

Lima driver status update 2021
XDC 2021
Erico Nunes

Outline

- Overview
- The Mali-4xx
- Status update
- Benchmark
- Going forward

Overview

- Lima is an open source graphics driver which supports Mali-4xx embedded GPUs from ARM via reverse engineering
- Upstreamed in mesa 19.1 and linux kernel 5.2
- Community developed driver

Mali-4xx

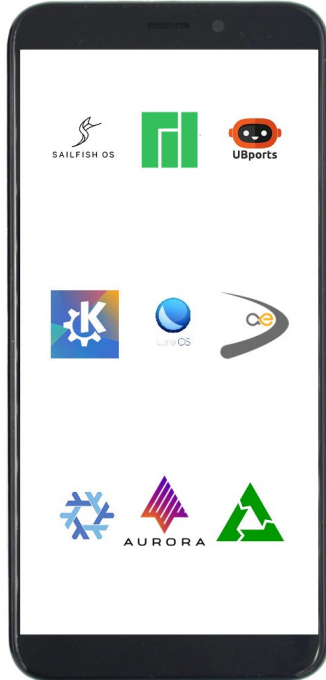
- Mali-400 (2008), Mali-450 (2012), Mali-470 (2015)
- One of the world's most shipped mobile GPUs
- OpenGL ES 2.0
- Tiling rendering model
- Not unified shader architecture
- Up to 8 PP cores, up to 2 GP cores
- No integers, only fp16
- Mali-4xx is not a display controller (HDMI, LCD, etc).

Mali-4xx

- Is it still relevant today?

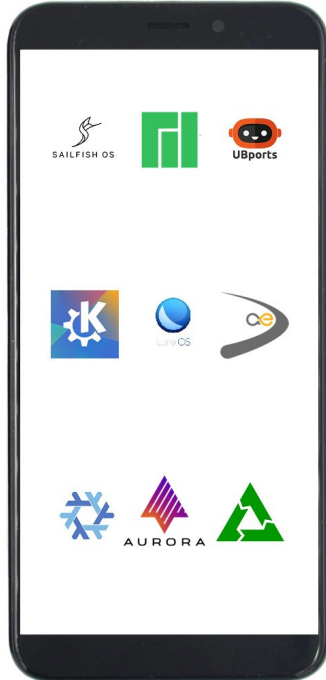
Mali-4xx

- Is it still relevant today?



Mali-4xx

- Is it still relevant today?



System info

5:40 PM

- Summary
- Storage
- Network
- Video**
- Hardware
- PVR service
- Privacy policy

GPU: Mali450
Screen resolution: 1920x1080@60.00Hz - Full screen
OpenGL vendor: lima
OpenGL version: 2.1 Mesa 21.2.0 (git-33595f88d6)
Windowing system: Gbm

System memory usage: 344MB / 1932MB - 18%

System CPU usage: #0: 5.9% #1: 5.8% #2: 1.9% #3: 16%

Version info:
Build: 19.1 (19.1.0)
Git: 20210603-nogitfound
Compiled: 2021-06-03

Status update

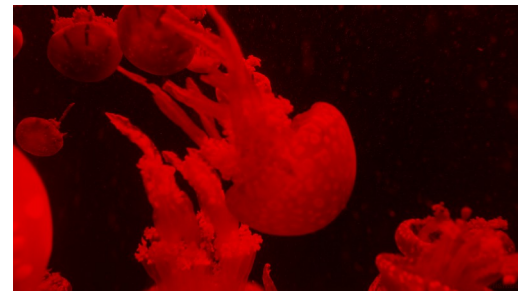
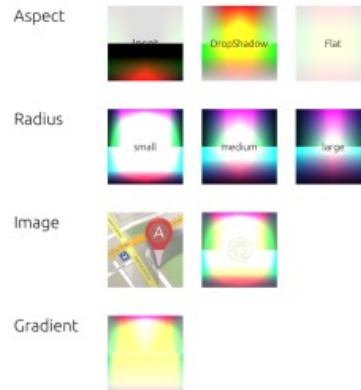
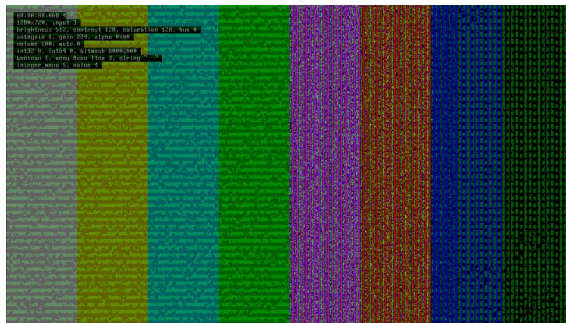
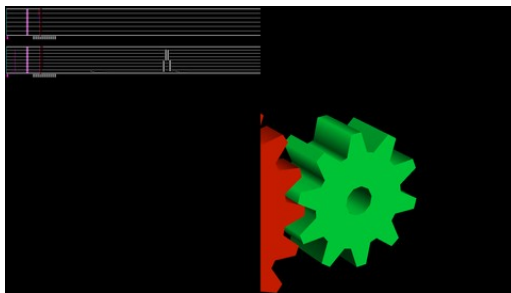
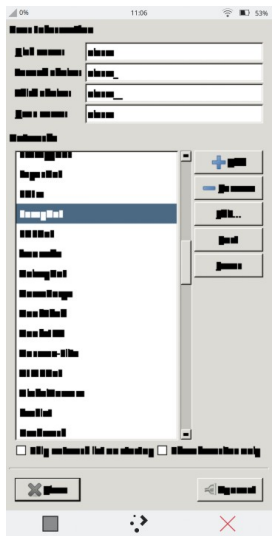
- Performance work
 - Job submission rework
 - Partial update
 - BO cache
 - Shader caches – runtime and disk

