



3D Tiles Next

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Linux & Open Source Solutions



3D OGC Standards

- › CityGML (3.0, 2021) / CityJSON (1.0, 2021)
- › OGC common database CDB
- › 3D Portrayal Service (2017)
- › ***Community Standards:***
 - › Indexed 3D Scene (I3S), ESRI
 - › 3D Tiles, Cesium



Indexed 3D Scene (I3S)

- OGC I3S Community Standard Version 1.2, 16.12.2021
- ArcGIS Pro, Enterprise, Online, Earth, City Engine
- Propetary: Bentley ContextCapture u.a.
- Open Source: loaders.gl → deck.gl
- <https://www.ogc.org/standards/i3s>
- <https://github.com/Esri/i3s-spec> (Version 1.7)



3D Tiles

- OGC 3D Tiles Community Standard version 1.0, 31.1.2019
- CesiumJS (Apache Lizenz)
- <https://www.ogc.org/standards/3DTiles>
- <https://github.com/CesiumGS/3d-tiles/>
- 3D Tiles Next draft extension
→ 3D Tiles 2.0





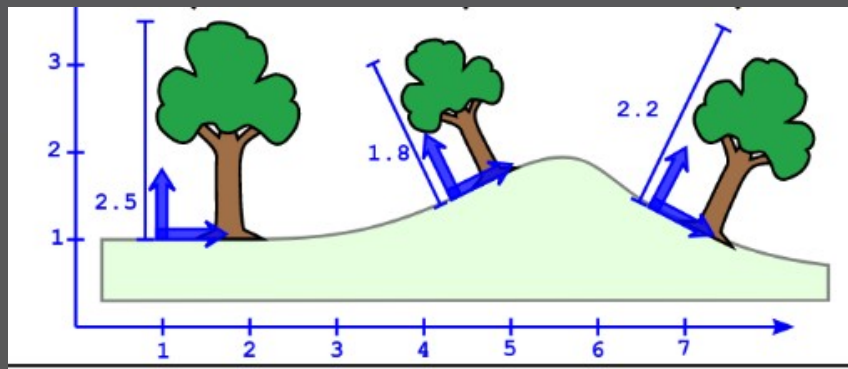
3D Tiles 1.0: Batched 3D Model



➤ **Tileset (JSON) → Model (b3dm) → glTF**



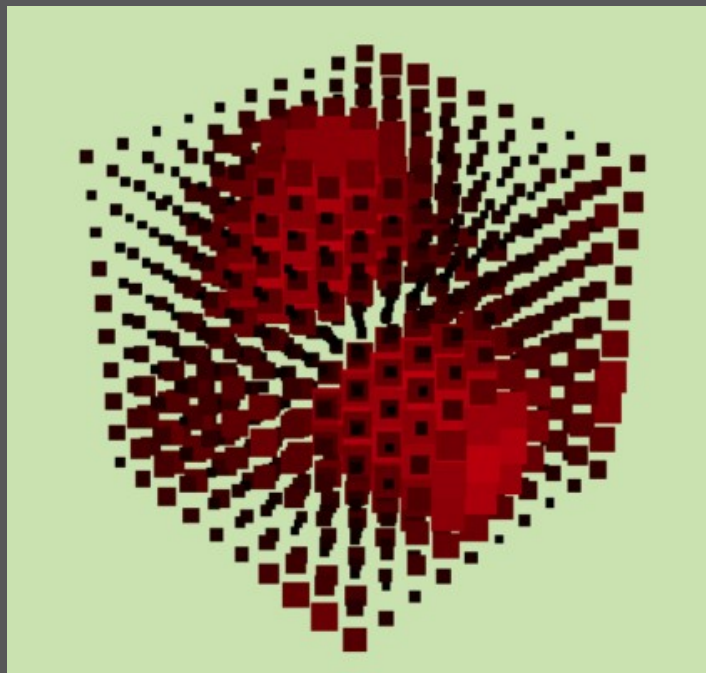
3D Tiles 1.0: Instanced 3D Model



➤ **Tileset (JSON) → Model (i3dm) → glTF**



3D Tiles 1.0: Point Cloud



➤ **Tileset (JSON) → Data (points)**



3D Tiles 1.0: Composite Tiles

Composite Tile:



- **Tileset (JSON) → Models (b3dm, i3dm, points)**



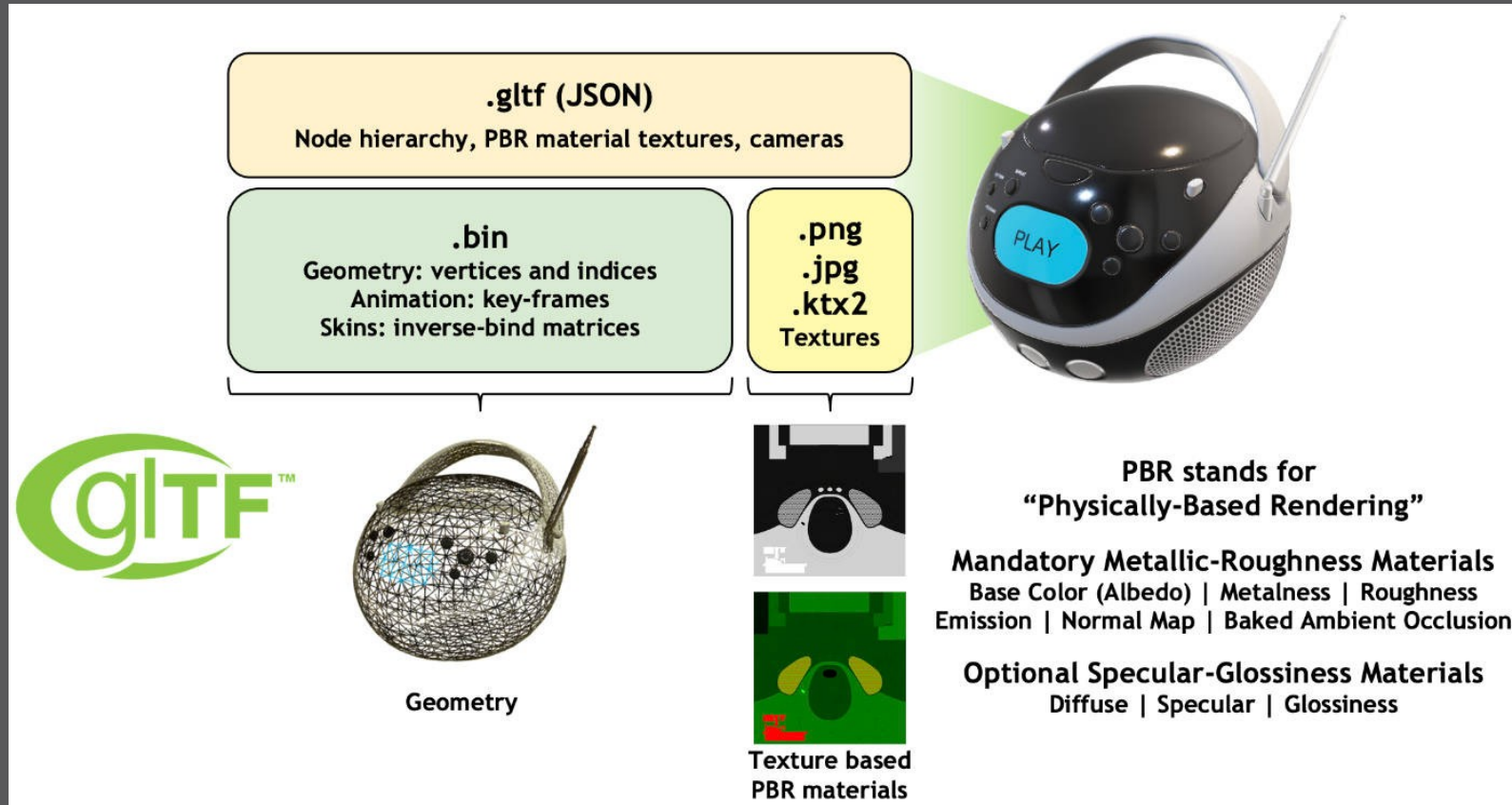
3D Tiles 1.0: Declarative Styling

```
{
  "color": {
    "conditions": [
      ["${height} >= 300", "rgba(45, 0, 75, 0.5)"],
      ["${height} >= 200", "rgb(102, 71, 151)"],
      ["${height} >= 100", "rgb(170, 162, 204)"],
      ["${height} >= 50", "rgb(224, 226, 238)"],
      ["${height} >= 25", "rgb(252, 230, 200)"],
      ["${height} >= 10", "rgb(248, 176, 87)"],
      ["${height} >= 5", "rgb(198, 106, 11)"],
      ["true", "rgb(127, 59, 8)"]
    ]
  }
}
```





