# Mesa 3D
## Overview

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# What is Mesa?

- Mesa3D or Mesa 3D Graphics Library

- An **open-source device driver** and **software implementation** of the **OpenGL, Vulkan** and other specifications.

- Supports major 2 vendor (**Intel / AMD**), 1 community (nvidia)driver.

  - And others (braodcom vc4/5, vivante, qualcomm, adreno) drivers

# A Little History

- **1993**: Mesa created by Brian Paul
- **2006**: Intel started contributing to the Kernel i915 and Mesa projects
  aiming to support for OpenGL® on Intel graphics for all Linux distributions
- **2011**: Chrome OS launched with Mesa
- **2013**: Steam OS launched with Mesa i965 on Intel graphics
- **2013**: Day-1 Khronos certification on OpenGL® ES 3.0
- **2015**: Day-1 Khronos certification on Vulkan® 1.0
- **2017**: Yun OS 6 shipped with Mesa i965
- **2017**: RadeonSI certified for OpenGL® 4.5, picked up by Steam OS
- **Feb 2017**: Khronos certification of Mesa i965 for
  OpenGL® 4.5, rounding out the Triple Crown of 3D computing with
  OpenGL® ES 3.2 & Vulkan® 1.0

# Implementations of rendering / Window System APIs

- **OpenGL** (~4.6)
- **OpenGLES** (~3.2)
- **Vulkan** (1.0, anv, radv)

- **Direct3D** (9.0c, gallium)
- **OpenCL** (gallium)

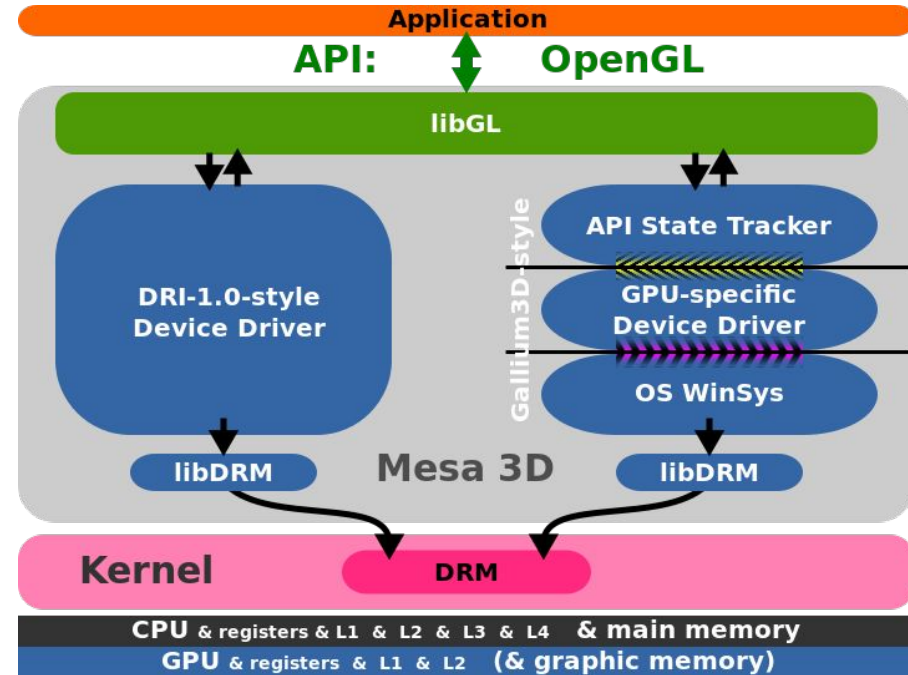- **GLX / EGL** (~1.5)
- **X11, Wayland, DRM**

