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CDAM stage

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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 ISO documents 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](https://www.iso.org/directives-and-policies.html)).

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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 website.

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](https://www.iso.org/members.html).

# Introduction

The conformance and reference software of ISO/IEC 23090-14 serves following main purposes:

* Validation of the written specification of the parts of ISO/IEC 23090-14: Second amendment 2.
* Clarification of the written specification of the parts of ISO/IEC 23090-14: Second amendment.
* Conformance testing for checking interoperability for the various applications against the reference software which aims to be complaint with ISO/IEC 23090-14: Second amendment.

Contents

[Foreword 6](#_Toc174716397)

[Introduction 6](#_Toc174716398)

[1 Scope 8](#_Toc174716399)

[2 Normative references 8](#_Toc174716400)

[3 Terms, definitions, symbols, and abbreviated terms 8](#_Toc174716401)

[4 Reference software 8](#_Toc174716402)

[5 Conformance software 8](#_Toc174716403)

Information technology — Coded representation of immersive media — Part 24: Conformance and reference software for Scene Description – Amendment 1: Support for Haptics, augmented reality, avatars, interactivity, and lighting

# Scope

This document specifies the conformance and reference software implementing the normative clauses of ISO/IEC 23090‑14: second amendment.

# 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.

*glTF 2.0 Khronos Group, The GL Transmission Format (glTF) 2.0 Specification*, Available at <https://github.com/KhronosGroup/glTF/tree/master/specification/2.0/>

*ISO/IEC 23090-14, Information technology – Coded representation of immersive media- Part 14: Scene description*

# Terms, definitions, symbols, and abbreviated terms

For this document, the terms, definition and symbols and abbreviated terms given in the ISO/IEC 23090-14 apply.

ISO and IEC maintain terminological databases for use in standardization at the following address:

* IEC Electropedia: available at <https://www.electropedia.org/>
* ISO online browsing platform: available at <https://www.iso.org/obp>

# Reference software

## General

The reference software is available in <https://standards.iso.org/iso-iec/23090/-24/>. The reference software ‘pympegsd’ is released with a tag version 3.0. The version 3.0 of reference software contains implementation for the following extensions:

1. MPEG\_anchor extension
2. MPEG\_node\_anchor extension
3. MPEG\_lights\_texture\_based extension
4. MPEG\_node\_interactivity extension
5. MPEG\_material\_haptic extension
6. MPEG\_haptic extension
7. MPEG\_scene\_interactivity extension
8. MPEG\_avatar extension

## MPEG\_anchor extension testing

The assets with the anchoring extensions are provided in the anchorAssets ZIP file.

For all test cases, start the render without the animations (no “-a” argument) and type the key "c" to start the anchoring.

To test the parsing, 16 files are delivered (Table 1). A base of 5 assets is used to build the files (Table 2). The different configurations allow the testing of the 8 different trackables and MPEG\_anchor extensions at glTF, node or scene level.

Only TRACKABLE\_FLOOR and TRACKABLE\_MARKER\_2D are simulated.

|  |  |  |
| --- | --- | --- |
| glTF file | Trackable type | Extension level |
| anchorTest\_v0 | TRACKABLE\_FLOOR | glTF and scene |
| anchorTest\_v1 | TRACKABLE\_FLOOR | glTF and node |
| anchorTest\_v2 | TRACKABLE\_VIEWER | glTF and scene |
| anchorTest\_v3 | TRACKABLE\_VIEWER | glTF and node |
| anchorTest\_v4 | TRACKABLE\_CONTROLLER | glTF and scene |
| anchorTest\_v5 | TRACKABLE\_CONTROLLER | glTF and node |
| anchorTest\_v6 | TRACKABLE\_GEOMETRIC | glTF and scene |
| anchorTest\_v7 | TRACKABLE\_GEOMETRIC | glTF and node |
| anchorTest\_v8 | TRACKABLE\_MARKER\_2D | glTF and scene |
| anchorTest\_v9 | TRACKABLE\_MARKER\_2D | glTF and node |
| anchorTest\_v10 | TRACKABLE\_MARKER\_3D | glTF and scene |
| anchorTest\_v11 | TRACKABLE\_MARKER\_3D | glTF and node |
| anchorTest\_v12 | TRACKABLE\_MARKER\_GEO | glTF and scene |
| anchorTest\_v13 | TRACKABLE\_MARKER\_GEO | glTF and node |
| anchorTest\_v14 | TRACKABLE\_APPLICATION | glTF and scene |
| anchorTest\_v15 | TRACKABLE\_APPLICATION | glTF and node |

