

FUGU 项目介绍 与技术实践

宋方振

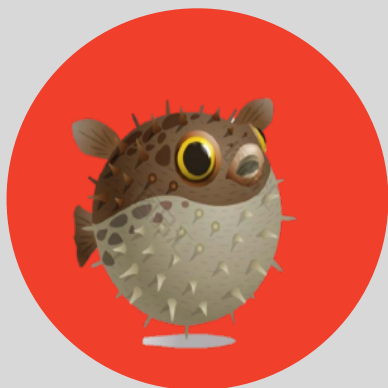


- 公司:  字节跳动
- 部门: Web Lab (开源、XR、AI etc)
- 工作经历:
 - 2020.06 – 2021.06 Chromium 开源社区 (Fugu、PWA)
 - 2021.07 – 至今 XR (WebXR、MetaWeb)
- 公开组织:
 -  Chromium 开源社区 (Committer)
 -  Immersive Web Working Group (Participants)

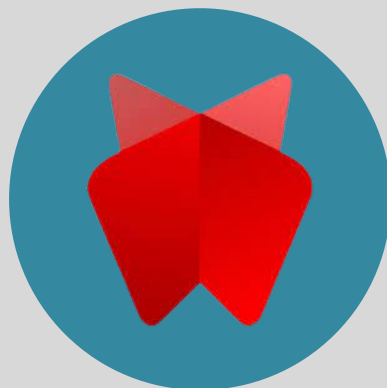
个人介绍



Outline



FUGU 项目介绍



技术实践 (WEBXR)



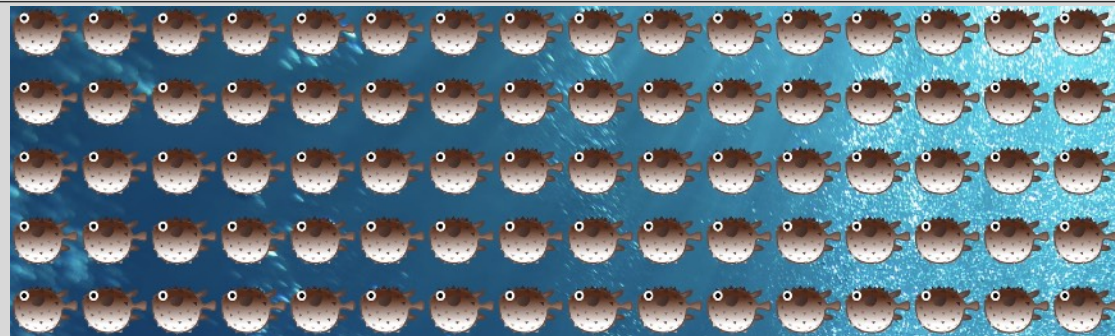
能力扩展
(METAWEB)



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 |

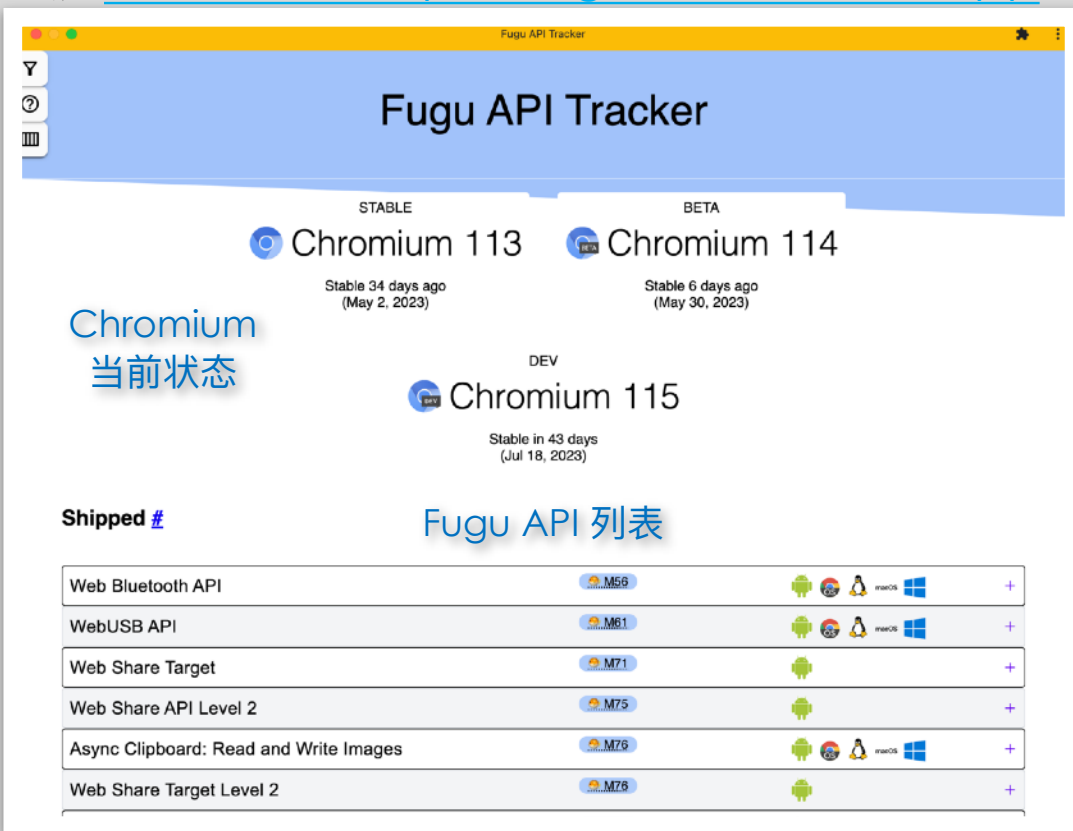


终极目标：

仅有一个 Web 浏览器，可以做到任何现有 App 可以做的事情。

能力状态

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



Fugu API Tracker

STABLE **Chromium 113** (Stable 34 days ago (May 2, 2023))

BETA **Chromium 114** (Stable 6 days ago (May 30, 2023))

DEV **Chromium 115** (Stable in 43 days (Jul 18, 2023))

Chromium 当前状态

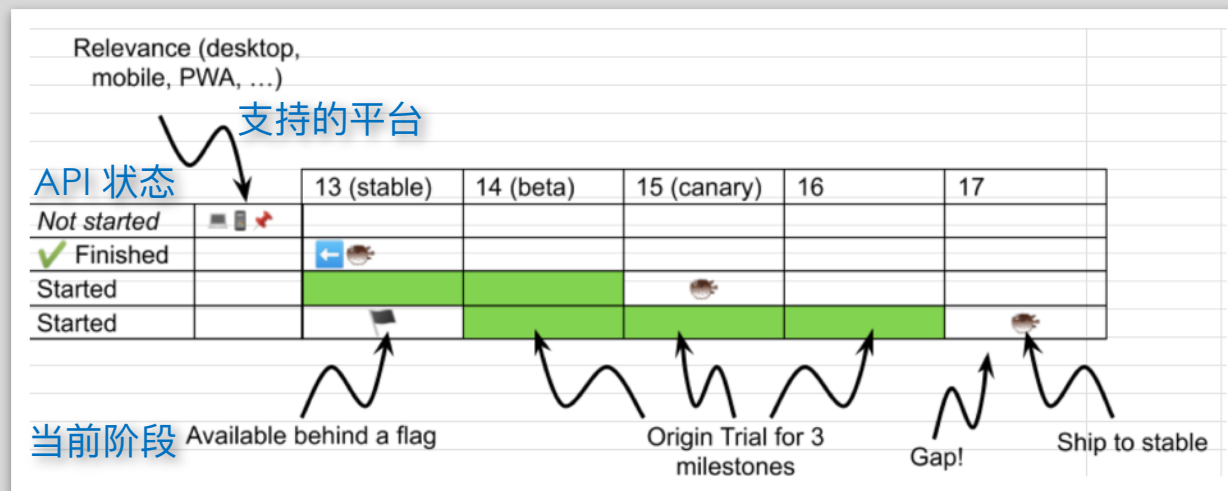
Shipped #

Fugu API 列表

| API Name | Milestone | Supported Platforms |
|--|-----------|------------------------------|
| Web Bluetooth API | M58 | Android, iOS, macOS, Windows |
| WebUSB API | M61 | Android, iOS, macOS, Windows |
| Web Share Target | M71 | Android |
| Web Share API Level 2 | M75 | Android |
| Async Clipboard: Read and Write Images | M76 | Android, iOS, macOS, Windows |
| Web Share Target Level 2 | M76 | Android |

