



AI-IoT 2023

Aspects of VR Three.js

Phillip G. Bradford
University of Connecticut

Outline

Motivation

High level view and learning path

Some structure of Three.js

Examples

Motivation

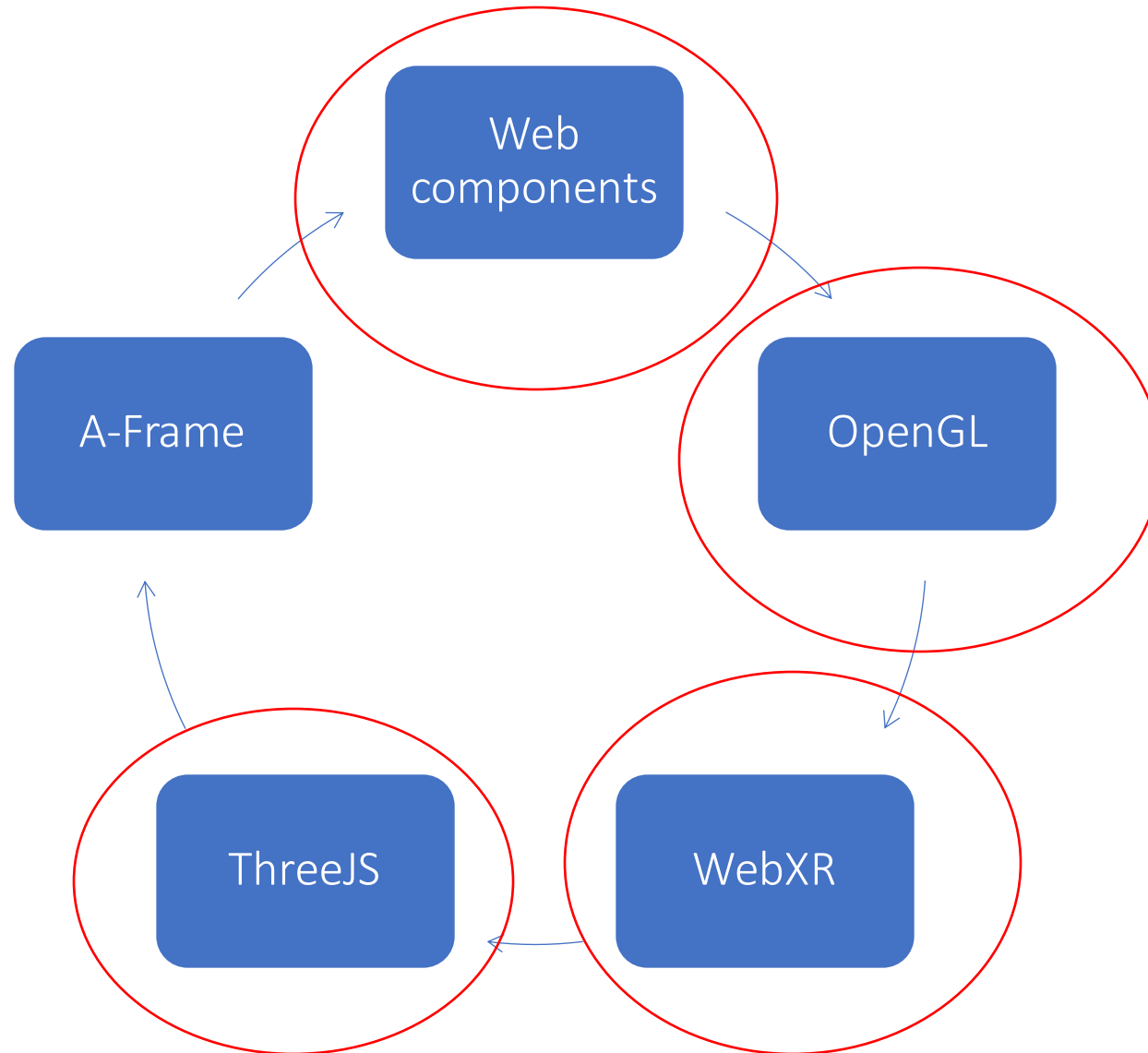
Perhaps the most popular JavaScript graphics library

- Based on WebGL

- Leverages graphics cards

ThreeJS is built on WebXR which is built on WebGL which is built on OpenGL

High level view and learning path



Main components

Renderer

Scene

Camera

Set up

Make a directory: js

Download <https://threejs.org/build/three.js>

Into js

Windows <right-click> save as...

