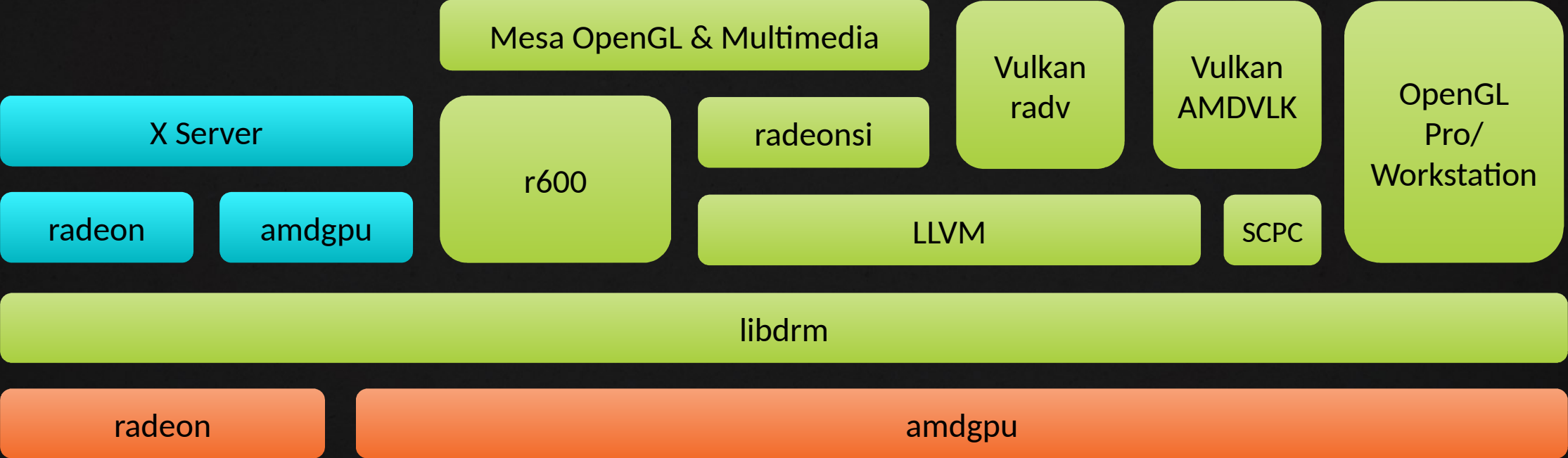




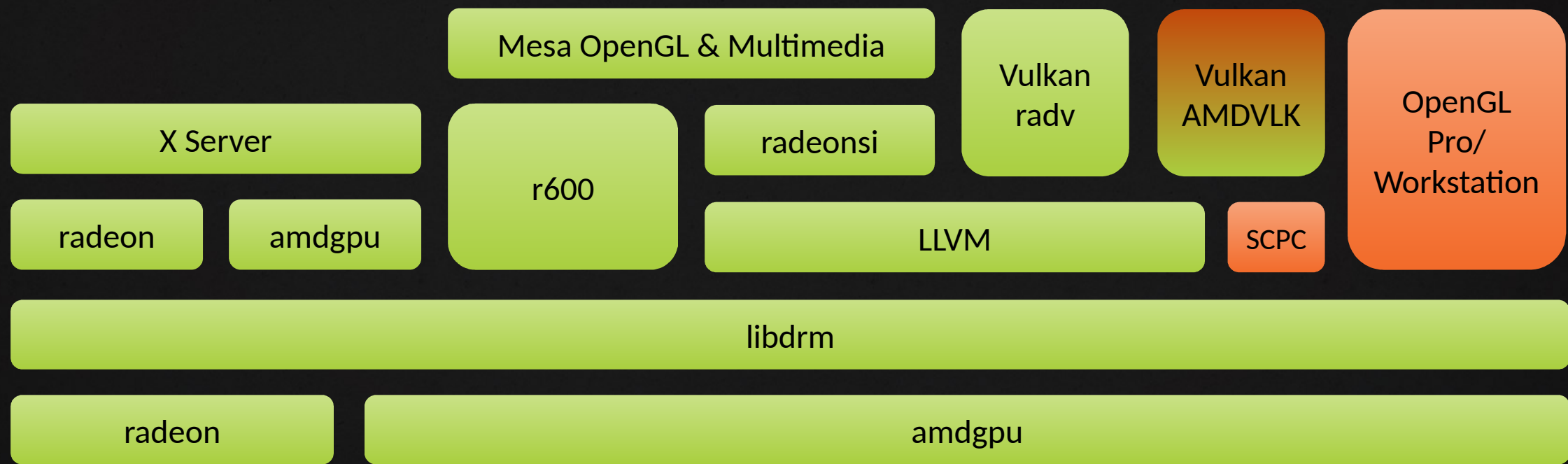
# THE AMD LINUX GRAPHICS STACK – 2018 EDITION

