



Ready Player One

Video Games

Virtual Reality Development

CS 415: Game Development (Virtual Reality Module)

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Disclaimer



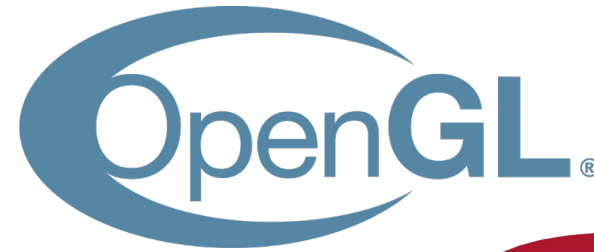
The following slides are based on most popular tools, or solutions.

Many other solutions for VR or XR are available.

Low Level Development APIs (Graphics Libraries)



- OpenGL
- Vulkan
- Direct3D (Microsoft DirectX)
- Metal (Apple)
- WebGL (HTML5)












Low Level Development APIs (AR/VR Libraries)





- Oculus (OVR)
- OpenVR
- MagicLeap
- Windows Mixed Reality (WMR)
- **OpenXR**

OpenXR Adopters

 Hololens and Mixed Reality Headsets. Includes hand and eye tracking extensions	 Rift S, Quest and Quest 2. Meta Deprecated their own API in favor of OpenXR	 Vive Focus 3, Vive Cosmos, Vive Wave Runtime
 Deprecated OpenVR APIs in favor of OpenXR	 All Varjo Headsets are fully compliant (VR-1, XR-1, XR-3, VR-3)	 Collabora's Monado Open-source OpenXR Implementation
 Snapdragon Spaces XR Development Platform	 Nreal Light and Nreal X	 Acer SpatialLabs Display Series and Acer XR Service Runtime

Newest OpenXR Adopters

 Magic Leap 2 (ML2)	 Bytedance Immersive Neo3 and Pico 4
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<https://www.khronos.org/openxr/>

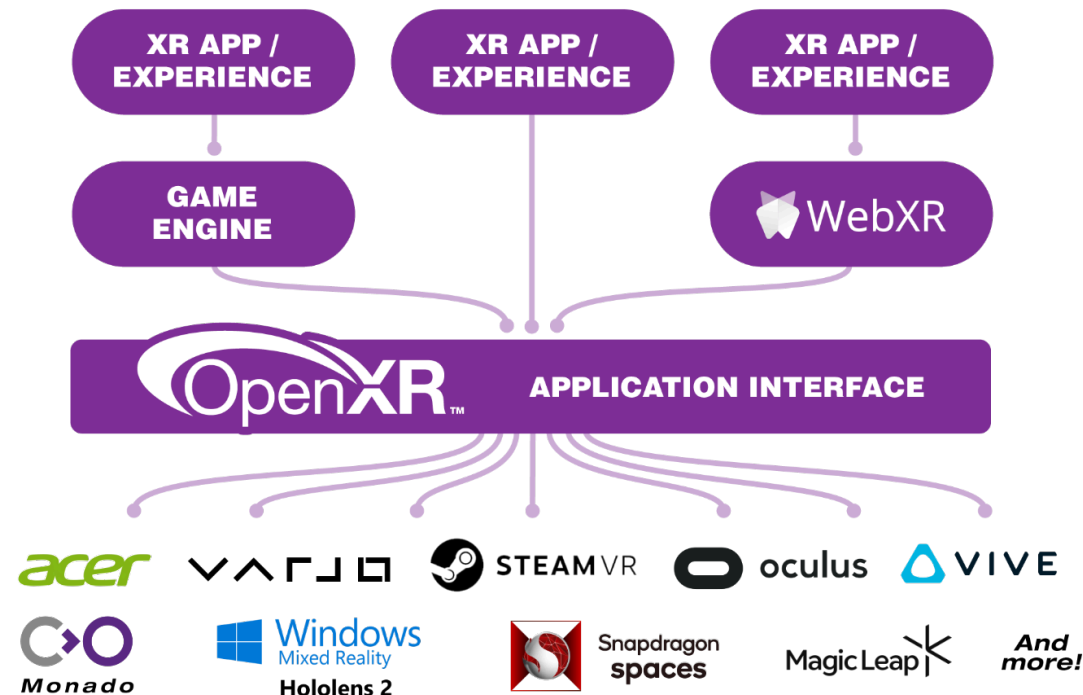


OpenXR is a royalty-free, open standard that provides high-performance access to Augmented Reality (AR) and Virtual Reality (VR) —collectively known as XR— platforms and devices.

Engine Adoption

 UNREAL ENGINE	 unity	
Unreal Engine Support since 4.24. UE5.0 Supports OpenXR	OpenXR Plugin available for Unity since 2020 LTS.	Chrome and Edge use WebXR which supports OpenXR as the default backend
	 GODOT Game engine	
	OpenXR Support since March 2022 (Core 4.0 Alpha 4)	

<https://www.khronos.org/openxr/>



OpenXR provides a single cross-platform, high-performance API between applications and all conformant devices.

