glTF Overview

July 2019

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Slides by Neil Trevett & the 3D Formats Working Group

glTF - The JPEG of 3D!

Audio	Video	Images	3D
MP3	H.264	JPEG	glTF™
napster®	YouTube™	facebook	New market opportunities for 3D content creation and deployment!

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

glTF™

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

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

glTF™

WebGL™

glTF 1.0 - December 2015
Primarily for WebGL
Uses GLSL for materials

WebGL™ DirectX 12 Vulkan®

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

MAYA 3DS MAX blender™

MARMOSET TOOLBAG Titania Paint 3D SOLIDWORKS SUBSTANCE PAINTER

SideFX® Modo KeyShot by Luxion

Dedicated 3D Authoring Tools

COMSOL SketchUp Dn

MINECRAFT Archilogic Adobe

Authoring Tools that Export 3D

8TH WALL Microsoft Maquette BETA spoke by moz://a make your space Oculus UNBOUND medium

VR / AR Authoring Tools

HUAWEI 3D Live Object scandy eCapture3D Sony 3D Creator

3D Scanning Tools

PiXYZ SOFTWARE Assimp Open Asset Import Library Rapid Compact gltfpack

Collada2gltf SIMPLYGON™ OBJ2GLTF SAFE SOFTWARE FBX2glTF

Convertors and Optimizers

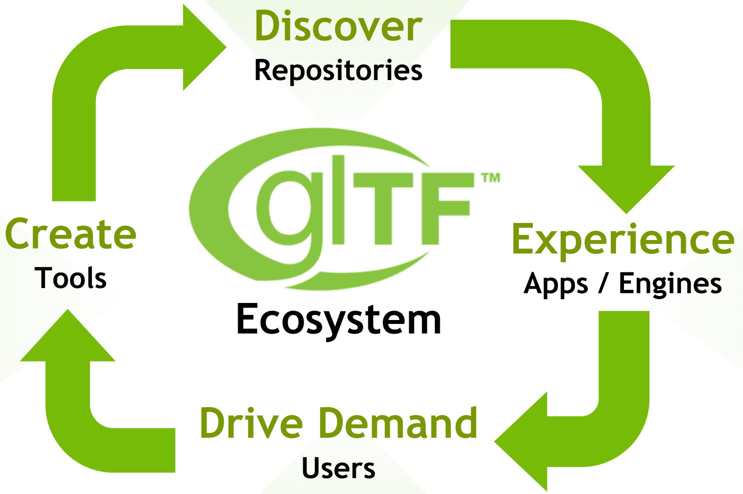
glTF Sample Viewer

gltf-vscode AGI glTF-asset-generator

glTF-validator glTF-Toolkit Microsoft

Validation and Reference Tools

TURBOSQUID Sketchfab Poly poly.google.com



Discover
Repositories

Experience
Apps / Engines

Drive Demand
Users

Create
Tools

glTF™
Ecosystem

Continental NVIDIA OGC otoy web3D CONSORTIUM IKEA

Bentley EA AMD

Uber shopify TARGET

VRM CONSORTIUM

UNREAL ENGINE PLAYCANVAS unity jMonkeyEngine GODOT Game engine OGRE

Game Engines

three.js babylon.js CLAYGL

Web Engines

AUTODESK® FORGE instant3Dhub [VENTUZ]

