

MPEG-4: A 15-minute Introduction

presented by

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Presentation Outline

- Introduction
- MPEG-4 Overview
- MPEG-4 Audio
 - Advanced Audio Coding (AAC)
- Conclusion
- References + Links

Introduction

- What is MPEG-4?
 - A standard for multimedia content delivery
 - Introduced in late 1998
 - Developed by the Moving Picture Experts Group (MPEG)
 - Goes beyond 2D video and audio
 - Provides a standardized framework for multiple media

Introduction

- A little bit of history...
 - MPEG-1: (1991)
 - 3 Layers of audio coding complexity (MP3 = MPEG-1 Layer 3)
 - Up to 2 audio channels
 - Video coding for Video-CD
 - Standard composed of 5 parts
 - MPEG-2: (1994)
 - Advanced Audio Coding (AAC)
 - Up to 5.1 audio channels
 - Enhanced video coding
 - Basis for coding format of DVD, Digital Television and broadcast
 - Standard composed of 10 parts

Introduction

- A little bit of history...
 - MPEG-3: (N/A)
 - Not MP3!
 - Originally meant for HDTV
 - Not released since HDTV requirements already present in MPEG-2
 - MPEG-4: (late 1998)
 - Some applications: Web media streaming, CD distribution, Videophone, broadcast television
 - Emphasis is on higher functionality rather than better compression efficiency
 - Standard composed of 22 parts

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MPEG-4 Overview

■ MPEG-4 Standard

- Meant to become the universal language between broadcasting, movie and multimedia applications
- Provides standardized ways of representing the various elements of multimedia content (e.g., audio, video, ...)
- Allows for intellectual property management and protection

MPEG-4 Overview

■ MPEG-4 Model

- Describes the multimedia content in an object-oriented way
 - Media elements are objects part of a scene
- Media objects can be natural or synthetic
- Objects can be encoded and transmitted separately in their own stream
- Composition of the scene occurs after transmission and decoding
 - In MPEG-2, composition happens before encoding

MPEG-4 Overview

■ MPEG-4 Model

- MPEG-4 consists of large number of tools grouped in profiles
 - An application may use a set of profiles based on the functionalities required
- Profiles exist at different levels of complexity
- MPEG-4 consists of closely interrelated but distinct individual parts

MPEG-4 Overview

■ MPEG-4 Parts

- Part 1: Systems
- Part 2: Visual
- Part 3: Audio
- Part 4: Conformance
- Part 5: Reference Software
- Part 6: Delivery Multimedia Integration Framework (DMIF)
- Part 7: Optimized Reference Software
- Part 8: Carriage over IP Networks
- Part 9: Reference Hardware
- Part 10: Advanced Video Coding
- Part 11: Scene Description and Application Engine (BIFS)

MPEG-4 Overview

■ MPEG-4 Parts

- Part 12: ISO Based Media File Format
- Part 13: Intellectual Property Management and Protection (IPMP)
- Part 14: MPEG-4 File Format
- Part 15: AVC File Format
- Part 16: Animation Framework eXtension (AFX)
- Part 17: Timed Text Subtitle Format
- Part 18: Font Compression and Streaming
- Part 19: Synthesized Texture Stream
- Part 20: Lightweight Scene Representation (LAsER)
- Part 21: MPEG-J Graphical Framework eXtension (GFX)
- Part 22: Open Font Format Specification (OFFS)

MPEG-4 Overview

- MPEG-4 Applications
 - Broadcasting
 - Collaborative Scene Visualization
 - “Content-based” Storage and Retrieval
 - Digital Television
 - DVD
 - Mobile Multimedia
 - Real-Time Communications
 - Web Streaming (video, audio, ...)
 - Studio Post-Production
 - Virtual Meeting
 - ...

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MPEG-4 Audio

■ Description

- A family of audio coding algorithms
- Spans a very broad range of bit rates
- Uses Advanced Audio Coding (AAC) to encode the audio signal
- MPEG-4 is a container file:
 - Song title
 - Album cover
 - ...
 - Audio
- Digital Rights Management (DRM) can be applied

MPEG-4 Audio

■ File Extension

- MP4:
 - Can be any MPEG-4 file (e.g., video, audio, ...)
 - Does not necessarily contain MPEG-4 audio
- MA4:
 - Stands for MPEG 4 Audio
- M4P:
 - MPEG 4 Audio files that are protected (using DRM)
 - Used by iTunes Music Store
- AAC:
 - Audio files that are not contained in a MPEG-4 container file
- Some software support M4A, others support MP4
 - Really only a file extension

Advanced Audio Coding

- Some Improvements over MPEG-1 Audio:
 - Sampling Frequencies: 8 - 96Hz (official MP3: 16 - 48Hz)
 - Up to 48 Channels (up to 2 channels)
 - Higher efficiency and simpler filterbank (pure MDCT)(hybrid transform)
 - Higher coding efficiency for stationary signals (larger block size)
 - Higher coding efficiency for transient signals (smaller block size)
 - Better handling of high frequencies (i.e. > 16kHz)
 - More flexible joint stereo

Advanced Audio Coding

- Some new features introduced in AAC
 - Pure Modified Discrete Cosine Transform (MDCT)
 - Longer/Shorter windows
 - Ability to toggle M/S stereo or intensity stereo on a subband basis
 - Temporal Noise shaping (TNS)
 - Perceptual Noise Substitution (PNS)
 - Long Term Prediction (LTP) for stationary signals

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Conclusion

- MPEG-4 provides a broad framework for efficient delivery of richer multimedia content
- MPEG-4 Audio features better sound quality in comparison to MPEG-1 due to its Advanced Audio Coding (AAC)

References

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Links

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- <http://www.m4a.com/>
- <http://www.m4if.org/>
- <http://www.mpeg.org/>
- <http://wikipedia.org/>