ISO/IEC FDIS 23090-26

ISO/IEC JTC 1/SC 29

Secretariat: JISC

Date: 2023-11-16

Information technology — Coded representation of immersive media —

Part 26:  
Conformance and reference software for carriage of geometry-based point cloud compression data

CD stage

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Published in Switzerland

Contents

[Foreword iv](#_Toc150440770)

[Introduction v](#_Toc150440771)

[1 Scope 1](#_Toc150440772)

[2 Normative references 1](#_Toc150440773)

[3 Terms and definitions 1](#_Toc150440774)

[4 Abbreviated terms 1](#_Toc150440775)

[5 Reference software for ISO/IEC 23090-18 1](#_Toc150440776)

[5.1 General 1](#_Toc150440777)

[5.2 Overview 2](#_Toc150440778)

[5.3 Feature support list 2](#_Toc150440779)

[5.4 GPCC carriage library API 4](#_Toc150440780)

[5.4.1 General 4](#_Toc150440781)

[5.4.2 GPCCCreateBox 4](#_Toc150440782)

[5.4.3 GPCCParseBox 4](#_Toc150440783)

[5.4.4 GPCCParseUnknownBox 4](#_Toc150440784)

[5.4.5 GPCCNewBitstreamSampleEntry 4](#_Toc150440785)

[5.4.6 GPCCNewMultiTrackGPCCSampleEntry 5](#_Toc150440786)

[5.4.7 GPCCAddGPCCParameterSet 5](#_Toc150440787)

[5.4.8 GPCCGetGPCCParameterSet 5](#_Toc150440788)

[5.5 Usage of GPCCCarriageApp 5](#_Toc150440789)

[5.6 Copyright disclaimer for software modules 6](#_Toc150440790)

[6 Conformance for ISO/IEC 23090-18 7](#_Toc150440791)

[6.1 General 7](#_Toc150440792)

[Bibliography 8](#_Toc150440793)

Foreword

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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 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](https://www.iso.org/members.html) and [www.iec.ch/national-committees](https://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 23090-18;
* Conformance testing for checking interoperability for the various applications against the reference software which aims to be compliant with ISO/IEC 23090-18.

The reference software is structured as an extension of the ISOBMFF reference software library and provides additional functions required for ISO/IEC 23090-18. In addition, it includes a small command line application that uses the library to perform some basic file operations such as multiplexing and demultiplexing a file.

Furthermore, this document is accompanied by a collection of conformance files. These files provide practical demonstrations of various features of ISO/IEC 23090-18, aiding in a more comprehensive understanding and application of the standard.

Information technology — Coded representation of immersive media —

Part 18:  
Conformance and reference software for carriage of geometry-based point cloud compression data

# Scope

This document specifies the reference software and conformance suite for carriage of G-PCC data as specified in ISO/IEC 23090-18. The information provided describes the reference software modules and the features that it supports. It includes the status of the development of the reference software for ISOBMFF encapsulation of carriage of G-PCC data. It also provides a description of how the reference software can be utilized. Finally, it also provides a description of conformance test vectors.

# 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 14496-12:2021, *Information technology — Coding of audio-visual objects — Part 12: ISO base media file format*

ISO/IEC 23008-12:2022, *Information technology — MPEG systems technologies — Part 12: Image File Format*

ISO/IEC 23090-18, *Information technology — Coded representation of immersive media (MPEG-I) — Part 18: Carriage of geometry-based point cloud compression data*

# Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 23090-9 and the following apply.

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

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

# Abbreviated terms

The relevant abbreviated terms and acronyms are specified in Clause 4 of ISO/IEC 23090-18.

# Reference software for ISO/IEC 23090-18

General

The source code for ISO/IEC 23090-18 reference software is available on MPEG’s GitLab server and is accessible to MPEG members via the following URL:

<http://mpegx.int-evry.fr/software/MPEG/Systems/PCC-SYS/23090-18-conformance>

All merge requests should be submitted to the repository on MPEG’s GitLab server after following the contribution guidelines from CONTRIBUTING.md file.

Overview

The G-PCC carriage reference software utilizes in the architecture the reference software for the ISOBMFF libisomediafile [1][2], the reference software for G-PCC mpeg-pcc-tmc13 [3] and other miscellaneous supporting libraries. Figure 1 shows the simplified overview of the architecture for the reference software implementation. Boxes with a gray colored background are in the scope of the reference software implementation.