NICOLAI HÄHNLE  
FOSDEM 2018

# GRAPHICS STACK: KERNEL / USER-SPACE / X SERVER

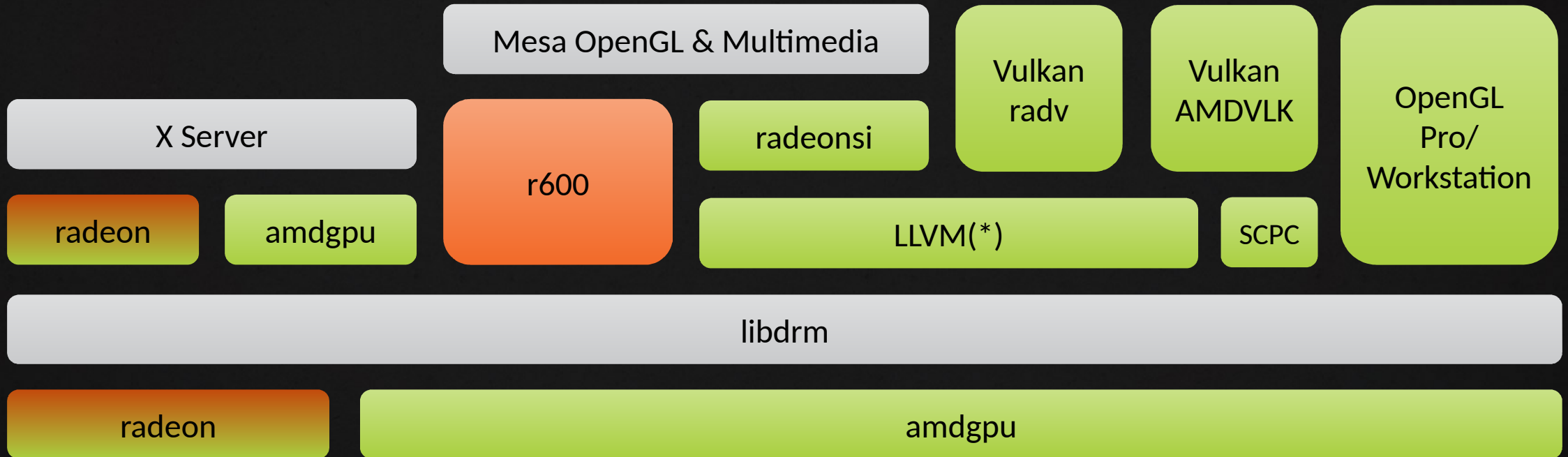


# GRAPHICS STACK: OPEN-SOURCE / CLOSED-SOURCE



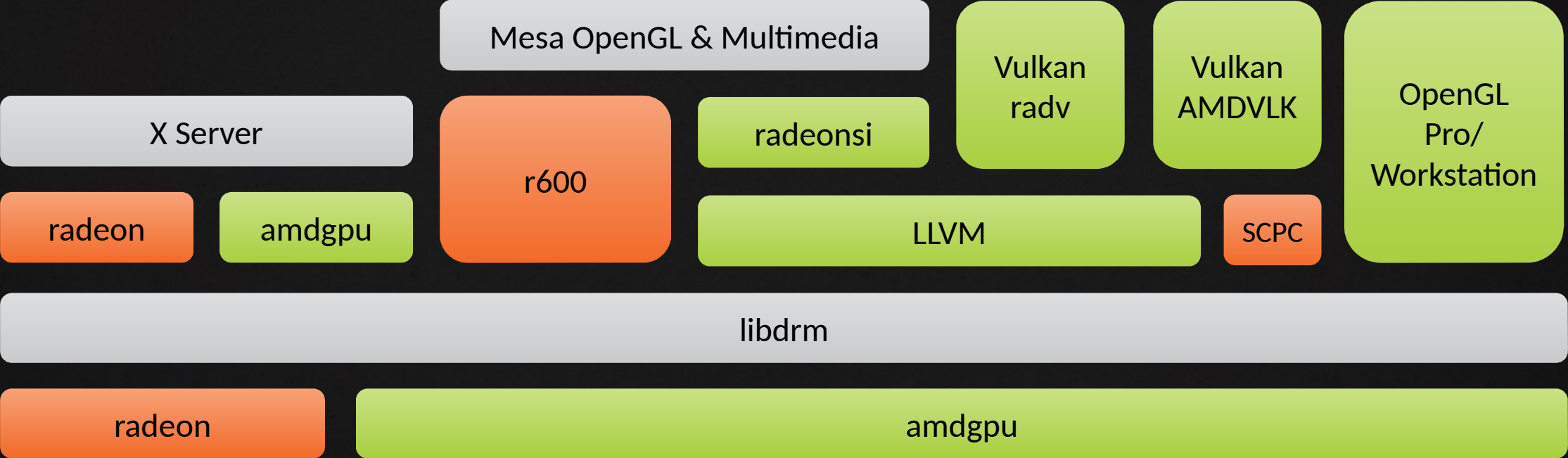
# GRAPHICS STACK: SUPPORT FOR GCN / PRE-GCN HARDWARE

ROUGHLY: GCN = NEW GPUS OF THE LAST 5 YEARS



(\*) LLVM has pre-GCN support only for compute

# GRAPHICS STACK: PHASING OUT “LEGACY” COMPONENTS



# MAJOR MILESTONES OF 2017

- Upstreaming the DC display driver
- Open-sourcing the AMDVLK Vulkan driver
- Unified driver delivery
- OpenGL 4.5 conformance in the open-source Mesa driver
- Zero-day open-source support for new hardware



# KERNEL: AMDGPU AND RADEON HARDWARE SUPPORT



# KERNEL: AMDGPU VS. RADEON

- amdgpu supports
  - Modern display features
  - Vulkan and closed-source user-space drivers
  - ROCm stack for compute
  - GPU scheduler
- Use amdgpu for all GCN cards
  - Kernel command line switch since 4.13
  - radeon.si\_support=0 amdgpu.si\_support=1
  - radeon.cik\_support=0 amdgpu.cik\_support=1



# UPSTREAMING DC

## MODERN DISPLAY DRIVER IN AMDGPU

- Why?
  - Support for all display features: atomic modesetting, audio via DP/HDMI, HDMI 2.0, DisplayPort MST, FreeSync, HDR, ...
  - Common code base with other operating systems
- Bringing a new team with a large code base into open-source
  - ~130 kloc
  - First published two years ago (February 2016)
  - Upstream since 4.15 (merged in November 2017, released last weekend)
- Supports GCN 2<sup>nd</sup> gen and higher, required since RX Vega
  - amdgpu.dc kernel option overrides default

