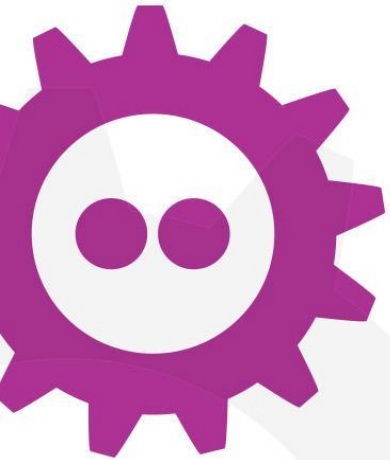

FOSS Virtual & Augmented Reality

Monado & OpenXR

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01/02/2020

FOSDEM'20

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Open First

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- What is AR & VR
- OpenXR
- Monado
- Status
- Demos
- Wrapping up

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- What is AR & VR
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What is Augmented Reality?

- Augment
  - Verb
  - /ɔːgˈmɛnt/
  - make greater by adding to it; increase

Open First

Open First

What is Virtual Reality?

- I reject your reality and substitute my own
  - Dungeonmaster, 1984
    - (popularized by Adam Savage)

BURGERS
AND
BYTES
AUGUST 5TH
7PM TO MIDNIGHT
PASSWORD:
101
EMAIL
PHOTOS
SRS
BUSINESS
INC.
ABC
WORDS
ONLINE
PAINT
World's
Most
Average
Worker!
How to Job
FOR DUMB HUMANS

Open First

Trinitron
Multiscan17sf II
50 100% 0%
AMMO HEALTH ARMS ARMOR
BULL 50 200
SHEL 50
ROKT 300
CELL
SONY
IBM
Intel Pentium 100

Open First

AR + VR = ?

- Also known as XR
- X = A | V
- Not eXtended Reality

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What is AR & VR

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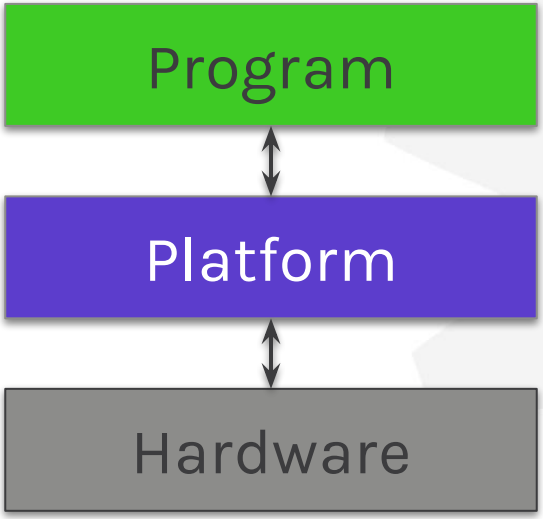
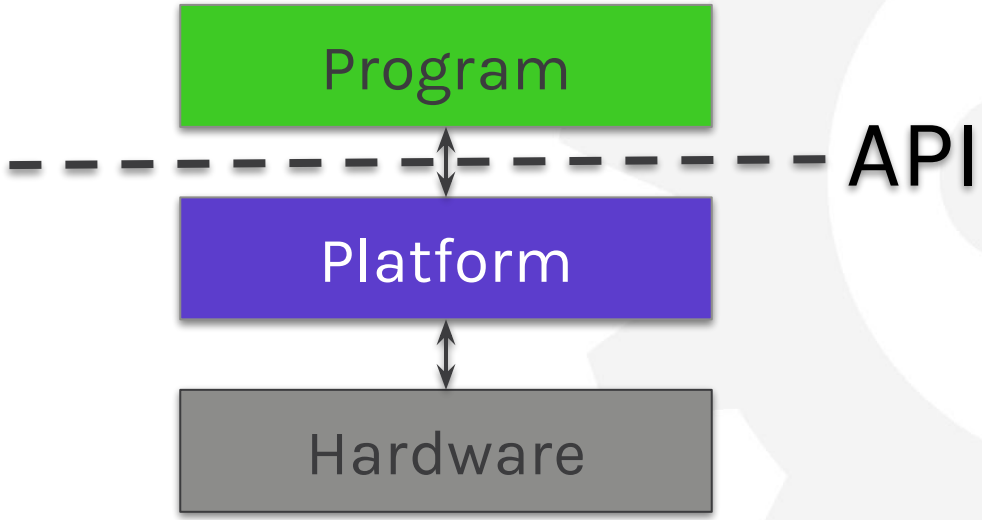
How do we XR?



