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Foreword

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This document was prepared by Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

A list of all parts in the ISO/IEC 14496 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document specifies Internet video coding, a video compression technology that is intended to be suitable for video distribution models currently adopted on the Internet.

The International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) draw attention to the fact that it is claimed that compliance with this document may involve the use of patents.

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Information technology — Coding of audio-visual objects —

Part 33:
Internet video coding

1 Scope

This document specifies MPEG-4 Internet video coding.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Rec. ITU-T H.262 | ISO/IEC 13818-2: 2013, *Information technology — Generic coding of moving pictures and associated audio information — Part 2: Video*

IEC 60461, *Time and control code*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
B frame
bidirectional frame
frame (3.28) that is coded using motion compensated prediction from past or future *reference frames* (3.53) in *output order* (3.40)

3.2
backward prediction
process of predicting the current *frame* (3.28) by using future *frames* in an *output order* (3.40) as *reference frames* (3.53)

3.3
bin
bit of a *bin string* (3.4)

3.4
bin string
intermediate binary representation of values of *syntax elements* (3.65) resulting from the *binarization* (3.5) of the *syntax element*

3.5
binarization
set of *bin strings* (3.4) for all possible values of a *syntax element* (3.65)

3.6
binarization process
unique mapping process of all possible values of a *syntax element* (3.65) onto a set of *bin strings* (3.4)

3.7
bitstream
ordered series of bits that forms the *coded representation* (3.14) of the data

3.8
block
MxN (M-column by N-row) array of samples, or an MxN array of *transform coefficients* (3.66)

3.9
byte
sequence of 8 bits, written and read with the most significant bit on the left and the least significant bit on the right, such that when represented in a sequence of data bits, the most significant bit of a byte is first

3.10
byte-aligned
positioning of a bit or *byte* (3.9) or *syntax element* (3.65) when the position at which it appears in a *bitstream* (3.7) is an integer multiple of 8 bits from the position of the first bit in the *bitstream*

3.11
byte stream
ordered series of bytes that forms the *coded representation* (3.14) of the data

3.12
chroma
sample array or single sample, identified symbolically by Cb or Cr, representing one of the two colour difference signals related to the primary colours

Note 1 to entry: The term chroma is used rather than the term chrominance in order to avoid the implication of the use of linear light transfer characteristics that is often associated with the term chrominance.

3.13
coded frame
coded representation (3.14) of a *frame* (3.28)

3.14
coded representation
series of data elements as represented in coded form in the *bitstream* (3.7)

3.15
component
array or single sample from one of the three arrays (*luma* (3.37) and two *chroma* (3.12)) that make up a *frame* (3.28) in 4:2:0 colour format

3.16
DC coefficient
transform coefficient (3.66) for which the *frequency index* (3.27) is zero in all dimensions

3.17
decoded frame
frame (3.28) derived by decoding a *coded frame* (3.13)

3.18
decoder
embodiment of the *decoding process* (3.20)

3.19
decoding order
order in which syntax elements are processed by the *decoding process* (3.20)

3.20
decoding process
process that derives *decoded frames* (3.17) from the syntax elements in the *bitstream* (3.7)

3.21
dequantization
process of *scaling* (3.57) the *quantized transform coefficients* (3.49) after their representation in the *bitstream* (3.7) has been *parsed* (3.42) and before they are presented to the *inverse transform* (3.34) part of the *decoding process* (3.20)

3.22
encoder
embodiment of an *encoding process* (3.23)

3.23
encoding process
process that produces a *bitstream* (3.7)

Note 1 to entry: This document does not specify an encoding process.

3.24
forbidden
specification that a value shall never be used

Note 1 to entry: This is usually to avoid emulation of a *start code* (3.63) pattern.

