

INTERNATIONAL
STANDARD

ISO/IEC
14496-33

First edition
2019-02

**Information technology — Coding of
audio-visual objects —**

**Part 33:
Internet video coding**

*Technologies de l'information — Codage des objets audiovisuels —
Partie 33: Codage vidéo Internet*



Reference number
ISO/IEC 14496-33:2019(E)

© ISO/IEC 2019



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2019

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Abbreviations	7
5 Conventions	7
5.1 Arithmetic operators.....	7
5.2 Logical operators.....	8
5.3 Relational operators.....	8
5.4 Bitwise operators.....	8
5.5 Assignment.....	8
5.6 Order of operation precedence.....	9
5.7 Mathematical functions.....	9
5.8 Variables, syntax elements and tables.....	10
5.9 Text description of logical operations.....	11
5.10 Processes.....	12
5.11 Description of bitstream syntax parsing process and decoding process.....	12
5.11.1 Method of describing bitstream syntax.....	12
5.11.2 Syntax functions.....	14
5.11.3 Syntax descriptors.....	15
5.11.4 Reserved, forbidden and marker bit.....	16
6 Source, coded, decoded and output data formats	16
6.1 Source.....	16
6.2 Colour format.....	16
6.3 Coded bitstream format.....	17
6.4 Sequence header.....	17
6.5 Frame.....	17
6.6 Frame types.....	17
6.7 Slice.....	18
6.8 Macroblock.....	18
6.9 Block.....	18
6.10 Frame re-ordering.....	19
6.11 Reference frames.....	19
6.12 Inverse scanning processes and derivation processes for neighbours.....	20
6.12.1 General.....	20
6.12.2 Inverse macroblock scanning process.....	20
6.12.3 Inverse macroblock partition scanning process.....	20
6.12.4 Inverse 8x8 luma block scanning process.....	21
6.12.5 Inverse 4x4 luma block scanning process.....	21
6.12.6 Derivation process of the availability for macroblock addresses.....	21
6.12.7 Derivation process for neighbouring macroblock addresses and their availability.....	22
6.12.8 Derivation processes for neighbouring macroblocks, blocks, and partitions.....	23
6.12.9 Derivation process for neighbouring locations.....	25
7 Syntax and semantics	26
7.1 Bitstream syntax.....	26
7.1.1 Start codes.....	26
7.1.2 Video sequence.....	27
7.1.3 Frame.....	28
7.1.4 Slice.....	30
7.1.5 Macroblock.....	30

	7.1.6	Block.....	33
7.2		Video bitstream semantics.....	34
	7.2.1	Start code.....	34
	7.2.2	Video sequence.....	34
	7.2.3	Frame.....	37
	7.2.4	Slice.....	38
	7.2.5	Macroblock.....	38
	7.2.6	Block.....	41
8		Decoding process.....	41
	8.1	General.....	41
	8.2	Intra prediction.....	42
		8.2.1 General.....	42
		8.2.2 Intra_4x4 prediction process for luma samples.....	42
		8.2.3 Intra_8x8 prediction process for luma samples.....	45
		8.2.4 Intra_16x16 prediction process for luma samples.....	47
		8.2.5 Intra prediction for 8x8 chroma block.....	49
	8.3	Inter prediction.....	51
		8.3.1 General.....	51
		8.3.2 Derivation process for motion vector components and reference indices.....	52
		8.3.3 Decoding process for inter prediction samples.....	60
	8.4	Transform coefficient decoding process and frame reconstruction process.....	69
		8.4.1 General.....	69
		8.4.2 Inverse scanning.....	70
		8.4.3 Inverse quantization.....	71
		8.4.4 Inverse transform process.....	74
		8.4.5 Reconstruction.....	79
	8.5	Loop filtering.....	79
	8.6	Reference frame buffer management.....	81
9		Parsing process.....	82
	9.1	General.....	82
	9.2	ue(v).....	82
	9.3	Parsing process for transform coefficient levels.....	82
	9.4	ae(v).....	83
		9.4.1 General.....	83
		9.4.2 Description.....	83
		9.4.3 Initialization.....	84
		9.4.4 Binarization process.....	84
		9.4.5 Parsing binary string.....	87
10		Profiles and levels.....	97
	10.1	General.....	97
	10.2	Profiles.....	98
	10.3	Levels.....	98

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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.

ISO and IEC take no position concerning the evidence, validity and scope of these patent rights.

The holders of these patent rights have assured ISO and IEC that they are willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statements of the holders of these patent rights are registered with ISO and IEC. Information may be obtained from:

Nokia Technologies Oy
Joensuukatu 7E
FIN-24100 Salo
FINLAND
Telephone : +358 50 366 2022

Apple Inc.
Intellectual Property and Licensing
1 Infinite Loop, MS 169-3IPL
Cupertino, CA 95014
USA
Telephone: +1(408) 974-0015

Industry-University Cooperation Foundation Hanyang University
222 Wangsimni-ro, Seongdong-gu
Seoul 04763
REPUBLIC OF KOREA
Telephone: +82-2-2220-2212

Mitsubishi Electric Corporation
Corporate Licensing Division
2-7-3 Marunouchi, Chiyoda-ku
Tokyo 100-8310
JAPAN
Telephone: +81-3-3218-3465

QUALCOMM Incorporated
5775 Morehouse Drive
San Diego, CA 92121
USA
Telephone: +1 (858) 587-1121

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those identified above. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

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*