glTF 2.0: Status and Outlook

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Content

Status	(15 minutes)
Outlook	(35 minutes)
Questions & Answers	(10 minutes)

Status glTF 2.0

What we **currently** have!

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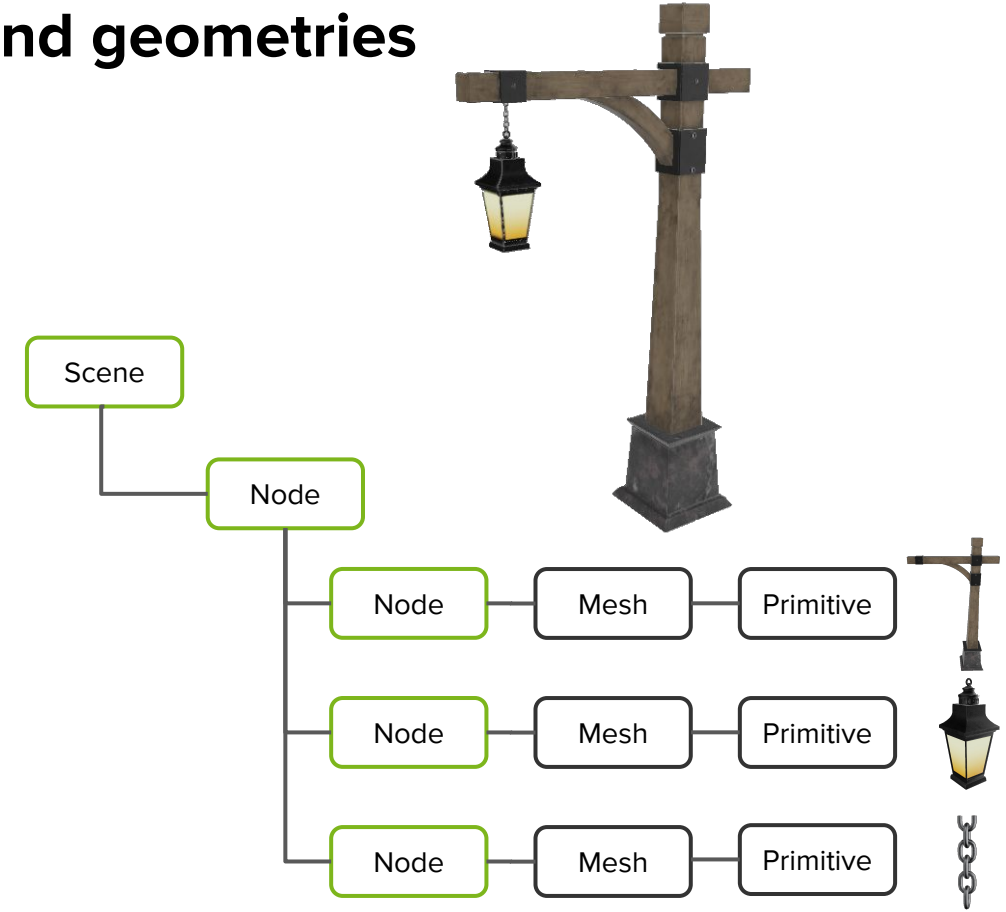
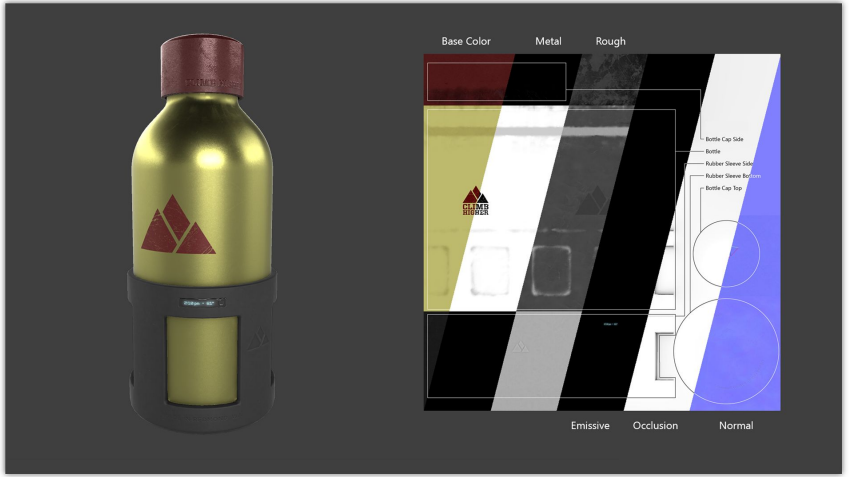
Scene, nodes, cameras and geometries

