Panfrost: Liberating ARM GPUs

• • •

Robert Foss
@memcpy_io
http://memcpy.io

$ whoami

Robert Foss

- Based in Berlin

- Work in Open Source

- Specialize in Linux Graphics
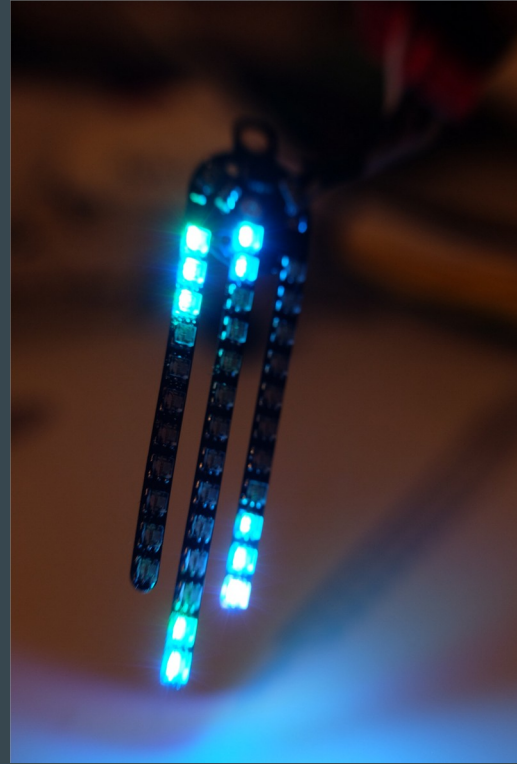
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ARM GPUs

Mali 2/3/4XX

- **Codenamed Utgard**

- **Supported by Lima driver**

- **Supports OpenGL ES <= 2.0**

- **Acquired with Phalanx**

Mali T-XXX

- **Codenamed Midgard**

- **Supported by Panfrost driver**

- **Supports OpenGL ES <= 3.1**

- **Supports Vulkan <= 1.0**

- **Design targeted OpenCL heavily**

Mali G-XX

- **Codenamed Bifrost**

- **Supported by Panfrost driver**

- **Supports OpenGL ES <= 3.2**

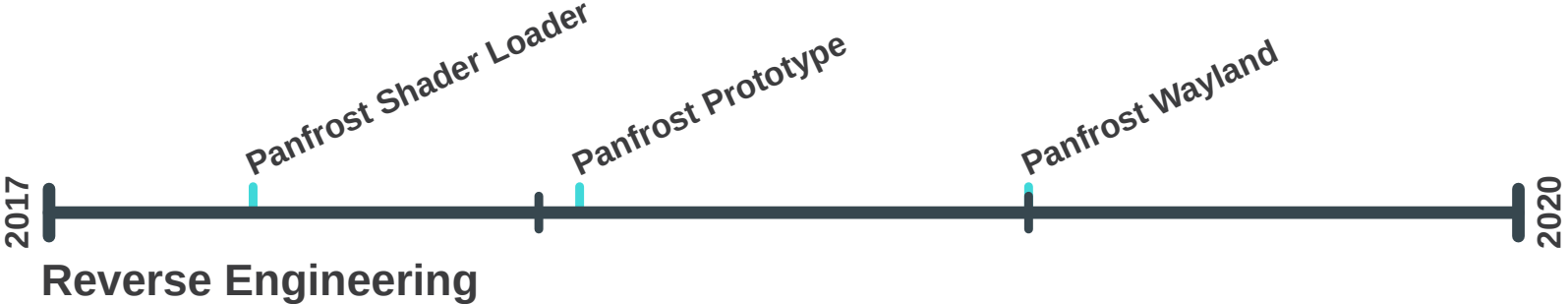- **Supports Vulkan <= 1.1**

- **Partial re-design of Midgard**

Mali G-YY

- **Codenamed Valhall**

- **Supports OpenGL ES <= 3.2**

- **Supports Vulkan <= 1.1**

- **New ISA & Compute core**

Driver History

Driver History

2017 — **Reverse Engineering** — Panfrost Shader Loader — Panfrost Prototype — Panfrost Wayland — **2020**