Status update

- Compiler work
 - Fully functional fragment shader compiler (ppir)
 - Fully functional vertex shader compiler (gpir)
 - Improvements in combining ppir instructions

Status update

- Lots of bug fixing!
- Please keep reporting any issues!



Status update

- Documentation in mesa: <https://docs.mesa3d.org/drivers/lima.html>
- FAQ

DRIVERS

D3D12

Freedreno

Lima

Supported APIs

Display drivers

Environment variables

Known hardware limitations

Bug Reporting

FAQ

Communication channels

Dump tool

Reference

LLVMpipe

OpenSWR

Panfrost

VMware SVGA3D

V3D

VC4

Virtio-GPU Venus

Zink

DEVELOPER TOPICS

Source Code Repository

» Lima

Edit on GitLab

Lima

Lima is an open source graphics driver which supports Mali Utgard (Mali-4xx) embedded GPUs from ARM. It's a reverse-engineered, community-developed driver, and is not endorsed by ARM. Lima was upstreamed in Mesa 19.1 and Linux kernel 5.2.

Product	Architecture	Status
Mali-400	Utgard	Supported
Mali-450	Utgard	Supported
Mali-470	Utgard	Unsupported

Newer Mali chips based on the Midgard/Bifrost architectures (Mali T or G series) are handled by the [Panfrost](#) driver, not Lima.

Note that the Mali GPU is only for rendering: the GPU does not control a display and has little to do with display-related issues. Each SoC has its own separate display engine to control the display output. To display the contents rendered by the Mali GPU to a screen, a separate [display driver](#) is also required, which is able to share buffers with the GPU. In Mesa, this is handled by [kmsro](#).

Supported APIs

Lima mainly targets [OpenGL ES 2.0](#), as well as [OpenGL 2.1](#) (desktop) to some extent.

The OpenGL (desktop) implementation is enabled by Mesa and Gallium, where it is possible to

Status update

- CI: New LAVA instance for Lima
- AML-S805X-AC (La Frite)

Status update



Status update

- deqp gles2: current deqp results from CI

Pass: 15989, ExpectedFail: 59, Warn: 62, Skip: 382, Duration: 3:17

Status update

- Android: great community efforts
- Seems to be in good shape



Status update

- Kernel
- Runtime power management
- Mostly reworks and keeping up to date

Benchmark

	mali	lima	vc4
Board	AML-S805X-AC (La Frite)		Raspberry Pi 3
GPU	Mali-450 MP3 @ 650MHz		VideoCore IV
OS	libre computer Debian 10 LXDE with Mali		Raspberry Pi OS
Kernel, dtb	v5.4/libretech-master-stable-build		v5.10/raspberrypi
Kernel driver	mali DX910-SW-99002-r7p0-00rel1_meson_gx	lima	vc4
User space	libMali.so r7p0-00rel0	mesa 21.2.0-devel	
Benchmark	glmark2-es2 2020.04		

