New Technology

WEBGL

WAT IS WEBGL?

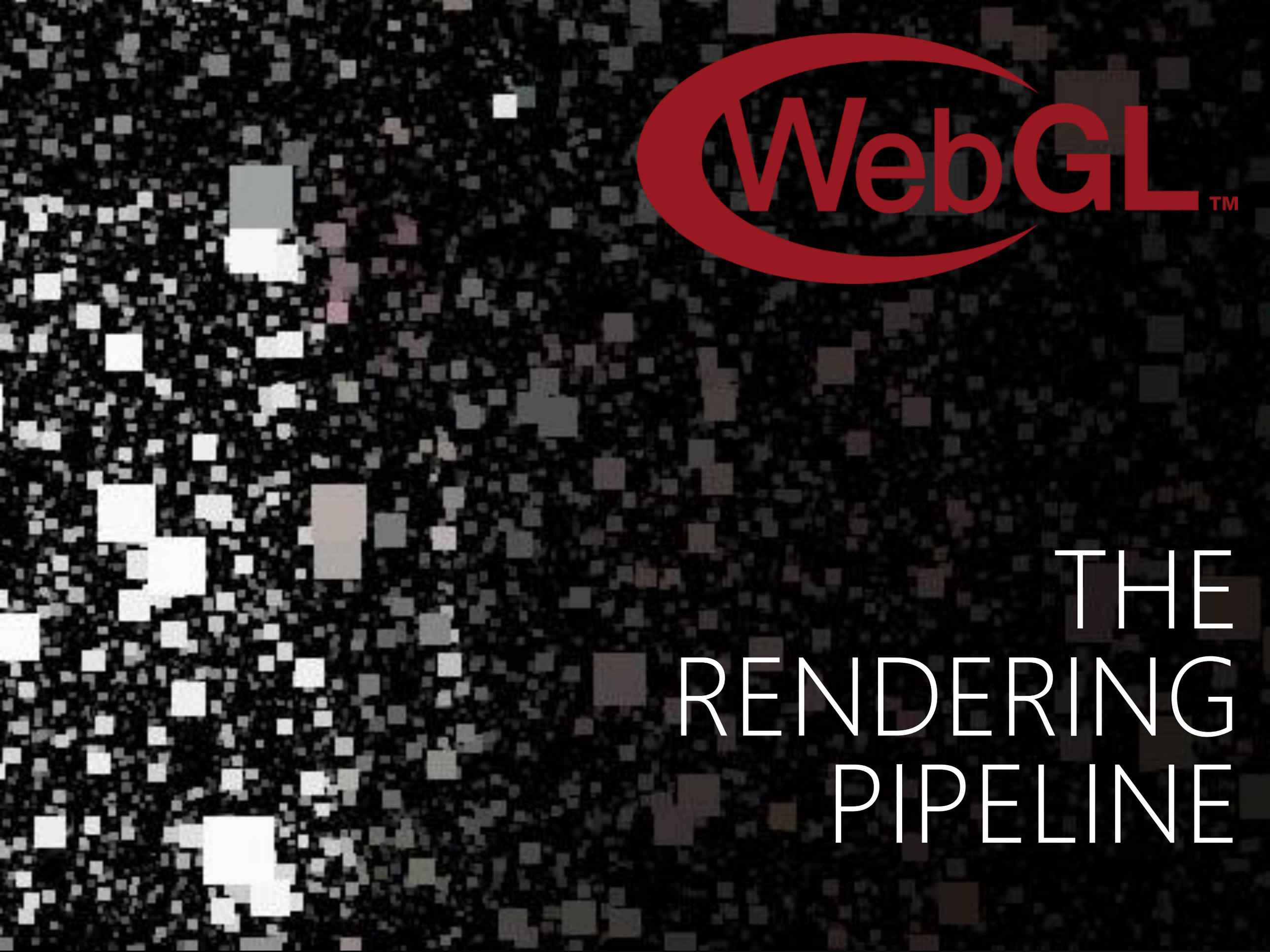
- Javascript API
- based on OpenGl ES 2.0
- 3D Graphics in <canvas>
- GPU
- Low-level
- WebGl Libraries (three.js,…)


WebGL™
INSTANTIATE

INSTANTIATE WEBGL

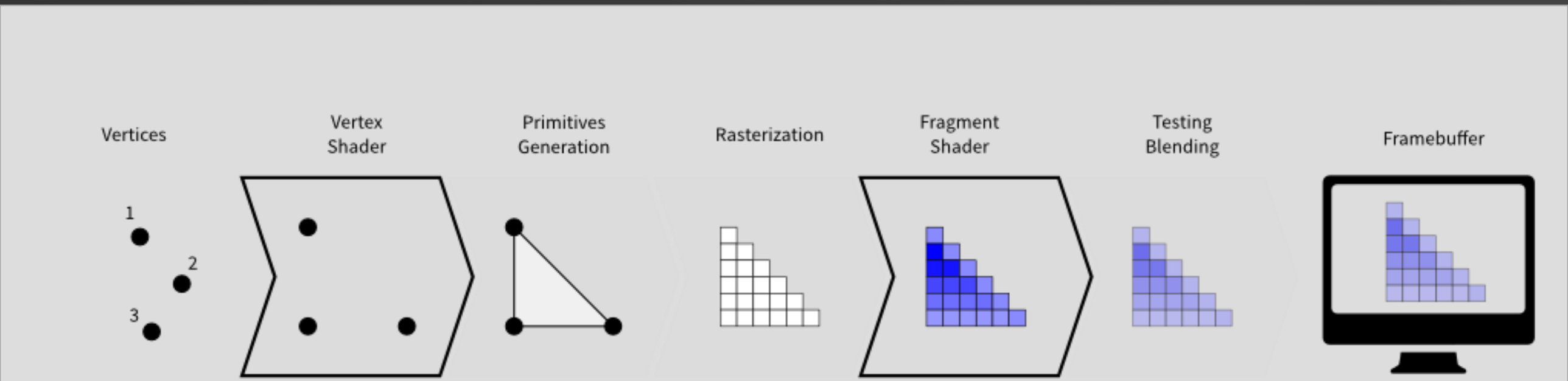
```
window.onload = function () {
  canvas = document.getElementById("canvas");

  // Try to grab the standard context. If it fails, fallback to experimental.
  var gl = canvas.getContext("webgl") || canvas.getContext("experimental-webgl")

  // Only continue if WebGL is available and working
  if (gl) {
    // Set clear color to blue, fully opaque
    gl.clearColor(0.2, 0.4, 0.67, 1.0);
    // Clear the color as well as the depth buffer.
    gl.clear(gl.COLOR_BUFFER_BIT | gl.DEPTH_BUFFER_BIT);
  }
};
```