Driver History

Panfrost Today

Panfrost Today

- Deployed on Mali T720, T820 & T860

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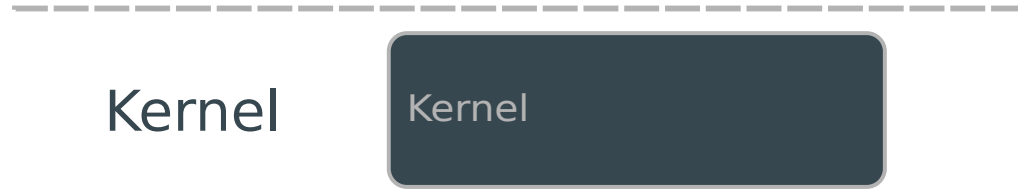- **Vulkan not started yet**

What is a driver?

Overview

Userspace

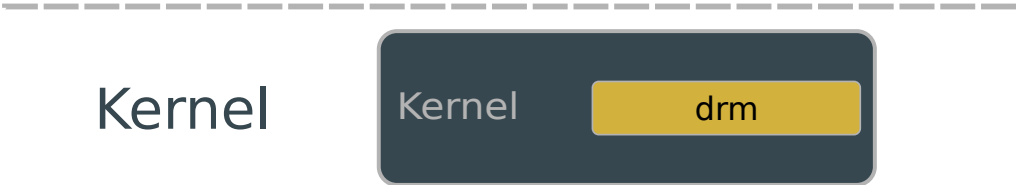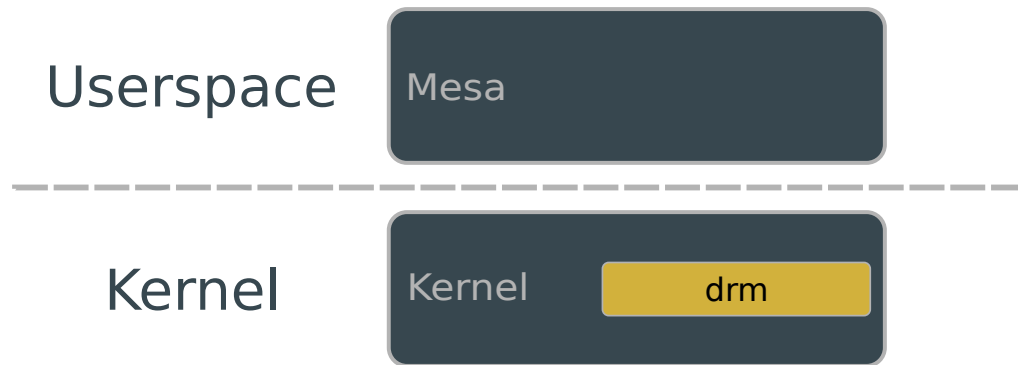— —

