



**SIGGRAPH 2015**

Xroads of Discovery  
Xroads for Interactive 3D Content

# Update on X3D Geospatial from the Web 3D Consortium

Carto BoF

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# X3D

- Declarative 3D Graphics
  - Simplifies 3D for content creators
  - Integrated with the HTML5 DOM (X3DOM)
  - Extensible
  - Open

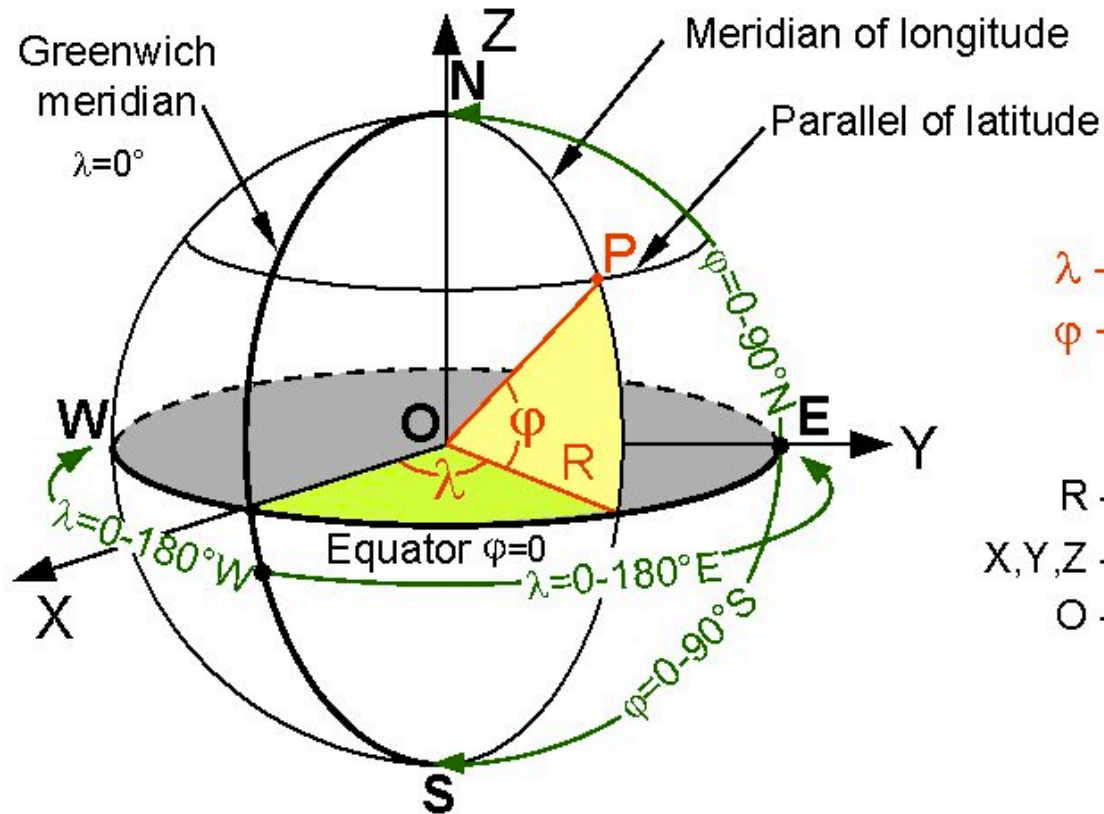
# Geospatial Component

Must deal with many coordinate systems

- Geographic (latitude, longitude, elevation)\*
- Geocentric – Cartesian, “ECEF”, “GCC”
- Local X3D – may be offset, may be rotated

\* X3D supports other other spatial reference systems via the geoSystem attribute, e.g. “UTM”

# Geospatial Component



$\lambda$  - Geographic longitude  
 $\phi$  - Geographic latitude

R - Mean earth radius

X,Y,Z - Geocentric coordinate system

O - Geocenter

# Geospatial Component

Makes it easy to use Geo in X3D

- Geo content provided in lat, lon, elev
- Computer graphics works in X, Y, Z
- Numerical precision issues
- Navigation, e.g. “fly” expects +Y to be “up”

# X3D Geospatial Component

Handles all the  
transformations and precision  
calculations needed to work  
with geographic data

# Geospatial Component

## X3D Geospatial Node set

1. **GeoCoordinate**
2. **GeoElevationGrid**
3. **GeoLocation**
4. **GeoLOD**
5. **GeoMetadata**
6. **GeoOrigin**
7. **GeoPositionInterpolator**
8. **GeoProximitySensor**
9. **GeoTouchSensor**
10. **GeoTransform**
11. **GeoViewpoint**
12. *GeoOriginTransform*
13. *GeoWebMap*

X3DOM supported


*X3DOM experimental*

# Recently Published



[My Binders](#) [SIGN](#)

### The X3D geospatial component: X3DOM implementation of GeoOrigin, GeoLocation, GeoViewpoint, and GeoPositionInterpolator nodes

