

Private:

Advancing Web Gaming To New Heights with Cocos

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Only for W3C Game Community Sharing



Outline

- ▶ Cocos Creator introduction with game cases
- ▶ Engine architecture on Web and core features
- ▶ Our journey to WebGPU

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01

Cocos Creator Introduction

02

03

Community Sharing



Cocos Creator

wine_fix_normal.scene example_bistro Cocos Creator 3.6.0

Cocos Creator File Edit Node Project Panel Extension Developer Help

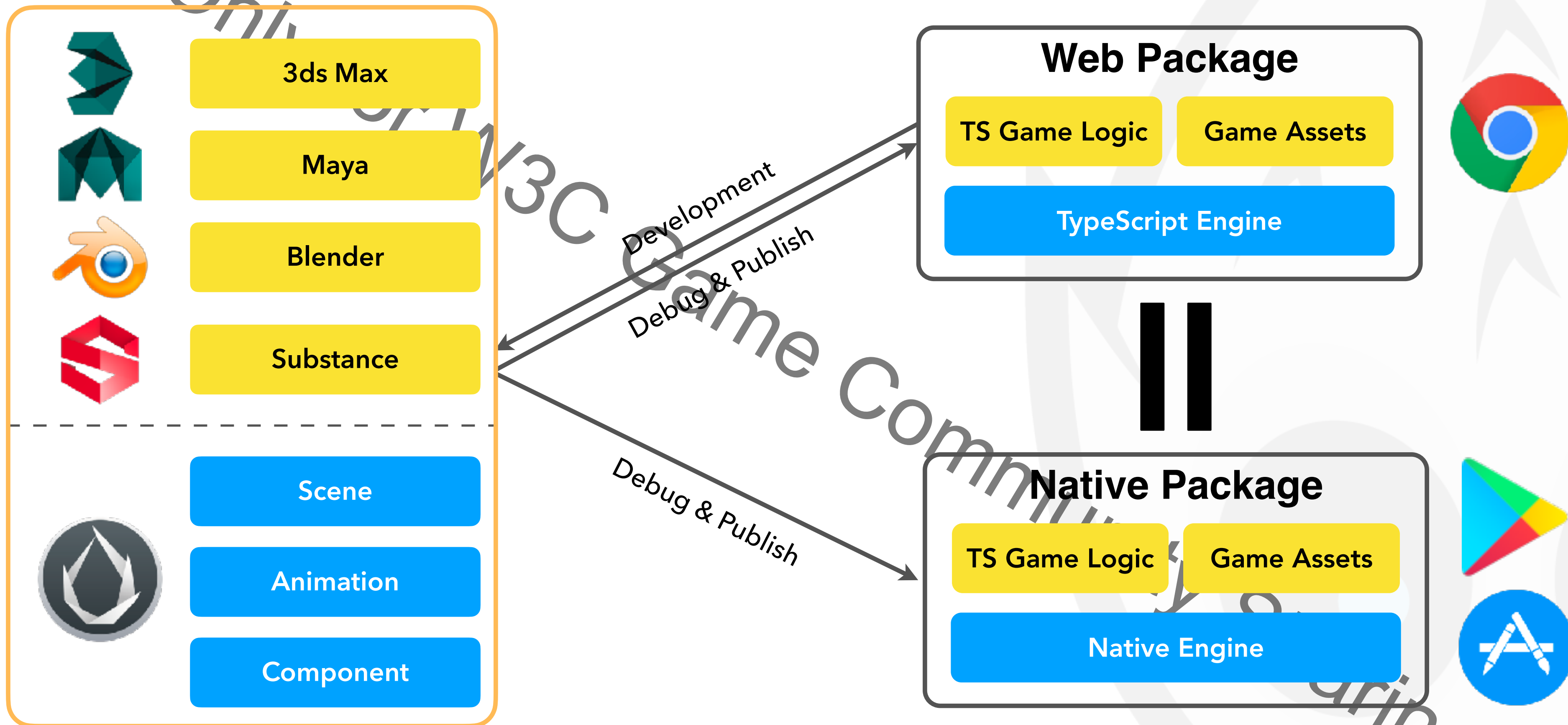
The screenshot displays the Cocos Creator 3.6.0 interface. The central 3D scene shows a detailed bistro named "Le Petit Café" with a red awning and a blue Vespa scooter parked in front. The interface is divided into several panels:

- Hierarchy Panel:** Lists scene objects such as "Bistro_Research_Exterior_bux_hedge_ball_small_3057" and "Bistro_Research_Exterior_led0_Vespa_3907".
- Assets Panel:** Shows a tree view of assets including "HDRs", "Materials", "resources", and "animation".
- Inspector Panel:** Displays properties for the selected "cc.Mesh" component, including "Lifest", "Technique", and "NormalMap".
- Assets Preview:** Shows icons for "HDRs", "Materials", "resources", "animation", "FBX", and "wine_fix_normal".

The bottom status bar indicates the version "Version 3.6.0".



Efficient Web Based Workflow





Top War

- ▶ Top ranking game
- ▶ Platform: Web + Mobile Native
- ▶ Merge + 4X SLG
- ▶ Merge gameplay makes ads buying much more efficient
- ▶ 100 millions downloads
- ▶ \$20m monthly revenue





Ubisoft Nano

- ▶ 10 multiplayer party games on web
- ▶ 21 Ubisoft IP landed on web
- ▶ 10 million players (2021)
- ▶ 188 countries (2021)
- ▶ 8 platforms: Web portals, telecom operators, social Apps
- ▶ 10mb package size, 4s loading time





Three Kingdoms



- ▶ Released in Korea and Taiwan
- ▶ Platform: Google Play, Apple Store, Web
- ▶ Highly unified experience
- ▶ 4X SLG



Complex Render Pipeline on Web



Framerate (FPS)	60
Draw call	331
Frame time (ms)	11.94
Instance Count	11689
Triangle	11655626
Game Logic (ms)	0.21
Physics (ms)	0.01
Renderer (ms)	11.65
GFX Texture Mem(M)	491.43
GFX Buffer Mem(M)	14.96

▼ Pipeline

- octreeCulling
- time 1.2
- sceneCulling 0.2
- > PlanarReflection
- > ShadowStage
- > ShadowBlurStage
- > GbufferStage
- > SSAOStage
- > SSAOBlurStage
- > LightingStage
- > BloomStage
- > LightShaftStage
- > TAAStage
- > TonemapStage
- > fsrEASUStage
- > fsrRCASStage
- > PostProcessStage

