3D webservices - where do we stand?

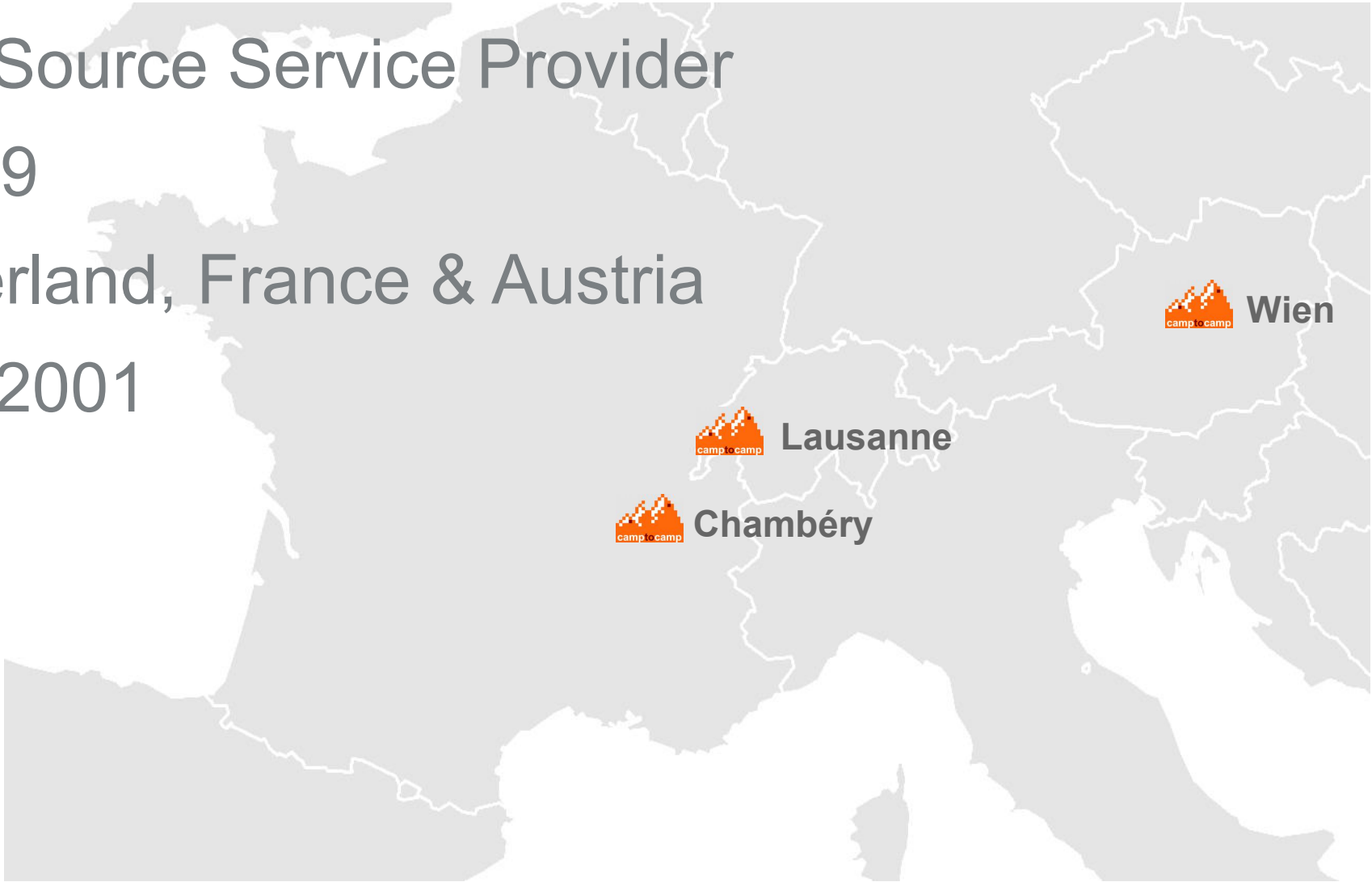
camptocamp

INNOVATIVE SOLUTIONS
BY OPEN SOURCE EXPERTS

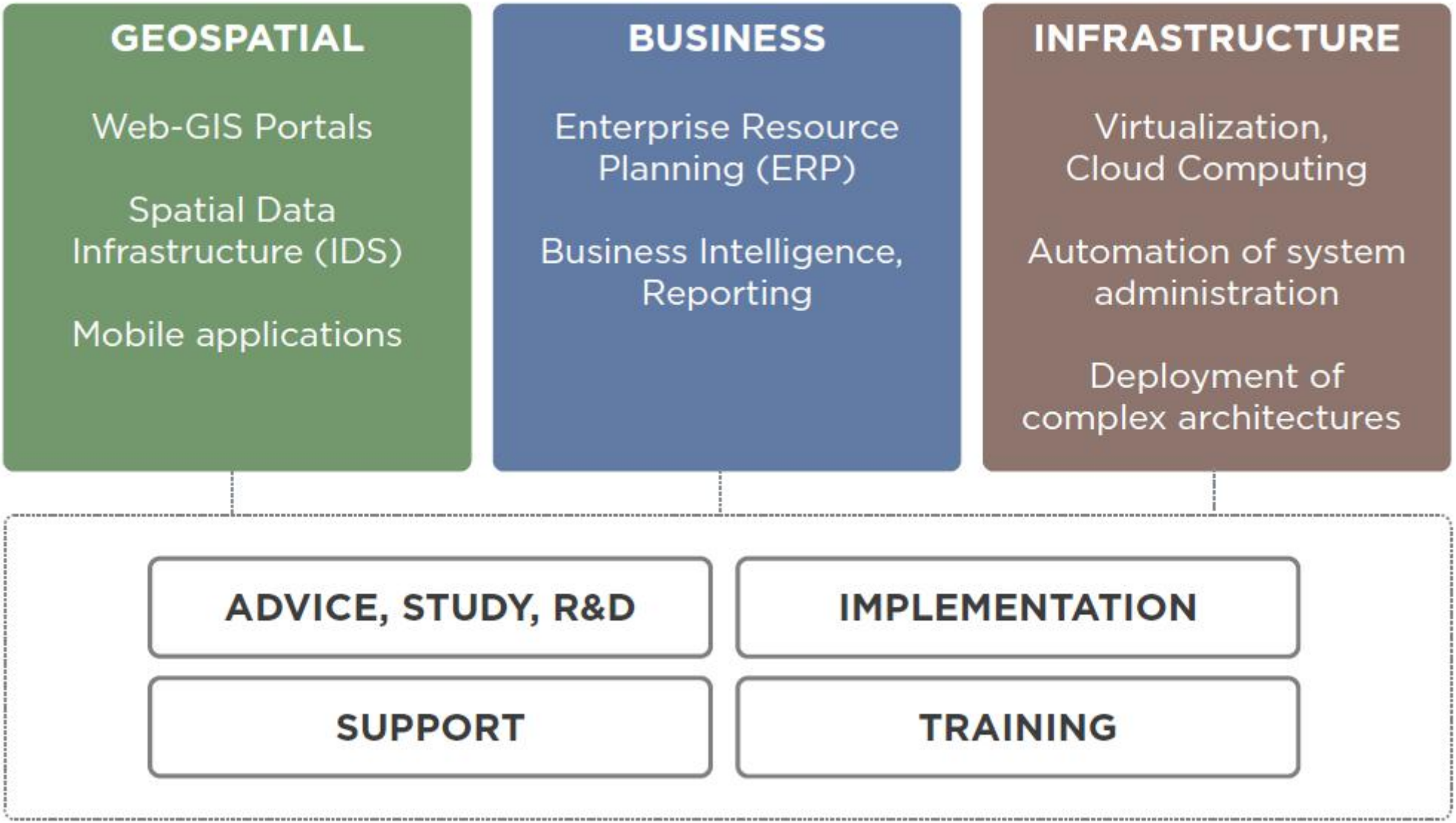
Emmanuel Belo
+41 21 619 10 25
emmanuel.belo@camptocamp.com

