

# Monado Based OpenXR Virtual Devices

## Linux Guide

By Andrew Hazelden <[andrew@andrewhazelden.com](mailto:andrew@andrewhazelden.com)>

Created 2023-07-23 Updated 2023-08-29 03.36 PM (UTC -4)



The open-source [Monado](#) framework makes it possible to display OpenXR rendered real-time stereoscopic 3D content on a passive stereoscopic 3D monitor like the Schneider Digital [PluraView3D display](#). Monado is cross-platform compatible and works on both Windows and Linux systems.

## Monado Documentation

How to use the remote driver

<https://monado.pages.freedesktop.org/monado/howto-remote-driver.html>

Getting started with Monado

<https://monado.freedesktop.org/getting-started.html>

## Developing with Monado

<https://monado.freedesktop.org/developing-with-monado.html>

## Monado OpenXR Resources

<https://monado.freedesktop.org/openxr-resources.html>

## Monado Developer Docs:

<https://monado.pages.freedesktop.org/monado/>

## Writing a new OpenXR based Monado HMD Driver

<https://gitlab.freedesktop.org/monado/monado/-/blob/main/doc/writing-driver.md>

## Monado Sample Driver

[https://monado.pages.freedesktop.org/monado/group\\_\\_drv\\_\\_sample.html](https://monado.pages.freedesktop.org/monado/group__drv__sample.html)

## Vulkan Extensions

<https://gitlab.freedesktop.org/monado/monado/-/blob/main/doc/vulkan-extensions.md>

## OpenComposite

An OpenVR replacement API that forwards calls to OpenXR.

<https://gitlab.com/znixian/OpenOVR>

## Generalised Perspective Projection

Perspective Displays and Frustums

<https://web.archive.org/web/20170722004237/http://csc.lsu.edu/~kooima/pdfs/gen-perspective.pdf>

# Compiling Monado on Linux

Note: The PluraView3D monitor might have a detectable USB ID or monitor EDID code for the display. This could allow the OpenXR `xrt_auto_prober` to detect the monitor presence using the vendor ID.

Note: On Linux the "Display Settings" list a PluraView3D display's panel as a "Liyama North America 28" monitor.

## Add the Linux build tools

```
sudo apt install g++ gcc cmake git git-lfs ninja-build libsdl2-dev  
zlib1g-dev libcjson-dev
```

## Add the supporting libraries

```
sudo apt install ffmpeg libavcodec58 libavcodec-dev libeigen3-dev  
libvulkan-dev libvulkan1 mesa-vulkan-drivers libglx-dev  
libglx-mesa0 libegl-dev libegl-mesa0 libegl1 libegl1-mesa-dev  
libglx0 libegl1-mesa libglul-mesa-dev mesa-utils libopenvr-api1  
libopenvr-dev libopengl-dev libopenhmd0 libopenhmd-dev  
libopenxr-loader1 libopenxr-dev libopenxr1-monado glslang-tools  
glslang-dev graphviz libann0 libcdt5 libcgraph6 libgl1-mesa-dev  
libglfw3 libglfw3-dev libglm-dev libgts-0.7-5 libgts-bin libgvc6  
libgvpr2 liblab-gamut1 libpathplan4 meson libusb-dev libusb-1.0-0  
libusb-1.0-0-dev libudev-dev libv4l-dev libx11-dev libx11-xcb-dev  
libxrandr-dev libhidapi-libusb0 libhidapi-dev libopencv-core4.5d  
libopencv-core-dev libopencv-dev libuvc0 libuvc-dev libjpeg-dev  
libbluetooth-dev doxygen libgstreamer1.0-0 libgstreamer1.0-dev  
gstreamer1.0-plugins-base gstreamer1.0-plugins-base-apps  
libonnx-dev libonnx1 libglew2.2 libglew-dev glew-utils  
libxcomposite1 libxcomposite-dev libxcb-randr0 libxcb-randr0-dev
```

## Compile Monado

```
{  
cd $HOME  
git clone https://gitlab.freedesktop.org/monado/monado.git  
cd $HOME/monado  
mkdir build  
cd build  
cmake .. -DCMAKE_BUILD_TYPE=Debug -G "Unix Makefiles"  
cmake --build .  
sudo cmake --build . --target install  
}
```

## The Monado command-line executable programs are:

```
/usr/local/bin/monado-cli  
/usr/local/bin/monado-gui  
/usr/local/bin/monado-ctl  
/usr/local/bin/monado-service
```

## The OpenXR JSON based configuration file is located at:

```
/usr/local/share/openxr/1/openxr_monado.json
```

## Edit the OpenXR JSON config file in the Ubuntu text editor:

```
xed /usr/local/share/openxr/1/openxr_monado.json
```

## Start Monado Service

```
export P_OVERRIDE_ACTIVE_CONFIG="remote"  
/usr/local/bin/monado-service
```

## Start Monado in the remote mode

```
export P_OVERRIDE_ACTIVE_CONFIG="remote"  
/usr/local/bin/monado-gui remote
```

## Start Monado in the simulated mode

```
export P_OVERRIDE_ACTIVE_CONFIG="simulated"  
/usr/local/bin/monado-gui simulated
```

## Start Monado in the QWERTY input mode

```
export P_OVERRIDE_ACTIVE_CONFIG="qwerty"  
export QWERTY_ENABLE=1  
export XRT_DEBUG_GUI=1  
/usr/local/bin/monado-service
```

