Everything Great
About
Upstream Graphics

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10 or so years ago ...

- graphics execution manager
- kernel modesetting
- drm/i915, drm/radeon
- fbdev vs drm modesetting
- proudly celebrating OpenGL 2
- … and a wasteland

today

- 10% of the kernel + userspace
- 54 atomic modeset drivers (and more others)
- latest OpenGL, GLES, Vulkan
- smallest kernel driver 246 lines
- largest kernel driver 2.2M lines

Case Study: ST7736R

- hotunplug support
- full atomic kms + fbdev + legacy kms
- devm, w/ correct refcounting
- dma-buf w/ dma-fence support
- system suspend/resume missing, 2 functions to hook up
- 243 lines total

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

Helpers, Everywhere you look!

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

Atomic: Lessons Learned

- free standing state structures are great
- hardware commit phase can't fail
- modular helpers: flexibility&experimentation
- decode/encode in the core
- locking in the core
- need tests and proper uapi specs

Case Study: Self-refresh&Manual-upload

- lots of entry points: fbdev, legacy kms, atomic modeset
- unified update path with damage helpers
- partial upload userspace API
- almost unified enable/disable path with self refresh helpers
- handful of driver lines in total

More Awesome Stuff

- bridge and panel drivers, components
- ongoing: bridge state, chaining, more flexibility
- hot(un)plug fixing
- more work needed around devm_

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
- drm fourcc + modifiers

Helpers, Everywhere you render!

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

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, vc4/v3d, nouveau
- even Intel now on board with Iris
- radv+ACO, one handful hackers vs. AMD

Open Userspace: Why

- technical necessary for review/support
- RDMA, media, … agree
- upstream customer value: standardization
- vendor value-add: dual stack

Shipping

- dual-stack: upstream kernel w/ either open or proprietary userspace

- backport entire subsystem ...

- … like Android GKI (rsn)

Testing

- in-kernel selftests (we need KUnit asap)
- IGT gpu tests: cross driver userspace testsuite
- CRC-based validation, writeback under review
- tests require for all new uapi

Great Community

- gitlab everywhere, Mesa3D leading
- (kernel stuck on infrastructure work)
- 150 attendees at XDC
- XDC haz (SoC!) sponsors now!

Coming Soon

- dma-buf heaps/ION destaging
- userspace allocator/modifier negotiations
- media integration, but how?

Summary

- 10'000x scaling: tiny embedded to BIG GPUs
- batteries included: modular helpers for everything
- dual-stack in userspace
- ship/backport entire subsystem