How do we XR?



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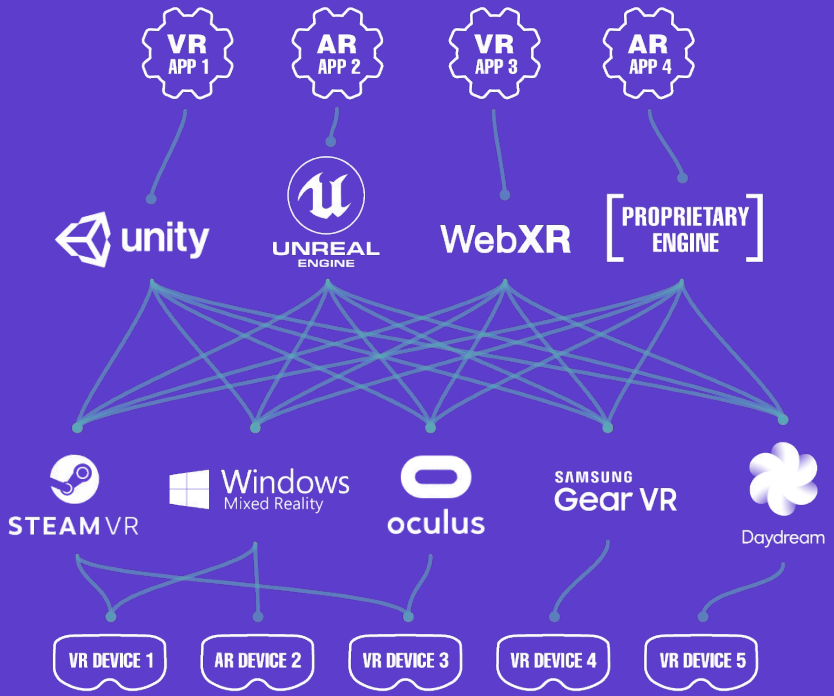
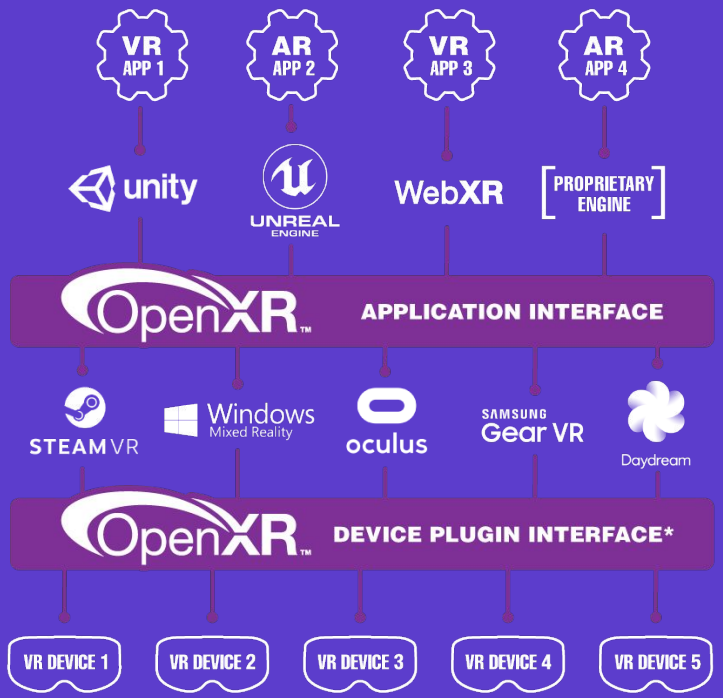


Before OpenXR

XR Market Fragmentation



After OpenXR

Wide interoperability of XR apps and devices

What's cool about OpenXR?