3.25
forward prediction
process of predicting the current frame by the past *reference frames* (3.53) in output order

3.26
flag
binary variable that can take one of the two possible values, 0 and 1

3.27
frequency index
one-dimensional or two-dimensional index associated with a *transform coefficient* (3.66) prior to an *inverse transform* (3.34) part of a *decoding process* (3.20)

3.28
frame
successive lines, numbered from the top-most line to the bottom-most line, containing samples numbered from the left-most sample to the right-most sample, representing the spatial information of a video signal from a single time instant

3.29
I frame
intra frame
frame (3.28) coded using information only from itself

3.30
inter macroblock
macroblock (3.38) which is coded using *inter prediction* (3.31)

3.31
inter prediction
prediction (3.44) derived from data elements (e.g. sample value or *motion vector* (3.39)) of *reference frames* (3.53) other than the current frame

3.32
intra macroblock
macroblock (3.38) which is coded using *intra prediction* (3.33)

3.33
intra prediction
prediction (3.44) derived from only data elements (e.g. sample values) of the same decoded *slice* (3.60)

3.34
inverse transform
part of the *decoding process* (3.20) by which a set of *transform coefficients* (3.66) are converted into spatial-domain values, or by which a set of *transform coefficients* are converted into *DC coefficients* (3.16)

3.35
layer
one of a set of syntactical structures in a non-branching hierarchical relationship, such that higher layers contain lower layers, with such coded layers being the *coded frame* (3.13), *slice* (3.60), *macroblock* (3.38) and *block* (3.8)

3.36
level

defined set of constraints on the values that may be taken by *syntax elements* (3.65) and variables; or in a different context, the value of a *transform coefficient* (3.66) prior to *scaling* (3.57)

Note 1 to entry: The same set of levels is defined for all *profiles* (3.47), with most aspects of the definition of each level being in common across different *profiles*. Individual implementations may, within specified constraints, support a different level for each supported *profile*.

3.37
luma
sample array or single sample, identified symbolically by Y or L, ordinarily representing the brightness signal related to the primary colours

Note 1 to entry: The term luma is used rather than the term luminance in order to avoid the implication of the use of linear light transfer characteristics that is often associated with the term luminance. The symbol L is sometimes used instead of the symbol Y to avoid confusion with the symbol y as used for vertical location.

3.38
macroblock
16 × 16 *luma* (3.37) sample value block and its corresponding two *chroma* (3.12) sample value blocks

3.39
motion vector
two-dimensional vector used for *inter prediction* (3.31) that provides an offset from the coordinates in the *decoded frame* (3.17) to the coordinates in a *reference frame* (3.53)

3.40
output order
order in which the *decoded frames* (3.17) are output from the *decoded frame* buffer in case the *decoded frames* are to be output from the *decoded frame* buffer

3.41
P frame
predictive frame
frame (3.28) that is coded using motion compensated prediction from past *reference frames* (3.53) in *output order* (3.40)

3.42
parse
procedure of obtaining the value of a *syntax element* (3.65) from a *bitstream* (3.7)

3.43
partitioning
division of a set into subsets such that each element of a set is in exactly one of the subsets

3.44
prediction
embodiment of a *prediction process* (3.45)

3.45
prediction process
use of a *predictor* (3.46) to provide an estimate of a data element (e.g. sample value or *motion vector* (3.39)) currently being decoded

3.46
predictor
combination of specified values or previously decoded data elements (e.g. sample value or *motion vector* (3.39)) used in the *decoding process* (3.20) of subsequent data elements

3.47
profile
specified subset of the syntax

3.48
quantization parameter
variable used by the *decoding process* (3.20) for *scaling* (3.57) of *transform coefficient levels* (3.67)

3.49
quantized transform coefficients
transform coefficients (3.66) before *dequantization* (3.21)

3.50
random access
starting the *decoding process* (3.20) for part of a *bitstream* at some point other than the beginning of the *bitstream* (3.7)

3.51
raster scan
mapping of a rectangular two-dimensional pattern to a one-dimensional pattern such that the first entries in the one-dimensional pattern are from the top-most row of the two-dimensional pattern scanned from left to right, followed similarly by the second, third, etc., top-most rows of the pattern (proceeding downwards), with each row scanned from left to right

