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Contents

[1 Scope 3](#_Toc77377287)

[2 Time Plan 3](#_Toc77377288)

[3 Extending Khronos glTF2.0 4](#_Toc77377289)

[3.1 General 4](#_Toc77377290)

[3.2 MPEG Extensions submitted to Khronos 5](#_Toc77377291)

[4 Communication with Khronos 5](#_Toc77377292)

[4.1 Overview 5](#_Toc77377293)

[4.2 Communication prior to MPEG#132 6](#_Toc77377294)

[4.3 Proposed Communication after MPEG#132 7](#_Toc77377295)

[4.4 Communication during MPEG#133 7](#_Toc77377296)

[4.5 Communication during MPEG#134 9](#_Toc77377297)

[4.6 Communication during MPEG#135 10](#_Toc77377298)

[5 Requirements, Scenarios and Test Assets 11](#_Toc77377299)

[5.1 Requirements 11](#_Toc77377300)

[5.2 Scenarios 11](#_Toc77377301)

[5.3 Template for Test Scenario 12](#_Toc77377309)

[5.4 Continuous Call for Test Data 12](#_Toc77377310)

[5.5 Timeline 12](#_Toc77377311)

[5.6 Available Test Assets 13](#_Toc77377312)

[5.7 Agreed Test Scenarios 13](#_Toc77377313)

[6 Contributions for Extensions 13](#_Toc77377314)

[6.1 General 13](#_Toc77377315)

[6.2 Extension Principles 14](#_Toc77377316)

[7 Reference Software 15](#_Toc77377317)

[8 Gitlab Management 15](#_Toc77377323)

[8.1 Reference implementation software 15](#_Toc77377324)

[8.2 Conformance software 15](#_Toc77377325)

[8.3 Scenarios 15](#_Toc77377326)

[8.4 Test assets 15](#_Toc77377327)

[8.5 Test vectors 16](#_Toc77377328)

[8.6 Summary logistics 16](#_Toc77377329)

[9 Candidate Phase 2 Technologies 17](#_Toc77377330)

[This clause provides and overview of candidate phase 2 technologies 17](#_Toc77377331)

[- Advanced Audio functionalities 17](#_Toc77377332)

[- Support for AR in Scene Description 17](#_Toc77377334)

[- Partial Access Support for Scene Description 17](#_Toc77377335)

[- CoAP Support for IoT streaming devices in Scene Description 17](#_Toc77377336)

[- Interactivity in Scene Description 17](#_Toc77377337)

[- Nodes with External Transformation 17](#_Toc77377338)

[- Basic support for Haptics 17](#_Toc77377339)

[10 Coordinators for Efforts until MPEG#136 17](#_Toc77377340)

# Scope

This document provides information and agreed processes in order to support the development of ISO/IEC 23090-14, "MPEG-I Scene Description" as well as ISO/IEC 23090-24, "Conformance and Reference Software for MPEG-I Scene Description".

# Time Plans and Projects

Time Plans and Projects for MPEG-I scene description can be checked here:

* ISO/IEC FDIS 23090-14 Information technology — Coded representation of immersive media — Part 14: Scene Description for MPEG Media
  + <https://www.iso.org/standard/80900.html>
  + https://sd.iso.org/projects/project/80900/overview
* ISO/IEC 23090-24 Information technology — Coded representation of immersive media — Part 24: Conformance and Reference Software for Scene Description for MPEG Media
  + <https://www.iso.org/standard/83696.html>
  + https://sd.iso.org/projects/project/83696/overview
* ISO/IEC DIS 23090-14/AMD 1 Information technology — Coded representation of immersive media — Part 14: Scene description — Amendment 1: Support for immersive media codecs in scene description
  + <https://www.iso.org/standard/84769.html>
  + https://sd.iso.org/projects/project/84769/overview

# Extending Khronos glTF2.0

## General

Based on the agreement during MPEG#128, MPEG-I Scene Description is developed as an extension to Khronos' glTF2.0 specification. This specification can be accessed here: <https://github.com/KhronosGroup/glTF/blob/master/specification/2.0/README.md>