- It's just like OpenGL & Vulkan
  - Made by Khronos
- Out now
- Action Based
- FOSS Implementation! :D

Action Based

- Type of controller not in focus
  - Only after the fact
- Context
  - From program
  - To runtime
  - Runtime decides what button does what

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What is AR & VR

OpenXR

- **Monado**

Status

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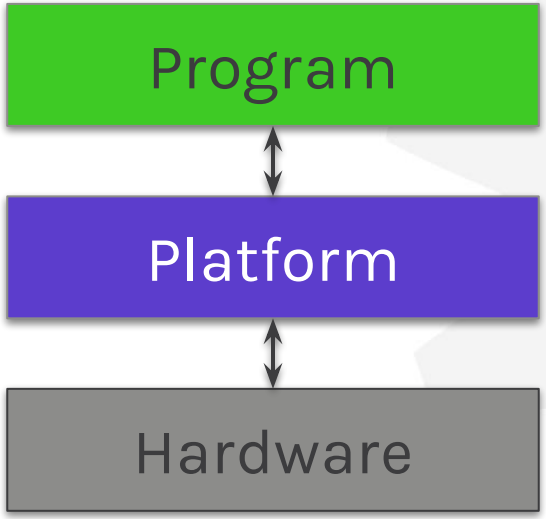
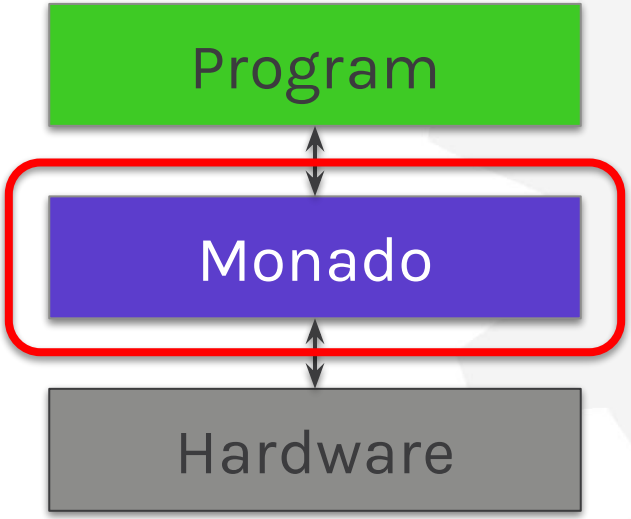
Wrapping up

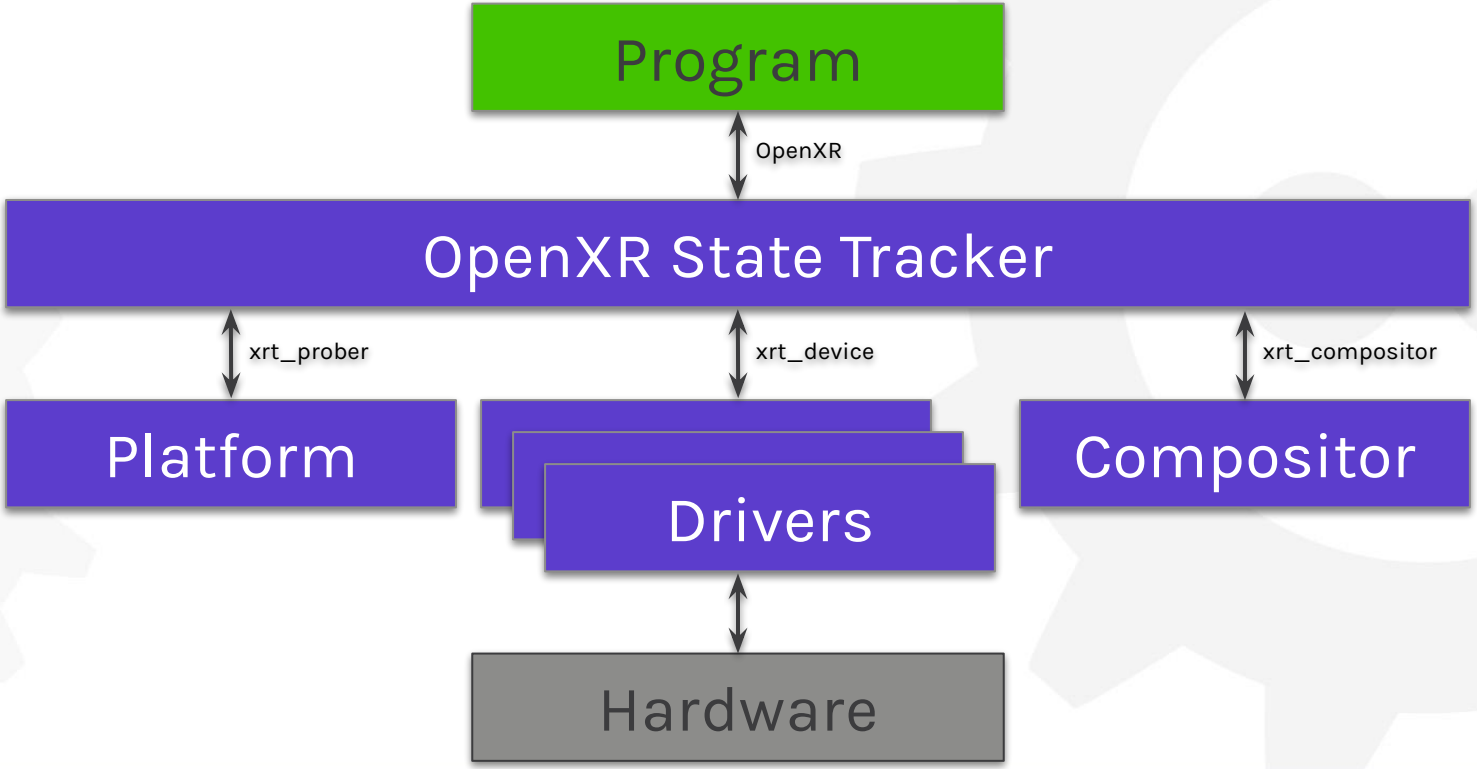
How do we XR?