Camptocamp

- Open Source Service Provider
- Staff 49
- Switzerland, France & Austria
- Since 2001



Camptocamp: 3 divisions

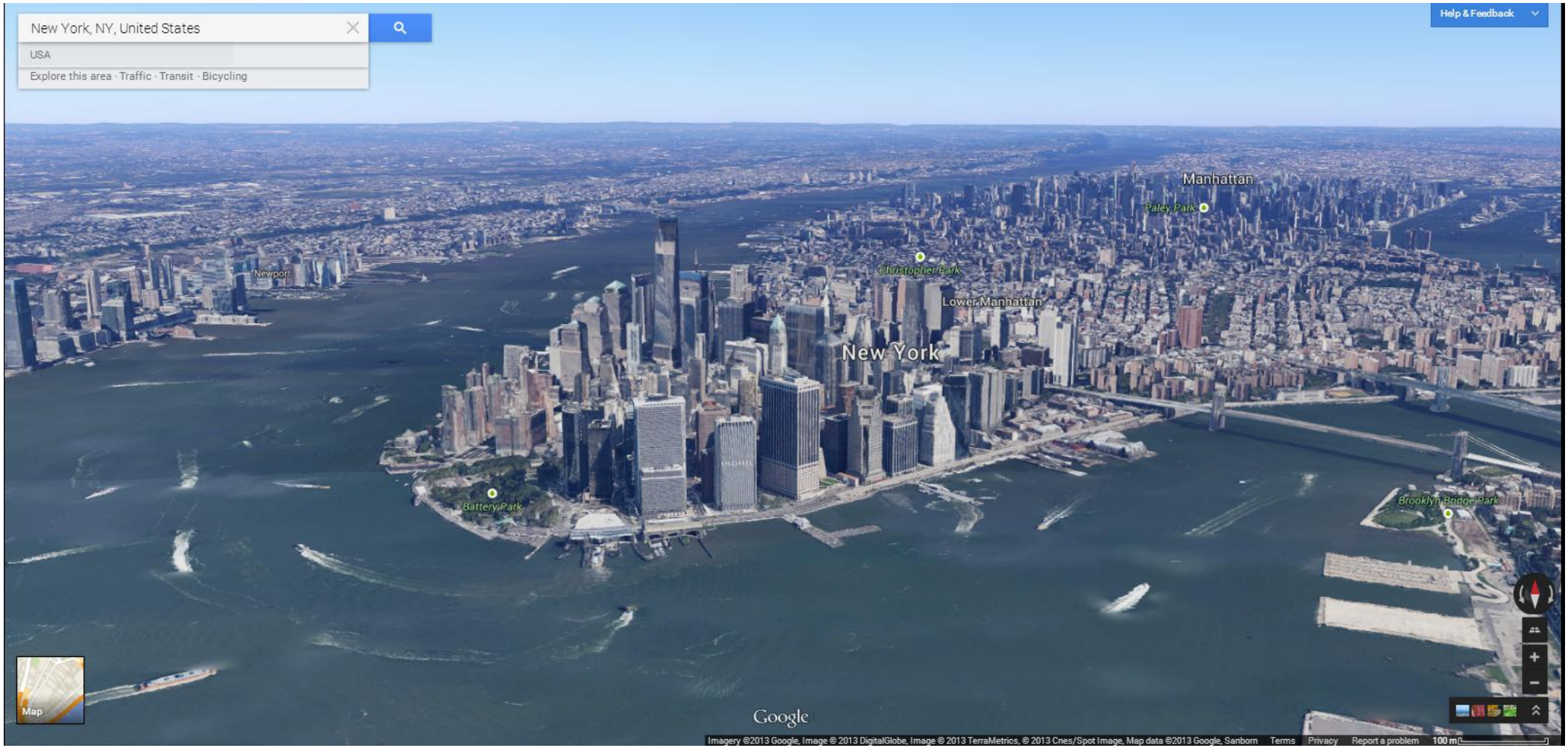


Google Maps

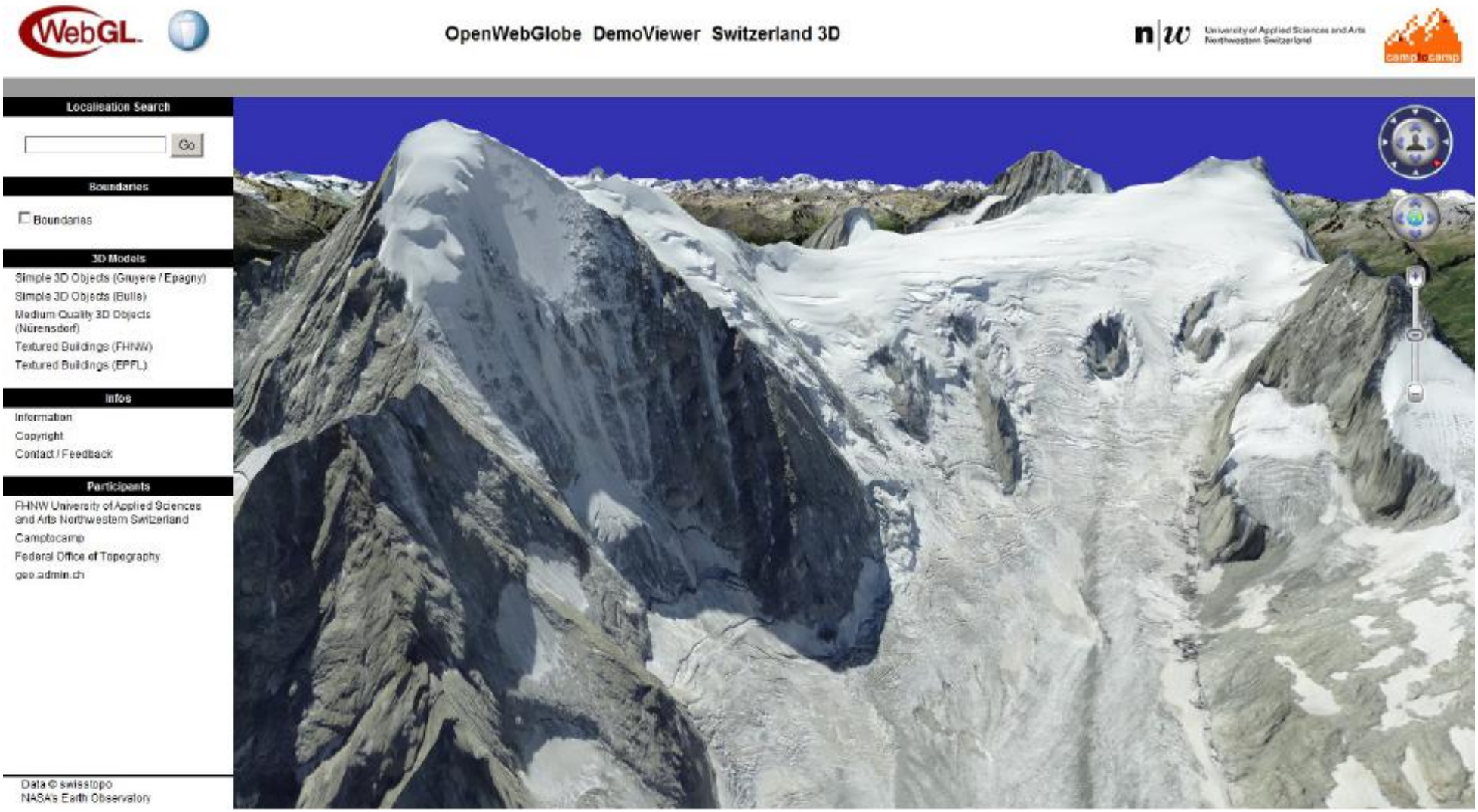
Google Maps


lausanne
Lausanne
Explore this area · Traffic · Bicycling
Help & Feedback
Gymnase de la Cité
Map
Google

Here maps (Nokia)



OpenWebGlobe



Cesium


dorama
Focus
Edit
Share
46
km/h
5.3 of 333 km
2890 m
-11 % (-9.0:1)
37.5 km/h (avg)
70.4 km/h (max)
Damien De Baenst
Ulrich Prinz
Tom Payne
bing
32x
00:16:21

Geospatial 3D Web expectations?

- 3D Scenes
  - Aerial imagery and terrain
  - Buildings with textures
  - Label and marker