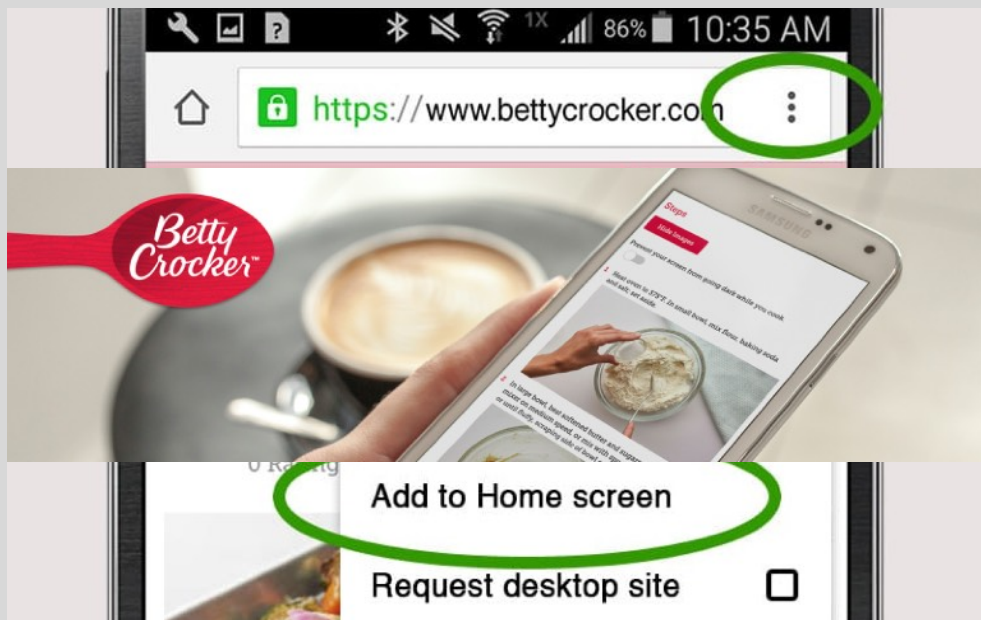
常用 API:

Wake Lock
Web Share Target
Badging API
File System Access
WebCodec



应用示例 01

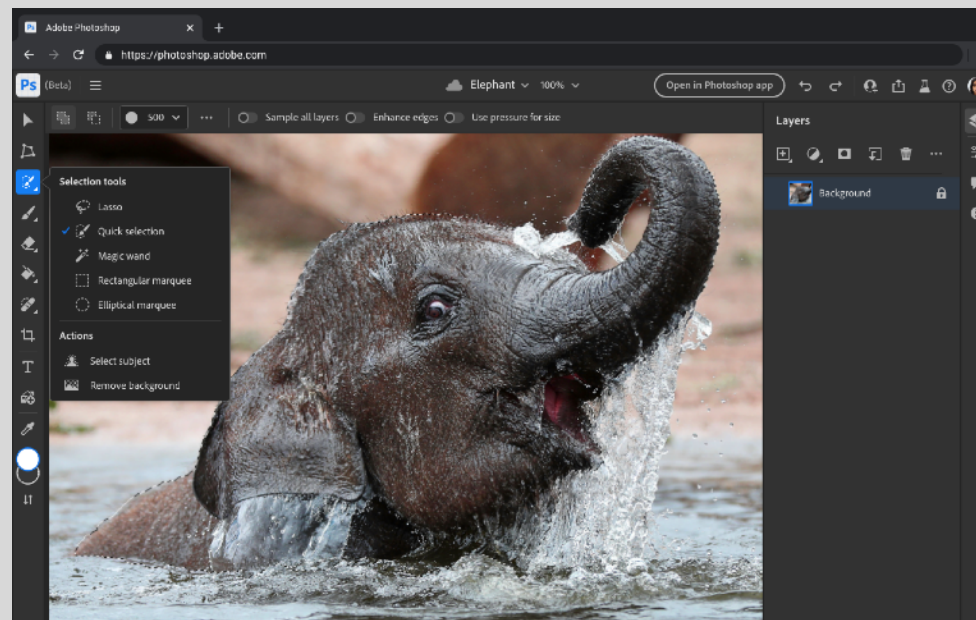
Betty Crocker Web 版



关键技术:

Wake Lock、Window Placement

PhotoShop Web 版

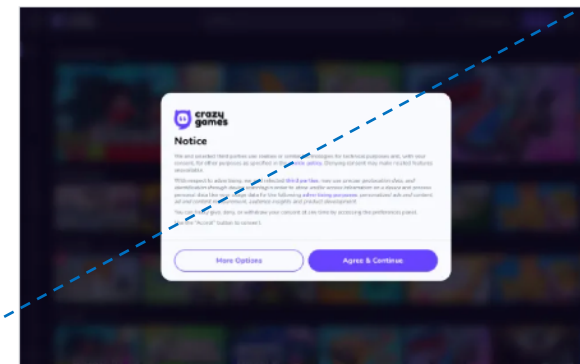
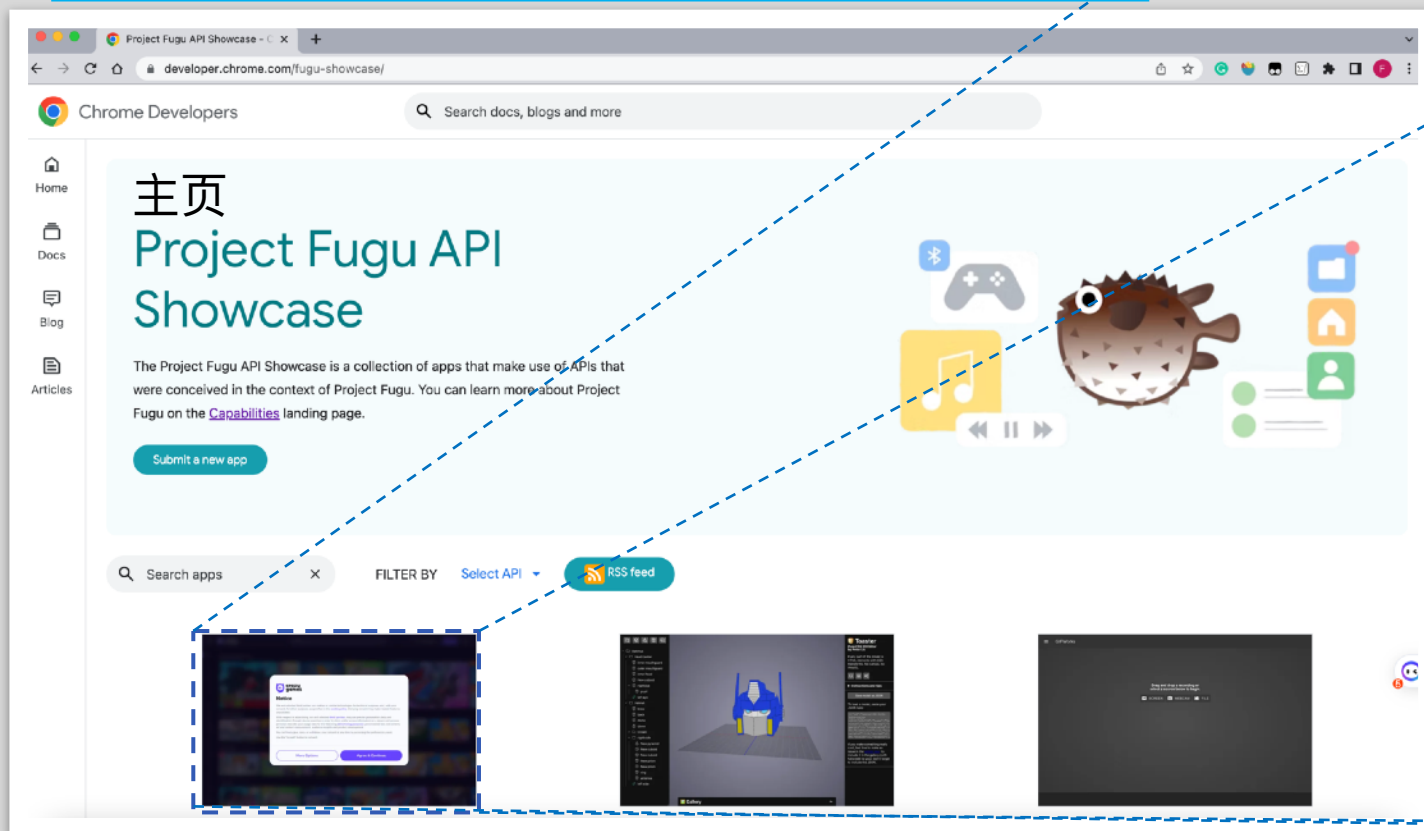


关键技术:

