

Compressing and streaming with Open tools

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Presentation plan

- **Overview of Audio coding**
- **Available free open source implementations**
- **Streaming with Icecast**

Audio coding methods

- **Perceptual coding: lossy, low-medium bitrate**
 - Based on psycho-acoustic model of the ear
 - Most of MPEG algorithms (Layer II, Layer III/mp3, AAC family)
- **Linear coding: lossless, high bitrate**
 - PCM
 - Compressed PCM using entropy coding methods
- **Parametric coding: lossy, very low bitrate**
 - Vocoder

Audio coding

- **Free Open Source implementation of MPEG algorithms**
 - **MPEG standards specify framework but not encoder parameters => be careful with audio quality**
 - **TwoLame: MPEG Layer II**
 - **Lame: MPEG Layer III (mp3)**
 - **FAAC: MPEG AAC-LC**
- **Free Open Source audio coding algorithms**
 - **Ogg/Vorbis: perceptual coding similar to MPEG Layer III, AAC**
 - **FLAC/Monkey Audio/Shorten: Lossless audio coding**
 - **Speex: speech coding**

Some legal aspects

- **MPEG standards**

- **MPEG algorithms are standardized but not patent free !**
 - **Royalty fee on encoder and decoder (generally per channel)**
 - **Sometime recurring royalty fee for use. Example: H.264 video**
- => Be careful with free open source MPEG implementations**

- **Free open coding algorithms**

- **No explicit patents**
- **Submarine patents (patents on processes) may be an issue. Difficult to evaluate**

Ogg/Vorbis



- **Maintained by Xiph.org foundation**
- **Ogg: container, Vorbis: perceptual audio coding**
- **Library: BSD licence, tools: GPL**
- **Perceptual audio coding**
 - **Based on MDCT and vector quantization**
 - **Bitrate settings: from 45kbps to 500kbps**
- **Performances similar to AAC-LC according to authors**

TwoLame

- **Open source implementation of ISO MPEG-1/2 Layer II**
 - **Format much used in broadcasting (production, DVB, DVD, etc)**
 - **Advised bitrate: >256kbps for stereo**
- **Support variable bitrate. (Hack, VBR is not ISO compliant)**
- **Be careful with audio quality, especially at low bitrate**
 - **Psychoacoustic model from ISO**
- **<http://www.twolame.org/>**

Lame



- **Open source implementation of ISO MPEG-1/2 Layer III (mp3)**
 - **Psychoacoustic model rewritten**
 - **Developers assume even/better quality than with Fraunhofer reference implementation**
- **Used in most of free software tools available**
- **<http://lame.sourceforge.net>**

FAAC/FAAD2

- **Open source MPEG-2/4 AAC implementation**
- **FAAC: encoder**
 - **Support AAC-LC, Main profiles**
- **FAAD2: decoder**
 - **Support AAC-LC, Main, SBR/PS (HE-AAC) profiles**
- **Be careful with audio quality**
- **<http://www.audiocoding.com> (source code only)**

FLAC



- **FLAC: Free Lossless Audio Coding**
 - Average compression: 60% of the original
 - Backward compatibility with previous versions
 - Multiplatform. Hardware: Slimdevices, Denon,...
 - Latest version keep BWF header (encoding/decoding)
 - Streamable



- **Use case: Euroradio file exchange (MusiPOP)**

FLAC compression ratio

- **Compression ratio (in % from original)**

Extracts:

- **C1-7: Classical music**
- **C8: Jazz**
- **R1-R4: Pop, rock, electro**
- **S1-3: Speech**

- C1: 41%
- C2: 49%
- C3: 37%
- C4: 34%
- C5: 38%
- C6: 22%
- C7: 30%
- C8: 57%
- R1: 61%
- R2: 61%
- R3: 71%
- R4: 64%
- S1: 37%
- S2: 39%
- S3: 34%



22% of the original size



71% of the original size

Other lossless audio coding systems

- **Wavpack**
- **Monkey's audio**
- **Shorten**
- **TTA**
- **MPEG-4 ALS**
- **Comparison on <http://wiki.hydrogenaudio.org/>**

Tools for audio coding/decoding



- **VLC: player, encoder, converter, streaming**
 - Runs on all platforms
 - Support a wide variety of audio and video coding tools



- **MPlayer: player, encoder, converter**

- **DBPoweramp: converter (free but not opened)**
 - User friendly tool for many format conversion

Video coding

- **Dirac, Royalty free format by BBC R&D**
- **Theora: Royalty free format by Xiph.org foundation**
- **XVid: MPEG-4/H.263 implementation**

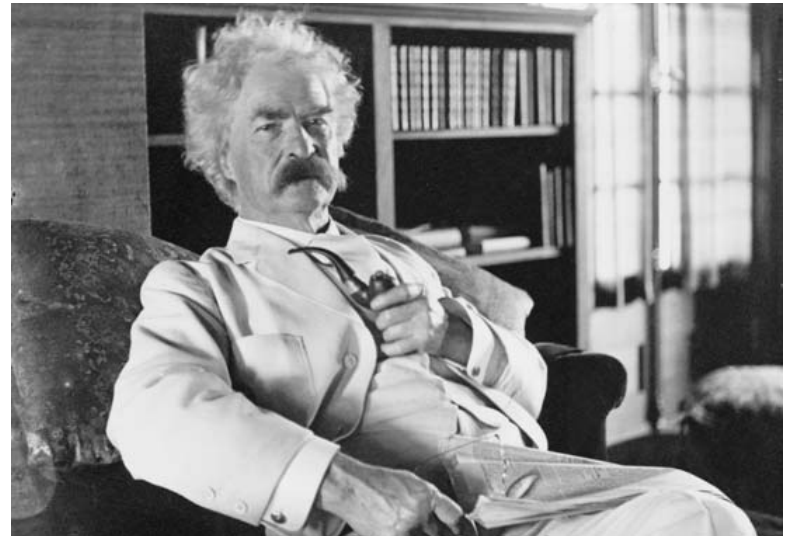
- **FFMPEG: MPEG-2 implementation**
- **X.264: MPEG-4 AVC/H.264 implementation**
- **JasPer: implementation of JPEG2000**



- **HTTP streaming (TCP)**
 - Large compatibility with common players (Windows Media, Real, Itunes, Winamp,...)
 - Transport of Ogg Vorbis, MPEG Layer II, MPEG Layer III, AAC
 - Easy NAT/Firewall traversal
 - Disadvantage: high overhead
- **Icecast server: replicate streams**
- **Source: encode + send stream to the server**
 - Free: Oddcast, Darkice, Nicecast, etc
 - Nonfree: Orban Opticodec, Traktor, Luci
- **Can be used as a cheap one-way contribution method**
- **Shoutcast (winamp.com): similar, free but not open source**

Audio quality

Different reactions depending on the audience...



Subjective listening tests (MUSHRA,..) must be done

Conclusion

- **Many solutions stable and ready for professional use**
- **Advantages: transparent, future-proof, scalable, easy to integrate**
- **Be careful with audio quality**
 - **More subjective tests needed**
- **Be careful with patent issues**