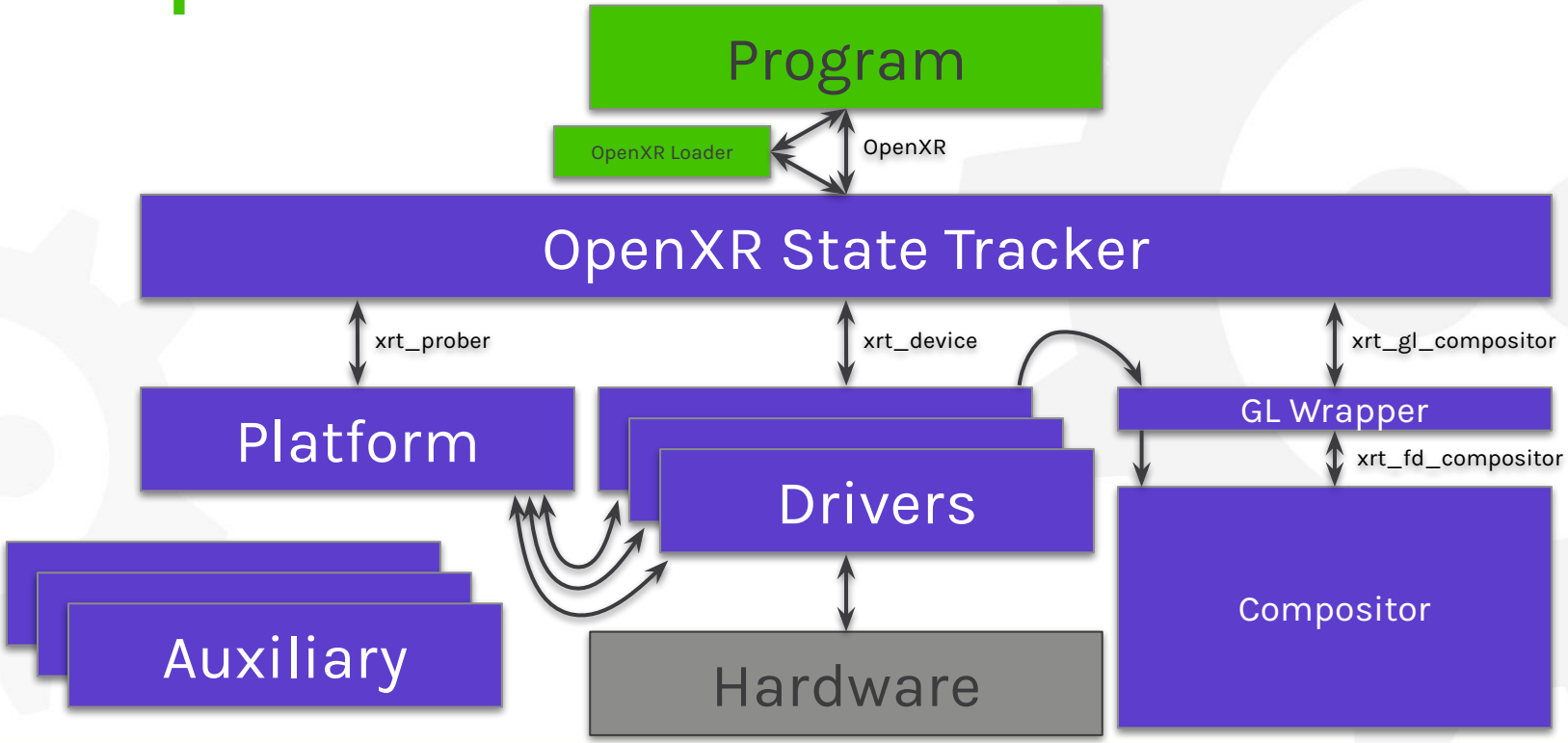
Where does Monado fit in?



