

ISO/IEC ~~FDIS~~ 14496-15:202x(E)

ISO/IEC JTC 1/SC 29 ~~AWG 02~~

Secretariat: JISC

Date: 2024-07-11

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

ITeh Standards
(<https://standards.iteh.ai>)
Document Preview

ISO/IEC FDIS 14496-15

<https://standards.iteh.ai/catalog/standards/iso/827b6806-8cb0-475d-a5c9-3e48d68492fb/iso-iec-fdis-14496-15>

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

FDIS stage

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

ISO/IEC FDIS 14496-15

<https://standards.iteh.ai/catalog/standards/iso/827b6806-8cb0-475d-a5c9-3e48d68492fb/iso-iec-fdis-14496-15>

© ISO/IEC ~~202x~~2024

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~~E-mail: copyright@iso.org
Website: ~~www.iso.org~~www.iso.org

Published in Switzerland

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

ISO/IEC FDIS 14496-15

<https://standards.iteh.ai/catalog/standards/iso/827b6806-8cb0-475d-a5c9-3e48d68492fb/iso-iec-fdis-14496-15>

Contents — Page

Forewordxii

Introductionxiv

1 Scope..... 1

2 Normative references 1

3 Terms, definitions, abbreviated terms and conventions..... 2

3.1 Terms and definitions 2

3.2 Abbreviated terms..... 11

3.3 Conventions..... 15

4 General definitions..... 15

4.1 Overview 15

4.2 Sample and configuration definition..... 15

4.2.1 General..... 15

4.2.2 Canonical order and restrictions..... 16

4.2.3 Sample format..... 16

4.2.4 Optional boxes in the sample entry 17

4.3 Video track structure..... 18

4.4 Template fields used..... 18

4.5 Visual width and height..... 18

4.6 Decoding time (DTS) and composition time (CTS) 19

4.7 Sample groups on random access recovery points 'roll' and random access points 'rap' 19

4.8 Hinting 20

4.9 On change of sample entry (informative) 20

4.10 SEI information box..... 21

4.10.1 Definition 21

4.10.2 Syntax..... 21

4.10.3 Semantics 22

4.11 Post-decoder requirements scheme for signalling of SEI 22

4.11.1 General..... 22

4.11.2 Definition 22

4.12 Alternative extraction source track grouping 22

4.13 NAL unit map entry..... 23

4.13.1 Definition 23

4.13.2 Syntax..... 23

4.13.3 Semantics 24

4.14 Rectangular region group entry 24

4.14.1 Definition 24

4.14.2 Syntax..... 25

4.14.3 Semantics 25

4.15 Layer information sample group..... 27

4.15.1 Definition 27

4.15.2 Syntax..... 27

4.15.3 Semantics 28

4.16 Storage of SEI manifest and SEI prefix indication SEI messages..... 28

4.17 Supplementary track reference 29

4.18 Picture region replacement sample group 30

4.18.1 Definition 30

4.18.2 Syntax 30

4.18.3 Semantics 30

5 AVC elementary streams and sample definitions 31

5.1 Overview 31

5.2 Elementary stream structure 31

5.3 Sample and configuration definition 34

5.3.1 Canonical order and restrictions 34

5.3.2 Decoder configuration information 36

5.4 Derivation from ISO base media file format 39

5.4.1 AVC file type and identification 39

5.4.2 AVC video stream definition 39

5.4.3 AVC parameter set stream definition 41

5.4.4 Parameter sets 42

5.4.5 Sync sample 43

5.4.6 Shadow sync 43

5.4.7 Layering and sub-sequences 44

5.4.8 Alternate streams and switching pictures 47

5.4.9 Definition of a sub-sample for AVC 50

6 SVC elementary stream and sample definitions 51

6.1 Overview 51

6.2 Elementary stream structure 51

6.3 Use of the plain AVC file format 52

6.4 Sample and configuration definition 53

6.4.1 Canonical order and restrictions 53

6.4.2 Decoder configuration record 53

6.5 Derivation from the ISO base media file format 54

6.5.1 SVC track structure 54

6.5.2 Data sharing and extraction 55

6.5.3 SVC video stream definition 55

6.5.4 SVC visual width and height 58

6.5.5 Sync sample 58

6.5.6 Shadow sync 59

6.5.7 Independent and disposable samples box 59

6.5.8 Sample groups on random access recovery points 'roll' and random access points 'rap' 59

6.5.9 Definition of a sub-sample for SVC 59

7 MVC and MVD elementary stream and sample definitions 61

7.1 Overview 61

7.2 Overview of MVC or MVD Storage 62

7.3 MVC and MVD elementary stream structures 64

7.4 Use of the plain AVC file format 65

7.5 Sample and configuration definition 66

7.5.1 Canonical order and restriction 66

7.5.2 Decoder configuration record 66

7.6 Derivation from the ISO base media file format 69

7.6.1 MVC and MVD track structures 69

7.6.2 Reconstruction of an access unit 69

7.6.3 Sample entry 70

7.6.4 Sync sample 83

7.6.5 Shadow sync 83

7.6.6 Independent and disposable samples box 84

7.6.7 Sample groups on random access recovery points 'roll' and random access points 'rap' 84

