

# FUGU 项目介绍 与技术实践

宋方振



- 公司:  ByteDance 字节跳动
- 部门: Web Lab (开源、XR、AI etc)
- 工作经历:
  - 2020.06 – 2021.06 Chromium 开源社区  
(Fugu、PWA)
  - 2021.07 – 至今 XR  
(WebXR、MetaWeb)
- 公开组织:
  -  Chromium 开源社区 (Committer)
  -  W3C Immersive Web Working Group (Participants)

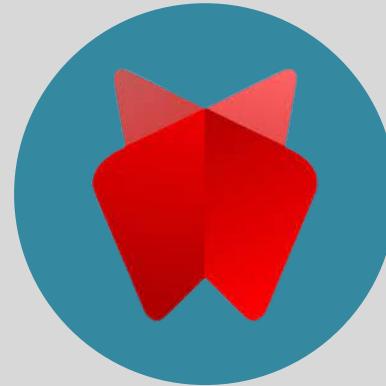
## 个人介绍



# Outline



FUGU 项目介绍



技术实践 (WEBXR)



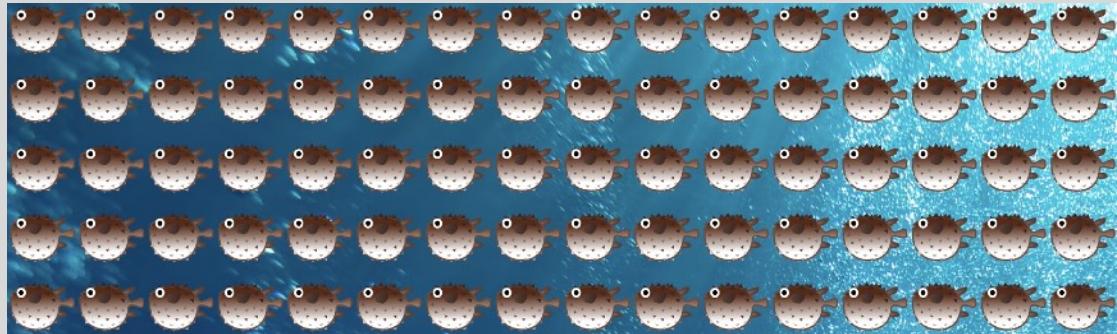
能力扩展  
(METAWEB)



# FUGU 项目介绍

"Web apps should be able to do anything iOS, Android, or desktop apps can."

# 项目背景



对比	河豚	Fugu
特点	较强的毒性	Web API(s) 访问设备硬件和操作系统功能
处理得当	餐桌上的美味	更加全面的系统操纵能力 增加应用的跨端能力



## 终极目标：

仅有一个 Web 浏览器，可以做到任何现有 App 可以做到的事情。

# 能力状态

Chromium <https://fugu-tracker.web.app>

The screenshot shows the Fugu API Tracker interface. At the top, there's a navigation bar with tabs for STABLE, BETA, and DEV. Below it, three versions of Chromium are listed:

- Chromium 113 (STABLE, Stable 34 days ago, May 2, 2023)
- Chromium 114 (BETA, Stable 6 days ago, May 30, 2023)
- Chromium 115 (DEV, Stable in 43 days, Jul 18, 2023)

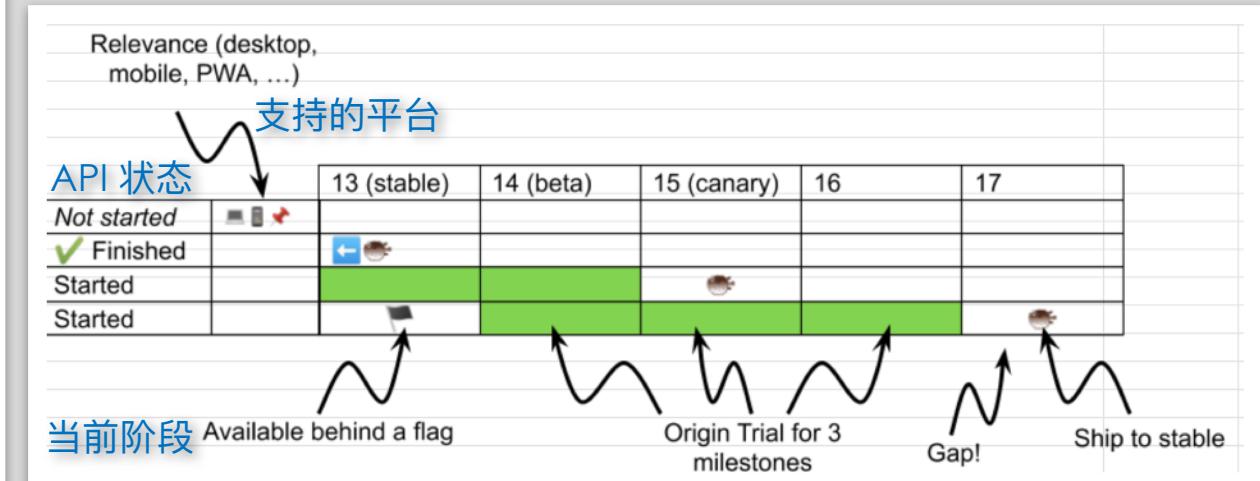
On the left, a blue box labeled "当前状态" (Current Status) contains the text "Chromium".

Below the releases, there's a section titled "Shipped # Fugu API 列表" (List of Fugu APIs). It lists several APIs with their corresponding milestones and supported platforms (Android, Chrome, Linux, macOS, Windows).

API	Milestone	Platforms
Web Bluetooth API	M56	Android, Chrome, Linux, macOS, Windows
WebUSB API	M61	Android, Chrome, Linux, macOS, Windows
Web Share Target	M71	Android
Web Share API Level 2	M75	Android
Async Clipboard: Read and Write Images	M76	Android, Chrome, Linux, macOS, Windows
Web Share Target Level 2	M76	Android

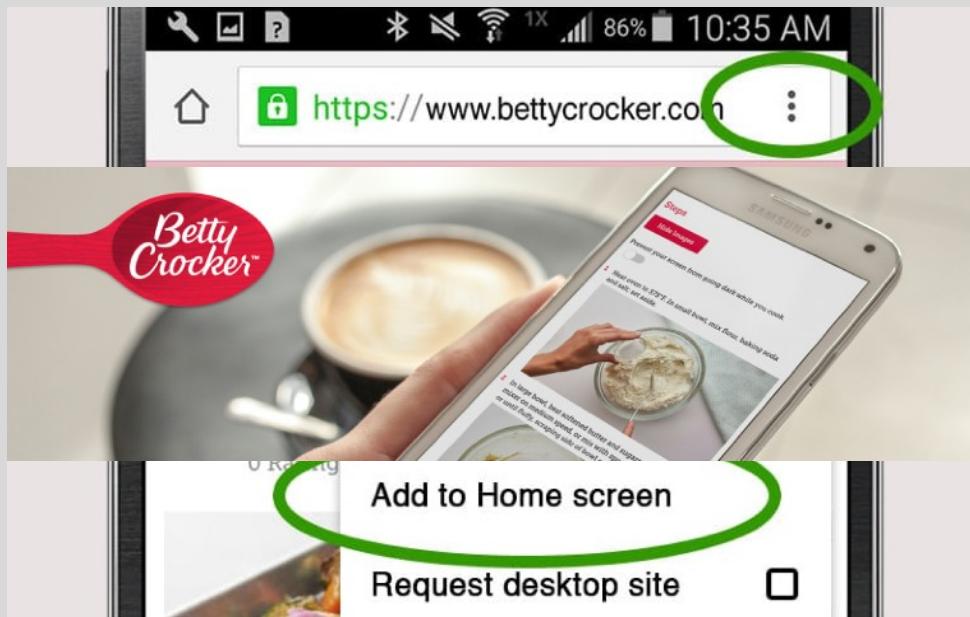
常用 API:

Wake Lock  
Web Share Target  
Badging API  
File System Access  
WebCodec

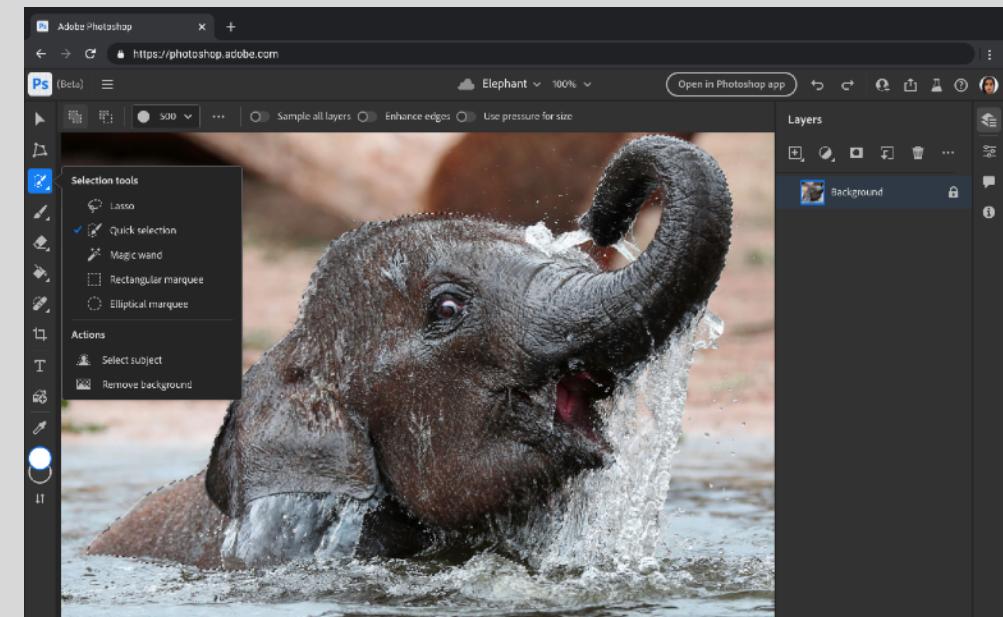


# 应用示例 01

## Betty Crocker Web 版



## PhotoShop Web 版



### 关键技术：

Wake Lock、Window Placement

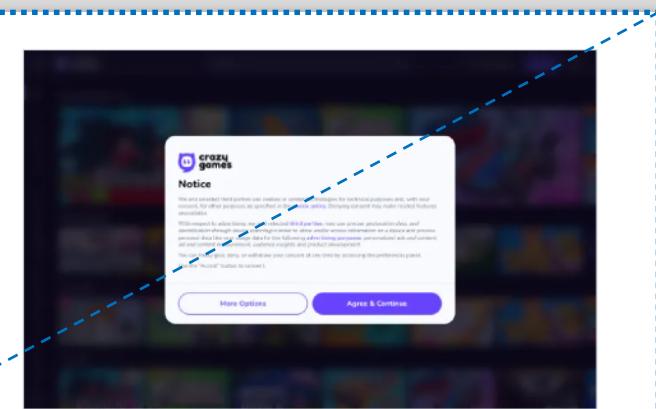
### 关键技术：

WebAssembly、Service Worker

# 应用示例 02

<https://developer.chrome.com/fugu-showcase>

The screenshot shows the homepage of the Project Fugu API Showcase. The main title is "Project Fugu API Showcase". Below it, there's a brief description: "The Project Fugu API Showcase is a collection of apps that make use of APIs that were conceived in the context of Project Fugu. You can learn more about Project Fugu on the [Capabilities](#) landing page." A "Submit a new app" button is visible. On the left, a sidebar menu includes "Home", "Docs", "Blog", and "Articles". At the bottom, there's a search bar labeled "Search apps", a "FILTER BY" dropdown set to "Select API", and a green "RSS feed" button. Three small screenshots of different apps are shown at the bottom: a game interface, a 3D model editor, and a dark-themed app.



Launch app Web App

CrazyGames - Free Online Games on [CrazyGames.com](#)

Play free online games at CrazyGames, the best place to play high-quality browser games. We add new games every day. Have fun!

Add to Home Screen Device Memory

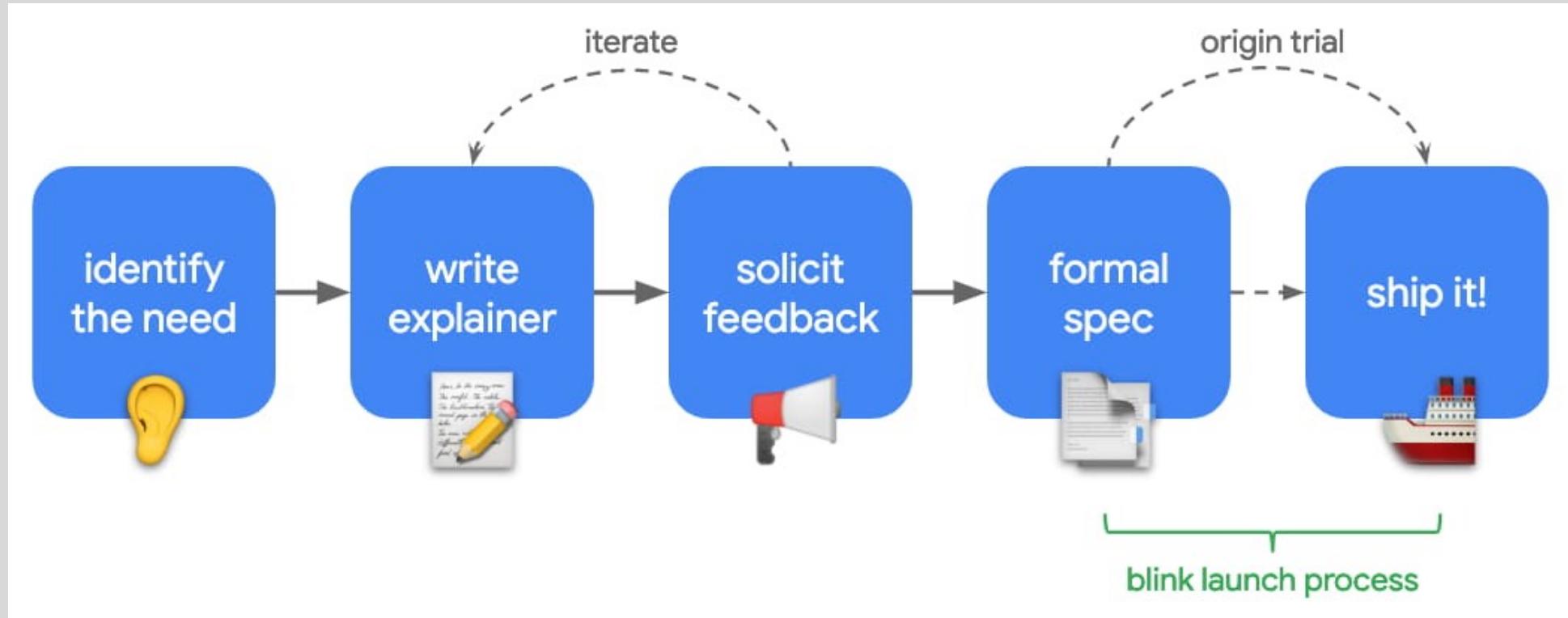
Service Worker Web Share

Web Share (Files)

用到的  
Fugu API(s)

# Copy link

# 开发流程



发现需求

撰写  
说明文档

项目审查  
文档更新  
代码开发

输出  
标准文档

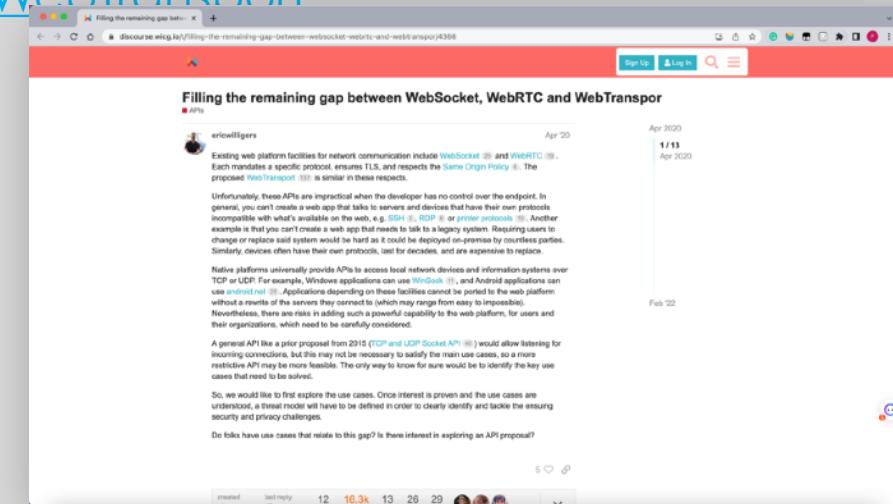
使能特性

# 案例详解 – Direct Sockets 01

IWA 状态: Started

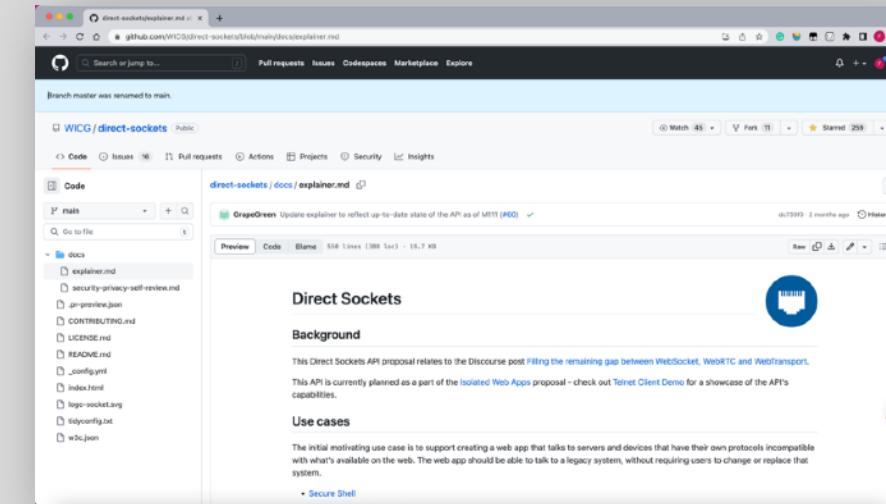
发现需求

[“Filling the remaining gap between WebSocket, WebRTC and WebTransport”](#)



