Industry Impact of Khronos Standards for AR and 3D Commerce

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Khronos Connects Software to Silicon

Open, royalty-free interoperability standards to harness the power of GPU, multiprocessor and XR hardware

3D graphics, augmented and virtual reality, parallel programming, inferencing and vision acceleration

Non-profit, member-driven standards organization, open to any company

Well-defined multi-company governance and IP Framework

Founded in 2000
>150 Members ~ 40% US, 30% Europe, 30% Asia

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Khronos Standards for XR

- **3D Assets**
  - Create and deploy 3D models and scenes

- **Input**
  - Vision and sensor processing, inferencing acceleration
  - Embedded Camera API
  - Exploratory Group

- **Output**
  - High-performance, low-latency 3D Graphics
  - Portable access to XR hardware and runtimes

- **HMDs**

- **3D Commerce**
  - Create and deploy 3D models and scenes

- **glTF**

- **OpenCL**

- **SYCL**

- **OpenVX**

- **WebGL**

- **Vulkan**

- **WebGL**

- **OpenGL ES**

- **OpenGL**

- **OpenXR**
Need for Embedded Camera API Standards

Increasing Sensor Diversity
Including camera arrays and depth sensors such as Lidar

Multiple Sensors Per System
Synchronization and coordination become essential

Cost and time to integrate and utilize sensors in embedded systems is a major constraint on innovation and efficiency in the embedded vision market

Sophisticated Sensor Processing
Including inferencing. Sensor streams need to be efficiently generated and fed into acceleration APIs and processors

Proprietary Interfaces
Vendor-specific APIs to control cameras, sensors and close-to-sensor ISPs
Benefits of Embedded Camera API Standard

An effective open, cross-vendor open standard for camera, sensor and ISP control could provide multiple benefits:

- Cross-vendor portability of camera/sensor code for easier system integration of new sensors
- Preservation of application code across multiple generations of cameras and sensors
- Sophisticated control over sensor stream generation increases effectiveness of downstream accelerated processing

Development of Camera and sensor APIs may also generate new requirements for downstream vision and inferencing acceleration APIs
Embedded Camera API Exploratory Group

Any company is welcome to join
No cost or IP Licensing obligations
Project NDA to cover Exploratory Group Discussions

Embedded Camera API Exploratory Group
Hosted by EMVA and Khronos

Online discussion forum and weekly Zoom calls, probably for a few months
Discuss industry requirements for open, royalty-free camera API(s)
No detailed design activity to protect participants IP
Explore if consensus can be built around an agreed Scope of Work document
Discuss what standardization activities can best execute actions in the Scope of Work

Agreement with standardization bodies and/or open source projects on initiative(s) to execute the SOW under proven processes and IP Frameworks

Scope of Work Document
Agreed SOW document released from NDA and made public

Proven Khronos Process to ensuring industry requirements are fully understood before starting standardization initiatives

Join and get involved!
https://www.khronos.org/embedded-camera/#getinvolved
XR Portability

OpenXR provides cross-platform, high-performance access directly into XR device runtimes across multiple platforms.

Virtual Reality

Augmented Reality

And More!
## OpenXR Widespread Industry Adoption

### Conformant Implementations
- **Microsoft HoloLens 2**
  - Windows Mixed Reality Headsets
- **Oculus Rift S**
  - Quest and Quest2
- **HTC Vive Cosmos**

### Developer Preview Implementations
- **Valve SteamVR**
  - Transitioning from OpenVR to OpenXR
- **Varjo**
  - Preliminary support shipping now
- **Collabora**
  - Opensourse Implementation

### Engine Support
- **Unreal Engine**
  - Support in 4.24. Optimizations in 4.25
- **Unity Engine**
  - OpenXR Plugin Preview in 2020.2+
- **Chromium 81 for Chrome and Edge Browsers**
  - OpenXR default backend for WebXR
Bringing XR to the Web

Native XR Apps

- vuforia
- Unreal Engine
- Unity

Native 3D Engines

Web XR Apps

- babylon.js

Web 3D Engines

Khronos provides the foundation for native and Web-based 3D/XR

Lifting OpenXR functionality into the Web stack

Close cooperation between WebXR and OpenXR
glTF - The JPEG of 3D!

**Audio**
- MP3

**Video**
- H.264

**Images**
- JPEG

**3D**
- glTF

New market opportunities for 3D content creation and deployment!