7.7 MVC specific information boxes..... 84

7.7.1 Overview 84

7.7.2 Multiview information box..... 85

7.7.3 Multiview group box 85

7.7.4 Multiview group relation box..... 87

7.7.5 Multiview relation attribute box 88

7.7.6 Multiview scene info box 94

7.7.7 MVC view priority assignment box 94

8 HEVC elementary streams and sample definitions 95

8.1 Overview 95

8.2 Elementary stream structure 96

8.3 Sample and configuration definition..... 96

8.3.1 Canonical order and restrictions..... 96

8.3.2 Decoder configuration information..... 97

8.4 Derivation from ISO base media file format..... 101

8.4.1 HEVC video stream definition..... 101

8.4.2 Parameter sets in sample entry 102

8.4.3 Sync sample 102

8.4.4 Sync sample sample grouping 104

8.4.5 Temporal scalability sample grouping 105

8.4.6 Temporal sub-layer access sample grouping..... 106

8.4.7 Step-wise temporal layer access sample grouping..... 107

8.4.8 Definition of a sub-sample for HEVC..... 108

8.4.9 Handling non-output samples 111

9 Layered HEVC elementary stream and sample definitions..... 111

9.1 Overview 111

9.2 Overview of L-HEVC storage 112

9.3 L-HEVC elementary stream structure 113

9.4 Sample and configuration definition..... 113

9.4.1 Overview 113

9.4.2 Canonical order and restrictions..... 113

9.4.3 Decoder configuration record..... 114

9.5 Derivation from the ISO base media file format and the HEVC file format (Clause 8)..... 115

9.5.1 L-HEVC track structure..... 115

9.5.2 Data sharing and reconstruction of an L-HEVC bitstream..... 115

9.5.3 L-HEVC video stream definition 117

9.5.4 L-HEVC visual width and height 122

9.5.5 Sync sample 122

9.5.6 Independent and disposable samples box..... 123

9.5.7 Stream access point sample group..... 123

9.5.8 The 'roll', 'rap', 'sync', 'tsas' and 'tsa' sample groups 124

9.5.9 Definition of a sub-sample for L-HEVC..... 124

9.5.10 Handling non-output samples 125

9.6 L-HEVC specific structures 125

9.6.1 External base layer sample group 125

9.6.2 The operating points information sample group..... 126

9.6.3 The layer information sample group 129

9.6.4 The decoding time hint sample group 130

10 Storage of tiled HEVC and L-HEVC video streams 130

10.1 Overview130

10.2 NAL unit map entry.....131

10.3 Tile region group entry132

10.4 Tile sub track definition.....132

10.4.1 Overview132

10.4.2 TileSubTrackGroupBox.....132

10.5 HEVC and L-HEVC tile track.....133

10.5.1 Overview133

10.5.2 Sample entry name and format for HEVC tile tracks.....134

10.5.3 Sample entry name and format for L-HEVC tile tracks.....135

10.5.4 Bitstream reconstruction from tile base and tile tracks.....136

10.5.5 Sample entry names for tile base tracks136

10.5.6 HEVC tile track with slice segment header info137

10.6 HEVC slice segment data track138

10.6.1 Overview138

10.6.2 Sample entry name and format for HEVC slice segment data tracks.....138

11 VVC elementary streams and sample definitions139

11.1 Overview139

11.1.1 General.....139

11.1.2 Background: features of VVC140

11.1.3 Types of tracks for carriage of VVC elementary streams.....141

11.1.4 Overview of VVC storage with multiple layers or sublayers.....141

11.1.5 Overview of VVC storage with VVC subpictures142

11.1.6 Overview of rectangular regions carried in a VVC bitstream145

11.2 Sample and configuration definition.....146

11.2.1 Sample format of VVC tracks and VVC subpicture tracks.....146

11.2.2 Sample format of VVC non-VCL tracks147

11.2.3 Canonical order and restrictions.....147

11.2.4 Decoder configuration information.....148

11.3 Derivation from ISO base media file format.....155

11.3.1 VVC sample entries.....155

11.3.2 VVC subpicture sample entry 'vvs1'.....157

11.3.3 VVC non-VCL sample entry158

11.3.4 Constraints related to VVC merge base tracks, VVC extraction base tracks and VVC subpicture tracks.....159

11.3.5 Sync sample160

11.3.6 Definition of a sub-sample for VVC165

11.3.7 Handling non-output samples167

11.4 Sample groups168

11.4.1 Common layer id method idc semantics.....168

11.4.2 Stream access point sample group.....170

11.4.3 Random access recovery point sample group170

11.4.4 Alternative startup sequences sample group170

11.4.5 Random access point sample group170

11.4.6 Temporal level sample group.....171

11.4.7 Step-wise sublayer access sample group171

11.4.8 Decoding time hint sample group171

11.4.9 Layer information sample group.....171

11.4.10 Operating points information sample group172

11.4.11 Decoding capability information sample group.....177

11.4.12 Parameter set sample group178