WebAssembly、Service Worker

应用示例 02

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



[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

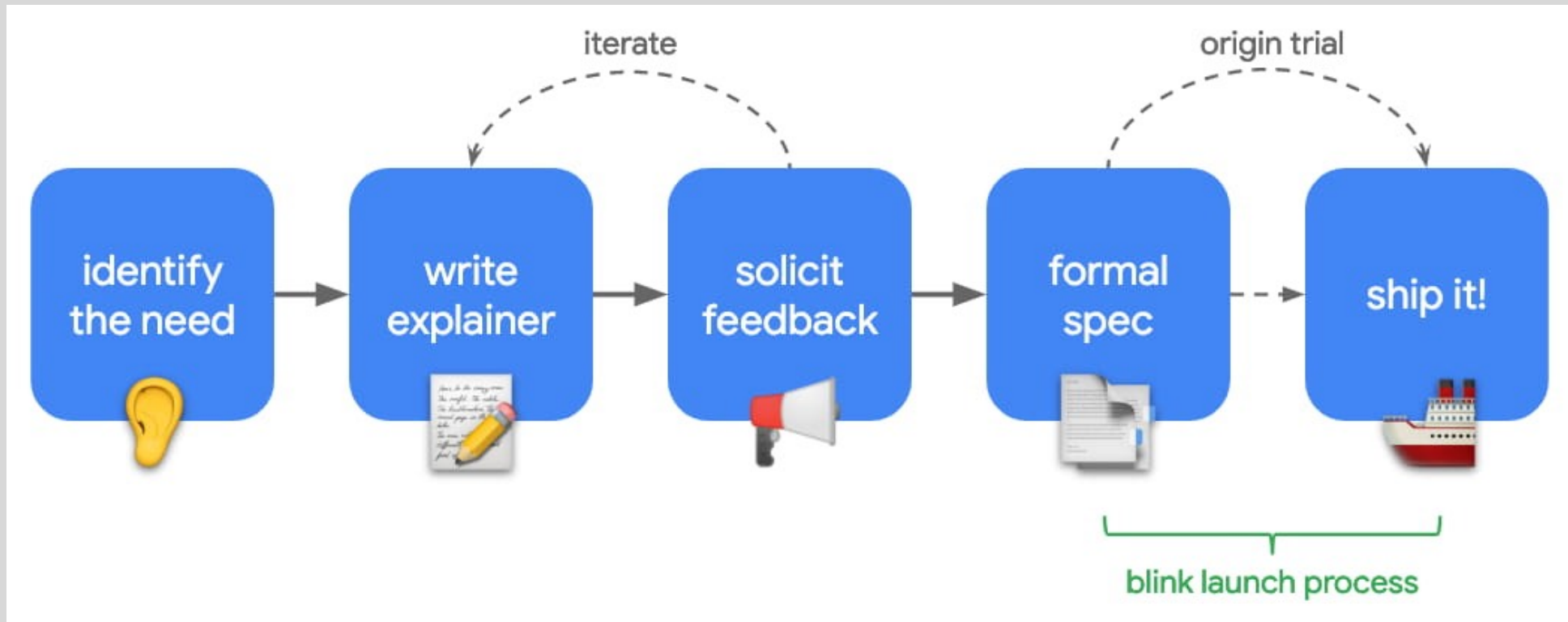
Web Share

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

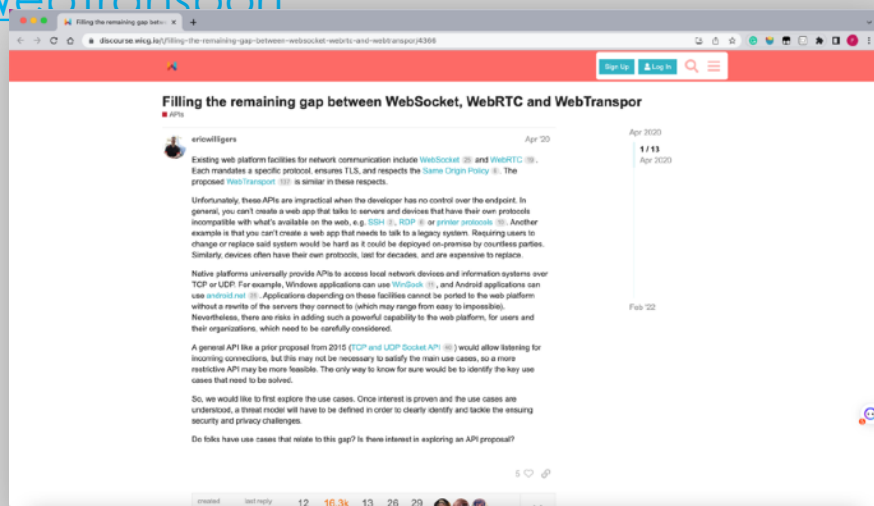
使能特性

案例详解 – Direct Sockets 01

IWA 状态: Started

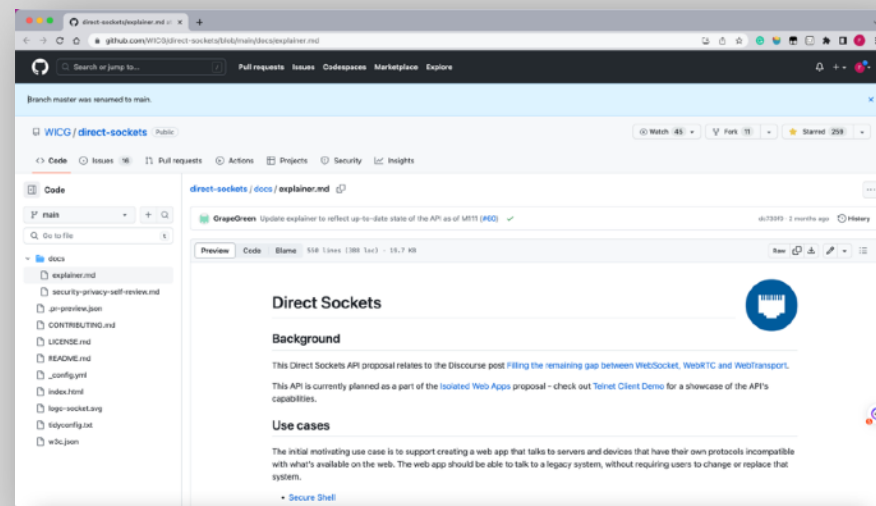
发现需求

“[Filling the remaining gap between WebSocket, WebRTC and WebTransport](https://discourse.wicg.io/t/filling-the-remaining-gap-between-websocket-webrtc-and-webtransport/4368)”



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

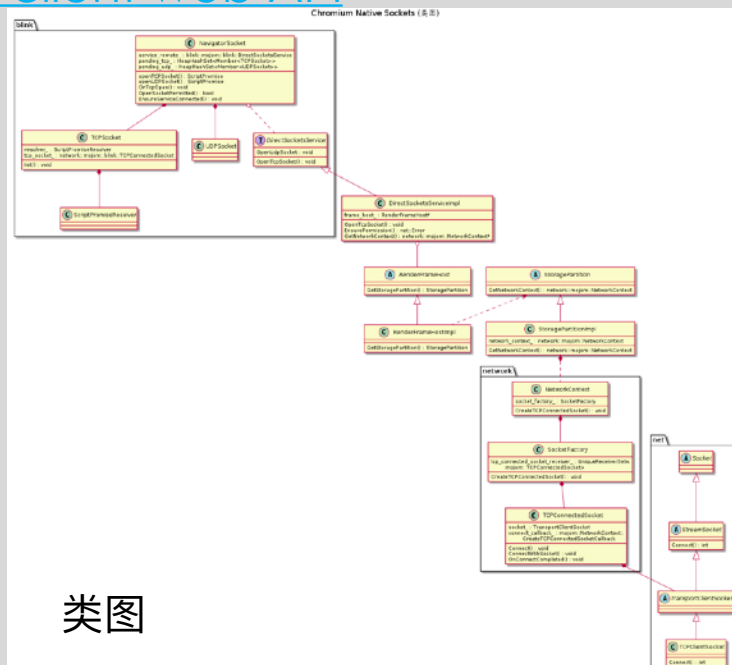
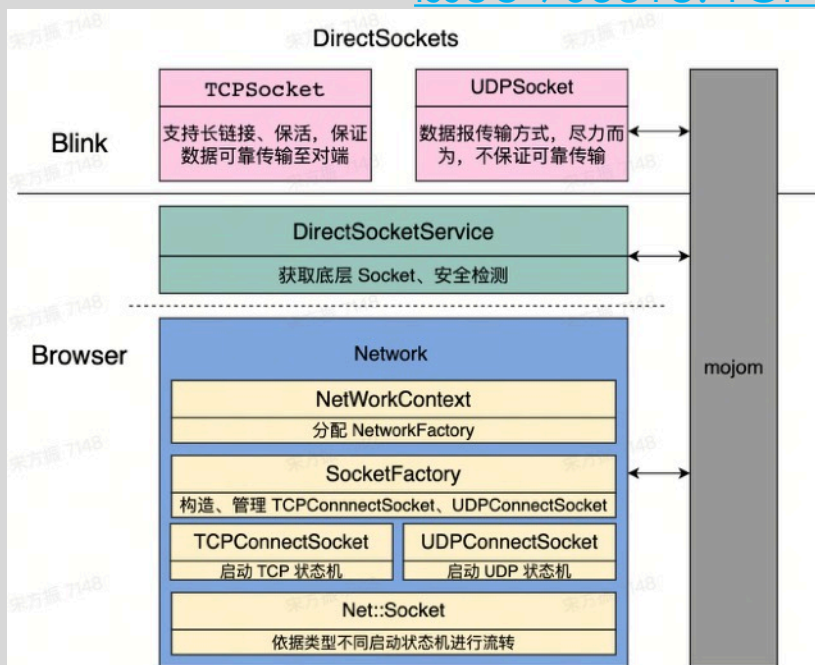
Cancel