  - Rich interaction (Navigate, pick, popup, measure, usw.)
  - Global perimeter, higher local resolution
- Technology
  - **Web** (no plugin), Cross Platform and Cross Device
  - **Open Standards** and Formats
  - **Open Source**
- What's available?

Web ?

WebGL !

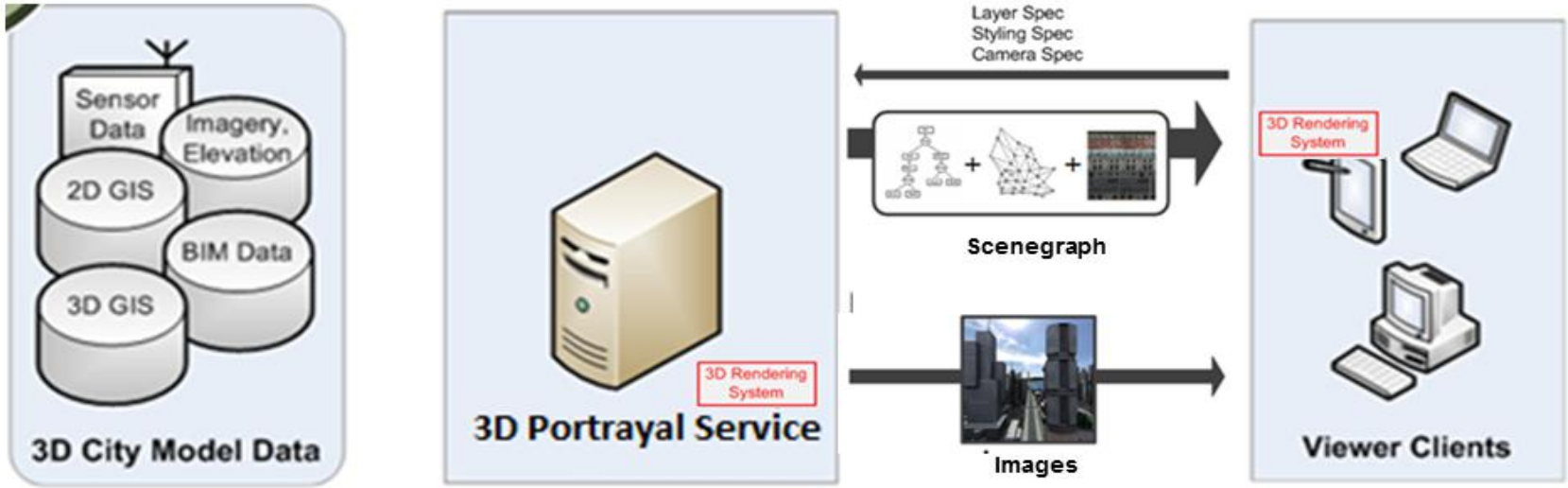
- Web Graphics Library
- Javascript API for rendering interactive 2D/3D graphics withing the webbrowser
- Hardware acceleration using the Graphics Processing Unit (GPU)
- WebGL Programs consist of :
  - Control code written in Javascript (CPU) and
  - Shader code that is executed on a computer's GPU
- No Plugin ! Also in IE11 !!!
- Mobile device ready : Firefox, Sony Android Browser, Opera

Open Standards ?