According to the specification, glTF defines an extension mechanism that allows the base format to be extended with new capabilities. Any glTF object can have an optional extensions property. For details see <https://github.com/KhronosGroup/glTF/blob/master/specification/2.0/README.md#specifying-extensions>. For more information on glTF extensions, consult the [extensions registry specification](https://github.com/KhronosGroup/glTF/blob/master/extensions/README.md).

glTF supports different ways on extending the specification as documented here: <https://github.com/KhronosGroup/glTF/blob/master/extensions/README.md#promoting-extensions>

The following principles are agreed:

* MPEG develops extensions to Khronos glTF2.0 under the *Vendor Extensions framework*. Contributing companies should be aware of this. If contributions do not provide a statement that says otherwise, it is expected that the proponents agree to this.
* MPEG has requested an extension with the prefix MPEG <https://github.com/KhronosGroup/glTF/blob/master/extensions/Prefixes.md>. Contact person is the MPEG convenor, the JTC1 SC29 WG3 MPEG Systems chair as well as the chair of the MPEG-I Scene Description BOG.
* If MPEG contributors are generally interested that their proposal may be considered as a KHR extension without any binding commitment, input contributions may state so. However, such a statement or the absence of such a statement does not impact the processing of a contribution in the context of the MPEG-I scene description work.

## MPEG Extensions submitted to Khronos

It is proposed that all MPEG agreed extensions after DIS and FDIS has been issued, are added to the Khronos repository as follows

* Contributors
  + Editor of MPEG spec, Affiliation, e-mail
  + Others as agreeable
* Status
  + Draft at DIS
  + Stable at FDIS
* Dependencies
  + Written against the glTF 2.0 spec
* Overview:
  + Two sentences should be provided on the extension
  + Pointer to ISO/IEC 23090-14 where the extension is defined
* glTF Schema Updates
  + Pointer to MPEG schema updates
* JSON Schema
  + Link to schema
* Known Implementation
  + Pointer to reference software
* Resources:
  + Pointer to all available resources
* Best Practices:
  + Implementation Guidelines, Fallback mechanisms, etc.

During MPEG#139, MPEG decided to submit all extensions of ISO/IEC 23090-14 and register those with Khronos based on document MDS21744\_SCWG3\_N0615.

# Communication with Khronos

## Overview

Khronos has active work in the context of glTF2.0, see the KHR extensions under development here: <https://github.com/KhronosGroup/glTF/blob/master/extensions/README.md>. It is also identified that there is an overlap between MPEG members and glTF participants. Khronos and graphics experts meet in Khronos meetings, but also at developer and research conferences such as GDC and Siggraph. For meetings, please refer to <https://www.khronos.org/events/>.

Khronos Member Meetings occur 3 times per year and offer the opportunity for Khronos members to come together in a face-to-face environment to discuss technical work, industry feedback, network with colleagues and have some fun.

However, due to the COVID-19 situation, Khronos meetings have been put on hold and are only scheduled for later in 2022.

|  |  |  |
| --- | --- | --- |
| Meeting | Date | Location |
| F2F Phoenix 2022 | October 17-21, 2022 | Phoenix, Arizona |
| F2F Osaka 2023 | May 8-12, 2023 | Osaka, Japan |

## Communication prior to MPEG#139

### MPEG#133

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| [MDS20159](https://dms.mpeg.expert/doc_end_user/current_document.php?id=78184&id_meeting=185) | WG 03 | 00180 | All | Liaison to Khronos on Scene Description for MPEG Media | WG 03 MPEG Systems | |  | | --- | | [MDS20159\_WG03\_N00180](https://dms.mpeg.expert/doc_end_user/documents/133_OnLine/wg11/MDS20159_WG03_N00180.zip) | |

### MPEG#135

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| [MDS20563](https://dms.mpeg.expert/doc_end_user/current_document.php?id=79965&id_meeting=187) | WG 03 | 00309 | WG 03 All | Liaison statement to Khronos on MPEG-I Scene Description | WG 03 MPEG Systems | |  | | --- | | [MDS20563\_WG03\_N00309](https://dms.mpeg.expert/doc_end_user/documents/135_OnLine/wg11/MDS20563_WG03_N00309.zip) | |