撰写说明文档

<https://github.com/WICG/direct-sockets/blob/main/docs/explainer.md>



# 案例详解 – Direct Sockets 02

IWA 状态: Started

## 项目审查

### TCPSocket

```
interface TCPSocket {  
    [RaisesException, CallWith=ScriptState, NotEnumerable]  
    Promise<void> close();  
  
    readonly attribute DOMString remoteAddress;  
    readonly attribute unsigned short remotePort;  
    readonly attribute ReadableStream readable;  
    readonly attribute WritableStream writable;  
};
```

IDL

```
const options = {  
    remoteAddress: 'example.com',  
    remotePort: 7,  
    keepAlive: false,  
    noDelay: false  
};  
navigator.openTCPsocket(options).then(tcpSocket => { ... }).else(error => { ... });  
  
let readableStream = tcpSocket.readable;  
let writableStream = tcpSocket.writable;  
...  
tcpSocket.close();
```

示例

## 文档更新

### Security Considerations

“web app 可能会在用户没有意识到的情况下进行网络连接的发起。”

#### 应对策略

This web application is requesting permission to connect to a network device.  
If you would like to proceed, please enter the device's IP address or hostname.

Address:

Port:

Allow future connections to this address from **www.example.com**

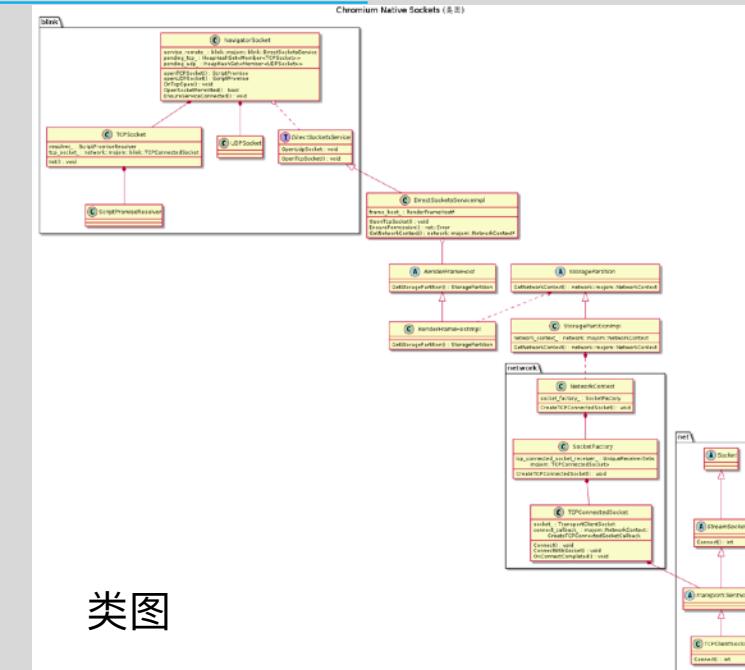
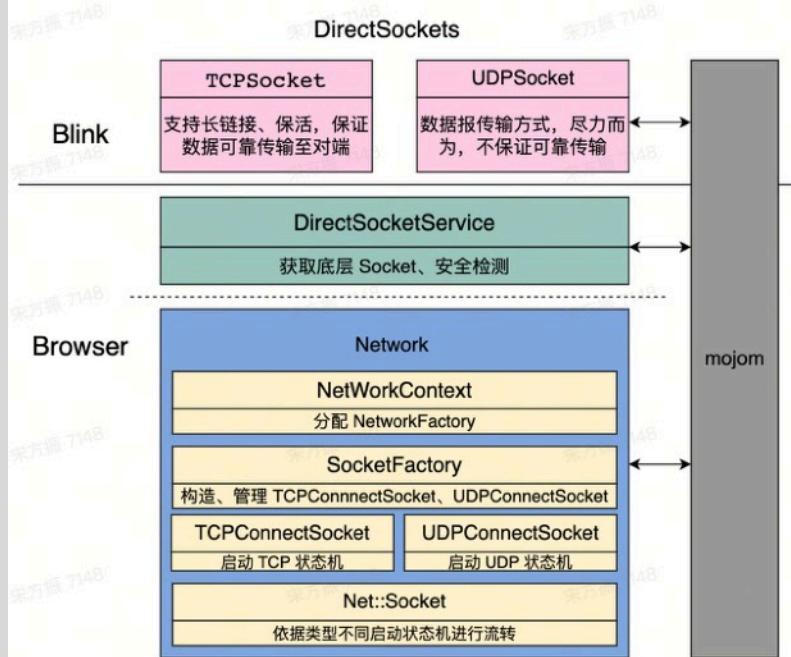
**Proceed** **Cancel**

# 案例详解 – Direct Sockets 03

IWA 状态: Started

代码开发

[Issue 905818: TCP Socket client web API](#)