Diagram

Description automatically generated

Figure 1 — Architecture overview

The reference software implementation consists of the G-PCC carriage library *libGPCCCarriage*, and the command line application with the name *GPCCCarriageApp*. While the library implements an API to parse and write data structures as defined in ISO/IEC 23090‑18, the command line application uses this API together with other helping libraries to implement actual multiplexing and demultiplexing functionality.

Feature support list

Table 1 summarizes a list of features specified in ISO/IEC 23090-18 and indicates which features are currently supported by the reference software.

Table 1: G-PCC Reference Software Feature Support List

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Feature** | **4CCs** | **Version** | **Status** |
| Common | GPCCConfigurationBox | gpcC | 0 | OK |
| GPCCComponentInfoBox | ginf | 0 | OK |
| TileInventoryInfoEntry | gtii | 0 | TBD |
| Single track | GPCCSampleEntry (single track) | gpe1 gpeg | 0 | OK |
| Multiplexer | N/A |  | OK |
| Demultiplexer | N/A |  | In progress |
| Sub-samples | N/A |  | OK |
| Multi track | GPCCSampleEntry (multiple tracks) | gpc1 gpcg | 0 | In progress |
| Multiplexer | N/A |  | TBD |
| Demultiplexer | N/A |  | TBD |
| Sub-samples | N/A |  | TBD |
| track reference | gpca |  | OK |
| Multi track with tile tracks | GPCCSampleEntry (Tile-base track) | gpeb gpcb | 0 | In progress |
| GPCCTileSampleEntry | gpt1 | 0 | In progress |
| GPCCTileConfigurationBox | gptC |  | In progress |
| Multiplexer (tile base track and tile track) | N/A |  | TBD |
| Demultiplexer (tile base track and tile track) | N/A |  | TBD |
| Sub-samples (tile base track and tile track) | N/A |  | TBD |
| Track reference | gpbt |  | OK |
| Non-timed | GPCCItemData | gpe1 gpc1 gpeb | 0 | TBD |
| GPCConfigurationProperty | gpcC | 0 | TBD |
| GPCCComponentInformationProperty | ginf | 0 | TBD |
| GPCCSpatialRegionInfoProperty | gpsr | 0 | TBD |
| GPCCTileItem | gpt1 | 0 | TBD |
| GPCCTileInfoProperty | gpti | 0 | TBD |
| Sub-sample item property | subs |  | TBD |
| Entity group | ViewportAssociationBox | vpta |  | TBD |
| Partial access | Vector3 | N/A |  | OK |
| GPCCBoundingBoxStruct | N/A |  | OK |
| TileInfoStruct | N/A |  | TBD |
| GPCCSpatialRegionStruct | N/A |  | OK |
| GPCCSpatialRegionInfoBox | gpsr | 0 | OK |
| DynamicGPCCSpatialRegionSampleEntry | gpdr | 0 | In progress |
| Static partial access multiplexer | N/A |  | TBD |
| Static partial access demultiplexer | N/A |  | TBD |
| Dynamic partial access multiplexer | N/A |  | TBD |
| Dynamic partial access demultiplexer | N/A |  | TBD |
| Viewport metadata | ExtCameraInfoStruct | N/A |  | OK |
| IntCameraInfoStruct | N/A |  | OK |
| ViewportInfoStruct | N/A |  | OK |
| GPCCViewportInfoConfigurationBox | gvpC | 0 | OK |
| DynamicGPCCViewportSampleEntry | gpdv | 0 | TBD |
| Static viewport multiplexer | N/A |  | TBD |
| Static viewport demultiplexer | N/A |  | TBD |
| Dynamic viewport multiplexer | N/A |  | TBD |
| Dynamic viewport demultiplexer | N/A |  | TBD |

GPCC carriage library API

General

This section contains documentation for the public exported API of the reference software. You are advised to use only the functions documented here. All function prototypes can be found in GPCCCarriage.h.

GPCCCreateBox

MP4Err GPCCCreateBox(u32 type, MP4AtomPtr \*pOut)

Create a GPCC Box of a given type. If type FOURCC is not recognized it will create an UnknownBox with the provided type.