<https://preview.cocos.com/lake/>



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01


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03

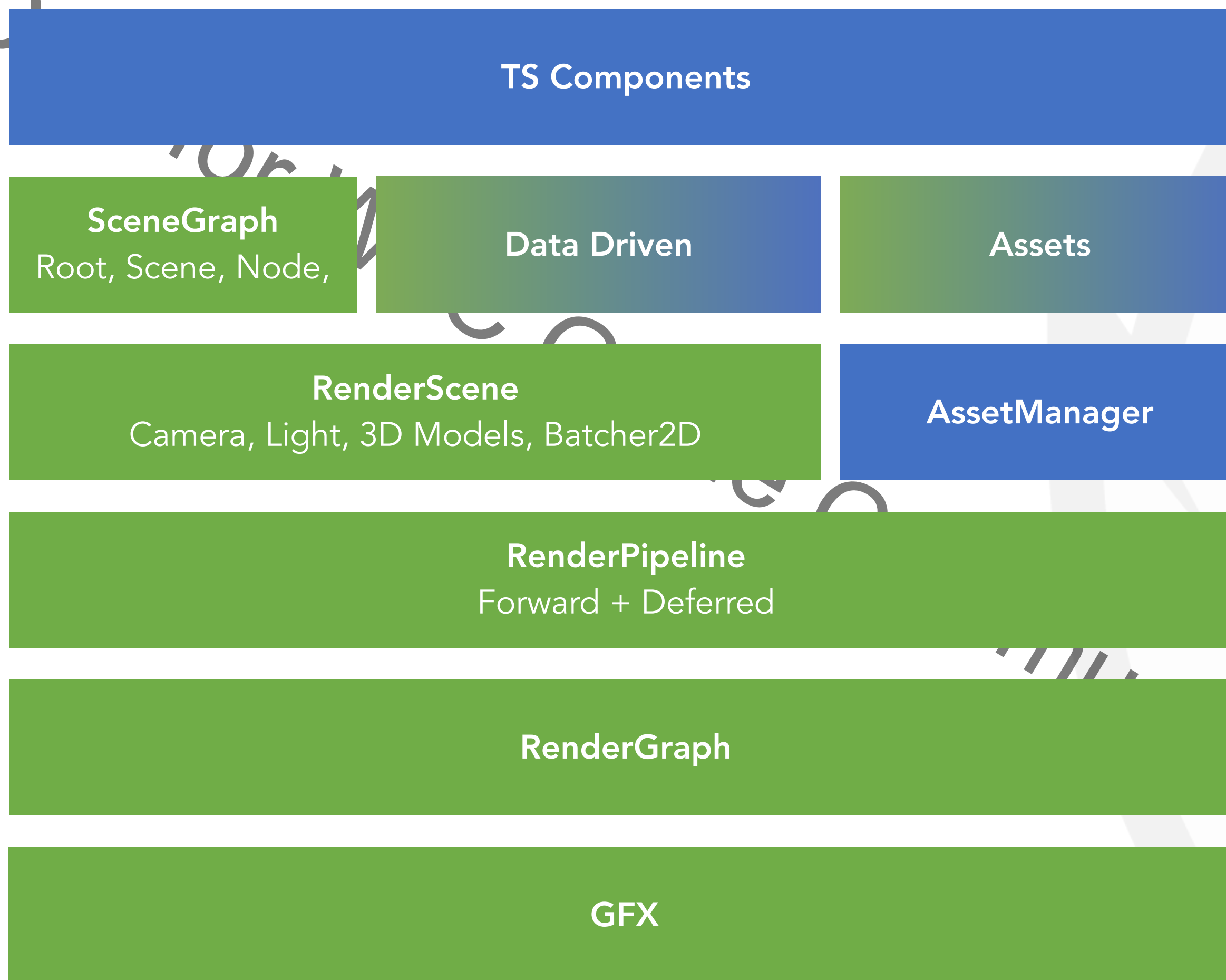
Engine Architecture and Features



Engine Architecture

 TS

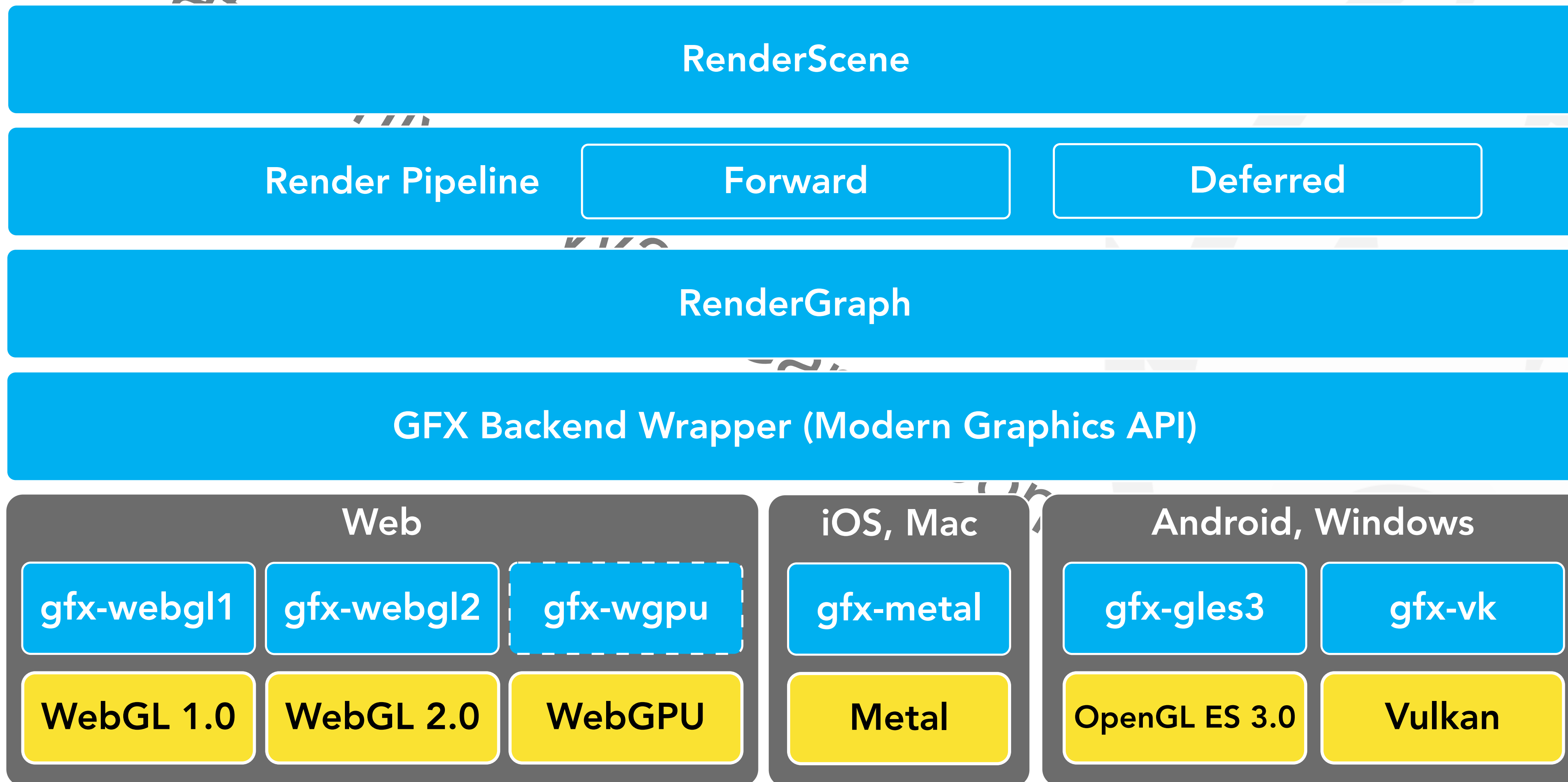
 C++ & TS



Sharing



Cross Platform Renderer



Renderer



Driver and GPU



Graphics Backend Upward Adaptation

Modern backend

GFX Backend Wrapper (Modern Graphics API)

