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

**Part 15:
Carriage of network abstraction layer
(NAL) unit structured video in the ISO
base media file format**

Technologies de l'information — Codage des objets audiovisuels —

*Partie 15: Transport de vidéo structurée en unités NAL sur la couche
réseau au format ISO de base pour les fichiers médias*





COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2022

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
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents	Page
Foreword	vi
Introduction	vii
1 Scope	1
2 Normative references	1
3 Terms, definitions, abbreviated terms and conventions	1
3.1 Terms and definitions	1
3.2 Abbreviated terms	10
3.3 Conventions	11
4 General definitions	12
4.1 Overview	12
4.2 Sample and configuration definition	12
4.3 Video track structure	14
4.4 Template fields used	14
4.5 Visual width and height	14
4.6 Decoding time (DTS) and composition time (CTS)	15
4.7 Sample groups on random access recovery points 'roll' and random access points 'rap'	15
4.8 Hinting	16
4.9 On change of sample entry (informative)	16
4.10 SEI information box	18
4.11 Post-decoder requirements scheme for signalling of SEI	18
4.12 Alternative extraction source track grouping	19
4.13 NAL unit map entry	19
4.14 Rectangular region group entry	21
4.15 Layer information sample group	23
5 AVC elementary streams and sample definitions	25
5.1 Overview	25
5.2 Elementary stream structure	25
5.3 Sample and configuration definition	28
5.4 Derivation from ISO base media file format	32
6 SVC elementary stream and sample definitions	44
6.1 Overview	44
6.2 Elementary stream structure	44
6.3 Use of the plain AVC file format	45
6.4 Sample and configuration definition	45
6.5 Derivation from the ISO base media file format	47
7 MVC and MVD elementary stream and sample definitions	53
7.1 Overview	53
7.2 Overview of MVC or MVD Storage	55
7.3 MVC and MVD elementary stream structures	56

7.4	Use of the plain AVC file format	57
7.5	Sample and configuration definition	58
7.6	Derivation from the ISO base media file format	61
7.7	MVC specific information boxes.....	76
8	HEVC elementary streams and sample definitions.....	86
8.1	Overview	86
8.2	Elementary stream structure	86
8.3	Sample and configuration definition	87
8.4	Derivation from ISO base media file format.....	92
9	Layered HEVC elementary stream and sample definitions	101
9.1	Overview	101
9.2	Overview of L-HEVC storage.....	102
9.3	L-HEVC elementary stream structure.....	103
9.4	Sample and configuration definition	103
9.5	Derivation from the ISO base media file format and the HEVC file format (Clause 8)	105
9.6	L-HEVC specific structures.....	116
10	Storage of tiled HEVC and L-HEVC video streams.....	122
10.1	Overview	122
10.2	NAL unit map entry	123
10.3	Tile region group entry	123
10.4	Tile sub track definition	123
10.5	HEVC and L-HEVC tile track	124
10.6	HEVC slice segment data track	129
11	VVC elementary streams and sample definitions	130
11.1	Overview	130
11.2	Sample and configuration definition	137
11.3	Derivation from ISO base media file format.....	146
11.4	Sample groups.....	160
11.5	Entity groups	180
11.6	Data sharing and VVC bitstream reconstruction	188
12	EVC elementary streams and sample definitions.....	199
12.1	Overview	199
12.2	Elementary stream structure	199
12.3	Sample and configuration definition	200
12.4	Derivation from ISO base media file format.....	203
Annex A (normative) In-stream structures		210
Annex B (normative) SVC, MVC, and MVD sample group and sub-track definitions.....		228
Annex C (normative) Temporal metadata support.....		251
Annex D (normative) File format toolsets and brands		260
Annex E (normative) Sub-parameters for the MIME type 'codecs' parameter.....		264

Annex F (informative) Unspecified nal_unit_type value management for sample entry types of AVC and HEVC..... 273

Annex G (informative) Examples of VVC base and subpicture tracks..... 275

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.

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 or www.iec.ch/members_experts/refdocs).

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) or the IEC list of patent declarations received (see <https://patents.iec.ch>).

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. In the IEC, see www.iec.ch/understanding-standards.

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

This sixth edition cancels and replaces the fifth edition (ISO/IEC 14496-15:2019), which has been technically revised. It also incorporates the Amendment ISO/IEC 14496-15:2019/Amd 1:2020.

The main changes are as follows:

- Support for the Versatile Video Coding (ISO/IEC 23090-3) and Essential Video Coding (ISO/IEC 23094-1)
- Addition of sample entry types 'hvc3', 'hev3', 'hvt2', and 'hvt3' targeted at tile-based delivery and merging of High Efficiency Video Coding (ISO/IEC 23008-2) bitstreams

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

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 and www.iec.ch/national-committees.

Introduction

This document defines a storage format based on, and compatible with, the ISO Base Media File Format (ISO/IEC 14496-12), which is used by the MP4 file format (ISO/IEC 14496-14) and the Motion JPEG 2000 file format (ISO/IEC 15444-3) among others. This document enables video streams formatted as Network Adaptation Layer Units (NAL Units) to

- a) be used in conjunction with other media streams, such as audio,
- b) be used in an MPEG-4 systems environment, if desired,
- c) be formatted for delivery by a streaming server, using hint tracks, and
- d) inherit all the use cases and features of the ISO Base Media File Format on which MP4 and MJ2 are based.

This document may be used as a standalone document; it specifies how NAL unit structured video content shall be stored in an ISO Base Media File Format compliant format. However, it is normally used in the context of a specification, such as the MP4 file format, derived from the ISO Base Media File Format, that permits the use of NAL unit structured video such as AVC (ISO/IEC 14496-10) video and High Efficiency Video Coding (HEVC, ISO/IEC 23008-2) video.

The ISO Base Media File Format is becoming increasingly common as a general-purpose media container format for the exchange of digital media, and its use in this context should accelerate both adoption and interoperability.

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 a patent.

ISO and IEC take no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured ISO and IEC that he/she is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with ISO and IEC. Information may be obtained from the patent database available at www.iso.org/patents or patents.iec.ch.

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

Information technology — Coding of audio-visual objects —

Part 15: Carriage of network abstraction layer (NAL) unit structured video in the ISO base media file format

1 Scope

This document specifies the storage format for streams of video that is structured as NAL Units, such as AVC (ISO/IEC 14496-10) and HEVC (ISO/IEC 23008-2) video streams. In addition, Annex E specifies parameters and sub-parameters applying when sample entries specified in this document are used as the 'codecs' parameter of a MIME type, as specified in IETF RFC 6381.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 14496-12:2020, *Information technology — Coding of audio-visual objects — Part 12: ISO base media file format*

ISO/IEC 14496-10:2020, *Information technology — Coding of audio-visual objects — Part 10: Advanced Video Coding*

ISO/IEC 23008-2:2020, *Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 2: High efficiency video coding*

ISO/IEC 23090-3:2021, *Information technology — Coded representation of immersive media — Part 3: Versatile video coding*

ISO/IEC 23094-1:2020, *Information technology — General video coding — Part 1: Essential video coding*

IETF RFC 4648, *The Base16, Base32, and Base64 data encodings*

IETF RFC 6381, *MIME codecs and profiles*