

ISO/IEC 23090-2:2023-06 (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 symbols.....	3
3.1 Terms and definitions.....	3
3.2 Abbreviated terms.....	11
3.3 Symbols.....	12
3.3.1 Arithmetic operators and mathematical functions.....	12
3.3.2 Order of operation precedence.....	13
3.3.3 Range notation.....	14
3.3.4 Variables.....	14
3.3.5 Processes.....	14
3.3.6 Syntax structures.....	15
3.3.7 Conventions for indicating the number of boxes in tables.....	15
4 Overview.....	15
4.1 Overall architecture.....	15
4.2 Projected omnidirectional video/images.....	18
4.2.1 General.....	18
4.2.2 Stitching, rotation, projection, and region-wise packing.....	18
4.3 Fisheye omnidirectional video/images.....	19
4.4 Mesh omnidirectional video.....	20
4.5 Streaming methods for omnidirectional video.....	20
4.5.1 Overview.....	20
4.5.2 Tile-based streaming with viewport-specific author-driven binding.....	22
4.5.3 Tile-based streaming with free-viewport author-driven binding.....	22
4.5.4 Tile-based streaming with late binding.....	23
4.6 Additional functionalities.....	25
4.7 Conformance and interoperability.....	25
4.7.1 General.....	25
4.7.2 Media profiles.....	26
4.7.3 Presentation profiles.....	28
4.7.4 Toolset brands.....	28
4.7.5 Summary of referenceable code points.....	28
5 Omnidirectional video projection and region-wise packing.....	35
5.1 Coordinate system.....	35
5.2 Omnidirectional projection formats.....	36
5.2.1 General.....	36
5.2.2 Equirectangular projection for one sample location.....	36
5.2.3 Cubemap projection for one sample location.....	37
5.3 Conversion from the local coordinate axes to the global coordinate axes.....	39
5.4 Region-wise packing formats.....	40
5.4.1 General.....	40
5.4.2 Conversion of one sample location for rectangular region-wise packing.....	41
6 Fisheye omnidirectional video.....	42
6.1 General.....	42
6.2 The <code>FisheyeVideoEssentialInfoStruct()</code> syntax structure.....	42
6.2.1 Syntax.....	42

6.2.2	Semantics.....	43
6.3	The <code>FisheyeVideoSupplementalInfoStruct()</code> syntax structure.....	46
6.3.1	Syntax.....	46
6.3.2	Semantics.....	47
7	Omnidirectional media storage and metadata signalling in the ISOBMFF	52
7.1	Generic extensions to the ISOBMFF.....	52
7.1.1	Indication of a track not intended to be presented alone.....	52
7.1.2	Clarifications on the stereo video box.....	52
7.1.3	Generic sub-picture track grouping extensions.....	53
7.1.4	Media offset box.....	57
7.2	Generic extensions to ISO/IEC 14496-15.....	58
7.2.1	Containing of <code>SpatialRelationship2DDescriptionBox</code> for HEVC tile base track and HEVC tile tracks.....	58
7.3	OMAF-specific extensions to the ISOBMFF	58
7.3.1	Sync samples in timed metadata tracks	58
7.4	OMAF-specific extensions to ISO/IEC 14496-15.....	59
7.4.1	Coverage information box in an HEVC tile base track.....	59
7.5	Structures and semantics that are common for video tracks and image items	59
7.5.1	Semantics of sample locations within a decoded picture.....	59
7.5.2	Projection format structure.....	62
7.5.3	Region-wise packing structure.....	63
7.5.4	Rotation structure.....	70
7.5.5	Content coverage structure.....	71
7.5.6	Sphere region structure.....	72
7.6	Restricted video schemes for omnidirectional video	76
7.6.1	Scheme types.....	76
7.6.2	Projected omnidirectional video box.....	81
7.6.3	Fisheye omnidirectional video box.....	82
7.6.4	Region-wise packing box.....	83
7.6.5	Rotation box.....	83
7.6.6	Coverage information box	84
7.6.7	Mesh omnidirectional video box	84
7.6.8	Mesh box.....	85
7.7	Timed metadata for sphere regions	87
7.7.1	General	87
7.7.2	Sample entry.....	88
7.7.3	Sample format.....	89
7.7.4	Initial viewing orientation.....	89
7.7.5	Recommended viewport.....	91
7.7.6	Timed text sphere location metadata.....	94
7.8	Signalling of region-wise quality ranking.....	95
7.8.1	General	95
7.8.2	Spherical region-wise quality ranking.....	95
7.8.3	2D region-wise quality ranking.....	97
7.9	Storage of omnidirectional images	99
7.9.1	General	99
7.9.2	Frame packing item property	99
7.9.3	Projection format item property	100
7.9.4	Essential fisheye image item property.....	101
7.9.5	Supplemental fisheye image item property.....	102
7.9.6	Region-wise packing item property.....	102
7.9.7	Rotation item property	103
7.9.8	Coverage information item property.....	103
7.9.9	Initial viewing orientation item property.....	104
7.10	Storage of timed text for omnidirectional video	105
7.10.1	General	105
7.10.2	OMAF timed text configuration box	105
7.10.3	IMSC1 tracks	108
7.10.4	WebVTT tracks	108
7.11	ERP region timed metadata.....	109
7.11.1	General	109
7.11.2	Sample entry format.....	109
7.11.3	Semantics	109
7.11.4	Sample format.....	110

