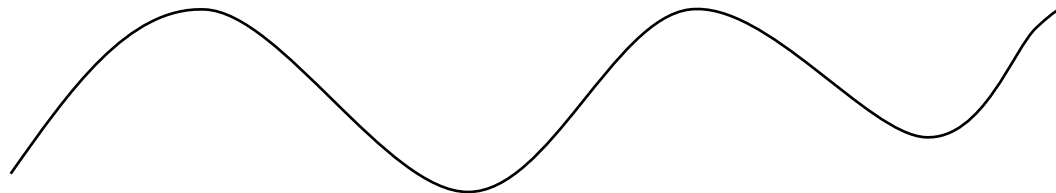




Audio (Sound)

Sound

- Sound in the natural world is analog and the result of a stream of continuous changes of vibrations in the atmosphere
- See Audacity – Digital Audio tutorial
http://audacity.sourceforge.net/manual-1.2/tutorial_basics_1.html



- Sound must be in digital format to be used on the Web.
- The process of converting an analog sound to numbers is called **encoding** or **sound sampling**.



Basic Digital Audio Concepts

■ ***Sampling Rate***

- Number of samples taken per second
- Standard sample rates:
 - 8 KHz (AM radio), 11.025 KHz, 11.127 KHz
 - 22.05 KHz (High quality / good for mono)
 - 44.1 KHz (CD quality)
 - 48KHz (DVD quality)

■ ***Bit Depth***

- Number of bits used to sample the sound
- Standard bit depth: 8-bit (telephone), 16-bit (CD quality), to 20-, 24-, 32-, and 48-bit depths (high-end digital audio)



Basic Digital Audio Concepts (cont)

■ ***Bit Rate***

- 32 kbit/s – MW (AM) quality
- 96 kbit/s – FM quality
- 128–160 kbit/s – Standard Bitrate quality; difference can sometimes be obvious (e.g. bass quality)
- 192 kbit/s – DAB (Digital Audio Broadcasting) quality.
- 224–320 kbit/s – Near CD quality.

■ ***Channel***

- Mono: one-channel
- Stereo: two-channel




Optimal Sound Quality Settings

- Based on my web research, you should use the following sound quality settings:
 - 16 bit depth,
 - 44.1 kHz sampling rate,
 - Mono channel (stereo OK)
- Apple Guide to understanding file formats, adding metadata, and compressing file in iTunes:
http://images.apple.com/support/itunes_u/docs/iTunes_U_Creating_Content.pdf



Optimizing Audio Files for the Web

- Create a balance between transfer time and sound quality
 - Length
 - Shorter audio clips = smaller files
 - Number of channels
 - Mono file = $\frac{1}{2}$ stereo file
 - Bit depth
 - 8-bit file = $\frac{1}{2}$ 16-bit file
 - 8-bit for Web usage
 - Sampling rate
 - 22.05 kHz = $\frac{1}{2}$ 44.1 kHz
 - 8 kHz voice-only and 22 kHz music files for Web usage



Various Levels of Uncompressed Audio for a One-minute Recording

	44.1 kHz	22.050 kHz	11.025 kHz
16-bit stereo	10.01 MB	5.05 MB	2.52 MB
16-bit mono	5.05 MB	2.52 MB	1.26 MB
8-bit stereo	5.05 MB	2.52 MB	1.26 MB
8-bit mono	2.5 MB	1.26 MB	630 KB



Uncompressed Audio File Formats

Format	Description
AU	Sparc-audio, or u-law format, is an older type of sound file format that generally has poorer sound quality and other files.
WAV	<p>Waveform (or wave) files are the most common sound format on the Windows platforms; it is also supported on Macs.</p> <p>Most recording happens directly into a .wav file. An uncompressed format will allow for future editing. The file sizes tend be very large, so they are not typically used for playback or distribution on the Internet.</p>
AIFF	Audio Interchange File Format is very common on Macs. It's also supported on the Windows platforms, but is not very common on the Web.
MIDI	Musical Instrument Digital Interface format contains instructions to recreate a musical sound rather than a digital recording of the sound itself. It is well-supported and files are very small, but it is useful only for certain applications because its reproduction quality is often limited by PC playback hardware.