Scene format glTF 2.0





Viewer

- › **CesiumJS**
- › **loaders.gl** → **deck.gl**
- › **iTowns (github)**
 - › Three.js based JS/WebGL Framework
- › **mapbox-3dtiles (github)**
 - › Mapbox GL JS custom layer for 3D Tiles
- › **3DCityDB-Web-Map-Client (github)**
 - › Cesium based Viewer for CityGML and 3D Tiles
- › **3d-tiles-renderer (github)**
 - › Three.js based renderer for 3D Tiles



Game Engines

- O3DE (OSS, Amazon)
- Unreal





Tile creation (Cesium GS, Inc.)

- › Cesium Ion (proprietary)
- › CDB to 3D Tiles ([Github](#))
 - › OGC CDB → 3D Tiles
- › Cesium Native ([Github](#))
 - › C++ library for 3D Tiles streaming, glTF processing
- › glTF Pipeline ([Github](#))
 - › Javascript tools for glTF / GLB conversion and optimization



Tile creation (Community)

- › **3D City Database (GitLab)**
 - › Geo database for virtual 3D city models.
- › **py3dtiles (GitLab)**
 - › LAS / XYZ → 3D Point Cloud tiles, b3dm API
- › **pg2b3dm (Github)**
 - › Conversion of PostGIS 3D geometries to b3dm tiles
- › **OpenDroneMap Obj2Tiles (Github)**
 - › Converts OBJ files to OGC 3D tiles
- › **3dtiles (Github)**
 - › Tools for 3D-Tiles conversion
- › **Cesium Point Cloud Generator (Github)**
 - › XYZ → 3D Point Cloud Tiles



3D Tiles Community

› Awesome 3D Tiles

- › <https://github.com/pka/awesome-3d-tiles>
- › Viewers
- › Tile creation
- › glTF tools
- › Terrain

› Contribute!

- › Blogs, Tutorials

› Discussions

- › Matrix, Discord, ...?



