Technical Specification

ISO/TS 32007

Document management — Portable Document Format — RichMedia annotations conforming to glTF assets

Gestion de documents — Portable Document Format — Annotations RichMedia conformes aux actifs glTF

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Contents

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Introduction

0.1 PDF: ISO 32000

ISO 32000-2 can embed 3D Computer-aided design (CAD) models as either 3D or RichMedia annotations. 3D node, stream and view dictionaries can only reference data saved in either the ECMA-363 [Universal 3D (U3D) file format] or ISO 14739-1 [the Product Representation Compact (PRC) file format]. This can require the authoritative CAD data to be translated to either U3D or PRC solely to embed the data in a PDF file.

0.2 glTF: ISO/IEC 12113

glTF is an open, royalty-free 3D asset delivery format designed and managed by the Khronos Group, which is a Standards Developing Organization (SDO).

The specification for glTF 2.0 is published as **ISO/IEC 12113:2022**.

0.3 Extending PDF to support glTF

The purpose of this document is to extend the PDF specification to allow RichMedia annotations to include 3D artworks saved in the glTF format.

Document management — Portable Document Format — RichMedia annotations conforming to glTF assets

1 Scope

This document specifies how to extend the ISO 32000-2 specification by adding the ISO/IEC 12113 (glTF) format as a valid format for 3D artworks contained in a RichMedia annotation. It is intended for:

— developers of software that creates PDF files (PDF writers);

— software that reads existing PDF files and usually interprets their contents for display (PDF readers);

— software that reads and displays PDF content and interacts with the computer users to modify and save the PDF file (PDF processors);

— PDF products that read and/or write PDF files for a variety of other purposes (PDF processors).

NOTE   PDF writers and PDF readers are more specialized classifications of PDF processors.

This document does not specify the following:

— specific processes for converting paper or electronic documents to the PDF file format;

— specific technical design, user interface implementation, or operational details of rendering;

— specific physical methods of storing these documents such as media and storage conditions;

— methods for validating the conformance of PDF files or PDF processors;

— required computer hardware or operating systems.

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 12113:2022, Information technology — Runtime 3D asset delivery format — Khronos glTF™ 2.0

ISO 32000-2:2020, Document management — Portable document format — Part 2: PDF 2.0

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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 http://www.electropedia.org/

3.1
Portable Document Format file
PDF file
contiguous stream of binary data that conforms to ISO 32000-2:2020

[SOURCE: ISO 32000-2:2020, 3.50, "this document" has been replaced by "ISO 32000-2:2020" in the definition.]

3.2
glTF
3D asset delivery format

Note 1 to entry: See ISO/IEC 12113:2022, 2.3 for further details.

3.3
glTF asset
file constituting a single glTF asset

Note 1 to entry: See ISO/IEC 12113:2022, 2.4 for further details.

4 RichMedia annotations with glTF assets

4.1 Document Requirements

4.1.1 General

Document requirements identify PDF features that are required for the correct handling of a document. Requirements are stored as requirement dictionaries (see ISO 32000-2:2020, 12.11).

4.1.2 Requirement types

As described in ISO 32000-2:2020, 12.11.2, the **S** entry in a requirement dictionary identifies a feature of the PDF language or a capability that may be present in a PDF processor.

4.1.3 glTF requirement

ISO 32000-2:2020, Table 275 lists requirement types that have been defined through PDF 2.0. Table 1 shows a new key, **glTF**, specifying that a glTF RichMedia annotation is stored in a PDF file.

Table 1 — Addition to requirement types in ISO 32000-2:2020, Table 275

Type	Description
glTF	Requires support for RichMedia annotations (ISO 32000-2:2020, 13.7.2.2) which shall be in accordance with ISO/IEC 12113:2022. This also includes support for associated ECMAScripts.
	If a **V** key is present in its Requirements dictionary, it shall represent the version of the glTF data in the PDF file and not the PDF version.

4.1.4 Identifying glTF 3D Artwork in a requirement dictionary

PDF files containing RichMedia annotations with assets conforming to the glTF specification shall have a **Requirements** dictionary containing an **S** key with the value of *glTF*.

