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

**Part 12:
ISO base media file format**

*Technologies de l'information — Codage des objets audiovisuels —
Partie 12: Format ISO de base pour les fichiers médias*



This document is a preview generated by ETS



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2020

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	ix
Introduction	x
1 Scope	1
2 Normative references	1
3 Terms, definitions and abbreviated terms	2
3.1 Terms and definitions	2
3.2 Abbreviated terms	6
4 Object-structured file organization	6
4.1 File structure	6
4.2 Object structure	6
4.2.1 Object syntax conventions	6
4.2.2 Object definitions	7
4.3 File-type box	9
4.3.1 Definition	9
4.3.2 Syntax	9
4.3.3 Semantics	9
4.4 Extended type box	10
4.4.1 Definition	10
4.4.2 Syntax	10
4.4.3 Semantics	10
5 Design considerations	10
5.1 Usage	10
5.1.1 Multi-purpose	10
5.1.2 Interchange	11
5.1.3 Content creation	11
5.1.4 Preparation for streaming	11
5.1.5 Local presentation	12
5.1.6 Streamed presentation	12
5.2 Design principles	12
6 ISO base media file organization	13
6.1 Presentation structure	13
6.1.1 Referencing external data	13
6.1.2 Object structure	13
6.1.3 Meta data and media data	13
6.1.4 Track identifiers	13
6.2 Metadata structure (objects)	14
6.2.1 Box	14
6.2.2 Data types and fields	14
6.2.3 Box order	15
6.2.4 URIs as type indicators	18
6.3 Brand identification	19
6.4 Time structure overview	19
7 Streaming support	19
7.1 Handling of streaming protocols	19
7.2 Protocol 'hint' tracks	20
7.3 Hint track format	20
8 Box structures	22
8.1 File structure and general boxes	22
8.1.1 Media data box	22
8.1.2 Free space box	22
8.1.3 Progressive download information box	23

8.1.4	Identified media data box	23
8.2	Movie structure	24
8.2.1	Movie box	24
8.2.2	Movie header box	24
8.3	Track structure	25
8.3.1	Track box	25
8.3.2	Track header box	26
8.3.3	Track reference box	29
8.3.4	Track group box	30
8.3.5	Track type box	32
8.4	Track media structure	32
8.4.1	Media box	32
8.4.2	Media header box	32
8.4.3	Handler reference box	33
8.4.4	Media information box	34
8.4.5	Media information header boxes	34
8.4.6	Extended language tag	35
8.5	Sample tables	36
8.5.1	Sample table box	36
8.5.2	Sample description box	36
8.5.3	Degradation priority box	38
8.5.4	Sample scale box	39
8.6	Track time structures	39
8.6.1	Time to sample boxes	39
8.6.2	Sync sample box	44
8.6.3	Shadow sync sample box	44
8.6.4	Independent and disposable samples box	45
8.6.5	Edit box	47
8.6.6	Edit list box	47
8.7	Track data layout structures	49
8.7.1	Data information box	49
8.7.2	Data reference box	50
8.7.3	Sample size boxes	51
8.7.4	Sample to chunk box	53
8.7.5	Chunk offset box	53
8.7.6	Padding bits box	54
8.7.7	Sub-sample information box	55
8.7.8	Sample auxiliary information sizes box	57
8.7.9	Sample auxiliary information offsets box	58
8.8	Movie fragments	59
8.8.1	Movie extends box	59
8.8.2	Movie extends header box	60
8.8.3	Track extends box	60
8.8.4	Movie fragment box	61
8.8.5	Movie fragment header box	62
8.8.6	Track fragment box	62
8.8.7	Track fragment header box	63
8.8.8	Track fragment run box	64
8.8.9	Movie fragment random access box	65
8.8.10	Track fragment random access box	66
8.8.11	Movie fragment random access offset box	67
8.8.12	Track fragment decode time box	67
8.8.13	Level assignment box	68
8.8.14	Sample auxiliary information in movie fragments	70
8.8.15	Track Extension Properties box	70
8.8.16	Alternative startup sequence properties box	71
8.8.17	Metadata and user data in movie fragments	72
8.9	Sample group structures	72