OpenXR runtime



- SteamVR
- Oculus App
- Monado (open source)
- ...



STEAM VR



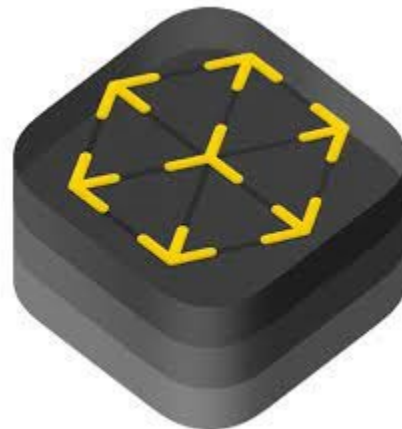
oculus

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Low Level Development APIs (AR/VR Mobile)



- ARCore
- ARKit





Integration Tools for Augmented Reality

- AR Foundation (Unity)
- AR Framework (Unreal)

- Vuforia



Low Level Development APIs (AR/VR Web)



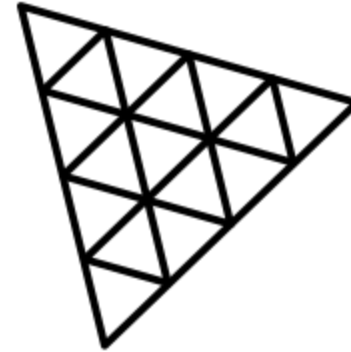
- WebXR (WebGL)



Graphical/VR 3D JavaScript libraries (Web)



- three.js (based on WebGL/WebXR)
- babylon.js (based on WebGL/WebXR)



X3D / VRML



- Universal 3D Data Transfer Format
- An open standard
- Easy to understand and model
- Portable across platforms



<https://www.web3d.org/>

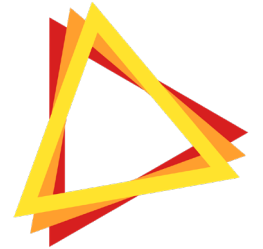
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VR Development Frameworks (Web)



VR Web Frameworks that support X3D/VRML (X3D)

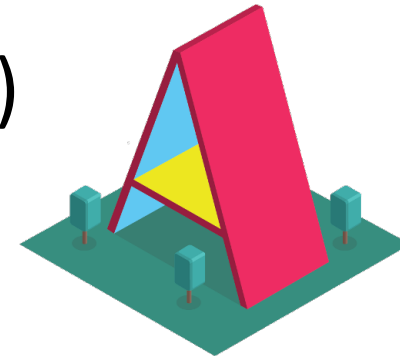
- X_ITE (based on WebGL)
- X3DOM (based on WebGL/WebXR*)



x3dom
Instant 3D the HTML way!

VR Web Framework (HTML)

- A-Frame (based on three.js/WebXR)



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High Level Virtual Reality SDKs



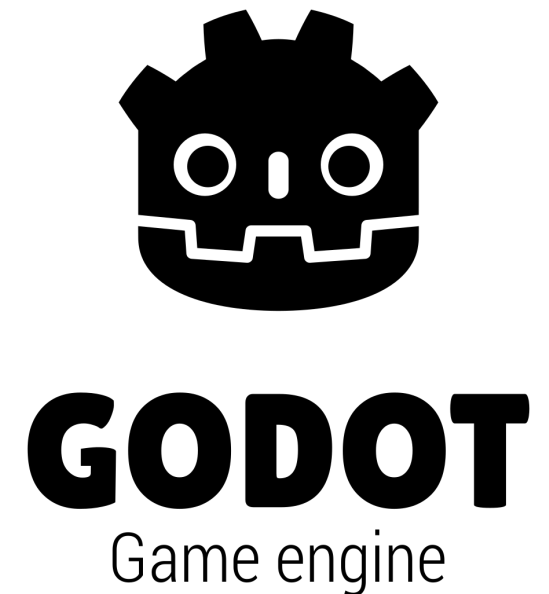
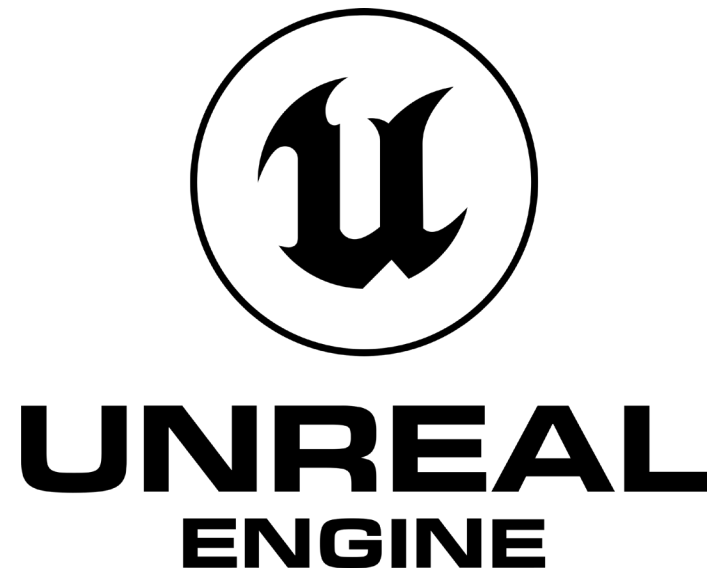
- FlowVR
- VRJuggler
- Avango