- Multiple scenes
- Node hierarchy
  - Translate
  - Quaternion rotate
  - Scale
  - Or: Matrix
- Per node mesh
- Multiple primitives per mesh
  - Points
  - Lines
  - Triangles
- Per node camera
  - Orthographic
  - Perspective



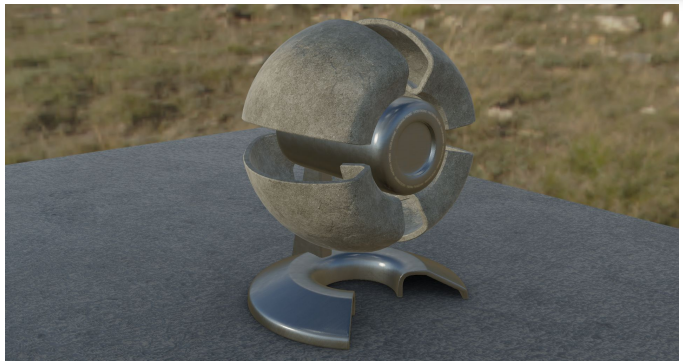
Textures, materials and animations

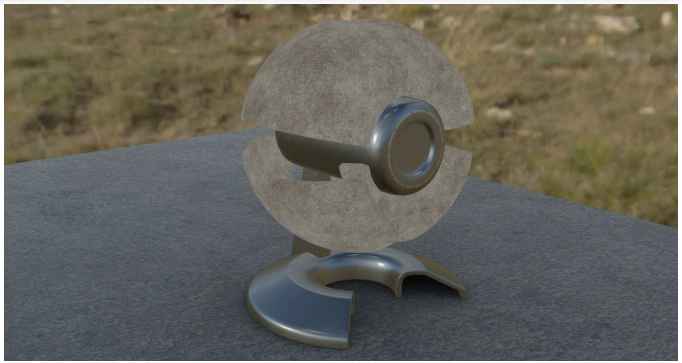
- Textures
  - Images
  - Samplers
- Materials
  - Metallic-Roughness PBR
  - Emission
  - Occlusion
  - Normal
  - Blending
- Animations
  - Nodes
  - Joints
  - Morphing



Material extensions

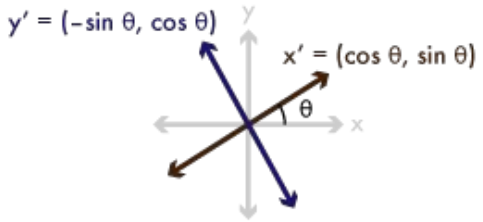
- Materials
  - Specular-Glossiness PBR
  - Unlit