Kernel

Kernel

Userspace

- -

Kernel

Kernel

Kernel

Userspace

- -

Kernel

Kernel   drm

Userspace

Userspace	Mesa

- -

Kernel	Kernel	drm

Userspace

Mesa

Userspace | libdrm

Kernel | Kernel | drm

Userspace

Userspace

Applications

Mesa
- OpenGL
- Vulkan

Userspace | libdrm

Kernel | Kernel | drm
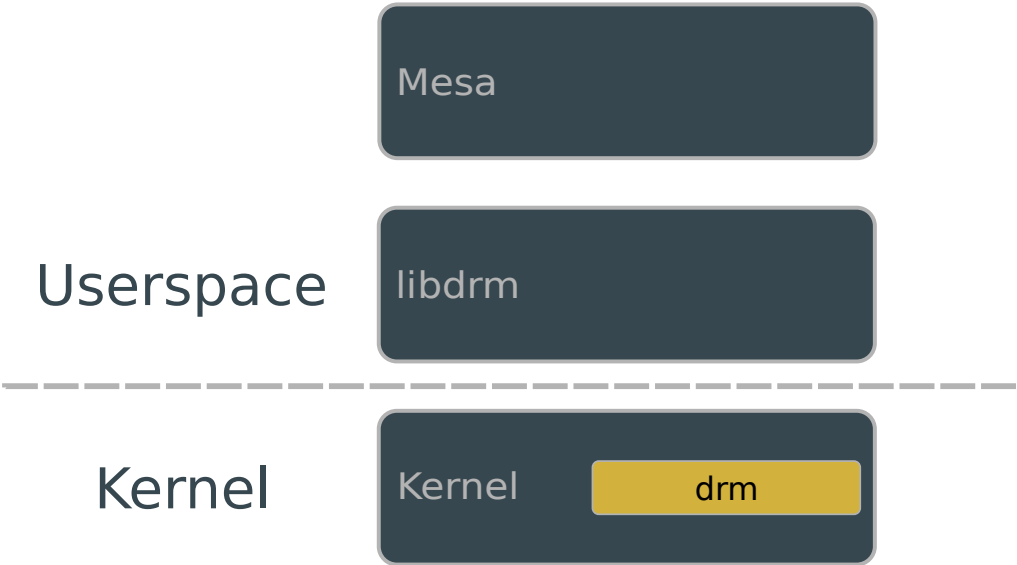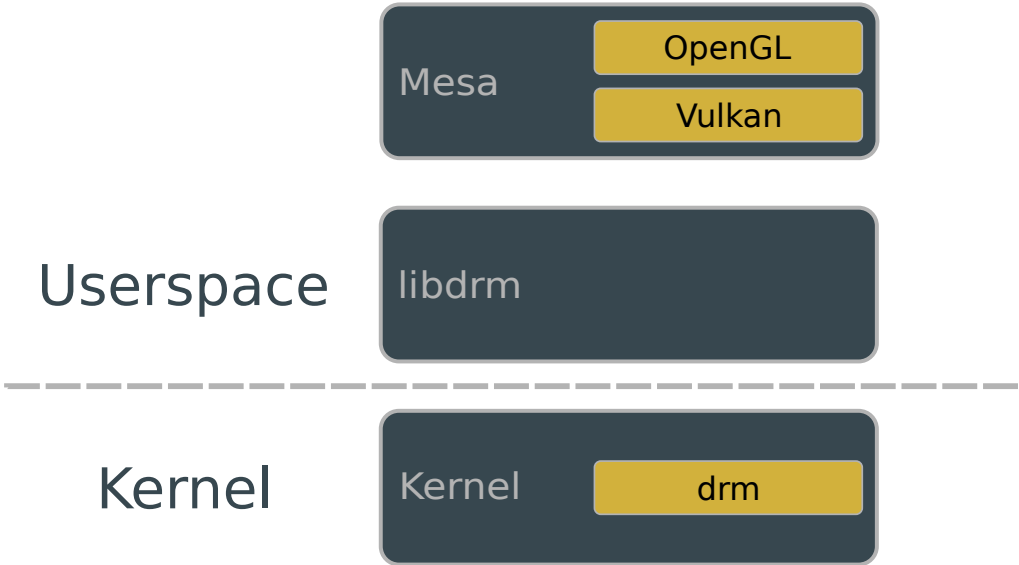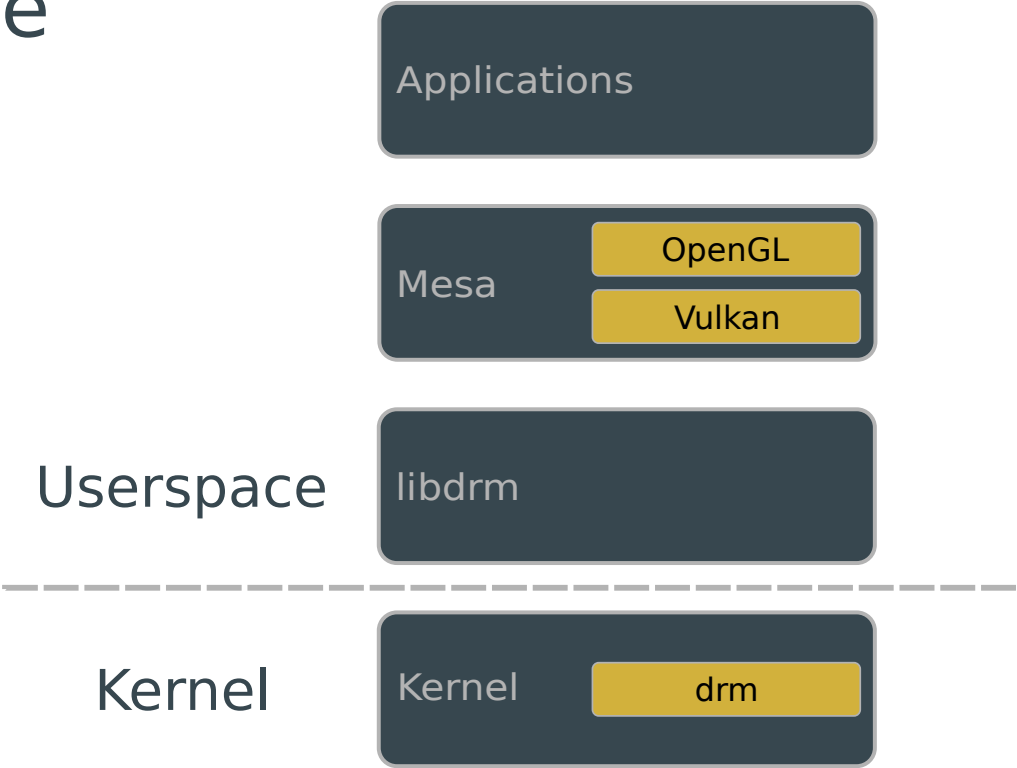
Mesa - Overview

