Panfrost
Open Source Meets Arm GPUs
Hardware
Architectures

Utgard

- Mali 2/4XX GPUs
- Launched 2007
- OpenGL ES 2.0
- Found in Samsung S2
Architectures

Midgard

- Mali TXXX GPUs
- Launched 2012
- OpenGL ES 3.2
- OpenCL 1.2
- Vulkan 1.1
- Found in Asus C100
Architectures

Bifrost

- Mali GXX GPUs
- Launched 2016
- OpenGL ES 3.2
- OpenCL 2.0
- Vulkan 1.1
- Found in Huawei Honor 10
Architectures

Valhall

- Mali G77 GPU
- Launched 2019
- OpenGL ES 3.2
- OpenCL 2.0
- Vulkan 1.1
- Found in ???
Drivers
Drivers
Proprietary

- Supports all GPUs
Drivers
Proprietary

• Supports all GPUs
• Proprietary userspace driver
Drivers
Proprietary

- Supports all GPUs
- Proprietary userspace driver
- Open Source kernel driver
Drivers
Proprietary

- Supports all GPUs
- Proprietary userspace driver
- Open Source kernel driver
- Kernel driver not upstreamable
Drivers
Lima

• Supports Utgard
Drivers
Lima

- Supports Utgard
- Open Source userspace driver
Drivers

Lima

- Supports Utgard
- Open Source userspace driver
- Open Source kernel driver
Drivers

Lima

- Supports Utgard
- Open Source userspace driver
- Open Source kernel driver
- Both upstreamed to Kernel & Mesa
Drivers
Panfrost

• Supports Midgard
Drivers

Panfrost

- Supports Midgard
- Targets adding Bifrost support
Drivers

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• Open Source userspace driver
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History
History

Reverse Engineering

2012

Lima Prototype

2013

Gxx Shader Loader
Lima Prototype #2
Panfrost Prototype

2019

Panfrost Wayland
Panfrost Gnome Shell

2020
Demo
What Comes Next
What Comes Next

- Improved OpenGL support
  - Desktop OpenGL, OpenGL ES 3.X
What Comes Next

• Improved OpenGL support
• Wider hardware support
  – Currently Mali T860 best tested
  – More GPUs need enabling
What Comes Next

- Improved OpenGL support
- Wider hardware support
- Improved performance
What Comes Next

glmark2 score

Mali-T860, RK3399, Wayland & On-screen

Proprietary

Panfrost
What Comes Next

- Improved OpenGL support
- Wider hardware support
- Improved performance
  - Currently faster in some tests
  - Compiler intense tests often slower
What Comes Next

- Improved OpenGL support
- Wider hardware support
- Improved performance
- OpenCL
What Comes Next

- Improved OpenGL support
- Wider hardware support
- Improved performance
- OpenCL
- Vulkan
Why Open Source?
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- Long-term support
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- High performance & conformance
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- Much simpler debugging
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- Old hardware receives new features
Why Open Source?

● Long-term support
● High performance & conformance
● Much simpler debugging
● Old hardware receives new features
● No vendor lock-in
Thank you!