类图



# 技术实践

WebXR

# 项目背景

Web API



运行平台

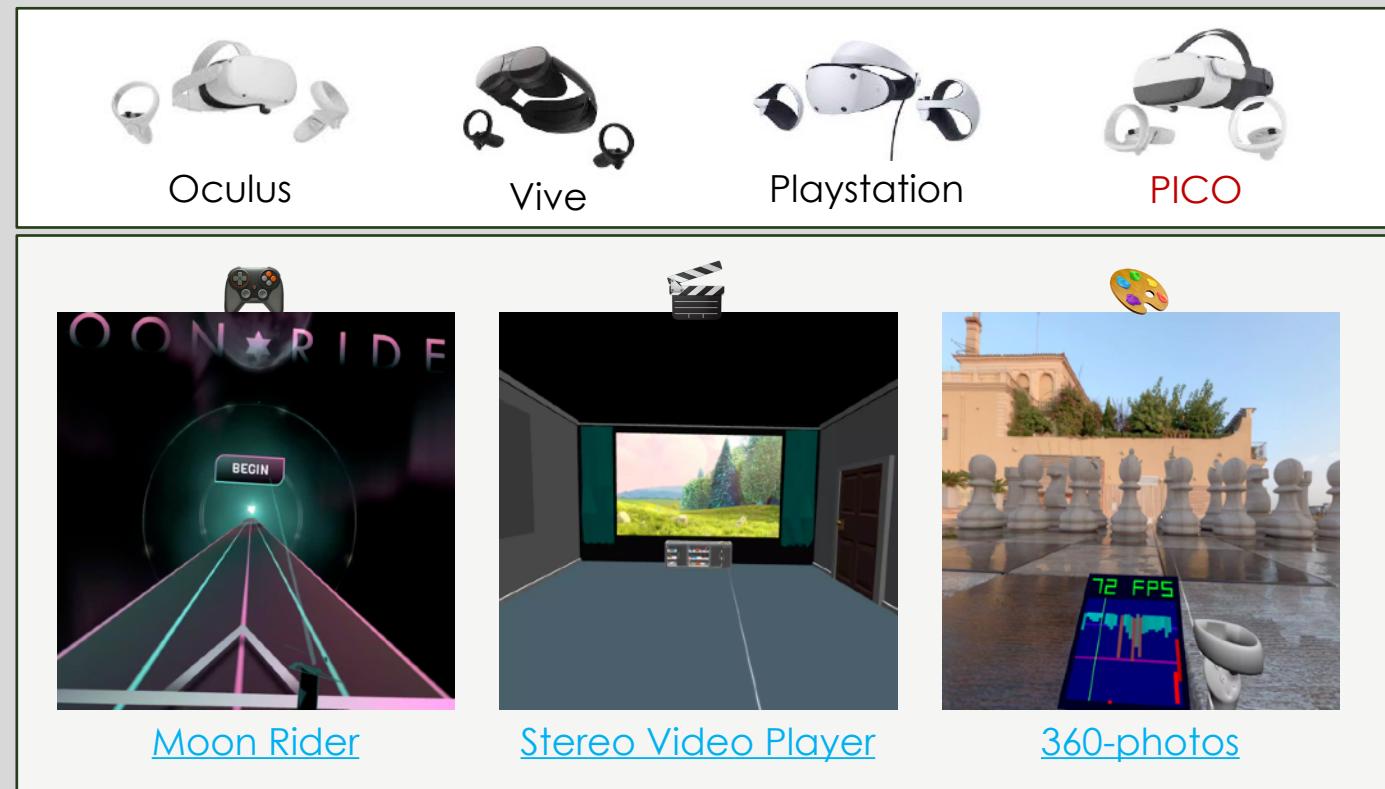
VR / AR 设备

能力提供

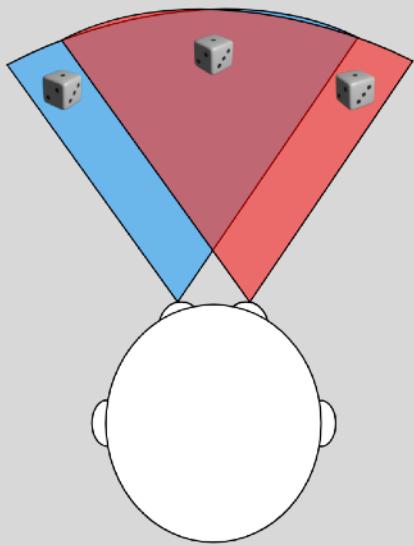
头部追踪  
手部姿势  
3D 场景渲染  
手柄交互

应用类型

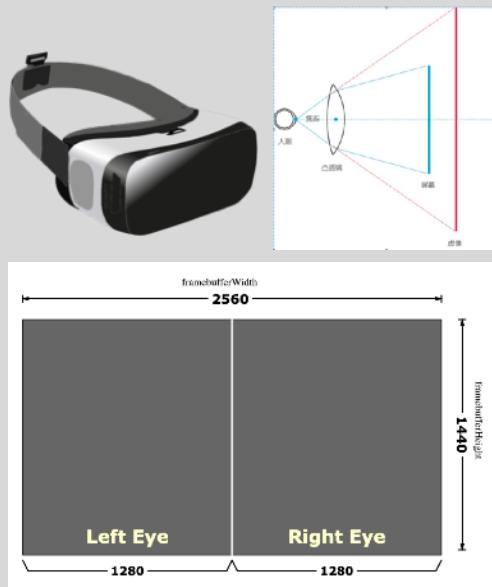
游戏  
视频  
图片



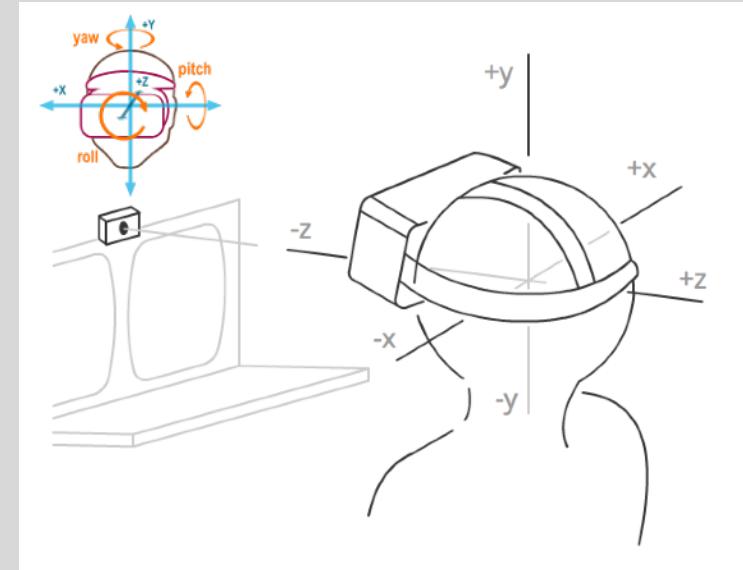
# 基础知识



FOV (field of view)  
双目成像  
产生立体感

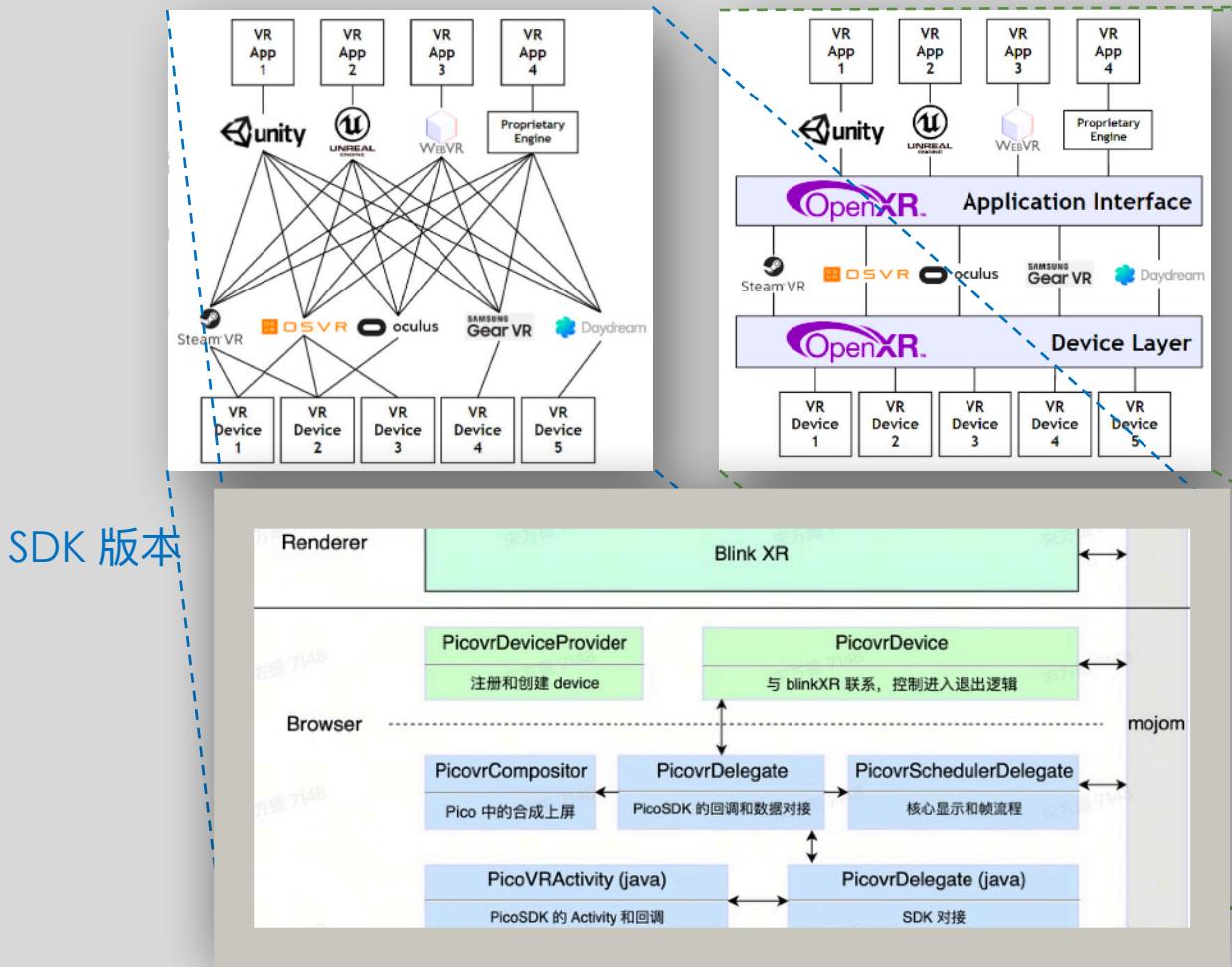


HMD (Head-Mounted Display)  
显示分区  
透镜折射

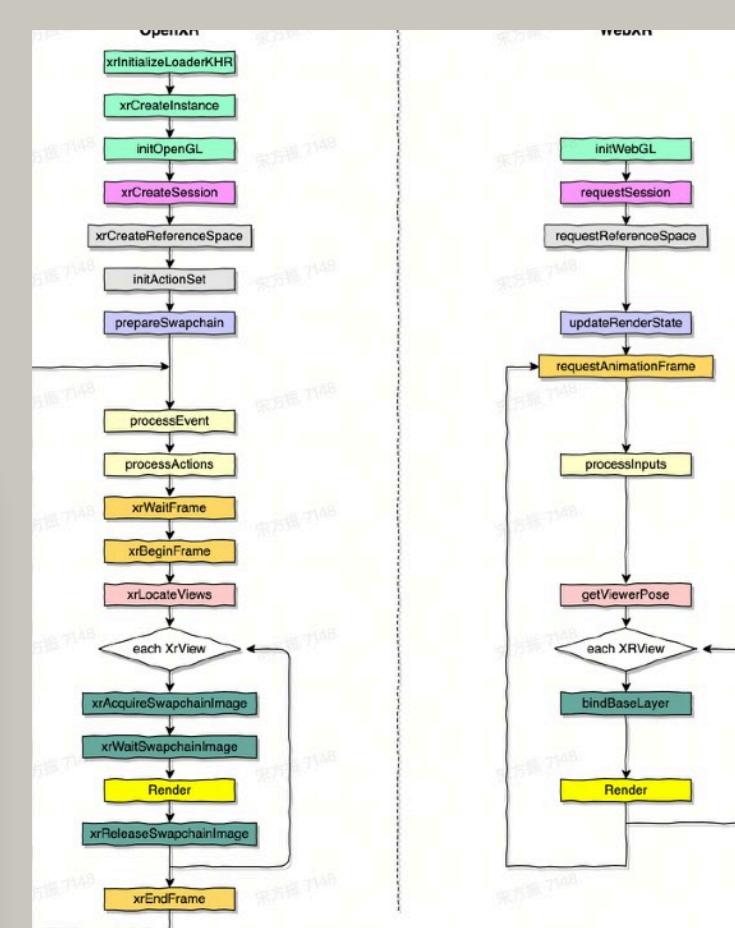


DOF (Degrees of freedom)  
旋转角度  
位移距离

# 能力支持



## OpenXR 版本



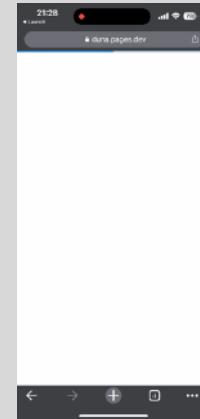
# 页面跳转 - 背景

WebXR APP



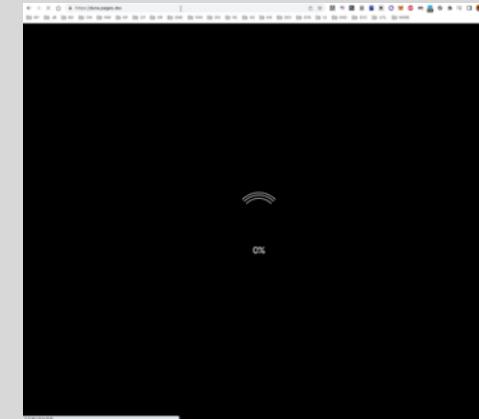
冗余 2D 页面

mobile



企业/品牌官网

desktop



WebXR



三端不一致的用户体验



A-FRAME [link](#)

流畅导航穿梭效果

# 页面跳转 - 实现

效果展示



启动进入沉浸  
流畅页面切换

[immersive-web/navigation](https://github.com/immersive-web/navigation)