# AMD OPEN SOURCE DRIVER FOR VULKAN

## INTRODUCING AMDVLK

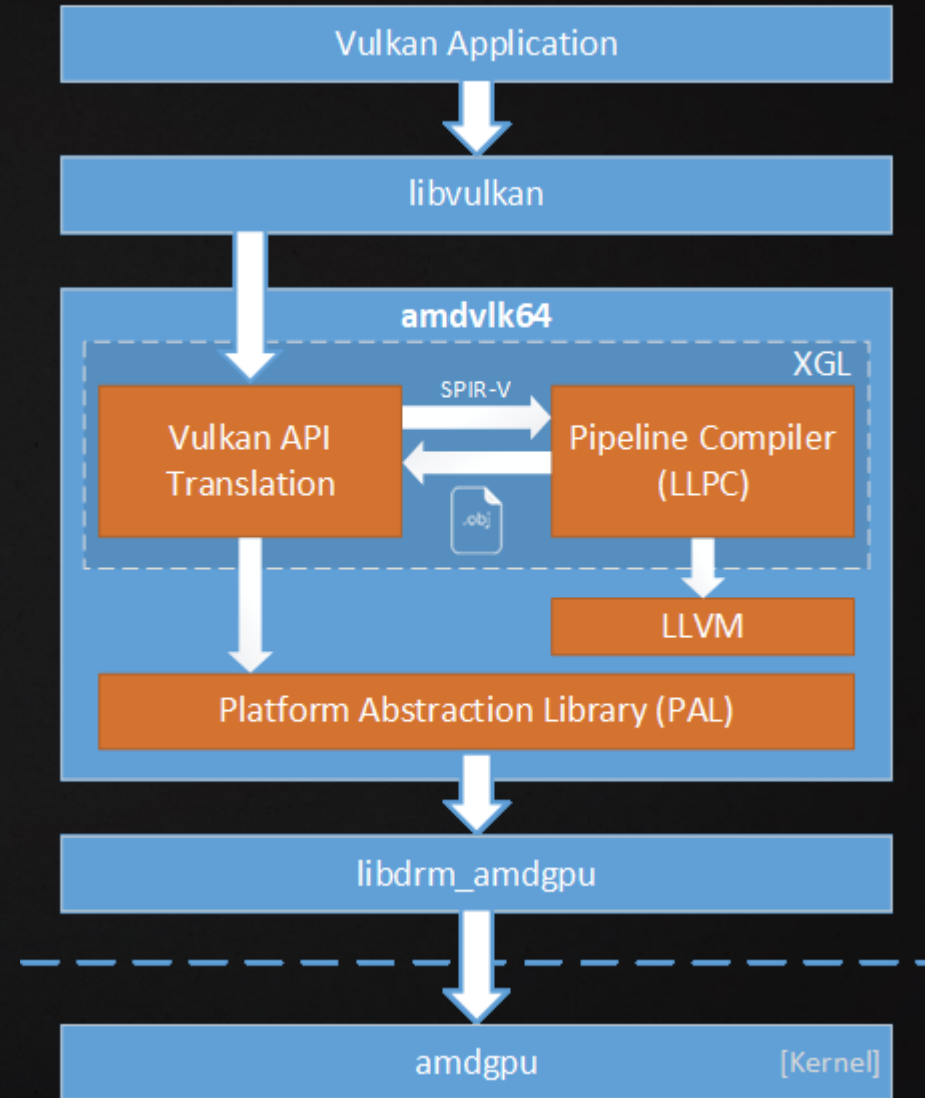
- Published on GitHub December 22, 2017:
  - <https://github.com/GPUOpen-Drivers/AMDVLK>
- Official AMD-supported open source Vulkan driver.
  - Same code base as Windows Vulkan driver.
  - Shares significant code with DirectX 12 and OpenCL drivers through the Platform Abstraction Library (PAL).
- Supports all GCN-based Radeon GPUs.
- Officially supported distros:
  - Ubuntu 16.04.3 (64-bit)
  - RedHat 7.4 (64-bit)

# RADEON VULKAN DRIVER COMPARISON

	AMDVLK Open	AMDVLK Closed	RADV
Open Source	●	●	●
AMD Contributions	●	●	●
Community Contributions	●	●	●
Upstreamed to Mesa	●	●	●
LLVM Shader Compiler Backend	●	●	●
AMD QA Qualification	●	●	●
Immediate Support for New GPUs	●	●	●
AMD GPU Tools Support	●	●	●
Windows Support	●	●	●

