

ISO/IEC 23090-2:2019-01 (E)

Information technology - Coded representation of immersive media - Part 2: Omnidirectional media format

| 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 | 6 |
| 3.3 Arithmetic operators and mathematical functions | 7 |
| 3.4 Order of operation precedence | 8 |
| 3.5 Range notation..... | 9 |
| 3.6 Variables..... | 9 |
| 3.7 Processes | 9 |
| 4 Overview | 9 |
| 4.1 Organization of this document | 9 |
| 4.2 Overall architecture for omnidirectional media with projected video | 10 |
| 4.2.1 Overview | 10 |
| 4.2.2 Stitching, rotation, projection, and region-wise packing | 11 |
| 4.3 Overall architecture for omnidirectional media with fisheye video..... | 12 |
| 4.4 Conformance and interoperability..... | 13 |
| 4.4.1 General | 13 |
| 4.4.2 Media profiles..... | 14 |
| 4.4.3 Presentation profiles | 15 |
| 4.4.4 Summary of referenceable code points..... | 16 |
| 5 Omnidirectional video projection and region-wise packing | 19 |
| 5.1 Coordinate system | 19 |
| 5.2 Omnidirectional projection formats | 20 |
| 5.2.1 General | 20 |
| 5.2.2 Equirectangular projection for one sample location | 20 |
| 5.2.3 Cubemap projection for one sample location | 21 |
| 5.3 Conversion from the local coordinate axes to the global coordinate axes | 23 |
| 5.4 Region-wise packing formats..... | 24 |
| 5.4.1 General | 24 |
| 5.4.2 Conversion of one sample location for rectangular region-wise packing | 24 |

| | | |
|--------|--|----|
| 6 | Fisheye omnidirectional video | 25 |
| 6.1 | General | 25 |
| 6.2 | FisheyeVideoEssentialInfoStruct syntax structure..... | 26 |
| 6.2.1 | Syntax | 26 |
| 6.2.2 | Semantics | 26 |
| 6.3 | FisheyeVideoSupplementalInfoStruct syntax structure | 29 |
| 6.3.1 | Syntax | 29 |
| 6.3.2 | Semantics | 30 |
| 7 | Omnidirectional media storage and metadata signalling in the ISOBMFF | 33 |
| 7.1 | Generic extensions to the ISOBMFF..... | 33 |
| 7.1.1 | Stereoscopic video track grouping | 33 |
| 7.1.2 | Indication of <code>track_group_id</code> uniqueness | 34 |
| 7.1.3 | Updated semantics of <code>track_IDs</code> of the track reference box | 34 |
| 7.1.4 | Indication of a track not intended to be presented alone | 34 |
| 7.1.5 | Timed metadata tracks | 34 |
| 7.1.6 | Compatible scheme type box | 35 |
| 7.1.7 | Multiple transformations for a single transformed media track | 35 |
| 7.1.8 | The ' <code>codecs</code> ' parameter for a transformed media track | 35 |
| 7.1.9 | Track type box | 36 |
| 7.1.10 | Clarifications on the stereo video box..... | 36 |
| 7.2 | Generic extensions to ISO/IEC 14496-15 | 37 |
| 7.2.1 | Alternative extraction source track grouping | 37 |
| 7.2.2 | Tile base track association with coverage information box and timed metadata data track..... | 37 |
| 7.3 | OMAF-specific extensions to the ISOBMFF | 37 |
| 7.3.1 | Sync samples in timed metadata tracks..... | 37 |
| 7.4 | OMAF-specific extensions to ISO/IEC 14496-15..... | 37 |
| 7.4.1 | Coverage information box in a tile base track..... | 37 |
| 7.5 | Structures and semantics that are common for video tracks and image items | 38 |
| 7.5.1 | Semantics of sample locations within a decoded picture | 38 |
| 7.5.2 | Projection format structure..... | 41 |
| 7.5.3 | Region-wise packing structure | 41 |
| 7.5.4 | Rotation structure | 48 |
| 7.5.5 | Content coverage structure..... | 48 |
| 7.5.6 | Sphere region structure | 49 |
| 7.6 | Restricted video schemes for omnidirectional video..... | 51 |
| 7.6.1 | Scheme types..... | 51 |
| 7.6.2 | Projected omnidirectional video box..... | 54 |
| 7.6.3 | Fisheye omnidirectional video box | 55 |
| 7.6.4 | Region-wise packing box | 55 |
| 7.6.5 | Rotation box | 56 |
| 7.6.6 | Coverage information box..... | 56 |
| 7.7 | Timed metadata for sphere regions | 56 |
| 7.7.1 | General | 56 |
| 7.7.2 | Sample entry | 57 |
| 7.7.3 | Sample format | 58 |
| 7.7.4 | Initial viewing orientation | 58 |
| 7.7.5 | Recommended viewport..... | 59 |
| 7.7.6 | Timed text sphere location metadata..... | 60 |
| 7.8 | Signalling of region-wise quality ranking | 61 |
| 7.8.1 | General..... | 61 |
| 7.8.2 | Spherical region-wise quality ranking..... | 61 |
| 7.8.3 | 2D region-wise quality ranking..... | 63 |