Audio File Compression

- Audio File Compression

- **Codec**: the COmpression/DECompression software

- Audio file is compressed on the serving side

- Audio file is decompressed back on the receiving end

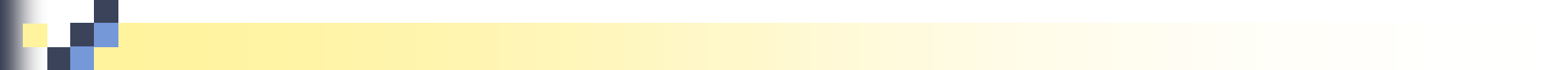
- Types of compression

- **Lossy** compression

- Discards frequencies on the high and low ends of the spectrum and removes unnecessary data

- **Lossless** compression

- Squeezes sound data into smaller packets of information without discarding anything

- 
- WAV is an uncompressed file format. Some equipment records directly into a .wav file. Although an uncompressed format will allow for future editing, the file sizes tend to be very large, so they are not typically used for playback or distribution on the Internet.
 - MP3 is a compressed file format. Compression allows for mp3 files to be easily distributed across the Internet that still sound good. Almost every media player supports the playback of mp3 files. Because of compression, there is a loss of information that makes editing of mp3 not a good idea.



Multimedia Delivery

■ Streaming

- Sends data to the desktop continuously into a buffer which is immediately playback – not stored on hard drive
 - Works by first compressing a digital audio file and then breaking it into small packets, which are sent, one after another, over the Internet.
- Once played the data is discarded
- Potential lose frames due to buffer or network problems

■ Downloadable

- Files are stored on client hard drive
- Quality is higher than streaming media



Downloadable and Streaming Media

ADVANTAGES OF DOWNLOADABLE MEDIA

- Once the file has been downloaded, it can be accessed again and again.
- Downloadable media utilizes HTTP protocol to transfer the data, and therefore does not require a specific media server.

DISADVANTAGES OF DOWNLOADABLE MEDIA

- Downloading media can take long periods of time, depending on the speed of the Internet connection and the size of the file.
- Typically the file is extremely large, resulting in both a long download time and considerable storage space being consumed on the user's computer.

ADVANTAGES OF STREAMING MEDIA

- Users have random access to the data, meaning they can choose the file portion they want to play via the player's control buttons.
- Streaming media consumes RAM only while being played and is purged after viewing.

DISADVANTAGES OF STREAMING MEDIA

- Streaming media has very high bandwidth requirements.
- Streaming media frequently requires a specific media server to transfer the data.



Streaming Technology

■ **Server Software and Protocols**

□ Streaming Protocols

- UDP (User Datagram Protocol)
- RTSP (RealTime Streaming Protocol)
- RTP (RealTime Transfer Protocol)

