GRAPHICS STACK: KERNEL / USER-SPACE / X SERVER

- X Server
  - radeon
  - amdgpu
- Mesa OpenGL & Multimedia
- r600
- radeon
- amdgpu
- Vulkan
  - radv
- Vulkan AMDVULK
- OpenGL Pro/Workstation
- LLVM
- SCPC
- libdrm
- radeon
- amdgpu
GRAPHICS STACK: OPEN-SOURCE / CLOSED-SOURCE

- Mesa OpenGL & Multimedia
- Vulkan radv
- Vulkan AMDVLK
- OpenGL Pro/Workstation
- X Server
- r600
- radeonsi
- LLVM
- SCPC
- libdrm
- radeon
- amdgpu
- radeon
- amdgpu
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

Mesa OpenGL & Multimedia

Vulkan radv
Vulkan AMDVLK
OpenGL Pro/Workstation

X Server
r600
radeonsi
LLVM
SCPC

libdrm

radeon
amdgpu

radeon
amdgpu
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

radeon

Pre-GCN
- GCN 1st gen (Southern Islands, SI, gfx6)
- GCN 2nd gen (Sea Islands, CI(K), gfx7)
- GCN 3rd gen (Volcanic Islands, VI, gfx8)
- GCN 4th gen (Polaris, RX 4xx, RX 5xx)
- GCN 5th gen (RX Vega, Ryzen Mobile, gfx9)

amdgpu
**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\(^{nd}\) 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

<table>
<thead>
<tr>
<th>Feature</th>
<th>AMDVLK Open</th>
<th>AMDVLK Closed</th>
<th>RADV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Source</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Green" /></td>
</tr>
<tr>
<td>AMD Contributions</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Red" /></td>
</tr>
<tr>
<td>Community Contributions</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Green" /></td>
</tr>
<tr>
<td>Upstreamed to Mesa</td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Green" /></td>
</tr>
<tr>
<td>LLVM Shader Compiler Backend</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Green" /></td>
</tr>
<tr>
<td>AMD QA Qualification</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Red" /></td>
</tr>
<tr>
<td>Immediate Support for New GPUs</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
</tr>
<tr>
<td>AMD GPU Tools Support</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Red" /></td>
</tr>
<tr>
<td>Windows Support</td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Red" /></td>
</tr>
</tbody>
</table>
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.
GitHub used for:
- Issue tracking
- Pull requests
- https://github.com/GPUOpen-Divers/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

Mesa OpenGL & Multimedia

Vulkan radv

Vulkan AMDVLK (*)

OpenGL Pro/Workstation

X Server
r600
radeonsi
libdrm
radeon
amdgpu
LLVM
SCPC
radeon
amdgpu
libdrm

(*) AMDVLK will transition to All Open

All Open only
Pro
Both