WebXR 在 3D 引擎的实践

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十年移动端 WebGL 开发经验

热爱图形学和 Web，崇尚开源精神

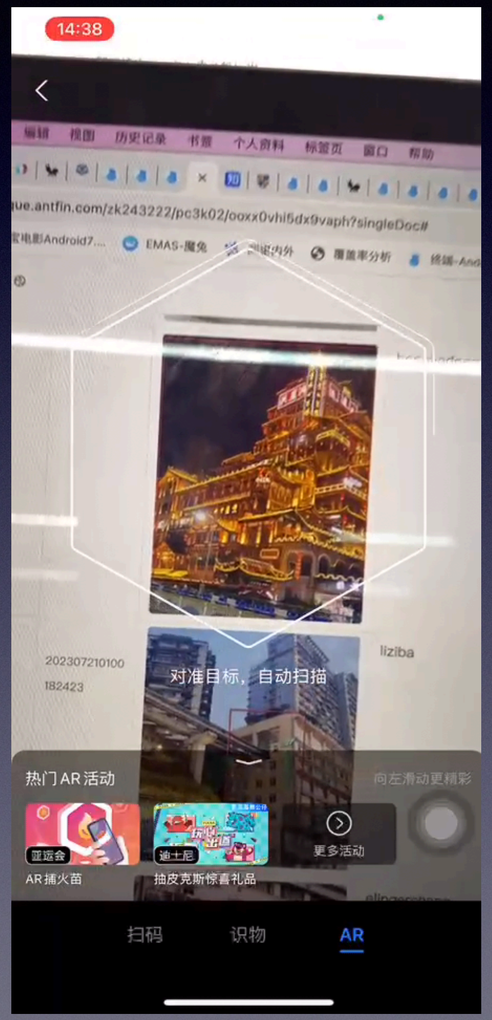
目录

XR 业务诉求

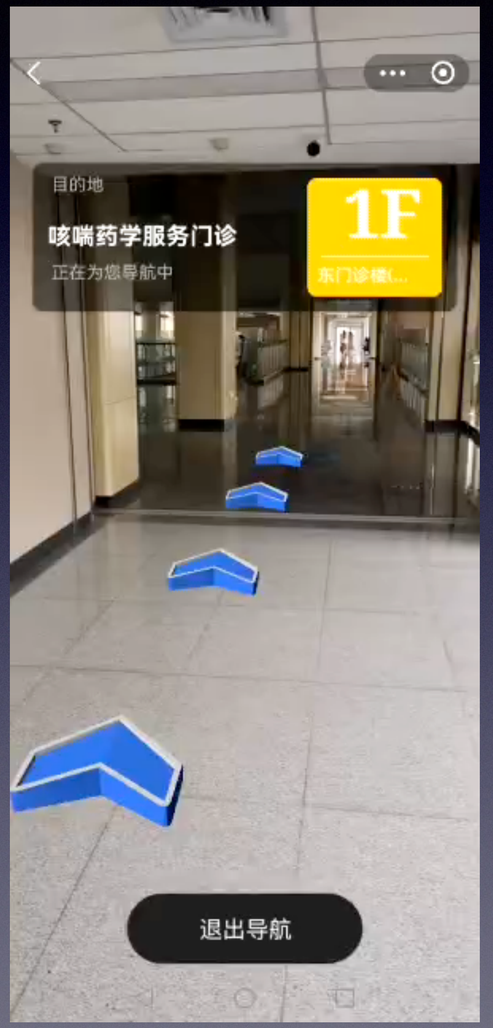
亚运会开幕式

五福活动

线下打卡



空间导航



Web 3D 引擎

Galacean Engine

