Bringing up FOSS GPU Drivers on Freescale i.MX6 Systems
Who's the guy in front?

- Lucas Stach
- Kernel- and graphics developer at Pengutronix
- Providing customers with stable Linux based on mainline for their projects
- Engineering made-to-measure solutions
- Helping customers to reduce long time maintenance cost by bringing things mainline
Where are we coming from

- IP Vendor deliver drivers
  - “open” kernel driver
  - Large closed-source userspace component
Where are we coming from

• Non-technical problems
  • Vendor lock-in
  • Licencing issues
  • Code hidden and not auditable
Where are we coming from

- Technical issues
  - Updating systems non-trivial
  - API support missing
  - Bugfixes take a long time to arrive
Where do we want to go

- Have a dependable, fully open base driver
- Easily extendable with new API support
- Security fixes possible over the full period of industrial chip lifetime
Where do we want to go

- Have a dependable, fully open base driver
- Easily extendable with new API support
- Security fixes possible over the full period of industrial chip lifetime
- And some of us just want to run Quake 3
i.MX6 Vivante hardware

- Different IP cores for 2D, 3D and VG
- 2D core for low power operations and some video
- 3D core (straight-) forward renderer
- Modelled after DX9 pipeline + unified shaders
- Higher end models have thread walker for compute
i.MX6 hardware configuration

- FE → 2D
- FE → 3D
- FE → VG
- Resolve
Etnaviv project

- FOSS driver for the Vivante IP cores
- Started as a reverse engineering project by Wladimir J. van der Laan
- Contributions from others like Christian Gmeiner
- Lots of the commands and ISA are known
Linux graphics driver concept

EGL + OpenGL/CL Library / X.Org driver

Kernel driver managing hardware
Etnaviv kernel driver

- Christian Gmeiner started kernel work in 2014
- Defining user-kernel API mostly complete
- Lots of stabilization has landed
- Power management supported in a simple form
Etnaviv kernel driver

- Replaced fat and obfuscated Vivante kernel driver

- Readable code

- 60+ KLOC → 6.5 KLOC
Outlook after mainling

- Better power management by use of core internal DVFS
- More secure command stream validation
- Better client separation by own address spaces
- Better insight for application developers by exporting performance counters
Etnaviv X.Org driver

- Xf86-video-armada is able to drive 2D GPU
- Mostly developed by Russell King
- Provides 2D acceleration for common operations
- X-Video acceleration
Etnaviv MESA driver

- Started by Wladimir on top of the Vivante kernel driver and libetna
- Reworked to work on top of etnaviv DRM driver
- Able to run simple applications
  - GUI acceleration in QT5
- Lots of bugfixing still outstanding
Embedded is (not so) special

- MESA EGL
- DRM Driver
- Scanout
- Render
Embedded is (not so) special

MESA EGL

DRM Driver

Scanout

DRM Driver

Render
Embedded is (not so) special

• Laptops with discreet graphics are in the same game

• Christian has a prototype working
  • Fusing imx-drm and etnaviv

• Clean solution still needs to be worked out
Conclusion and outlook

- The ball is rolling
- Etnaviv may be the 2nd embedded graphics driver hitting mainline projects
- It is possible to get away from vendor supplied drivers
- Wayland support is coming
Questions?