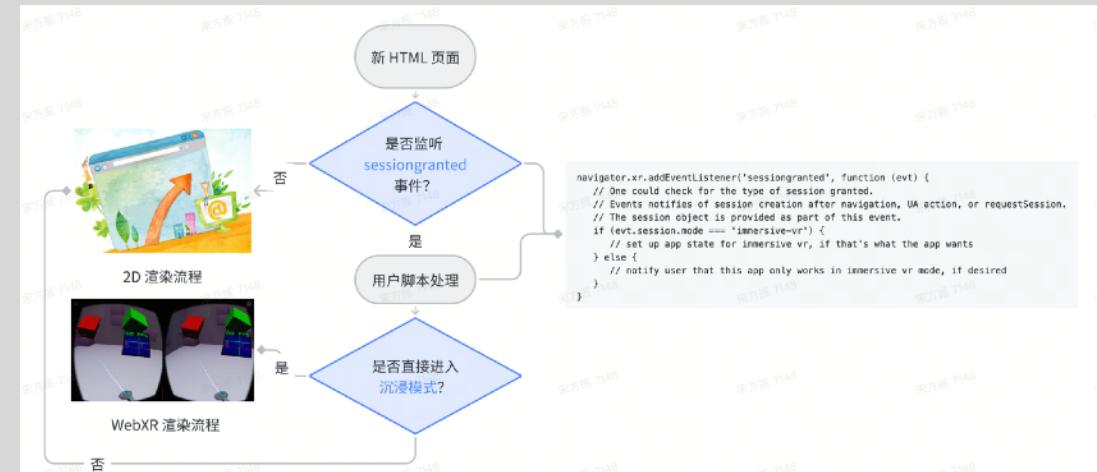
UA initiated immersive sessions

Motivation

Current workflow to request a WebXR session requires user gesture activation. 2D pages usually provide a button that users click or tap to allow immersive mode, preventing pages to take over the display inadvertently without user's permission.

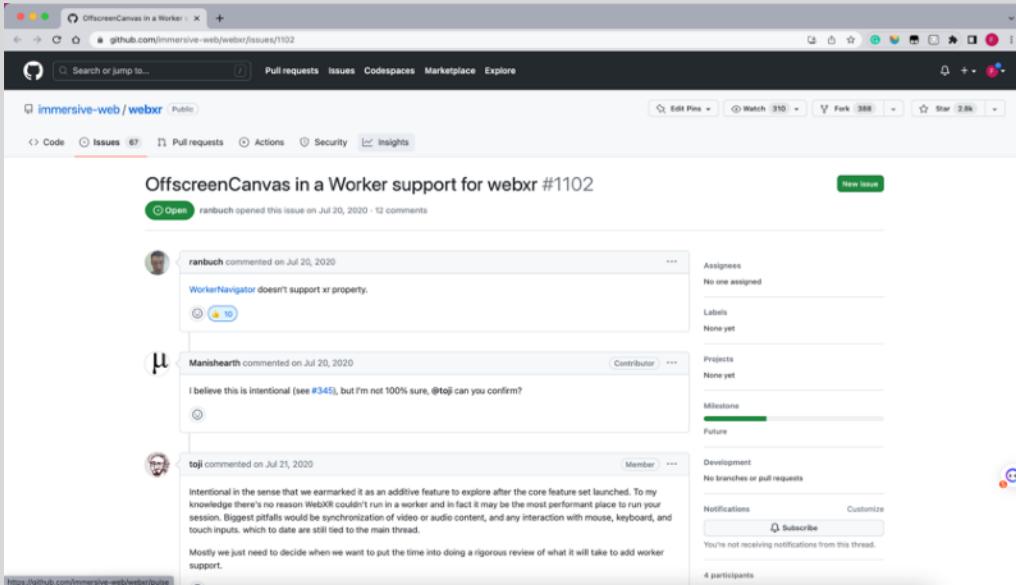
Some scenarios like in-vr navigation require pages to enter immersive mode immediately without loading a 2D page first. UAs need an additional standard mechanism to explicitly grant immersive sessions. Browsers will have the responsibility to inform the user and ask for appropriate permissions outside of the context of a 2D page.

流程示意



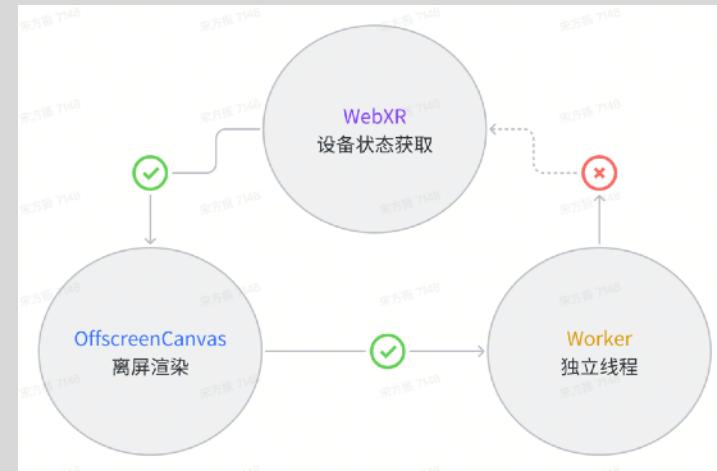
# 独立线程 - 背景

[immersive-web/webxr](#)

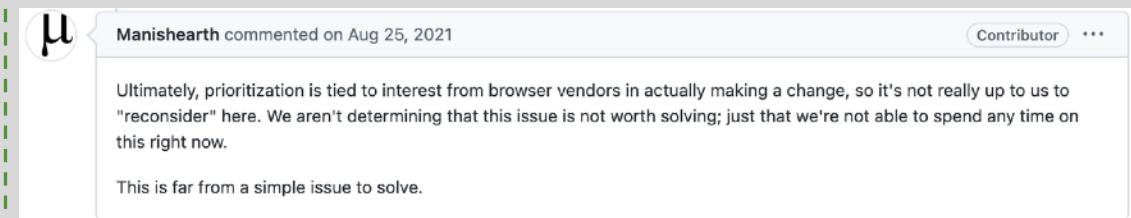


[WorkerNavigator 尚未支持 xr 属性](#)