### MPEG#136

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| [MDS21056](https://dms.mpeg.expert/doc_end_user/current_document.php?id=81135&id_meeting=188) | WG 03 | 00434 | WG 03 All | Liaison statement to Khronos on MPEG-I Scene Description | WG 03 MPEG Systems | |  | | --- | | [MDS21056\_WG03\_N00434](https://dms.mpeg.expert/doc_end_user/documents/136_OnLine/wg11/MDS21056_WG03_N00434.zip) | |

### MPEG#137

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [MDS21327](https://dms.mpeg.expert/doc_end_user/current_document.php?id=82177&id_meeting=189) | WG 03 | 00511 | WG 03 All | Liaison statement to Khronos on MPEG-I Scene Description | WG 03 MPEG Systems | |  |  | | --- | --- | | [MDS21327\_WG03\_N00511](https://dms.mpeg.expert/doc_end_user/documents/137_OnLine/wg11/MDS21327_WG03_N00511.zip) |  | |

### MPEG#138

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| [MDS21435](https://dms.mpeg.expert/doc_end_user/current_document.php?id=82962&id_meeting=190) | WG 03 | 00542 | WG 03 MPEG-I | Registration of Khronos extensions | WG 03 MPEG Systems | |  | | --- | | [MDS21435\_WG03\_N00542](https://dms.mpeg.expert/doc_end_user/documents/138_OnLine/wg11/MDS21435_WG03_N00542.zip) | |
| [MDS21603](https://dms.mpeg.expert/doc_end_user/current_document.php?id=83120&id_meeting=190) | WG 03 | 00588 | WG 03 All | Liaison statement to Khronos on mesh attributes in glTF 2.0 | WG 03 MPEG Systems | |  | | --- | | [MDS21603\_WG03\_N00588](https://dms.mpeg.expert/doc_end_user/documents/138_OnLine/wg11/MDS21603_WG03_N00588.zip) | |

## Proposed Communication from MPEG#139

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [MDS21744](https://dms.mpeg.expert/doc_end_user/current_document.php?id=83961&id_meeting=191) | WG 03 | 00615 | 2022-07-23 09:42:24 | 2022-10-11 18:45:42 | WG 03 MPEG-I | Registration of Khronos extensions | WG 03 MPEG Systems | |  | | --- | | [MDS21744\_WG03\_N00615](https://dms.mpeg.expert/doc_end_user/documents/139_OnLine/wg11/MDS21744_WG03_N00615.zip) | |

# Requirements, Scenarios and Test Assets

## Requirements

The work of the MPEG-I scene description is based on the requirements defined in N18965, later revised to N19511. The coverage of the requirements and the progress is documented in WG3\_N0606.

## Scenarios

Providing Extension to MPEG-I Scene Description is based on well-defined and agreed scenarios. WG3\_N0606 also covers the mapping of requirements to scenarios.

Scenarios include:

* Description of the scenario
* A set of test assets that are needed for the scenario

Agreed scenarios and test assets can be accessed:

* <https://gitlab.com/mpeg-i/scene-description/scenarios/>

Agreed Test Assets can be accessed here.

* <http://mpegfs.int-evry.fr/mpegcontent/ws-mpegcontent/MPEG-I/Part14-SceneDescriptions>

Note: access and contribution to this requires an account. To request an account, please contact the test asset coordinators (see clause 9)

For adding new scenarios, please provide an input contribution to MPEG with the following information

* Description of the scenario
* A set of test assets that are needed for the scenario

A template for the scenario is provided in clause 5.3.

## Template for Test Scenario

The following table should be used to propose test scenarios for scene description:

|  |  |
| --- | --- |
| Item | Description |
| Title | <give it a catchy title, e.g. as those listed in clause 2> |
| Description | * What is the basic use case? * How does it relate to MPEG-I Requirements and Use Cases? |
| Required test assets | * 3D scene, real-time assets for media (2D/3D) * Anything else * References to test assets |
| Current Support | * How can glTF Scene Description be used today * What are gaps/inefficiencies of glTF2.0 to address this scenario? |
| Criteria | * What are relevant criteria for the user experience/QoE? * What are relevant criteria for passing the test scenario? |

## Continuous Call for Test Data

Among others, we solicit the following material to be used as content for the creation and validation of MPEG-Scene Descriptions:

* 2D content that can server as overlays, video textures
* 2D and 3D content that is captured from a local camera, e.g. representing a conference room or flat surfaces for overlay
* 3D game content, e.g. provided in Unity, that can be used for the online gaming scenario
* 3D cinematographic content that includes complete scenes
* VR content and 3D mesh and point cloud content that can be used for VR scenes
* etc…

We welcome contributions of content that can be made available to the MPEG community for the sake of the MPEG-I Scene Description activity.