# AMDVLK TOP LEVEL ARCHITECTURE

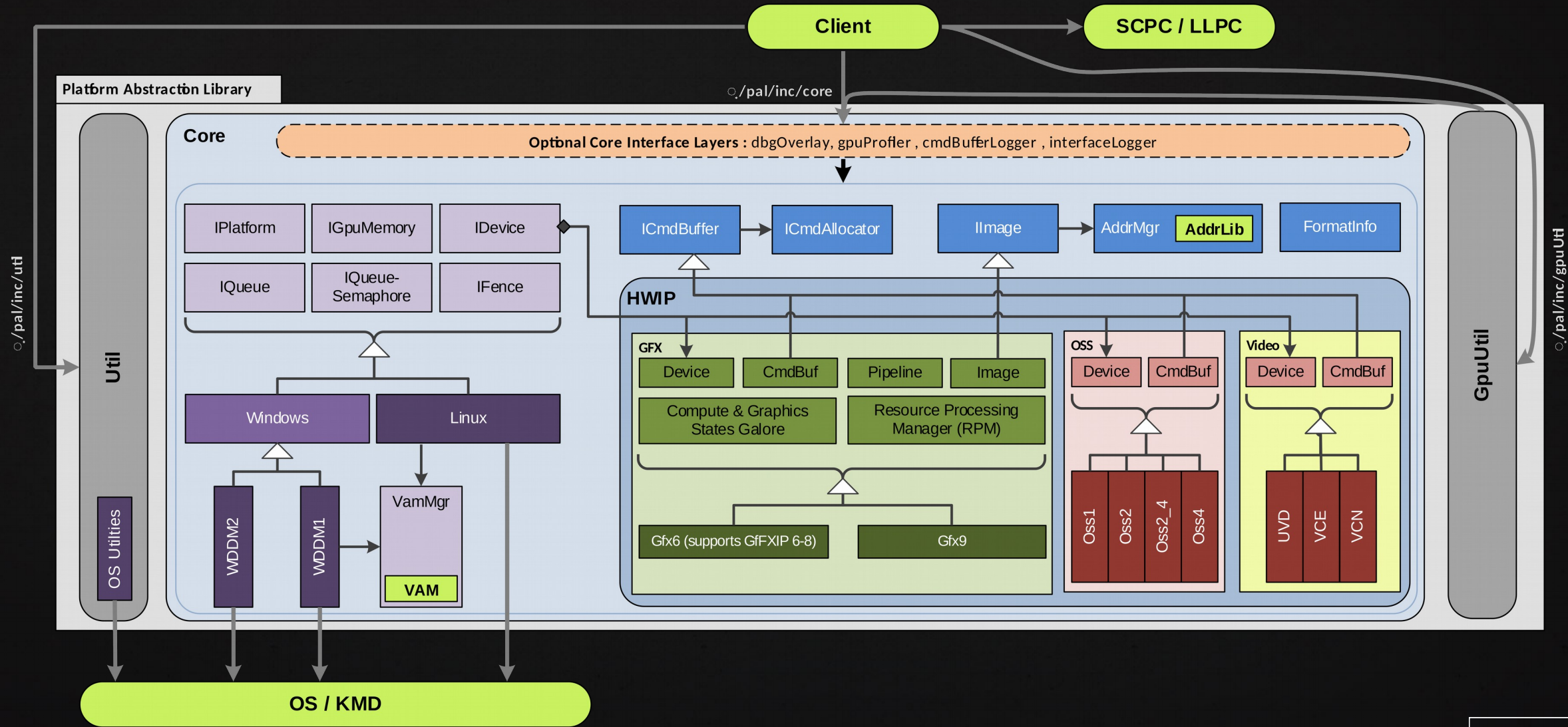
- PAL interface is a full featured, AMD-specific 3D graphics, compute, and video encode/decode API.
  - Abstracts all hardware and operating system details for XGL.
- PAL does not compile shaders, but does define ABI for external compilers.
  - PAL's ABI requires complete *pipelines* rather than individual shaders.
- AMDVLK is built from:
  - Target API to PAL API translation.
  - Front-end pipeline compiler (LLPC). Accepts SPIR-V.
  - LLVM.
  - PAL.