 专注于移动端 Web

 Entity-Component 架构

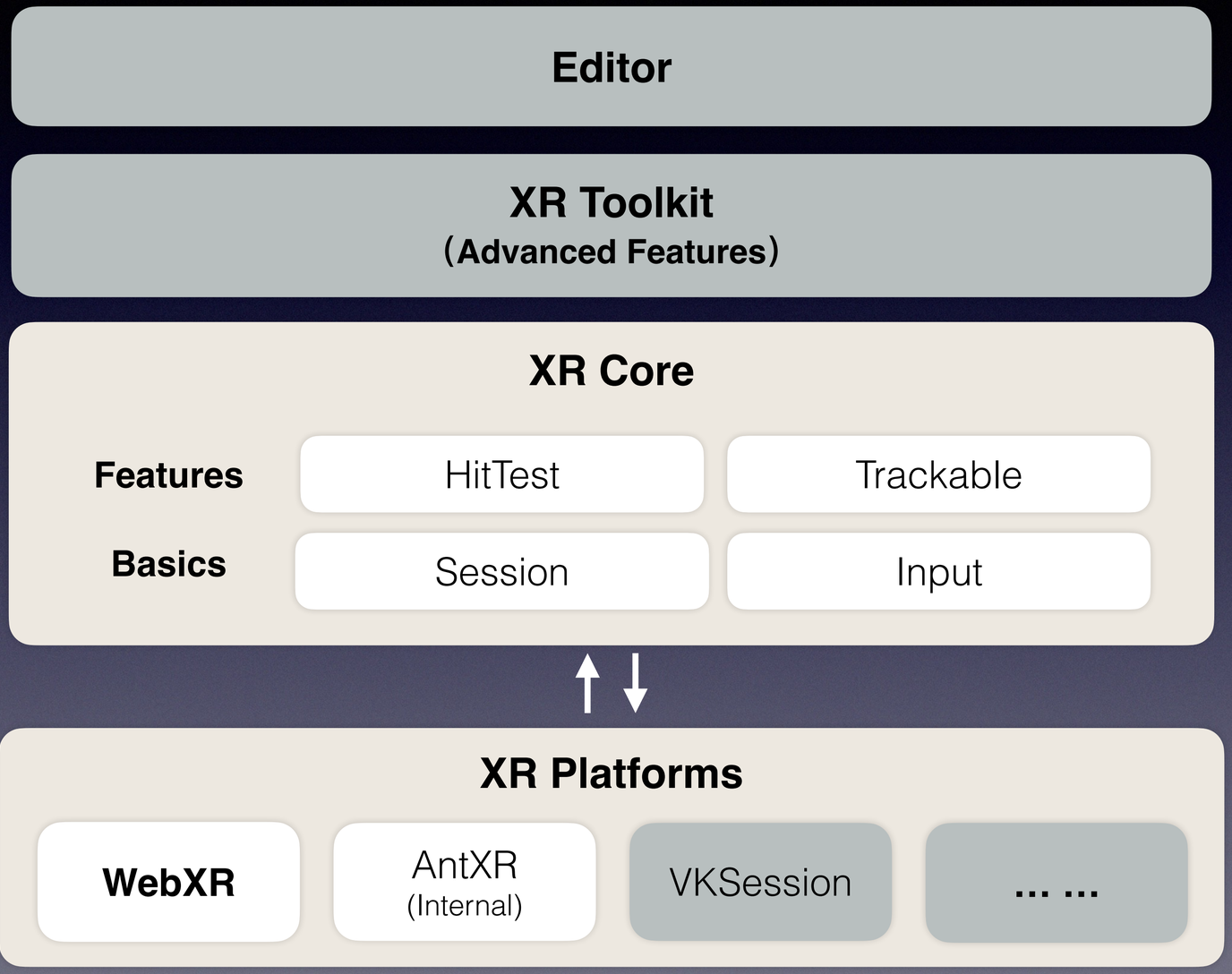
 2021年初开源

为什么选择 WebXR?

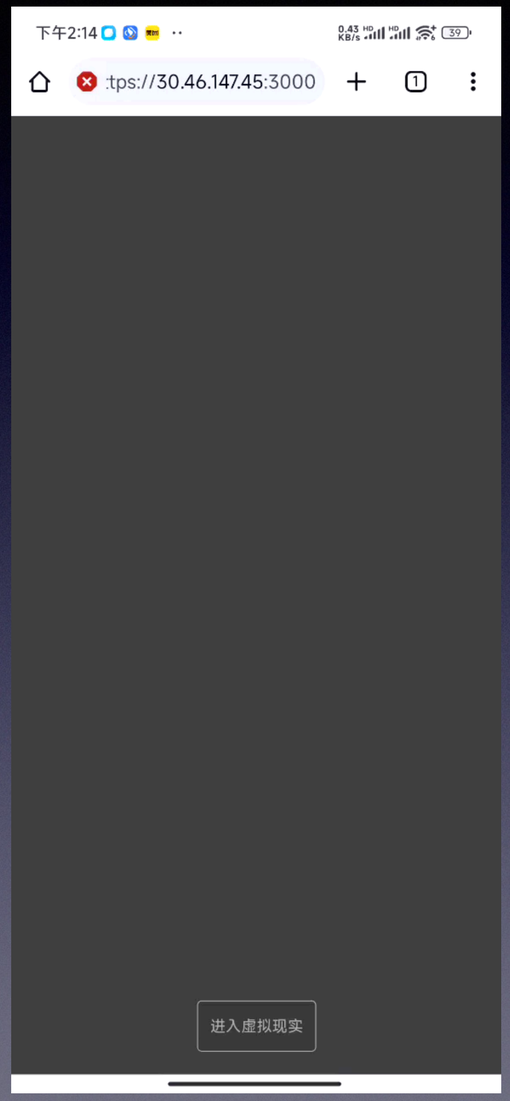
- 与 Galacean Engine 天然融合，达到一体化的开发体验
- Web 标准受欢迎，前端工程师是一方业务开发主力，三方业务更好地实现技术开放
- 面向未来 XR 业务形态和硬件生态做好技术布局

