

MPEG 1

An Overview

Introduction

- History of the standard
- Goals of the standard
- Types of MPEG 1 audio streams
- Overview of Layers
- Conclusion

History of MPEG

- WHO -
 - Created by Motion Picture Experts Group (JTC1/SC29/WG11)
- WHEN
 - Committee formed in 1988
 - Standard published in 1991
- WHAT
 - Compression for video which included standards for the associated stereo audio

Types of Streams

- Designed to accommodate all purposes
 - Multiple sample rates (32, 44.1, and 48 KHz)
 - 4 types of stereo encoding
 - Mono
 - Mono duplicated track
 - Stereo
 - Joint encoded stereo
 - 3 Layers of encoding.

Goals

- Efficient compression algorithm that can be decoded in real time on ~1993 commodity hardware.
- Perceptually identical to original sources at high bit rates
- Describe only outcomes. Explicitly eschew specifying algorithms.

Overview of Encoder

- Polyphase filter bank
- Layer specific frequency mapping
- Layer specific bit packing
- Reverse process for decoder

Polyphase Filter Bank

- 32 equal spaced filters (not critical bands)
- Designed to be computationally efficient, not necessarily most accurate
 - 512 sample window
 - 1 sample/filter bank for every 32 samples
 - Special hanning window to account for errors introduced by computational short cuts.

Layers – What are they

- 3 different ways of encoding a stream
- Each uses different structures for applying psychoacoustic properties for masking.
- Deliberately ambiguous in the description

Layer 1

- Designed to be fast, not accurate or high compression rates
- 384 samples per frame with a 512 sample analysis window
- FFT (or other discrete time \leftrightarrow frequency algorithm with data centered in window.
- Estimate noise vs tonal via peak analysis

Layer 2/3

- Greater complexity.
- 1152 samples per frame.
- 2 windows of 1024 per frame
- FFT or similar with 576 values centered in each window
- Linear prediction of tonal component over previous 2 windows using linear prediction

Compliance Testing

- Ambiguous algorithmic structure
- Numerous optional components
- Testing using standard samples
 - Sets of test data to decode/encode
 - Compliance is generating results within a delta of reference implementation

MPEG Patents

- There exists a number of patents on the algorithms
- These patents have automatic licensing requirements
- Pricing:
 - \$0.75 / software decoder
 - \$2.50 / software encoder

Available encoders

- LAME
 - Best of the free mp3 encoders.
 - Widely available as a library
- Blade-enc
 - Predates LAME, but lags in quality