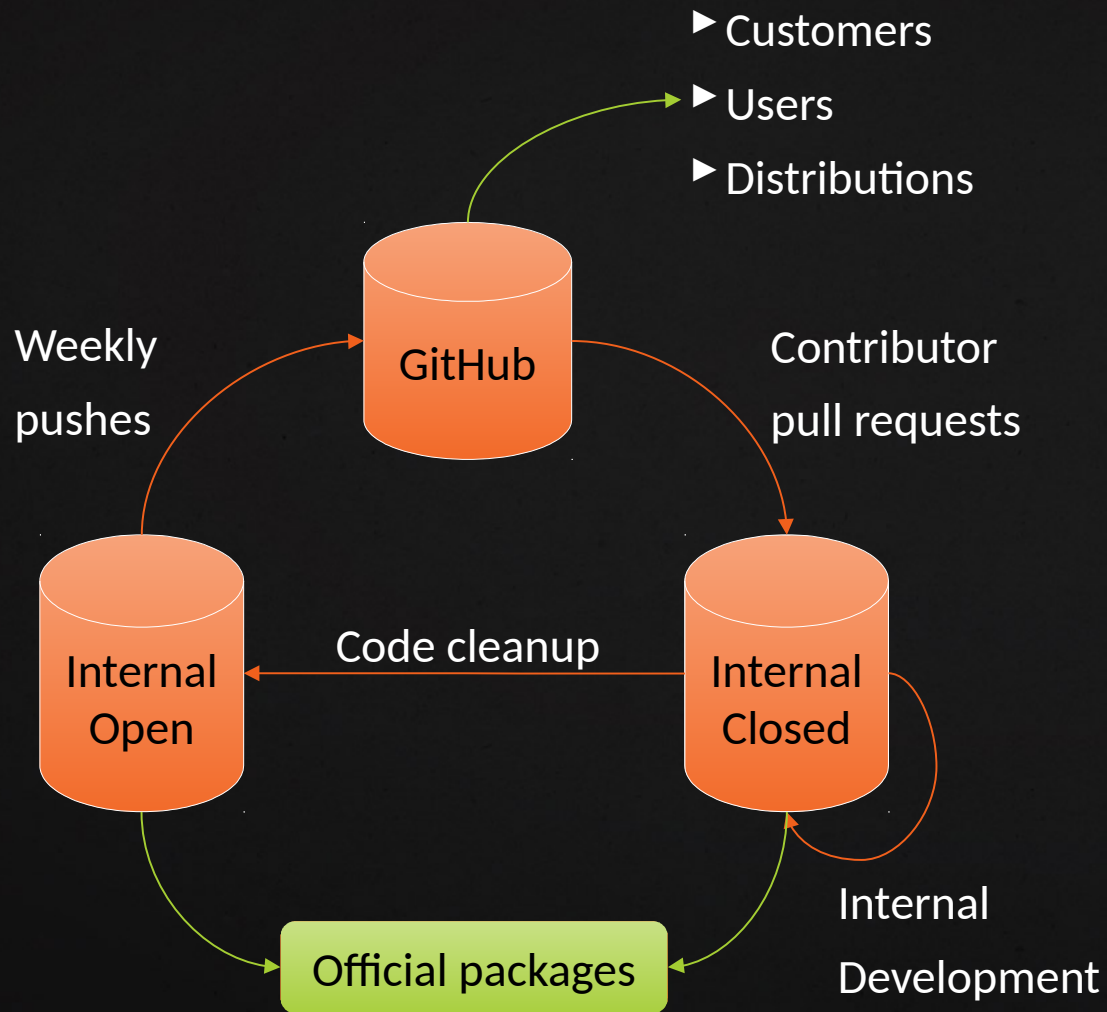


# PAL: PLATFORM ABSTRACTION LIBRARY

## INTERNAL ARCHITECTURE



# DEVELOPMENT PROCESS



- GitHub used for:
  - Issue tracking
  - Pull requests
  - <https://github.com/GPUOpen-Drivers/AMDVLK>
- Different for LLVM:
  - Start from stable upstream base
  - Cherry-pick individual commits
  - Changes submitted to LLVM ReviewBoard for upstream



# FUTURE PLANS FOR AMDVLK

- LLPC optimizations.
  - Strive to meet/exceed closed-source shader compiler performance.
  - Deliver LLPC in official packages.
- CPU-limited performance optimization.
- Future GPU support.
- Future Vulkan version and extensions support.
- Wayland support.
- Iron out external contribution process.