Standardizing and Merging worlds

- Geo: OGC
  - **3D Portrayal Services** (Proposals: WVS WMS-Like & W3DS WFS-Like)
  - KML – XML/COLLADA
  - CityGML - representation, storage, and exchange
  - **CZML (AGI/Cesium)** ***?***
- Geo: OSGEO
  - TMS (Cesium Terrain Server z.B)
- Web: Web3d
  - **X3D** - Extensible 3D Graphics
- Graphics: Khronos Group
  - COLLADA – eXchange / interoperability
  - **glTF** – graphic language Transmission Format

3D Portrayal Service (3DPS)



- Goal:
  - Standard service interface to visualize very large 3D geospatial databases online vie Web-Browser and Mobile Devices
  - 3D Scenegraph and image based rendering

Model Challenges

- Compact object representation
  - Bandwith
- Progressive transfert
  - Streaming
  - LOD
- Fast Model Display
  - GPU intensive, reduce CPU usage
- Application/Software independent
  - Standard

Mesh encodings for X3DOM:Recent Advances
by Max Limper and Johannes Behr, Fraunhofer IGD

X3D Geometries

- Basic primitives (Box, Cone Cylinder, Sphere)
- IndexedFaceSet (3D shape formed by constructing faces - polygons) <IndexedFaceSet coordIndex='0 11 12 *-1* 12 1 0 *-1* etc />

  <Coordinate point='0.7000 1.2000 0.0000, 0.6930 1.2177 0.0000, etc />

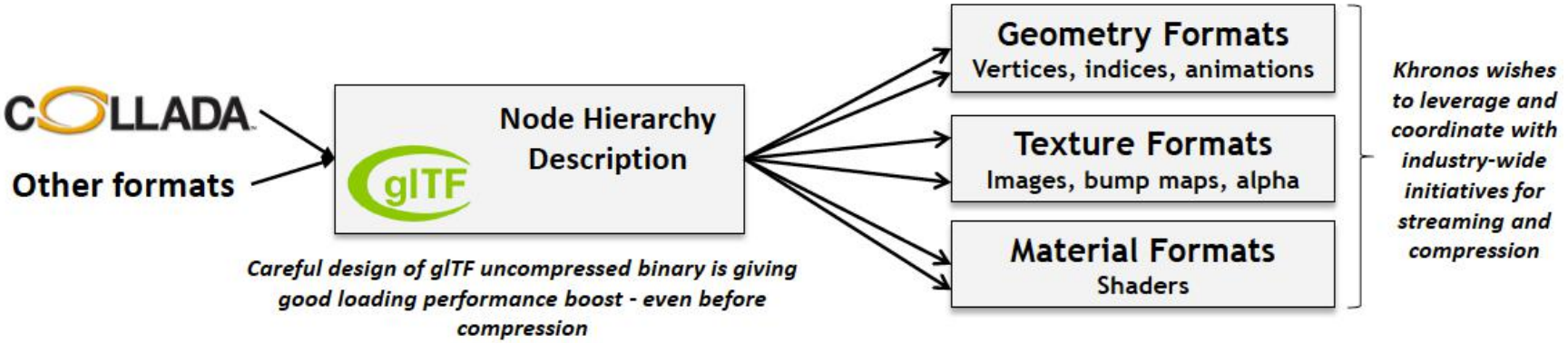
  - => Large HTML pages, CPU + Loading time
- X3dom optimizations
  - Binary Geometry employs several files to store the index and geometry data directly in the requested precision
  - **Progressively Ordered Primitive (POP) Buffer**

CZML - Cesium Language

- Describes
  - Graphical scene
  - Time-dynamic data
- Caracteristics
  - JSON structure
  - Line, points, markers, models
  - Describes changes over time
  - Supports datastreaming
  - Extensible

glTF graphic language Transmission Format

- JSON used to describe node hierarchy
- Node hierarchy refers to EXTERNAL binary asset blobs
  - Geometry, Texturen, Material
- Non-compressed asset blob format
  - Direct load in WebGL
- Extensible
  - Streaming and compression



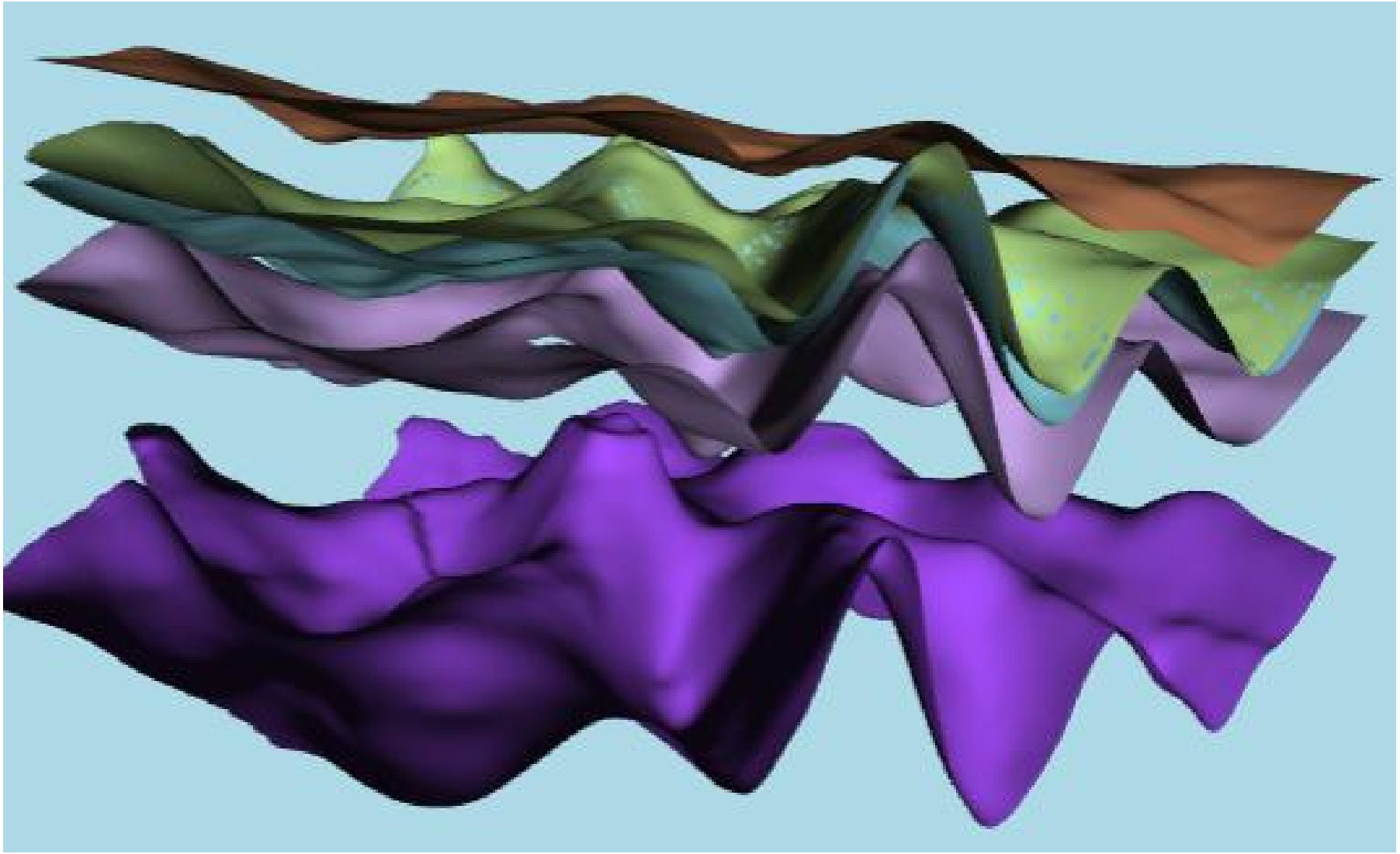
© Copyright Khronos Group 2013 -

Open Source Software ?