Full Text:  [PDF](#)

Authors: [Andreas Plesch](#) Harvard University  
[Mike McCann](#) MBARI



2015 Article



# Example application: STOQS

How X3D Geospatial can be used in  
practice

# Browser-database data flow

- Browser makes HTTP request
- Server software translates to SQL request
- Server responds with XHR as JSON structure
- JavaScript updates DOM elements
- Scene updates with selected data

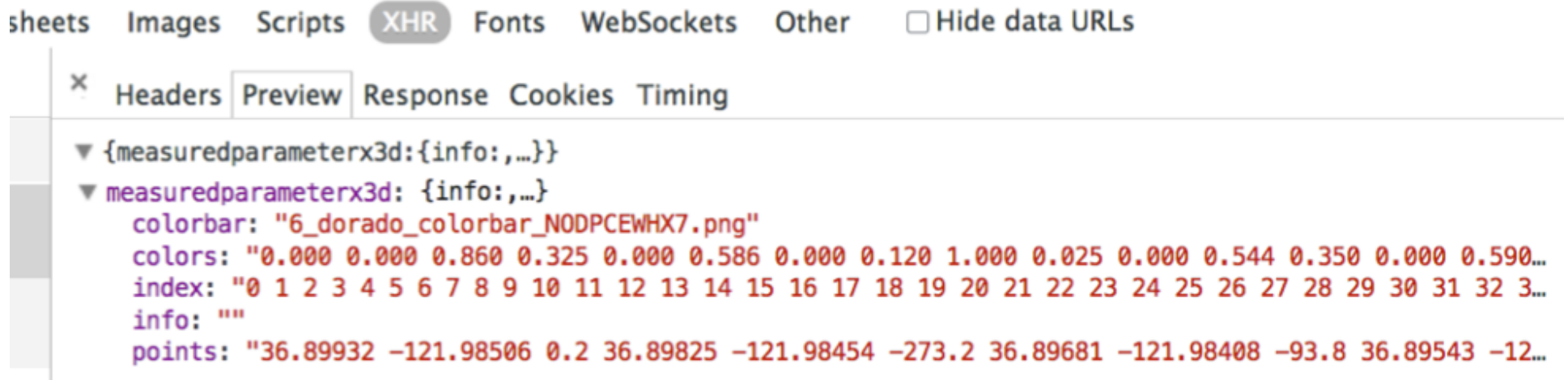
# Browser-database data flow

## X3D Scene Graph DOM

```
<div>  
<X3D id="spatial-3d-x3d" style="width:100%; height:100%;">  
  <Scene>  
    <shape id="mp-x3d-track"></shape>  
    <Viewpoint id="mp-x3d-viewpoint1"></Viewpoint>  
    <Inline id="mp-x3d-terrain1"></Inline>  
  </Scene>  
</X3D>  
</div>
```

## Browser-database data flow

### XML HTTP Response (XHR) containing JSON



The screenshot shows a browser's developer tools interface. At the top, there are tabs for 'sheets', 'Images', 'Scripts', 'XHR', 'Fonts', 'WebSockets', and 'Other'. The 'XHR' tab is selected. Below the tabs, there are sub-tabs for 'Headers', 'Preview', 'Response', 'Cookies', and 'Timing'. The 'Response' sub-tab is active, displaying a JSON object. The JSON object has a root key 'measuredparameterx3d' with a value of another object. This inner object has several properties: 'colorbar' (a string), 'colors' (a long string of numbers), 'index' (a long string of numbers), 'info' (an empty string), and 'points' (a long string of numbers).

```
{measuredparameterx3d:{info:,...}}
measuredparameterx3d: {info:,...}
  colorbar: "6_dorado_colorbar_NODPCEWHX7.png"
  colors: "0.000 0.000 0.860 0.325 0.000 0.586 0.000 0.120 1.000 0.025 0.000 0.544 0.350 0.000 0.590..."
  index: "0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 3..."
  info: ""
  points: "36.89932 -121.98506 0.2 36.89825 -121.98454 -273.2 36.89681 -121.98408 -93.8 36.89543 -12..."
```

## Browser-database data flow

JavaScript (jQuery) code to update the scene graph with data from the database

```
$('#mp-x3d-track').html([  
  '<indexedlineset coordIndex="' + data.measuredparameterx3d.index + '">',  
  '<color color="' + data.measuredparameterx3d.colors + '"></color>',  
  '<geocoordinate point="' + data.measuredparameterx3d.points + '"></geocoordinate>',  
  '</indexedlineset>',  
].join(''));
```

# Demonstration

Search MBARI's YouTube channel for  
"STOQS"

# Getting involved

- Visit the Web3D Consortium at booth #1018
  - x3d-public mailing list
  - geospatial mailing list\*
  - Strong liaison with Open Geospatial Consortium
- Contribute to open source projects
  - X3DOM on GitHub
  - ...

\* Members only