Adaptation

gfx-webgl1

Older backend

WebGL 1.0

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Feature Backward Compatibility for WebGL

GPU Instancing

WebGL1: ANGLE_instanced_arrays
WebGL2: Builtin support

Merge draw calls

Float Texture

WebGL1: OES_texture_float
WebGL2: Builtin support

Pack floats to
RGBA8 texture

GPU Skeleton Animation, GPU Particle,

Compressed Texture

Extensions: PVRTC, ETC, ETC2, ASTC

Reduce memory footprint

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Outcome: GPU Based Skeletal Animation

iPhone 7 plus
WebGL1
Full PBR model
Instances: 1000
Draw Call: 10
FPS: 30

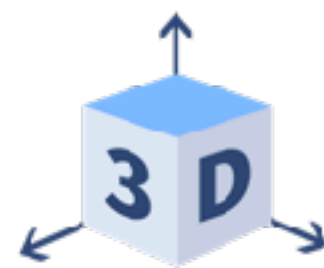
Baseline Compare Group

Frame time (ms)	34.02
Framerate (FPS)	30
Draw call	10
Instance Count	1073
Triangle	1329353
Game Logic (ms)	1.52
Physics (ms)	0.08
Renderer (ms)	29.7
GFX Texture Mem(M)	95.08
GFX Buffer Mem(M)	1.1