Benchmark

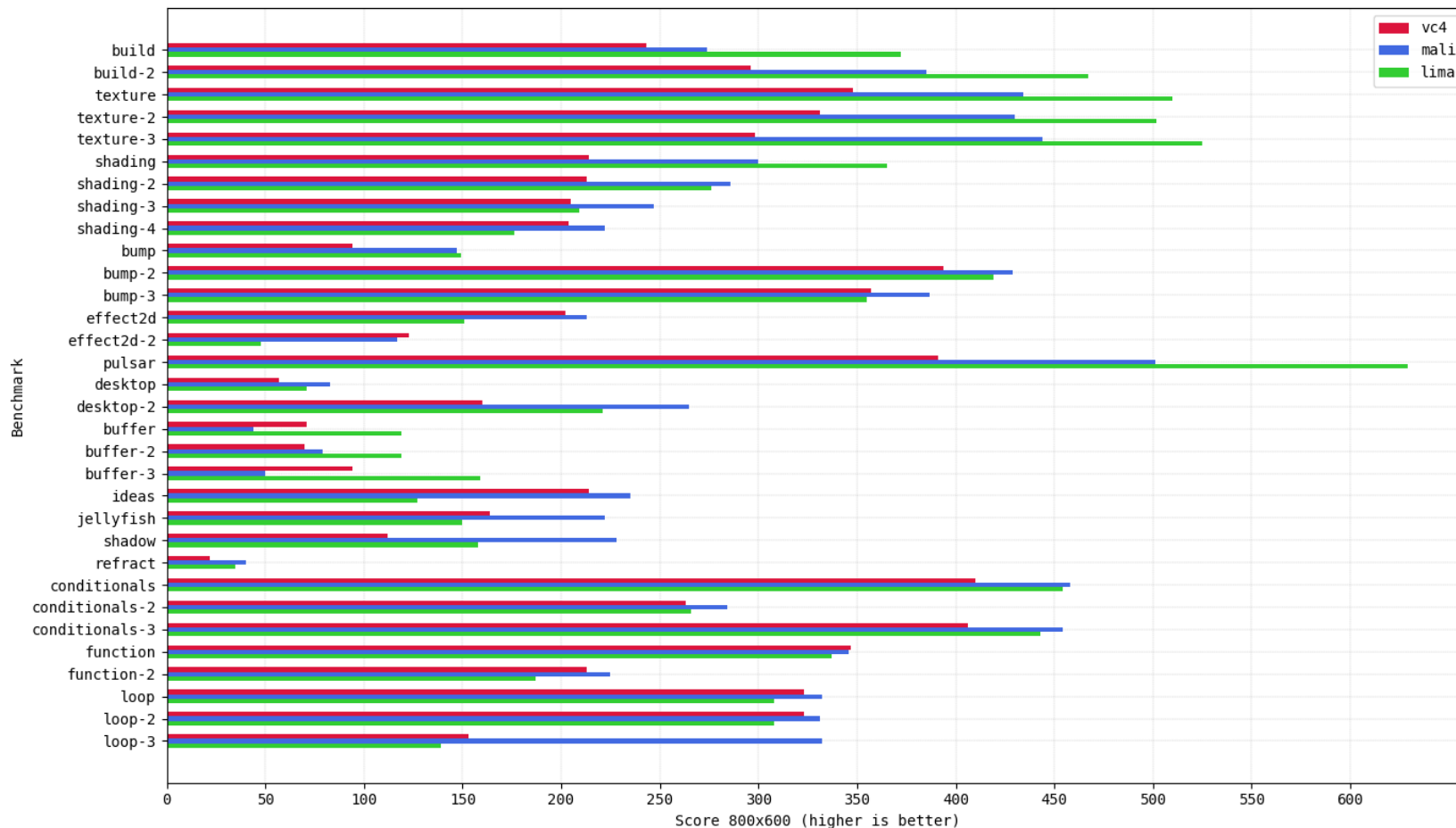
[usual benchmark disclaimers]

Benchmark

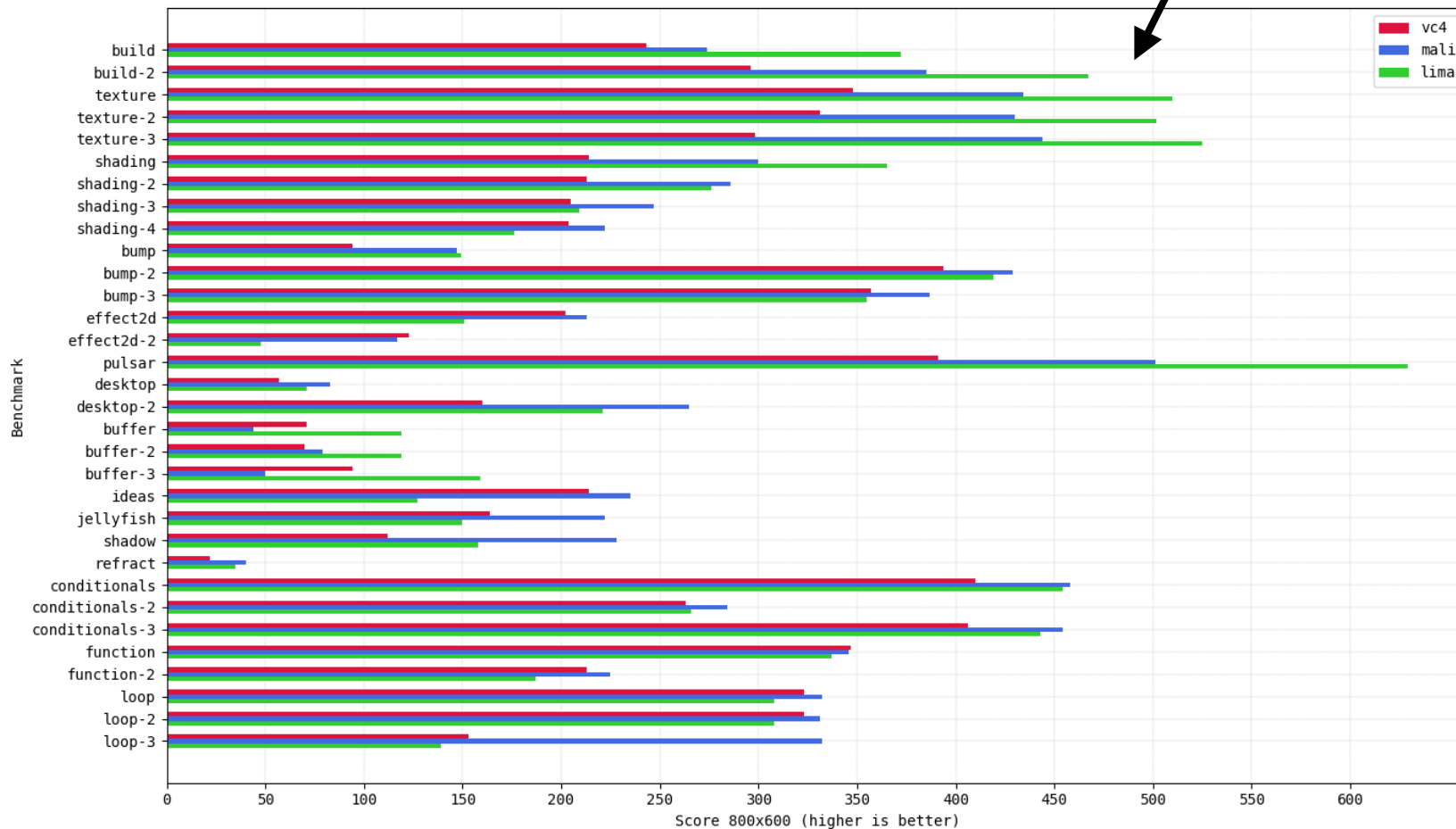
[usual benchmark disclaimers]