Open Source implementations

- PostGIS – stores and exports 3D data
  - Export X3D data: ST_AsX3D
- Geoserver
  - Provides a W3DS API (getScene & getTile)
  - X3D & Cesium Terrain API
- X3dom
  - JS API for displaying and interacting with X3D data
- Three.JS
  - Rich 3D model visualisation
- OpenWebGlobe & CesiumJS
  - Full geospatial suites to process and display/interact with 3D in the Web

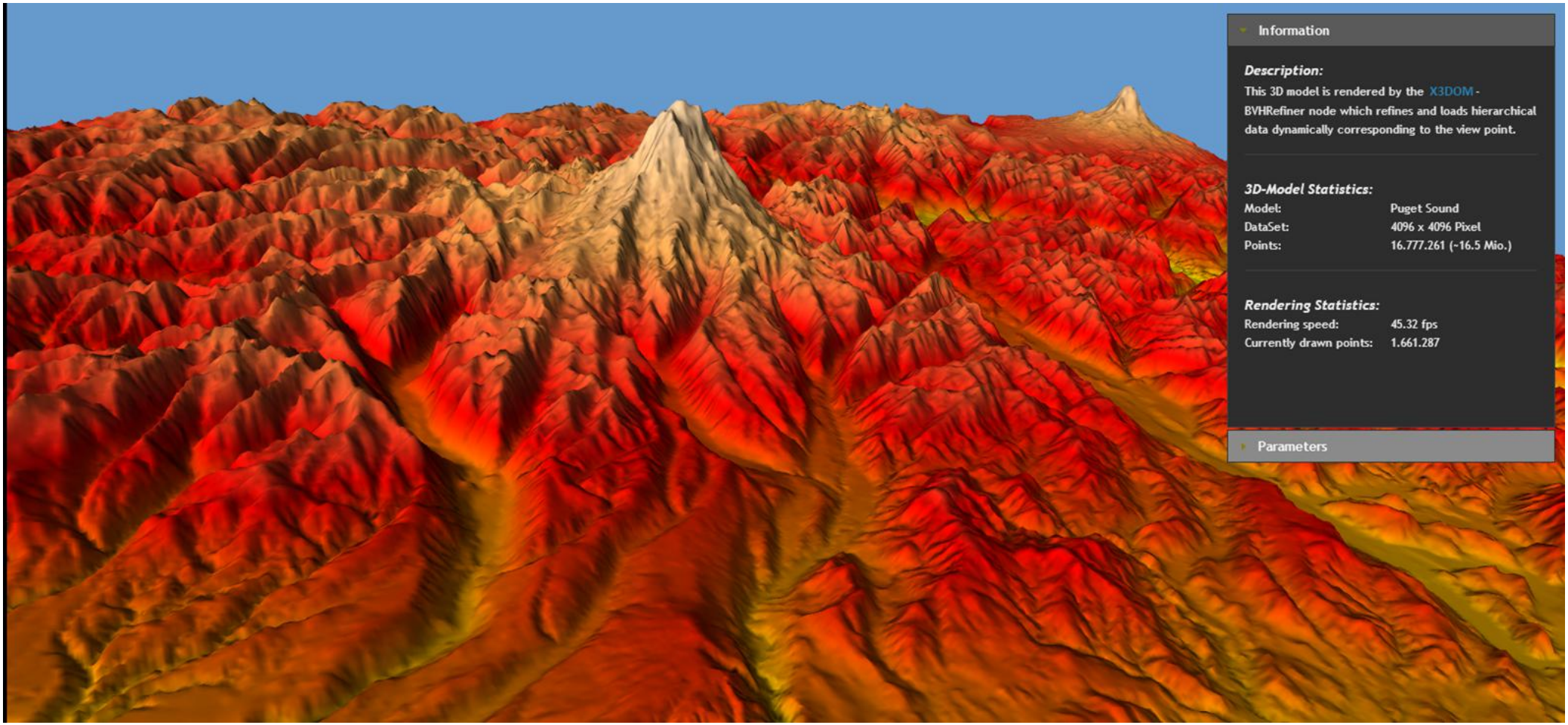
PostGIS/Geoserver W3DS/X3D/X3DOM



X3DOM

- Experimental Open Source Framework
- Display 3D models with WebGL
- Web3D & W3C Standardizing Process
- Goal : 3D objects in the Web
- Easy to use (HTML5 DOM)
- Supports HTML Events (Ex : OnClick)