Mesa

Mesa – Gallium

Mesa – Gallium

Mesa – Winsys

Panfrost Driver

Winsys

Gallium

Mesa

Mesa – Winsys

Panfrost Winsys

Panfrost Driver

Winsys

Gallium

Mesa

Mesa – Compiler

Panfrost
Winsys

Panfrost
Driver

Winsys

Gallium

Compiler

Mesa

Mesa – Compiler

Mesa

Mesa – Compiler

Mesa

Who contributes?

Who contributes?

```
linux$ git shortlog -s -n -e  -- drivers/gpu | head -n 10
  4922  Chris Wilson <chris@chris-wilson.co.uk>
  3027  Ben Skeggs <bskeggs@redhat.com>
  2909  Daniel Vetter <daniel.vetter@ffwll.ch>
  2903  Ville Syrjälä <ville.syrjala@linux.intel.com>
  2646  Dave Airlie <airlied@redhat.com>
  2502  Alex Deucher <alexander.deucher@amd.com>
  1450  Christian König <christian.koenig@amd.com>
  1032  Jani Nikula <jani.nikula@intel.com>
   823  Rex Zhu <Rex.Zhu@amd.com>
   720  Paulo Zanoni <paulo.r.zanoni@intel.com>
```

```
mesa$ git shortlog -s -n -e | head -n 10
 18725  Brian Paul <brianp@vmware.com>
  7288  Marek Olšák <maraeo@gmail.com>
  6511  Eric Anholt <eric@anholt.net>
  5498  Jason Ekstrand <jason@jlekstrand.net>
  5217  Kenneth Graunke <kenneth@whitecape.org>
  3777  Ian Romanick <ian.d.romanick@intel.com>
  3606  Dave Airlie <airlied@redhat.com>
  3552  José Fonseca <jfonseca@vmware.com>
  2555  Keith Whitwell <keithw@vmware.com>
  2440  Samuel Pitoiset <samuel.pitoiset@gmail.com>
```

Contribution Process

- Kernel uses Mailing list

- Mesa uses Mailing list & Gitlab Merge Requests

Continuous Integration

- **Kernel CI**
  https://kernelci.org/

- **Mesa CI**
  https://gitlab.freedesktop.org/mesa/mesa/

Thanks!

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@memcpy_io
http://memcpy.io