能力状态



社区规划



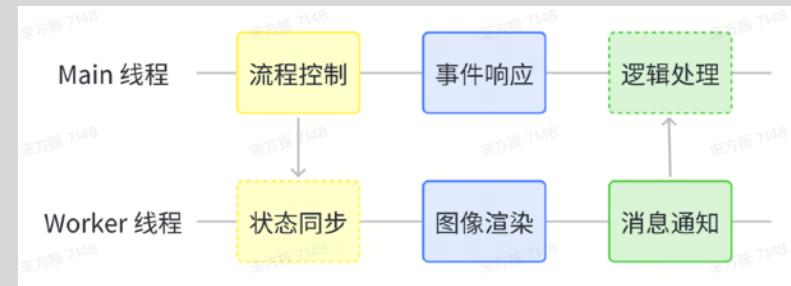
# 独立线程 - 实现

效果展示



独立线程渲染  
逻辑渲染分离

流程示意



IDL

```
// Copyright 2017 The Chromium Authors. All rights reserved.  
// Use of this source code is governed by a BSD-style license that can be  
// found in the LICENSE file.  
  
// https://immersive-web.github.io/webxr/#xrsystem-interface  
// WebXR system 基本接口声明  
[  
  SecureContext,  
  Exposed=DedicatedWorker, Window,  
  RuntimeEnabled=WebXR  
] interface XRSystem : EventTarget {  
  attribute EventHandler ondevicechange;  
  [CallWith=ScriptState, DeprecateAs=XRSupportsSession, RaisesException] Promise<void> supportsSession(XRSessionMode mode);  
  [CallWith=ScriptState, MeasureAs=XRIsSessionSupported, RaisesException] Promise<boolean> isSessionSupported(XRSessionMode mode);  
  [CallWith=ScriptState, MeasureAs=XRRequestSession, RaisesException] Promise<XRSession> requestSession(XRSessionMode mode, optional  
XRSessionInit options = {});  
};  
  
// Copyright 2017 The Chromium Authors. All rights reserved.  
// Use of this source code is governed by a BSD-style license that can be  
// found in the LICENSE file.  
  
// https://immersive-web.github.io/webxr/#xrsystem-interface  
// Window 环境下的 XRSystem 接口声明  
[  
  SecureContext,  
  Exposed=Window,  
  RuntimeEnabled=WebXR  
] interface MainXRSystem : XRSystem {  
};  
  
// Copyright 2023 The Chromium Authors. All rights reserved.  
// Use of this source code is governed by a BSD-style license that can be  
// found in the LICENSE file.  
  
// https://immersive-web.github.io/webxr/#xrsystem-interface  
// Worker 环境下的 XRSystem 接口声明  
[  
  SecureContext,  
  Exposed=DedicatedWorker,  
  RuntimeEnabled=WebXR  
] interface WorkerXRSystem : XRSystem {  
};
```



# 能力扩展

MetaWeb

# 项目背景



传统 Web

Home > HTML > HTML Video > Tryit: The video element

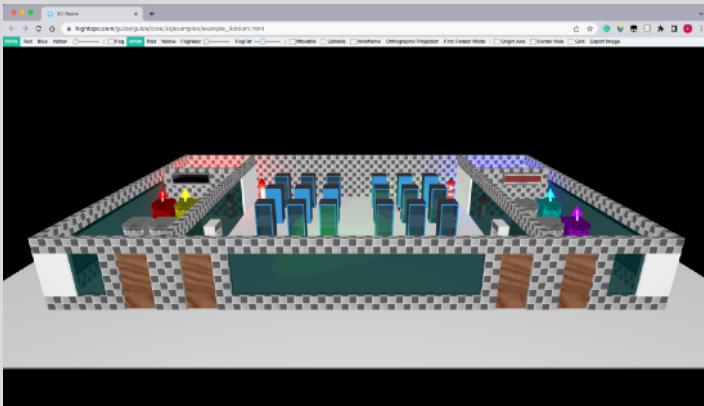
Result Size: 417 x 238 Get your website

```
<!DOCTYPE html>
<html>
<body>

<video width="400" controls>
  <source src="mov_bbb.mp4" type="video/mp4">
  <source src="mov_bbb.ogv" type="video/ogg">
Your browser does not support HTML video.
</video>

</body>
</html>
```

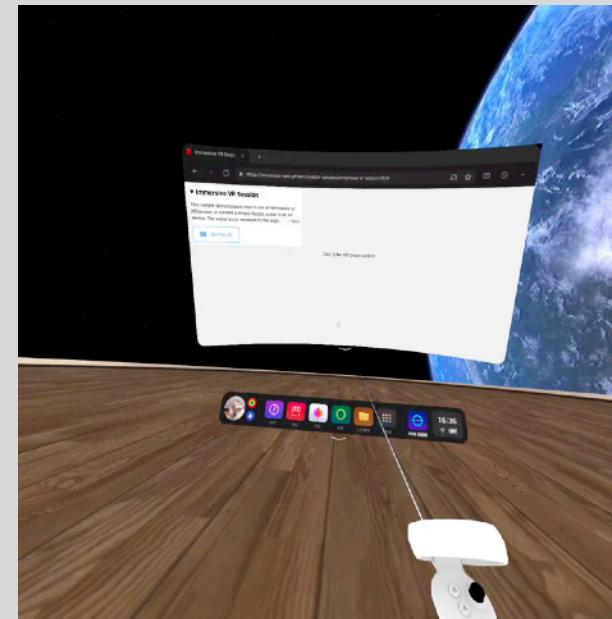
声明式的 HTML 标签语法



纯 2D 或伪 3D 场景



WebXR



复杂 3D 场景渲染



+



+



入门难度较高

# 3D CSS – 能力介绍

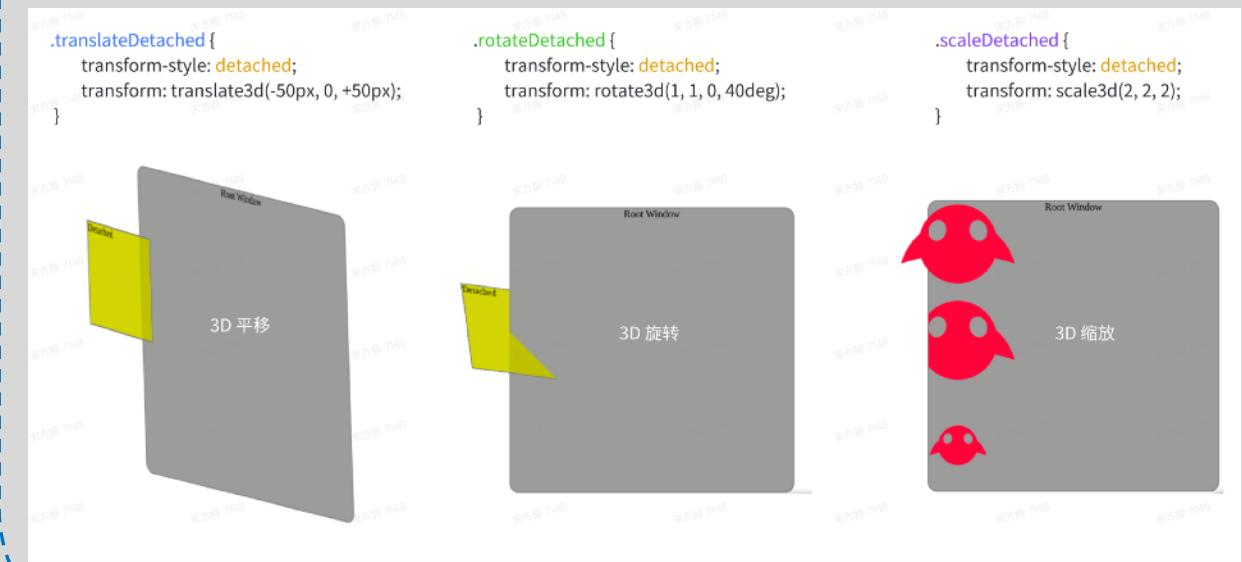
## transform-style

The screenshot shows the W3C Editor's Draft page for the 'transform-style' property. The left sidebar contains a table of contents with sections like Introduction, Terminology, and The Transform Rendering Model. The main content area is titled '§ 7. The 'transform-style' Property'. It includes a detailed table for the 'flat' value:

Name:	'transform-style'
Value:	flat   preserve-3d
Initial:	flat
Applies to:	transformable elements
Inherited:	no
Percentages:	N/A
Computed value:	specified keyword
Canonical order:	per grammar
Animation type:	discrete
Used value:	flat if a grouping property is present, specified keyword otherwise

