
**Information technology — Coded
representation of immersive media —
Part 17:
Reference software and conformance
for omnidirectional media format
(OMAF)**

*Technologies de l'information — Représentation codée de média
immersifs —*

*Partie 17: Logiciel de référence et conformité pour le format de média
omnidirectionnel (OMAF)*



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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

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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 <https://patents.iec.ch>).

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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.

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*.

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.

Introduction

The conformance and reference software in this document serves two main purposes:

- validation of the written specification of ISO/IEC 23090-2;
- conformance testing for checking interoperability for the various applications against the reference software which aims to be compliant with ISO/IEC 23090-2.

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Information technology — Coded representation of immersive media —

Part 17:

Reference software and conformance for omnidirectional media format (OMAF)

1 Scope

This document specifies the conformance and reference software for omnidirectional media format (specified in ISO/IEC 23090-2). This document describes the reference software modules and the features that it supports. It also provides a description of how the reference software can be utilized.

In addition, the document lists and describes test vectors comprising ISO base media file format files, media presentation descriptions, segments and combinations thereof that conform to ISO/IEC 23090-2.

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/IEC 23090-2, *Information technology — Coded representation of immersive media — Part 2: Omnidirectional media format*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 23090-2 apply.

ISO and IEC maintain terminology 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/>

4 Abbreviated terms

2D	two-dimensional
DASH	MPEG dynamic adaptive streaming over HTTP (specified in ISO/IEC 23009-1)
HEVC	high efficiency video coding
IDR	instantaneous decoder refresh
ISOBMFF	ISO base media file format (specified in ISO/IEC 14496-12)
JSON	JavaScript object notation

MPD	media presentation description
OMAF	omnidirectional media format

5 Reference software for ISO/IEC 23090-2

5.1 General

The reference software is available at: <https://standards.iso.org/iso-iec/23090/-17/ed-1/en/>.

5.2 Description

The OMAF reference software has two components: **libomaf** and **omaf_tool**. The **libomaf** library provides an extension to MPEG's ISOBMFF library (libisomediafile), described in ISO/IEC 14496-32, by defining and implementing OMAF-related atoms and providing functions to create and parse these atoms. The **omaf_tool** software uses **libomaf** and is able to parse and display OMAF metadata present in an ISOBMFF container files.

Both **libomaf** and **omaf_tool** are implemented using the C/C++ language. The software uses the CMake tool for managing the build process and enabling cross-platform compilation. The **libomaf** library can also be used independently from the **omaf_tool** by including the `omaf.h` header file in the user's code and linking to the library.

5.3 Feature support list

[Table 1](#) provides a complete list of features available in ISO/IEC 23090-2 and indicates which features are currently supported by the reference software.

Table 1 — OMAF reference software feature support list

Feature	OMAF version	Support	
		Parsing	Packaging
Restricted schemes for omnidirectional videos	1	✓	✗
Projected omnidirectional video	1	✓	✓
Equirectangular projected video	1	✓	✓
Packed equirectangular or cube map video	1	✓	✓
Fisheye omnidirectional video	1	✓	✗
Region-wise packing information	1	✓	✓
Rotation information	1	✓	✓
Coverage information	1	✓	✓
Region quality ranking information	1	✓	✗
2D region quality ranking	1	✓	✗
Sphere region quality ranking	1	✓	✗
Timed-metadata for sphere regions	1	✓	✗
Sphere region configuration box	1	✓	✗
Recommended viewport sample entry	1	✓	✗
Timed text sphere location metadata	1	✓	✗
Timed text information for omnidirectional videos	1	✓	✗
Sub-picture tracks	2	✗	✗
Overlays	2	✗	✗
Multiple viewpoints	2	✗	✗

Table 1 (continued)

Feature		OMAF version	Support	
			Parsing	Packaging
	Dynamic viewpoint information	2	x	x
	Initial viewpoint	2	x	x
Viewing space information		2	x	x

5.4 Reference software data structures mapping

Table 2 specifies the mapping between the data structures in the reference software code and the constructs defined in ISO/IEC 23090-2.

Table 2 — Reference software data structures and corresponding boxes in ISO/IEC 23090-2

Reference software structure	OMAF box
OMAFProjectedOmniVideoAtom	ProjectedOmniVideoBox
OMAFProjectionFormatAtom	ProjectionFormatBox
OMAFRotationAtom	RotationBox
OMAFCoverageInfoAtom	CoverageInformationBox
OMAFFisheyeOmniVideoAtom	FisheyeOmniVideoBox
OMAFFisheyeVideoEssentialInfoAtom	FisheyeVideoEssentialVideoBox
OMAFFisheyeVideoSupplementalInfoAtom	FisheyeVideoSupplementalInfoBox
OMAFSphereRegionConfigAtom	SphereRegionConfigBox
OMAFRecommendedViewportSampleEntry	RcvpSampleEntry
OMAFRecommendedViewportInfoAtom	RcvpInfoBox
OMAFRegionWisePackingAtom	RegionWisePackingBox
OMAFSphereRegionQualityRankingAtom	SphereRegionQualityRankingBox
TimedTextConfigAtom	OmafTimedTextConfigBox
TimedTextSphereLocationSampleEntry	TTSphereLocationSampleEntry
TwoDRegionQualityRankingAtom	2DQualityRankingBox

5.5 Usage of *omaf_tool*

5.5.1 General

The *omaf_tool* software is a simple command line application that can be used to parse an ISO/BMFF container and write OMAF-related metadata (if present) to a JSON-formatted output file. The same tool can also be used along with a JSON configuration file to package an OMAF-compliant video in an ISO/BMFF container.