Compression and texture extensions

- Compression
  - Draco mesh compression (“JPEG” of 3D)
- Texture
  - Transform



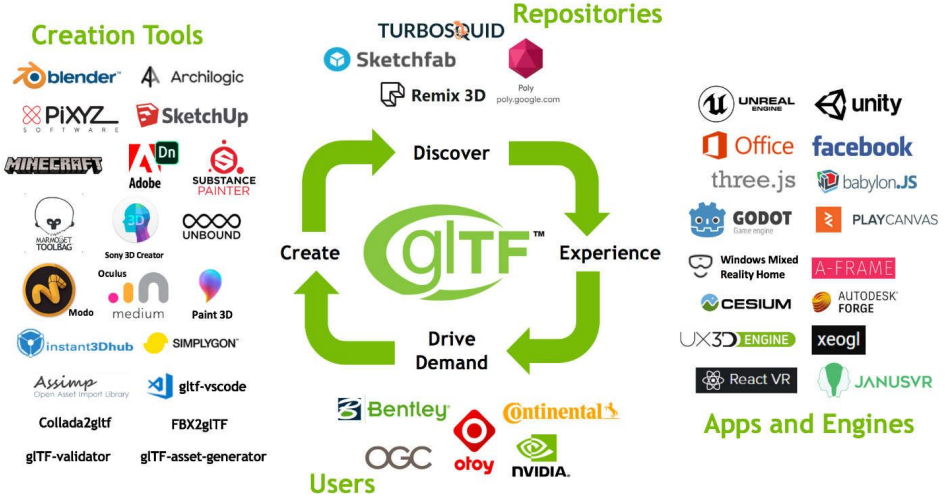
$$\begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

```
mat3(vec3( cos(theta), sin(theta), 0.0),
     vec3(-sin(theta), cos(theta), 0.0),
     vec3(        0.0,        0.0, 1.0))
```

DRACO
3D DATA COMPRESSION

Large glTF ecosystem

- Big industry support
- glTF is the “JPEG” of 3D



Adobe AGI allegorithmic AMD AREA Archilogic
AUTODESK Bentley BINOMIAL blender box CESIUM
Continental Fraunhofer Google JANUSVR Microsoft moz://a
MPEG NVIDIA oculus OGC otoy PiXYZ TURBOSQUID
Sketchfab unity UX3D web3D CONSORTIUM

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Outlook glTF

What we **could** have!
(Do not say it will or should come)

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Extending glTF PBR materials

- Driven by
  - Games
  - Movies
  - ...
  - ...

SIGGRAPH 2017 Course: Physically Based Shading in Theory and Practice

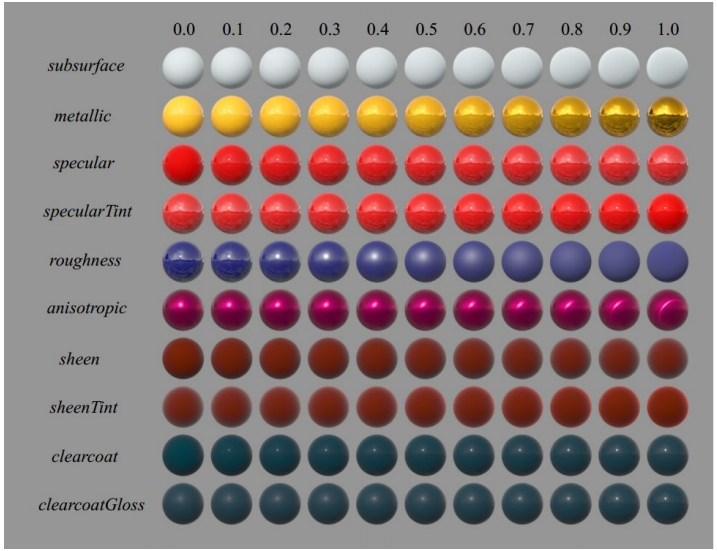
© DreamWorks Animation 2017.

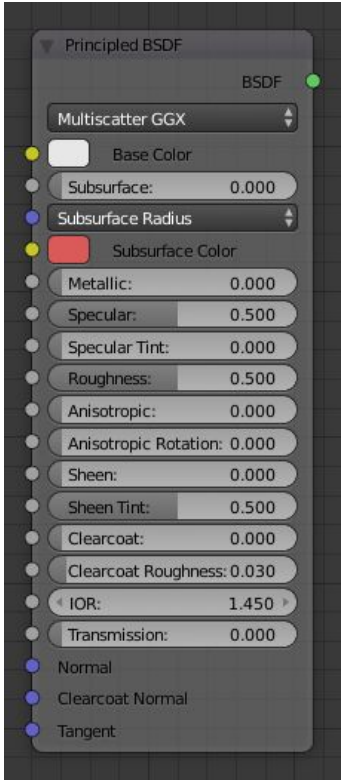
- “Take the latest stuff from the engines and put it into glTF!”