11.4.13	Access unit delimiter sample group	179
11.4.14	End of sequence sample group.....	179
11.4.15	End of bitstream sample group.....	180
11.4.16	Subpicture ID sample group	181
11.4.17	Subpicture order sample group.....	182
11.4.18	Subpicture layout map entry.....	184
11.4.19	Mixed NAL unit type pictures sample group	184
11.4.20	Rectangular region order sample group	185
11.4.21	Subpicture level information sample group	187
11.5	Entity groups.....	187
11.5.1	Subpicture entity groups	187
11.5.2	Operating point entity group.....	190
11.5.3	VVC bitstream entity group.....	193
11.5.4	VVC switchable tracks entity group.....	194
11.6	Data sharing and VVC bitstream reconstruction	195
11.6.1	General.....	195
11.6.2	Implicit reconstruction of a VVC bitstream	197
11.6.3	Reconstructing a picture unit from a sample in a VVC track with 'subp' or 'vvcN' track references	199
11.6.4	Resolving subpicture track references	201
11.6.5	Parameter set updating.....	202
11.6.6	Reconstructing a picture unit from a sample in a VVC track with 'recr' track reference	203
12	EVC elementary streams and sample definitions	205
12.1	Overview	205
12.2	Elementary stream structure	205
12.3	Sample and configuration definition.....	205
12.3.1	Overview	205
12.3.2	Canonical order and restrictions.....	206
12.3.3	Decoder configuration information: EVC decoder configuration record.....	206
12.4	Derivation from ISO base media file format.....	209
12.4.1	EVC video stream definition: sample entry name and format.....	209
12.4.2	Parameter sets.....	210
12.4.3	Sync sample	211
12.4.4	Definition of a sub-sample for EVC.....	212
12.5	EVC slice track.....	213
12.5.1	Overview	213
12.5.2	Implicit reconstruction of an EVC bitstream.....	213
12.5.3	EVC slice component track	213
12.5.4	EVC slice base track.....	215
13	LCEVC elementary streams and sample definitions.....	216
13.1	Overview	216
13.2	Elementary stream structure	217
13.3	Sample and configuration definitions.....	217
13.3.1	Overview	217
13.3.2	Canonical order.....	217
13.3.3	Decoder configuration information.....	218
13.4	Derivation from ISO base media file format.....	220
13.4.1	LCEVC video stream definition: sample entry name and format.....	220
13.4.2	LCEVC track structure.....	221
13.4.3	Parameter sets.....	222

13.4.4 Sync sample 222

Annex A (normative) In-stream structures..... 223

Annex B (normative) SVC, MVC, and MVD sample group and sub-track definitions 240

Annex C (normative) Temporal metadata support..... 265

Annex D (normative) File format toolsets and brands 278

Annex E (normative) Sub-parameters for the MIME type 'codecs' parameter..... 281

Annex F (informative) Unspecified nal unit type value management for sample entry types of
AVC and HEVC 290

Annex G (informative) Examples of VVC base and subpicture tracks..... 292

Forewordvi

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 HEVC273~~
~~Annex G (informative) Examples of VVC base and subpicture tracks.....275~~

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

<https://standards.iteh.ai/catalog/standards/iso/827b6806-8cb0-475d-a5c9-3e48d68492fb/iso-iec-fdis-14496-15>

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).

Field Code Changed

~~Attention is drawn to the possibility that some of the elements implementation of this document may involve the use of (a) patent(s). ISO and IEC take no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO and IEC had received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents and [https://patents.iec.ch](http://patents.iec.ch). 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](http://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 or www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards or 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 seventh edition cancels and replaces the sixth edition (ISO/IEC 14496-15:2022), which has been technically revised. It also incorporates the Amendment ISO/IEC 14496-15:2022/Amd 1:2023.

The main changes are as follows:

- ~~Support~~support for the Low Complexity Enhancement Video Coding (ISO/IEC 23094-2);
- ~~Addition~~addition of the supplementary track reference and the picture region replacement sample group, for support of picture-in-picture services.

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.

Field Code Changed

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

<https://standards.iteh.ai/catalog/standards/iso/827b6806-8cb0-475d-a5c9-3e48d68492fb/iso-iec-fdis-14496-15>

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 they are 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.~~