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| **Title** | Exploration Experiment on Dynamic Scene Update |
| **Author** | **Eric Yip, Lukasz Kondrad, Ahmed Hamza** |
| **Serial** | **20569** |

# Abstract

This document provides descriptions of the Exploration Experiment on the proposed technologies for extended dynamic scene update scenarios for Scene Description for MPEG Media.

# Introduction

The goal of EE2 is to identify suitable enhancements for advanced dynamic scene updates in phase 2 of MPEG scene description. Based on the list of advanced dynamic scene update scenarios identified, and listed in this description, the potential solutions listed are expected to be used as a starting point for discussions and further contributions.

# Mandates

The mandates for this EE are as follows:

* To study the different potential solutions for the list of advanced dynamic scene update scenarios, in particular the necessary metadata and their usage to enable such dynamic scene update scenarios.
* To provide recommendations on dynamic scene update scenarios and solutions to support such scenarios.
* To mandate text to be incorporated into the phase 2 of ISO/IEC 23090-14.

# Participants

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Participant | Contact | Email | Type | - |
| Samsung Electronics | Eric Yip | [eric.yip@samsung.com](mailto:eric.yip@samsung.com) | P |  |
| Nokia Corp. | Lukasz Kondrad | [lukasz.kondrad@nokia.com](mailto:lukasz.kondrad@nokia.com) | P |  |
| InterDigital | Ahmed Hamza | [ahmed.hamza@interdigital.com](mailto:ahmed.hamza@interdigital.com) | P |  |

(P = proponent, C = cross checker)

# Advanced dynamic scene update scenarios

# According to requirements 13, 21, 22, 23, 24, 85 and 86 as listed in the Annex of this document, the dynamic scene update scenarios gathered satisfy a combination of these requirements related to time and interactivity related scene updates,

# The advanced dynamic scene update scenarios to be supported are:

# Timed dynamic scene updates

# Wallclock time triggered dynamic scene updates

# Presentation timed triggered dynamic scene updates (supported in DIS)

# Conditional timed dynamic scene updates

# Event triggered dynamic scene updates

# Trigger update to event scene and go to new presentation timeline

# Trigger update to event scene and return to original scene

# Trigger update to event scene and skip to different scene in same presentation timeline

# Trigger update to skip to different scene in same presentation timeline

# Potential solutions

### Timed dynamic scene update scenarios

#### Wallclock time triggered dynamic scene updates [CD text]

The current DIS text does not contain any support for the indication of a wallclock time to be used for triggering dynamic scene updates.

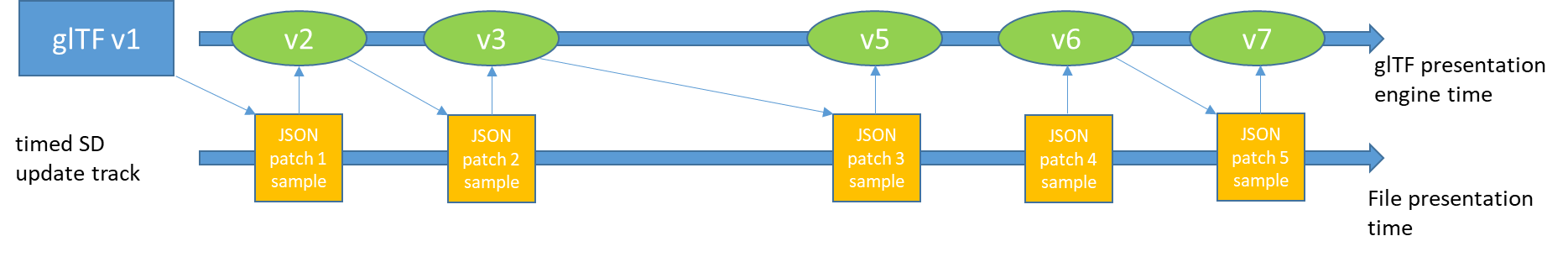
A potential solution is to include dynamic scene update attributes related to wallclock time triggers, as shown in table 1.

**Table 1 – Definitions of wallclock time attributes for dynamic scene updates**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Default** | **Description** |
| absolute\_time\_UTC | DateTime | n/a | Wall clock time identifying the execution time of the scene update transaction on the glTF object. The value is denoted in UTC. |
| absolute\_time\_TAI | DateTime | n/a | Wall clock time identifying the execution time of the scene update transaction on the glTF object. The value is denoted in TAI. |

#### Presentation time triggered dynamic scene updates [DIS text]

The current DIS text supports timed dynamic scene updates which are triggered by presentation time. The presentation timestamp of the track samples containing JSON patch documents (as defined in clause 8.4 of the DIS) can be used to trigger the dynamic scene update as shown in figure 4.



**Fig. 4 Presentation time triggered dynamic scene updates**

#### Conditional timed dynamic scene updates [CD text, m56736]

Dynamic scene updates may be restricted by conditions such as the version of a scene description which is being maintained in the Presentation Engine memory at a given time. In such a scenario, the scene update sample is only applied when the version of the current scene description matches to that specified by the update sample.