The following command line parameters are defined:

Parameter	Description
-h	Prints a description of the parameters.
-i <i>InputFile</i>	Path to input file.
-o <i>OutputFile</i>	Path to output file. Output file is a JSON file (when parsing) or MP4 file (when packaging).
-t	Track ID of video track to package from input file.
-c	Path to JSON configuration file containing the metadata to be added to the output file.

5.5.2 Syntax for printing a description of parameters

```
$ omaf_tool -h
```

5.5.3 Packaging

5.5.3.1 Syntax

```
$ omaf_tool package -i <input_file> -c <json_cfg_file> -t <video_track_id> -o <output_file>
```

5.5.3.2 Example

```
$ omaf_tool package -i erp_file.mp4 -c config.json -t 2 -o omaf_out.mp4
```

5.5.4 Parsing

5.5.4.1 Syntax

```
$ omaf_tool parse -i <input_file> -o <output_json_file>
```

5.5.4.2 Example

```
$ omaf_tool parse -i omaf_file.mp4 -o out.json
```

5.6 Copyright disclaimer for software modules

Each source code module in this document contains a copyright disclaimer, which shall not be removed from the source code module.

A generic disclaimer is provided as follows:

This software module was originally developed by

<CN>

in the course of development of MPEG-I. This software module is an implementation of one or more MPEG-I tools as specified by the MPEG-I standards.

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6 Conformance for ISO/IEC 23090-2

6.1 General

This clause defines conformance for ISO/IEC 23090-2. There is no official reference tool provided to check the conformance of files. The reference software allows users to check the conformance (i.e. syntactic correctness and value range validation) of a given ISOBMFF container file to ISO/IEC 23090-2. At the basic level, this can be achieved using *omaf_tool* by providing a listing of OMAF-related metadata which can then be used to verify conformance.

A set of test vectors for conformance are available at: <https://standards.iso.org/iso-iec/23090-17/ed-1/en/>.

6.2 Description of conformance files

This set of test vectors contains a number of files that conform to the following OMAF profiles: HEVC-based viewport-independent OMAF video profile, HEVC-based viewport-dependent OMAF video profile, and OMAF HEVC image profile. In addition, DASH MPDs and media segments for some of the test vectors in this set are also available. Table 3 describes the main features of this set of test vectors.

Table 3 — Description of ISO/IEC 23090-2 conformance test vectors

ID	Projection	Profile	Mono/ stereo	Region-wise packing/tiling structure	Output	DASH profile and MPD
1	equirectan- gular	HEVC- based view- port-inde- pendent OMAF video pro- file	mono	—	MP4 Case1/PoleVault.omaf. mp4	—
2	equirectan- gular	HEVC- based view- port-inde- pendent OMAF video pro- file	stereo (top-bot- tom frame packing)	—	MP4 Case2/PoleVault. TB.omaf.mp4	—
3	equirectan- gular	HEVC- based view- port-inde- pendent OMAF video pro- file	mono	—	DASH Case3/PoleVault.omaf. mpd	on-demand profile MPD contains: — projection format
4	equirectan- gular	HEVC- based view- port-inde- pendent OMAF video pro- file	stereo (top-bot- tom frame packing)	—	DASH Case4/PoleVault. TB.omaf.mpd	on-demand profile MPD contains: —projection format —VideoFramePacking- Type indicator

Table 3 (continued)

ID	Projection	Profile	Mono/ stereo	Region-wise packing/tiling structure	Output	DASH profile and MPD
5	equirectan- gular	HEVC- based view- port-de- pendent OMAF video pro- file	mono	as described in ISO/IEC 23090-2:2021, Figure D.7.	DASH Case5/BalboaPark. omaf.mpd	live profile in segment template mode MPD contains: — projection format — spherical quality rank- ing — region-wise packing indicator — coverage information — extractor with prese- lection descriptor
6	equirectan- gular	HEVC- based view- port-de- pendent OMAF video pro- file	mono	as described in ISO/IEC 23090-2:2021, Figure D.8.	DASH Case6/BalboaPark. omaf.mpd	on-demand profile MPD contains: — projection format — spherical quality rank- ing — region-wise packing indicator — coverage information — extractor with prese- lection descriptor
7	equirectan- gular	HEVC- based view- port-de- pendent OMAF video pro- file	mono	equal resolu- tion streams as described in ISO/IEC 23090- 2:2021, D.4.2 with 4×2 tiling	DASH Case7/PoleVault.4x2. omaf.mpd	on-demand profile MPD contains: — projection format — spherical quality rank- ing — region-wise packing indicator — coverage information — extractor with prese- lection descriptor
8	equirectan- gular	HEVC- based view- port-de- pendent OMAF video pro- file	stereo (top-bot- tom frame packing)	equal resolu- tion streams as described in ISO/IEC 23090- 2:2021, D.4.2 with 4×4 tiling (4×2 per eye)	DASH Case8stvi/PoleVault. TB.4x4.omaf.mpd	on-demand profile MPD contains: — projection format — spherical quality rank- ing — region-wise packing indicator — coverage information — VideoFramePacking- Type indicator — extractor with prese- lection descriptor