Filament VTK xeogl CESIUM

3D Builder Prep for 3D printing STK®

Qt UX3D ENGINE ParaView

Apps and Engines

magic leap JANUSVR hubs by moz://a

Mixed Reality Viewer A-FRAME worldviz

ARCore Windows Mixed Reality Home React 360

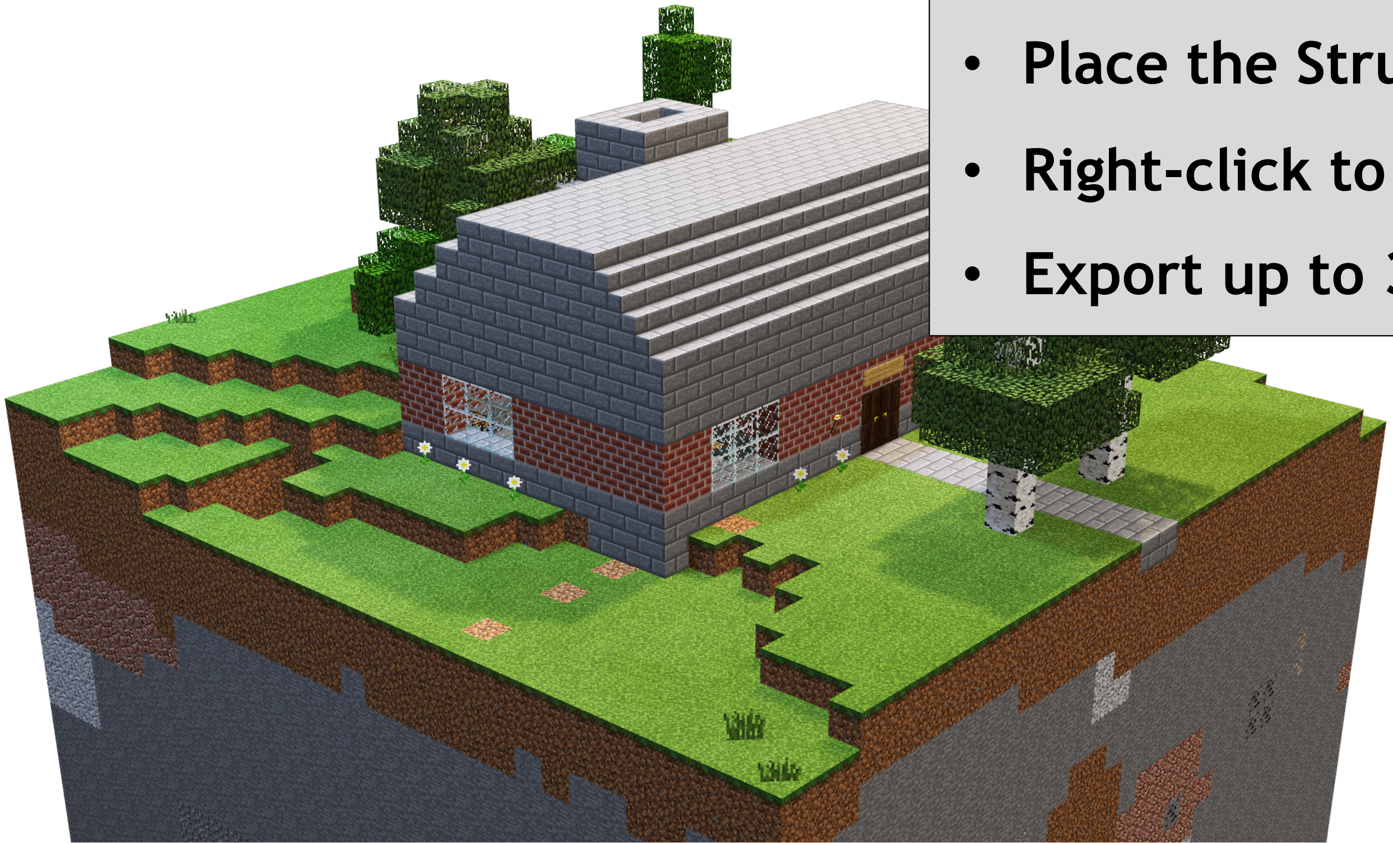
VR / AR Apps and Engines

Office facebook WordPress

Productivity and Social Apps

Wait... MINECRAFT ???

