Nouveau

Recap, on-going and future work

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Summary

1 The Nouveau community at FOSDEM

2 History

3 Architecture

4 Demos

Your host for the next hour

- Martin Peres (mupuf)
- Maarten Lankhorst (mlankhorst)
- Lucas Stach (lynxeye)

Also attending

- Emil Velikov (xexaxo)
- Francisco Jerez (curro)
- Roy Spliet (rspliet)

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History: NVIDIA – a new hope

- 1998(?): NVIDIA releases a Linux open-source 2D-only driver(nv)
- 1998: Obfuscation commit (release only pre-processed source)

After we already finalized XFree86-3.3.3 NVIDIA forced The XFree86 Project to replace the sources we had with sources that were partly run through the C preprocessor in order to remove some of the names that NVIDIA thought might give away IP from NVIDIA. This resulted in unreadable and unmaintainable code.

The XFree86 Project is strongly opposed to such obfuscated code. We do not regard this as free software according to our standards. Due to the extremely late date of this decision from NVIDIA we decided to include the code as offered by NVIDIA. We are considering to remove support for the later NVIDIA chips in a future release, though.

Xfree86, commit message from 11/18/98

History: The open-source strikes back

- 2005: Stephane Marchesin improves nv and works on 3D
  - Project named Nouveau after an unfortunate automatic spelling correction
  - Back-port nv updates to Nouveau
- 2008: Open Arena runs on nv40
- 2009: KMS driver based on TTM
- 2010: Merged in Linux 2.6.33
- 2010: Nv is deprecated by NVIDIA, say “use VESA”.

History: The return of the Jedi

"It's so hard to write a graphics driver that open-sourcing it would not help [...] In addition, customers aren't asking for opensource drivers."
Andrew Fear, NVIDIA software product manager, April 2006

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- Short hardware introduction
- Components

4 Demos

Chipset families

- NV03: RIVA 128
- NV04: RIVA TNT/TNT2
- NV10: Geforce2/4 MX
- NV20: Geforce 3, Geforce 4 Ti
- NV30: Geforce FX
- NV40: Geforce 6/7 (the first real family)
- NV50: Geforce 8/9/100/200/300 (the biggest family)
- NVC0: Geforce 400/500, AKA Fermi
- NVD9: Half-Kepler chipset

Hardware Introduction

- NVIDIA GPUs consists of "objects"
- command submission by DMA buffers
- GPU can accesss system memory through the aperture
- NV50 features a full blown virtual memory system

important engines

- PFIFO: main command fetching engine
- PCRTC/PDISPLAY: display scanout engines
- PGRAPH: main graphics object AKA OpenGL cast into silicon
- PMPEG: video acceleration found on older cards (not much use today)
- PVDEC/PPPP: modern video decoding engines

The 4 parts of Nouveau

- Linux Kernelmodule
- libdrm-nouveau
- DDX: xf86-video-nouveau
- Mesa3D drivers:
  - nouveau-vieux
  - nvfx
  - nv50
  - nvc0

Linux kernel module Nouveau

- Resource management
  - GPU Channels
  - Memory Management
- Command-submission
- Kernel Mode Setting
- Power Management

Power management

- Readings: Temperature & clocks
- vbios parsing: mostly
- setting clocks: unreliable, potentially dangerous

WIP

- nvc0: setting clocks
- nv40-d9: memory timings (almost ready)
- nv30-c0: reliable clock changes (almost ready)
- AGP/PCIE, clock gating: reverse engineering
- performance counters, dynamic reclocking: WIP

libdrm-nouveau

- buffer management
  - everything is a buffer!
- wraps around the IOCTL interface

work in progress

- currently rewritten
- designed with nv40 class hardware in mind
- pushbuffer replay

DDX – xf86-video-nouveau

- EXA (2D acceleration)
- X-Video
- supports full range of GPUs (NV04 - NVD9)
- makes use of all engines for acceleration (including 3D engine)

Mesa3D: drivers for 3D and more

- two different approaches here: Classic and Gallium3D
- nouveau-vieux: classic Mesa3D driver for NV04,NV1x,NV2x
  - only supports fixed function OpenGL
- Gallium pipe-driver
  - nvfx
  - nv50
  - nvc0

nvfx

- Gallium driver for NV3x,4x class GPUs
- one of the first gallium drivers
- created by merging separate nv30 and nv40 drivers
- accumulated much old cruft
- no maintainer for over one year

work in progress

- will hopefully be soon replaced by rewritten driver

nv50

- Gallium driver for NV50 class GPUs
- current codebase was formed by adapting nvc0
- maybe first free software driver to allow hardware OpenCL

work in progress

- merge reworked shader compiler
- implement remaining OpenGL 3 features
- merge OpenCL work

nvc0

- nvc0: Gallium driver for NVC0 class GPUs
- one of the first drivers to support OpenGL 3

work in progress

- working towards features in DX11 and OGL3+

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MPEG1/2 video decoding

- using MPlayer
- Kernel-side: done
- Mesa: merged 3 days ago

Dynamic reclocking

- see clocks changing according to the load
- performance improvements in OpenArena
- performance improvements in xvmc