| | | |
|--------|--|-----|
| 7.9 | Storage of omnidirectional images | 65 |
| 7.9.1 | General | 65 |
| 7.9.2 | Frame packing item property | 65 |
| 7.9.3 | Projection format item property | 65 |
| 7.9.4 | Essential fisheye image item property..... | 66 |
| 7.9.5 | Supplemental fisheye image item property | 67 |
| 7.9.6 | Region-wise packing item property | 67 |
| 7.9.7 | Rotation item property | 68 |
| 7.9.8 | Coverage information item property..... | 68 |
| 7.9.9 | Initial viewing orientation item property | 69 |
| 7.10 | Storage of timed text for omnidirectional video | 69 |
| 7.10.1 | General | 69 |
| 7.10.2 | OMAF timed text configuration box | 70 |
| 7.10.3 | IMSC1 tracks..... | 72 |
| 7.10.4 | WebVTT tracks | 73 |
| 8 | Omnidirectional media encapsulation and signalling in DASH | 73 |
| 8.1 | Architecture of DASH delivery in OMAF | 73 |
| 8.2 | Usage of DASH in OMAF | 74 |
| 8.2.1 | General | 74 |
| 8.2.2 | Signalling of stereoscopic frame packing | 74 |
| 8.2.3 | Carriage of timed metadata..... | 74 |
| 8.3 | DASH MPD descriptors for omnidirectional media | 75 |
| 8.3.1 | XML namespace and schema | 75 |
| 8.3.2 | Signalling of projection type information..... | 75 |
| 8.3.3 | Signalling of region-wise packing type | 76 |
| 8.3.4 | Signalling of content coverage | 76 |
| 8.3.5 | Signalling of spherical region-wise quality ranking | 79 |
| 8.3.6 | Signalling of 2D region-wise quality ranking..... | 84 |
| 8.3.7 | Signalling of fisheye omnidirectional video | 88 |
| 9 | Omnidirectional media encapsulation and signalling in MMT | 89 |
| 9.1 | Architecture of MMT delivery in OMAF | 89 |
| 9.2 | OMAF signalling in MPEG composition information..... | 90 |
| 9.3 | VR application-specific MMT signalling | 90 |
| 9.3.1 | General | 90 |
| 9.3.2 | MMT signalling..... | 91 |
| 10 | Media profiles | 103 |
| 10.1 | Video profiles | 103 |
| 10.1.1 | Overview | 103 |
| 10.1.2 | HEVC-based viewport-independent OMAF video profile | 103 |
| 10.1.3 | HEVC-based viewport-dependent OMAF video profile | 106 |
| 10.1.4 | AVC-based viewport-dependent OMAF video profile..... | 109 |
| 10.2 | Audio profiles..... | 111 |
| 10.2.1 | Overview | 111 |
| 10.2.2 | OMAF 3D audio baseline profile | 111 |
| 10.2.3 | OMAF 2D audio legacy profile..... | 114 |
| 10.3 | Image profiles..... | 118 |
| 10.3.1 | Overview | 118 |
| 10.3.2 | Common specifications for image profiles | 119 |
| 10.3.3 | OMAF HEVC image profile | 120 |
| 10.3.4 | OMAF legacy image profile..... | 121 |

| | | |
|---------|---|-----|
| 10.4 | Timed text profiles | 122 |
| 10.4.1 | Overview | 122 |
| 10.4.2 | OMAF IMSC1 timed text profile | 123 |
| 10.4.3 | OMAF WebVTT timed text profile..... | 123 |
| 11 | Presentation profiles..... | 124 |
| 11.1 | OMAF viewport-independent baseline presentation profile | 124 |
| 11.1.1 | General (informative) | 124 |
| 11.1.2 | ISO base media file format constraints | 124 |
| 11.2 | OMAF viewport-dependent baseline presentation profile | 124 |
| 11.2.1 | General..... | 124 |
| 11.2.2 | ISO base media file format constraints | 124 |
| Annex A | (normative) OMAF DASH schema | 125 |
| Annex B | (normative) DASH integration of media profiles | 128 |
| Annex C | (normative) CMAF integration of media profiles | 134 |
| Annex D | (informative) Viewport-dependent omnidirectional video processing | 136 |
| Annex E | (informative) DASH MPD examples | 154 |
| Annex F | (informative) MMT signalling examples..... | 158 |