# DELIVERING OUR DRIVERS TO USERS

- Upstream first where possible
  - Everything works out of the box with distro packages, today
- Packages provided by AMD for:
  - AMDGPU-PRO drivers (Workstation OpenGL, OpenCL, closed-source AMDVLK)
  - New hardware support
  - Specific customer engagements
- Since end of 2017, we provide both:
  - All Open Graphics Stack
  - Pro Graphics Stack as an add-on

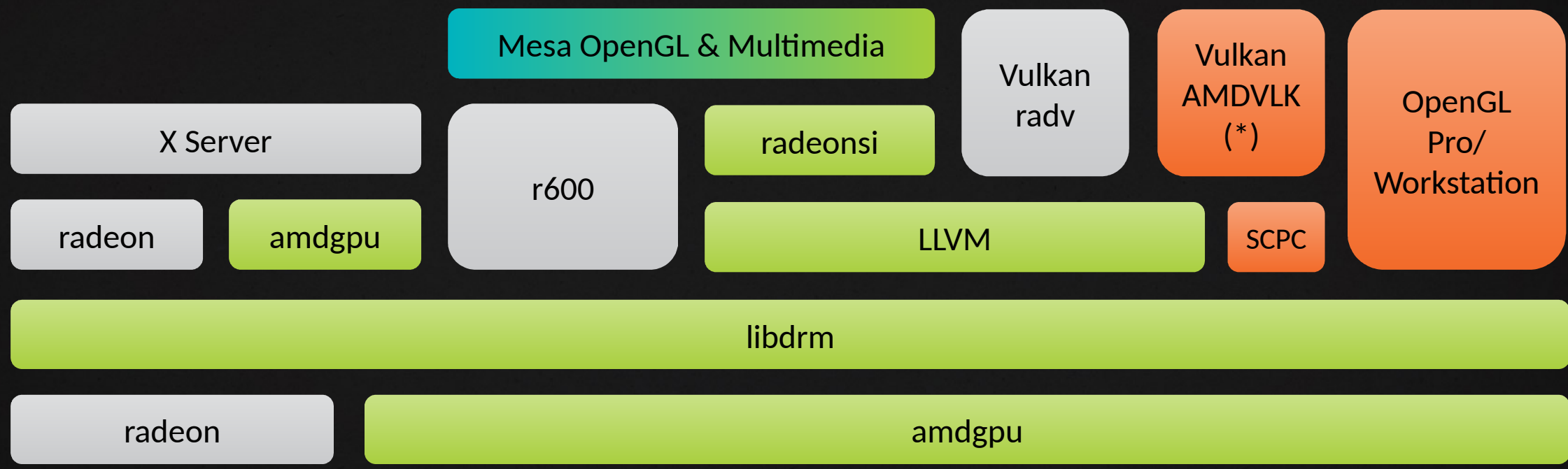
# UNIFIED DRIVER DELIVERY

ALL OPEN CORE AND PRO ADDONS

- Release calendar shared with Windows: 17.40, 17.50, 18.10, 18.20, ...
- Currently one big tarball, different installation scripts
  - Contains distribution-specific packages (.deb, .rpm), for graphics & compute
  - Adventurous folk could e.g. install vulkan-amdgpu-pro alongside distribution's Mesa for OpenGL (obviously not an officially supported use case)
- Supported distributions:
  - RHEL 7.4, RHEL 6.9 and CentOS 7.4, CentOS 6.9
  - Ubuntu 16.04 LTS
  - SLED/SLES 12 SP2

# GRAPHICS STACK: ALL OPEN VS. PRO COMPONENTS

OPEN-SOURCE CORE WITH PRO ADDONS



(\*) AMDVLK will transition to All Open

All Open only

Pro

Both

THANK YOU



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