Source: http://blog.selfshadow.com/publications/s2017-shading-course/

Extending glTF PBR materials (cont.)

- Materials
  - Subsurface Scattering
  - Sheen
  - Coating
- “Just” need to agree on parameters

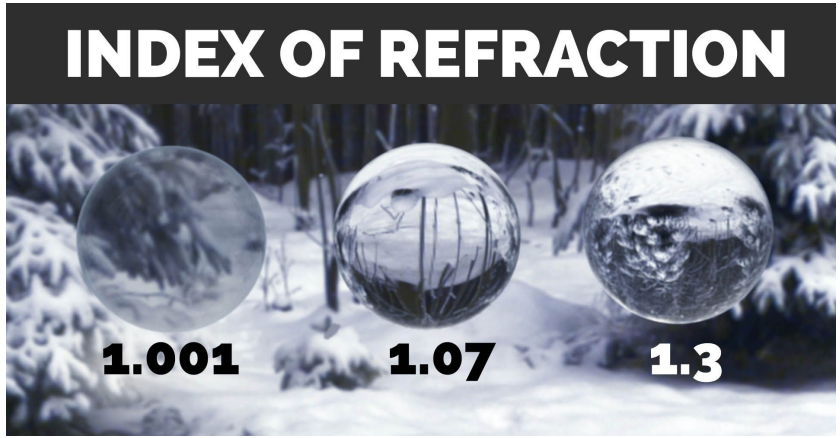




Source: http://blog.selfshadow.com/publications/s2012-shading-course/burley/s2012_pbs_disney_brdf_notes_v3.pdf

Extending glTF PBR materials (cont.)

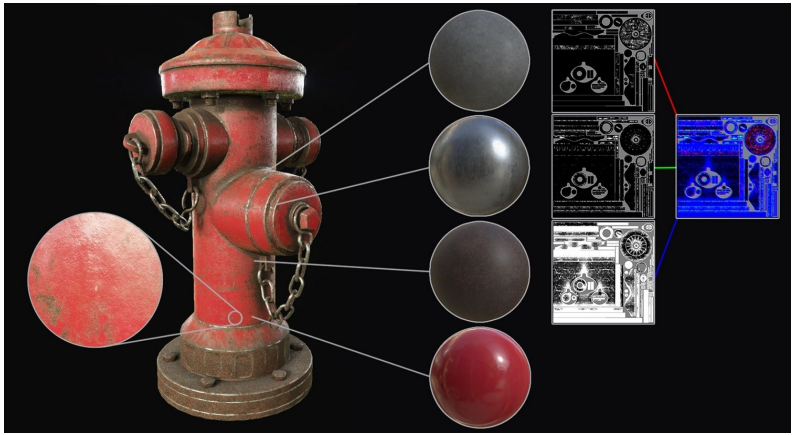
- Materials
  - Refraction
  - Anisotropy
    - Tangent texture
- It's getting sophisticated …
  - … for real-time



Source: https://www.creativeshrimp.com/create-realistic-ice-lighting-book-02.html
https://www.blenderguru.com/tutorials/making-realistic-pbr-materials-part-2-metal

Extending glTF PBR materials (cont.)

- Materials
  - Thin Film
- Dynamic material layering



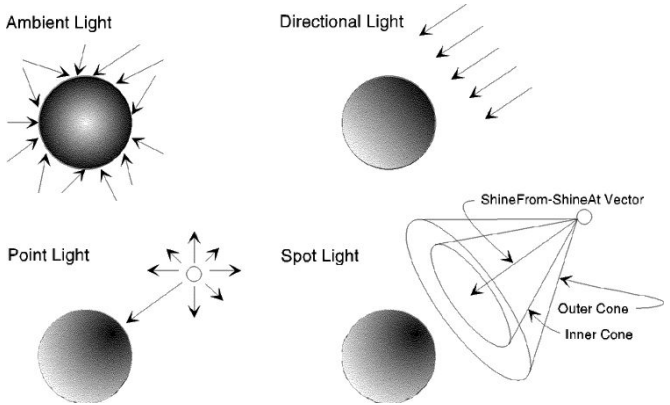
Source: https://belcour.github.io/blog/research/2017/05/01/brdf-thin-film.html
https://support.allegorithmic.com/documentation/display/SPDOC/Dynamic+Material+Layering