## Timeline

The data sets should be submitted as input contributions to the 140th MPEG meeting (October 2022), but early submission into AHG is welcome.

## Available Test Assets

The following table lists the available assets and provides a brief description:

|  |  |
| --- | --- |
| **Asset** | **Description** |
| conferenceroom.zip | a glTF asset that represents a conference room. |
| livingroom.zip | a glTF asset that represents a living room. |
| island.zip | a glTF asset that represents an island. |
| chair.zip | a glTF asset that represents a chair. |
| bbb.mp4 | Big Buck Bunny video file in mp4 format. |
| longdress\_frame.ply | a binary PLY file from the longress point cloud sequence. |
| Scenario 11 | Test Assets:  1. Pine Forest  "author": "fangzhangmnm (https://sketchfab.com/fangzhangmnm)",  "license": "CC-BY-4.0 (http://creativecommons.org/licenses/by/4.0/)",  "source": "https://sketchfab.com/3d-models/pine-forest-ece69535f7584e099488f65f2072264e",  2. woodland-5\_trim\_SN3D.wav  Obtained and modified from EigenScape.  EigenScape is a database of acoustic scenes recorded spatially using the mh Acoustics EigenMike. https://doi.org/10.5281/zenodo.1012809  Marc Green <marc.c.green@york.ac.uk> |

NOTE: A permanent web page will be created to document the existing test assets.

Note that the first 4 assets are downloaded from sketchfab and are available for download and usage under the Creative Commons license as describe in CC Attribution License: <https://creativecommons.org/licenses/by/4.0/>.

## Agreed Test Scenarios

Agreed Test scenarios are provided here:

http://mpegx.int-evry.fr/software/-/ide/project/MPEG/Systems/SceneDescription/test-assets

# Contributions for Extensions

## General

For every extension documented in ISO/IEC 23090-14 under the framework in clause 3 the following information is expected to be provided:

* The schema for the extension as part of the standard as well as a json document
* The semantics for the extension
* The processing model on the "Presentation Engine"
* The conformance description, i.e. conformance requirements for the Presentation Engine that supports the extension
* *A promise for example content that uses the extension that is finally available within 1 meeting after the technology was added. If not fulfilled, the feature is expected to be removed and this will be documented as a note in the draft standard.*
* *A promise of a reference implementation in one of the agreed reference software libraries as documented in clause 7, that is finally available within 2 meetings after the technology was added. If not fulfilled, the feature is expected to be removed and this will be documented as a note in the draft standard.*

Hence, contributions addressing extensions to glTF under the framework in clause 3 should include the following:

* The scenarios that this extension is addressing. The scenarios are documented in clause 5.8.
* All information from above

As long as not all the above information is available, a documented extension is not moved into the WD/CD, but is maintained in the Technology under Consideration (TuC) document. The status of the completed information and the missing one is documented in the TUC.

The following text processes is recommended, but needs final verification:

*To fulfill the requirement on the reference software, it is sufficient to demonstrate that the reference software is able to properly process the test scenario. The test scenario content shall at least have a scene description file in glTF textual format that makes use of the proposed extension. The test scene description glTF document should use one of the available assets. The proposal must indicate any dependencies on other extensions.*

*The following is an example of this procedure:*

* *A test scenario is defined around support for video textures*
* *The proposal is to make use of the MPEG\_video\_texture extension*
* *A sample content is proposed based on the "conferenceroom" glTF file, which is part of the assets. The glTF file is extended to include the MPEG\_video\_texture extension. The bbb.mp4 asset is used to describe the video texture, which is attached to a rectangular mesh in the "conferenceroom" scene.*
* *The reference software is run with the modified scene description document and the expected behavior is demonstrated, showing the video texture.*