- **glTF 1.0 - December 2015**
  - Efficient, reliable transmission
  - Bring 3D assets into 1000s of apps and engines

- **glTF 2.0 - June 2017**
  - Native AND Web APIs
  - Physically Based Rendering
  - Metallic-Roughness and Specular-Glossiness

Efficient, reliable transmission
Bring 3D assets into 1000s of apps and engines

Compact to Transmit
Simple and Fast to Load
Describes Full Scenes
Runtime Neutral
Open and Extensible

glTF spec development on open GitHub - get involved!
https://github.com/KhronosGroup/glTF
Core glTF 2.0 Asset Structure

.glTF (JSON)
Node hierarchy, PBR material textures, cameras

.bin
Geometry: vertices and indices
Animation: key-frames
Skins: inverse-bind matrices

.png
.jpg
.ktx2
Textures

PBR stands for “Physically-Based Rendering”

Mandatory Metallic-Roughness Materials
Base Color (Albedo) | Metalness | Roughness
Emission | Normal Map | Baked Ambient Occlusion

Optional Specular-Glossiness Materials
Diffuse | Specular | Glossiness

Texture based PBR materials

Geometry
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Creating a rich physically-based material framework for the glTF ecosystem

glTF extensions add PBR material parameters that integrate with existing materials
Building consensus on interoperable PBR deployable on diverse platforms and devices

June 2017
Core glTF 2.0
Mandatory Metallic-Roughness
Optional Specular-Glossiness

December 2020
First Wave glTF PBR Extensions
Clear Coat
Transmission
Sheen

Future Waves of glTF PBR Extensions
Subsurface Scattering, Attenuation,
Index of Refraction (IOR), Thickness, Specular Color,
Anisotropy, Translucency, Thin Film (iridescence)
and more…

Water Bottle sample is CC0, by Microsoft

https://belcour.github.io/blog/research/2017/05/01/brdf-thin-film.html
3D Commerce - Today’s Reality

Products don’t come with 3D data - and I can’t physically scan them all fast enough!

CAD tools don’t let me easily generate the data I need for E Commerce!

I wish I had high quality, realistic 3D models for virtual promotional photoshoots!

Everyone defines their product data for sizes and colors differently - nothing is consistent!

I need the materials in my 3D models to look completely realistic!

The green couch looks blue on some devices - lots of product returns are expensive!

Many 3D products on my ecommerce website first appear upside down! I have to hand-tune 1000s of models!

Complex retail pipeline with hundreds of companies and thousands of products
Many friction points - tooling, technical and commercial

3D Commerce can’t reach industrial scale so...
Interoperability standards to the rescue!
Rich Mix of Tech and Retail Companies

World-Leading 3D Technology Companies

World-Leading E-Commerce Companies

- AMD
- antilatency
- AREA
- Microsoft
- DisplayLink
- EPIC
- LUNAR
- Dassault Systèmes
- VARJO
- Imagination
- Intel
- Dassault Systèmes
- MediaTek
- arm
- mozilla
- Google
- Qualcomm
- RAZER
- SAMSUNG
- NVIDIA
- logitech
- acer
- NOKIA
- UX3D
- HP
- VeriSilicon
- COLLABORA
- Autodesk
- Pico
- Valve
- Adobe
- Otoy
- SONY
- ultraleap
- pluto
- Facebook
- Alibaba.com
- threediium
- Migens
- HTC
- HoloChips
- Tobii
- AGI
- emersya
- TASKCAN
- COOHOM

- Target
- SimplyAugmented
- OLIV
- Amazon.com
- CAPPA
- VNTANA
- IKEA
- DreamView Studios
- TURBOQUID
- Wayfair
- Marxent
- Arcane
- Innrision
- Shopify
- ThreeKit

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Khronos 3D Commerce Areas of Focus

**Asset Creation Guidelines**

For tools and product designers to create assets with consistent data to be used through the 3D Commerce pipeline

**Viewer Certification**

Test models, reference viewer, display analysis tools and capability specifications to guarantee a consistent and accurate end user experience

**Product Configuration**

Universal product configurability data and guidelines on how to drive consistent product display

**Metadata**

Structured metadata definitions and examples to consistently carry product information through the retail pipeline

**Asset Creation Guidelines 1.0 Released**

**glTF KHR_materials_variants** Extension

**Materials Variants Blog**

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**glTF’s first new generation PBR materials enable realistic and reliable display of many household goods.**

Next wave glTF requirements may include realistic rendering and animation of apparel

- [https://belcour.github.io/blog/research/2017/05/01/brdf-thin-film.html](https://belcour.github.io/blog/research/2017/05/01/brdf-thin-film.html)

- [https://google.github.io/filament/Filament.md.html](https://google.github.io/filament/Filament.md.html)

- [https://modelviewer.dev/fidelity/](https://modelviewer.dev/fidelity/)

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**glTF KHR_xmp** adds support for XMP (Extensible Metadata Platform) (ISO 16684-1) metadata to glTF
3D Commerce Wider Industry Impact

glTF Extensions for 3D Commerce Use Cases
Expanding power and flexibility of asset format standards for increasingly realistic models and enterprise process integration

Asset Creation Guidelines
Inspiring tools and techniques to effectively create 3D assets that can be reliably used everywhere

Viewer Certification
Ensuring that 3D objects and scenes are being accurately displayed by diverse apps and engines