- Operator of “Creative” mode game
- `/give @s structure_block`
- Place the Structure Block into the world
- Right-click to activate
- Export up to 32 x 32 x 32 area to .glb



↓

Office

glTF 2.0 Scene Description Structure

.gltf (JSON)

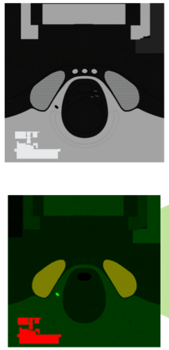
Node hierarchy, PBR material textures, cameras

.bin

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

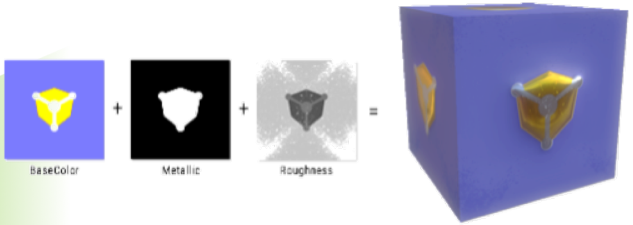
.png
.jpg
.ktx2
Textures

Geometry

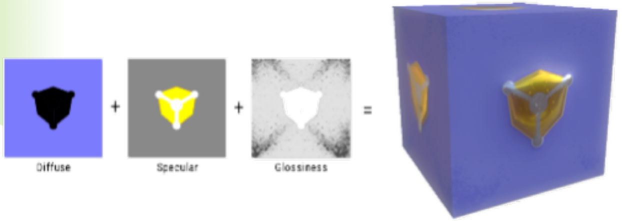


Texture based PBR materials

Mandatory Metallic-Roughness Materials

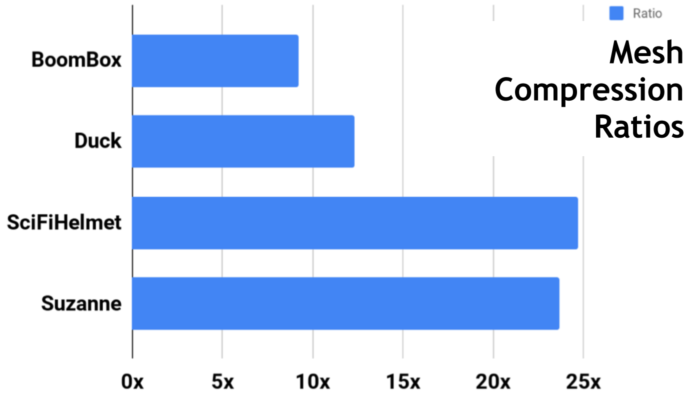


Optional Specular-Glossiness Materials



Draco glTF Mesh Compression Extension

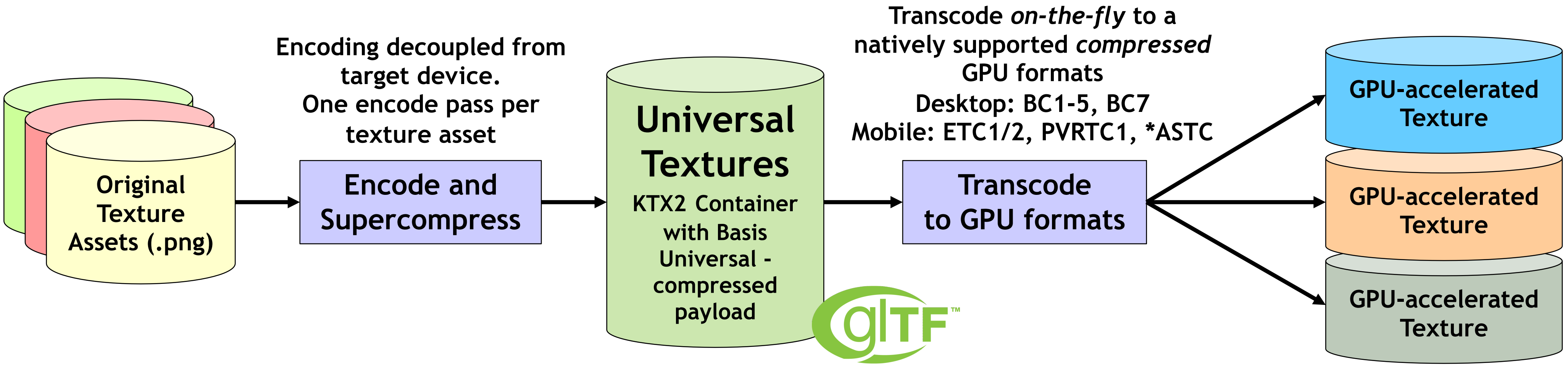
- **Library for compressing and decompressing 3D geometric meshes and point clouds**
  - Draco designed and built for compression efficiency and speed - great fit with glTF!
  - https://github.com/google/draco
- **Draco glTF extension launched in February 2018**
  - https://github.com/KhronosGroup/glTF/blob/master/extensions/2.0/Khronos/KHR_draco_mesh_compression/README.md
- **Google has released Draco encoders and decoders in open source**
  - C++ source code encoder to compress 3D data
  - C++ and JavaScript decoders for the encoded data
  - https://github.com/google/draco/tree/gltf_2.0_draco_extension
- **glTF/Draco compression already in use**
  - Blender, three.js, BABYLON.JS, Adobe Dimension, glTF pipeline, FBX2glTF, AMD Compressonator and glTF sample models