For best results, benchmark your own application

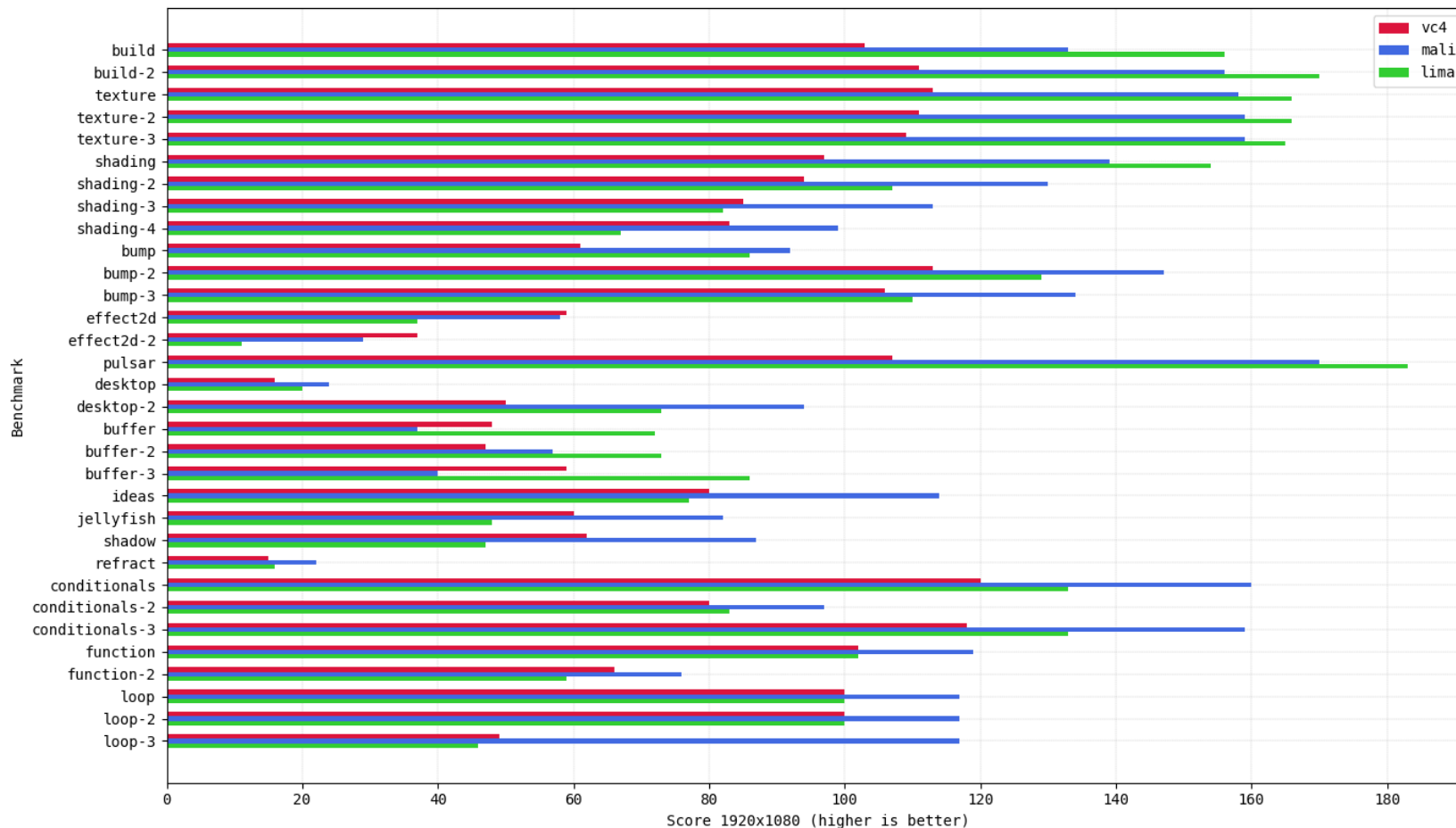
Benchmark



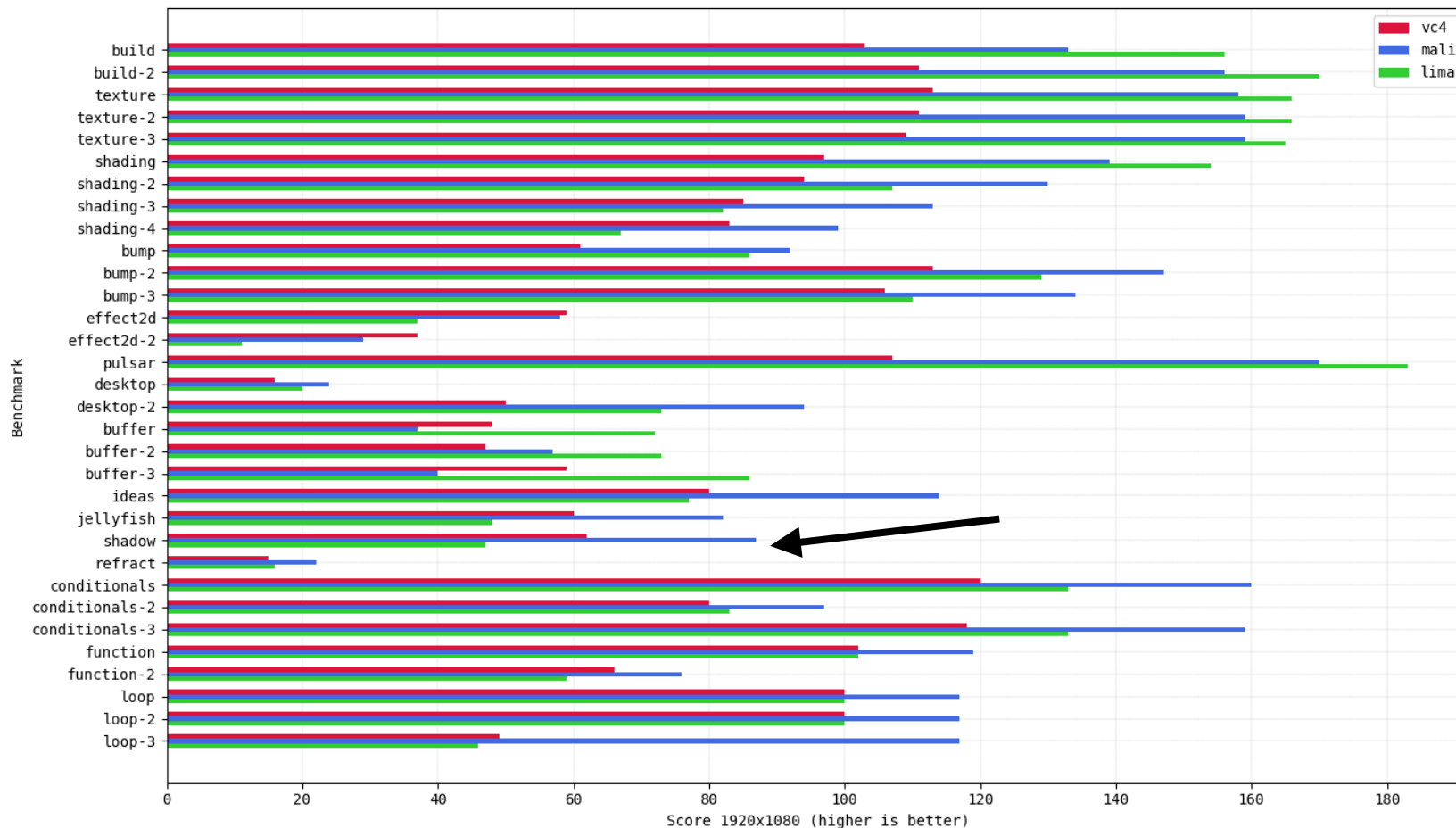