8.9.1	Overview	72
8.9.2	Sample to group box	73
8.9.3	Sample group description box	74
8.9.4	Representation of group structures in movie fragments	76
8.9.5	Compact sample to group box	77
8.10	User data	79
8.10.1	User data box	79
8.10.2	Copyright box	79
8.10.3	Track selection box	80
8.10.4	Track kind	81
8.11	Metadata support	82
8.11.1	MetaBox	82
8.11.2	XML boxes	83
8.11.3	Item location box	84
8.11.4	Primary item box	86
8.11.5	Item protection box	87
8.11.6	Item information box	87
8.11.7	Additional metadata container box	90
8.11.8	Metabox Relation box	90
8.11.9	URL forms for MetaBoxes	90
8.11.10	Static metadata	90
8.11.11	Item data box	91
8.11.12	Item reference box	92
8.11.13	Auxiliary video metadata	93
8.11.14	Item properties box	93
8.11.15	Brand item property	94
8.12	Support for protected streams	95
8.12.1	Overview	95
8.12.2	Protection scheme information box	96
8.12.3	Original format box	97
8.12.4	IPMPInfoBox	97
8.12.5	IPMP control box	97
8.12.6	Scheme type box	97
8.12.7	Scheme information box	98
8.12.8	Scramble Scheme Information Box	98
8.13	File delivery format support	99
8.13.1	Overview	99
8.13.2	FD item information box	99
8.13.3	File partition box	100
8.13.4	FEC reservoir box	101
8.13.5	FD session group box	102
8.13.6	Group ID to name box	103
8.13.7	File reservoir box	103
8.14	Sub tracks	104
8.14.1	Overview	104
8.14.2	Backward compatibility	104
8.14.3	Sub track box	105
8.14.4	Sub track information box	105
8.14.5	Sub track definition box	106
8.14.6	Sub track sample group box	106
8.15	Post-decoder requirements on media	107
8.15.1	General	107
8.15.2	Restricted sample entry transformation	107
8.15.3	Restricted scheme information box	108
8.15.4	Scheme for stereoscopic video arrangements	108
8.15.5	Compatible scheme type box	110
8.16	Segments	111
8.16.1	Overview	111

8.16.2	Segment type box	111
8.16.3	Segment index box	111
8.16.4	Subsegment index box	115
8.16.5	Producer reference time box	116
8.17	Support for incomplete tracks	118
8.17.1	General	118
8.17.2	Transformation	119
8.17.3	Complete track information box	119
8.18	Entity grouping	119
8.18.1	General	119
8.18.2	Groups list box	120
8.18.3	Entity to group box	120
8.19	Compressed boxes	121
8.19.1	Overview and processing	121
8.19.2	Processing model	121
8.19.3	General syntax	123
8.19.4	General semantics	123
8.19.5	Original file-type box	123
8.19.6	Compressed movie box	123
8.19.7	Compressed movie fragment box	124
8.19.8	Compressed segment index box	124
8.19.9	Compressed subsegment index box	125
9	Hint track formats	125
9.1	RTP and SRTP hint track format	125
9.1.1	Overview	125
9.1.2	Sample description format	126
9.1.3	Sample format	127
9.1.4	SDP information	129
9.1.5	Statistical information	130
9.2	ALC/LCT and FLUTE hint track format	131
9.2.1	Overview	131
9.2.2	Design principles	131
9.2.3	Sample description format	133
9.2.4	Sample format	133
9.3	MPEG-2 transport hint track format	136
9.3.1	Overview	136
9.3.2	Design principles	137
9.3.3	Sample description format	138
9.3.4	Sample format	140
9.3.5	Protected MPEG 2 transport stream hint track	142
9.4	RTP, RTCP, SRTP and SRTCP reception hint tracks	143
9.4.1	RTP reception hint track	143
9.4.2	RTCP reception hint track	146
9.4.3	SRTP reception hint track	147
9.4.4	SRTCP reception hint tracks	149
9.4.5	Protected RTP reception hint track	150
9.4.6	Recording procedure	150
9.4.7	Parsing procedure	150
10	Sample groups	150
10.1	Random access recovery points	150
10.1.1	Definition	150
10.1.2	Syntax	151
10.1.3	Semantics	151
10.2	Rate share groups	151
10.2.1	Overview	151
10.2.2	Rate share sample group entry	152
10.2.3	Relationship between tracks	153