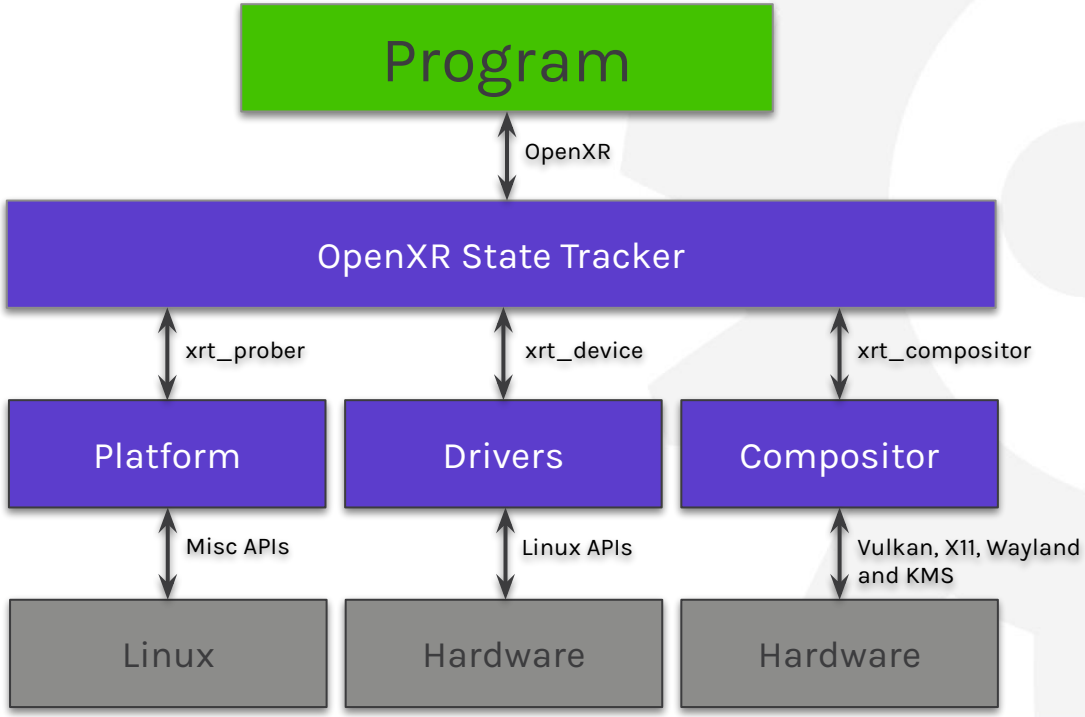
Monado


Program
OpenXR
OpenXR State Tracker
xrt_prober
xrt_device
xrt_compositor
Platform
Drivers
Compositor
Hardware

