glTF Composition and Interactivity

Dan Frith, Avataar
Gerald Guyomard, Adobe
Leonard Daly, Daly Realism
Welcome to glTF: Complex Scenes & Interactivity

glTF Meetup
October 17, 2023
Today’s Presenters

Dan Frith (Avataar)
Gerald Guyomard (Adobe)
Leonard Daly (Daly Realism/ Khronos)
How to Participate

• Speaker Questions
  - During the presentations, please submit your questions to the speakers by using the Zoom Q&A feature, not the chat button. At the end of the talk, our moderator will put as many questions as possible to the speaker.

• Recording
  - We are recording this webinar and will be sharing it via the event page on the Khronos website. A direct link will be posted in chat.

• Survey
  - To help us design future glTF events, we would appreciate it if you could complete the short survey form that will pop up at the end of the webinar. The survey link will also be sent out in our follow up email.
Dan Frith, Avataar
Chair, 3D Commerce | Vice Chair, 3D Formats
Welcome to

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Chair, 3D Commerce | Vice Chair, 3D Formats
Khronos Ecosystem Segmentation

Multiple Khronos standards are often relevant to developers with similar requirements. Khronos currently identifies six such market segments. Working Groups within a segment coordinate and cooperate to develop coherent solutions and outreach programs.
Khronos Ecosystem Segmentation

3D content is already pervasive in retail. Virtual representations of products are everywhere from ads, web on mobile & computer, Augmented Reality, Virtual Reality to Mixed Reality devices.
glTF Ecosystem
glTF Ecosystem & 3D Commerce

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Industry Support glTF & 3D Commerce
Ace Hardware Teams with Epigraph for glTF-based 3D Web & AR Experiences.
EGO Power+ Z6 ZT4204L 42 in. 56 V Battery Zero Turn Riding Mower Kit (Battery & Charger) W/ FOUR 10.0 AH BATTERIES

![Image of the EGO Power+ Z6 ZT4204L 42 in. 56 V Battery Zero Turn Riding Mower Kit](image-url)

**SALE**

**$4,999.00**

**Regular Price** $6,499.00

**Save** $1,500.00

**Make 6 payments of $833.33/mo at 0% APR. [Learn more]**

**Promos**

- **Ace Rewards members save $500**

**Estimated Points Earned:** 49,990

**Add-on Service**

- **Assembly available $20.00**

**Get it from:**

- **Westlake Ace Hardware, Kansas City MO**

**Shipping Options**

- **Ships to Store for Pickup**

  Get it Fri, Jul 7

**ADD TO CART**

**ADD TO LIST**
Epigraph > Ace Hardware Pipeline

1. CAD
2. pixyz (Decimations and LOD Creation)
3. blender® (Model Creation, Tweaking, Texturing and Publishing)
4. glTF (KHR Draco Mesh Compression, KHR Materials Sheen)
5. Epigraph (Portal, Customization and Management of 3D Experiences, 3D Geo and Variant Parsing Software, Distribution Platform)
6. Epigraph > Ace Hardware Pipeline
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- **Open Metaverse & Wearable AR (New Customers)**
  - As new devices become more readily available and more affordable, so does the need to bring a consistent experience in other types of space and device. The demographic changes as does the requirement.
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- **NeRF (Neural Radiance Fields), Machine Learning & AI in 3D scanning & representation.**
  - The use of generative AI in 3D Asset & scene creation whilst following standards.
Retailers looking to join the conversation about scaling 3D in their own eCommerce applications are invited to join the 3D Commerce Working Group at Khronos. Learn more at: khronos.org/3dcommerce/ or email 3dcommerce-feedback@khronos.org.
Scene Interactivity

Gerald Guyomard, Adobe
Scene Interactivity

Gerald Guyomard, Adobe
Adding Interactivity to glTF

★ Interactivity brings your 3D Content to life:
  ○ content dynamically reacts to user inputs
  ○ A typical use case: Product Configurators
Adding Interactivity to glTF

glTF can embed static scenes made of multiple sorts of assets (meshes, textures, animations, sounds...) but there is no internal rules to define how the runtime should handle them.

Until now interactivity has been external to glTF, hence hardcoded into the application.

Interactive content is not portable to other applications.
Adding Interactivity to glTF

This new glTF extension:

- Provides blueprint for implementation of Interactive Assets (static geometry + behaviors)
- Empowers development of simple interactive applications (Games, Education, Design Review, e-commerce...)
General Strategies for building Interactivity

- **Write code**
  - Compiled Language: C, C++, Swift...
  - Interpreted Language: Javascript, Lua, Python...
  - It requires some programming skills
  - Portability Issues

- **Visual Scripting**
  - Creator assembles and connects building blocks
  - Much easier to learn for non engineers (no syntax to learn, no compilation necessary)
  - More portable (lightweight runtime, no sandboxed VM to rely on)
  - Limited set of blocks makes it more secure

```c++
#include "GameEngine.h"

class MyGame {
    private:
        Object* _object;
    public:
        void onKeyDownPressed(char key) override {
            if (key == 's') {
                while (true) /* pseudo code... */{
                    ::sleep(1);
                    _object->rotateBy(30.f);
                }
            }
        }
};
```