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



Oculus



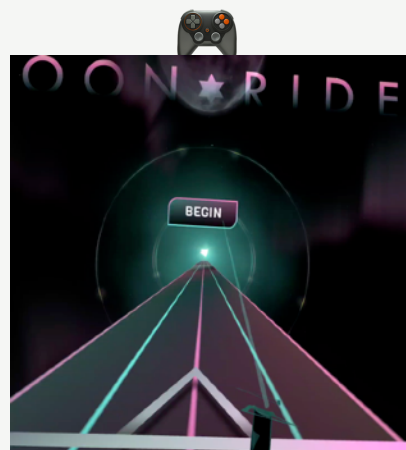
Vive



Playstation



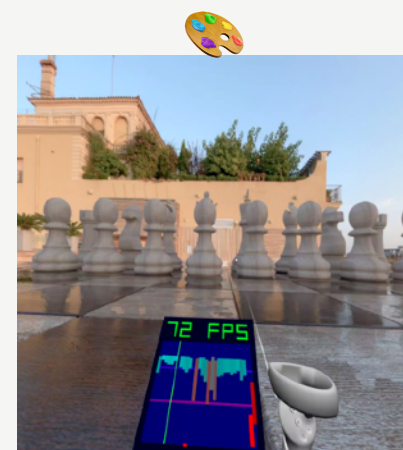
PICO



[Moon Rider](#)

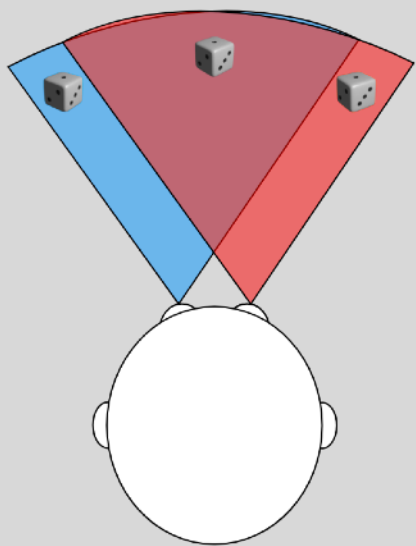


[Stereo Video Player](#)



[360-photos](#)

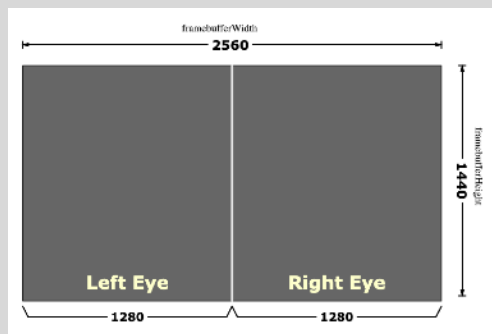
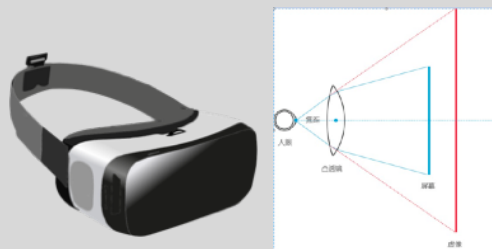
基础知识



FOV (field of view)

双目成像

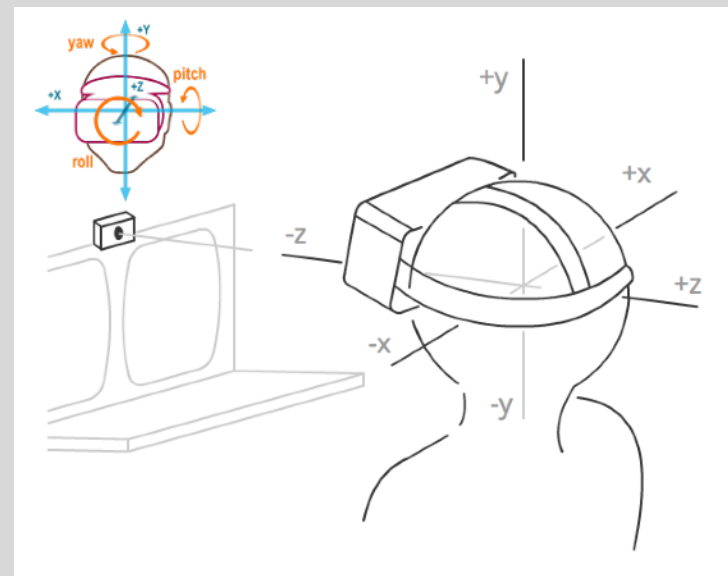
产生立体感



HMD (Head-Mounted Display)

显示分区

透镜折射

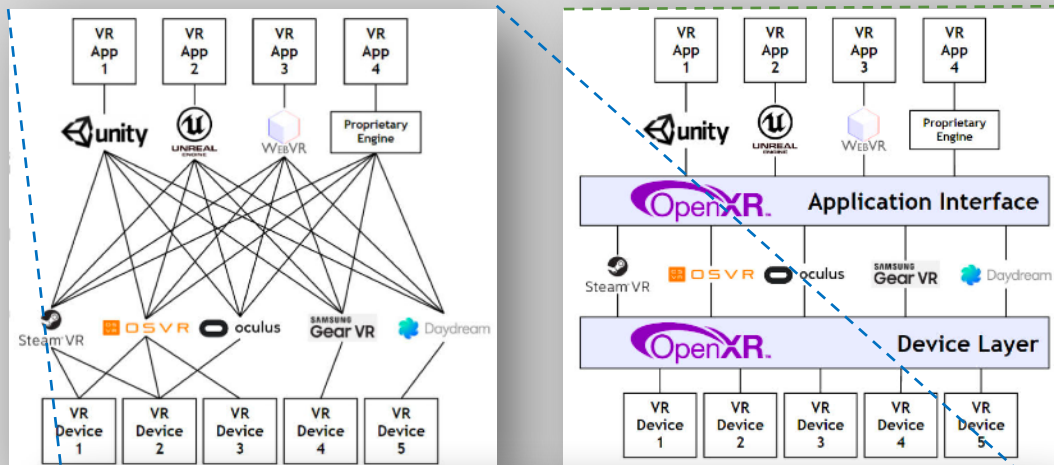


DOF (Degrees of freedom)