The currently considered extensions

## Extension Principles

The following extension principles apply

* If the extension adds a new top-level array (by extending the root glTF object), its elements should inherit all properties of glTFChildOfRootProperty.schema.json.
* Other objects introduced by the extension should inherit all properties of glTFProperty.schema.json.
* By glTF 2.0 conventions, schemas should allow additional properties.
* Names MUST begin with an MPEG prefix, followed by an underscore.
* Names MUST use lowercase snake-case following the prefix, e.g. MPEG\_materials\_sand.
* Names SHOULD be structured as MPEG\_<scope>\_<feature>, where scope is an existing glTF concept (e.g. mesh, texture, image) and feature describes the functionality being added within that scope. This structure is recommended, but not required.
* Scope SHOULD be singular (e.g. mesh, texture), except where this would be inconsistent with an existing Khronos extension (e.g. materials, lights).

# Reference Software

The reference software for the scene description is documented in WD of ISO/IEC 23090-24 as available in WG3 N0617.

# Gitlab Management

## Reference implementation software

Candidate Reference Software Libraries are documented in clause 7 . Each of these software projects are be forked at the start time of the project and the development of the MPEG extensions will be done in the 'mpeg' branch. This would ease future import from and export to the original repositories if this needs to happen.

One Git repository per library will be created. The reason is repositories are free to create and separation of different software, build platform, documentation, etc. is desirable. The names of the repositories are documented in clause 7.

## Conformance software

JSON glTF file are validated using JSON schema. For glTF binary files, it is proposed to define the binary structure in the [Kaitai](https://kaitai.io/) format (YAML based). This will allow the automatic generation of parsing libraries which can in turn be used to validate these binary files.

Both the JSON schemas and the Kaitai files, if needed, are proposed to be hosted on the same Git repositories here: https://gitlab.com/mpeg-i/scene-description/conformance.

## Scenarios

In order to provide use cases that are to be supported by the standard, scenarios are collected. Scenarios are described on what the basic setup an experience is expected to be and provides along with this test assets and test vectors (may be compressed or uncompressed) that may be used in the scenario. These test scenarios are collected the same Git repository with a folder at the root per library then a folder for each scenario inside each library. The name of this repository is https://gitlab.com/mpeg-i/scene-description/scenarios.

## Test assets

Test assets are not accessed on a frequent basis but usually requires protection by password to comply with the corresponding usage licenses, at least as it is commonly done in MPEG.

A folder in the MPEG content server will be created for the MPEG-I scene description standard. All the original "raw" test assets will be stored there along with the corresponding usage licenses.

## Test vectors

The test vectors are exercising the normative aspects of the specification. They will be stored in a single Git repository. When test vectors are binary, the LFS feature of the Git hosting service will be used in order to avoid polluting the Git tree with binary files. The location of the repository is here https://gitlab.com/mpeg-i/scene-description/test-vectors.

## Summary logistics

|  |  |  |
| --- | --- | --- |
| **Asset** | **Hosting** | **Location name** |
| Repository | Gitlab.com | https://gitlab.com/mpeg-i/scene-description |
| Candidate Reference software Diligent Graphics | Gitlab.com | <https://gitlab.com/mpeg-i/scene-description/reference-diligentengine> |
| MPEG Trimesh (mpegtrimesh) Reference software | Gitlab.com | https://gitlab.com/mpeg-i/scene-description/mpegtrimesh |
| Conformance software | Gitlab.com | https://gitlab.com/mpeg-i/scene-description/conformance |
| Scenarios | Gitlab.com | https://gitlab.com/mpeg-i/scene-description/scenarios |
| Test vectors | Gitlab.com with LFS for binary files | <https://gitlab.com/mpeg-i/scene-description/test-vectors> |
| Test assets | MPEG content | <http://mpegfs.int-evry.fr/mpegcontent/ws-mpegcontent/MPEG-I/Part14-SceneDescriptions> |

For access to the project, please register an account on GitLab.com at <https://gitlab.com/users/sign_in> and collect the following information:

* GitLab.com username
* GitLab.com email address

Please then send an email containing this information to the gitlab managers as listed in clause 9.

For uploading content to the Test Assets, please bring an input contribution to the MPEG meeting.

# Coordinators for Efforts until MPEG#140

* BOG Chair:
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