目录

XR 框架的架构

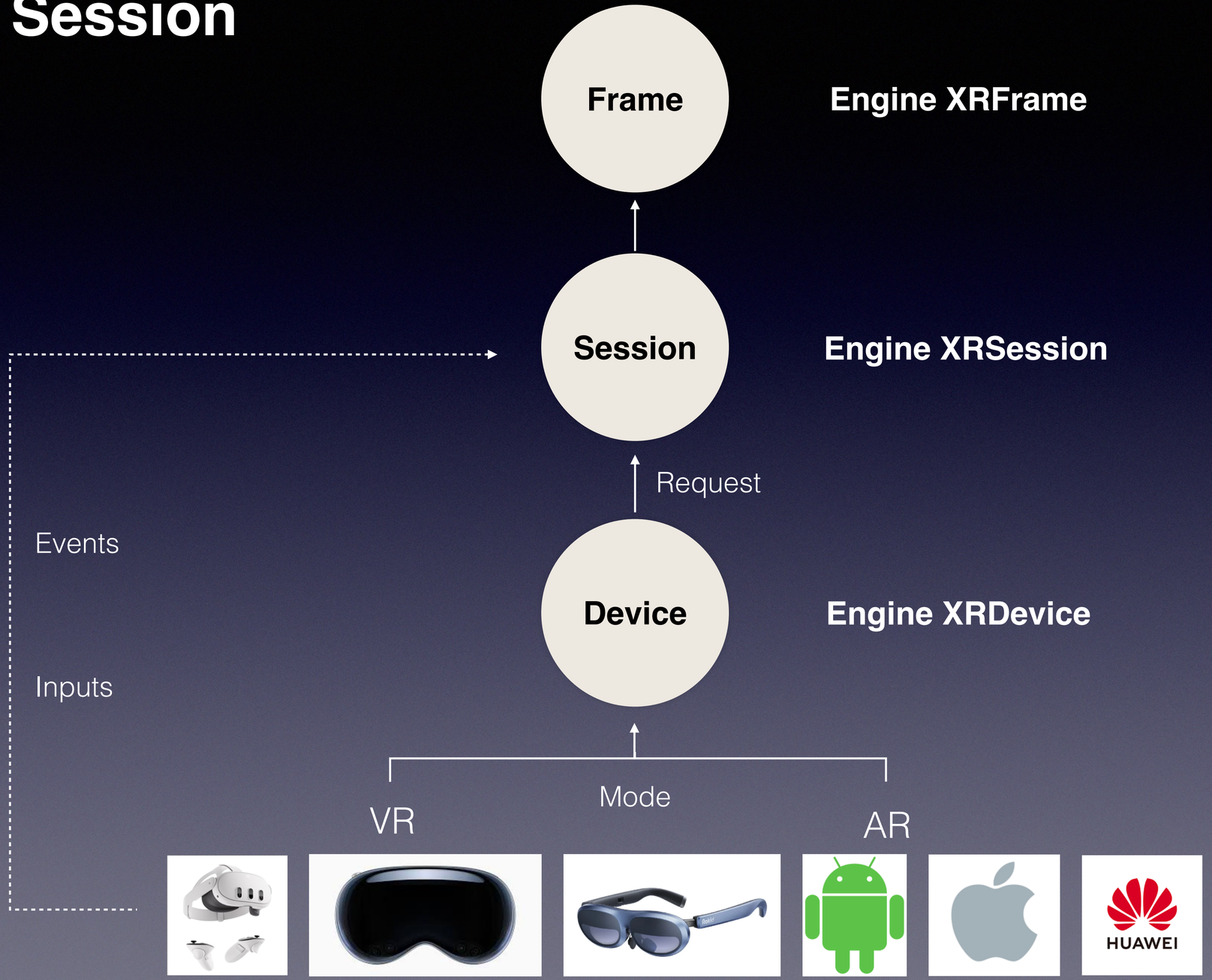

Editor
XR Toolkit
（Advanced Features）
XR Core
Features
HitTest
Trackable
Basics
Session
Input
XR Platforms
WebXR
AntXR
(Internal)
VKSession
... ...

代码示例

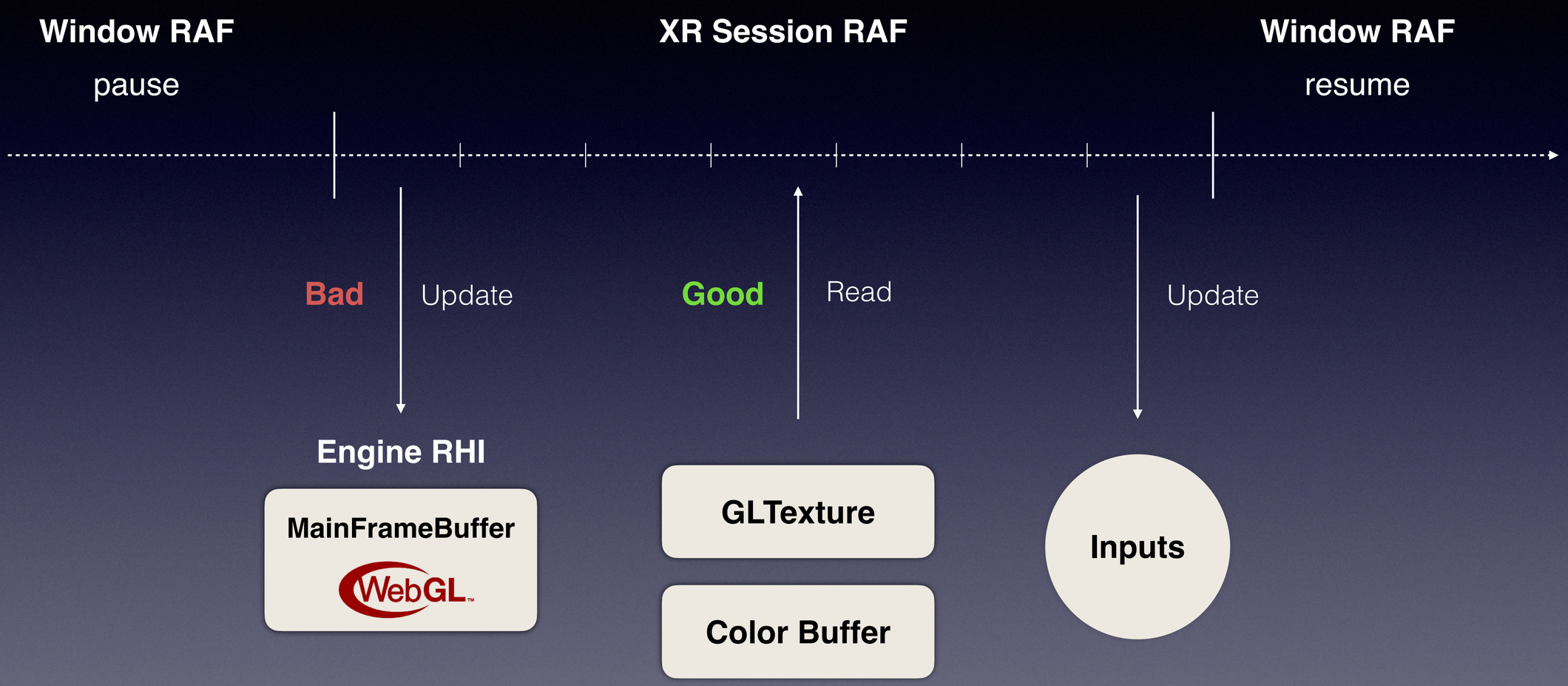



```
14  WebGLEngine.create({
15    canvas: "canvas",
16    xrDevice: new WebXRDevice(),
17  }).then((engine) => {
18    const { sceneManager, xrManager } = engine;
19    const scene = sceneManager.scenes[0];
20    const origin = (xrManager.origin = scene.createRootEntity("origin"));
21    // 添加环境光
22    engine.resourceManager
23      .load<AmbientLight>({
24        type: AssetType.Env,
25        url: "https://gw.alipayobjects.com/os/bmw-prod/f369110c-0e33-47eb-8296-756e9c80f254.bin",
26      })
27      .then((ambientLight) => {
28        scene.ambientLight = ambientLight;
29      });
30    // 添加一个球作为参照物
31    const renderer = origin.createChild("ball").addComponent(MeshRenderer);
32    renderer.mesh = PrimitiveMesh.createSphere(origin.engine, 0.05, 32);
33    const material = new PBRMaterial(origin.engine);
34    renderer.setMaterial(material);
35    material.metallic = 1;
36    material.roughness = 0;
37    // 添加相机，并与 XR 设备关联
38    const camera = origin.createChild("camera").addComponent(Camera);
39    xrManager.cameraManager.attachCamera(XRTrackedInputDevice.Camera, camera);
40    // 点击按钮进入AR
41    (document.getElementById("VRButton") as HTMLButtonElement).onclick = () => {
42      xrManager.enterXR(XRSessionMode.AR);
43    };
44    engine.run();
45  });
```