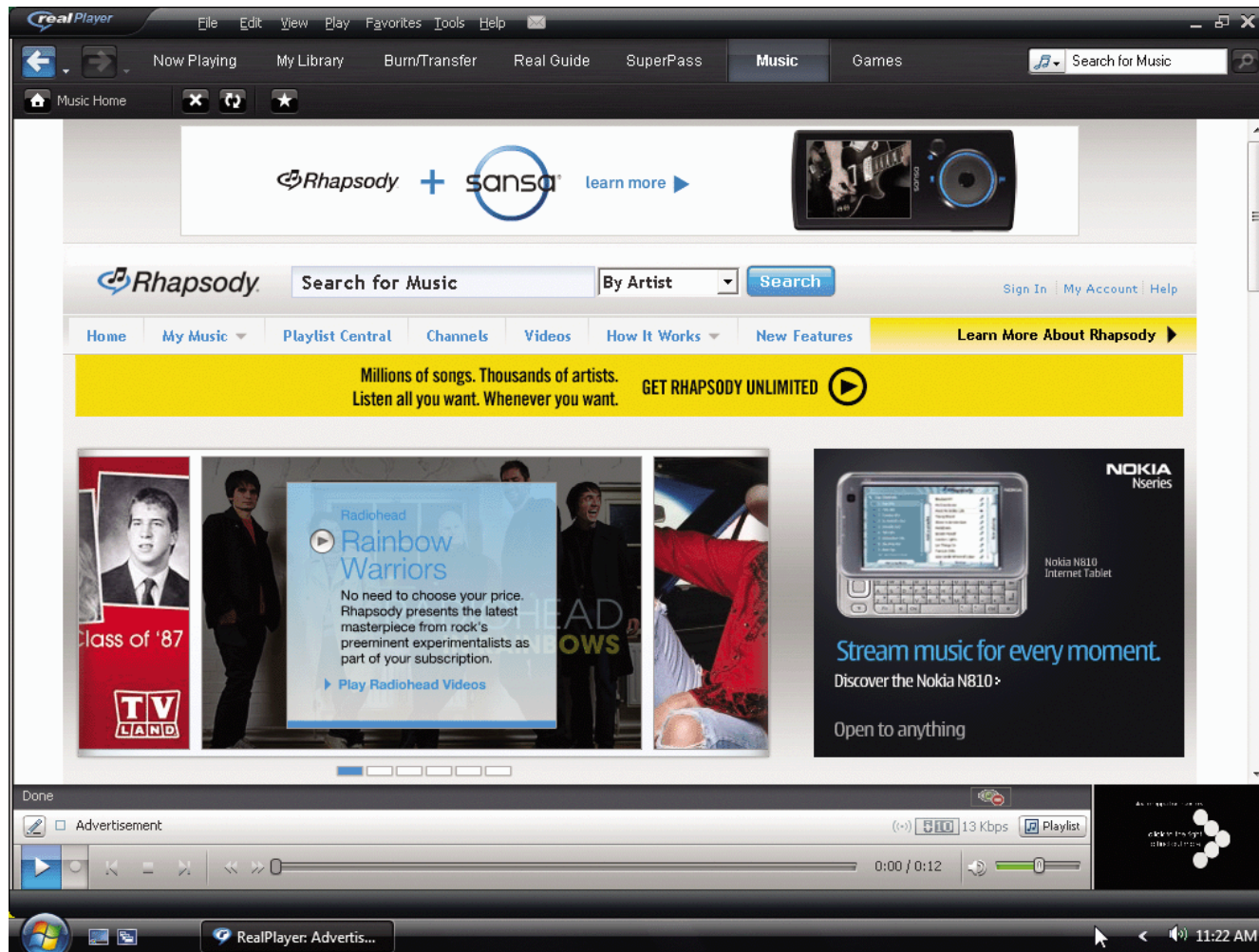
□ Streaming server software

- Windows Media Server
- RealNetworks Helix Universal

■ **Pseudostreaming (HTTP-Streaming)**

- Media formats that are designed to begin playing before they've completely downloaded; no streaming server
 - Windows Media, RealMedia, QuickTime, MP3, Flash

Streaming Audio



Visitors are offered a variety of songs to choose from the Web site.



Streaming Audio Format

- RealMedia/RealAudio (.rm, .ra)
 - Widely used format
 - Delivery: Streaming (the RealNetworks Helix Universal server); HTTP-streaming
 - Creation tool: *RealProducer Plus*
 - Player: RealPlayer; RealPlayer Plus, RealPlayer plug-in
- Quicktime (.mov)
 - Create high-quality, cross-platform streaming audio
 - Delivery: Streaming (the QuickTime Server); HTTP-streaming
 - Creation tool: *QuickTime Pro*
 - Player: QuickTime Player; QuickTime plug-in



Streaming Audio Format

- Windows Media (.wma, .asf)
 - Developed by Microsoft
 - Codecs are automatically downloaded by the player
 - Delivery: Streaming (the Windows Media Server); HTTP-streaming (.asf); download (.wma)
 - Creation tool: *Windows Media Encoder*
 - Player: Windows Media Player
- Flash (.swf)
 - Small file size, support streaming audio
 - Delivery: Streaming (QuickTime or RealServer); HTTP-streaming; download
 - Creation tool: *Adobe Flash*
 - Player: Flash Player; Flash plug-in



Streaming Audio Format

- MP3 - MPEG-1 Audio Layer 3 (.mp3)
 - Developed by MPEG (Moving Picture Experts Group)
 - Lossy compression - Discarding components less audible to human hearing and recording the remaining information in an efficient manner – easy web distribution.
 - Delivery: Streaming (the SHOUTcast server); HTTP-streaming; download

- AAC – Advanced Audio Coding (.aac, .m4a, .m4p, .mp4)
 - Developed by MPEG as the successor to MP3
 - The audio format at the core of the MPEG-4 standard
 - Offers higher sound quality at lower file size than MP3
 - Adopted by the iTunes Music Store