Mesh Compression Ratios

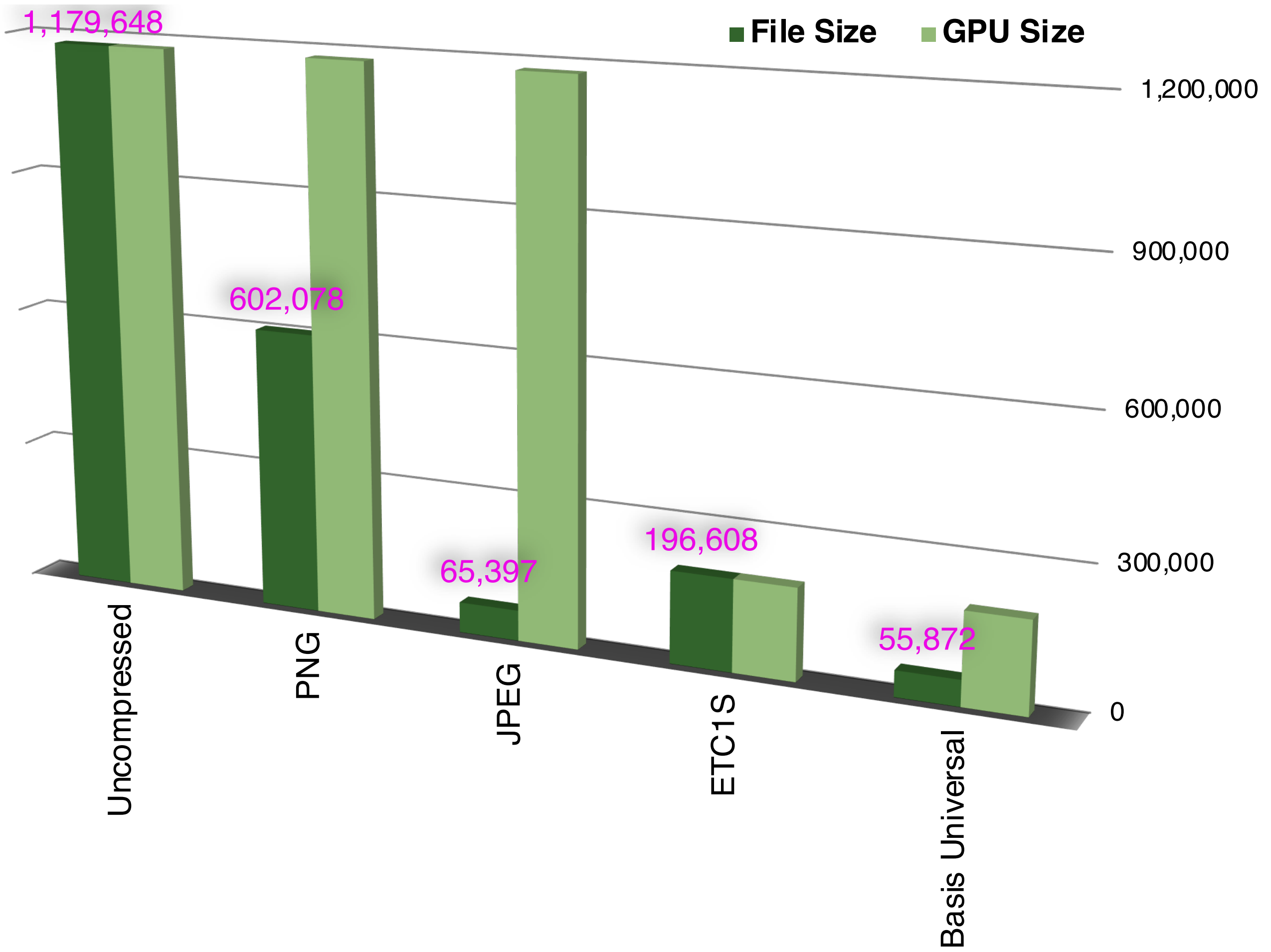
Universal Textures for glTF

- **Fragmentation of GPU texture formats is significant issue for developers**
  - Binomial's 'Basis Universal' technology enables JPEG-sized texture assets
  - Transcodable on-the-fly to natively supported compressed GPU formats
- **glTF Universal Texture extension uses KTX2 as a flexible container**
  - Precisely defined specification for consistent, cross-vendor generation and validation
  - Can contain wide range of texture formats used in Vulkan/DirectX/Metal
  - Supports streaming and full random access to MIP levels
  - Subset of full KTX2 - mandating supercompressed textures using Basis Universal technology


Original Texture Assets (.png)
Encoding decoupled from target device.
One encode pass per texture asset
Encode and Supercompress
Universal Textures
KTX2 Container with Basis Universal - compressed payload
Transcode *on-the-fly* to a natively supported *compressed* GPU formats
Desktop: BC1-5, BC7
Mobile: ETC1/2, PVRTC1, *ASTC
Transcode to GPU formats
GPU-accelerated Texture
GPU-accelerated Texture
GPU-accelerated Texture
glTF

*ASTC support in development

Compare File Sizes: 512 x 768 RGB Photo



Universal Textures - Get Involved!

- **Design discussions**
  - https://github.com/KhronosGroup/glTF/pull/1612
- **Khronos open source tools**
  - https://github.com/KhronosGroup/KTX-Software/tree/ktx2
  - toktx - create a KTX2 file from a set of .png images
  - ktxsc - convert images in KTX2 file to supercompressed images using Basis transcoder
- **Ecosystem forming around KTX2**
  - Khronos glTF texture tool with GUI for generating supercompressed textures
  - Increasing number of run-times integrating prototype KTX2 support