Engine features and recent updates

Private: C



3D scene editor



Animation editor



Skeletal animation



Terrain editor



glTF 2.0



TS & NPM



Asset manager



Editor extension



VK & Metal



PBR material



PBR lighting and shadow



Material system



3D physics



3D particle



UI layout

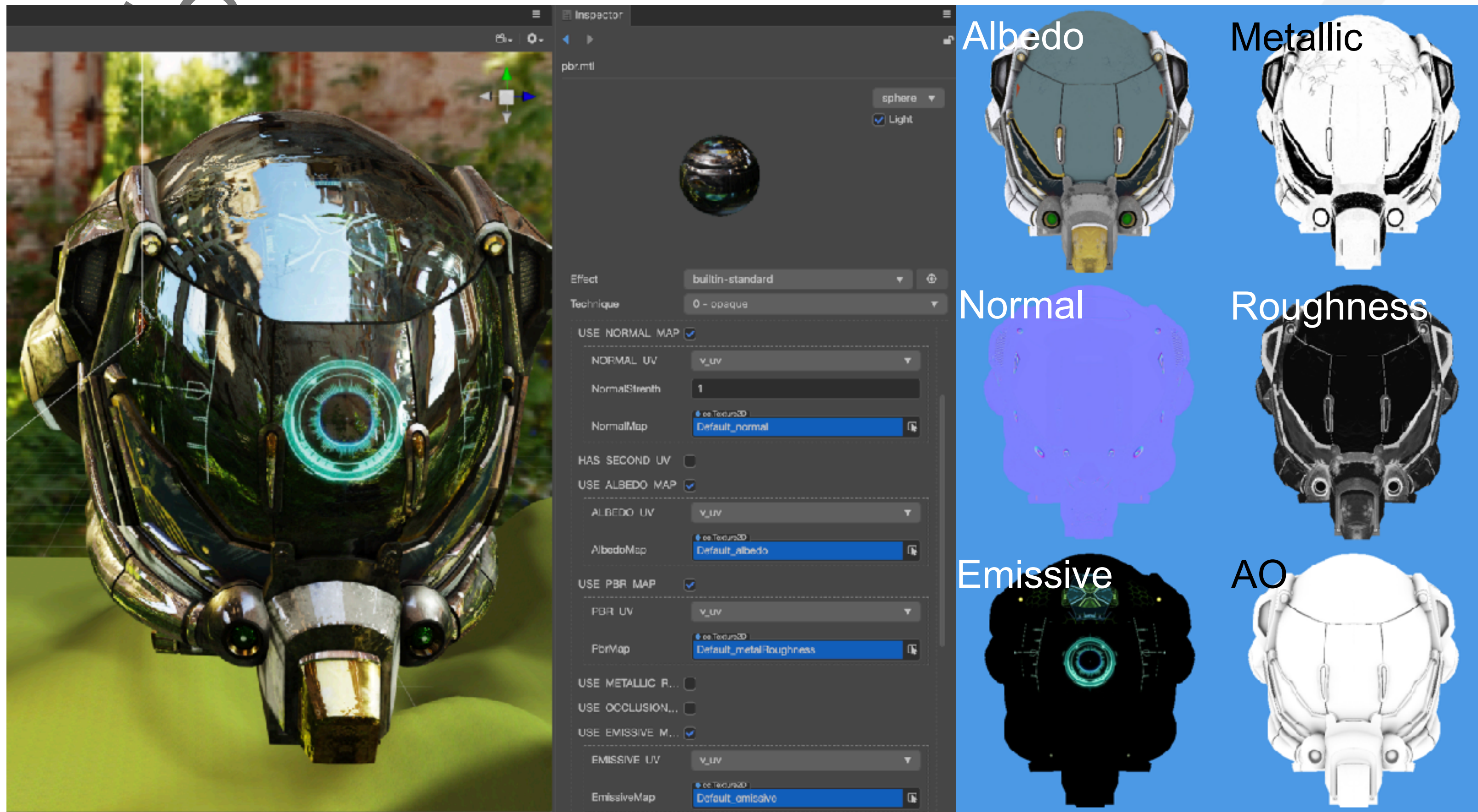


Cross platform

Sharing



Physically Based Rendering





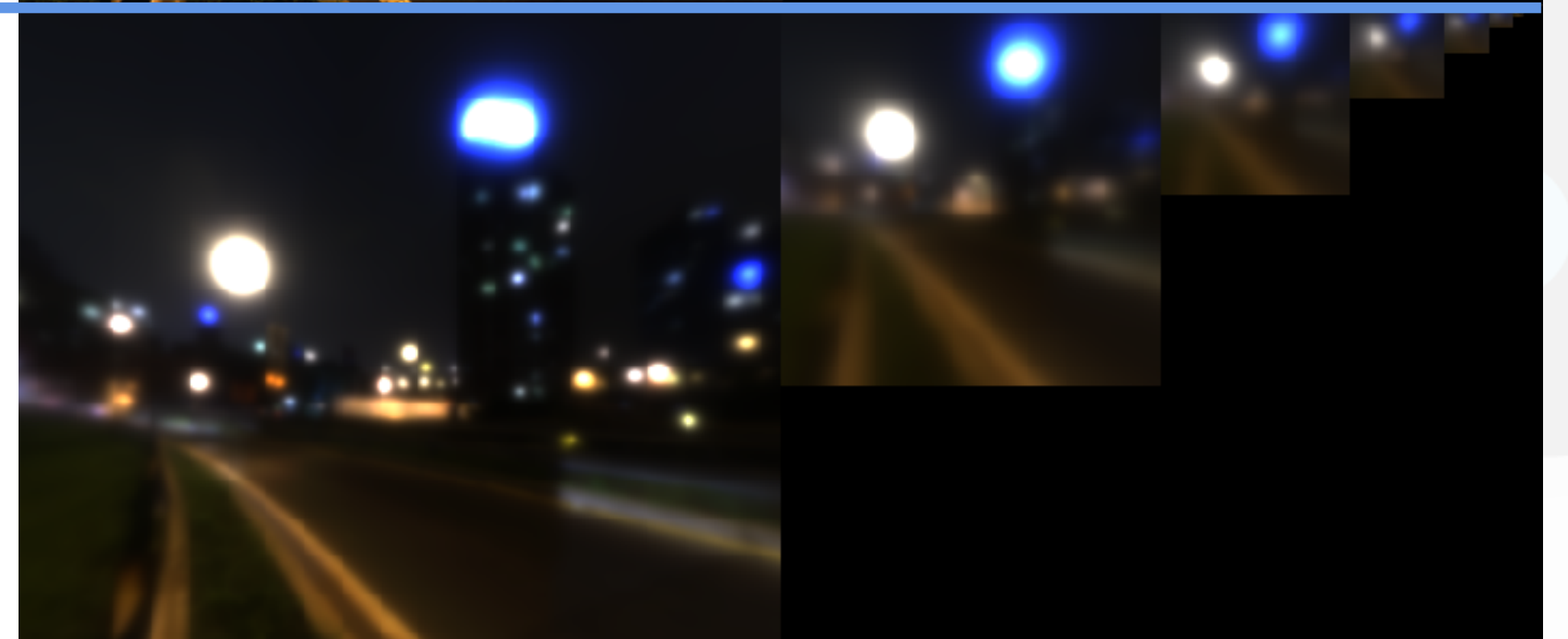
Lighting

- ▶ Physically based metrics
- ▶ Multi-pass direct light
- ▶ Diffuse with environment convolution map
- ▶ Reflection with GGX convolution mipmaps
- ▶ IBL reflection denoise