Device & Session



Frame


Window RAF
pause
XR Session RAF
Window RAF
resume
Bad
Update
Good
Read
Update
Engine RHI
MainFrameBuffer
WebGL
GLTexture
Color Buffer
Inputs

Input

Camera

Camera

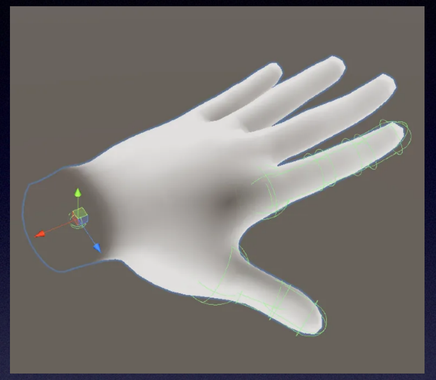
LeftCamera

RightCamera

Controller

LeftController

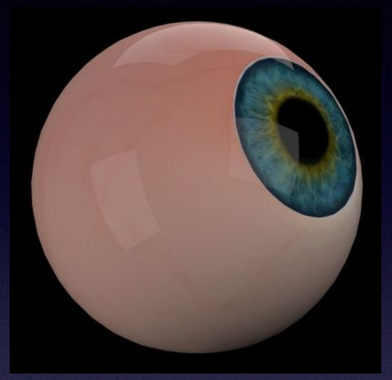
RightController



Hand

LeftHand

RightHand



Eye

Input - Camera

Device Camera —Attach→ **Engine Camera** —ClearMask→ **RenderPipe**

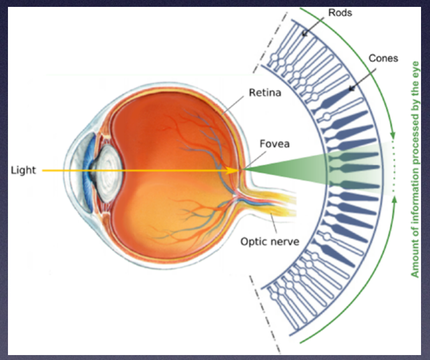
Transform Viewport ProjectionMatrix

ClearMask: **Bad**

Glass

Attach **Batch Render** Attach

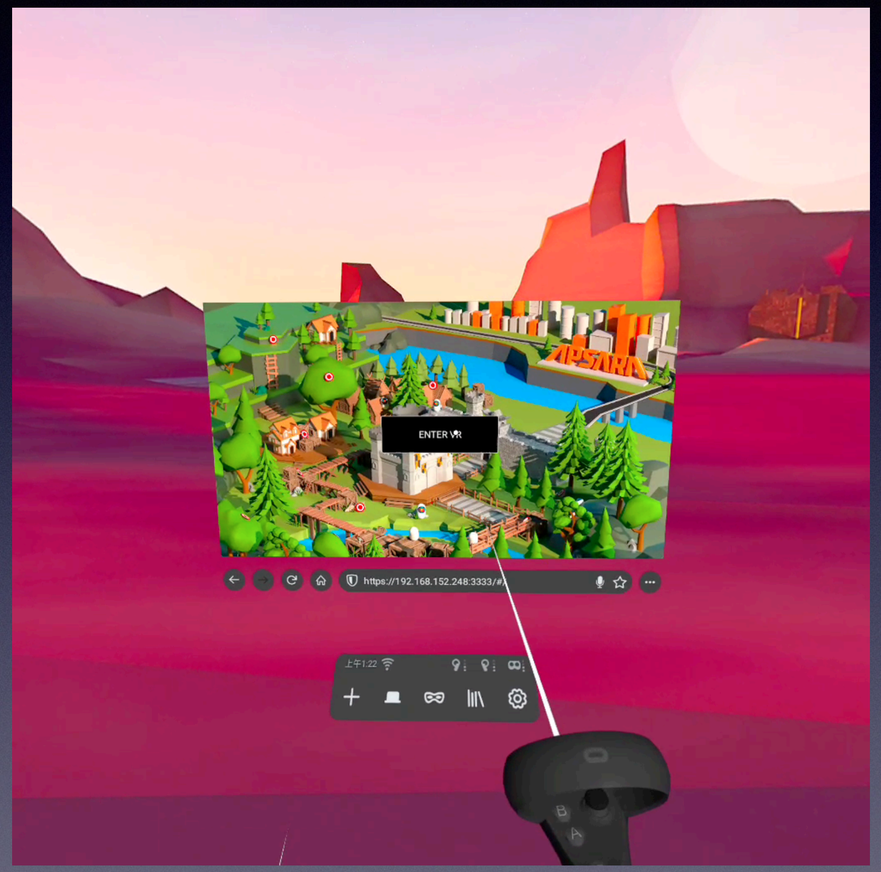
Left Camera **Right Camera**



Biological foveation mechanism, from Bear et al. (2007)

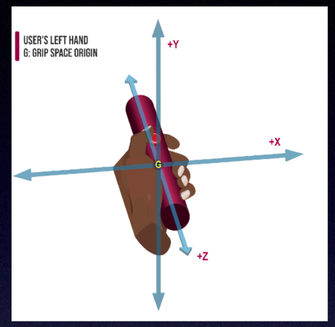
Foveation
(Performance issue)

