glTF Update

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3D Needs a Transmission Format!

- **Need to bridge the gap between tools and today's GL based apps**
  - Reduce duplicated effort in content pipelines
  - Enable richer 3D representation – OBJ, STL etc. too limited
  - Provide common publishing format for content tools and services
- **Why is 3D the last data type with an agreed transmission format?**

Audio	Video	Images	3D
MP3	H.264	JPEG	?
napster	YouTube	facebook	!

An effective and widely adopted codec ignites previously unimagined opportunities for a media type

glTF = “JPEG for 3D”

- ‘GL Transmission Format’
  - Runtime asset format for WebGL, OpenGL ES, and OpenGL applications
- **Compact representation for fast download**
  - Meshes, skins and animation data etc. binary files/typed arrays
  - Extension capability for future formats with compression and streaming
- **Loads quickly into memory**
  - JSON for scene structure and other high-level constructs
  - GL native data types require no additional parsing
- **Full-featured and pragmatic**
  - 3D constructs (hierarchy, cameras, lights, common materials, animation)
  - Full support for shaders and arbitrary materials
- **Runtime Neutral**
  - Can be created and used by any tool, app or runtime

Some JSON

Describing scene structure

```
"nodes": {
    "LOD3sp": {
      "children": [],
      "matrix": [
            ],                  …
      "meshes": [
        "LOD3spShape-lib"
      ],
      "name": "LOD3sp"
    },
```

Defining a mesh

```
"meshes": {
    "LOD3spShape-lib": {
      "name": "LOD3spShape",
      "primitives": [
        {
          "attributes": {
            "NORMAL": "accessor_25",
            "POSITION": "accessor_23",
            "TEXCOORD_0": "accessor_27"
          },
          "indices": "accessor_21",
          "material": "blinn3-fx",
          "primitive": 4
        }
      ]
    }
  },
```

Referencing buffers

```
"bufferViews": {
    "bufferView_29": {
      "buffer": "duck",
      "byteLength": 25272,
      "byteOffset": 0,
      "target": 34963
    },
    "bufferView_30": {
      "buffer": "duck",
      "byteLength": 76768,
      "byteOffset": 25272,
      "target": 34962
    }
  },
```

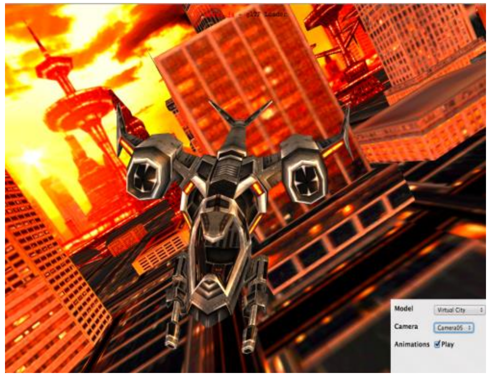
Project Status

- **Open specification; Open process**
  - Specification and sample code: https://github.com/KhronosGroup/glTF
  - Multiple implementations in sample source
- **glTF 0.8 schema available**
  - Getting very close to glTF 1.0 - most likely no major breaking changes in 1.0
- **Features TBD**
  - Extensions e.g. Mesh Compression
  - Cube maps
- **Next steps**
  - Draft 1.0 target date September 23 (Graphical Web conference)

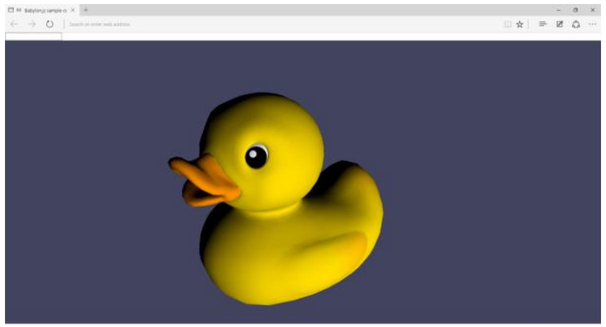
We're looking for your feedback!