A **V** key in a requirement dictionary is used to specify the version number for a specific technology related to the requirement in question (see ISO 32000-2:2020, 12.11.4).

RichMedia annotations with assets conforming to the glTF specification shall have a **V** key that specifies the version of glTF format used by the asset, represented as a major version number (decimal integer) followed by a period and a minor version number (decimal integer) as a name object. For example, *2.0*.

4.2   glTF assets

4.2.1   General

The glTF artwork shall be embedded into the PDF file as a RichMedia annotation in accordance with ISO 32000-2:2020, 13.7.2.

The glTF assets shall be serialized as one or several interrelated files in accordance with ISO/IEC 12113:2022, 2.4. This includes the following options:

— glTF JSON points to external binary data (geometry, key frames, skins), and images;

— glTF JSON embeds base64-encoded binary data, and images inline using data URIs;

— a glTF asset, including JSON, buffers, and images, stored in a binary blob, called Binary glTF. A binary glTF can still refer to external resources.

ISO/IEC 12113:2022, 2.6 defines IANA Media types for all files that may be used to define the glTF asset. In particular, the IANA registered Media type for the Binary glTF is *model/gltf-binary,* and the IANA registered Media type of the JSON glTF is *model/gltf+json*.

4.2.2   Embedded assets

All glTF assets of a given RichMedia annotation shall be embedded into the PDF file and referenced by the **Assets** entry of the RichMediaContent dictionary in accordance with ISO 32000-2:2020, Table 341.

All embedded glTF assets shall correctly specify their MIME type as a value of the **Subtype** entry of the embedded file stream dictionary in accordance with ISO 32000-2:2020, Table 44.

All embedded glTF resources shall have **F** entry in the file specification dictionary equivalent to the URI string inside glTF that is used to reference this resource.

4.3   RichMediaInstances

4.3.1   General

ISO 32000-2:2020, 13.7.2.3.4, describes a single instance of an asset with settings to populate the artwork of an annotation, as described in ISO 32000-2:2020, Table 343.

4.3.2   New Scene entry in a RichMediaInstance dictionary

All visible nodes in a glTF asset belong to a *scene* (see ISO/IEC 12113:2022, 3.5), which is required for rendering of glTF. A glTF asset embedded into a PDF file shall contain at least one scene.

NOTE   glTF 2.0 assets (ISO/IEC 12113:2022, 3.5.1) can contain zero or more scenes defined in a scenes array. The above requirement specifies that glTF scenes array is non-empty.

The glTF object (ISO/IEC 12113:2022, 5.17) contains an optional scene property defining the index of the default scene for the glTF artwork. If it is not present, the scene with index 0 is used.

Table 2 shows a new optional **Scene** entry added to ISO 32000-2:2020, Table 343 to be able to override this property for any RichMediaInstance referencing an embedded glTF asset.

Table 2 — An additional entry in ISO 32000-2:2020, Table 343

Key	Type	Description
Scene	(various)	*(Optional)* The identifier of a scene within a given asset that shall be rendered when the instance is activated.
		In case of a 3D asset of type glTF the value shall be a non-negative integer not exceeding limits of the scenes array in the glTF asset. If present, it shall be used as a zero-based index of a scene in the glTF scenes array and shall override the value of the scene property in the glTF root object specified in ISO/IEC 12113:2022, 5.17.

The glTF scene, specified either via the default scene property in the glTF object or via the above **Scene** entry defines the set of nodes that constitute the glTF artwork instance. The states of these nodes, including its opacity and its position in world space, may be optionally specified by the **NA** entry of the *3DView* dictionary (see ISO 32000-2:2020, 13.6.4). Any node state specified for the node that is not a part of a given glTF scene, shall be ignored.

4.4   3D views

4.4.1   General

As defined in ISO 32000-2:2020, 13.6.4, a 3D view (or simply view) specifies parameters that shall be applied to the virtual camera associated with a 3D annotation.

NOTE   Lighting and background colour parameters are not defined inside the glTF format and can be defined via **LS** and **BG** entries in a 3D view dictionary (see ISO 32000-2:2020, Table 315) to guarantee the consistent rendering across different implementations.

