

# GNOME OS on RISC-V

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July 21st  
GUADEC 2021

# What is GNOME OS?

A vanilla GNOME OS for:

- Development
- Automatic testing
- Design
- Promotion

Runs on virtual machines and hardware (...some).

The website, `os.gnome.org`, says:

“Bad things may happen if you use it in production.”

# Using GNOME OS on hardware

Should I use GNOME OS? Only if you...

- ... want to test.
- ... plan to contribute to it.
- ... do not need proprietary GPU drivers (unless you have a plan to make it work).
- ... do not use it live for a GUADEC talk like I do.

There are two trees: user and development.

## **What distribution is it based on?**

- None. It is build on top of Freedesktop SDK.

## **What package manager?**

- None. You can use Flatpak. You can also use Podman, Toolbox, systemd-nspawn.

## **How do you upgrade?**

- Atomic updates using OSTree. It is integrated in GNOME Software.

## **How is it built?**

- We build everything “at once” with Buildstream (for remote cache and reproducibility)

# What is RISC-V?

- Opensource CPU instruction set architecture
- 32, 64, 128 bits
- Multiple extensions for multiple applications
- From micro controllers to super computers... and desktop!

# Why RISC-V now?

- GNU binutils 2.28: March 6th 2017
- GCC 7.1: May 2nd 2017
- Linux 4.15: January 28th 2018
- glibc 2.27: February 1st 2018
- GDB 8.3: May 11th, 2019
- LLVM 9.0.0: September 19th 2019
- Rust 1.42.0 (tier 2, compiler+lib): March 12th 2020
- GO 1.16: February 17th 2021

Also desktop capable experimental hardware has been released and some more is under way.

- We target RV64GC, with lp64d ABI.
- Freedesktop SDK's bootstrap phase can be cross compiled.
- The rest needs to build on target architecture.
- No hardware in the beginning: QEMU user mode emulation.

GNOME OS and Freedesktop SDK do not have cyclic dependencies. So no chicken and egg problem.

# Using QEMU

## QEMU user mode vs system

- user mode does not need an OS image
- user mode allows building everything as one command
- user mode is faster
- user mode hangs...

`G_SLICE=always-malloc` and everything works

# Targets

- QEMU virtual machines.
- Hifive Unmatched by Sifive
  - 1.4GHz 4-core U740, 16GB RAM and PCIe
  - we received them after the CfP for this talk



## Previous hardware worked on

We have made GNOME OS work on Aarch64:

- QEMU
- Rock64 (same OSTree as QEMU, different image)
- PineBook Pro (different OSTree)
- Raspberry Pi 4 (different OSTree)

All of them using systemd-boot through U-Boot as EFI firmware.

For RISC-V,

- We want one built kernel per architecture, one OSTree.
- We do not want to deal with device trees. Firmware should provide it.
- We do not want special partitions with firmware.

Sifive Unmatched requires some kernel patches. We applied them in the Freedesktop SDK's kernel. They are being actively upstreamed.

# Installing

Same installer ISO image for both targets:

## QEMU

- Load U-Boot+OpenSBI through '-bios'
- Add installer ISO as disk
- Add a blank image as disk

## Sifive Unmatched

- SD card contains U-Boot+OpenSBI, and kernel compatible device tree
- USB stick contains installer ISO
- Blank NVMe disk installed on M.2

## Where was the work tricky?

Freedesktop SDK had much more components that needed changes than GNOME OS layer.

Updating some software. Or backporting fixes.

Finding out why QEMU was hanging.

Getting GNU-EFI to work.

- Freshly merged to master
- Sifive Unmatched requires Freedesktop SDK 21.08beta2
- Need some wiki page to describe the build and installation process
- We need to setup builders and CI
- Some patches should be upstreamed, specially GNU-EFI

# Unrelated new things in GNOME OS

- systemd-homed works manually
  - Include logging with smart-cards/security keys.
  - we need support in accountsservice (or in Settings?), but can be tested.
- openvpn, vpnc, fortisslvpn, openconnect plugins for NetworkManager
- LXC added to development tree
- Hopefully, v4l2loopback modules for OBS, so you can also use a green screen!

# Aknowlegdements

GNOME OS is a part of the GNOME build metadata:

<https://gitlab.gnome.org/GNOME/gnome-build-meta>

#gnome-os on IRC/Matrix

Work done by engineers at Codethink.