Monado
Open Source Augmented & Virtual Reality

Christoph Haag & Joey Ferwerda
Christoph Haag

Twitter - @haagch42
christoph.haag
@collabora.com
● What is AR & VR
● Monado
● Wrapping up
> What is AR & VR <

- Monado
- Wrapping up
HMD, what?

- HMD (Head Mounted Display)
  - Facebrick containing a screen, some tracking solution (IMU, camera, photodiodes, lasers)
What is Augmented Reality?

- **Augment**
  - **verb**
  - /əˈɡɪmɛnt/
  - make greater by adding to it; increase
What is Virtual Reality?

- I reject your reality and substitute my own
  - Dungeonmaster, 1984
  - (popularized by Adam Savage)
What is AR & VR?

- Also known as XR
What is AR & VR

> Monado <

Wrapping up
Open standard for Virtual Reality and Augmented Reality

Open First
OpenXR
How do we XR?

- Program
- Platform
- Hardware
The API - Setup

- `xrCreateInstance()`
- `xrGetSystem()`
  - `XR_FORM_FACTOR_HEAD_MOUNTED_DISPLAY`
  - `XR_FORM_FACTOR_HANDHELD_DISPLAY`
- `xrEnumerateViewConfigurations()`
  - `XR_VIEW_CONFIGURATION_TYPE_PRIMARY_MONO`
  - `XR_VIEW_CONFIGURATION_TYPE_PRIMARY_STEREO`
- `xrCreateSession()`, `xrBeginSession()`
  - D3D10, 11, 12, OpenGL, OpenGL ES, Vulkan, Headless
  - Right now: no simultaneous Sessions (e.g. “Overlays”)
- `xrCreateSwapchain()`
  - Textures, that are sent to the runtime
The API - Rendering

- **xrWaitFrame, xrBeginFrame, xrEndFrame**
  - Render for predicted pose at next frame interval
  - XrCompositionLayerProjection
  - XrCompositionLayerQuad (UI, Video Stream, “Overlays”)
  - Optional: Cube, Cylinder, Depth, Equirect
  - XR_ENVIRONMENT_BLEND_MODE_OPAQUE
  - XR_ENVIRONMENT_BLEND_MODE_ADDITIVE
  - XR_ENVIRONMENT_BLEND_MODE_ALPHA_BLEND

- **xrLocateViews()**
  - App builds projection & view matrix
The API - Actions

● Similar to OpenVR Actions
● XrCreateAction()
  ○ Name, Type, suggested Input path mapping
  ○ BOOLEAN, VECTOR1F, VECTOR2F, POSE, VIBRATION
● Input path example
  ○ /user/hand/left/input/select/click
● Interaction Profiles
  ○ khr/simple_controller, google/daydream_controller,
    htc/vive_controller, htc/vive_pro, microsoft/motion_controller,
    microsoft/xbox_controller, oculus/go_controller,
    oculus/touch_controller, valve/knuckles_controller
The API - Actions

6.4.1. Khronos Simple Controller Profile

Path: /interaction_profiles/khr/simple_controller

Valid for user paths:

- /user/hand/left
- /user/hand/right

This interaction profile provides basic pose, button, and haptic support for applications with simple input needs. There is no hardware associated with the profile, and runtimes which support this profile should map the input paths provided to whatever the appropriate paths are on the actual hardware.

Supported component paths:

- ../input/select/click
- ../input/menu/click
- ../input/grip/pose
- ../input/aim/pose
- ../output/haptic
The API - Spaces

- `xrCreateReferenceSpace`
  - `XR_REFERENCE_SPACE_TYPE_VIEW = 1`
  - `XR_REFERENCE_SPACE_TYPE_LOCAL = 2`
  - `XR_REFERENCE_SPACE_TYPE_STAGE = 3`
  - `XR_REFERENCE_SPACE_TYPE_UNBOUNDED_MSFT`

- Input remapping
Compositor

- Extended Mode, Direct Mode
- Reprojection
- Overlays
- Vulkan, OpenGL Interop
- Distortion Correction
  - Quad Shader
  - Mesh Undistortion
Hardware support

- HDK
- PSVR, PS Move
- Razor Hydra
- Other devices through OpenHMD
Notable FOSS Tracking projects

- OpenHMD (Open Source drivers)
- libsurvive (Open Source lighthouse)
- Maplab (SLAM Tracking)
- Others: Lighthouse Redox, PSMoveService, OpenPSVR, OSVR, Opentrack, openvslam
Community

- VR Enthusiasts
- Want to improve Open Source VR in their free time
- Create drivers for all Headsets they have access to
- Regular Hackfests
- Friendly Boost Licence
- [http://openhmd.net](http://openhmd.net)
Reverse Engineering

- IMU (Accelerometer, Gyroscope)
- Firmware communication
  - Lots of wireshark (thanks usbmon!)
    - Decrypting hex like a boss
- Camera access
- Display modes
Demo!

Ish
● What is AR & VR
● Monado
● > Wrapping up <
Questions?

We don’t bite
Get in touch

- https://gitlab.freedesktop.org/monado
- https://monado.dev
- Irc.freenode.net - #Monado
- joey.ferwerda@collabora.com
- christoph.haag@collabora.com
We are hiring

Get hired to work on your favourite Open Source projects

Collabora is a leading global consultancy specializing in delivering the benefits of Open Source software to the commercial world. For over 10 years, we've helped our clients navigate the ever-evolving world of Open Source, enabling them to develop the best solutions - whether writing a line of code or shaping a longer-term strategic software development plan.

What working at Collabora means:


2. Amazing clients and cutting-edge technology. Being part of a worldwide Open Source software consultancy, Collaborans get to work on some of the most innovative, high-profile projects in the world.
Thank you!