Game Engines

“Graphic Engines” are currently used to produce most of the Virtual Reality applications.



Toolkits / Interaction SDK



- VRTK - Virtual Reality Toolkit (Unity/Unreal)
- Windows Mixed Reality Toolkit (Unity)
- Oculus Interaction SDK (Unity/Unreal)
- SteamVR plugin (Unity/Unreal)

- XR Interaction Toolkit (Unity)
- OpenXR extension plugin (Unreal)
- XR Tools (Godot)

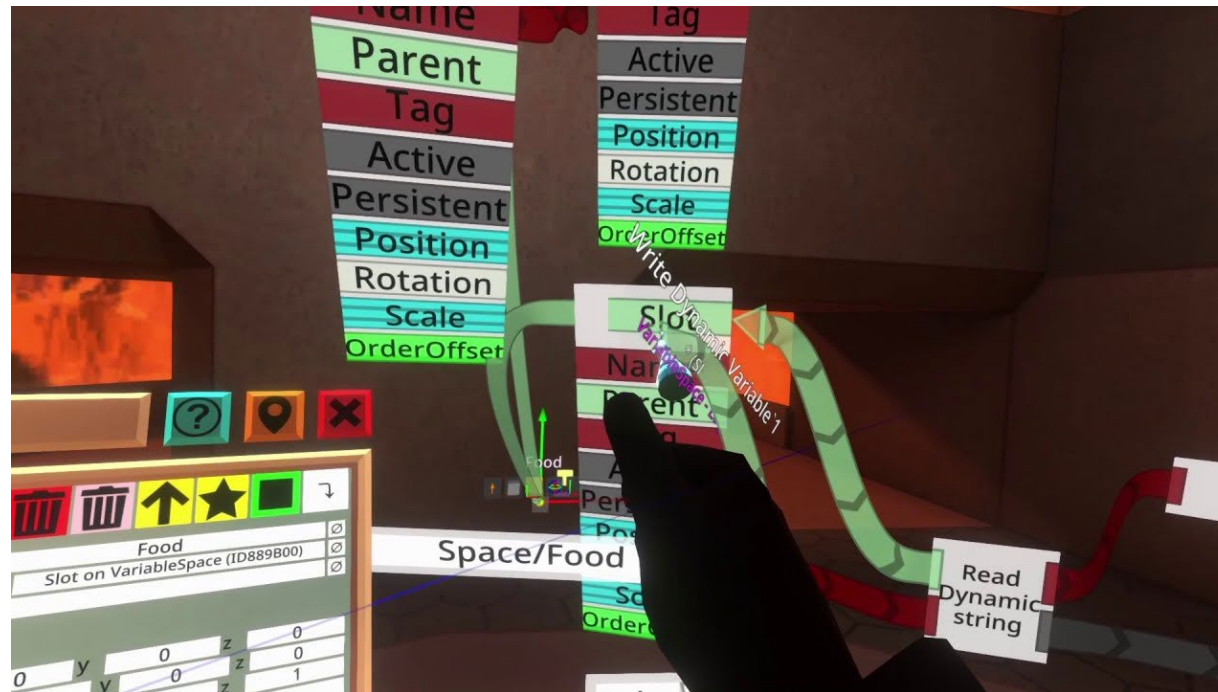


Developing in Virtual Reality



There are several platforms (already in Virtual Reality) that can be used to develop Virtual Reality application.

- Neos (LogiX)



<https://neos.com/>

Illixir (System and Testbed)



Illinois Extended Reality testbed or ILLIXR (pronounced like elixir) is the first fully open-source Extended Reality (XR) system and testbed. The modular, extensible, and OpenXR-compatible ILLIXR runtime integrates state-of-the-art XR components into a complete XR system.





Considerations for choosing a platform



API Level

- Low Level
- High Level

Target Platform

- PC-VR
- Standalone/Mobile

Execution

- Native
- Web browser

Game Engine Platform

- Unity
- Unreal
- Godot
- ...

Develop to a specific Metaverse