Input - Controller

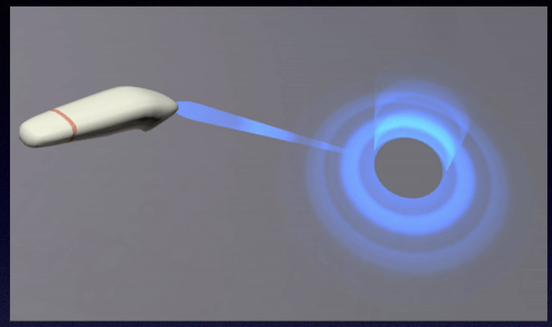


Poses

Grip Pose



Target Ray Pose



From https://developer.mozilla.org/

Buttons

Select | **Squeeze** | Trigger | AButton | BButton

Events Queue

Select Start ---Select---▸ Select End

Squeeze Start ---Squeeze---▸ Squeeze End

Feature

Trackable

HitTest

Depth Sensing

Lighting Estimation

Feature - Trackable

Trackable Type

Anchor

Plane

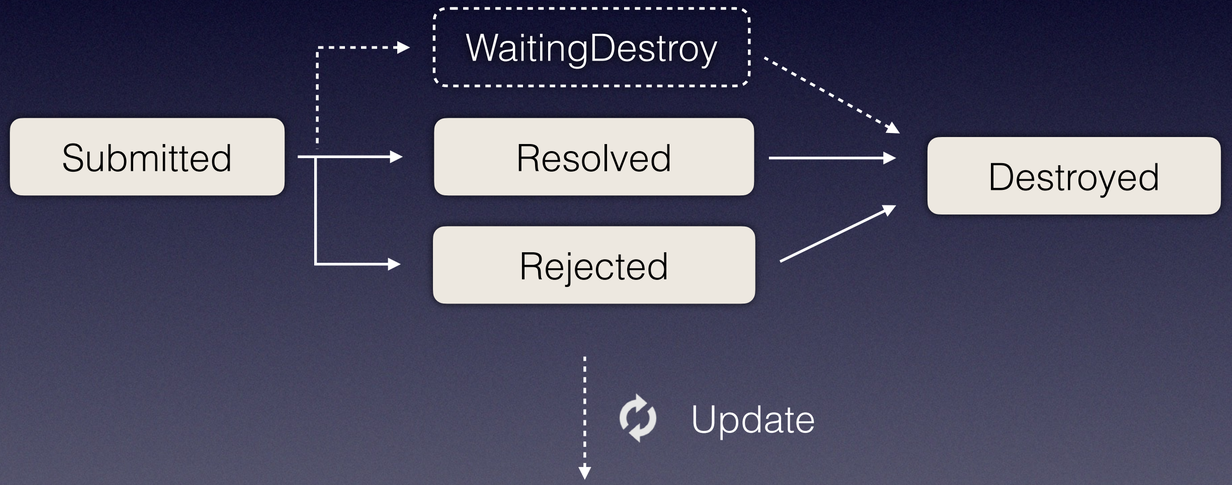
Image

Body

Face

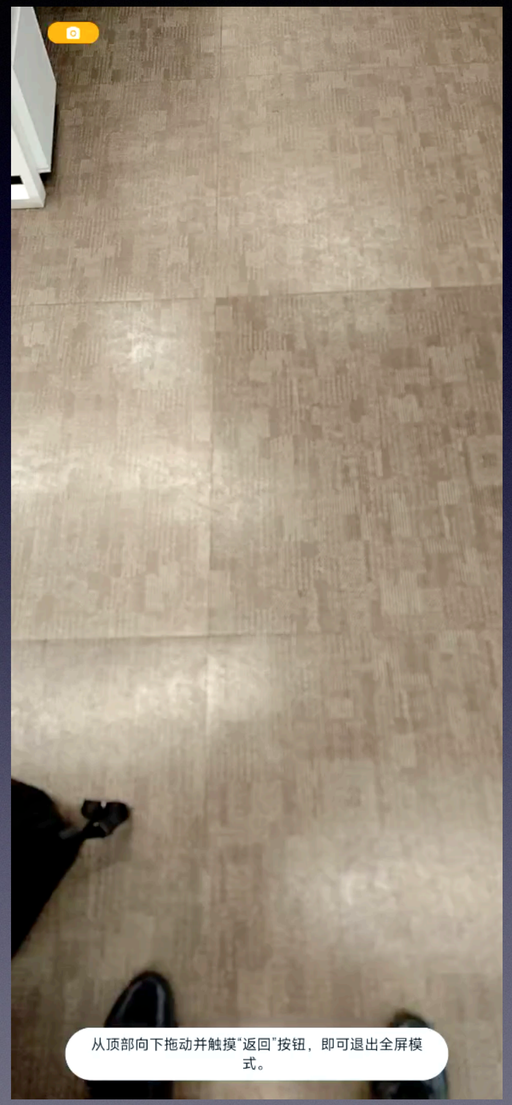
Request Tracking State

WebXR



Tracked Objects

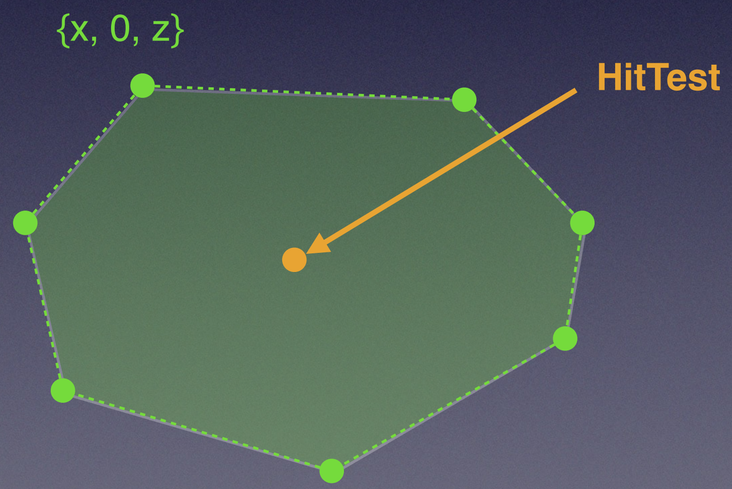
Feature - Trackable Plane



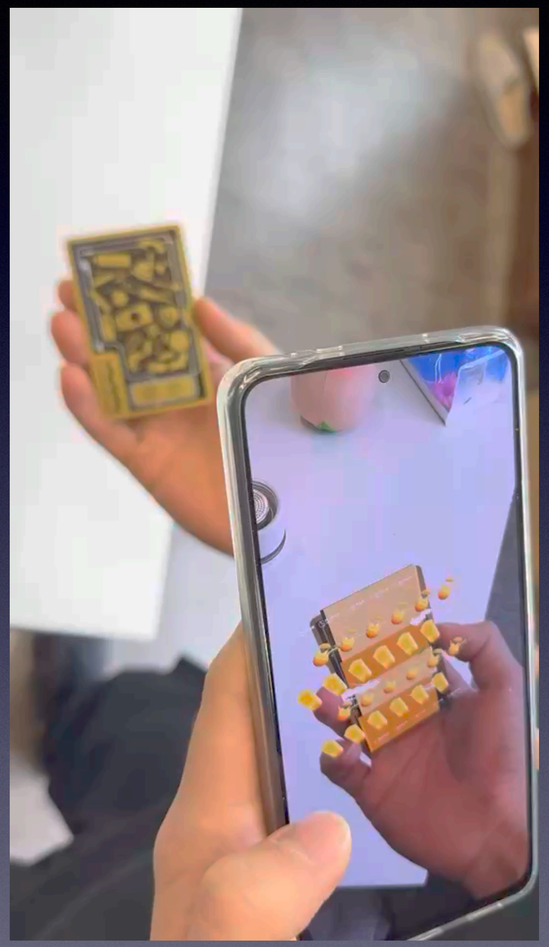
Plane Mode Horizontal | Vertical

Pose Position Rotation Matrix Inverse Matrix

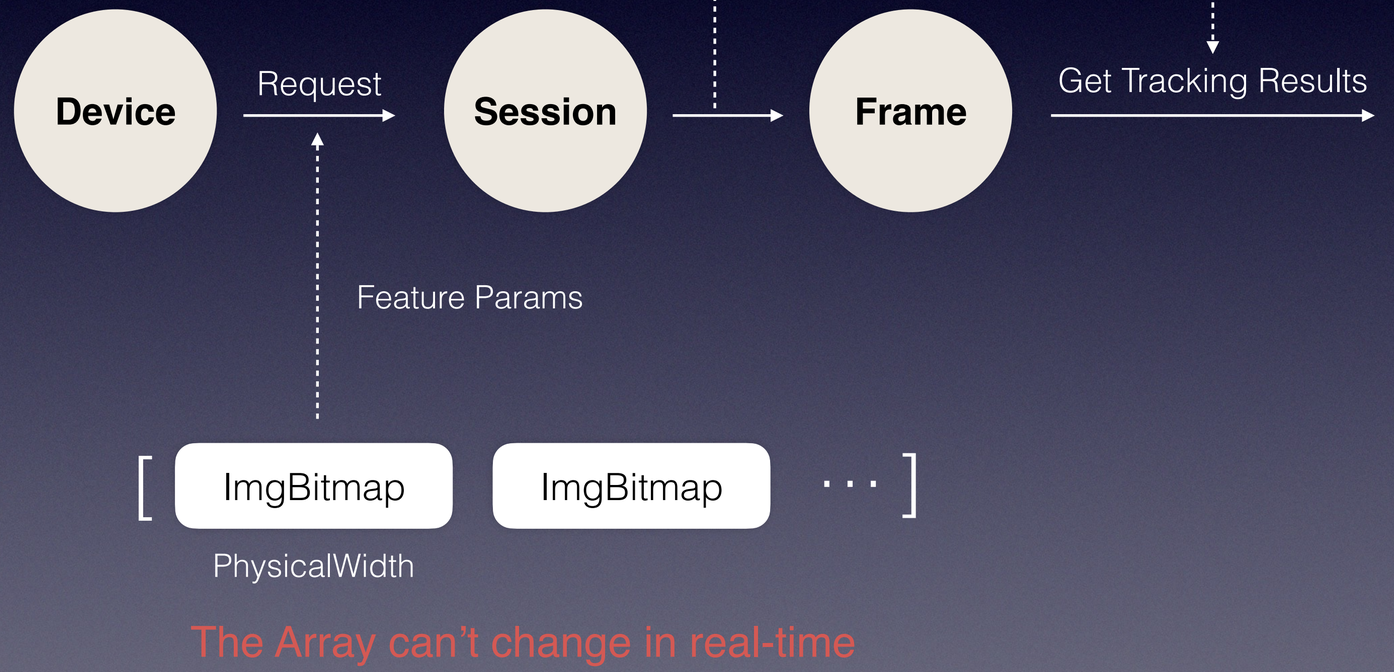
Polygon

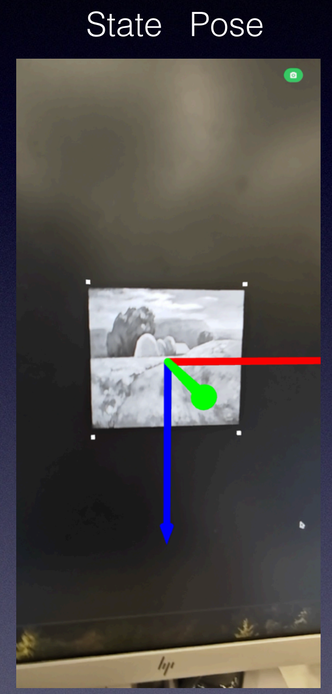