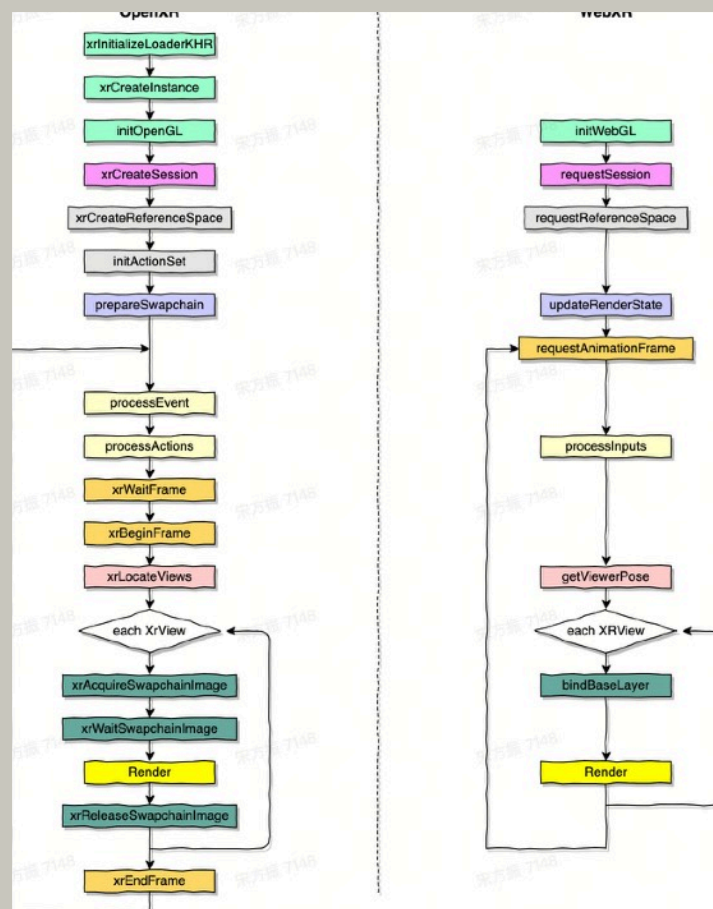
旋转角度

位移距离

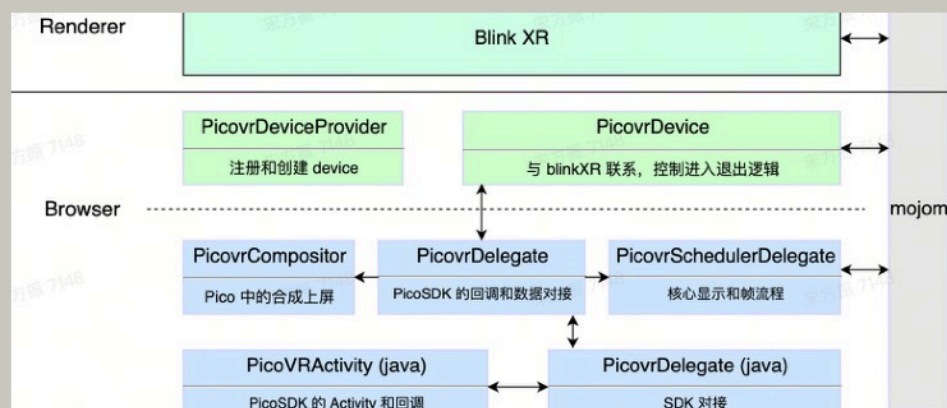
能力支持



OpenXR 版本



SDK 版本



页面跳转 - 背景

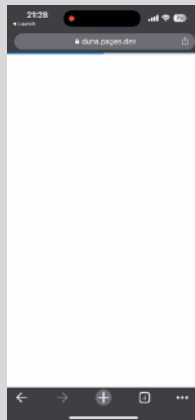
[WebXR APP](#)



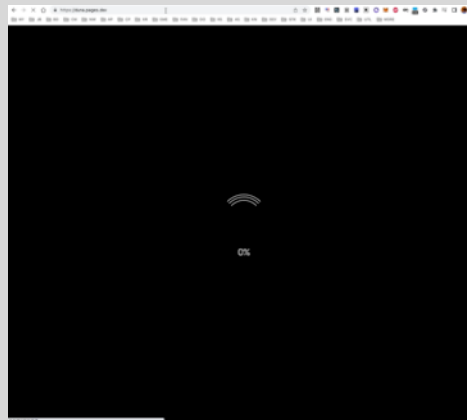
冗余 2D 页面

[企业/品牌官网](#)

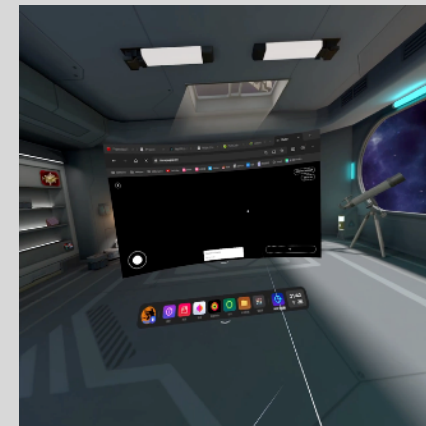
mobile



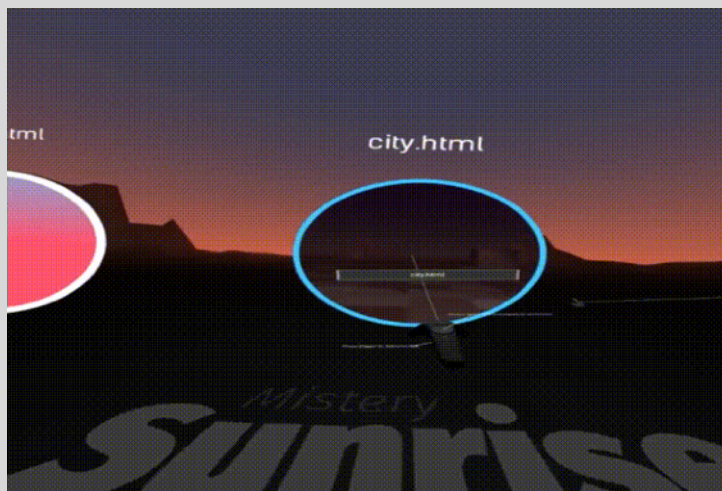
desktop



WebXR



三端不一致的用户体验



A-FRAME [link](#)