Auto Generated



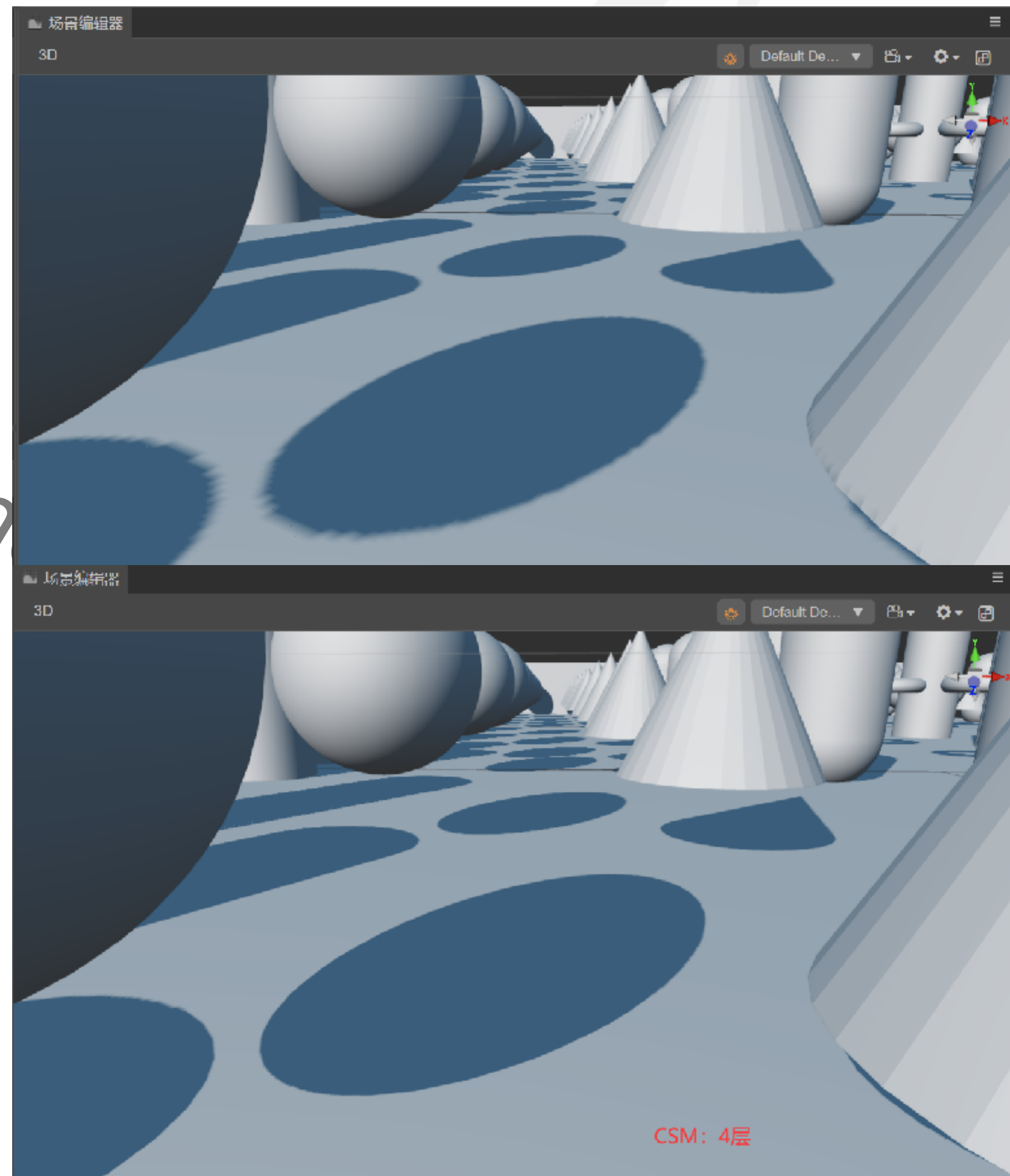
GGX Convolution





Shadows

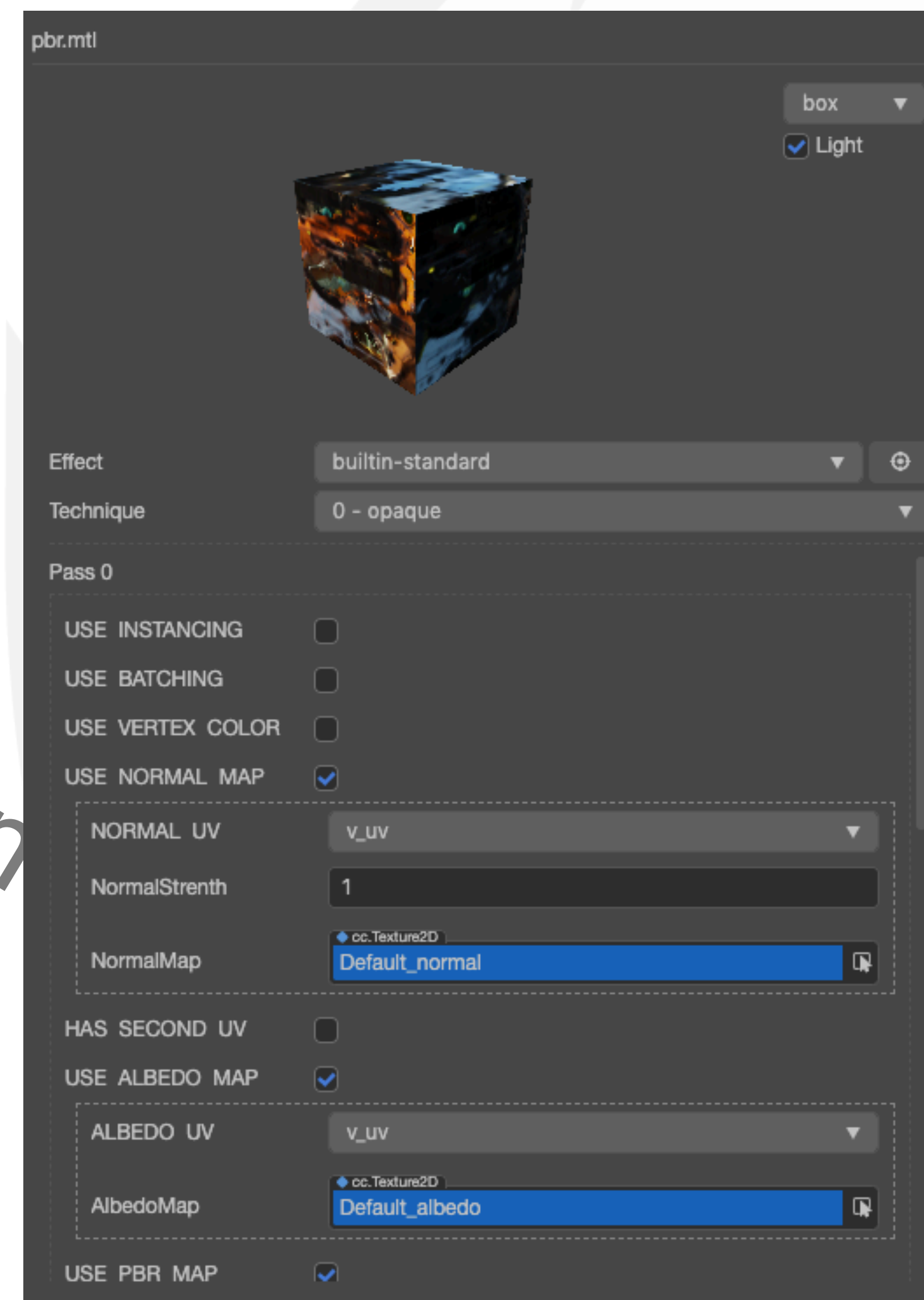
- ▶ Supports planar shadow and shadow map
- ▶ PCF soft shadow
- ▶ Depth bias and model bias
- ▶ Four layer cascade shadow map
- ▶ Support instancing batch





Material System

- ▶ Effect based on YAML descriptive format
- ▶ Effect with Surface Shader customization
- ▶ Shader using GLSL 300es
- ▶ Keep uniform value while switch materials
- ▶ Uniform key frame animation support





Smart Material Conversion

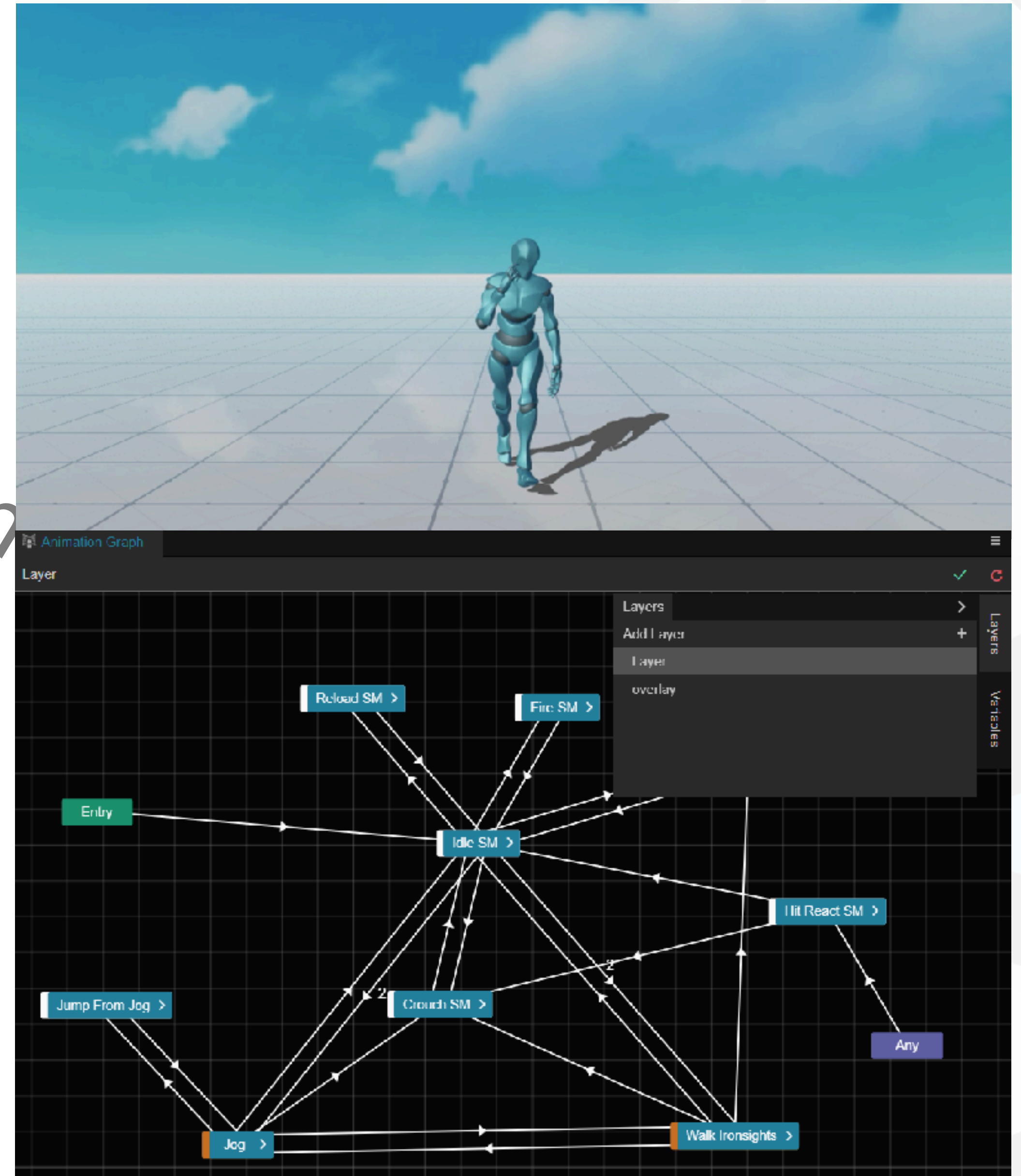
- ▶ Supports 3ds Max, Maya, Blender, C4D
- ▶ Supports Lambert, Blinn, Phong, PBR
- ▶ Convert traditional lighting model to PBR lighting model
- ▶ Supports both Metallic Roughness and Specular Glossiness workflows