10.2.4	Bitrate allocation	154
10.3	Alternative startup sequences	154
10.3.1	Definition	154
10.3.2	Syntax	155
10.3.3	Semantics	155
10.3.4	Examples	155
10.4	Random access point (RAP) sample group	157
10.4.1	Definition	157
10.4.2	Syntax	157
10.4.3	Semantics	157
10.5	Temporal level sample group	157
10.5.1	Definition	157
10.5.2	Syntax	158
10.5.3	Semantics	158
10.6	Stream access point sample group	158
10.6.1	Definition	158
10.6.2	Syntax	158
10.6.3	Semantics	158
10.7	Sample-to-item sample group	159
10.7.1	Definition	159
10.7.2	Syntax	159
10.7.3	Semantics	159
10.8	Dependent random access point (DRAP) sample group	159
10.8.1	Definition	159
10.8.2	Syntax	160
10.8.3	Semantics	160
11	Extensibility	160
11.1	Objects	160
11.2	Storage formats	161
11.3	Derived file formats	161
12	Media-specific definitions	162
12.1	Video media	162
12.1.1	Media handler	162
12.1.2	Video media header	162
12.1.3	Sample entry	162
12.1.4	Pixel aspect ratio and clean aperture	163
12.1.5	Colour information	165
12.1.6	Content light level	166
12.1.7	Mastering display colour volume	166
12.1.8	Content colour volume	166
12.2	Audio media	167
12.2.1	Media handler	167
12.2.2	Sound media header	167
12.2.3	Sample entry	168
12.2.4	Channel layout	170
12.2.5	Downmix instructions	172
12.2.6	DRC information	175
12.2.7	Audio stream loudness	176
12.3	Metadata media	178
12.3.1	Media handler	178
12.3.2	Media header	178
12.3.3	Sample entry	178
12.4	Hint media	180
12.4.1	Media handler	180
12.4.2	Hint media header	180
12.4.3	Sample entry	180
12.5	Text media	181

12.5.1	Media handler	181
12.5.2	Media header	181
12.5.3	Sample entry	181
12.6	Subtitle media	181
12.6.1	Media handler	181
12.6.2	Subtitle media header	181
12.6.3	Sample entry	182
12.7	Font media	183
12.7.1	Media handler	183
12.7.2	Media header	183
12.7.3	Sample entry	183
12.8	Transformed media	183
12.8.1	General	183
12.8.2	Multiple transformations for a single transformed media track	183
12.8.3	Determining the untransformed sample entry type	184
12.8.4	The 'codecs' MIME parameter for a transformed media track	184
12.9	Multiplexed timed metadata tracks	184
12.9.1	General	184
12.9.2	Overall design	184
12.9.3	Sample format	185
12.9.4	Sample entry format	185
12.9.5	Defined formats	188
Annex A (informative) Overview of the file format		190
Annex B (informative) Guidance on deriving from this document		194
Annex C (normative) Fragment identifiers for ISO base media resources		203
Annex D (informative) Management of extension code points		204
Annex E (normative) File format brands		205
Annex F (normative) MIME type registration of segments		217
Annex G (informative) URI-labelled metadata forms		218
Annex H (informative) Processing of RTP streams and reception hint tracks		220
Annex I (normative) Stream access points		235
Annex J (informative) Segment index examples		238
Annex K (normative) Use of IETF RFC 6381 for ISO BMFF files		241
Bibliography		244

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).

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 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 <https://www.iso.org/foreword-supplementary-information.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*.

This sixth edition cancels and replaces the fifth edition (ISO/IEC 14496-12:2015), which has been technically revised. It also incorporates Amendments ISO/IEC 14496-12:2015/Amd.1:2017 and ISO/IEC 14496-12:2015/Amd.2:2018.

The main changes compared to the previous edition are as follows:

- incorporation of all changes provided in Amendments 1 and 2 and unpublished draft COR.1 for the fifth edition and draft Amendments 1 through 4 for this sixth edition.
- editorial changes to align the document with the drafting rules in ISO/IEC Directives Part 2.