General Three.js code structure

Context – canvas

Camera – create, setup, position

Geometry

Materials

Lights

Mesh

Draw

Animation loop - requestAnimationFrame(render)

Update resize

Animation loop

The function `requestAnimationFrame(render)` applied to `render` asks the browser to animate when a state change occurs

```
function animate() {  
    requestAnimationFrame( animate );  
    square.rotation.x += 0.025; /* state change - browser re-renders */  
    renderer.render( scene, camera );  
}  
animate();
```

Browser re-renders by calling `animate(time)` !

Changing the speed of the animation loop

```
const interval = setInterval( () => { line.rotation.x += 0.1; }, 1500);  
function animate(time) {  
    requestAnimationFrame( animate );  
    renderer.render( scene, camera );  
    //console.log('Animate:' + time.toString());  
}  
animate();
```

Set up html

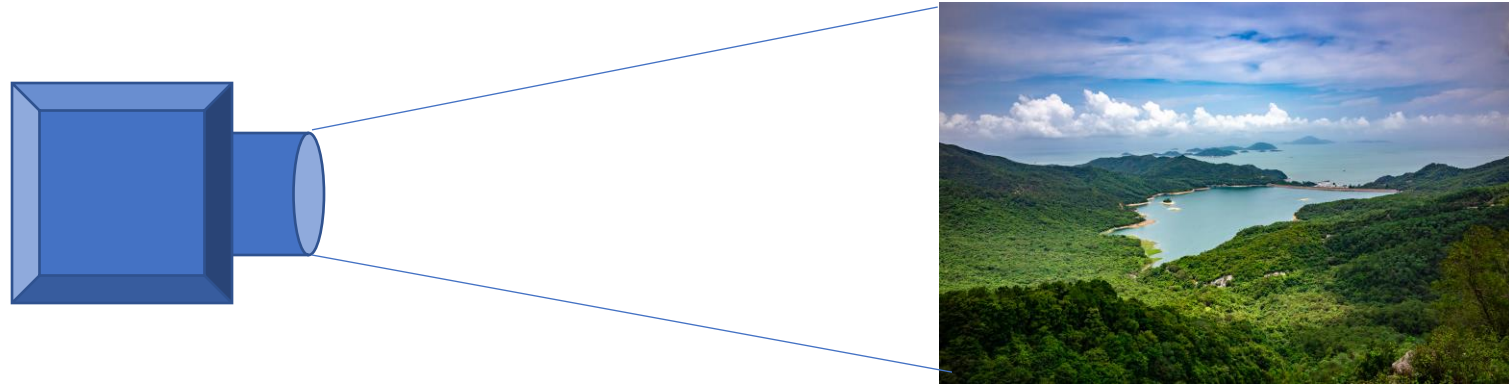
```
<!DOCTYPE html>
<html>
  <head> <meta charset="utf-8">
    <title>My first three.js app</title>
    <style> body { margin: 0; } </style>
  </head>
  <body> <script src="js/three.js"></script>
  <script> // Our Javascript will go here. </script>
</body>
</html>
```

Camera

Scene

Camera

Renderer



Perspective Camera

```
const camera = new THREE.PerspectiveCamera( 75,  
                                             window.innerWidth / window.innerHeight, 0.1, 1000 );
```

Field of view: 75 degrees

Aspect ratio: width/height

0.1, 1000: Near, far clipping



Perspective Camera()

```
camera = new THREE.PerspectiveCamera(45,  
                                     window.innerWidth / window.innerHeight,  
                                     0.1, 1000);  
  
// position and point the camera to the center  
camera.position.x = 15;  
camera.position.y = 16;  
camera.position.z = 13;  
camera.lookAt(scene.position);
```

THREE.Scene()

This data structure holds elements of a picture
Also holds sub-components

Holds objects, lights, textures,

THREE.BoxGeometry(x,y,z)

Lambert and Phong materials

THREE.WebGLRenderer() – uses canvas tag

```
const renderer = new THREE.WebGLRenderer();
```

Generating image via a model

```
renderer.setSize( window.innerWidth, window.innerHeight );
```

Fit to our screen

```
document.body.appendChild( renderer.domElement );
```

Web component

Object3D

<https://github.com/mrdoob/three.js>

<https://threejs.org/docs/#api/en/core/Object3D>

THREE.Line

THREE.CircleGeometry

```
const geometry = new THREE.BoxGeometry( 1, 1, 1 );
```


NPM and three

What is node? Npm?

Installing npm, node,...

<https://nodejs.org/en/download/>

Windows> npx create-react-app test

Example node Three.js system

<https://github.com/edwinwebb/three-seed.git>

Blender – example from Ubuntu

References

<https://cdn.jsdelivr.net/npm/three-orbitcontrols@2.110.1/>