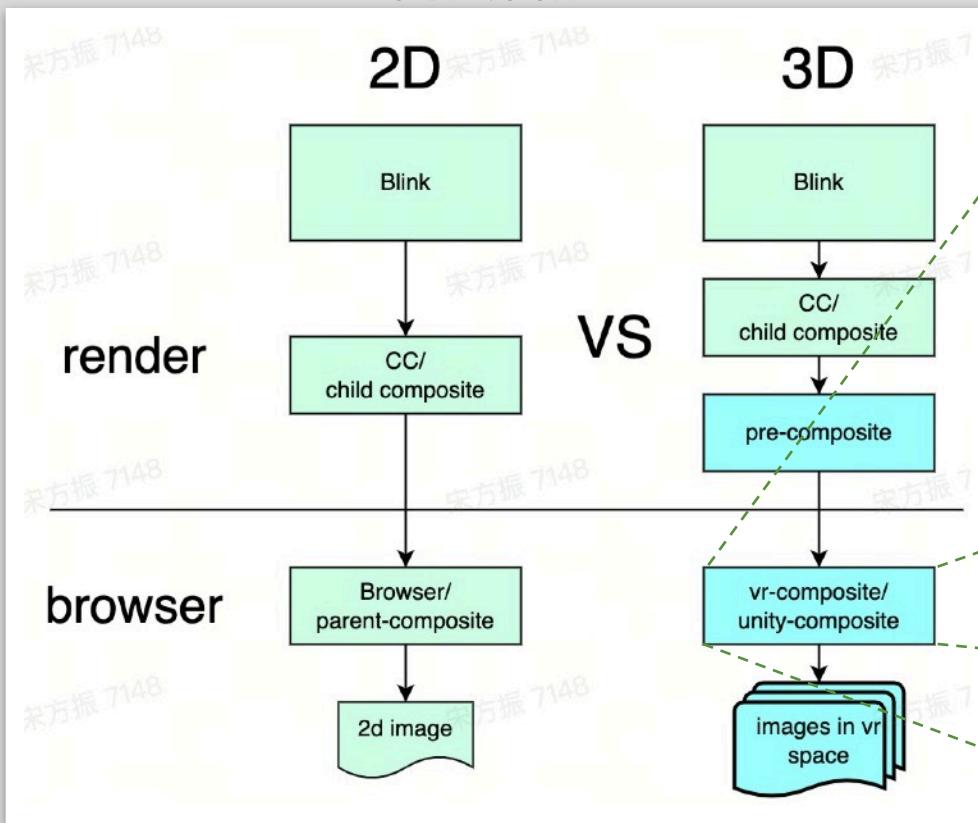
A note below states: "A computed value of 'preserve-3d' for transform-style on a transformable element establishes both a stacking context and a containing block for all descendants. If the used value is 'preserve-3d' then it also establishes or extends a 3D rendering context." The section '§ 7.1. Grouping property values' follows.

## detached

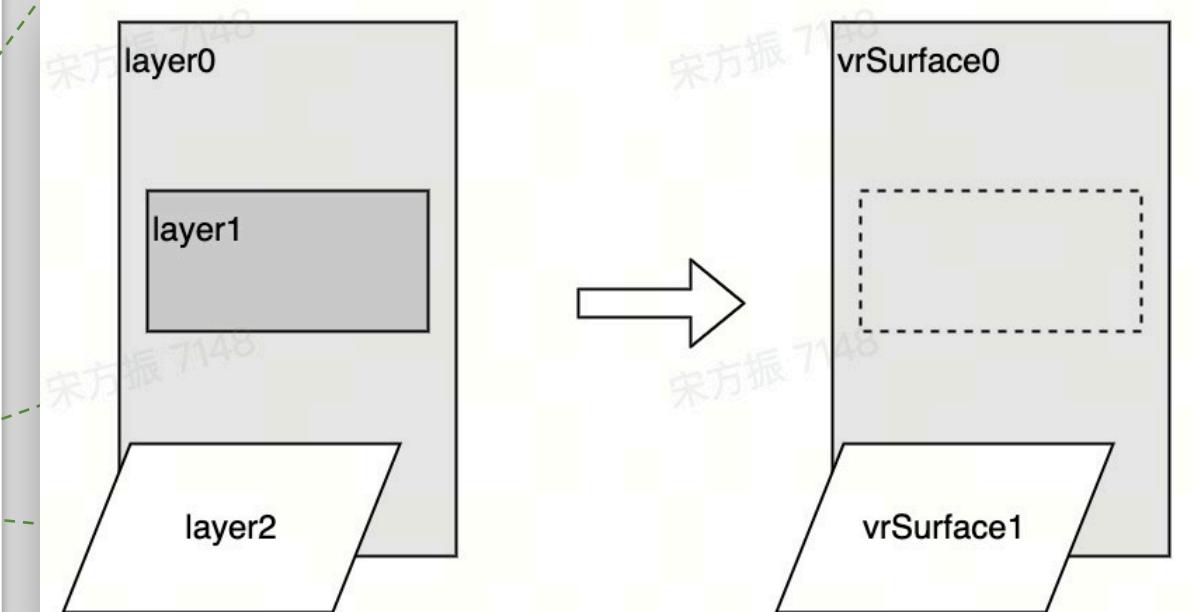


# 3D CSS – 流程改造

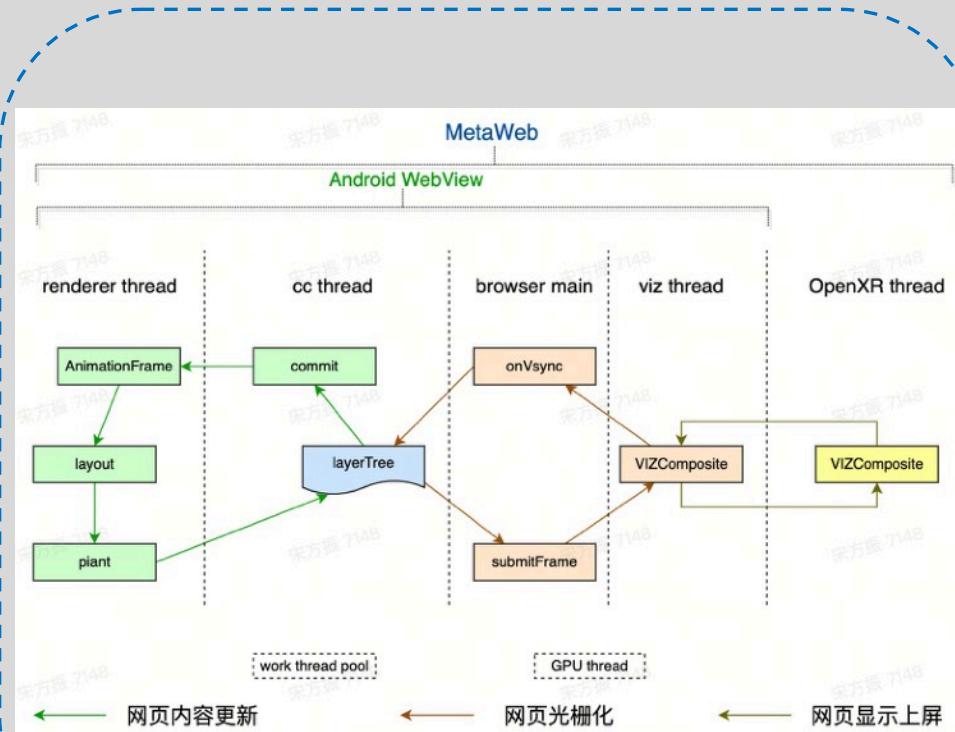
网页合成



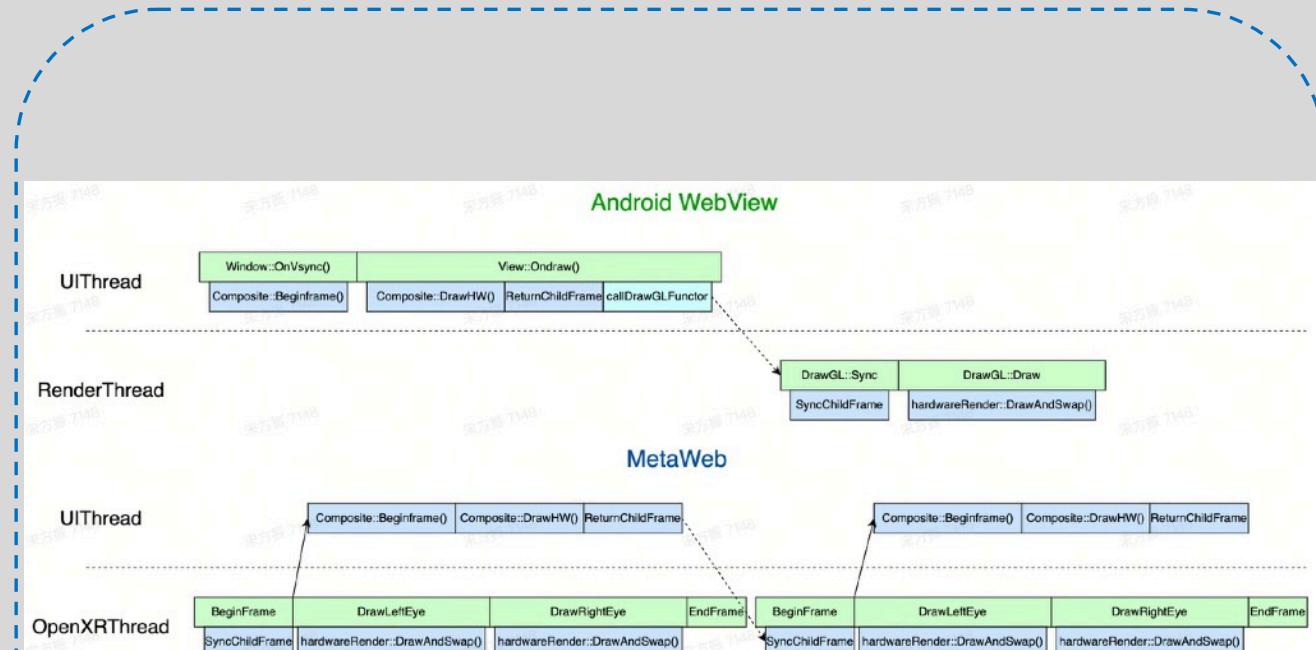
# Pre-composite



# 3D CSS – 底层实现



渲染管线



上屏逻辑

# <model> – 能力介绍

## <model> element

The <model> element  
Draft Community Group Report 05 June 2023

Latest published version: <https://www.w3.org/model-element/>  
Latest editor's draft: <https://immersive-web.github.io/model-element/>  
Editor: Marcos Cáceres ([Apple Inc.](#))  
Feedback: [GitHub immersive-web/model-element](#) (pull requests, new issue, open issues)

Copyright © 2023 the Contributors to the The <model> element Specification, published by the [Immersive Web Community Group](#) under the [W3C Community Contributor License Agreement \(CLA\)](#). A human-readable [summary](#) is available.

