Upstream Graphics: Too Little, Too Late

Daniel Vetter, Intel OTC
@davnet
LPC 2019, Lisbon
Upstream Graphics: Too Little, Too Late

Daniel Vetter, Intel OTC
@danvet
LPC 2019, Lisbon
10 or so years ago ...

- graphics execution manager
- kernel modesetting
- drm/i915, drm/radeon
- proudly celebrating OpenGL 2
- ... and a wasteland
today

- 10% of the kernel + userspace
- 50 atomic modeset drivers (and more others)
- latest OpenGl, GLES, Vulkan
- smallest kernel driver 246 lines
- largest kernel driver 2.2M lines
Awesome uapi: Atomic Modeset

- lots of planes for SoC
- lots of outputs for desktop
- blending, writeback, color space conversions, ...
- gracefully handling link failures
- content protection
- everything else
Awesome APIs for Rendering

- `dma_buf`, `dma_resv`, `dma_fence` for buffer sharing
- `ww_mutex` for graph locking problems
- `drm_syncobj`, better uAPI for fences
Helpers, Everywhere you look!

- modular atomic modeset helpers
- simple display pipe
- DisplayPort, MIPI, HDMI, EDID
- self refresh display/damage tracking
- fbdev emulation
Helpers, Everywhere you render!

- gpu scheduler
- TTM refactoring and helperification
- VRAM helpers, SHMEM helpers, ...
- batteries included by default
More Awesome Stuff

- bridge and panel drivers, components
- hot(un)plug fixing
- in-kernel selftests (we need KUnit asap)
- IGT gpu tests: cross driver userspace testsuite
Awesome Stuff, in Userspace!

- gallium: GL stack to rule them all
- gpu compiler troubles settling on NIR
- r/e tools, better than the real docs
- Khronos is opening up
Userspace drivers

- panfrost, lima, freedreno, etnaviv
- even Intel now on board with Iris
- radv+ACO, one handful hackers vs. AMD
Great Community

- gitlab everywhere, Mesa3D leading
- (kernel stuck on infrastructure work)
- XDC running on LPC
- XDC haz sponsors now!
NVIDIA
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Daniel Vetter, Intel OTC
@dantvet
LPC 2019, Lisbon
Celebrating Vendor Lock-in

- ~20 years of desktop GL
- ~15 years of CUDA
- high margins need a moat
NVIDIA and Linux

- libglvnd
- EGL_display_device
- EGL_streams
- buffer format modifiers
- non-redistributable signed firmware
- … not trying would be stupid (for NVIDIA)
Open GPU Driver Business Case

- more reverse-engineered drivers than not
- only 3 hw vendors do open source GPU drivers
- fairly big teams
- need to pay the bills
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e.g. Android, by Google

- ~half year from linux-next to release, worst case
- one year to the next LTS, worst case
- one year for Google to rebase
- add more for non-Google Android
- same story for servers, ...
There is no LTS

- sometimes different baseline
- often different drivers/gpu
- often tons of patches
- everyone is different
Shipping Upstream First

- cp -R a/drivers/gpu/* b/drivers/gpu
- cherry-pick specific patches (hundreds)
- forklift entire upstream history (thousands patches)
- DKMS + a few hundred fixups
Stable Driver ABI

- it works in userspace, all helpers linked into drivers
- ship random upstream driver snapshot
- also: Android project treble
- defeats code sharing
- stable subsystem ABI?
Shipping Upstream First

- refactor for upstream
- add the crap back in
- ship it
- ...
- [there is no profit]
- sounded good 10 years ago
some customers require upstream
... and then proceed to ignore it
too big, too fast for stable ABI
too little, too late for upstream first
kernel's upstream first business case is broken
Linux Kernel: Upstream First

- some customers require upstream
- ... and then proceed to ignore it
- too big, too fast for stable ABI
- too little, too late for upstream first

⇒ kernel's upstream first business case is broken