X3DOM – JS Library

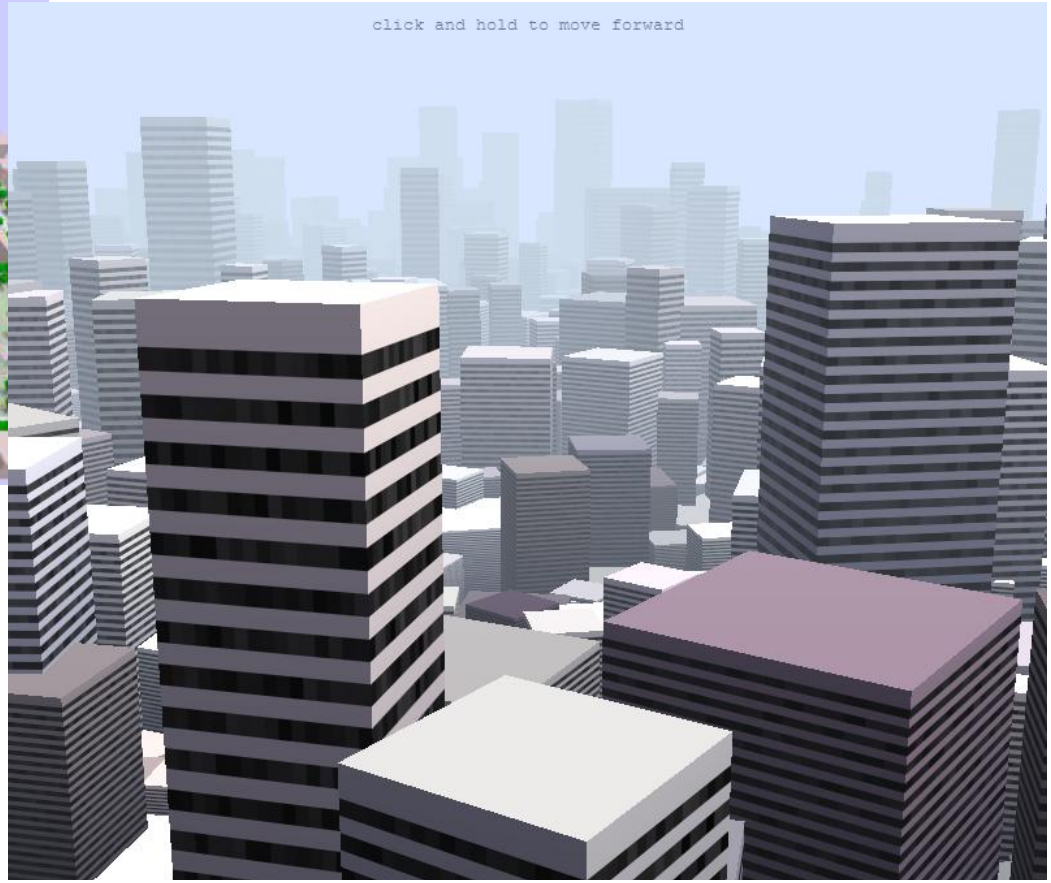


Three.JS

- Lightweight xBrowser JS library/API
- Goal : create and display animated **3D computer graphics** on a Web browser.
- HTML5 SVG/WebGL
- Proprietary format + glTF

Three.JS examples

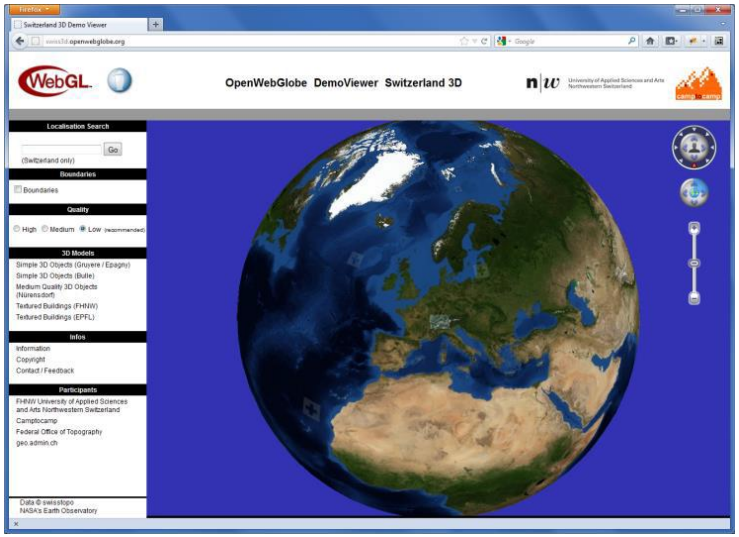
QGIS export (c) http://anitagraser.com/

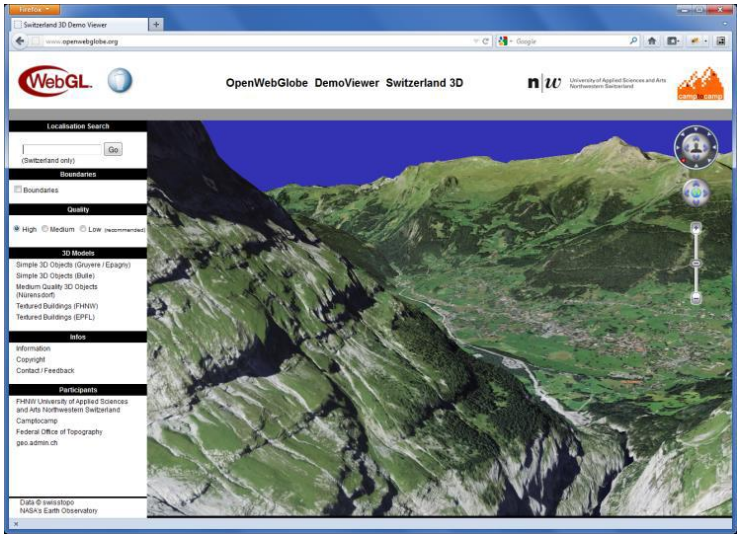


Procedural city (c) http://mrdoob.com

OpenWebGlobe

- Helps you to create your own virtual globe applications running plug-in free in a web browser
- Allows the visualization of large scale image, elevation or other geospatial data
- OpenSource (MIT License)