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 <https://www.iso.org/members.html>.

Introduction

The ISO base media file format is designed to contain timed media information for a presentation in a flexible, extensible format that facilitates interchange, management, editing, and presentation of the media. This presentation may be 'local' to the system containing the presentation, or may be via a network or other stream delivery mechanism.

The file structure is object-oriented; a file can be decomposed into constituent objects very simply, and the structure of the objects inferred directly from their type.

The file format is designed to be independent of any particular network protocol while enabling efficient support for them in general.

The ISO base media file format is a base format for media file formats.

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 the patent database available at www.iso.org/patents.

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 12: ISO base media file format

1 Scope

This document specifies the ISO base media file format, which is a general format forming the basis for a number of other more specific file formats. This format contains the timing, structure, and media information for timed sequences of media data, such as audio-visual presentations.

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.

ISO 639-2, *Codes for the representation of names of languages — Part 2: Alpha-3 code*

ITU-T X.667 | ISO/IEC 9834-8, *Information technology — Procedures for the operation of object identifier registration authorities — Part 8: Generation of universally unique identifiers (UUIDs) and their use in object identifiers*

ISO/IEC 10646, *Information technology — Universal Coded Character Set (UCS)*

ISO/IEC 13818-2:2013, *Information technology — Generic coding of moving pictures and associated audio information — Part 2: Video*

ISO/IEC 14496-1, *Information technology — Coding of audio-visual objects — Part 1: Systems*

ISO/IEC 14496-10:2014, *Information technology — Coding of audio-visual objects — Part 10: Advanced Video Coding*

ISO 15076-1, *Image technology colour management — Architecture, profile format and data structure — Part 1: Based on ICC.1:2010*

ISO/IEC 15938-1, *Information technology — Multimedia content description interface — Part 1: Systems*

ISO/IEC 23001-1, *Information technology — MPEG systems technologies — Part 1: Binary MPEG format for XML*

ISO/IEC 23002-3, *Information technology — MPEG video technologies — Part 3: Representation of auxiliary video and supplemental information*

ISO/IEC 23003-4, *Information technology — MPEG audio technologies — Part 4: Dynamic range control*

ITU-T H.265 | ISO/IEC 23008-2, *Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 2: High efficiency video coding*

ISO/IEC 23091-2, *Information technology — Coding-independent code points — Part 2: Video*

ISO/IEC 23091-3, *Information technology — Coding-independent code points — Part 3: Audio*

IETF RFC 1951, *DEFLATE Compressed Data Format Specification version 1.3*

IETF RFC 2045, *Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies*

IETF RFC 2046, *Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types*

IETF RFC 3629, *UTF-8, a transformation format of ISO 10646*

IETF RFC 3711:2004, *The Secure Real-time Transport Protocol (SRTP)*

IETF RFC 5052, *Forward Error Correction (FEC) Building Block*

IETF RFC 5905, *Network Time Protocol Version 4: Protocol and Algorithms Specification*

ITU-R TF.460-6:2002, *Standard-frequency and time-signal emissions*

ITU-R BS.1770-4, *Algorithms to measure audio programme loudness and true-peak audio level*

IETF BCP 47, *Tags for Identifying Languages*

IETF RFC 4122, *A Universally Unique Identifier (UUID) URN Namespace*

IETF RFC 3061, *A URN Namespace of Object Identifiers*

W3C Recommendation, *Extensible Markup Language (XML) 1.0 (Fifth Edition)*, 26 November 2008, <https://www.w3.org/TR/2008/REC-xml-20081126/>

3 Terms, definitions and abbreviated terms

3.1 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:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1.1

box

object-oriented building block defined by a unique type identifier and length

Note 1 to entry: Called 'atom' in some specifications, including the first definition of MP4.

3.1.2

chunk

contiguous set of samples for one track

3.1.3

clean aperture

part of a decoded video image from which undesirable pixels introduced for coding purposes such as having integer number of coding blocks have been removed for presentation

3.1.4

container box

box whose sole purpose is to contain and group a set of related boxes

Note 1 to entry: Container boxes are normally not derived from FullBox.

3.1.5

file level

byte position in an ISO base media file not contained in a Box structure