## OpenXR Simple Playground

<https://gitlab.freedesktop.org/monado/demos/openxr-simple-playground>

```
{  
cd $HOME  
git clone  
https://gitlab.freedesktop.org/monado/demos/openxr-simple-playgrou  
nd.git  
cd $HOME/openxr-simple-playground/  
cmake -GNinja -Bbuild -DCMAKE_BUILD_TYPE=Release  
ninja -C build  
cd $HOME/openxr-simple-playground/build  
./openxr-playground  
}
```

## XR Gears Example

<https://gitlab.freedesktop.org/monado/demos/xrgears>

```
{
cd $HOME
git clone https://gitlab.freedesktop.org/monado/demos/xrgears.git
cd $HOME/xrgears
meson build
ninja -C build
cd $HOME/xrgears/build/src/
./xrgears
}
```

## OpenXR Simple Example:

<https://gitlab.freedesktop.org/monado/demos/openxr-simple-example>

```
{
cd $HOME
git clone
https://gitlab.freedesktop.org/monado/demos/openxr-simple-example.
git
cd $HOME/openxr-simple-example/
cmake -GNinja -Bbuild -DCMAKE_BUILD_TYPE=Release
ninja -C build
cd $HOME/openxr-simple-example/build
./openxr-example
}
```

## Check the Display Settings on Linux

xrandr is the official configuration utility to the RandR (Resize and Rotate) X Window System extension.

<https://wiki.archlinux.org/title/xrandr>

You can use either of these two commands to get a generic display settings output from the xrandr utility:

```
xrandr --prop
```

```
xrandr
```

The resulting terminal output:

```
Screen 0: minimum 320 x 200, current 3440 x 1440, maximum 16384 x
16384
DP-1 disconnected (normal left inverted right x axis y axis)
HDMI-1 disconnected (normal left inverted right x axis y axis)
DP-2 disconnected (normal left inverted right x axis y axis)
HDMI-2 connected primary 3440x1440+0+0 (normal left inverted right
x axis
y axis) 800mm x 335mm
```

|           |                               |
|-----------|-------------------------------|
| 3440x1440 | 59.97*+ 49.99 29.99           |
| 2560x1440 | 59.97                         |
| 1920x1440 | 59.97                         |
| 2560x1080 | 60.00 59.94 50.00 60.00       |
| 1856x1392 | 59.97                         |
| 1792x1344 | 59.97                         |
| 2048x1152 | 59.97                         |
| 1920x1200 | 59.97                         |
| 1920x1080 | 60.00 60.00 50.00 59.94 59.97 |
| 1600x1200 | 59.97                         |
| 1680x1050 | 59.97 59.88                   |
| 1400x1050 | 59.97                         |
| 1600x900  | 60.00 59.97                   |
| 1280x1024 | 60.02 59.97                   |
| 1400x900  | 59.97                         |
| 1280x960  | 59.97                         |
| 1440x810  | 59.97                         |
| 1368x768  | 59.97                         |
| 1280x800  | 59.97 59.91                   |
| 1280x720  | 60.00 50.00 59.94 59.97       |
| 1024x768  | 60.00 59.97                   |
| 960x720   | 59.97                         |
| 928x696   | 59.97                         |
| 896x672   | 59.97                         |
| 1024x576  | 59.97                         |
| 960x600   | 59.97                         |
| 960x540   | 59.97                         |
| 800x600   | 60.32 59.97                   |
| 840x525   | 59.97                         |
| 864x486   | 59.97                         |
| 720x576   | 50.00                         |
| 700x525   | 59.97                         |
| 800x450   | 59.97                         |
| 720x480   | 60.00 59.94                   |
| 640x512   | 59.97                         |
| 700x450   | 59.97                         |
| 640x480   | 60.00 59.97 59.94             |
| 720x405   | 59.97                         |
| 684x384   | 59.97                         |
| 640x360   | 59.97                         |
| 512x384   | 59.97                         |
| 512x288   | 59.97                         |
| 480x270   | 59.97                         |
| 400x300   | 59.97                         |
| 432x243   | 59.97                         |
| 320x240   | 59.97                         |
| 360x202   | 59.97                         |
| 320x180   | 59.97                         |

DP-3 disconnected (normal left inverted right x axis y axis)

As an xrandr usage example, if you connect the two PluraView3D video cables to the lower pair of display port connectors on a NVIDIA RTX 3090 GPU, the following ports are used:

- DP-2 - USED
- DP-3 - USED

## Monado Based Simulator OpenXR Display Canvas Resolution

If you want to change the default resolution of a Monado OpenXR HMD screen, you can edit the following lines of code in the file named "r\_hmd.c":

```
// Setup info.
struct u_device_simple_info info;
info.display.w_pixels = 3840*2;
info.display.h_pixels = 2160;
```

## Environment Variables

If you want to have the Monado environment variables accessible system-wide you can add the following two entries to the end of your "\$HOME/.profile" document:

```
export
XR_RUNTIME_JSON=/usr/local/share/openxr/1/openxr_monado.json
export P_OVERRIDE_ACTIVE_CONFIG=remote
```

Or

```
export
XR_RUNTIME_JSON=/usr/local/share/openxr/1/openxr_monado.json
export P_OVERRIDE_ACTIVE_CONFIG=qwerty
export QWERTY_ENABLE=1
export XRT_DEBUG_GUI=1
```