3.52
reference index
order indication of the *reference frames* (3.53) in the frame buffer in the *decoding process* (3.20)

3.53
reference frame
frame that contains samples that may be used for *inter prediction* (3.31) in the *decoding process* (3.20) of subsequent *frames* (3.28) in *decoding order* (3.19)

3.54
reserved
specification that some values of a particular *syntax element* (3.65) are for future use by ISO/IEC, such that these values shall not be used in *bitstreams* (3.7), but may be specified for use in future extensions by ISO/IEC

3.55
residual
decoded difference between a *prediction* (3.44) of a sample or data element and its decoded value

3.56
run
number of data elements with the same value or the same treatment in the *decoding process* (3.20)

Note 1 to entry: In one context, it means the number of zero coefficients before a non-zero coefficient in the block scan, and in another context, it means the number of consecutive *skipped macroblocks* (3.59).

3.57
scaling
process of multiplying *transform coefficient levels* (3.67) by a factor, resulting in *transform coefficients* (3.66)

3.58
sequence
highest layer syntax structure of the *bitstream* (3.7), including one or more consecutive *coded frames* (3.13)

3.59
skipped macroblock
macroblock (3.38) for which no syntax elements are present in the *bitstream* (3.7) except for the indication that the *macroblock* is a *skipped macroblock* (3.59)

3.60
slice
integer number of consecutive *macroblock* (3.38) rows in the *raster scan* (3.51) order that is associated with the same header data

3.61
slice header
part of a coded *slice* (3.60) containing the data elements pertaining to the first or all *macroblocks* (3.58) represented in a *slice*

3.62
source
video material or some of its attributes before operation of an *encoding process* (3.23)

3.63
start code
32-bit codeword pattern which is unique in the whole *bitstream* (3.7)

Note 1 to entry: Start codes can be used to identify the starting point of a syntax structure in the *bitstream* (e.g. to enable *random access* (3.50)).

3.64
stuffing bits
bit string having a prescribed pattern of fixed values at a particular position in the *bitstream* (3.7)

3.65
syntax element
element of data represented in the *bitstream* (3.7)

3.66
transform coefficient
scalar quantity, considered to be in a frequency domain, that is associated with a particular one-dimensional or two-dimensional *frequency index* (3.27) in an *inverse transform* (3.34) part of the *decoding process* (3.20)

3.67
transform coefficient level
integer quantity representing the value associated with a particular two-dimensional frequency index in the *decoding process* (3.20) prior to *scaling* (3.57) for computation of a *transform coefficient* value (3.66)

3.68
video buffering verifier
hypothetical reference *decoder* (3.18) that operates on the *bitstream* (3.7) to perform the *decoding process* (3.20) with a specified timing and with a specified limited capacity for buffering the coded data and *decoded frames* (3.17)

Note 1 to entry: Its purpose is to provide a constraint on the variability of the data rate that an *encoder* (3.22) or editing process may produce.

4 Abbreviations

LSB	least significant bit
MB	macroblock
MSB	most significant bit
VBV	video buffering verifier

5 Conventions

NOTE The mathematical operators and their precedence rules used in this document are similar to those used in the C programming language. However, operators of integer divisions with truncation and of rounding are specifically defined. If not specifically explained, numbering and counting begin from zero.

5.1 Arithmetic operators

+	Addition
–	Subtraction (as a binary operator) or negation (as a unary prefix operator)
*	Multiplication
a^b	Exponential operation: a is raised to power of b. (May alternatively represent a superscript.)
/	Integer division with truncation of the result toward zero. For example, 7/4 and (–7)/(–4) are truncated to 1 and (–7)/4 and 7/(–4) are truncated to –1.
÷	Division in mathematical formulae where no truncation or rounding is intended.
$\frac{a}{b}$	Division in mathematical formulae where no truncation or rounding is intended.
$\sum_{i=a}^{b} f(i)$	The summation of *f*(i) with i taking integral values from a up to and including b.
a % b	Remainder of a divided by b, defined only for a >= 0 and b > 0.