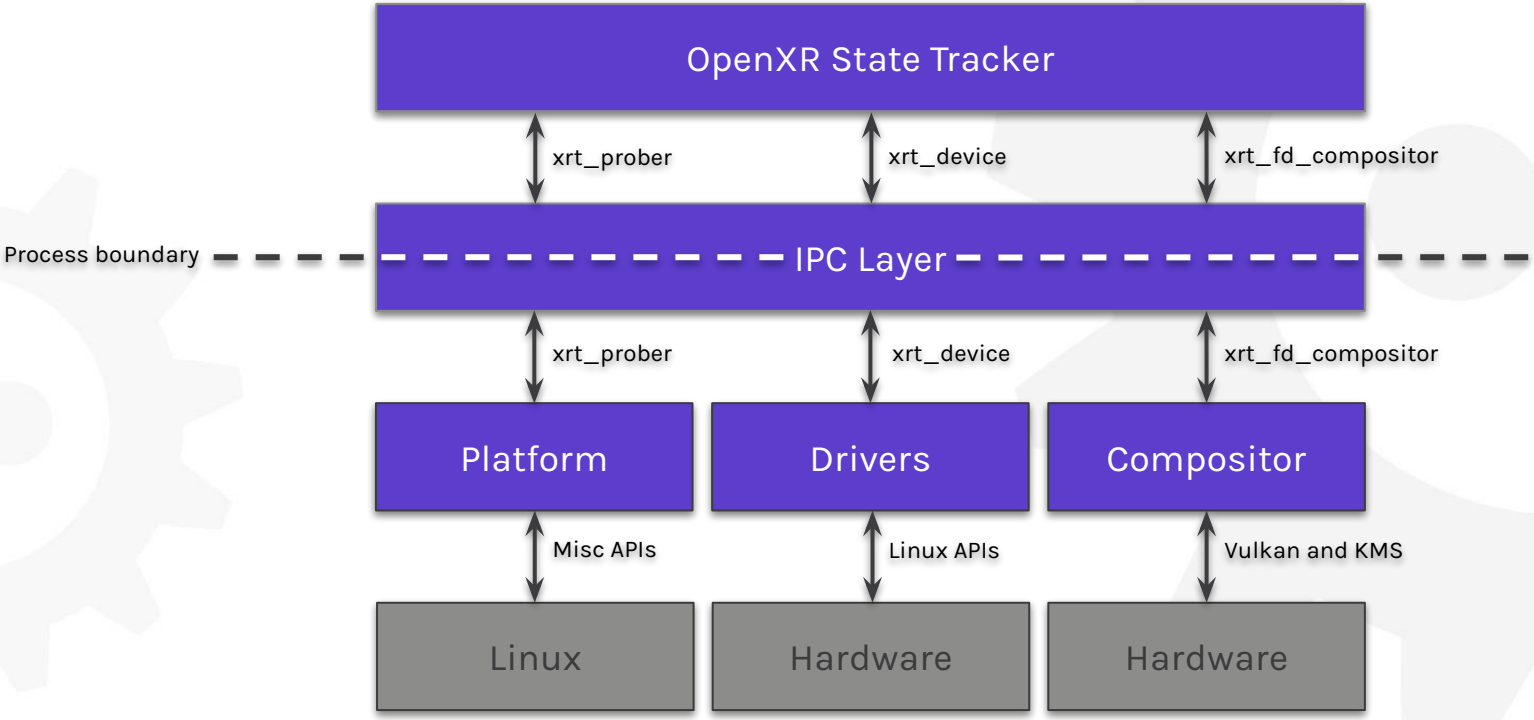
Complex Truth



Desktop Stack



With IPC - Anticipated



XRT Interfaces

- Between different components
  - Auxiliary code has their own interfaces
- Purely C
- Not stable![1]

xrt_device

- HMDs
- Controllers
- Aspect pattern
  - Optional structs
  - HMD info
- Functions
  - Input Sync
  - Output Set
  - View/Position Retrieval
- Info (immutable)
  - Input/Outputs
  - Tracking Origin
  - Screen position (HMD)
  - Distortion (HMD)

xrt_compositor

- Base class
  - xrt_[gl|vk|fd]_compositor
  - GL & VK are wrappers
    - Client side only
  - FD is “real” compositor
    - Written in Vulkan
    - Only “talks” in FDs
- xrt_swapchain
  - xrt_[gl|vk|fd]_swapchain
  - acquire, wait & release
- Functions
  - More explicit then OpenXR
  - Create Swapchain
  - Prepare, Begin & End
  - Wait, Begin, Discard & End
  - Poll Events (Refactor?)
- Info (immutable)
  - Supported Formats

xrt_prober

- Policy holder
  - Reads configuration
  - Decides what devices open
- Device prober
  - Used by OpenXR ST
- Platform code
  - Abstract native interfaces
  - Used by device drivers
- Should be split in two
  - xrt_prober
  - xrt_platform