# Mesa's Intermediate Representations

- **SPIR-V**
- **GLSL IR**
- **NIR**
- **TGSI**
- **LLVM IR**



Mesa compilation stack (2016+)
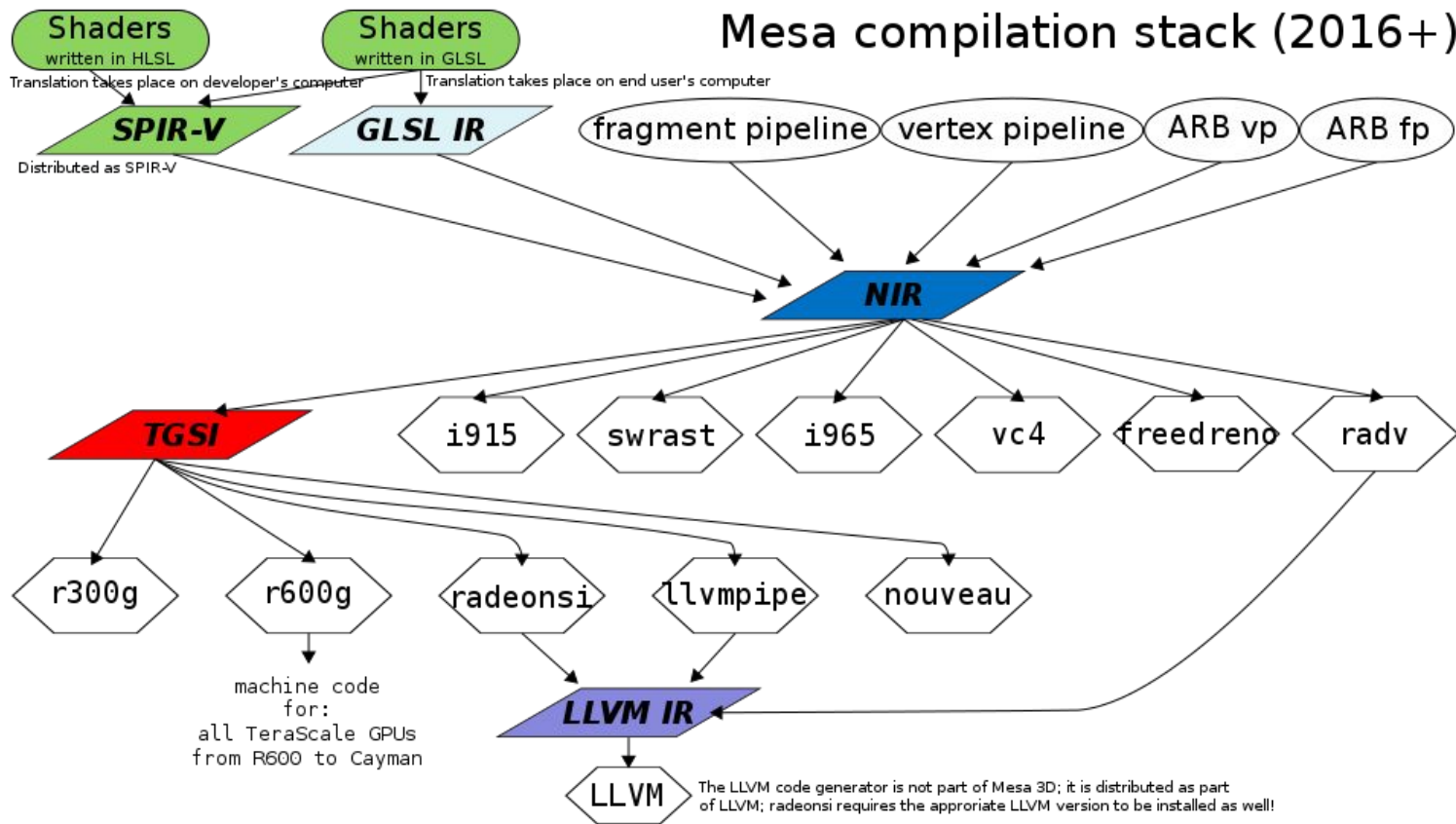
# Driver Model

- **Classic**
  - **Intel I965**
- **Gallium**
  - **Currently, Non Intel**
  - **A set of interface / library for developing GPU Driver**
  - **State Trackers**

## OpenGL to Vulkan

Why a new 3D API?

OpenGL is old - Released in 1992

Mesa Started in August 1993

24 years of development, GL has done well.

# OpenGL vs Vulkan

Complex drivers cause
overhead and inconsistent
behaviour across vendors

Always active error handling

Full preprocessor and
compiler for shading
language

OpenGL vs OpenGL ES

## OpenGL

| Application |
| :---: |
| Driver<br><br>Memory Management<br>Error handling<br>Context handling |
| GPU |