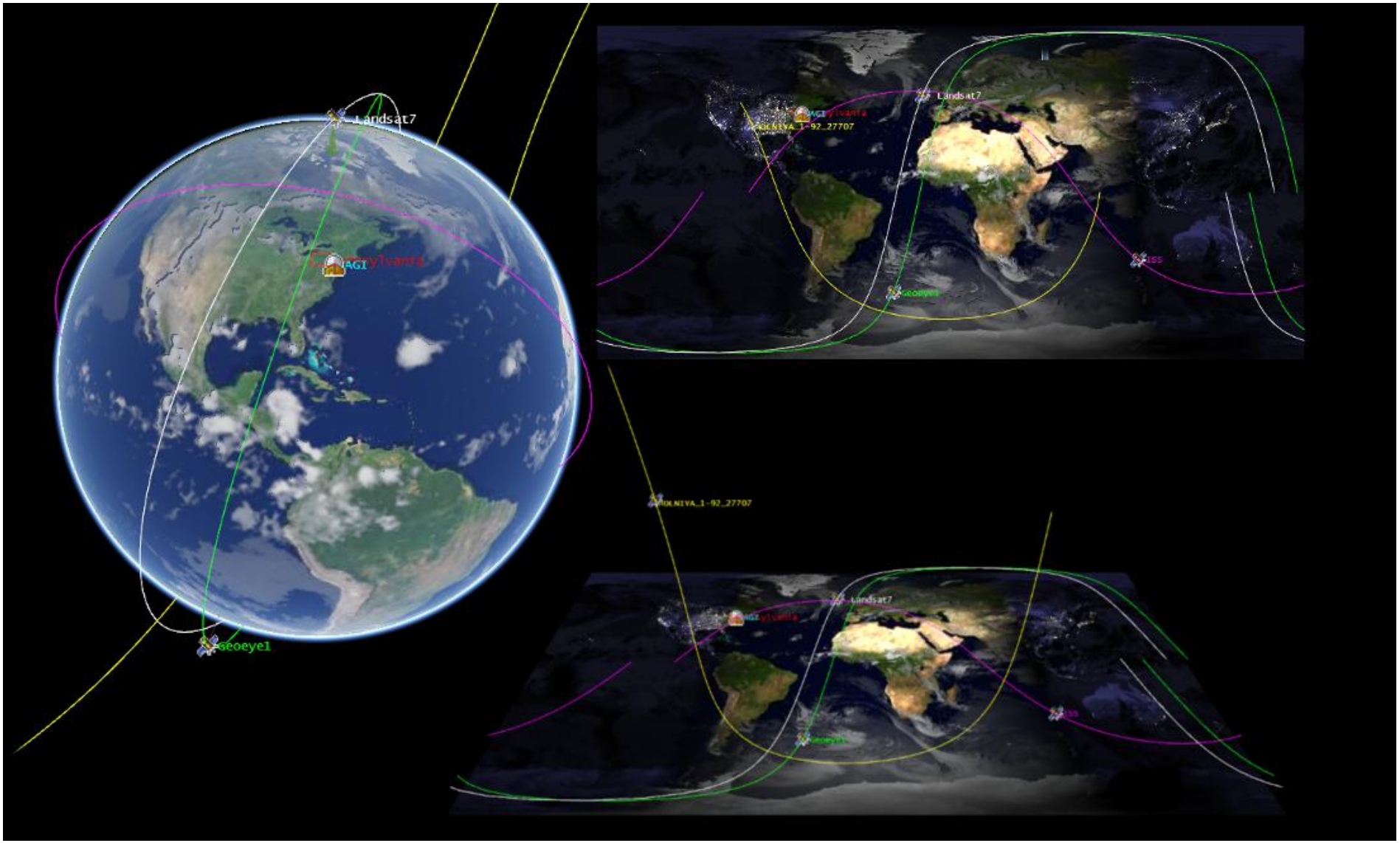




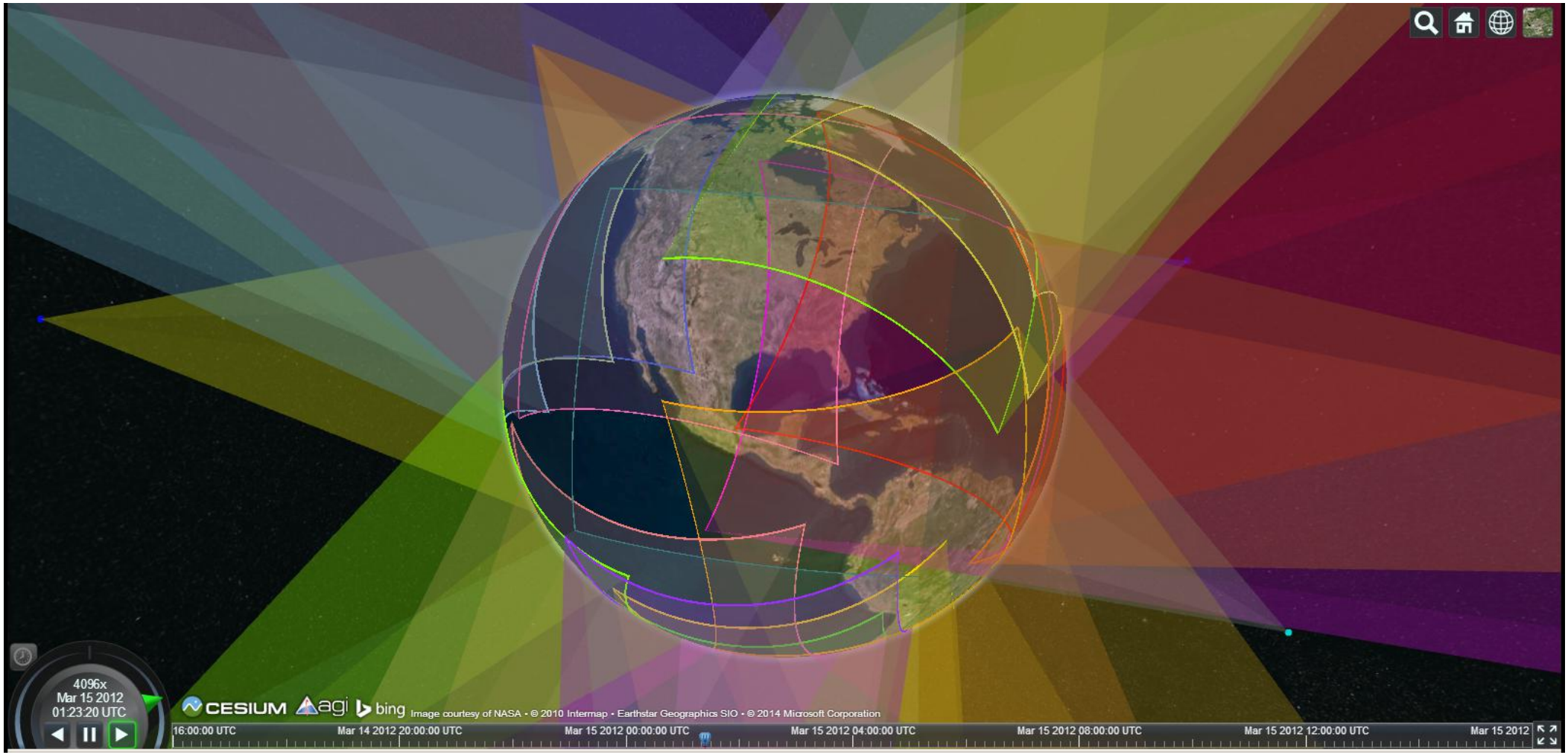
CesiumJS

- Javascript Software with WebGL for displaying
  - 3D virtual globe
  - 2D map
  - 2.5D Collombus View
- Time-dynamic Scenes with CZML
- Multiple terrain sources
- Overlays :
  - Raster : WMS, TMS, OSM, Bing & Esri
  - Vector : glTF, CZML, KML, Shapefiles
- Extensible with plugins

