OpenWebGlobe
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WebGL

- 3D Graphics on the Web (*based on OpenGL ES 2.0*)
- Rendering interactive 2D/3D graphics within the web browser
- Highly Optimized for JavaScript
- Hardware acceleration using the Graphics Processing Unit (GPU)
- WebGL programs consist of:
  - application code written in JavaScript (CPU) and
  - shader code (GLSL) for the GPU
- No plugin for these (desktop) browsers:
• Virtual Globe without plugins for modern web browsers, using WebGL

• Open Source Project started in April 2011 (based on C++ version started in 2005)

• JavaScript Library for rapid development of web-based 3D geoinformation applications

• Full integration into customer web sites

• Runs on Windows, MacOS X, Linux
Demo

http://world.openwebglobe.org
http://swiss3d.openwebglobe.org
Layers / Contents

- Imagery / Elevation
- POIs
- 3D Models
- HTML5 Canvas Element
- Overlays
- Point Clouds
<!DOCTYPE html>
<html>
<head>
  <meta charset=utf-8 />

  <script type="text/javascript" src="http://www.openwebglobe.org/js/openwebglobe-0.9.8.js"></script>

  <script type="text/javascript">
    function main()
    {
      ogSetArtworkDirectory("http://www.openwebglobe.org/art/");

      var ctx = ogCreateContextFromCanvas("canvas", true);
      var globe = ogCreateGlobe(ctx);

      var imgBlueMarble500 =
      {
        url : ["http://www.openwebglobe.org/data/img"],
        layer : "World500",
        service : "i3d"
      };
      ogAddImageLayer(globe, imgBlueMarble500);
    }
  </script>

</head>
<body onload="main()" style="padding:0px; margin:0px; overflow:hidden;">
  <canvas id="canvas"></canvas>
</body>
</html>

http://jsbin.com/owg_layer_example/1/edit
Global Datasets in 2D

First we need to understand how global 2D maps work.
OpenStreetMap, Google Maps, Bing Maps, ...

Theoretical example Earth:

– Land area of around 148.9 Mio. km\(^2\) (~ 29%)
– Water area of around 361.2 Mio. km\(^2\) (~ 71%)

If we had a global dataset with 25cm\(^2\) / Pixel:

– Land area (uncompressed) around 170 Petabytes
2D Tiles

Always one zoom level visible

User zooms in/out
(GUI / mouse wheel)

only **required** data ("visible data") is requested from the server (or cloud)
2D Maps – Quadtree structure

(Image courtesy of Microsoft, Bing Maps)
The Step to 3D

Basically the same like 2D, however:

- The View Frustum contains different LOD
- Level of detail depends on camera position.
- Elevation data can be displayed (change of perspective)
OpenWebGlobe: 2.5D Elevation Tiles (Level of Detail)
Important Tile Types

2D Image Tile
contents: 256x256 Pixels (in most cases)
(May also contain rasterized vectors etc.)

2D Vector Tile
contents: 2D Geometry
(Number of Elements limited for LOD)

2D Elevation Tile (-> for creating 3D Tiles)
contents: Elevation values (e.g. numbers)
contents 17x17 values (or similar).
Solution #1: Preprocessing all tiles in the cloud

- Upload **Raw data** to Cloud (or web server)
- Raw: Image, Elevation, 3D-Models, Point Clouds, ...
- Generate tiles (for Streaming)
- Other Data Sources
  - WMS, WMTS, TMS, ...
  - Postgres / PostGIS
  - 3DPS (*in Future*)
- (Web-) Viewer
  - HTML5
  - JavaScript
  - WebGL for 3D
- download visible data fragments (tiles)
Solution #2:
Partial Preprocessing Tiles & On-The-Fly Tile Generation and Caching
HPC: 120 TB Data (900MB/s), >50 CPU Cores  in combination with cloud
Showcase: Streaming 3D-Geometry Tiles (from OSM data & Buildings of Interest)
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Image courtesy of BTh Hürbi/Daetwyler, MTh Lucas Oertli, 2013
Demo (Civil Engineering Department Basel-Stadt)
ShowCase: Rapid 3D Mapping
ShowCase: SwizzQuiz – Interactive Geo Game
Some features:

- Easier Data Processing & Cloud Setup
- Create Native iOS, Android, Windows Phone Applications
- Create Native Desktop Applications
- Browser Support using WebGL
- Improved Speed
  - Faster downloads
  - Improved Graphics
- Streaming all Layers (Image, Elevation, 3D, PC, ...)

OpenWebGlobe 2
Augmented Maps
Conclusion

• OpenWebGlobe – an Open Source Platform for
  • Visualization of a virtual globe on the Web
  • Processing 2D and 3D- Data for streaming large scale data

• Streaming large Scale Dataset requires new standards

• 2D & 3D Tiles... almost the same... but very different

• New possibilities
  • Scale Point Cloud Streaming
  • Augmented 3D Maps
Questions?

MapData © MapPuls, ASTER GDEMv2, Landsat

https://github.com/OpenWebGlobe

@OpenWebGlobe
@MartinChristen
"Web Mercator" / "Popular Visualization Pseudo Mercator"

- Min/Max Latitude at around +-85 degrees (-> square map...)
- Projection: **Sphere** (!) with radius of 6378137m
- Invented by Google, unfortunately many web maps use it today (Reason was performance, but that is not really the case)
- "almost conformal" projection.
- EPSG:3857 *(don't use EPSG: 900913)*
3D Tiles ?