流畅导航穿梭效果

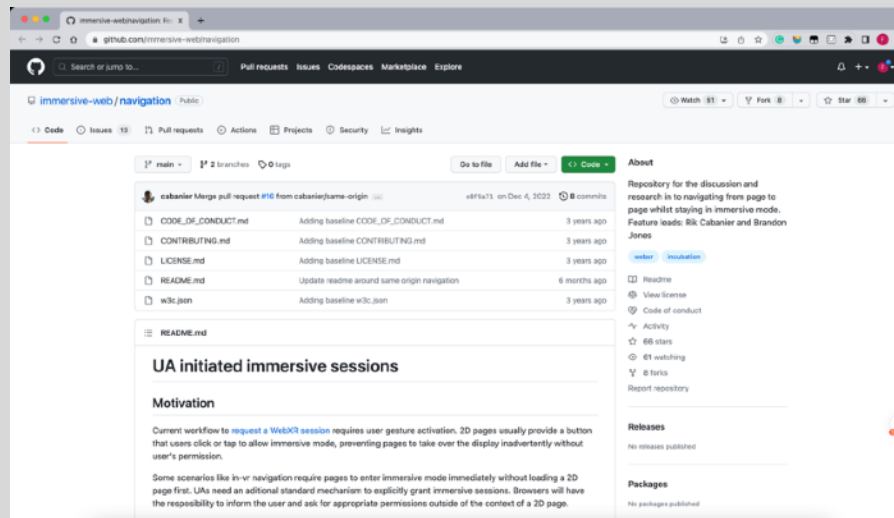
页面跳转 - 实现

效果展示

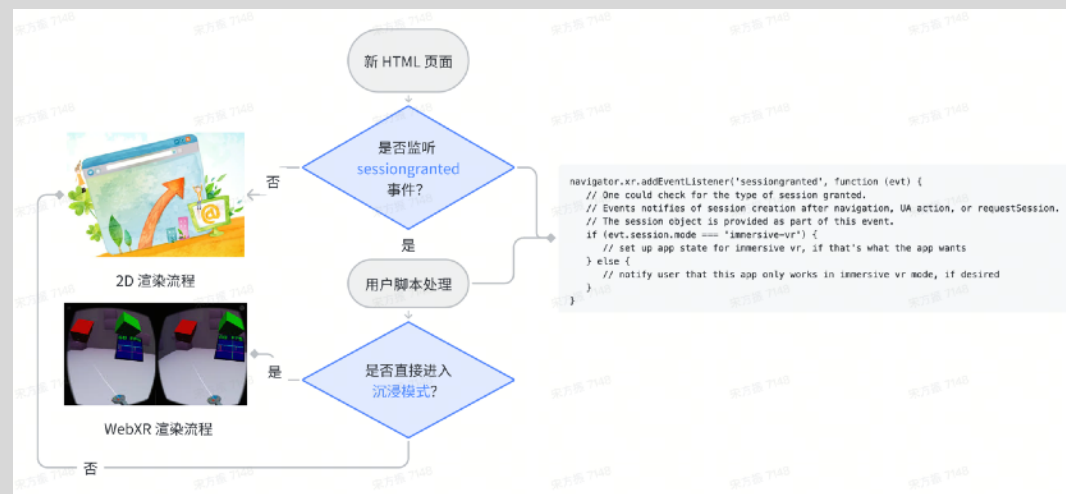


启动进入沉浸
流畅页面切换

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

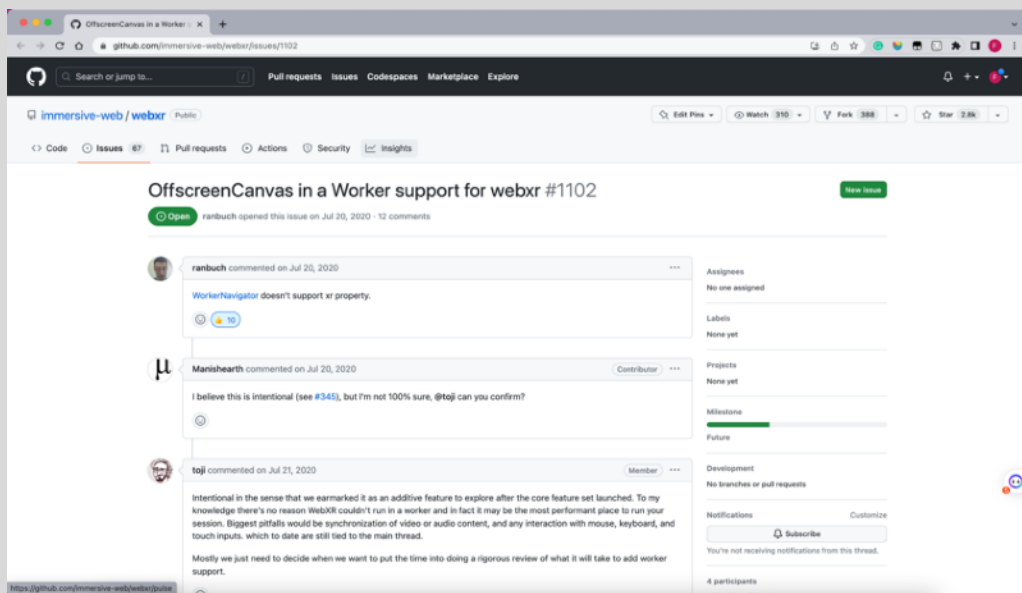


流程示意



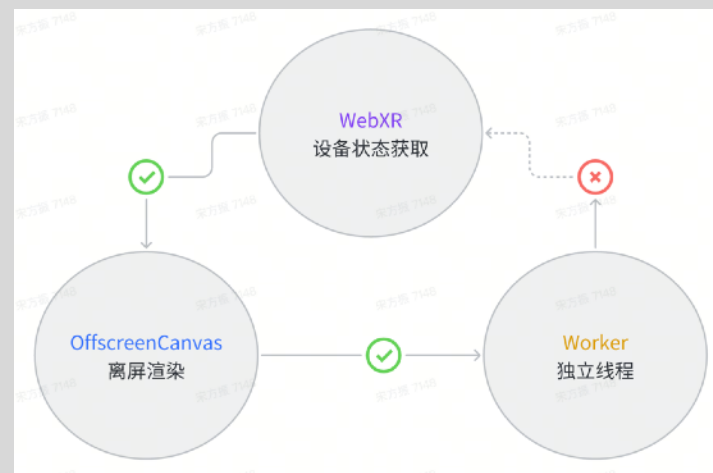
独立线程 - 背景

immersive-web/webxr

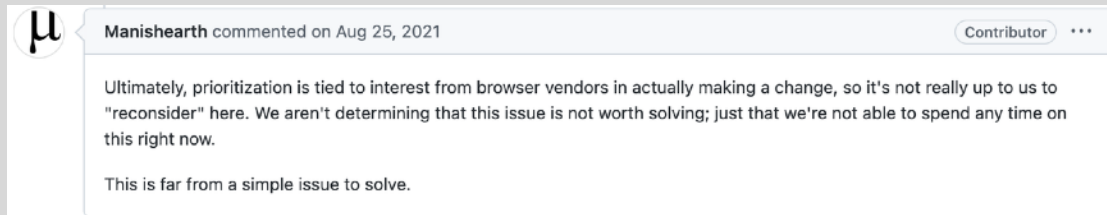


[WorkerNavigator](#) 尚未支持 xr 属性

能力状态



社区规划



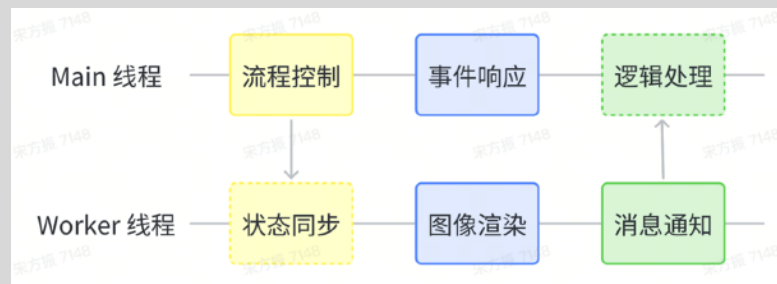
独立线程 - 实现

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 {  
};
```

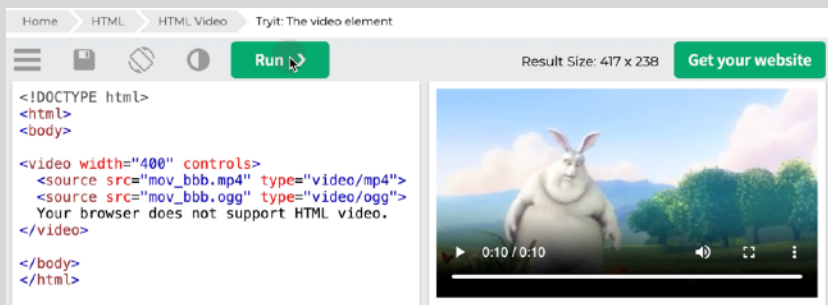
```
// Copyright 2023 The Chromium Authors. All rights reserved.  
// Use of this source code is governed by a BSD-style license that can be  
// found in the LICENSE file.  
  
// https://immersive-web.github.io/webxr/#xrsystem-interface  
// Worker 环境下的 XRSystem 接口声明  
[  
  SecureContext,  
  Exposed=DedicatedWorker,  
  RuntimeEnabled=WebXR  
] interface WorkerXRSystem : XRSystem {  
};
```



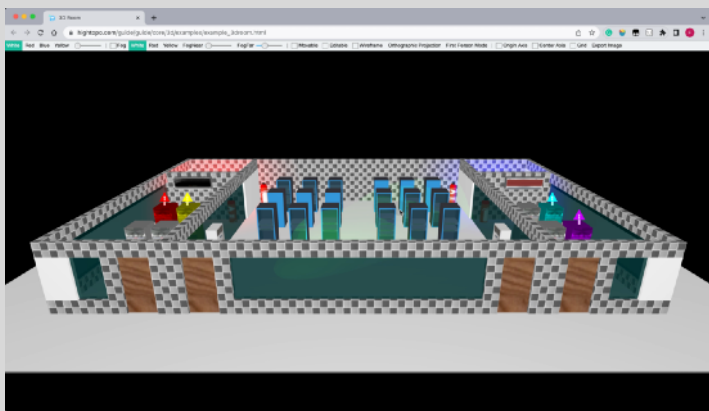
能力扩展

MetaWeb

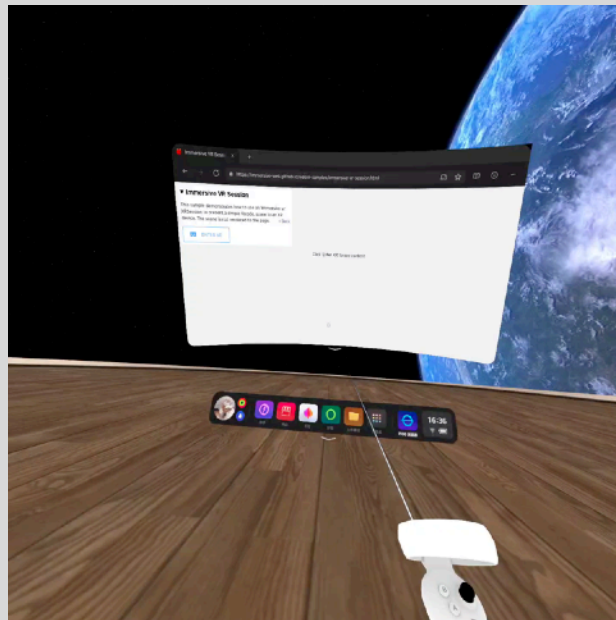
项目背景



声明式的 HTML 标签语法



纯 2D 或伪 3D 场景



复杂 3D 场景渲染



+



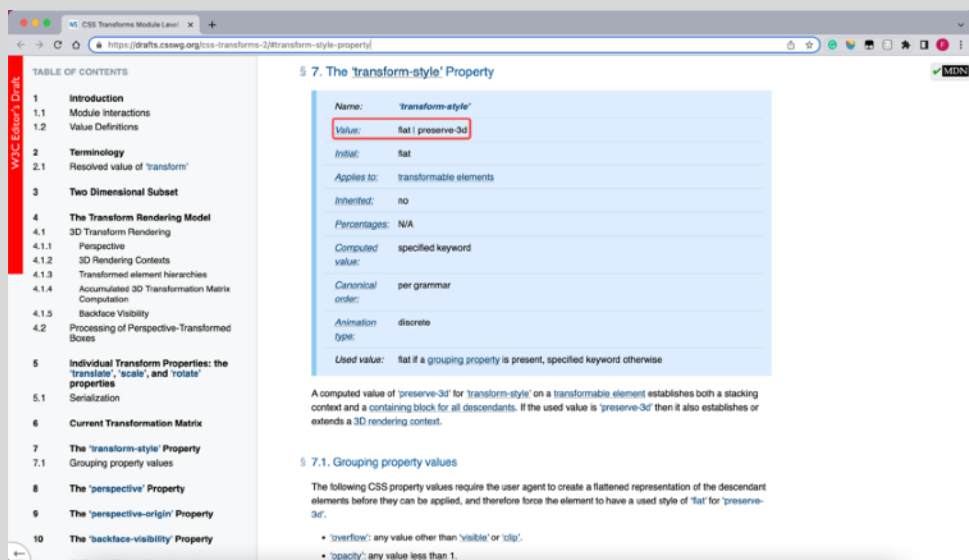
+



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 table of contents on the left lists sections from Introduction to The 'backface-visibility' Property. The main content area is titled '§ 7. The 'transform-style' Property' and includes a table with the following details:

| | |
|------------------|---|
| 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 |

Below the table, there is a paragraph explaining that a computed value of 'preserve-3d' on a transformable element establishes both a stacking context and a containing block for all descendants. If the used value is 'preserve-3d', it also establishes or extends a 3D rendering context.

§ 7.1. Grouping property values

The following CSS property values require the user agent to create a flattened representation of the descendant elements before they can be applied, and therefore force the element to have a used style of 'flat' for 'preserve-3d':

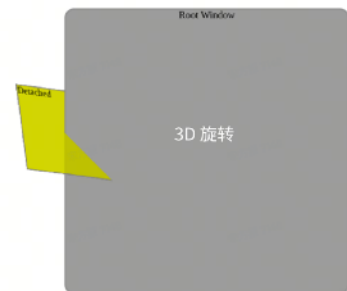
- 'overflow': any value other than 'visible' or 'clip'.
- 'opacity': any value less than 1.

detached