Cesium – 3 views, WebGL

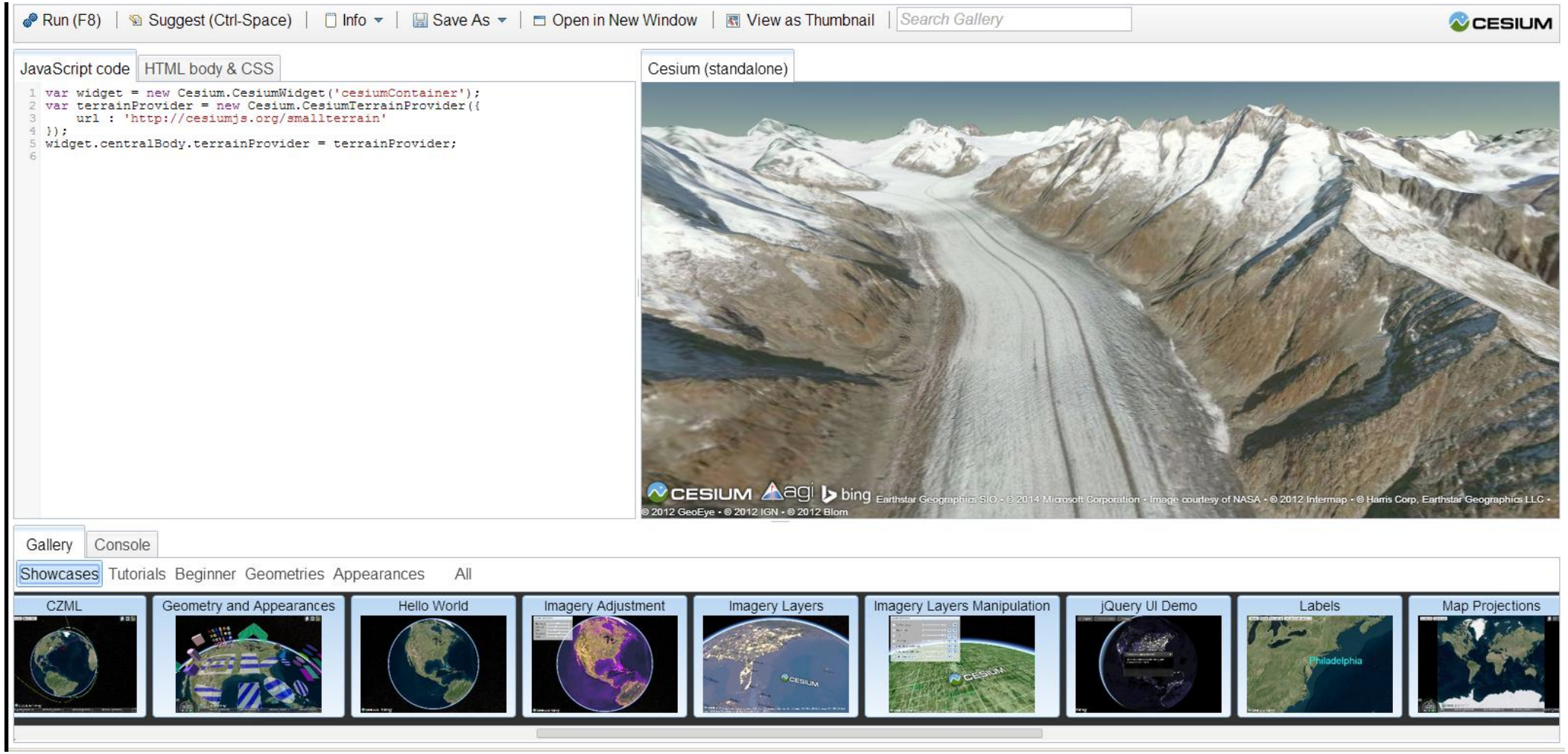


CZML 3D + time-dynamic display

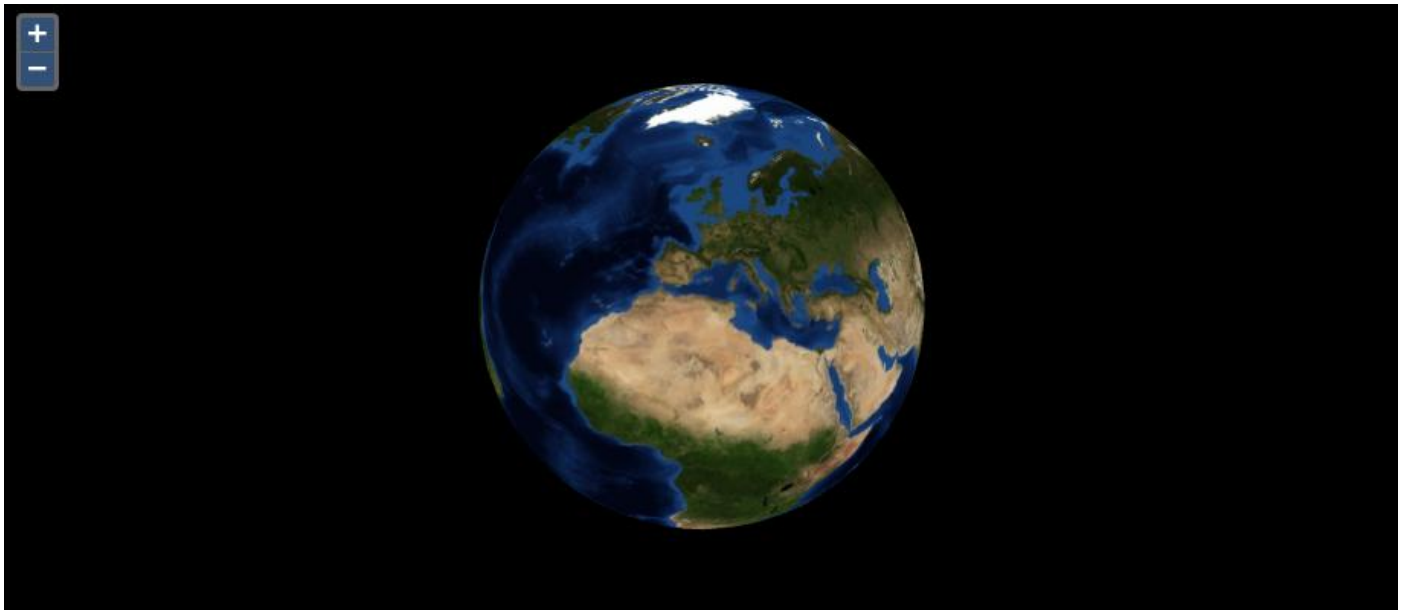


Cesium – Terrain + Overlay

Cesium Sandcastle



OpenLayers 3 – Cesium Integration



Conclusion

- High activity in the 3D WebGL domain
  - Big Players set public expectations
  - Ongoing standardizations efforts
  - WebGL momentum (Microsoft is now on board)
- Consider :
  - Dataquantity to be stored and processed in the backend
  - Data transfer and streaming with different LODs
  - Deliver data for the GPU, avoid CPU processing AND Provide access to semantics for the CPU
  - Web3D implementations have limited encoding possibilities applied to the geospatial world

tocamp

camptocamp

INNOVATIVE SOLUTIONS
BY OPEN SOURCE EXPERTS