One solution is to include version related dynamic scene update attributes; namely a target\_version\_id, which specifies the version of the target scene description for which the dynamic scene update is applicable, as well as a result\_version\_id, which specifies the resulting scene description when the dynamic scene update is applied. These attributes are shown in table 2.

**Table 2 – Definitions of version attributes for dynamic scene updates**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Default** | **Description** |
| target\_version\_id | String | n/a | Identifier for the version of the target scene description for which the dynamic scene update is applicable |
| result\_version\_id | String | n/a | Identifier for the version of the resulting scene description when the dynamic scene update is applied |

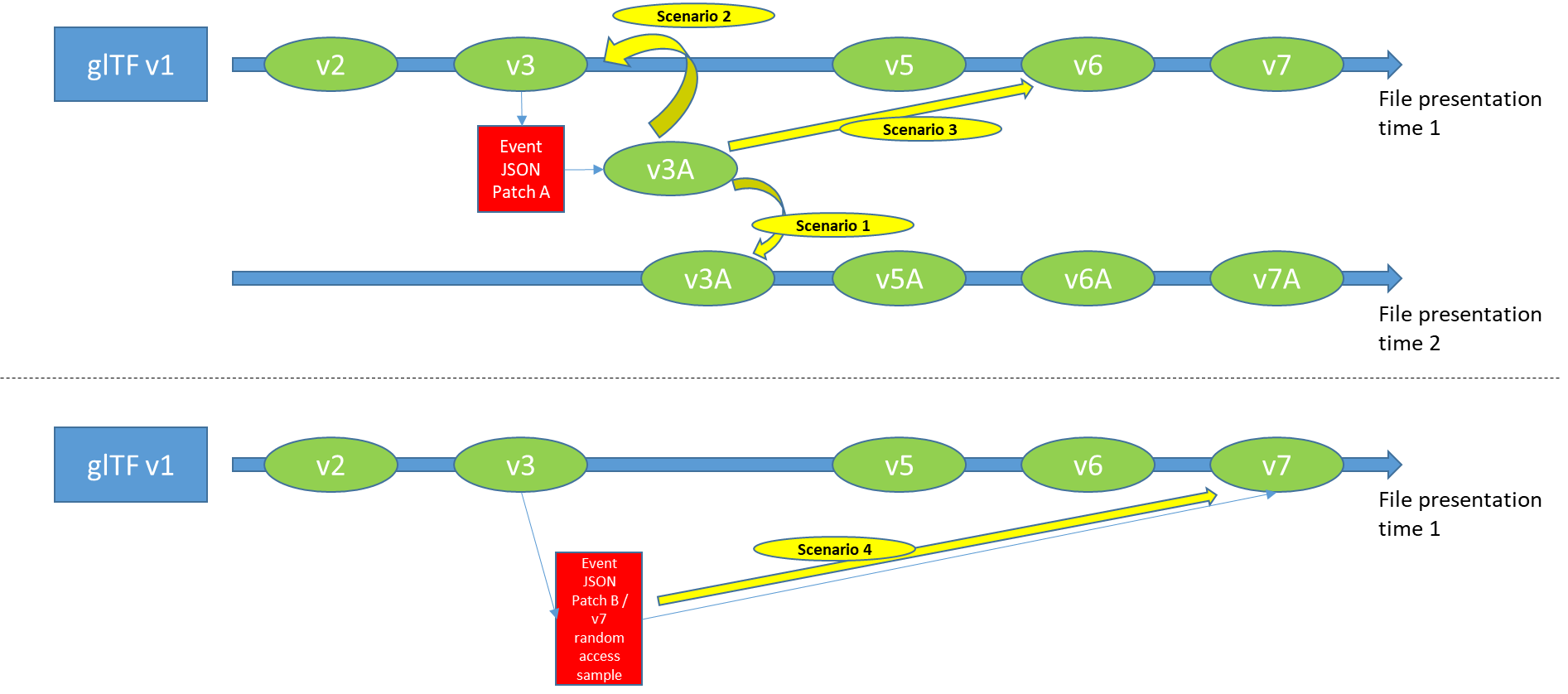
### Non-timed dynamic scene update scenarios

#### Event triggered dynamic scene updates [m56736]

The current DIS text does not contain any support for the indication of dynamic updates which are triggered by interaction events.

The triggering of a scene update by an interaction event is highly content dependent, and can be expressed as content metadata through event scene update attributes. Unlike a timed scene update which typically progresses the timeline of the content, an event triggered scene update may allow for deviations from the main content timeline, hence allowing for loops or skips in the content timeline.

Depending on the content author’s intent, there may be four different event update scenarios as shown in figure 5.



