OpenXR Ecosystem Update
Bringing to Life the Dream of Portable Native XR
July 2020
Khronos Standards for XR

Create and deploy 3D assets and scenes

High-performance, low-latency 3D Graphics

Vision and sensor processing, inferencing acceleration

Portable access to native XR runtimes
OpenXR Ecosystem Updates

Khronos open sources conformance tests and launches Adopters Program

First officially conformant runtimes shipping from Microsoft and Oculus

Preview implementations from Valve, Varjo and Collabora

Hand and eye tracking cross-vendor extensions for advanced UI

OpenXR being used by key games and open source software
Minecraft! Blender! WebXR!

Now is the time for application developers to leverage OpenXR for widespread deployment!
OpenXR provides cross-platform, high-performance access directly into XR device runtimes across multiple platforms
Widespread Industry Support

Companies publicly supporting OpenXR

OpenXR is a collaborative design that integrates many lessons from proprietary ‘first-generation’ XR APIs to create a new generation API with cutting-edge capabilities and a flexible, extensible, future-proof architecture
Broadening OpenXR 1.0 Availability

- Signiﬁcant Community Feedback
  - Improved Input subsystem
  - Game engine editor support
  - Loader and Layers...

- Provisional Specification
  - GDC, March 2019

- Ratify and Release
  - OpenXR 1.0
  - SIGGRAPH, July 2019

- OpenXR 1.0 Adopter Program Released
  - Enable Ofﬁcially Conformant Implementations

- Conformant OpenXR 1.0 for Windows
  - Mixed Reality headsets and HoloLens 2
  - PLUS extensions to support HoloLens 2 hand tracking, eye tracking, spatial mapping and spatial anchors

- Conformant OpenXR 1.0 for Oculus Rift and Quest
  - SDK Oculus PC SDK & Android SDK V19 include OpenXR native C/C++ development
  - Developers can now submit their OpenXR apps to the Oculus Store

- Valve OpenXR 1.0 Developer Preview
  - New SteamVR features will ship through OpenXR, rather than OpenVR

- ‘Monado’ OpenXR 1.0 open source implementation
  - Supports variety of HMDs, including Project Northstar AR HMD

- Varjo OpenXR 1.0 Developer Preview
  - For Varjo headsets

- OpenXR 1.0 plugin for Unreal Engine v4.2.5
  - Enhanced support for late stage reprojection, mixed reality capture from a 3rd person camera view, optimized rendering by up to 2ms/frame

- Hand and eye tracking cross-vendor extensions for advanced UI
  - Shipping on HoloLens 2. Ultraleap hand tracking developer preview
First Conformant OpenXR Devices

A conformant OpenXR can use the OpenXR logo and has patent protection under the Khronos IP Framework.

- Prototype OpenXR Implementation
  - Use tests to aid development
  - Contribute test fixes and enhancements
  - Submit Test Results

- Production OpenXR Implementation
  - Test Results Approved
  - Khronos grants Trademark and Patent License

- OpenXR Adopters Website
  - OpenXR Adaptors
  - Website

- OpenXR Working Group

Conformant Devices

- Oculus Rift S
- Oculus Quest
- HoloLens 2
- Windows Mixed Reality Headsets
OpenXR Architecture Flexibility

- **Tethered**: Oculus Rift S, Windows Mixed Reality
- **All In One**: Microsoft HoloLens 2, Oculus Quest

Platforms:
- Android
- Windows 10
Advanced UI Cross-Vendor OpenXR Extensions

Developers can build cross-platform applications that use advanced UI solutions from different technology vendors. OpenXR API layers can be used to implement extensions.

**Hand Tracking**

- 26 unique joints per hand for fully articulated hands visible to the user
- Shipping on HoloLens 2 and [Microsoft Hand Mesh Extension](https://developer.microsoft.com/en-us/windows/holoLens/hand-mesh-extension) for HoloLens 2 layers over it
- [Ultraleap developer preview](https://developer.ultraleap.com) available

**Eye Tracking**

- Eye gaze interaction for intuitive interfaces
- 2-Step Interaction
- Hand-eye coordination
- Natural aiming
- Shipping on HoloLens 2
Microsoft is excited to announce that Minecraft’s new RenderDragon rendering engine is building its desktop VR support using OpenXR!
OpenXR and Open Source

Microsoft open source OpenXR Samples for Mixed Reality Developers, shows how to use OpenXR to access the full capabilities of HoloLens 2.

Google Chromium 81 uses OpenXR as its default backend for WebXR, enabling Google Chrome and Microsoft Edge browsers to use any OpenXR-compatible hardware.

Blender 2.83 integrates OpenXR to deliver native VR scene inspection capabilities.
OpenXR is used with a 3D API

High-performance, low-latency 3D rendering and composition*
- Multiview
- Context priority
- Front buffer rendering
- Tiled rendering (beam racing)
- Variable rate rendering

Display, composition and optical correction parameters

Cross-platform access to XR
- HMDs and sensors
- XR application lifecycle
- Input device discovery and events
- Sensor tracking and pose calculation
- Frame timing and display composition
- Haptics Control

OpenXR is strongly influenced by Vulkan with a shared spec toolchain and support for API layers. OpenXR is a “lower-frequency” API than Vulkan and is a much smaller spec.

* OpenXR can be used with other 3D APIs such as Direct3D, OpenGL and OpenGL ES
Bringing XR to the Web

Native XR Apps
- vuforia
- Unity
- Unreal

Native 3D Engines

Web XR Apps
- three.js

Web 3D Engines
- WebGL
- OpenXR
- Vulkan

Lifting OpenXR functionality into the Web stack

Close cooperation between WebXR and OpenXR

Khronos provides the foundation for native and Web-based 3D/XR
Structure of an OpenXR App

- **Get started**
  - Create an Instance
  - Choose extensions, layers, bind to graphics API

- **Find out where/how to run**
  - Get HMD characteristics - mono/stereo, form factor etc..

- **Set up interaction/input handles**
  - Bind physical inputs to actions
    - grab_object, teleport etc.

- **Prepare your immersive experience**
  - Create Session
  - Create Swapchain to drive the display

- **Participate in the frame loop**
  - Handle input and haptics
  - Manage swapchain to drive imagery to the display
  - Poll for events
Cloud XR with 5G and OpenXR

OpenXR will enable AR applications to run portably on edge server architectures.

Significant industry effort in developing this use case.

Runtime using 5G implemented across device and server and accessed through OpenXR API.

MEC (Multi-access Edge Computing) Server
1. Processes sensor data, can include machine learning for environmental lighting, occlusion, scene semantics, object reconstruction and UI
2. Generates imagery from 3D models, can include stereo, foveal rendering, ray-tracing, optics pre-distortion, varifocal processing

Low latency Sensor Data

Generated Augmentations & Scenes

Sensor handling

Display composition

Wireless mobile device with display and sensors
OpenXR Win-Win-Win

XR Vendors
Can bring more applications onto their platform by leveraging the OpenXR content ecosystem

XR ISVs
Can easily ship on more platforms for increased market reach

XR End-Users
Can run the apps they want on their system - reducing market confusion and increasing consumer confidence

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www.khronos.org/openxr/