```
.translateDetached {  
  transform-style: detached;  
  transform: translate3d(-50px, 0, +50px);  
}
```



```
.rotateDetached {  
  transform-style: detached;  
  transform: rotate3d(1, 1, 0, 40deg);  
}
```



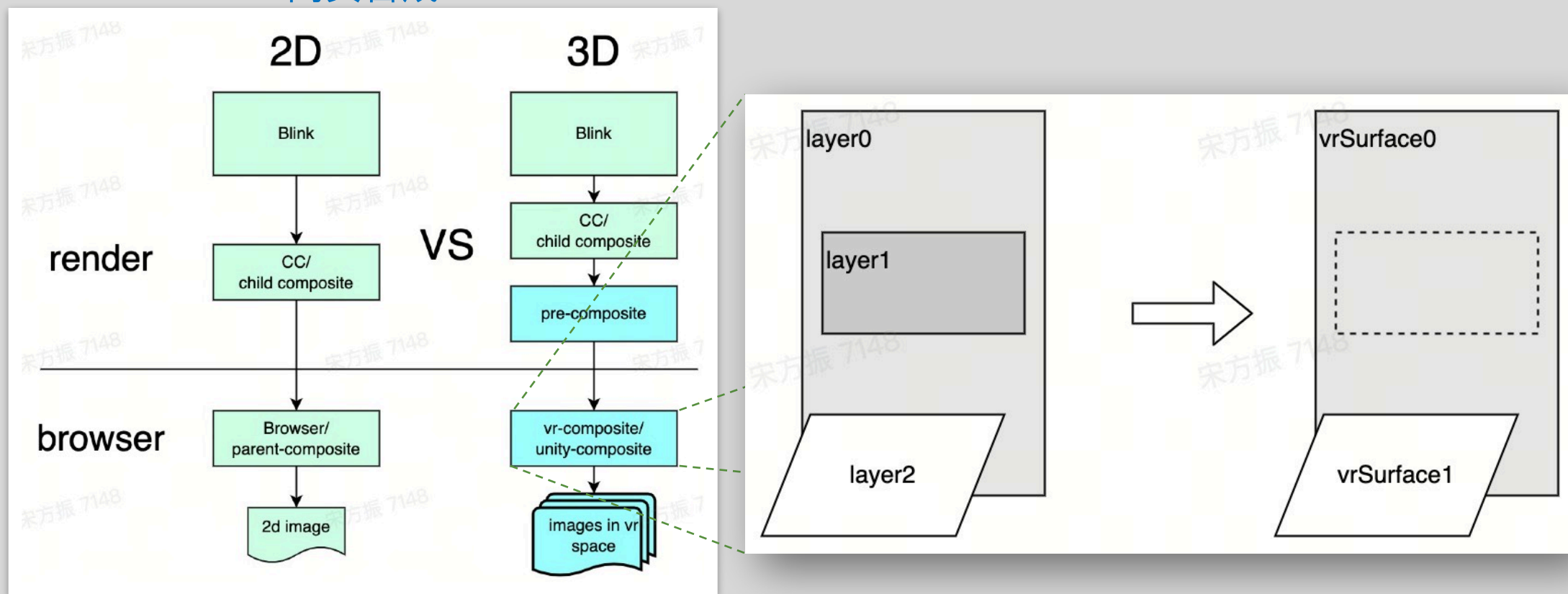
```
.scaleDetached {  
  transform-style: detached;  
  transform: scale3d(2, 2, 2);  
}
```



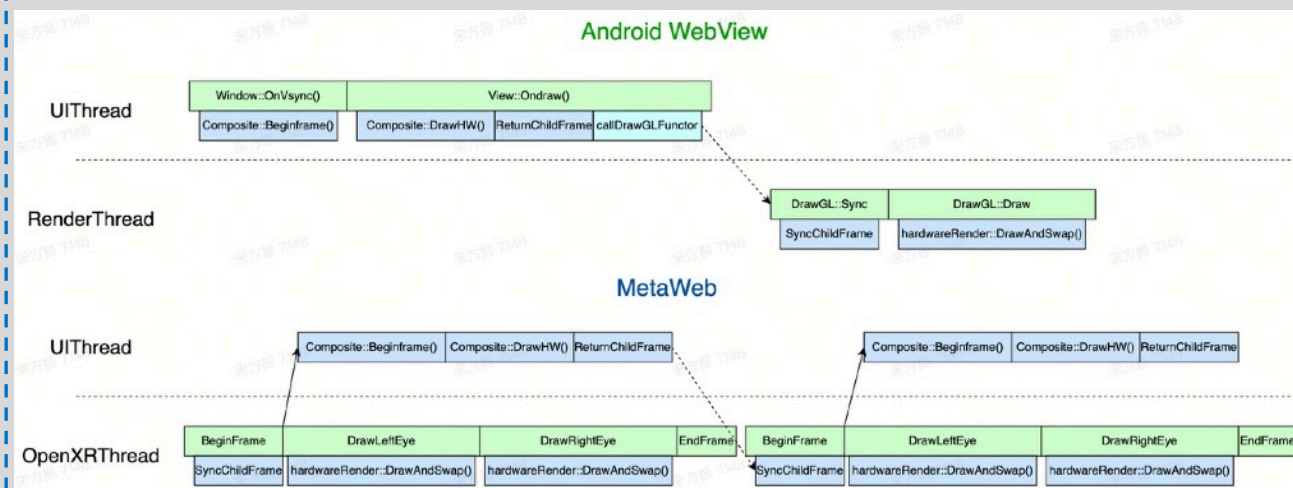
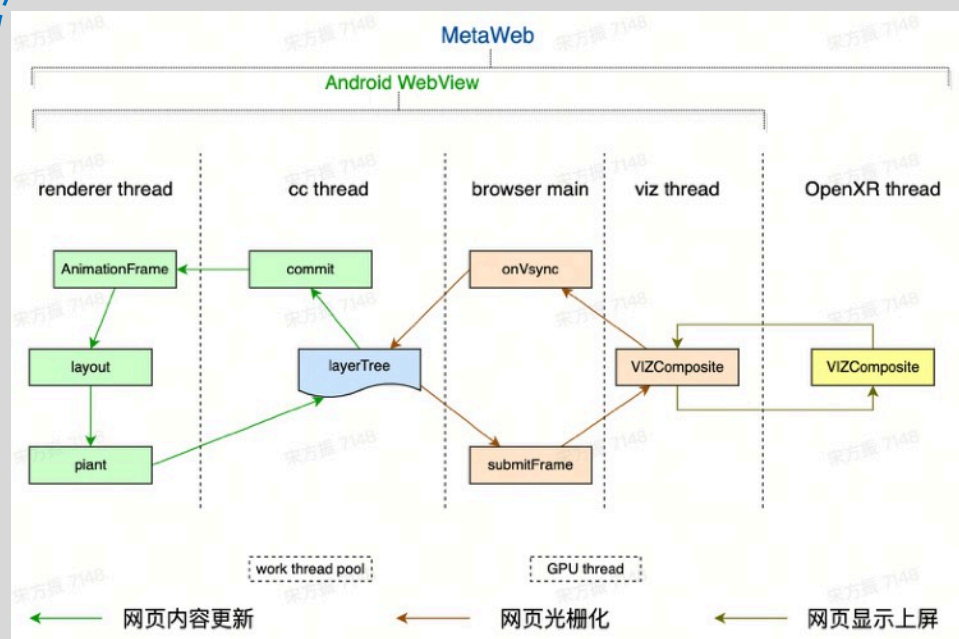
3D CSS – 流程改造

网页合成

Pre-composite



3D CSS – 底层实现



<model> – 能力介绍

<model> element

The screenshot shows the W3C draft report for the <model> element. The page title is "The <model> element" and it is a "Draft Community Group Report 05 June 2023". The page includes a table of contents, an abstract, and a status of this document section. The abstract states: "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](#)". The status of this document section states: "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."

调用方式

The diagram illustrates the usage of the <model> element in HTML. It shows two examples of HTML code snippets. The first example shows a basic HTML structure:

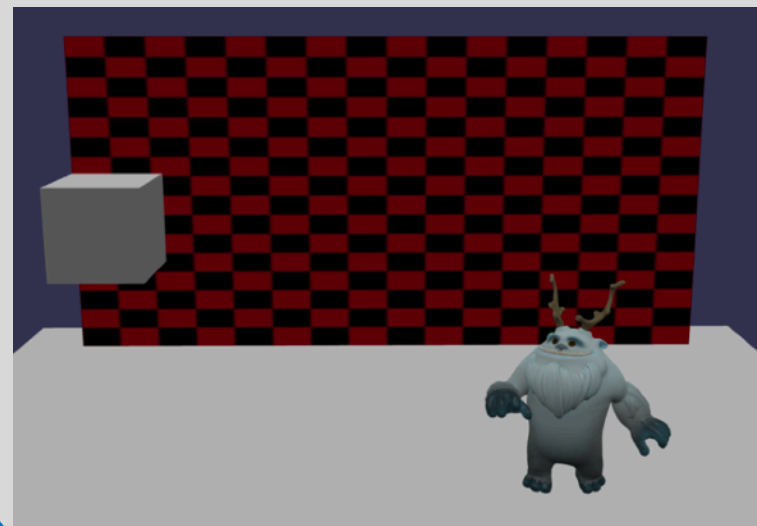
```
<body>
<div>.....</div>
</body>
```

 The second example shows the <model> element being used to embed a 3D model:

