



The Moving Picture Experts Group

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## Video

**Standard:** [MPEG-2 \(/standards/mpeg-2\)](#).

**Part number:** 2

**Activity status:** Open

**Technologies:** [2-d video coding \(/technologies/media-coding/2-d-video-coding\)](#).

## MPEG-2 Video

### 1 Introduction

ISO/IEC 11172-2 extends the specifications of MPEG-1 Video for more generic classes of video sources and applications. It supports interlaced video and more rigid display timing constraints. Encoded data rates can be up to about 40 Mbit/s for storage and transmission, or even higher for professional applications in video production. Larger frame sizes of up to HD resolution are supported.

### 2 Technical Solution

MPEG-2 is forward compatible with MPEG-1 (which means that MPEG-1 streams observing typical constraints e.g. in frame sizes and data rates can be decoded by MPEG-2 decoders). In terms of video encoding tools, specific provisions are made for interlaced video. Further, MPEG-2 defines tools for scalable video coding, e.g. to embed streams which can be used to either decode with CIF+SD, SD+HD resolution. The main technical extensions as compared to MPEG-1 can hence be summarized as follows:

- To support the properties of interlaced video, different methods for field/frame adaptive motion compensation (*frame based*, *field based* and *dual prime* prediction modes), as well as switching between field-/frame-wise DCT are specified. Further, it is possible to switch into a 16x8 prediction mode, where separate motion vectors can be defined for the top and bottom halves of a macroblock.
- The variable-length coding (VLC) tables were extended for better compression performance in higher data rates and resolutions.
- Methods of *scalable* coding are defined, which provide SNR scalability and spatial scalability over a limited number of layers each. In this context, the bitstream is sub-divided into two or three parts, which means that by retaining or receiving only core parts of the stream, it is e.g. possible to reconstruct frames at lower resolution. To encode DCT coefficients related to the different resolution levels, differently optimized variable length codes are provided in the spatial scalable mode.
- Methods to encode sequences with 4:2:2 chrominance sampling are defined by allowing additional 8x8 transform blocks to be subsumed within a macroblock.
- A method of temporal scalability is defined, which allows prediction of additional inserted frames either from a base-layer sequence or from another frame of the enhancement layer sequence. This method can also be used for encoding of stereoscopic sequences with an LRLRLR... interleaving of left and right pictures, as e.g. required for shutter-glass display.
- All scalability modes can also be used to achieve a forward and backward compatible combination of MPEG-1 and MPEG-2, when MPEG-1 syntax is exclusively used in the base layer.
- Methods of data partitioning for DCT coefficients are defined, which can improve the error resilience of video streams.

The number of application domains and necessary combinations of elementary tools is manifold for the case of MPEG-2. As it appears not to be useful for any MPEG-2 device to support *all* elements of the standard, MPEG-2 defines different *profiles*. Further, within each *profile*, *levels* are specified, which describe maximum sizes or image formats which must be decodable. Each bitstream carries information indicating which profile capability is required at the decoder, as well as the level of required support in the profile, to identify the requirements of decoder capability for the bitstream. From this information, any conforming MPEG-2 decoder can decide immediately whether it will be able to process the bitstream. Within certain application domains, specific 'profile@level' configurations have been established as mandatory, e.g. 'Main Profile@Main Level' is typically required for digital TV broadcast or DVD storage applications. Four levels are defined: 'Low', 'Main' (SD), 'High-1440' and 'High' (HD), where however not each level is combinable with each profile. The profiles defined by MPEG-2 video are as follows:

- *Simple profile*: This is for *low cost* and *low delay* applications, allowing frame sizes up to SD resolution (ITU-R Rec. BT.601) and frame rates up to 30 Hz. Usage of *B* frames is not allowed.
- *Main profile*: This is the most widely used MPEG-2 profile, defined for SD and HD resolution applications in storage and transmission, without providing compatible decoding of different resolutions. All interlaced-specific prediction modes as well as *B* frames are supported.
- *SNR scalable profile*: Similar to Main profile, but allows in addition SNR scalability invoking drift at the base layer; resolutions up to SD are supported.
- *Spatial scalable profile*: Allows usage of (drift free) spatial scalability, also in combination with SNR scalability.
- *High profile*: Similar to Spatial Scalable profile, but supporting a wider range of levels, and allowing 4:2:2 chrominance sampling additionally. This profile was primarily defined for upward/downward compatible coding between SD and HD resolutions, allowing embedded bitstreams for up to 3 layers with a maximum of two different spatial resolutions.
- *4:2:2 profile*: This profile extends the Main profile by allowing encoding of 4:2:2 chrominance sampling, and allows larger picture sizes and higher data rates.
- *Multiview profile*: This allows encoding of stereoscopic sequences provided in a left-right interleaved multiplex, using the tool of temporal scalability for exploitation of left-right redundancies. The displacement

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between left and right pictures is estimated and used for *disparity compensated prediction*, which follows the same principles as motion-compensated prediction. In addition, camera parameters can be conveyed in the stream.

The text of the MPEG-2 Video standard is common with ITU-T Rec. H.262. Subsequent to the second edition of the standard text which was published in 2000, the following corrigenda and amendments are integral part of the MPEG-2 Video specification:

- ITU-T Rec.H.262(2000)/Cor.1 (2002)|ISO/IEC 13818-2:2000/Cor.1:2002
- ITU-T Rec. H.262(2000)/Amd.1(2000)|ISO/IEC 13818-2:2000/Amd.1:2001
- ITU-T Rec.H.262(2000)/Cor.2 (200X)|ISO/IEC 13818-2:2000/Cor.2:200X (in preparation)

## 3 Application areas

MPEG-2 is mainly used for consumer-level video broadcast (e.g. DVB) and storage (e.g. DVD), as well as for professional applications such as video storage in studios.

### MPEG-2 Copyright Identifier

MPEG doc#: N842

Date: July 2006

Author: Niels Rump

## 1 Overview

MPEG-2 (ISO/IEC 13818) contains two tools for the Identification as well as the Protection of (copyright on) content: For purposes of *copyright notification*, there is the copyright descriptor. Individual streams as well as collections of streams forming a program can be identified as containing copyrighted material. The copyright can be signalled at the Audio or Video level, but also (as a collection) at the Systems Level.

For enabling *protection*, there are similar provisions, which can be used to signal whether particular packets have been scrambled; to send messages to be used in (proprietary) Conditional Access systems; and to identify the Conditional Access System used.

## 2 Two Elements of the Copyright Descriptor

The copyright descriptor consists of two parts:

- A unique copyright identifier of four bytes (i.e. four ASCII characters), which identifies the type of the identifier. This number points to an authority thgoverns the identification of the content type in question. Each such governing authority defines the syntax and semantics for 'its' identifiers;
- The content identifier — as specified by the governing authority — itself. The identifier can vary in length.

ISO/IEC 13818 also establishes the requirements of a Registration Authority for registering the copyright identifiers.

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