Feature - Trackable Image



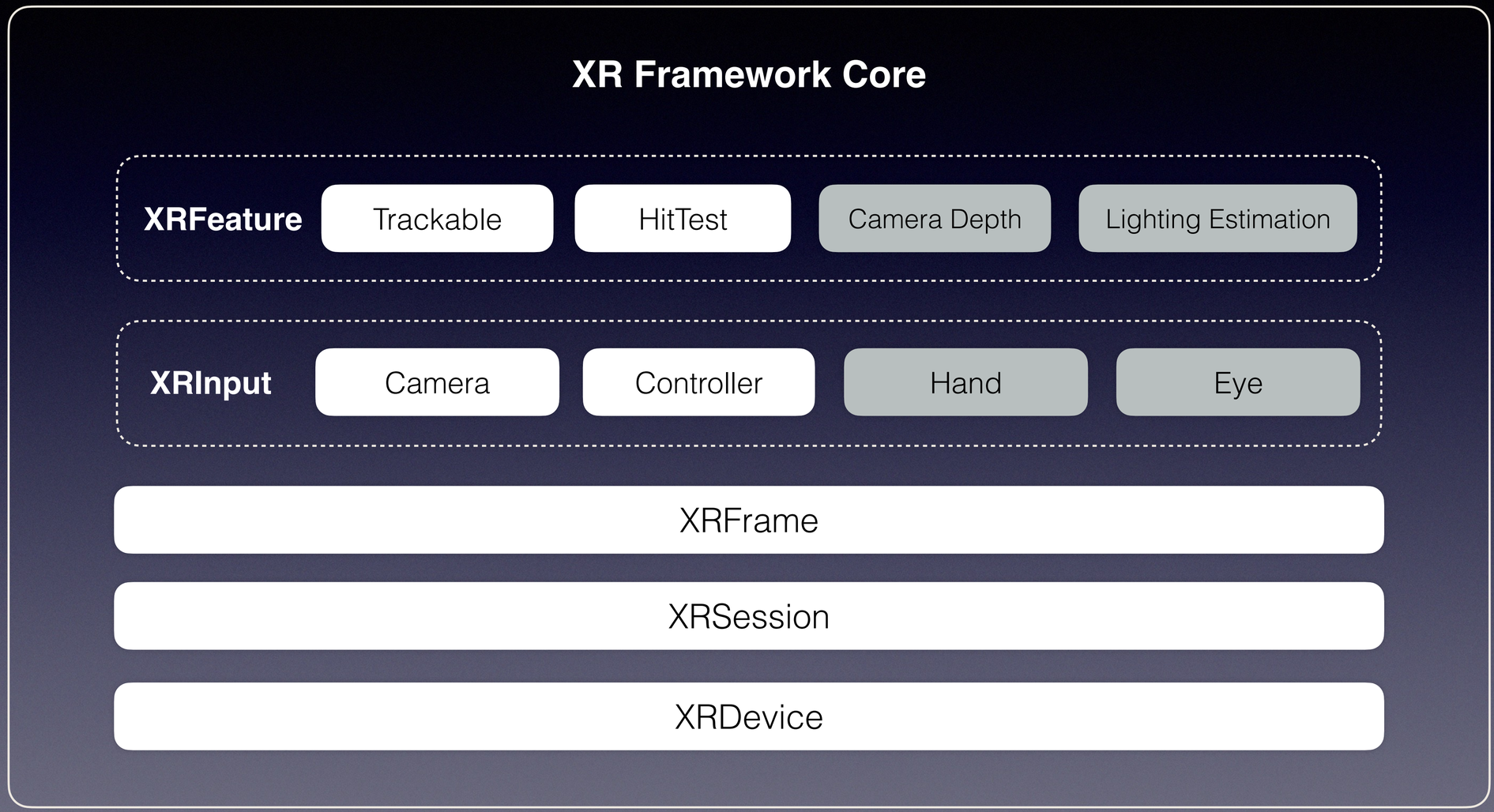
Each tracked image can appear at most once





The Array can’t change in real-time

XR 框架核心小结


XR Framework Core
XRFeature
Trackable
HitTest
Camera Depth
Lighting Estimation
XRInput
Camera
Controller
Hand
Eye
XRFrame
XRSession
XRDevice

WebXR 问题小结

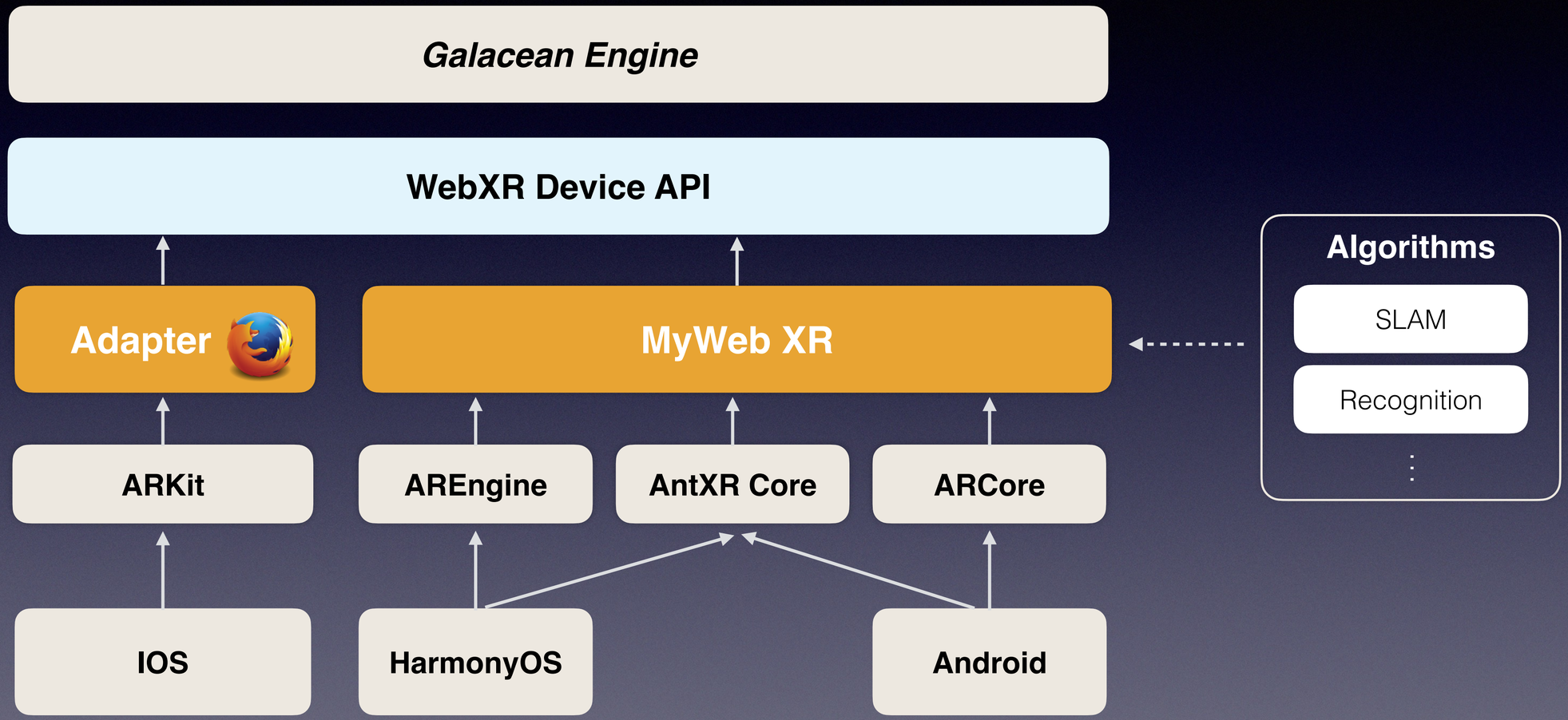
- XR Session 入侵 RAF 和 MainFrameBuffer
- Tracking feature 各类 API 不一致

