INTERNATIONAL STANDARD

ISO/IEC 23090-2

Second edition
2021-07

Information technology — Coded representation of immersive media —

Part 2: Omnidirectional media format

Technologies de l'information — Représentation codée de média immersifs —
Partie 2: Format de média omnidirectionnel

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

ISO/IEC 23090-2:2021
https://standards.iteh.ai/catalog/standards/iso/f0dac648-62ef-4195-b404-0cdfc5ed8a9a/iso-iec-23090-2-2021

Reference number
ISO/IEC 23090-2:2021(E)

© ISO/IEC 2021

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

ISO/IEC 23090-2:2021
https://standards.iteh.ai/catalog/standards/iso/f0dac648-62ef-4195-b404-0cdfc5ed8a9a/iso-iec-23090-2-2021

COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2021

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

 © ISO/IEC 2021 – All rights reserved

Contents

Page

Foreword vii

Introduction viii

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 10
3.3 Conventions 10
3.3.1 Arithmetic operators and mathematical functions 10
3.3.2 Order of operation precedence 12
3.3.3 Range notation 12
3.3.4 Variables 13
3.3.5 Processes 13
3.3.6 Conventions for indicating the number of boxes in tables 13

4 Overview 13
4.1 Organization of this clause 13
4.2 Overall architecture 14
4.3 Projected omnidirectional video/images 16
4.3.1 General 16
4.3.2 Stitching, rotation, projection, and region-wise packing 16
4.4 Fisheye omnidirectional video/images 17
4.5 Mesh omnidirectional video 18
4.6 Streaming methods for omnidirectional video 18
4.6.1 Overview 18
4.6.2 Tile-based streaming with viewport-specific author-driven binding 20
4.6.3 Tile-based streaming with free-viewport author-driven binding 20
4.6.4 Tile-based streaming with late binding 21
4.7 Additional functionalities 22
4.8 Conformance and interoperability 23
4.8.1 General 23
4.8.2 Media profiles 23
4.8.3 Presentation profiles 25
4.8.4 Toolset brands 25
4.8.5 Summary of referenceable code points 26

5 Omnidirectional video projection and region-wise packing 32
5.1 Coordinate system 32
5.2 Omnidirectional projection formats 33
5.2.1 General 33
5.2.2 Equirectangular projection for one sample location 34
5.2.3 Cubemap projection for one sample location 34
5.3 Conversion from the local coordinate axes to the global coordinate axes 36
5.4 Region-wise packing formats 37
5.4.1 General 37
5.4.2 Conversion of one sample location for rectangular region-wise packing 38

6 Fisheye omnidirectional video 39
6.1 General 39
6.2 The `FisheyeVideoEssentialInfoStruct()` syntax structure 39
6.2.1 Syntax 39
6.2.2 Semantics 40
6.3 The `FisheyeVideoSupplementalInfoStruct()` syntax structure 43
6.3.1 Syntax 43
6.3.2 Semantics 44

iTeh Standards
(https://standards.iteh.ai)
Document Preview
ISO/IEC 23090-2:2021
https://standards.iteh.ai/catalog/standards/iso/edac648-62ef-4195-b404-0cdfc5ed8a9a/iso-iec-23090-2-2021