Unity Visual Scripting
Visual Scripting: Node Based Graph

- Comprehensive feature set (get/set variables or world state, branching flow, logic)

- Implemented by Unity (Visual Scripting), Unreal (Blueprints), Nvidia Omniverse (Action Graph), …

★ KHR_interactivity provides specifications for Node Based Graphs:

  - Accessible and powerful
  - Extensible with future extensions
  - Compatible with visual editing, but visual editors are not required

Example Implementation: Unreal Editor
KHR_interactivity Principles

An interactivity Graph is a set of connected Nodes forming a Directed Acyclic Graph (no cycles)

Node characteristics:
- type defining the action (add numbers, listen to an event, branch on a condition...)
- an immutable configuration
- some input sockets (value and flow)
- some output sockets (value and flow)
Example of a glTF Interactivity Graph

- Enumerates a sequence of integers 1, 2, 3, 4, 5
- Sends custom events "odd" or "even" for every number (eg \((value \% 2) == 0\)?)
- Once done, after 2 seconds, sends custom event "Done"

Various categories of Node:
- lifeCycle/onStart, onTick...
- flow/forLoop, delay, branch, while...
- logic/modulo, equal, add, subtract...
- customEvent/send, receive
Accessing the Scene Graph from the Behavior Graph

- High level actions change runtime scene state by starting / stopping animations, sounds, etc.

- Direct access to set / get runtime scene state using JSON paths
  - Set "/nodes/6/translation"
  - Set "/nodes/3/scale"

Extends the proposed `KHR_animation_pointer`’s JSON paths for interactivity
What can't you do, and why?

Considerations: Security, Portability, Ease of Implementation

Limitations:
- No dynamic allocation (no object instantiation, no array variables, no dynamic strings)
- No network access
- No file system access
- No multi user
Scene Composition with glTF eXternal

Leonard Daly, Daly Realism/ Khronos
Leonard Daly, Daly Realism
Origination of Idea

- Adobe came to 3D Formats with a description of Composition & Interactivity at the same time as 3D Commerce was beginning to formulate use cases for the same.
- Separate development with knowledge of the others work.
- Combined efforts this spring with 3D Commerce taking the lead on Composition and 3D Formats for Interactivity.

- Standardized on name: glTF eXternal
Types of Composition

- Level of detail
  - Distance based [traditional]
  - Time based [items that do not need to be visible throughout experience]
  - Environment based
- Streaming [large model progressive loading]
- Smart Loading [based on user device & network]
- Change (add/delete) objects in scene
LOD - Geospatial

Tree arrangement of data to support scene detail at varying distance and allow ease of navigation while streaming important data
LOD: Building Information Modeling

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Energy and thermal modelling of an office building to develop an artificial neural networks model

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LANDSKRONA
3-sits soffa, Grann/Bomstad svart/metall
9 995:-
7 995: exkl. moms
(29)
Delbetalning Fr. 392: m/mkr (66 mkr: totalbelopp 11 224:-; eff. ränta 7.97%) med Klarna Bank
10 års garanti
Medelfast
Multi-Object Lighting
Lighting - Object & Scene

Desk lamp, © 2018, Videoplasty.com, Creative Commons Attribution-ShareAlike 4.0
Desk Lamp Flat Icon Vector.svg from Wikimedia Commons

Bamboo forest in Arashiyama (Sagano), Kyoto, Japan
© 2021, Naokijp, Creative Commons Attribution-ShareAlike 3.0
Wikimedia Commons, Skewed for perspective

Tokyo at night, © 2011, Nalllor, Creative Commons Attribution-ShareAlike 3.0
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Billboards

- National Mall ©2010, Matti Blume, Creative Commons-Share Alike 4.0 International [Wikimedia Commons](https://commons.wikimedia.org/wiki/National_Mall).
Work to Date

- Work done in May 2023 as Prototype
- Basic test of current specification
- Note name change to “glTF eXternal” [from “gltf Composition”]
Plans and Next Steps

• Specification development
  - Interactivity - already described & in progress
  - Composition - work just starting
  - All in public GitHub

• Prototype development
  - Use case & Specification development by 3D Commerce
  - Technical development by 3D Formats
  - Prototype development by UX3D by extending Sample Viewer

• Initial Work
  - Lighting
  - LODs
  - Billboards
Ask the Experts

Dan Frith (Avataar)
Gerald Guyomard (Adobe)
Leonard Daly (Daly Realism/ Khronos)
Dwight Rodgers (Adobe)

Use the Zoom Q&A feature to ask your questions
Upcoming Khronos Group Events

- Oct 31: Let’s Get Moving- Adding Physics to glTF
- Nov 14: Standardizing Body Attachment Points for 3D Commerce Virtual Try On
- Available Recordings:
  - Exploring the Artistic Frontier: Unleashing Creativity in 3D Models with glTF and PBR
  - Optimizing glTF

Join our next glTF Meetup! If you are interested in presenting at an upcoming glTF meetup, please contact events@khronosgroup.org
A recording of this presentation and the slides will be available on the Khronos Group website.

www.khronos.org/events

For more information on glTF and links to online resources, please visit

www.khronos.org/gltf