From WebGL to WebGPU

Jasper St. Pierre
Senior Graphics at Yacht Club Games
jstpierre@mecheye.net
@JasperRLZ
For high-level WebGL / WebGPU differences

- Go watch Kai’s May 2021 talk
- Slides have extra details as well!
- [https://tiny.cc/202105webgpu](https://tiny.cc/202105webgpu)
Uniforms in WebGL 1

// GLSL
uniform vec3 u_LightPos;
uniform vec3 u_LightDir;
uniform vec3 u_LightColor;

// JS
gl.uniform3fv(gl.getUniformLocation(p, "u_LightPos"), [100, 300, 500]);
gl.uniform3fv(gl.getUniformLocation(p, "u_LightDir"), [0, 1, 0]);
gl.uniform3fv(gl.getUniformLocation(p, "u_LightColor"), [255, 0, 0]);
Uniforms in WebGL 2

// GLSL
layout(std140) uniform ub_Params {
    vec4 u_LightPos;
    vec4 u_LightDir;
    vec4 u_LightColor;
};

// JS
gl.bindBufferBase(gl.UNIFORM_BUFFER, 1, gl.createBuffer());
const data = [
    100, 300, 500, 0,
    0, 1, 0, 0,
    255, 0, 0, 0,
    0, 0, 0, 0,
];
gl.bufferData(gl.UNIFORM_BUFFER, data, gl.DYNAMIC_DRAW);
Uniforms in WebGPU

// WGSL
[[block]] struct Params {
    u_LightPos : vec4<f32>;
    u_LightColor : vec4<f32>;
    u_LightDirection : vec4<f32>;
};
[[group(0), binding(0)]] var<uniform> ub_Params : Params;

// JS
const b = device.createBuffer({ usage: GPUBufferUsage.UNIFORM, size: 8 });
const group = device.createBindGroup({
    layout, entries: [
        { binding: 0, resource: { buffer: b } },
    ]
});

queue.writeBuffer(b, 0, data);
renderPass.setBindGroup(0, group);
Shaders

sampler2D myTexture;

varying vec2 vTexCoord;
void main() {
  return texture(myTexture, vTexCoord);
}

[[group(0), binding(0)]] var mySampler: sampler;
[[group(0), binding(1)]] var myTexture: texture_2d<f32>;

[[stage(fragment)]]
fn main([[location(0)]] vTexCoord: vec2<f32>) -> [[location(0)]] vec4<f32> {
  return textureSample(myTexture, mySampler, vTexCoord);
}
**Shaders**

- [https://github.com/gfx-rs/naga/](https://github.com/gfx-rs/naga/)
- Rust library to convert GLSL to WGSL (and much more!)
- Running in the browser using WebAssembly!
Viewport Space Convention Differences
Viewport Space Convention Differences

glTexImage2D

texture2D
Viewport Space Convention Differences

**OpenGL Default / WebGL**

```plaintext
texCoord.y = 1.0 - texCoord.y;
```

**Direct3D / Metal / WebGPU**

```plaintext
texCoord.y = 1.0 - texCoord.y;
```
Clip Space Convention Differences
Clip Space Convention Differences

OpenGL Default / WebGL

Direct3D / Metal / WebGPU
Clip Space Convention Differences

```javascript
if (webGPU)
    mat4.perspective(0, Math.PI / 4, ...);
else
    mat4.perspective(out, Math.PI / 4, ...);
```

\[
\begin{bmatrix}
1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 \\
0 & 0 & 0.5 & 0 \\
0 & 0 & 0.5 & 1
\end{bmatrix}
\]

\[
proj' = \begin{bmatrix} 1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 \\
0 & 0 & 0.5 & 0 \\
0 & 0 & 0.5 & 1 \end{bmatrix} \cdot proj
\]
WebGPU is still a work in progress!

- Still in flux as browsers and implementations come online
- Exiting progress so far!
- Join the community!
- #WebGPU on Matrix.org

Open-Source Links

noclip.website - [http://github.com/magcius/noclip.website](http://github.com/magcius/noclip.website)

Thank You!

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- **WebGPU WG & Implementers**
  - Dzmitry Malyshau
  - Kai Ninomiya
  - Corentin Wallez
  - Austin Eng

- **Naga team**
  - João Capucho