7 Omnidirectional media storage and metadata signalling in the ISOBMFF 48
7.1 Generic extensions to the ISOBMFF 48
7.1.1 Indication of a track not intended to be presented alone 49
7.1.2 Association of timed metadata tracks with media tracks or track groups 49
7.1.3 Clarifications on the stereo video box 49
7.1.4 Generic sub-picture track grouping extensions 49
7.1.5 Track reference indicating a track providing shadow sync samples 53
7.1.6 Media offset box 54
7.2 Generic extensions to ISO/IEC 14496-15 55
7.2.1 Containing of `SpatialRelationship2DDescriptionBox` for HEVC tile base track and HEVC tile tracks 56
7.3 OMAF-specific extensions to the ISOBMFF 56
7.3.1 Sync samples in timed metadata tracks 56
7.4 OMAF-specific extensions to ISO/IEC 14496-15 56
7.4.1 Coverage information box in an HEVC tile base track 56
7.5 Structures and semantics that are common for video tracks and image items 56
7.5.1 Semantics of sample locations within a decoded picture 56
7.5.2 Projection format structure 60
7.5.3 Region-wise packing structure 60
7.5.4 Rotation structure 68
7.5.5 Content coverage structure 69
7.5.6 Sphere region structure 70
7.6 Restricted video schemes for omnidirectional video 73
7.6.1 Scheme types 73
7.6.2 Projected omnidirectional video box 78
7.6.3 Fisheye omnidirectional video box 79
7.6.4 Region-wise packing box 80
7.6.5 Rotation box 80
7.6.6 Coverage information box 81
7.6.7 Mesh omnidirectional video box 81
7.6.8 Mesh box 82
7.7 Timed metadata for sphere regions 84
7.7.1 General 84
7.7.2 Sample entry 85
7.7.3 Sample format 86
7.7.4 Initial viewing orientation 86
7.7.5 Recommended viewport 88
7.7.6 Timed text sphere location metadata 91
7.8 Signalling of region-wise quality ranking 92
7.8.1 General 92
7.8.2 Spherical region-wise quality ranking 92
7.8.3 2D region-wise quality ranking 94
7.9 Storage of omnidirectional images 96
7.9.1 General 96
7.9.2 Frame packing item property 96
7.9.3 Projection format item property 97
7.9.4 Essential fisheye image item property 98
7.9.5 Supplemental fisheye image item property 99
7.9.6 Region-wise packing item property 99
7.9.7 Rotation item property 100
7.9.8 Coverage information item property 100
7.9.9 Initial viewing orientation item property 101
7.10 Storage of timed text for omnidirectional video 102
7.10.1 General 102
7.10.2 OMAF timed text configuration box 102
7.10.3 IMSC1 tracks 104
7.10.4 WebVTT tracks 105
7.11 ERP region timed metadata 105
7.11.1 General 105
7.11.2 Sample entry format 106

iTeh Standards
(https://standards.iteh.ai)
Document Preview
ISO/IEC 23090-2:2021
https://standards.iteh.ai/catalog/standards/iso/f0dac648-62ef-4195-b404-0cdfc5ed8a9a/iso-iec-23090-2-2021

 © ISO/IEC 2021 – All rights reserved

7.11.3 Semantics ... 106
7.11.4 Sample format ... 107
7.11.5 Generating ERP region metadata ... 108
7.12 Storage and signalling of viewpoints for omnidirectional video and images ... 108
7.12.1 Viewpoint information structures ... 108
7.12.2 Viewpoint entity grouping ... 117
7.12.3 Timed metadata for viewpoints ... 119
7.13 Storage of omnidirectional video in sub-picture tracks ... 123
7.13.1 General ... 123
7.13.2 Projected omnidirectional video ... 124
7.13.3 Indication of composition pictures being packed pictures or projected pictures ... 125
7.13.4 Fisheye omnidirectional video ... 125
7.14 Storage and signalling of overlays for omnidirectional video and images ... 125
7.14.1 General ... 125
7.14.2 Overlay structure ... 128
7.14.3 Overlay control structures ... 129
7.14.4 Overlay configuration box ... 139
7.14.5 Overlay item property ... 140
7.14.6 Overlay timed metadata track ... 140
7.14.7 Entity groups ... 142
7.14.8 Overlay alpha auxiliary image ... 144
7.15 Signalling of viewing space information ... 145
7.15.1 General ... 145
7.15.2 Viewing space structure ... 145
7.15.3 Viewing space box ... 148
7.15.4 Viewing space item property ... 148
7.15.5 Time varying immersive viewing space signalling ... 148
7.16 Mapping of rectangular regions to the 3D mesh ... 149
7.16.1 General ... 149
7.16.2 Tile mesh sample grouping ... 149
7.16.3 Rectangular region structure ... 151
7.16.4 Projection of a sample location onto the 3D mesh ... 152