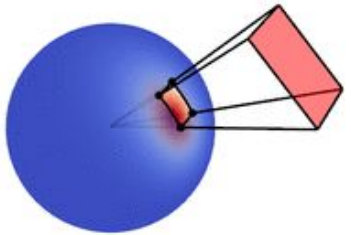
Extending glTF PBR materials summary

- Define for usage with rasterizer and real-time/offline ray/path tracer
- Encoding: GPU vs. transfer friendly
- Limits: Embedded vs. render farm

Adding lighting to glTF

- Lighting
  - Punctual lights
  - Environment lights
    - Cube maps
    - Mip mapping
    - HDR
  - Area lights
- Shadowing
  - Decision up to engine

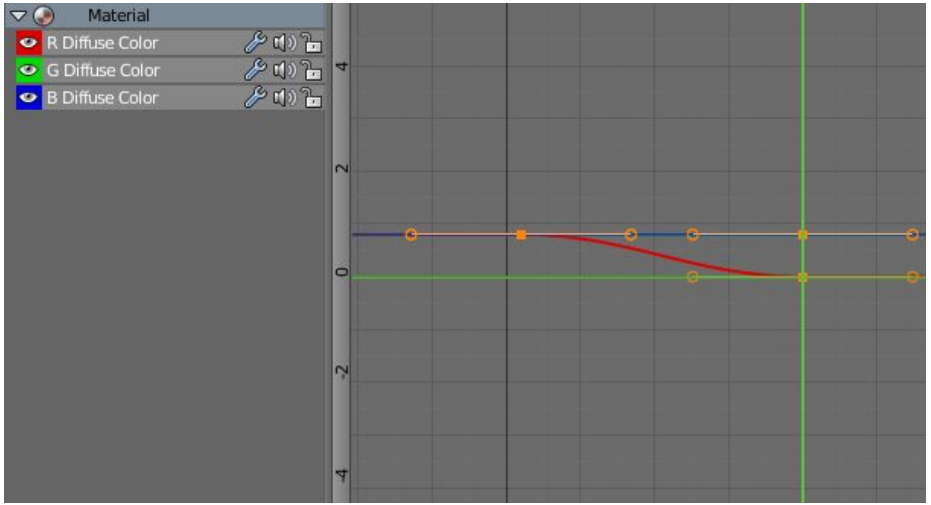




Source:https://stackoverflow.com/questions/16406861/difference-between-positioned-and-direct-light-in-c-opengl
http://blog.magnum.graphics/guest-posts/area-lights-with-ltcs/

Enhancing the animation system

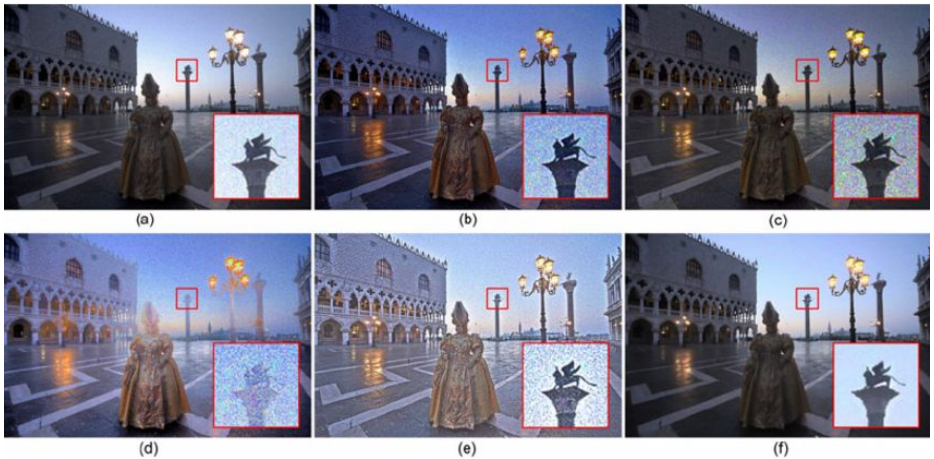
- Animate
  - Scalars and vectors (e.g. factors and colors)
- Generic “everything” animation vs. animation for specific element
  - E.g. any parameter vs. base color value