glTF Adoption

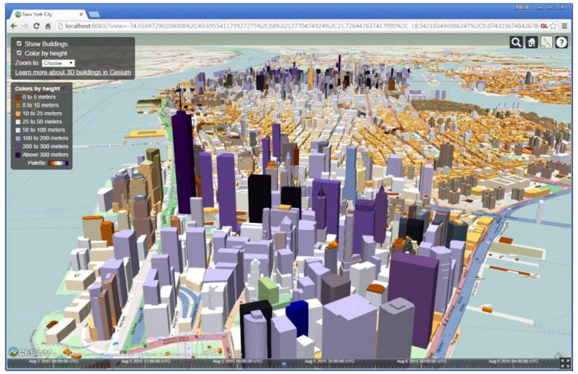
three.js loader
(updates coming 9/15)
https://github.com/mrdoob/three.js/



BabylonJS
(under development)
http://www.babylonjs.com/



Cesium – it's the native format!
http://cesiumjs.org/



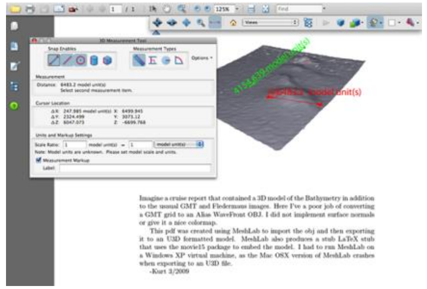
PIPELINE TOOLS

collada2gltf converter
https://github.com/KhronosGroup/glTF

Online drag and drop converter
http://cesiumjs.org/convertmodel.html

FBX to glTF
(under development)
http://gltf.autodesk.io/

LibreOffice



[a·mo·bee]

glTF Extensibility

- **glTF**
  - Simple format
  - Need more?
    - Extras and extensions on any object
- **Extras**
  - For app-specific data
    - `mesh.extras.description: { ... }`
- **Extensions**
  - For new general-purpose functionality specs
    - `bufferView.extensions.mesh_compression_open3dgc: { ... }`

Open3DGC Mesh Compression

- Open3DGC mesh compression library (Khaled Mamou, AMD; MIT-licensed)
  - 40–80% compression over flat arrays
    - Fast decompression
  - C++ encoder/decoder + JavaScript decoder
    - Floating-point quantization, parallelogram prediction, animations, etc.

      Mamou, K., Zaharia, T. and Prêteux, F. (2009), TFAN: A low complexity 3D mesh compression algorithm. Comp. Anim. Virtual Worlds, 20: 343–354. doi: 10.1002/cav.319
- **In glTF**
  - Insert decompression between file buffer and vertex data
- **WIP encoder support in COLLADA2GLTF**
  - Static models
  - Some support for uncompressed animation data
- **WIP decoder support in Cesium**
  - Very straightforward: about 1 workday (static models)
  - Supports decompression in a Web Worker
- **Feedback welcome**
  - Join the discussion on GitHub!
    - https://github.com/KhronosGroup/glTF/issues/398

Sample Results

- **Comparison of**
  - Default flat-array mesh encoding + gzip
  - Open3DGC, ASCII-mode + gzip
    - Compression parameters tuned manually for quality

Model	Verts	Tris	Flat+Gzip	O3DGC+Gzip		JavaScript
COLLADA Duck	2.1k	4.2k	54 KiB	14 KiB	-74%	24 ms
Stanford Bunny	2.5k	5.0k	105 KiB	56 KiB	-47%	30 ms
Stanford Dragon	435k	871k	7792 KiB	2141 KiB	-73%	Σ = 630 ms
3D Tile	12.8k	6.5k	102 KiB	59 KiB	-42%	—
OpenStreetMap NYC	—	—	337 MiB	207 MiB	-39%	*(Streamed)*

- Σ: Dragon decompressed in 7 parts (64k vertices each)
- Google Chrome 44.0, Windows 8.1, Intel i7-4980HQ @ 2.80GHz

Demos