8 Omnidirectional media encapsulation and signalling in DASH ... 153
8.1 Architecture of DASH delivery in OMAF ... 153
8.2 Usage of DASH in OMAF ... 155
8.2.1 General ... 155
8.2.2 Signalling of stereoscopic frame packing ... 155
8.2.3 Carriage of timed metadata ... 155
8.2.4 Associating Adaptation Sets or Representations with each other ... 156
8.3 DASH MPD descriptors for omnidirectional media in the namespace "urn:mpeg:mpegI:omaf:2017" ... 157
8.3.1 XML namespace and schema ... 157
8.3.2 Signalling of projection type information ... 157
8.3.3 Signalling of region-wise packing type ... 158
8.3.4 Signalling of content coverage ... 159
8.3.5 Signalling of spherical region-wise quality ranking ... 162
8.3.6 Signalling of 2D region-wise quality ranking ... 168
8.3.7 Signalling of fisheye omnidirectional video ... 173
8.4 Carriage of images ... 173
8.4.1 General ... 173
8.4.2 Format and constraints for Segments ... 174
8.5 DASH MPD descriptors for omnidirectional media in the namespace "urn:mpeg:mpegI:omaf:2020" ... 174
8.5.1 XML namespace and schema ... 174
8.5.2 Signalling of association ... 174
8.5.3 Signalling of viewpoints ... 176
8.5.4 Signalling of sub-picture composition identifier and its attributes ... 183
8.5.5 Signalling of overlays ... 184
8.5.6 Entity to group descriptor ... 186

iTeh Standards
(https://standards.iteh.ai)
Document Preview
https://standards.iteh.ai/catalog/standards/iso/4ee23090-2-2

© ISO/IEC 2021 – All rights reserved

8.6 Segment formats ... 188
8.6.1 Initialization Segment for OMAF base track ... 188
8.6.2 Tile Index Segment ... 192
8.6.3 Tile Data Segment ... 193

9 Omnidirectional media encapsulation and signalling in MMT ... 194
9.1 Architecture of MMT delivery in OMAF ... 194
9.2 OMAF signalling in MPEG composition information ... 195
9.3 VR application-specific MMT signalling ... 195
9.3.1 General ... 195
9.3.2 MMT signalling ... 196

10 Media profiles ... 212
10.1 Video profiles ... 212
10.2 Audio profiles ... 243
10.3 Image profiles ... 252
10.4 Timed text profiles ... 257

11 Presentation profiles ... 258
11.1 OMAF viewport-independent baseline presentation profile ... 258
11.1.1 General ... 258
11.1.2 ISO Base Media File Format constraints ... 259
11.2 OMAF viewport-dependent baseline presentation profile ... 259
11.2.1 General ... 259
11.2.2 ISO Base Media File Format constraints ... 259

12 OMAF toolset brands ... 260
12.1 Overlay toolset brand ... 260
12.1.1 Overview ... 260
12.1.2 ISO Base Media File Format constraints ... 260
12.1.3 OMAF player operation ... 260
12.2 Viewpoint toolset brand ... 260
12.2.1 Overview ... 260
12.2.2 ISO Base Media File Format constraints ... 260
12.2.3 OMAF player operation ... 260
12.3 Non-linear storyline toolset brand ... 260
12.3.1 Overview ... 260
12.3.2 ISO Base Media File Format constraints ... 261
12.3.3 OMAF player operation ... 261

Annex A (normative) OMAF DASH schema ... 262

Annex B (normative) DASH integration of media profiles ... 266

Annex C (normative) CMAF integration of media profiles ... 279

Annex D (informative) Viewport-dependent omnidirectional video processing ... 282

Annex E (informative) DASH MPD examples ... 316

Annex F (informative) MMT signalling examples ... 320

Annex G (normative) Expected behaviour of OMAF player ... 322

Bibliography ... 332

iTeh Standards
(https://standards.iteh.ai)
Document Preview
ISO/IEC 23090-2:2021
https://standards.iteh.ai/catalog/standards/iso/f0dac648-62ef-4195-b404-0cdfc5ed8a9a/iso-iec-23090-2-2021

© ISO/IEC 2021 – All rights reserved

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 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.

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

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 second edition cancels and replaces the first edition (ISO/IEC 23090-2:2019), which has been technically revised.

ISO/IEC 23090-2:2021
https://standards.iteh.ai/catalog/standards/iso/f0dc648-62e6-4195-b404-0cdfc5ed8a9a/iso-iec-23090-2-2021

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

— Multiple viewpoints have been added. Viewpoints can be used for example to provide several user-switchable camera positions to view the content or to express a storyline where the user is given the choice to select which storyline path is followed.

— Sphere-relative and viewport-relative video and image overlays have been added.

— Mesh omnidirectional video where the video is projected on an indicated set of mesh elements has been added.

— Two tiling OMAF video profiles for viewport-dependent streaming have been added.

A list of all parts in the ISO/IEC 23090 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.

© ISO/IEC 2021 – All rights reserved