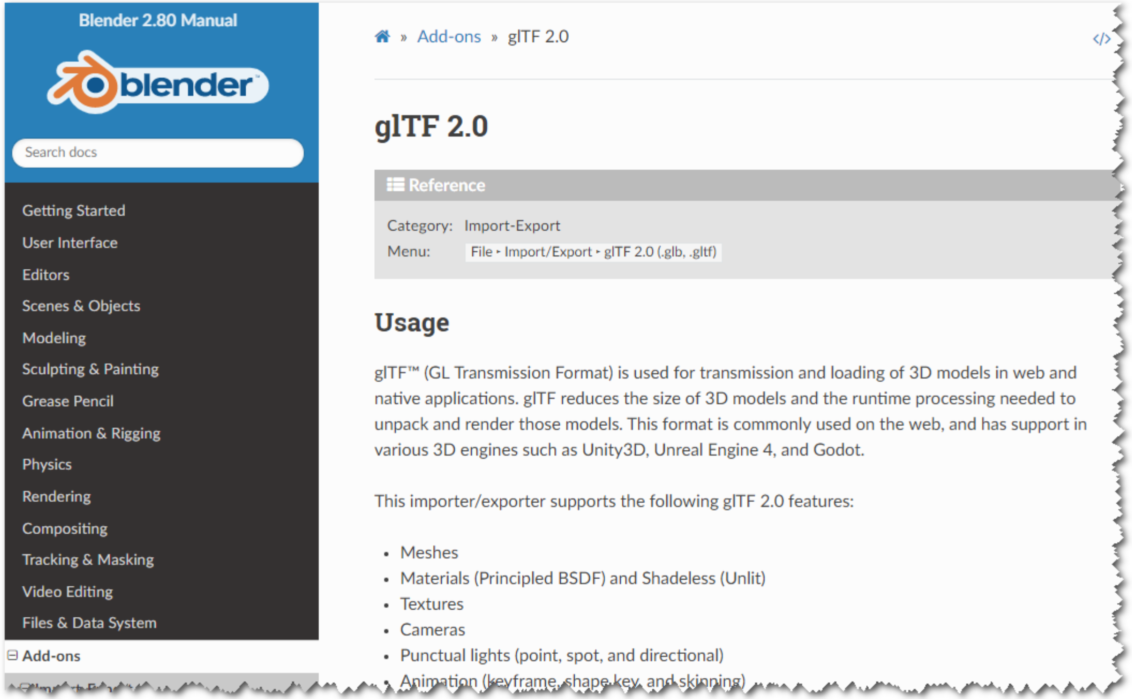
babylon.js CESIUM three.js UX3D

Applications and engines with prototype KTX2 support

https://www.khronos.org/assets/uploads/developers/library/2019-siggraph/glTF-KTX2-Basis-SIGGRAPH_Jul19.pdf

Blender 2.80 Supports Full glTF Import/Export

Project driven by Mozilla, Khronos and the glTF community



Blender 2.80 Manual

Search docs

- Getting Started
- User Interface
- Editors
- Scenes & Objects
- Modeling
- Sculpting & Painting
- Grease Pencil
- Animation & Rigging
- Physics
- Rendering
- Compositing
- Tracking & Masking