Benchmark



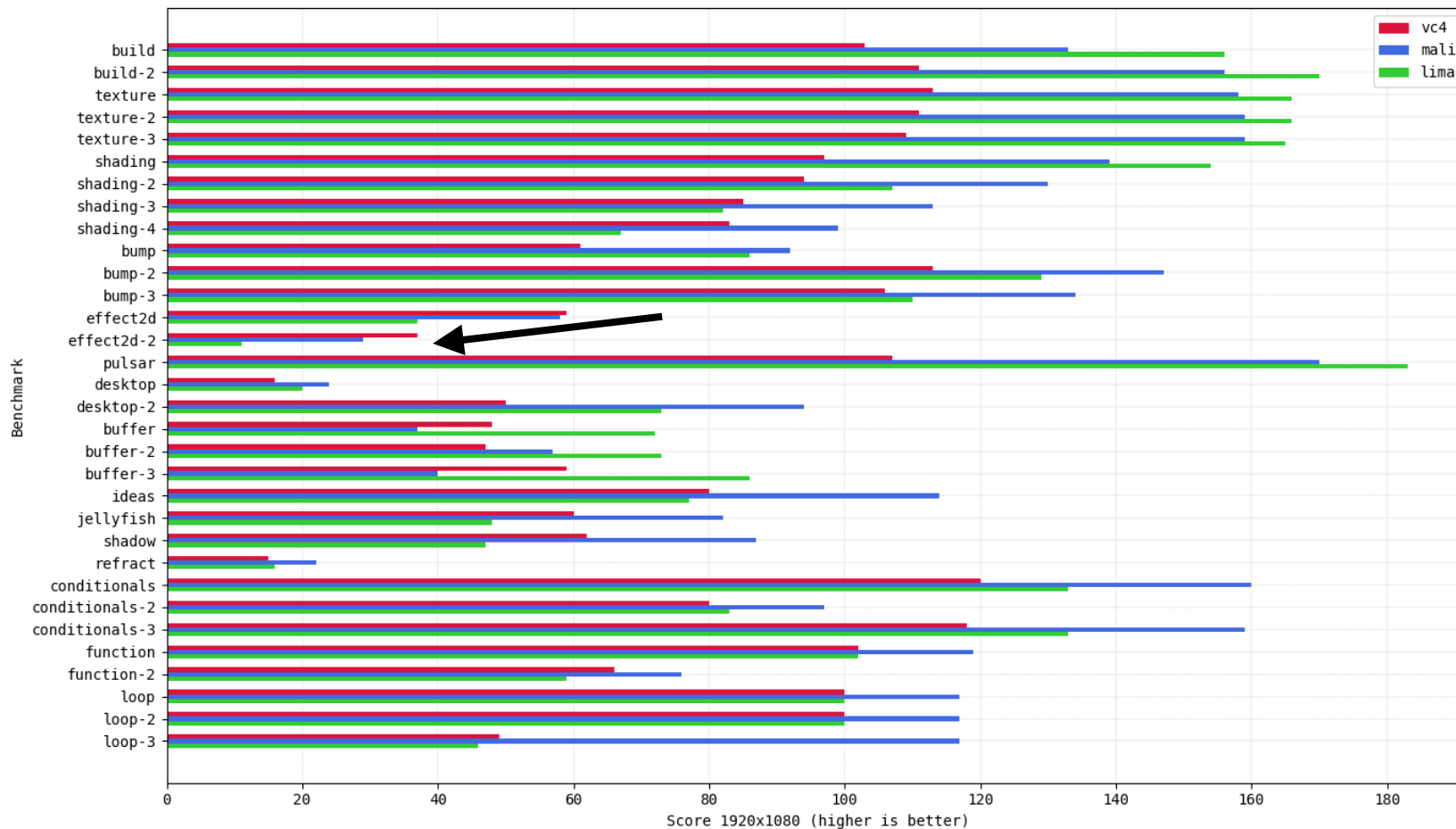
Benchmark



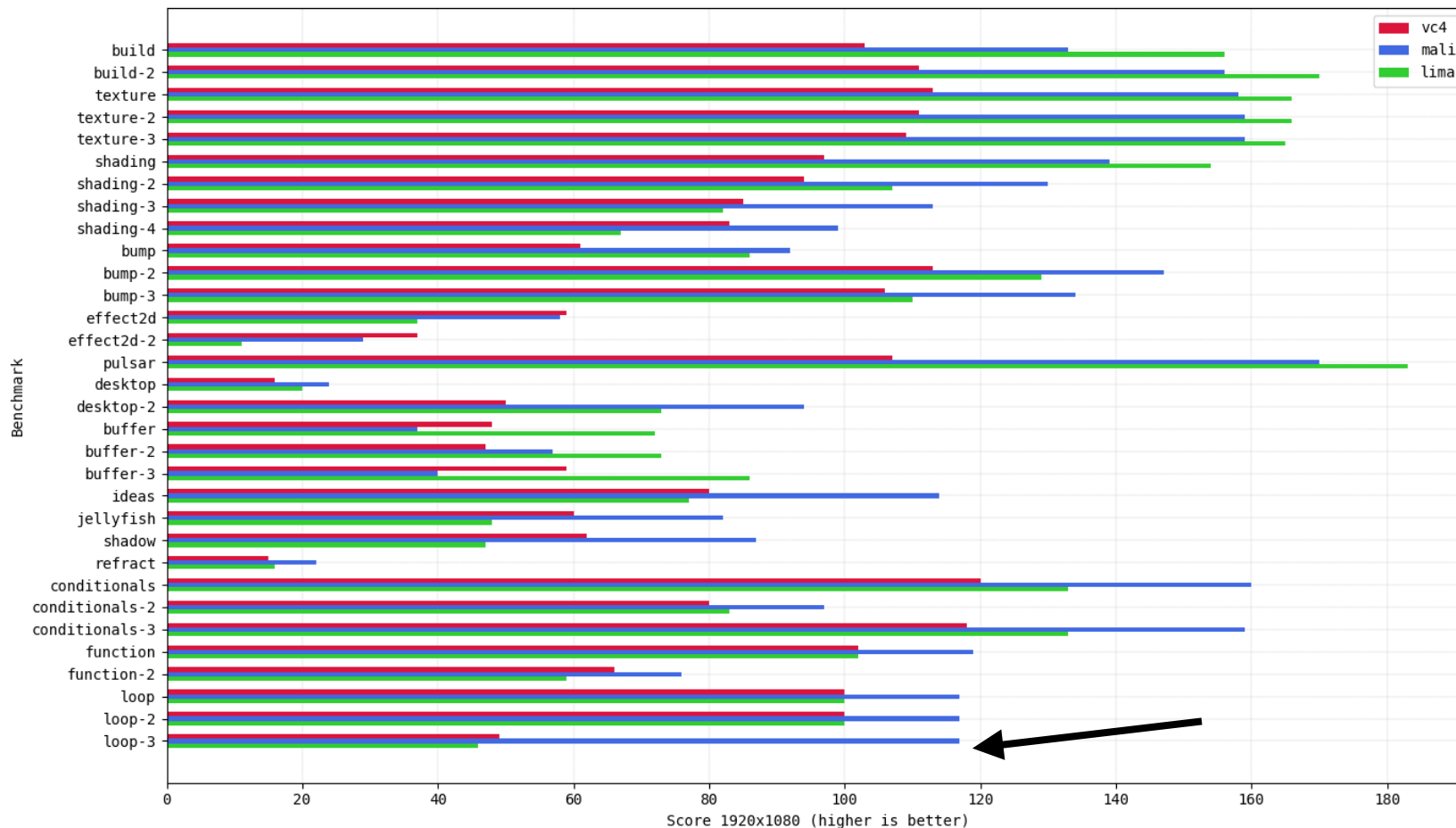
Benchmark