```
<body>
  <model src="earth.glb"> </model>
  <div>.....</div>
</body>
```

 Below the code snippets, there are two visual representations of HTML documents. The first is a simple gray box labeled "html". The second is a gray box labeled "html" with a 3D globe model embedded in it, demonstrating the visual output of the <model> element.

展现形式

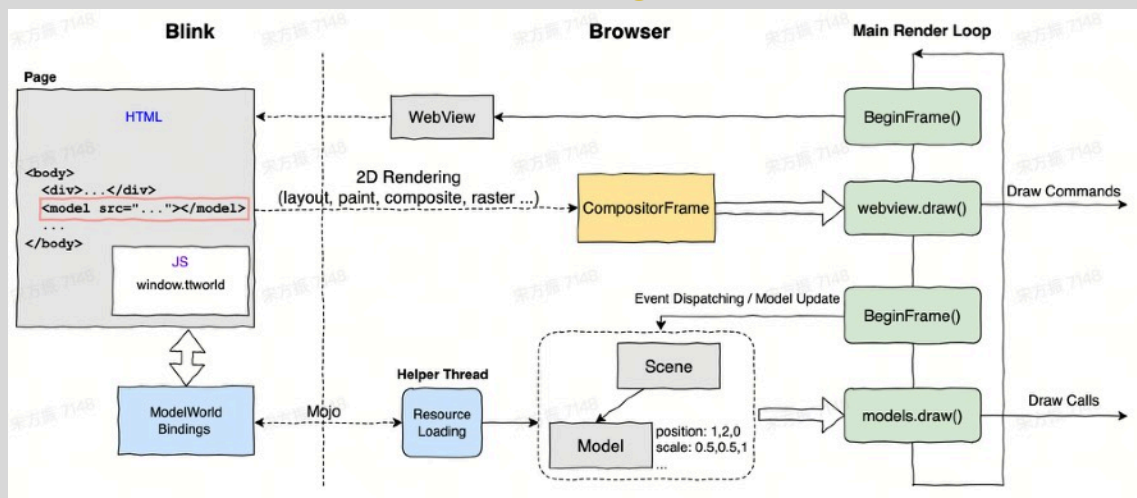


<model> – 底层实现

Custom Element

JS Binding

Stereo Kit

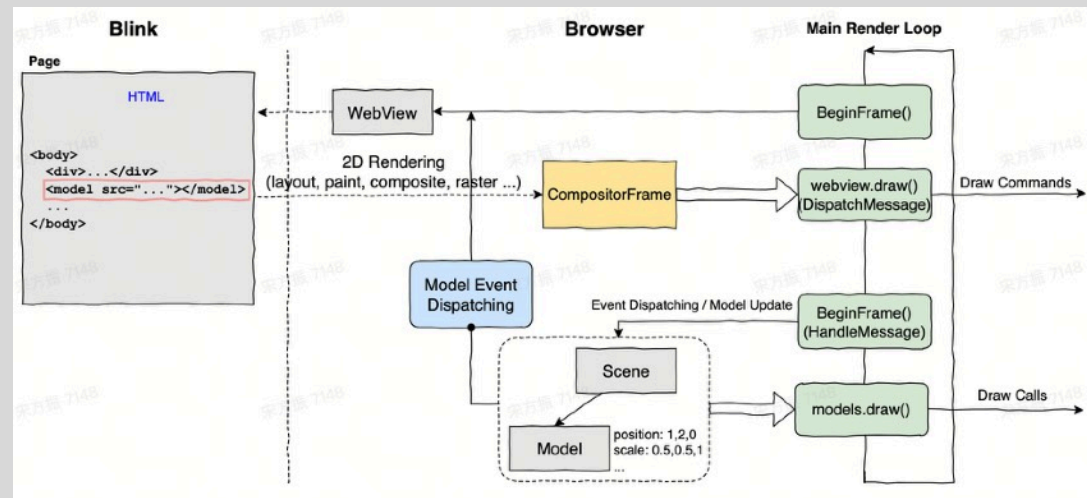


1.0 版本

HTMLModel Element

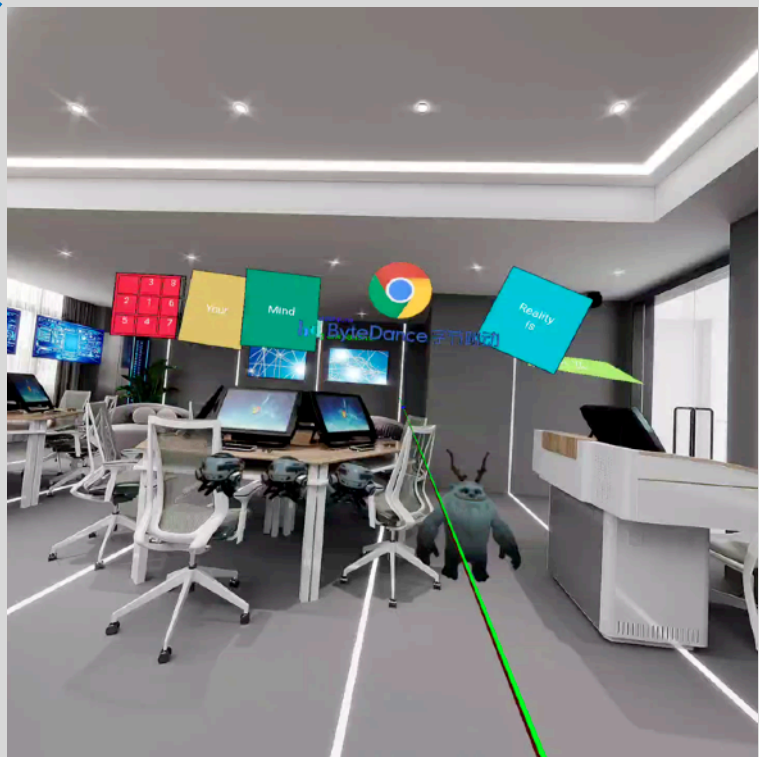
WebView 转发

Stereo Kit



2.0 版本

能力展示



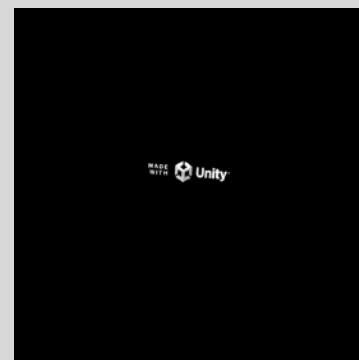
基础能力



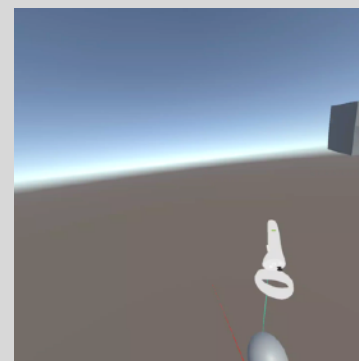
应用搭建



全景视频
<pano-video>



Unity 集成



页面多开



感谢倾听！

Q&A