- Video Editing
- Files & Data System
- ⊟ Add-ons

» Add-ons » glTF 2.0

glTF 2.0

Reference

Category: Import-Export

Menu: File ‣ Import/Export ‣ glTF 2.0 (.glb, .gltf)

Usage

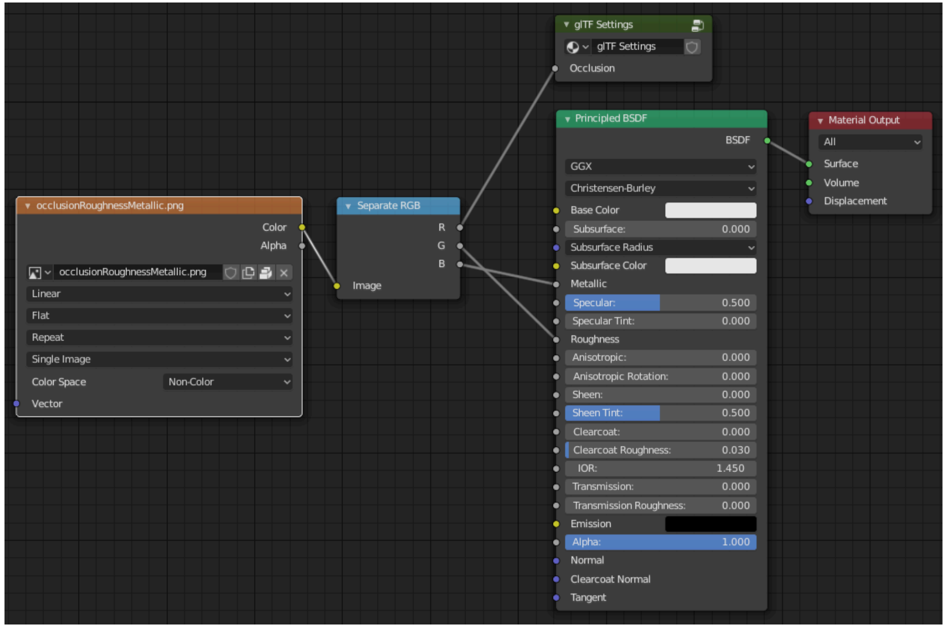
glTF™ (GL Transmission Format) is used for transmission and loading of 3D models in web and native applications. glTF reduces the size of 3D models and the runtime processing needed to unpack and render those models. This format is commonly used on the web, and has support in various 3D engines such as Unity3D, Unreal Engine 4, and Godot.