- WebXR 众多标准尚处草案阶段

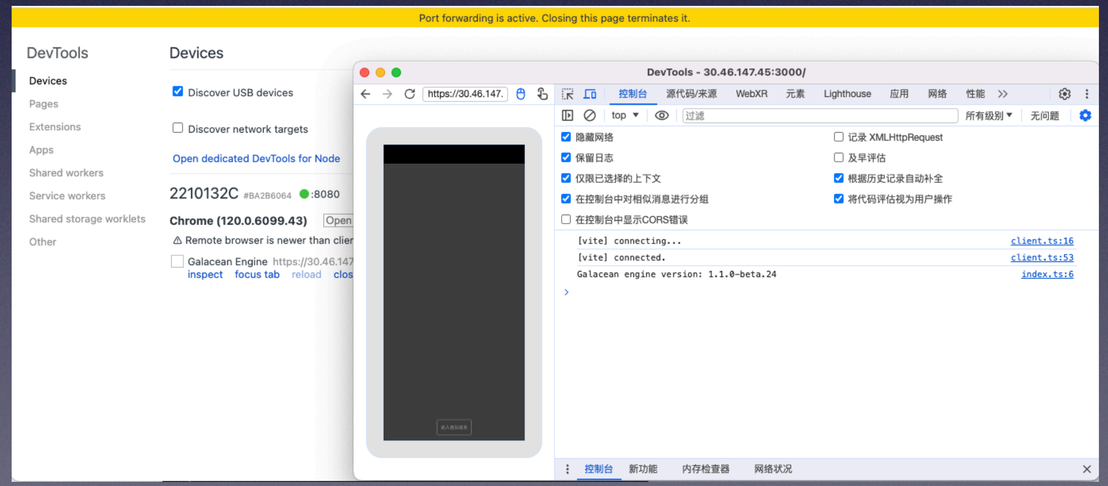
WebXR Layers API	Draft Standard
WebXR Device	Candidate Standard
WebXR Gamepads	Draft Standard
WebXR Hand Input	Draft Standard
WebXR DOM Overlays	Draft Standard
WebXR Augmented Reality	Candidate Standard
WebXR Lighting Estimation	Draft Standard
WebXR Depth Sensing	Draft Standard
WebXR Hit Test	Draft Standard
WebXR Image Tracking	Early Draft
WebXR Plane Detection	Early Draft
.....	

目录

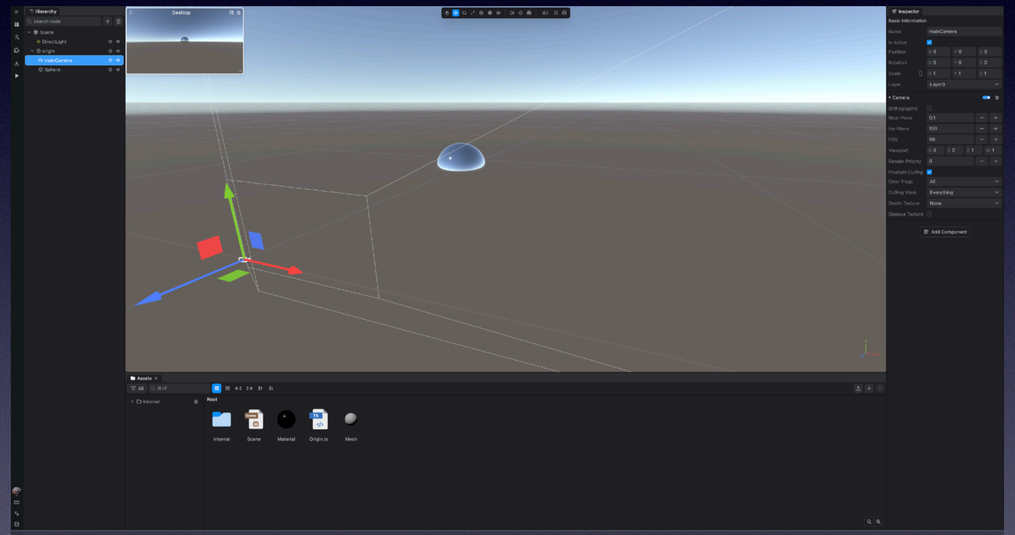
客户端 WebXR 基建


Galacean Engine
WebXR Device API
Adapter
MyWeb XR
Algorithms
SLAM
Recognition
ARKit
ARCore
IOS
HarmonyOS
Android

XR 编辑器



可视化编辑、调试



Thanks!