## Vulkan

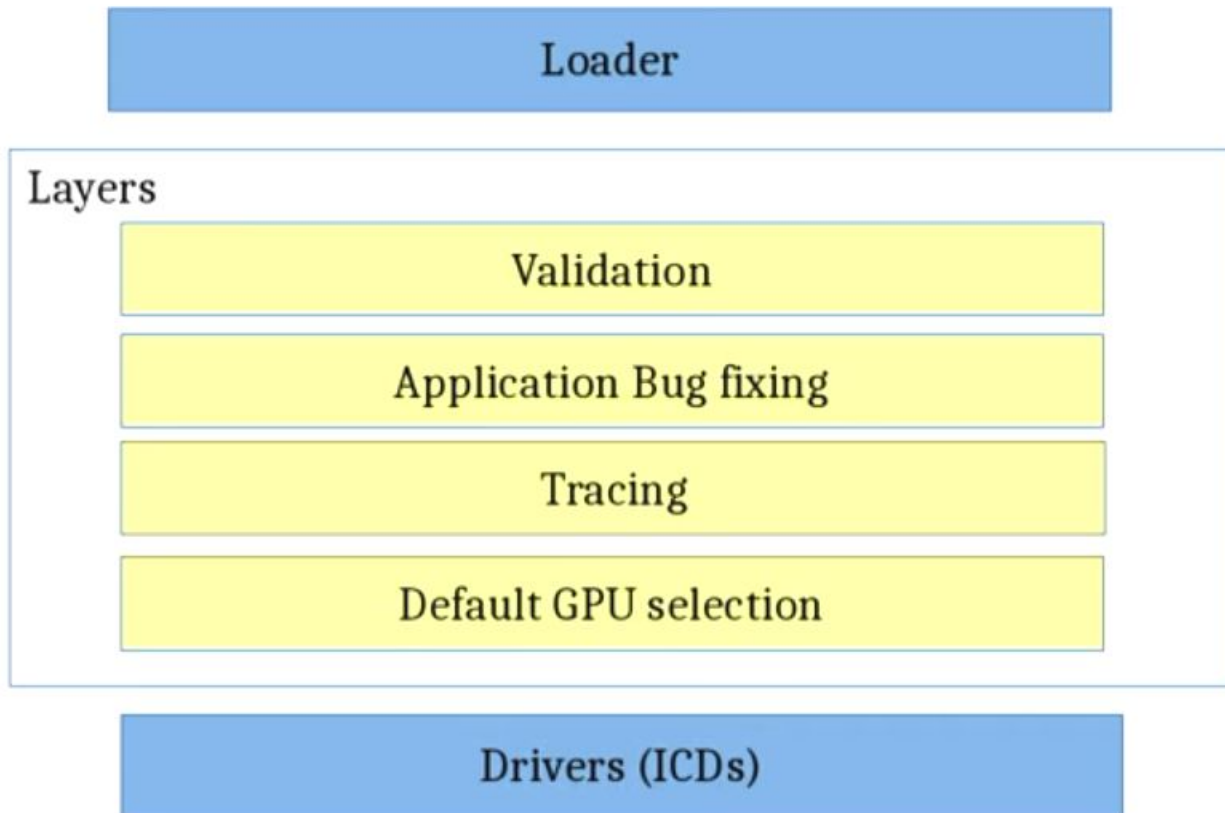| Application<br><br>Memory Management<br>Thread management<br>Command buffer generation |
| :---: |
| Driver |
| GPU |

Low overhead driver
Consistent behaviour

Validate and debug layers
can be loaded only when
needed

SPIR-V intermediate
language

Unified API

# Vulkan Stack

# Open source driver components (anv)

| | |
|---|---|
| SPIR-V → NIR | Vulkan X11/Wayland WSI |
| | anv Vulkan |
| NIR → i965 gen | ISL library (image layout/tiling) |

# Open source driver components (radv)

| | |
|---|---|
| SPIR-V → NIR | Vulkan X11/Wayland WSI |
| NIR → LLVM (amdgpu) | Radv Vulkan |
| LLVM compiler backend | AMD addrlib (image layout/tiling) |

# Performance

**phoronix performance result**

https://www.phoronix.com/scan.php?page=article&item=radv-pro-may2017&num=1

**AMD GPU**

- Radeon SI > AMDGPU-PRO
- radv >= AMDGPU-PRO

## Just like Mesa?

Major 2 vendor's Opensource Driver - Intel / AMD

Customers require "**Just like Mesa**".

Top contributors - Intel, AMD, Redhat, Google, valve (steam), Collabora,

Igalia …

Up To About 8,000 Commits This Year, 2.2 Million Lines.

# Howto contribute

- **Subscribe to the mailing list (mesa-dev)**
- **Get the code**
    git clone git://anongit.freedesktop.org/mesa/mesa
- **Build the drivers**
- **Find bugs**: https://bugs.freedesktop.org/
- **Testing:** piglit, Khronos CTS, etc ...
- **Send patch to Mesa-Dev Maliling List like LKML**.

- **IRC Channels** (@freenode)
  #dri-devel
  #intel-gfx

- **Get started page for new Mesa developers:**
  https://01.org/3Dcollab

# Questions?