



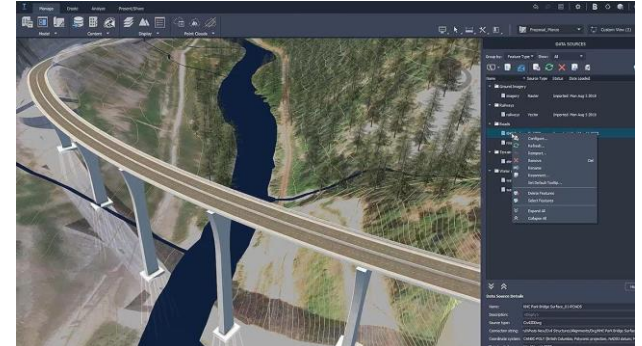
# AEC & Geospatial

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# AEC

## glTF for Architecture, Engineering, and Construction

- Millions of objects
- Geometry + materials + metadata
- Complex data models: IFC, Revit, etc.



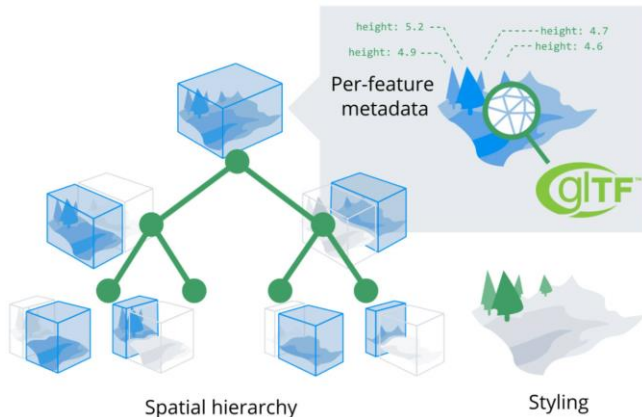
# AEC - glTF optimizations

- Single draw call while still preserving interactivity
  - Vertex colors
  - Batching
  - Instancing
  - Feature IDs
- Compression
  - Meshopt
  - KTX2 / Basis Universal



# AEC - Scaling

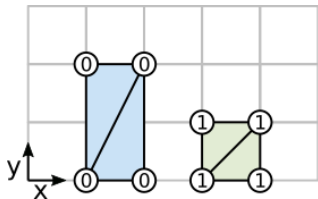
- Snowdon Towers: 42.7 MB .glb
- Larger models can be 500 MB+
- 3D Tiles + glTF
  - Streaming
  - Level of detail
  - Culling



# AEC - Metadata

## EXT\_mesh\_features

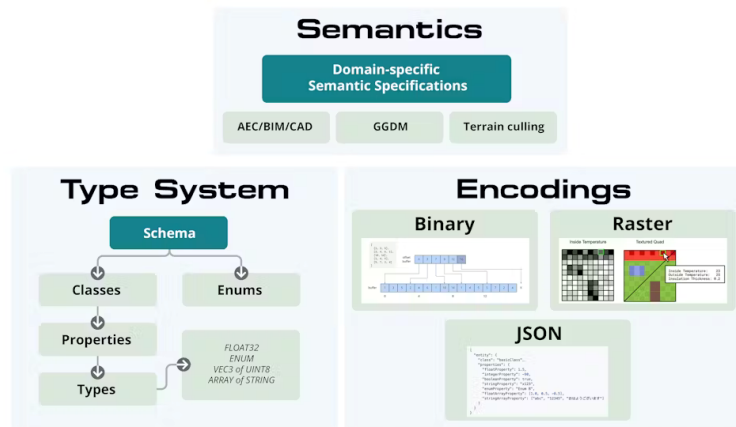
- Feature ID attribute
- Lookup into property table or external DB



|               |                  |                  |         |         |         |         |         |         |
|---------------|------------------|------------------|---------|---------|---------|---------|---------|---------|
| POSITION      | 1, 0, 0          | 2, 0, 0          | 2, 2, 0 | 1, 2, 0 | 3, 0, 0 | 4, 0, 0 | 4, 1, 0 | 3, 1, 0 |
| _FEATURE_ID_0 | 0                | 0                | 0       | 0       | 1       | 1       | 1       | 1       |
| indices       | 0, 1, 2, 0, 2, 3 | 4, 5, 6, 4, 6, 7 |         |         |         |         |         |         |