**Fig. 5 Event triggered dynamic scene update scenarios**

Scenario 1

* An event A triggers the dynamic scene update of glTF v3 to glTF v3A. This update utilises the event update sample containing JSON Patch document A.
* The updated scene description (v3A) is executed by the presentation engine, after which further updates may be enabled through timed or non-timed scene updates.

Scenario 2

* An event A triggers the dynamic scene update of glTF v3 to glTF v3A. This update utilises the event update sample containing JSON Patch document A.
* The updated scene description (v3A), as a result of, and through the nature of the event, has a certain playout period (a certain presentation time period).
* After the playout of scene description v3A, the presentation engine returns the scene to the scene description version before the occurrence of the event (v3).

Scenario 3

* An event A triggers the dynamic scene update of glTF v3 to glTF v3A. This update utilises the event update sample containing JSON Patch document A.
* The updated scene description (v3A), as a result of, and through the nature of the event, has a certain playout period (a certain presentation time period).
* After the playout of scene description v3A, the presentation engine skips to a specified scene description version (v6).

Scenario 4 (a special case of scenario 1, mixed with scenario 3)

* An event B triggers the dynamic scene update of glTF v3 to glTF v7.
* glTF v7 is a scene description version which exists within the same presentation timeline of glTF v3, and so the update can also be considered a direct scene skip.
* This update may utilize an event update sample containing JSON Patch document B, or may be realised by the execution of a random access scene description sample containing glTF v7.

The support of these scenarios can be specified by event scene update attributes shown in table 3.

**Table 3 – Definitions of event related attributes for dynamic scene updates**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Default** | **Description** |
| event\_id | String | n/a | Identifier for the event triggering the dynamic scene update |
| skip\_version\_id | String | n/a | Identifier for the version of the skip to scene description which is executed by the presentation engine, after the playout of the event updated scene graph |
| skip\_time | integer | n/a | Specifies the skip to time (referenced to the presentation time) of the scene graph version to skip to by the presentation engine, after the playout of the event updated scene graph |
| return\_event | integer | n/a | Flag to indicate whether the scene graph version is returned after the event scene playout. When set to 1, this flag indicates that the scene graph version is returned to the version previous to the event, after the playout of the scene graph version triggered by the event scene update. |
| playout\_time | integer | n/a | Specifies the playout time of the updated scene graph version triggered by the event scene update (in seconds, or any other time unit) |

## Timeline

* 2021-08-02: Release of EE2 description
* 2021-09-29: Deadline for participants to submit new potential solutions.
* 2021-10-06: MPEG document upload deadline
* 2021-10-11: MPEG #136(online) meeting start

## Annex

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number | Requirements N19511 | Fulfillment gltf2.0, including N18869 | Status MPEG Extensions | Suitability as Test Scenario |
| Phase 2a Requirements | | | | |
| General | | |  | 1 – must have  2 – quite important  3 – nice to have  4 – if there is lots of time  5 – unnecessary |
| 13 | The scene description shall support definitions to indicate how sub-graphs and objects are related in terms of their temporal, spatial and logical relationships | This requirement is partially supported, since with exception of animations, all nodes of a scene graph are assumed to be active at time 0 and there is no concept of scene updates in glTF2. Regarding the logical relationships between media elements within a scene, means of interactivity and possible constrains to it should be defined. | Partially supported in gltf by nodes (spatially and logically).  Scene description updates are under development and partially addressed in DIS. More work in EEs and TuC. | 4 |
| 21 | It shall be possible to update the whole scene-graph, a sub-graph, or a node in the scene description | glTF2 does not come with a scene update mechanism.  MPEG needs to provide appropriate extensions to address this issue | Partially supported in the DIS, work ongoing in EEs. | 1  Need to define a scenario. This is part of the current discussion |
| 22 | It shall be possible to correctly render a 6DoF Presentation after a random access in time | glTF2 does neither have support for a timing model nor scene updates through time and as such every glTF2 is considered a random access point in time.  MPEG needs to provide appropriate extensions to address this issue | Partially supported in the DIS, work ongoing in EEs. | 2  Likely covered by extension from above |
| 23 | It shall be possible to perform timed scene description updates | glTF2 does not come with a scene update mechanism.  MPEG needs to provide appropriate extensions to address this issue | Partially supported in the DIS, work ongoing in EEs. | 1  See 21 |
| 24 | It shall be possible to associate a scene description update with the corresponding scene description | glTF2 does not come with a scene update mechanism.  MPEG needs to provide appropriate extensions to address this issue | Partially supported in the DIS, work ongoing in EEs. | 2  See 21 |
| 85 | It shall be possible to discover user interactivity modules | glTF2.0 supports this, but interaction with timed media still needs to be defined.  MPEG needs to provide appropriate extensions to address this issue | Left to phase 2b. Needs work |  |
| 86 | it shall be possible to define custom interactivity procedures based on input from the user or from the user’s devices and sensors | glTF2.0 supports this, but interaction with timed media still needs to be defined.  MPEG needs to provide appropriate extensions to address this issue | Left to phase 2b. Needs work |  |