*Table 1: glTF files*

Each glTF file includes 5 assets: floor, image, camera, red cone, blue cube (Table 5).

|  |  |  |
| --- | --- | --- |
| Node 0 | Floor | Real Elt |
| Node 1 | Image | Real Elt |
| Node 2 | Camera | Real Elt |
| Node 3 | Blue Cube | Children |
| Node 4 | Red Cone | Root |

*Table 2: Assets*

Floor and Image nodes are used as real element by the simulation software. The camera is also included in the GLTF file as the user camera.

The virtual scene is composed of two elements, a red cone (Node4) and a blue cube (Node3).

When the MPEG\_anchor is present at scene level, all the root nodes of the scene are anchored. As some nodes are used as real element for the simulation, these nodes must be excluded from the anchoring process (Floor, Image, Camera).

A folder “simulation” is provided. In this folder (under data), a simulation.ini file allows to identify in the scene array the root nodes to be anchored.

The *simulation* folder contains code and data to simulate the trackable. The *simulation.ini* file in the *simulation/data* folder contains parameters for the simulation:

For **TRACKABLE\_MARKER\_2D**, the size of the maker must be given.

[TRACKABLE\_MARKER\_2D]

marker\_width = 6.181522

marker\_height = 4.71872

For **TRACKABLE\_MARKER\_2D**, the index of the node used as floor plane must be given.

[TRACKABLE\_FLOOR]

floor\_node = 0

For extension **MPEG\_scene\_anchor**, the index of the root node must be given.

[root\_node\_in\_scene]

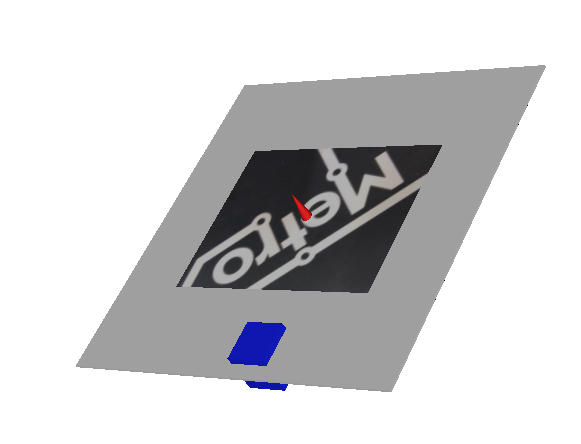
root\_node = 4

For TRACKABLE\_FLOOR (anchorTest\_v0, anchorTest\_v1), the detection of the floor plane is not implemented. We use the mesh referenced by the 'floor' node (Node 0 / the gray square) of the glTF file as the result of the floor plane detection. Tracking is not implemented.

The result of the anchoring process is shown in the figure below (Figure 1). The position of the Red Cone is the center of the plane (there is no TRS in the glTF File).

Axes are defined as follow:

Chart

Description automatically generated with medium confidence

*Figure 1 :TRACKABLE\_FLOOR anchoring*

For TRACKABLE\_MARKER\_2D (anchorTest\_v8, anchorTest\_v9), the image (Node 1 / Metro) is used as the 2D marker. Opencv is used for the detection (Orb features). The pose is computed with a solvePnPRansac function. Tracking is not implemented.

To install Opencv :

pip install opencv-contrib-python

The result of the anchoring process is shown in the figure below (Figure 2). The position of the Red Cone is the center of the image (there is no TRS in the glTF File). Note that the marker has been rotated of 180°.

Axes are defined as follow:

Chart

Description automatically generated with medium confidenceA close-up of a logo

AI-generated content may be incorrect.