7.11.5	Generating ERP region metadata.....	111
7.12	Storage and signalling of viewpoints for omnidirectional video and images	111
7.12.1	Viewpoint information structures.....	111
7.12.2	Viewpoint entity grouping.....	120
7.12.3	Timed metadata for viewpoints	122
7.13	Storage of omnidirectional video in sub-picture tracks.....	127
7.13.1	General.....	127
7.13.2	Projected omnidirectional video.....	127
7.13.3	Indication of composition pictures being packed pictures or projected pictures	128
7.13.4	Fisheye omnidirectional video.....	128
7.14	Storage and signalling of overlays for omnidirectional video and images.....	129
7.14.1	General.....	129
7.14.2	Overlay structure	131
7.14.3	Overlay control structures.....	132
7.14.4	Overlay configuration box.....	143
7.14.5	Overlay item property	143
7.14.6	Overlay timed metadata track.....	144
7.14.7	Entity groups.....	145
7.14.8	Overlay alpha auxiliary image.....	148
7.15	Signalling of viewing space information.....	149
7.15.1	General.....	149
7.15.2	Viewing space structure.....	149
7.15.3	Viewing space box	152
7.15.4	Viewing space item property.....	152
7.15.5	Time varying immersive viewing space signalling.....	152
7.16	Mapping of rectangular regions to the 3D mesh.....	153
7.16.1	General.....	153
7.16.2	Tile mesh sample grouping	153
7.16.3	Rectangular region structure.....	155
7.16.4	Projection of a sample location onto the 3D mesh.....	156
8	Omnidirectional media encapsulation and signalling in DASH	157
8.1	Architecture of DASH delivery in OMAF	157
8.2	Usage of DASH in OMAF	159
8.2.1	General.....	159
8.2.2	Signalling of stereoscopic frame packing.....	159
8.2.3	Carriage of timed metadata.....	159
8.2.4	Associating Adaptation Sets or Representations with each other	160
8.3	DASH MPD descriptors for omnidirectional media in the namespace	
	"urn:mpeg:mpegI:omaf:2017"	161
8.3.1	XML namespace and schema	161
8.3.2	Signalling of projection type information	161
8.3.3	Signalling of region-wise packing type.....	162
8.3.4	Signalling of content coverage	163
8.3.5	Signalling of spherical region-wise quality ranking.....	166
8.3.6	Signalling of 2D region-wise quality ranking	172
8.3.7	Signalling of fisheye omnidirectional video	177
8.4	Carriage of images	177
8.4.1	General.....	177
8.4.2	Format and constraints for Segments.....	178
8.5	DASH MPD descriptors for omnidirectional media in the namespace	
	"urn:mpeg:mpegI:omaf:2020"	178
8.5.1	XML namespace and schema	178
8.5.2	Signalling of association.....	178
8.5.3	Signalling of viewpoints.....	180
8.5.4	Signalling of sub-picture composition identifier and its attributes	187
8.5.5	Signalling of overlays	188
8.5.6	Entity to group descriptor	190
8.5.7	Content component attribute for Representation.....	192
8.6	Segment formats.....	192

8.6.1	Initialization Segment for OMAF base track.....	192
8.6.2	Tile Index Segment.....	196
8.6.3	Tile Data Segment.....	197
9	Omnidirectional media encapsulation and signalling in MMT	198
9.1	Architecture of MMT delivery in OMAF	198
9.2	OMAF signalling in MPEG composition information.....	199
9.3	VR application-specific MMT signalling.....	199
9.3.1	General	199
9.3.2	MMT signalling	200
10	Media profiles	216
10.1	Video profiles.....	216
10.2	Audio profiles	250
10.3	Image profiles.....	259
10.4	Timed text profiles	266
11	Presentation profiles.....	267
11.1	OMAF viewport-independent baseline presentation profile	267
11.1.1	General	267
11.1.2	ISO Base Media File Format constraints.....	267
11.2	OMAF viewport-dependent baseline presentation profile	268
11.2.1	General	268
11.2.2	ISO Base Media File Format constraints.....	268
12	OMAF toolset brands.....	268
12.1	Overlay toolset brand.....	268
12.1.1	Overview.....	268
12.1.2	ISO Base Media File Format constraints.....	268
12.1.3	OMAF player operation.....	269
12.2	Viewpoint toolset brand	269
12.2.1	Overview.....	269
12.2.2	ISO Base Media File Format constraints.....	269
12.2.3	OMAF player operation.....	269
12.3	Non-linear storyline toolset brand.....	269
12.3.1	Overview.....	269
12.3.2	ISO Base Media File Format constraints.....	269
12.3.3	OMAF player operation.....	270
	Annex A (normative) OMAF DASH schema	271
	Annex B (normative) DASH integration of media profiles	275
	Annex C (normative) CMAF integration of media profiles.....	288
	Annex D (informative) Viewport-dependent omnidirectional video processing.....	292
	Annex E (informative) DASH MPD examples	335
	Annex F (informative) MMT signalling examples.....	340
	Annex G (normative) Expected behaviour of OMAF player.....	342
	Bibliography	352