A Holistic Approach to Building 3D Web Apps

Raluca Nicola
Russell Roberts
Session Overview

- Introduction to 3D
- Web scenes
- Building custom web apps with web scenes
Introduction to 3D
What is 3D in the platform?

- Scene layers and feature layers
- Powered by services; accessible across clients
- Combine 2D and 3D in Esri WebGIS architecture
- Create higher value visualizations, analyses, and information products using data and geoprocessing with 2D and 3D
- Web scenes as building blocks for 3D apps
Global vs. Local Scenes

Global
• Web Mercator or WGS84
• Sphere/curved surface

Local
• Any PCS (including Web Mercator)
• Flat surface/no curvature
• ClippingExtent
• Underground navigation
Global Scenes

```javascript
var map = new Map({
  basemap: "topo",
  layers: []
});

var view = new SceneView({
  container: "viewDiv",
  map: map,
  // this is the default viewingMode: "global"
});
```
Local Scenes

```javascript
var map = new Map({
    basemap: "topo"
});

var view = new SceneView({
    container: "viewDiv",
    map: map,
    viewingMode: "local",
    clippingArea: {
        // set extent properties here
    }
});
```
```javascript
var view = new SceneView({
  container: "viewDiv",
  map: map,
  camera: {
    position: {
      x: -111.526,
      y: 38.984,
      // elevation in meters
      z: 2500000,
      // WGS84
      spatialReference: { wkid: 4326 }
    },
    // aka "pitch"
    tilt: 45,
    heading: 330.023
  }
});
```
Navigation

- Manual with mouse and keyboard gestures
- Programmatic navigation with goTo()

```javascript
view.goTo({
  center: [-126, 49],
  zoom: 13,
  tilt: 75,
  heading: 105
});

view.goTo(myCamera);
view.goTo(geometry);
view.goTo([ graphic1, graphic2, ... ]);
Elevation layers

- Provide vertical geographic context to your map
- Can be published to Portal for ArcGIS or ArcGIS Online
Elevation layers

Esri world elevation service

```javascript
var map = new Map({
  basemap: "satellite",
  // Esri world elevation service
ground: "world-elevation",
  // operational layers
layers: [...]
});
```

Hosted elevation layer

```javascript
var map = new Map({
  basemap: "topo",
  ground: {
    // Collection of elevation layers
    layers: [
      new ElevationLayer({
        url: "../OsoLandslide_After_3DTerrain/ImageServer"
      })
    ]
  },
  // operational layers
layers: [...]
});
```
Visualization

PointSymbol3D

LineSymbol3D

PolygonSymbol3D

IconSymbol3DLayer

LineSymbol3DLayer

FillSymbol3DLayer

ObjectSymbol3DLayer

PathSymbol3DLayer

ExtrudeSymbol3DLayer

**Flat**
- Screen size units (pt, px)
- Graphics are in screen space

**Volumetric**
- Real world units (feet, meter)
- Graphics are in real world space

Real world units

Graphics are in real world space

Screen size units

Graphics are in screen space
Visualization

Symbol layers within 3D symbols drive the visualization

```javascript
function createSymbol(color){
  return new MeshSymbol3D({
    symbolLayers: [
      new FillSymbol3DLayer({
        material: { color: color }
      }
    ]
  });
}
```
Web Scenes
Web Scenes

- Author in ArcGIS Online (can also be done in ArcGIS Pro)
- Publish layers in ArcGIS Online
- Author the scene with slides
- Save – get item ID
Intro to Web Scenes

• Allow you to visualize and analyze geographic information in an intuitive and interactive 3D environment

• Can add and customize 2D and 3D layers
  - Feature layer, map image layer, scene layer

• Control environment settings
  - Shadows
  - Time of day

• Can be global or local
Scene Layers

- Cached web layers that are optimized for displaying a large amount of 2D and 3D features and can be viewed in the scene viewer
- Three different types of scene layers:
  - Point
  - 3DObject
  - IntegratedMesh
  - PointCloud
How to Create a Scene Layer in ArcGIS Online & Enterprise

• Create a scene package in ArcGIS Pro
• Upload the scene package to ArcGIS Online or Portal
• Publish a scene layer from the scene layer package
  - Use this to publish Point, 3D Object, Integrated Mesh, Point Cloud scene layers

• Share data directly from ArcGIS Pro to ArcGIS Online (Pro 2.1) or Portal
  - Creates a scene layer with associated feature layer
    - Use this to publish Point and 3D Object scene layers

• Publish scene layers from hosted feature layers in ArcGIS Online
  - Use this to publish Point and 3D Object scene layers
How to Create a Web Scene in ArcGIS Online & Enterprise

• Click the Scene text inside your Organization to launch the Scene Viewer
• Add 2D and 3D layers to your web scene
• Configure your web scene

• In ArcGIS Pro add 2D and 3D layers
• Configure your layers (popups, style etc)
• Share web scene from ArcGIS Pro to ArcGIS Online or Portal
  - This can also be used to publish hosted layers as well directly to ArcGIS Online or Portal
Building a city visualization
Add custom functionality to the New York webscene

- Portal API - loading the webscene
- Filter buildings based on attributes

- Customize popups
- Use the slides to create a tour
Loading a webscene

```javascript
var webscene = new WebScene({
    portalItem: {
        id: "804f91d0219c40f3a6049e6f946e9859"
    }
});

var view = new SceneView({
    map: webscene,
    container: "viewDiv"
});
```
Loadable pattern

- Loaded means that the resources are available and ready for drawing
- Does not mean features have completely drawn in the view

```javascript
webscene.load().then(function(webscene) {
    console.log("The webscene loaded successfully: ", webscene);
}).otherwise(function(error) {
    console.log("The webscene failed to load: ", err);
});
```
Loadable pattern

- The view is a promise, which resolves when the view is ready and when the scene’s resources have finished loading

```javascript
view.when(function () {
    // access resources
    console.log(view.map.presentation.slides);
    console.log(view.map.layers);
});
```
Filter buildings

- Client-side for scene layers => fast
- Set an SQL query to filter out features

```sql
layer.definitionExpression = 'HEIGHTROOF >= 100 AND HEIGHTROOF <= 1000';
```
Customize popups

```javascript
buildingsLayer.popupTemplate = {
  title: "{NAME}"
  content: `The building was built in {CNSTRCT_YR}
               and is {HEIGHTROOF} feet tall.`
};
```
Create a tour

```javascript
function startTour(slideId) {
    var slides = view.map.presentation.slides;
    var slide = slides.getItemAt(slideId);
    var title = document.getElementById("title");
    title.innerHTML = slide.title.text;

    slide.applyTo(view, { duration: 4000 })
        .then(function () {
            window.setTimeout(function () {
                slideId++;
                if (slideId < slides.length) {
                    startTour(slideId);
                }
            }, 8000);
        });
}
```