*Figure 2 :TRACKABLE\_MARKER\_2D anchoring*

## MPEG\_interactivity testing

The testing procedure for MPEG\_interactivity extensions is described in this section. The assets with MPEG\_interactivity extension are available in asset file. The testing procedure for the assets is described below:

* For all test cases, start the render without the animations (no “-a” argument).
* For “UseCase\_01xxxxx.gltf” and “UseCase\_0Xxxxxx.gltf” test cases, once the renderer window is open, start the animation (key “a”) and let the balls collide.
* For “UseCase\_02xxxxx.gltf” and “UseCase\_03xxxxx.gltf” test cases, enter full screen (key “f”) and use the mouse to make the scene visible and/or get it closer or further to the camera.
* For “UseCase\_03-variant1-Interactivity”, enter key “l” to force animation loop.

Table 3 describes 4 test cases in which 3 balls are rolling on a surface and collide.

Table 3 Different variants of Use case 1 of Interactivity

|  |  |
| --- | --- |
| glTF file | Description |
| UseCase\_01-variant1-Interactivity | When the red and yellow balls collide, the material of the gray ball changes to blue color. |
| UseCase\_01-variant2-Interactivity | When the red and yellow balls collide, the material of the gray ball changes to blue color and simultaneously play a sound. When the red and gray/blue balls collide, the sound stops playing. |
| UseCase\_01-variant3-Interactivity | When the red and yellow balls collide, the material of the gray ball changes to blue color and play a sound 3s later. |
| UseCase\_01-variant4-Interactivity | Additional glTF file with the description of many triggers and actions that may be combined to create new behaviors and use cases. |

Table 4describes 4 test cases with a virtual scene composed of 3 balls, 3 cones and 1 cylinder.

Table 4 Different variants of Use case 2 of Interactivity

|  |  |
| --- | --- |
| glTF file | Description |
| UseCase\_02-variant1-Interactivity | When the scene is visible OR the scene is close to the camera, the 7 objects bump, and the 3 cones play a sound. |
| UseCase\_02-variant2-Interactivity | When the scene is visible AND the scene is close to the camera, the 7 objects bump and the 3 cones play a sound after 2, 4 and 6s. |
| UseCase\_03-variant1-Interactivity | When the scene is close to the camera, the 7 objects bump, and the 3 cones play a sound. When the scene is far, the objects stop bumping. |
| UseCase\_03-variant2-Interactivity | When the scene is visible AND the scene is close to the camera, the 7 objects bump, and the 3 cones play a sound. |

This avatar file contains a virtual scene with several cubes. An MPEG\_node\_avatar extension is defined but not processed in this branch.

Table 5 Description of MPEG\_node\_anchor testing

|  |  |
| --- | --- |
| glTF file | Description |
| cubes\_avatar\_actions | After a mouse click on the scene, a SET AVATAR action is launch (urn console log only). |

Table 5 describes as a haptic test case with 3 balls are rolling on a surface and collide. The collision effect triggers haptic feedback.

|  |  |
| --- | --- |
| glTF file | Description |
| UseCase\_0X-variant1-Haptic | When the red and yellow balls collide, a haptic effect is played (console log only). |

## Bug fixes

ISO/IEC 23090-14 DAM 2 specifies the required targetSampleRate property on MPEG\_audio\_spatial sources. The implementation is updated to support the parsing of targetSampleRate property.

The update also tries to clarify Media.alternative.track parsing. When parsing fails, a default track id with value 0 is passed to the MAF pipeline. This ensures compatibility with test assets that use file with extension “mp3”.

# Conformance software

## General

The conformance software is available in <https://standards.iso.org/iso-iec/23090/-24/>. The reference software ‘MPEG glTF validator’ is released with a tag version 2.0. The version 2.0 of reference software contains implementation for the following extensions:

1. MPEG\_anchor extension
2. MPEG\_node\_anchor extension
3. MPEG\_lights\_texture\_based extension
4. MPEG\_lights\_punctual extension
5. MPEG\_node\_interactivity extension
6. MPEG\_material\_haptic extension
7. MPEG\_haptic extension
8. MPEG\_scene\_interactivity extension
9. MPEG\_avatar extension

## Unit testing

The conformance software is updated to run unit tests. Unit testing is a software testing technique in which individual units or components of a software application are tested in isolation. This process helps in identifying issues in the development cycle and enhancing code quality thus promoting reliability of the code.

The unit tests are run on valid glTF files with corresponding MPEG extensions. The unit tests check the validation report of a glTF file and checks the expected value(s) of the various properties described in a glTF file.

[Ed. Note: Unit testing is proposed as part of the procedure document. Some of the extensions have not been unit tested yet.]