## EXT\_structural\_metadata

- Efficient binary encoding for metadata
- Type system + domain specific semantics



Recently added to <https://github.com/NASA-AMMOS/3DTilesRendererJS>

# AEC - Future Work

- Implicit surfaces
- Improvements to EXT\_structural\_metadata
  - Class hierarchy
  - Object hierarchy
  - Split into multiple extensions?
- Semantic data model for AEC

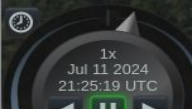
# Gaussian Splatting



3DTiles™



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# Gaussian Splat Data Pre-processing

- X, Y, and Z - read as is
- Color - Converted to RGB values from spherical harmonics
  - Only using SH0 for diffuse for now
- Opacity - Logistic sigmoid
- Scale - Exponentiated
- Rotation - Normalized quaternion

Polycam uses y-axis down which requires further processing for position and rotation values.

# Splat to glTF Mapping

| Gaussian Splat Data                   | glTF                               |
|---------------------------------------|------------------------------------|
| <b>Position</b>                       | <b>POSITION</b>                    |
| Color (Diffuse, spherical harmonic 0) | COLOR_0 (RGB value of RGBA)        |
| Opacity                               | COLOR_0 (A value of RGBA)          |
| Rotation                              | _ROTATION                          |
| Scale                                 | _SCALE                             |
| Specular (Spherical Harmonics 1-15)   | <i>Unused (Future work needed)</i> |

# glTF Draft Extension

## KHR\_gaussian\_splatting

```
"meshes": [{  
  "primitives": [{  
    "mode": 0,  
    "attributes": {  
      "POSITION" : 0,  
      "COLOR_0"  : 1,  
      "_ROTATION": 2,  
      "_SCALE"   : 3,  
    },  
    "extensions": {"KHR_gaussian_splatting": {}}  
  }]  
}]
```



[Draft Extension Branch](#)

# Splat Level of Detail in 3D Tiles





# Voxels



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# Voxels in glTF



Current State

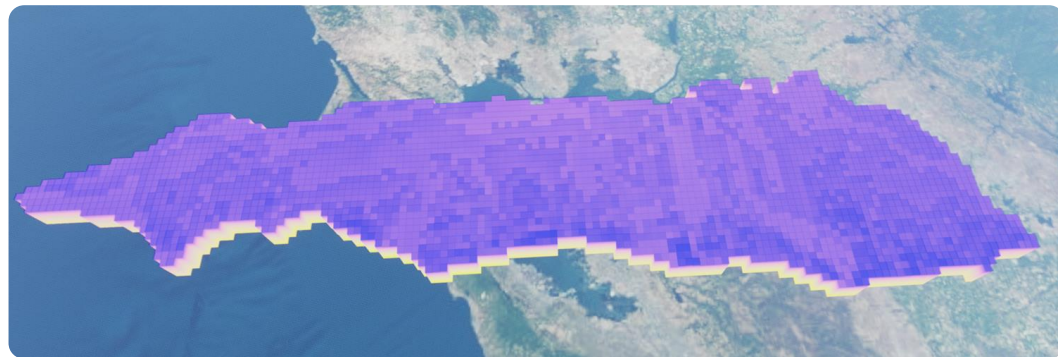
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*3DTILES\_content\_voxels*



Future Work

*EXT\_primitive\_voxels*



*Voxel data from Campotocamp, tiled as glTF, rendered in Unreal*