### Abstract

The model element allows embedding 3D graphical content into a [HTML] document. The `HTMLModelElement` interface then provides a means to interface with the embedded resource. [Access-Control-Request-Method](#)

### Status of This Document

This specification was published by the [Immersive Web Community Group](#). It is not a W3C Standard nor is it on the W3C Standards Track. Please note that under the [W3C Community Contributor License Agreement \(CLA\)](#) there is a limited opt-out and other conditions apply. Learn more about [W3C Community and Business Groups](#).

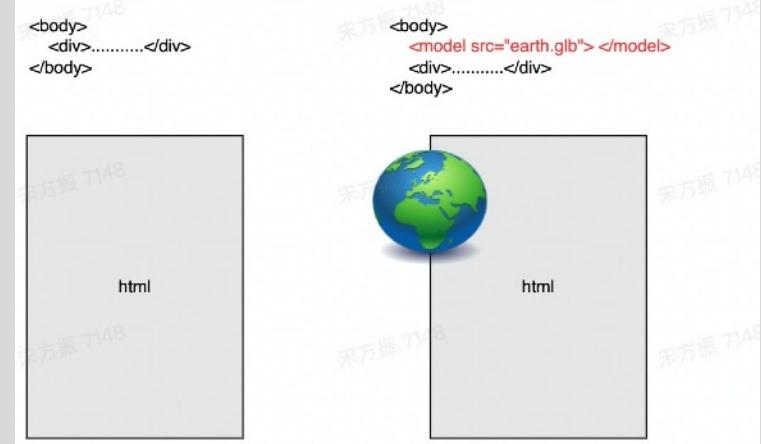
This is a work on progress.

[GitHub Issues](#) are preferred for discussion of this specification.

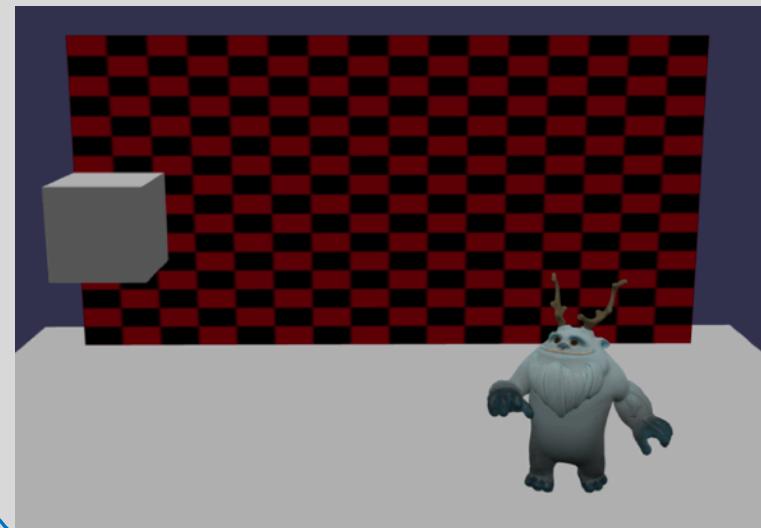
### 1. Examples

UNOFFICIAL

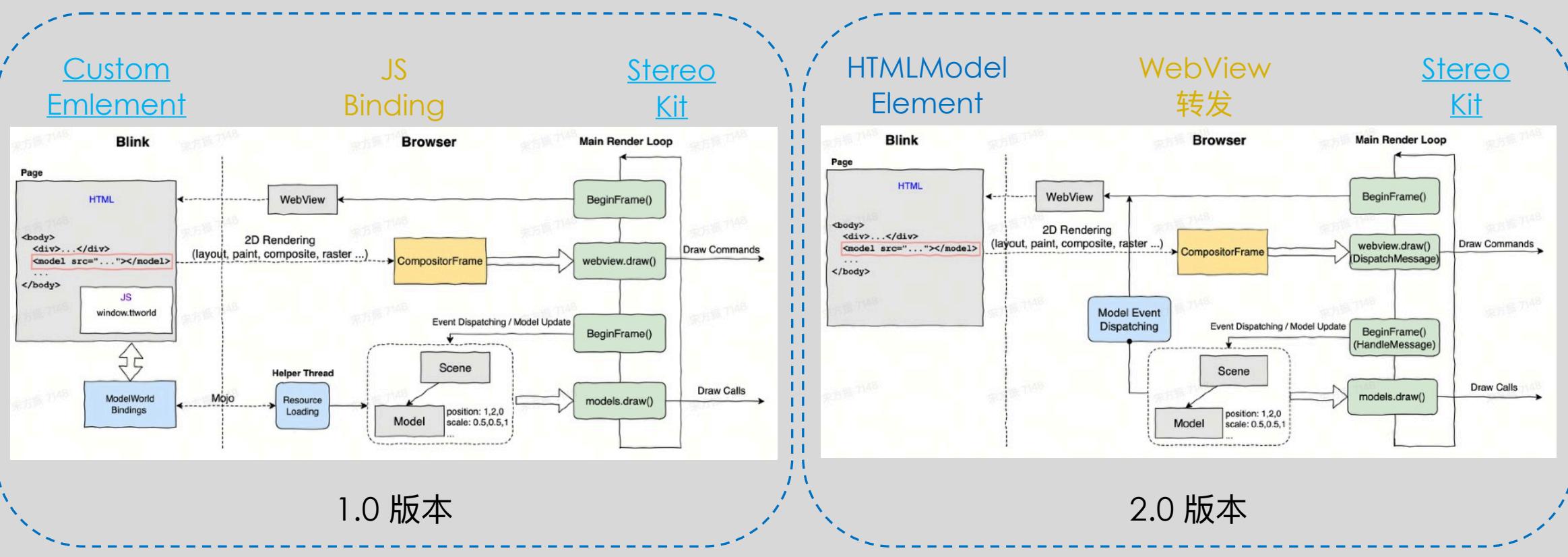
## 调用方式



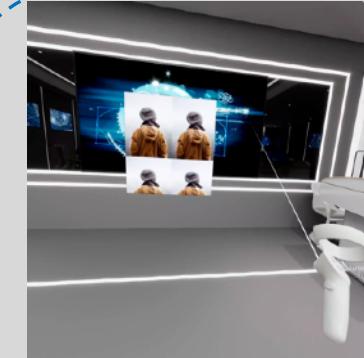
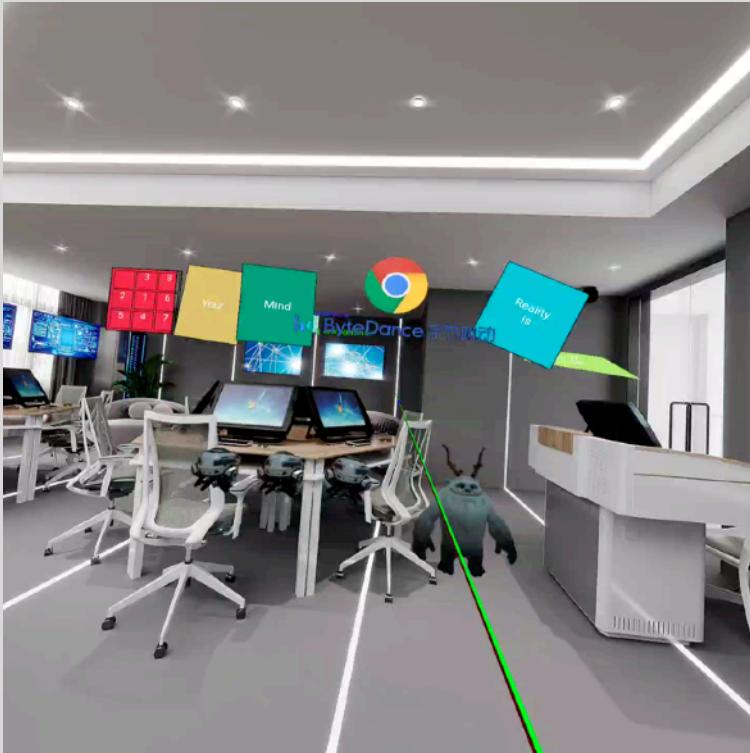
## 展现形式



# <model> – 底层实现



# 能力展示



全景视频  
<pano-video>



Unity 集成



页面多开



感谢倾听！

Q&A