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Information technology - Multimedia application format (MPEG-A) —

Part 13: Augmented reality application format

AMENDMENT 1: ARAF reference software and conformance

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Partie 13: Format pour les Applications de Realité Augmentée

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Foreword

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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 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).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

Amendment 1 to ISO/IEC 23000-13:2014 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

— *Part 1: Purpose for multimedia application formats*

— *Part 2: MPEG music player application format*

— *Part 3: MPEG photo player application format*

— *Part 4: Musical slide show application format*

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Introduction

Augmented Reality (AR) applications refer to a view of a real-world environment (RWE) whose elements are augmented by content, such as graphics or sound, in a computer driven process. Augmented Reality Application Format (ARAF) is a collection of a subset of the ISO/IEC 14496-11 (MPEG-4 part 11) Scene Description and Application Engine standard, combined with other relevant MPEG standards (e.g. ISO/IEC 23005 - MPEG-V), designed to enable the consumption of 2D/3D multimedia content. Consequently, ISO/IEC 23000-13 focuses not on client or server procedures but on the data formats used to provide an augmented reality presentation.

Information technology — Multimedia application format (MPEG-A) — Part 13: Augmented reality application format, AMENDMENT 1: ARAF reference software and conformance

1 Scope

This part of ISO/IEC 23000 specifies the Reference Software and Conformance.

2 Reference software

The components of the ARAF reference software are implemented in one of the following manners:

- By using existing MPEG-4 scene elements;
- By creating a library that is loaded by a utility software.

The implementation is provided in the electronic attachment of this document.

2.1 Implementation details

Table 1 presents the PROTOs that are implemented using existing MPEG-4 elements as well as the name of the file in which the implementation is included. The implementation is provided using the BT syntax (ISO/IEC 14496-11).

Table 1. ARAF Components implemented using existing MPEG-4 scene elements.

PROTO name	Filename
Map	Map.bt
MapMarker	MapMarker.bt
MapOverlay	MapOverlay.bt

Table 2 presents the PROTOs that are implemented by creating a library loaded by a utility software. This is a C/C++ dynamic library acting as a GPAC module. It implements the PROTO by extending GPAC by using its built-in external proto interface.

Table 2. ARAF Components implemented using a library

PROTO name	Filename
ReferenceSignal	reference_signal.zip
CameraCalibration	reference_signal_reg.zip
ReferenceSignalDetection	reference_signal_reg.zip

It should be noted that the *CameraCalibration* and *ReferenceSignalDetection* PROTOs share the same library.

The way how the implementation of the plugins was performed is described in the following sections.

2.2 Implementation procedure for adding PROTOs in a library

First a new dynamic library project was added to the main GPAC solution. GPAC loads the modules using predefined functions that need to be implemented in each module. Those functions are the following:

```
const u32 *QueryInterfaces();
GF_BaseInterface *LoadInterface(u32 InterfaceType);
void ShutdownInterface(GF_BaseInterface *ifce);
```

The function **QueryInterface** returns the types of extensions that are supported by the module, in the case of a hardcoded proto it returns GF_HARDCODED_PROTO_INTERFACE.

The function **LoadInterface** and **ShutdownInterface** create and destroy an interface object. The interface object for the hardcoded proto contains two functions:

```
Bool can_load_proto(const char* url);
Bool init(GF_HardcodedProto* itfs, GF_Compositor *compositor, GF_Node *node);
```

The function **can_load_proto** receives a URL as an argument which contains the URL to the PROTO requested by the scene. If the module supports this PROTO, it returns positively.

The function **init** creates a new instance of the PROTO and returns positively on success.

The next step is to define the PROTO object by declaring a new structure. An example of the structure is presented below.


```
struct ReferenceSignalNode
{
    BASE_NODE
    MFString   *source;                /*exposedField*/
    MFString   *referenceResources;    /*exposedField*/
    SFBool     *enabled;               /*exposedField*/
    MFString   *detectionHints;        /*exposedField*/
    SFVec3f    *translation;           /*exposedField*/
    SFRotation *rotation;              /*exposedField*/
    MFInt32    *onInputDetected;       /*eventOut*/
    MFInt32    *onTranslationChanged;  /*eventOut*/
    MFInt32    *onRotationChanged;     /*eventOut*/
    SFInt32    *onError;               /*eventOut*/
};
```

However since this structure is not known to GPAC internally, it cannot fill in the values, instead it uses a generic representation for the values in the proto. Therefore it is necessary to copy the values from the generic representation in the structure one by one. This is done using the code presented below.

```
1. if (gf_node_get_field(node, 0, &field) != GF_OK) return GF_FALSE;
2. if (field.fieldType != GF_SG_VRML_MFSTRING) return GF_FALSE;
3. rc->source = (MFString *) field.far_ptr;
```

Line 1 uses the function **gf_node_get_field** to get the pointer to the value of the field. Line 2 makes sure that the type of the field value returned corresponds to the expected one. Finally line 3 initializes the value.

The values of the node are initialized each time some of the functions that use them are called.

The initialization of the proto is done few steps.

First step is to create a new instance of the PROTO node and a private stack associated with the node. The association of the stack with the node is done by calling the function:

```
gf_node_set_private(node, stack);
```

The second step is to register the node traversal function with GPAC. This function will be called each time the node is traversed and when the node should be destroyed. The registration is done by calling the function:

```
gf_node_set_callback_function(node, TraverseReferenceSignal);
```

The final step is to register the node to receive image updates from the source. This is done by creating a TextureHandler as setting a texture update function to it. The following code is an example:

```
gf_sc_texture_setup(&(stack->refreshTextureHandler), compositor, node);
stack->refreshTextureHandler.update_texture_fcnt = UpdateTextures;
```

The texture handler function will be called at each step in the simulation. This is where the PROTO can have access to the media to reference resources images and the source image. In order to access the images the PROTO has to request their decoding. This is done by accessing the media object for the image:

```
gf_scene_get_media_object_ex((GF_Scene*)gf_sg_get_private(gf_node_get_graph(node)),
        &murl, GF_MEDIA_OBJECT_VIDEO, GF_FALSE, NULL, GF_FALSE, node);
```


and then requesting the decoding:

```
gf_mo_play(media_object, 0, -1, GF_TRUE);
```


When the image is decoded, a call to the function

```
data = gf_mo_fetch_data(stack->mediaToDetectStreams[i], GF_TRUE, &eos, &ts, &size);
```

will return the image data.

Depending if the image is a reference resource or a source it will analyzed and added to the database, or analyzed and compared to the database respectively. If the result of the comparison is positive, the corresponding event outs are executed and the appropriate fields modified by using the code presented below.

```
1. gf_node_get_field(node, 6, &onInputDetected);
2. gf_node_event_out(node, onInputDetected.fieldIndex);
3. gf_node_changed(node, &onInputDetected);
```

Line 1 gets the field from the PROTO node instance, line 2 fires the event out for that field and line 3 notifies the system that the node field value has changed.

2.3 Utility Software

The utility software of MPEG-U is the Osmo4 player of GPAC (https://github.com/gpac/gpac). GPAC is an open-source project distributed under the LGPL license.

For convenience, an installer for the Windows platform is made available at the following URL: http://gpac.wp.mines-telecom.fr/downloads/gpac-nightly-builds/.