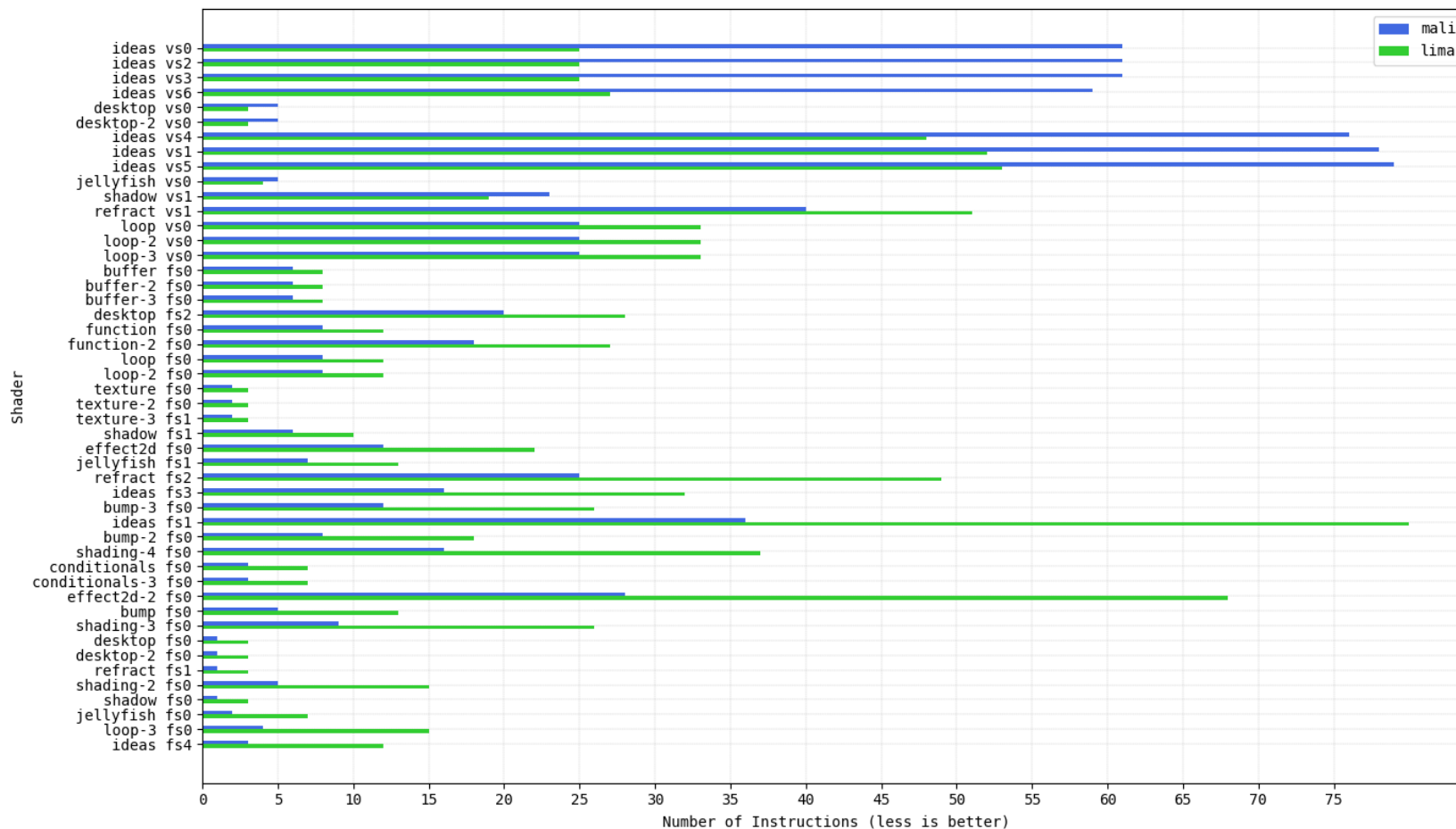
Benchmark



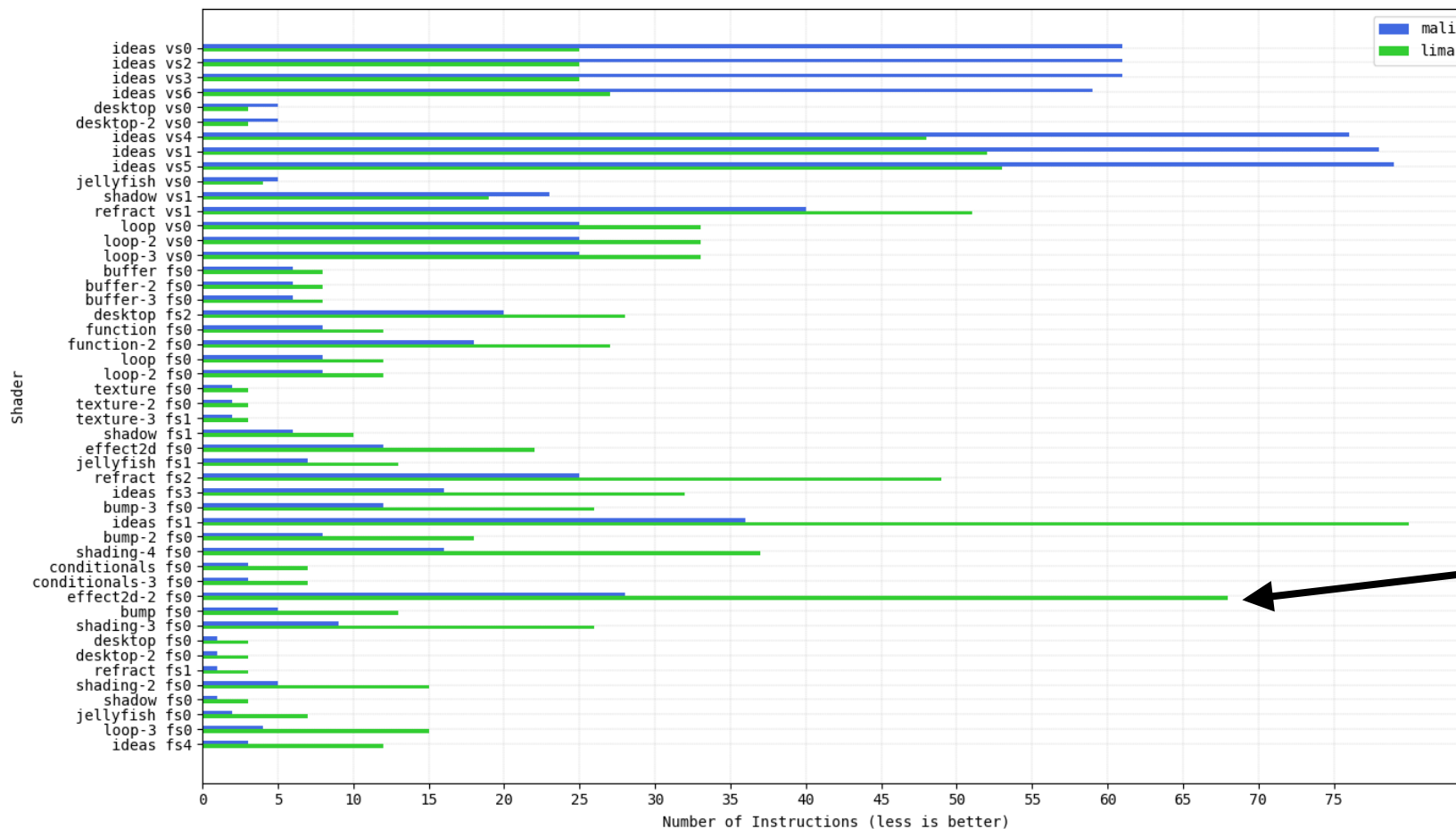
Benchmark



Benchmark



Benchmark



Going forward

- Not many gitlab issues left
- More performance work?
 - Compiler improvements?
 - Performance counters?
- Need more community feedback

Going forward

- <https://docs.mesa3d.org/drivers/lima.html>
- <https://lists.freedesktop.org/mailman/listinfo/lima>
- #lima channel on OFTC