- Functions
  - Look for devices
  - Select (opens devices)
  - List & Open Video devices
  - Misc USB
- Info (immutable)
  - None

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What is AR & VR
OpenXR
Monado
- **Status**

Demos
Wrapping up

Status

- Mostly complete OpenXR support
- In-process Compositor
  - Mesh shader
- Video processing framework
- Tracking PS Move
- Nifty debug UI

Hardware support

- North Star*
- Daydream Ctrl*
- OSVR HDK
- Vive (Pro) & Index
  - Positional tracking through libsurvive
- PlayStation VR
- PlayStation Move
- Razer Hydra
- OpenHMD
  - Port to native drivers where it makes sense.

Code

- 35.5K lines of codes
  - Drivers: 6.9K
    - 9 drivers
    - Vive: 1.5K
    - HDK: 0.5K
  - Compositor: 6.6K
  - Auxiliary: 7.6K
  - State Trackers: 10.1K
  - Targets: 1.3K

Next Up

- Complete OpenXR support
- Improve PS Move Tracking
- PSVR Tracking
- Out of process compositor

Even further out

- Safe space
- System UI
- Setup UI
- Lighthouse Tracking
- AR and SLAM

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What is AR & VR
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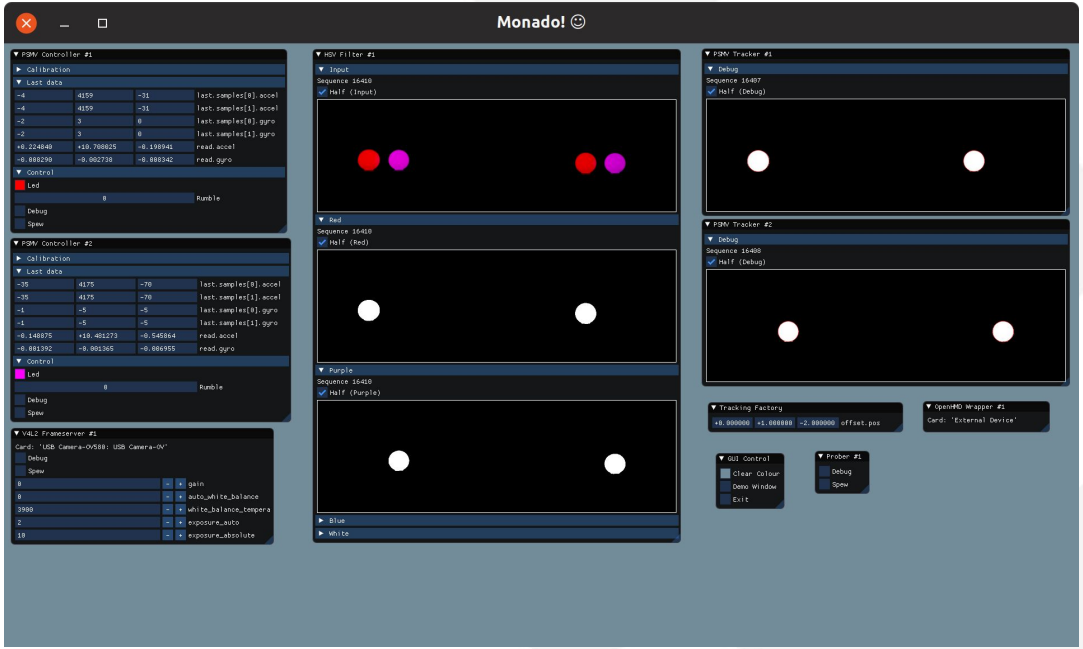
Tracking