4.4.2   Changes to the MS key in a 3D view dictionary

The **MS** key in a 3D view dictionary (see ISO 32000-2:2020, Table 315) specifies how the 3D camera-to-world transformation matrix is determined. Table 3 modifies the description of this key to include the glTF format.

Table 3 — Modified MS entry in ISO 32000-2, Table 315

Key	Type	Description
MS	name	*(Optional)* A name specifying how the 3D camera-to-world transformation matrix shall be determined. The following values are valid:
		M Indicates that the **C2W** entry shall specify the matrix
		U3D Indicates that the view node selected by the **U3Dpath** entry in the 3D stream object shall specify the matrix.
		NOTE There is no corresponding **MS** field value, that would correspond to a 3D asset of type PRC or glTF. **M** is the only valid entry for 3D asset of type PRC or glTF (or it can be omitted).
		If omitted, the view specified in the 3D artwork shall be used.

4.5   3D node dictionaries

4.5.1   General

The PDF interface to 3D geometry is through 3D node dictionaries (see ISO 32000-2:2020, 13.6.4.7).

4.5.2   Changes to the N key in a 3D node dictionary

An **N** key in a 3D node dictionary specifies the unique name of the node being described by the node dictionary (see ISO 32000-2:2020, Table 323). Table 4 changes the description of **N** entry to include the glTF format:

Table 4 — Modified N entry in ISO 32000-2:2020, Table 323

Key	Type	Description
N	text string	(*Required*) The name of the node being described by the node dictionary. All names in the node dictionary shall be unique. Interpretation of this entry shall depend upon the 3D format specified either in the **Subtype** entry of the 3D annotation (U3D format only) in accordance with ISO 32000-2:2020, Table 311 or the **Subtype** entry of the File Specification Dictionary referenced by **Asset** entry of the corresponding *RichMediaInstance* dictionary (PRC and glTF formats only) in accordance with ISO 32000-2:2020, Table 343:
		U3D — the value of this entry shall correspond to the field Node block name, specified in the Universal 3D file format.
		PRC — (*PDF 2.0*) the value of this entry shall be the Unique Identifier (UUID). ISO 14739-1:2014, 8.4.7 provides an example of this UUID within PRC files.
		glTF — (*PDF 2.0*) the value of this entry shall be the text representation of the zero-based index (non-negative integer) of the node in the glTF nodes array within in the embedded glTF asset.
		When comparing this entry to node names for a particular 3D model format, PDF processors shall translate between the PDF text encoding used by PDF and the character encoding specified in the 3D stream.
		NOTE — This description of the value of the **N** key was clarified ISO 32000-2:2020 and is further updated in this document to align with different ways to embed different 3D formats into PDF file.

4.6 RichMediaAnimation dictionary

4.6.1 General

ISO 32000-2:2020, 13.7.2.2.4, describes the preferred method that an interactive PDF processor should use to drive keyframe animations present in this artwork.

In case of a glTF model referenced by the RichMedia annotation, the animation properties are stored inside the animations array of the embedded glTF asset. In addition to the properties already specified in RichMediaAnimation dictionary, glTF supports articulated and skinned animation via key frame animations of nodes' transforms.

4.6.2 New AO entry in a RichMediaAnimation dictionary

Animation properties in glTF are defined via key frame animations of nodes' transforms (see ISO/IEC 12113:2022, 3.1.1). A glTF asset may contain multiple animation objects, defining different animation effects. Table 5 shows a new optional **AO** entry in a RichMediaAnimation dictionary specifying the glTF animation object used when the RichMedia annotation is activated.

Table 5 — An additional entry in ISO 32000-2:2020, Table 337

Key	Type	Description
AO	(various)	(*Optional; PDF 2.0*) The identifier of an animation object within a given asset that shall be used when the instance is activated.
		In case of a 3D asset of type glTF the value shall be a non-negative integer not exceeding limits of the animations array in the glTF root object in accordance with ISO/IEC 12113:2022, 5.17.

4.7 Metadata

Metadata related to a glTF asset may be specified at various levels:

— via **Metadata** entry of the RichMedia annotation dictionary that contains a given glTF asset;