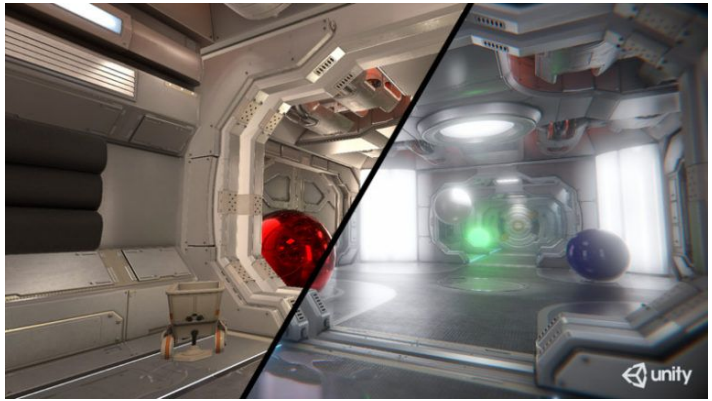


Final pixel on the screen

- Tone mapping
- Post processing

- glTF becomes huge

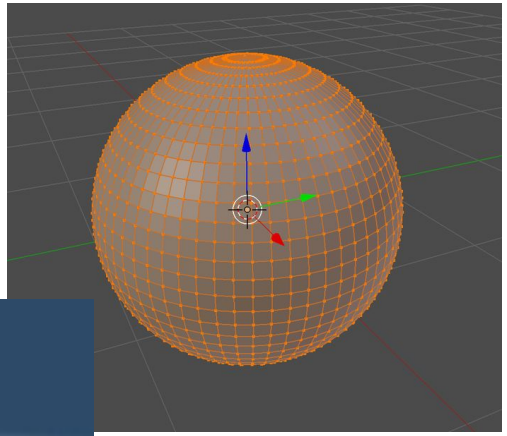


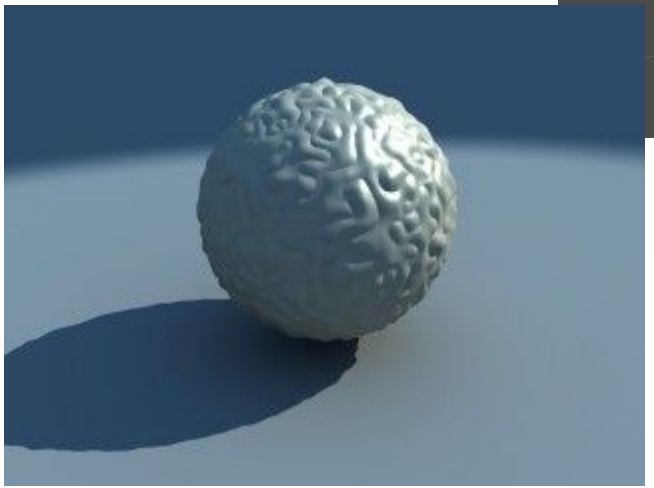


Source: https://www.researchgate.net/figure/Visual-comparison-of-different-tone-mapping-algorithms-a-global-tone-curve-16-b_fig5_262237809
https://cutsceneartist.com/tools/unity-post-processing-stack/

Extending geometry and compression

- Geometry
  - Procedural e.g. spheres, cubes etc.
  - Displacement mapping
  - LOD
- Compression
  - Texture / image data
  - Animation
  - glTF JSON data