Marionette Animation System

- ▶ State machine and sub state machine
- ▶ Blend Tree
- ▶ Event Trigger
- ▶ Animation Layer
- ▶ Skeleton Masking





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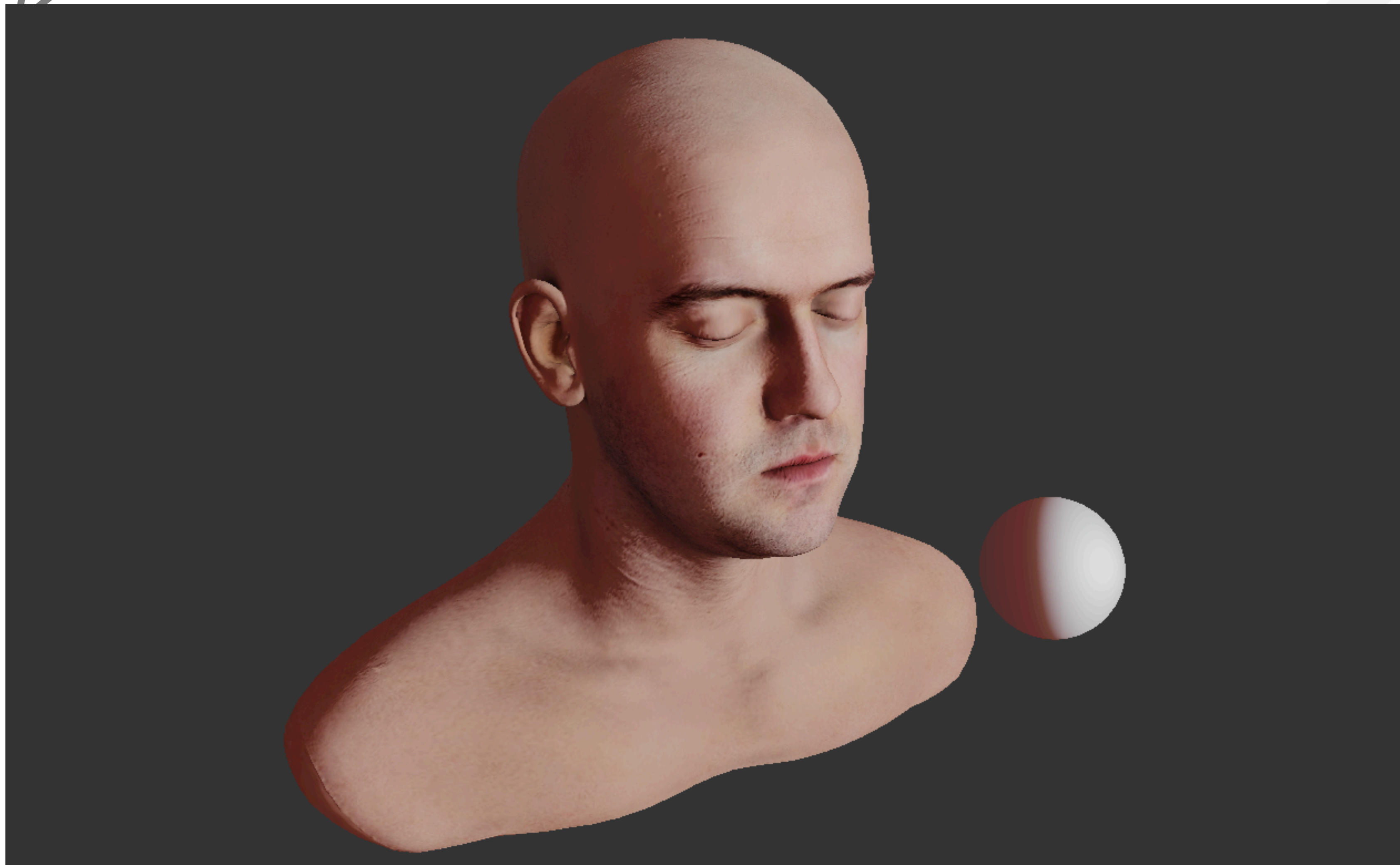
02

03

Our Journey to WebGPU



Our first WebGL demo



Chrome Canary 900323: <https://game.cocosjoy.com/games-preview/web-desktop/>



Initial implementation: The classic web way

TypeScript

render-pipeline

gfx (Backend Wrapper)