Debug UI


Monado!
PSMV Controller #1
Calibration
Last data
Control
Led
Rumble
Debug
Spew
PSMV Controller #2
Calibration
Last data
Control
Led
Rumble
Debug
Spew
V4L2 Frameserver #1
Debug
Spew
gain
auto_white_balance
white_balance_tempera
exposure_auto
exposure_absolute
HSV Filter #1
Input
Half (Input)
Red
Half (Red)
Purple
Half (Purple)
Blue
White
PSMV Tracker #1
Debug
Half (Debug)
PSMV Tracker #2
Debug
Half (Debug)
Tracking Factory
offset.pos
OpenHMD Wrapper #1
GUI Control
Clear Colour
Demo Window
Exit
Prober #1
Debug
Spew

Tracking (back-up)

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What is AR & VR

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Rant

- Gnome-Shell
  - Output hot-plug
  - non-desktop
- Intel Missing Extension
  - GL_EXT_memory_object_fd

Some thoughts

- Lots of work needed
- GNOME & KDE UIs?
  - Monado interface library?
- Switching between apps?

FOSS XR Community

@FossXR

Links

- Monado
  - https://monado.dev/
  - https://monado.pages.freedesktop.org/monado
  - https://gitlab.freedesktop.org/monado/monado
- OpenXR
  - https://www.khronos.org/openxr
- Work on GFX & XR
  - Internships @ Collabora
  - Work @ Collabora

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Talk to me about

- XR, VR & AR
- FOSS XR
- Volt Programming Language
- FPGAs & FOSS
- Amiga (FPGA), mc68k (LLVM)
- Voxel/SVO rendering
- FOSS & Society
- Joining Collabora!

Open First

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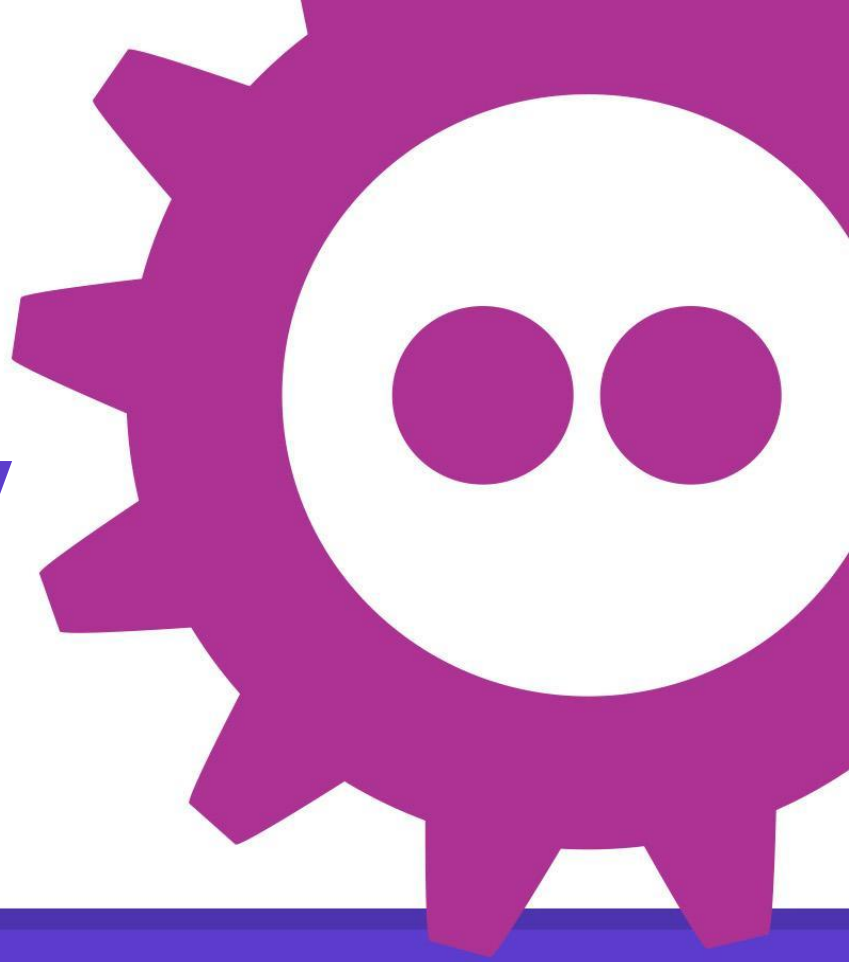
FOSS Virtual & Augmented Reality

Questions?



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