Parameters

type FOURCC of the box

pOut output Box (if Box type is not supported return an unknown Box)

GPCCParseBox

MP4Err GPCCParseBox(MP4Handle inputHandle, MP4AtomPtr \*pOut)

Parse a handle with raw data into a GPCC Box

Parameters

inputHandle handle with raw data of the box

pOut output Box (if data is not recognized return an unknown Box)

GPCCParseUnknownBox

MP4Err GPCCParseUnknownBox(MP4AtomPtr inBox, MP4AtomPtr \*outBox)

Parse an unknown Box into a GPCC Box

Parameters

inBox input UnknownBox which can be obtained from the libisomedia API

pOut output Box (if data is not recognized return an unknown Box)

GPCCNewBitstreamSampleEntry

MP4Err GPCCNewBitstreamSampleEntry(MP4Track theTrack,  
 MP4VolumetricVisualSampleEntryAtomPtr \*sampleEntryPtr,  
 u32 inBandFlag,   
 u32 dataRefIdx)

Create a new GPCC bitstream track sample entry (single track)

Parameters

theTrack track to put the sample entry to

sampleEntryPtr output sample entry box

inBandFlag 0 - out of band 'gpe1', 1 - in band 'gpeg'

dataRefIdx sample entry data reference index

GPCCNewMultiTrackGPCCSampleEntry

MP4Err GPCCNewBitstreamSampleEntry(MP4Track theTrack,  
 MP4VolumetricVisualSampleEntryAtomPtr \*sampleEntryPtr,  
 u32 inBandFlag,   
 u32 dataRefIdx)

Create a new GPCC multi track sample entry

Parameters

theTrack track to put the sample entry to

sampleEntryPtr output sample entry box

inBandFlag 0 - out of band 'gpc1', 1 - in band 'gpcg'

dataRefIdx sample entry data reference index

GPCCAddGPCCParameterSet

MP4Err GPCCAddGPCCParameterSet(  
 MP4VolumetricVisualSampleEntryAtomPtr sampleEntryPtr,  
 MP4Handle gpccParameterSetH,  
 u32 payloadType)

Add GPCC Parameter sets to Volumetric Visual Sample Entry

Parameters

sampleEntryPtr Volumetric Visual Sample Entry to add parameter sets to

gpccParameterSetH data to add

payloadType type of setup unit (TLV payload type)

GPCCGetGPCCParameterSet

MP4Err GPCCGetGPCCParameterSet(  
 MP4VolumetricVisualSampleEntryAtomPtr sampleEntryPtr,  
 MP4Handle ps,  
 u32 payloadType,  
 u32 index)

Get GPCC Parameter sets from Sample Entry

Parameters

sampleEntryPtr Volumetric Visual SampleEntry to get setup unit from

ps [out] handle which is holding the setup unit.

payloadType type of setup unit (TLV payload type)

index the index of the parameter set

Usage of GPCCCarriageApp

GPCCCarriageApp is a simple console application which is using the libGPCCCarriage library and the API described in subclause 5.4 to multiplex G-PCC bitstreams into ISOBMFF and to demultiplex.

Usage:

GPCCCarriageApp [OPTION...]

-h, --help Print usage  
 -l, --log\_level arg Logging level 0-6. Default is 4.  
 -c, --config arg JSON Configuration file  
 -i, --input arg Input file name  
 -o, --output\_file arg Output file name  
 -f, --fps arg Frame rate (FPS) for multiplexer   
 -t, --timescale arg Timescale for tracks.  
 -d, --demultiplexer\_mode Execute demultiplexing if set.  
 -e, --encapsulation\_mode arg Encapsulation mode when multiplexer\_mode  
 is set to true.  
 0 - timed single-track  
 1 - timed multi-track  
 2 – encapsulation with tile tracks  
 3 - non-timed

For testing multiplexing ISOBMFF with the single track encapsulation using GPCCCarriageApp, a G-PCC conformance file [4] can be used with following command line:

-i ../test/testdata/ST\_G\_LGE\_3.bit -l 6 -e 0 -o ST\_G\_LGE\_3\_single\_track.mp4

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# Conformance for ISO/IEC 23090-18

General

This clause documents the status of the conformance files.

[Ed: The following will be added.]

Bibliography

[1] ISO/IEC 14496-32, Information technology — Coding of audio-visual objects — Part 32: File format reference software and conformance

[2] ISOBMFF reference software available at https://github.com/MPEGGroup/isobmff

[3] G-PCC Test Model 13 available at <https://mpeg.expert/software/MPEG/PCC/TM/mpeg-pcc-tmc13>

[4] ISO/IEC 23090-22, Information technology — Coded representation of immersive media — Part 22: Conformance for G-PCC