gfx-wgpu

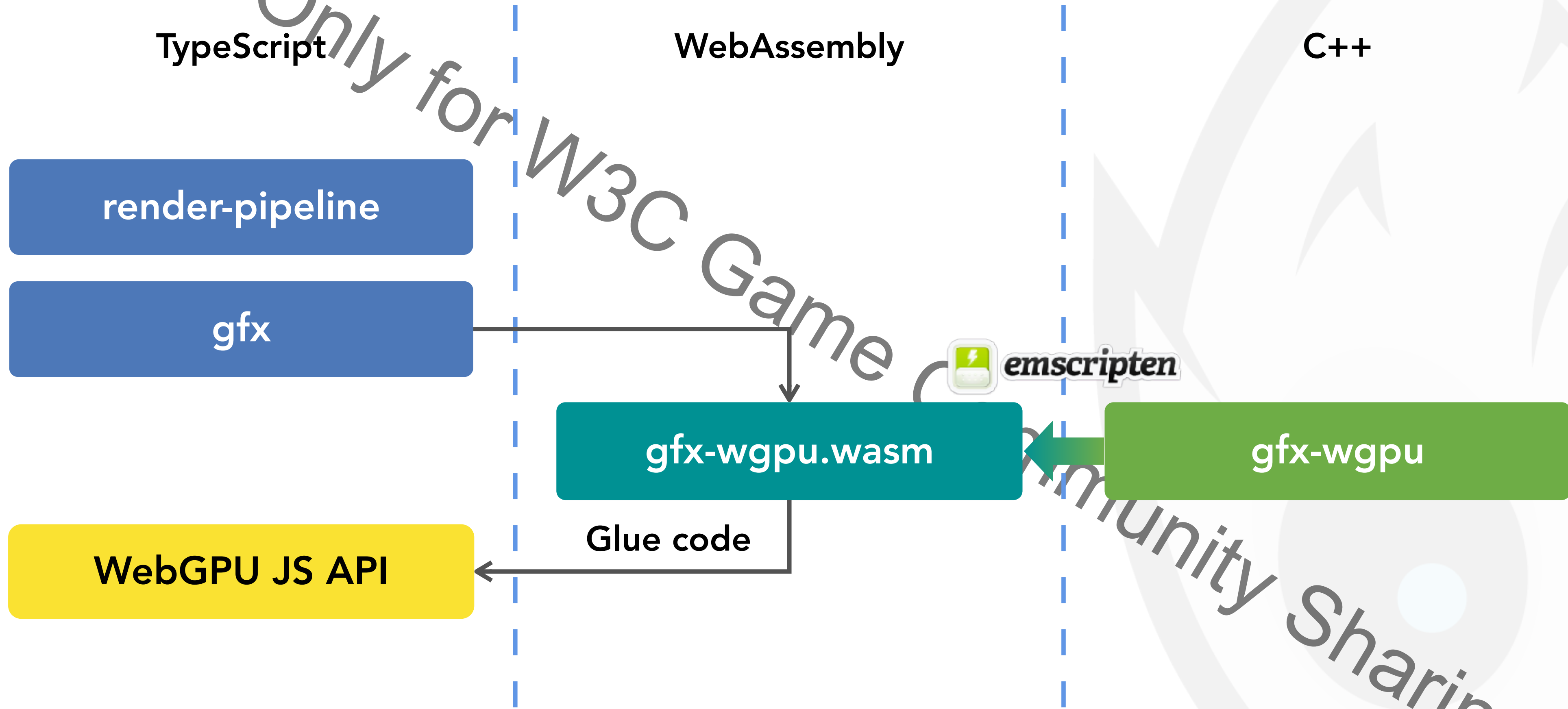
WebGPU JS API

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Current implementation: Native WebGPU