This importer/exporter supports the following glTF 2.0 features:

- Meshes
- Materials (Principled BSDF) and Shadeless (Unlit)
- Textures
- Cameras
- Punctual lights (point, spot, and directional)
- Animation (keyframe, shape key, and skinning)

https://docs.blender.org/manual/en/2.80/addons/io_scene_gltf2.html

Blender's Principled BSDF Shader node maps to glTF's PBR materials

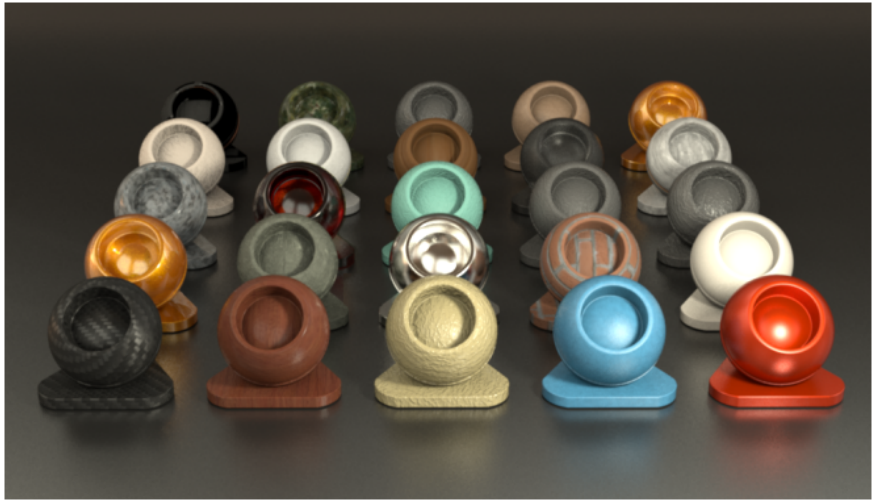


Roadmap Discussions

- Many of these topics are being discussed on GitHub
  - https://github.com/KhronosGroup/glTF
  - Come and give your views!
- Next Generation PBR Materials
- Animation 2.0
  - Advanced Avatars and Face emoji, with compression
- LOD and Streaming
- Cross-asset linking
- Enhanced Metadata

glTF Roadmap is Driven by Developer Feedback and Requirements

NVIDIA MDL Physically Based Rendering



Focus on glTF Ecosystem Robustness

- **Khronos constantly working on improving ecosystem's consistency**
  - Rendering (reference viewer, reference environment)
  - Technical low-level issues (validator & asset generator)
- **If you are CREATING glTF Files**
  - Ensure generated files are validator clean
    - https://github.com/KhronosGroup/glTF-Validator
  - Help the community understand what your exporter supports
    - https://github.com/KhronosGroup/glTF/issues/1271
- **If you are LOADING glTF files**
  - Ensure loader can correctly load all sample models (integration tests)
    - https://github.com/KhronosGroup/glTF-Sample-Models
  - Ensure loader can correctly load all asset generator models (unit tests)
    - https://github.com/KhronosGroup/glTF-Asset-Generator

Users of glTF can help to keep glTF reliable and consistent!

Resources

- glTF Home Page
  - https://www.khronos.org/gltf/
- glTF GitHub
  - https://github.com/KhronosGroup/glTF
- PBR 2.0 – advanced materials
  - https://github.com/KhronosGroup/glTF/issues/1442
- Khronos 3D Commerce Exploratory Group
  - https://www.khronos.org/exploratory/3d-commerce/
- More Information
  - www.khronos.org
  - ntrevett@nvidia.com
  - @neilt3d

Up Next

- Facebook, Renee Rashid
- Cesium, Omar Shehata
  - 3D Tiles & KTX2 / Basis Universal
- DGG, Max Limper
- Uber, Georgios Karnas
- UX3D, Fabian Wahlster and Moritz Becher
  - glTF editor and tools
- Esri, David Körner
  - glTF with Esri JS API
- Sketchfab, Alban Denoyel
- Google, Adrian Perez
  - AR Search at Google
- Wayfair, Shrenik Sadalgi
  - Khronos 3D Commerce