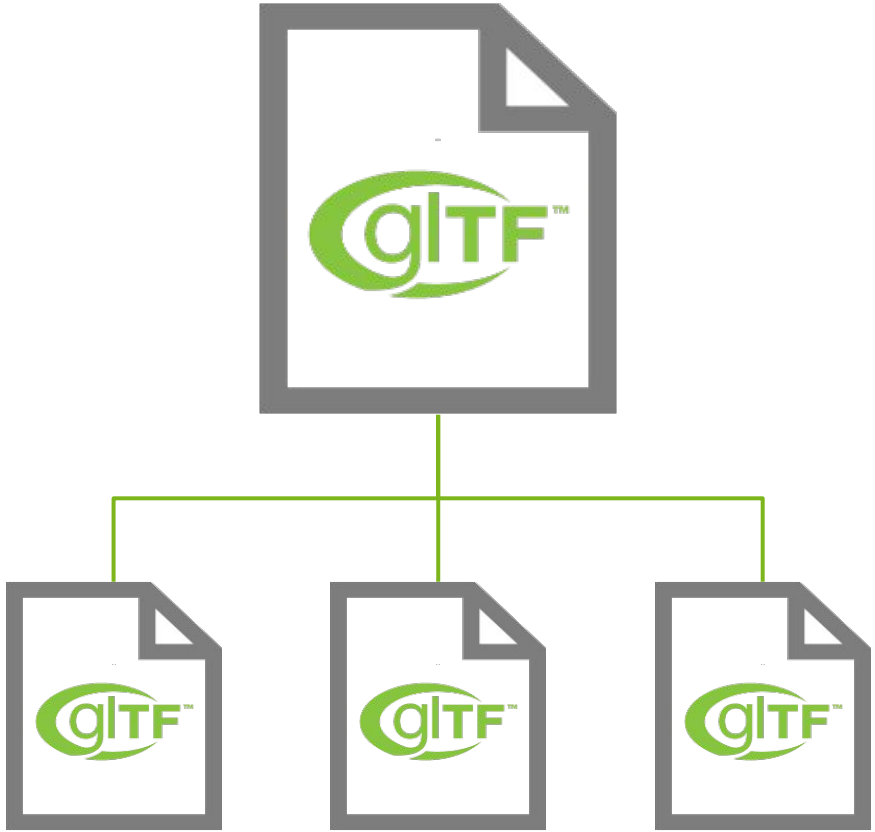




Source:http://help.chaosgroup.com/vray/help/150SP1/tutorials_displacement.htm

Organizing glTF

- glTF files can get quite large
  - Facebook is restricting size
- Scene composition
  - Referencing other glTF files



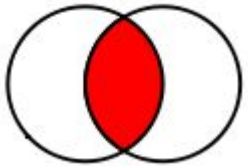
Rendering quality

- Quantity: Lot of tools etc.
  - Very good
- Quality: Minor Differences
  - Game-industry: “Fine, I’ll adapt anyway”
  - Non-game-industry: “No go!”

Organizing the extensions

- Many Khronos companies involved
  - Already hard to agree :-)
- Huge community support
  - https://github.com/KhronosGroup/glTF/issues

- What we need:
  - Many small extensions
    - Dependency graph
  - Or: Few large extensions



  - How do we avoid extensions overlapping and fragmentation?

Progress of glTF

- Fast or slow progress of extensions
  - People/companies need time to implement
- Next version of glTF
  - Frequent vs. not frequent

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Extending glTF with non-graphics

- “Level” description
  - Events and triggers
  - Audio
  - Video
  - …
- MPEG of 3D
  - Do we want this?

Outlook Summary

- glTF is the JPEG of 3D
  - Required features available now
  - Lot of features to come (if we want)

- Eco system
  - Quantity: Huge
  - Quality: Good, but this 1% needs to be fixed

- Extension and future glTF coordination
  - Biggest challenge in my mind

Questions & Answers

2018 SIGGRAPH

Khronos BOFs: Wednesday, August 15

Location: Pinnacle Ballroom, Vancouver Marriott Pinnacle Downtown

https://www.khronos.org/gltf/