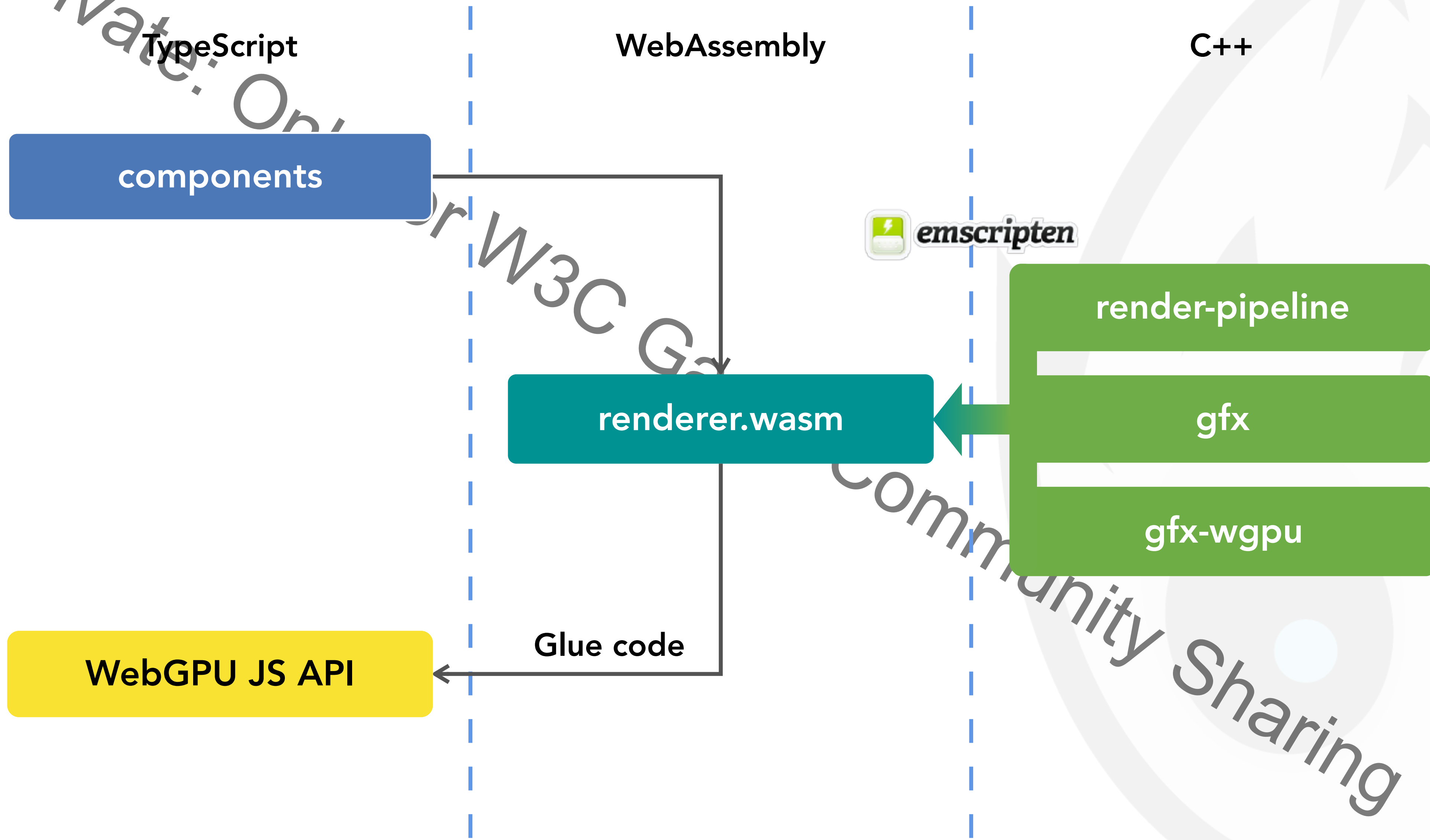


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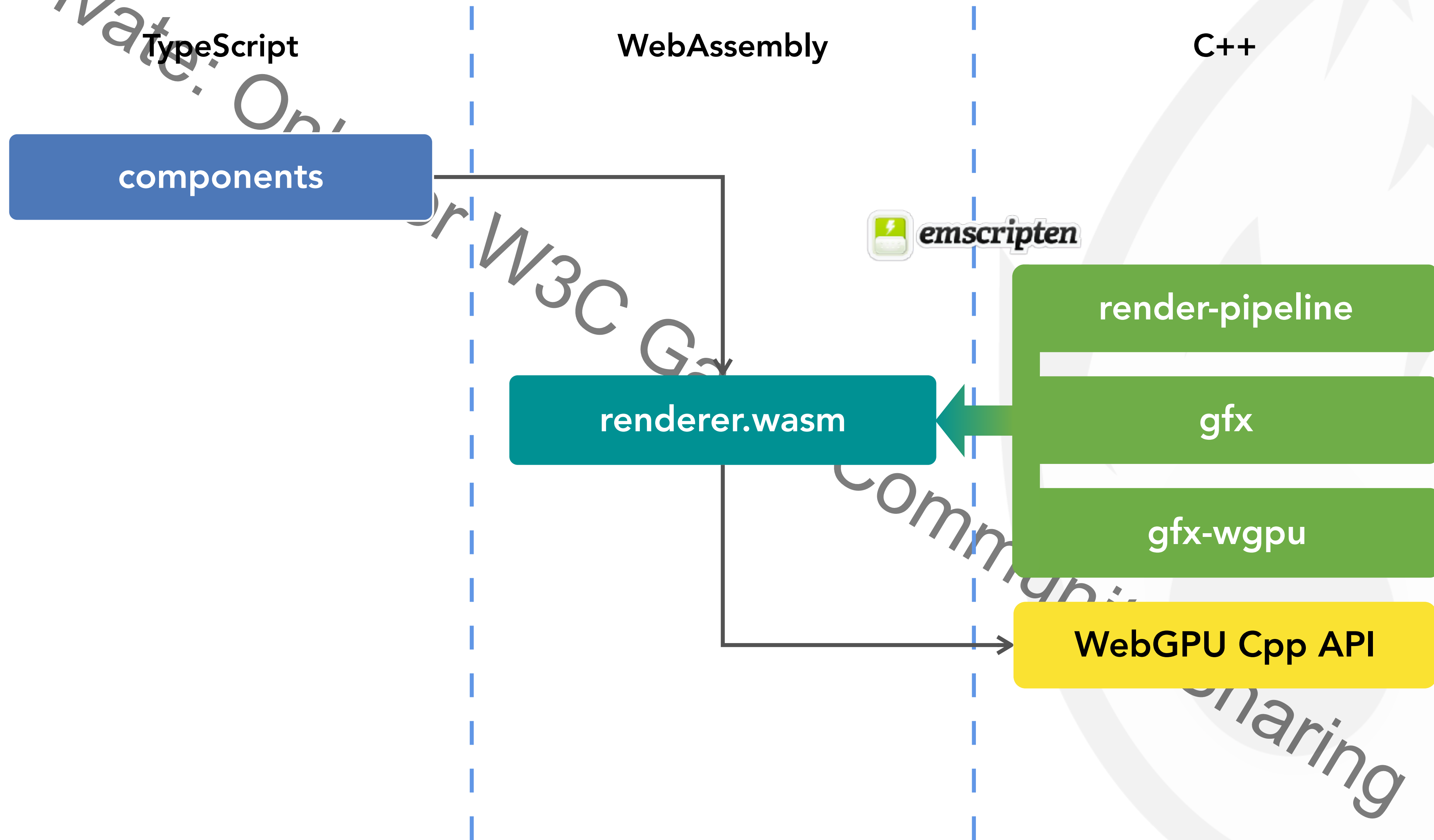


Next step



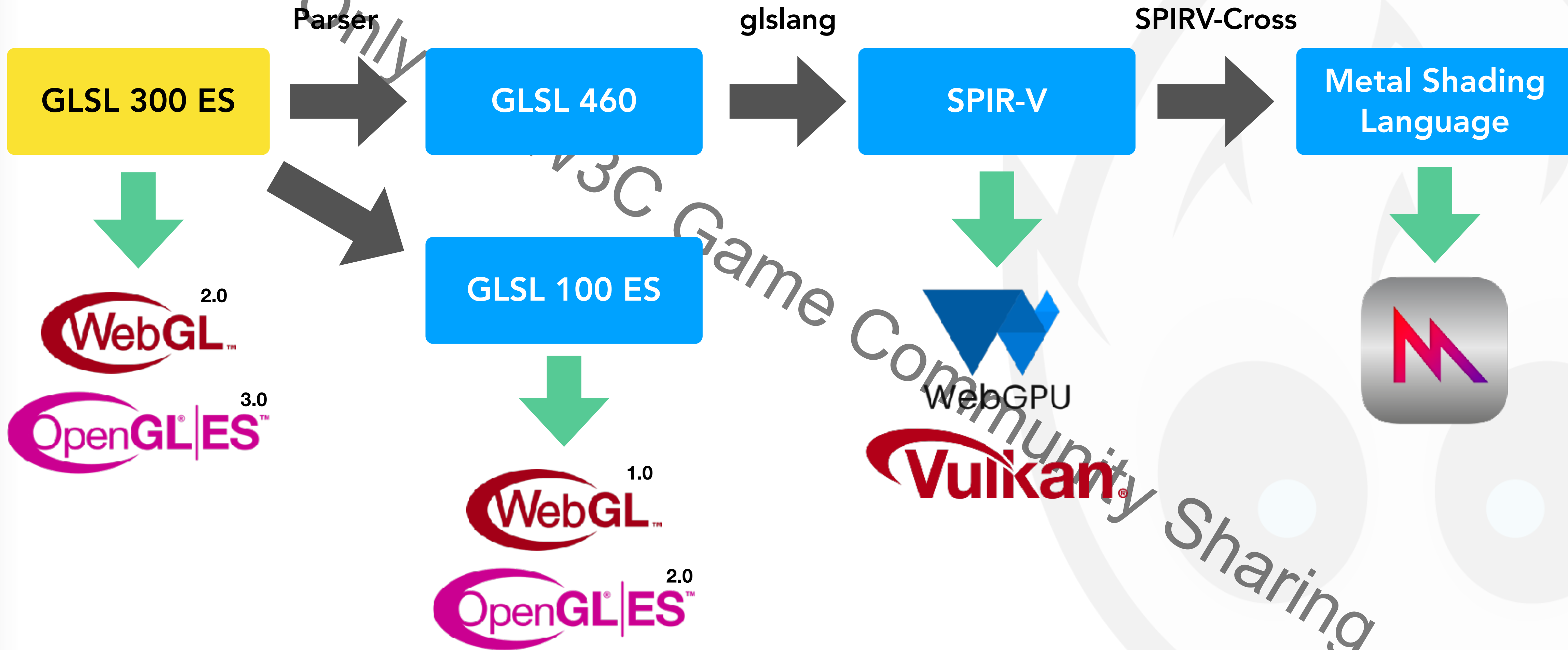


Hmmm, why not ? 🤔





Full shader compilation graph





Design principles of our architecture

- ▶ Performance is key !
- ▶ Make cross platform development easy and as seamless as possible.
- ▶ Maximize accessibility for our game.
- ▶ Build future ready infrastructure.
- ▶ Bring next generation graphics and computing power to the Web.
- ▶ Reduce engine maintenance cost.



Stay tuned for new updates



Social medias: @cocosengine



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