3D Tiles Next migration 1/3

- Batched 3D model → glTF with EXT_mesh_features

3D Tiles 1.0

.b3dm file

b3dm Header

Batch Table

glTF

3D Tiles Next

.glb file + extension

glTF

EXT_mesh_features



3D Tiles Next migration 2/3

- Instanced 3D model → glTF with EXT_mesh_gpu_instancing, EXT_mesh_features

3D Tiles 1.0

.i3dm file

i3dm Header

Per-instance
Transformations

Batch Table

glTF

3D Tiles Next

.glb file + extension

glTF

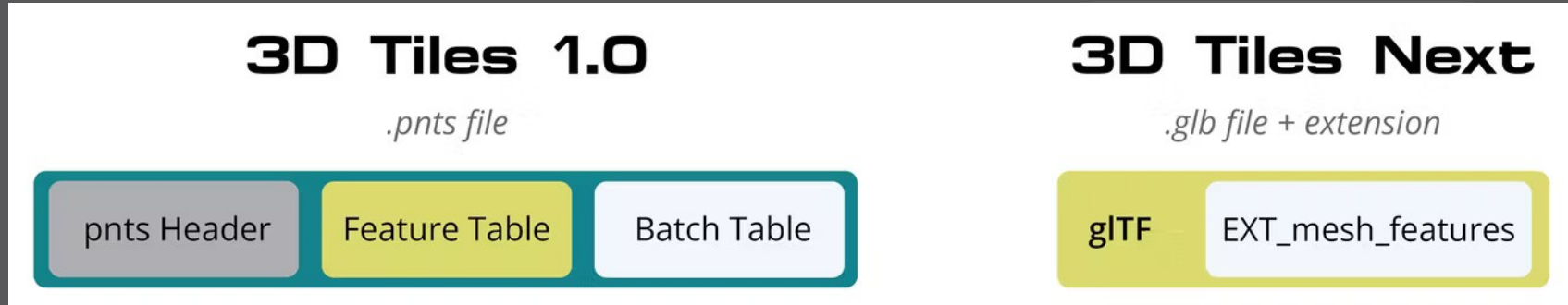
EXT_mesh_gpu_instancing

EXT_mesh_features



3D Tiles Next migration 3/3

- Point Cloud → glTF POINTS mode mit
EXT_meshopt_compression, KHR_mesh_quantization,
EXT_mesh_features

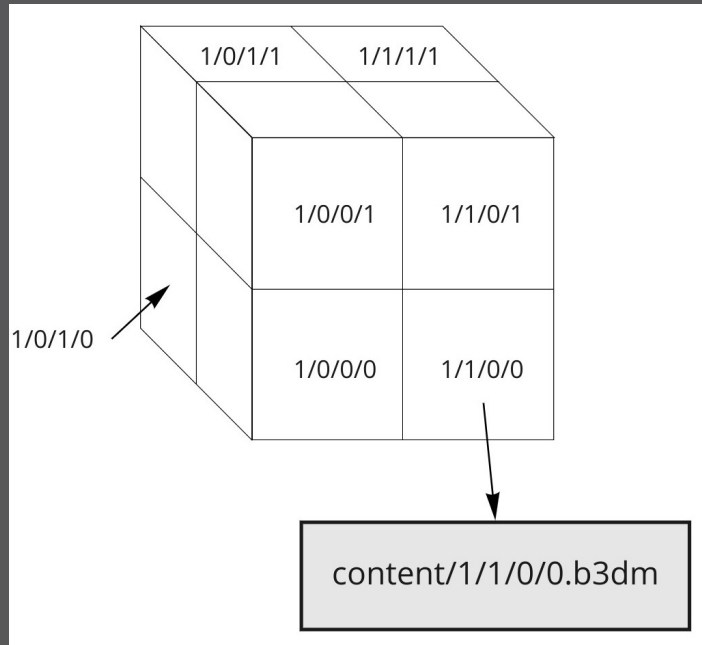


- Composite → glTF with extensions



Implicit Tiling

› Quadtree + Octree



› Subtrees: tile + content + child subtree availability



3D Tiles Next extensions

- › GLTF 2.0 extension:
 - › EXT_mesh_features
- › 3D Tiles 1.0 extensions:
 - › 3DTILES_content_gltf, 3DTILES_multiple_contents
 - › 3DTILES_metadata
 - › 3DTILES_implicit_tiling, 3DTILES_bounding_volume_S2



- › **3D Tiles Next → OGC 3D Tiles 2.0**
- › **Community building**
 - › Knowledge collection: Awesome 3D tiles
 - › Establish a discussion platform
- › **OSS workflows for tile creation**
 - › City model (CityGML/CityJson) → 3D Tiles
 - › OSM data → 3D Tiles
 - › 3D scenes / glTF (e.g. Blender exporter)
 - › Point cloud → mesh → 3D Tiles (or better COPC?)
- › **Welcome to the “Metaverse”!**



FOSS4G 2022

Thank you!



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