- <canvas>
- Provide fallback



THE RENDERING PIPELINE

THE RENDERING PIPELINE *(Code to 3D)*



```
// Create buffers
var boxVertices = [
  // X, Y, Z   // COLOR: R, G, B
    // Top
    -1.0, 1.0, -1.0,   0.5, 0.5, 0.5,
    -1.0, 1.0, 1.0,    0.5, 0.5, 0.5,
    1.0, 1.0, 1.0,     0.5, 0.5, 0.5,
    1.0, 1.0, -1.0,    0.5, 0.5, 0.5,

    // Left
    -1.0, 1.0, 1.0,    0.75, 0.25, 0.5,
    -1.0, -1.0, 1.0,   0.75, 0.25, 0.5,
    -1.0, -1.0, -1.0,  0.75, 0.25, 0.5,
    -1.0, 1.0, -1.0,   0.75, 0.25, 0.5,

    ...
```

```
// Create Buffer on GPU
var BoxVertexbuffer = gl.createBuffer();
gl.bindBuffer(gl.ARRAY_BUFFER, BoxVertexbuffer);
gl.bufferData(gl.ARRAY_BUFFER, new Float32Array(boxVertices), gl.STATIC_DRAW);
```

VERTICES

- Vertex array
- Attributes
- Created on CPU
- On GPU = **vertex buffers**
- Index array
- limit data transfer

VERTEX SHADER

```
attribute vec2 vertPosition;
attribute vec3 vertColor;

varying vec3 fragColor;

void main() {
  fragColor = vertColor;

  gl_Position = vec4(vertPosition, 0.0, 1.0);
}
```

- Use default or own vertex shaders
- Calculates position,...

FRAGMENT SHADER

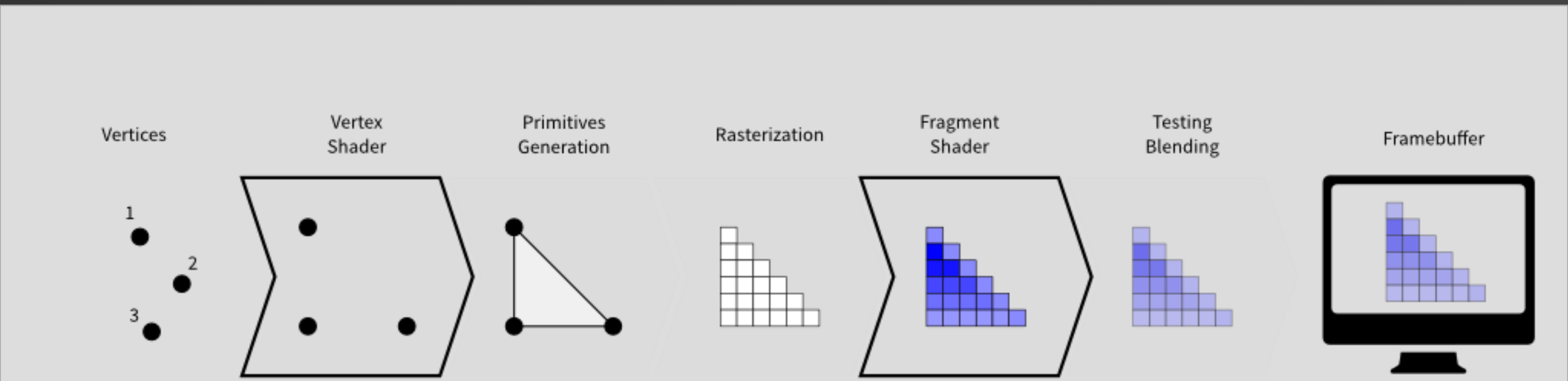
```
precision mediump float;

varying vec2 fragTexCoord;
uniform sampler2D sampler;

void main() {
  gl_FragColor = texture2D(sampler, fragTexCoord);
}
```

- After rasterizer (pixels)
- GLSL
- Outputs color, lighting, texture mapping

FRAME BUFFER

- Final destination
- Screen

THE RENDERING PIPELINE *(Code to 3D)*




WebGL
SHADERS

SHADERS

- Vertex shader and Fragment shader
- Functions
- Linked into program
- Typically several programs per app
- GLSL (Graphics Library Shader Language)

VERTEX SHADERS

- clipspace coordinates
- Called once per vertex
- gl_Position
- Needs data
  - Attributes (pulled from buffers)
  - Uniforms (data that stays the same)
  - Textures (data from pixels)

FRAGMENT SHADERS

- Provides color to pixel
- Called once per pixel
- gl_FragColor
- Needs data
  - Uniforms (data that stays the same)
  - Textures (data from pixels)
  - Varyings (data passed from the vertex shader)


WebGL
CODE