

Nouveau

The community & past, current and future developments

Martin Peres & the Nouveau community

Ph.D. student at LaBRI

September 8, 2011

Summary

- 1 History
- 2 Architecture
- 3 Current status
- 4 Current work
- 5 Demos
- 6 The Nouveau community

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.

History: The open-source strikes back

- 2005: Stephane Marchesin decides to improve the pre-obfuscation version by adding 3D
 - The project is named Nouveau because of an automatic spelling correction
 - Back-port of the missing features from nv to Nouveau
- 2008: Open Arena runs on nv40 powered by Nouveau and the nvfx gallium driver
- 2009: Nouveau gets a working KMS driver based on TTM
- 2010: Nouveau is 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

Summary

- 1 History
- 2 **Architecture**
 - Chipset families
 - Components
- 3 Current status
- 4 Current work
- 5 Demos
- 6 The Nouveau community

Chipset families

- NV03: RIVA 128
- NV04: RIVA TNT/TNT2
- NV10: Geforce2/4 MX
- NV20: Geforce 3, Geforce 4 Ti
- NV30: Geforce 5/FX
- NV40: Geforce 6/7 (the first real family)
- NV50: Geforce 8/9/200/300 (the biggest family)
- NVC0: Geforce 400/500, AKA Fermi
- NVD0: Kepler, nvd9 is the first partial version

Linux module Nouveau

- Kernel Mode Setting
- Command-submission
- Resource allocation

Nouveau DDX

- EXA (2D acceleration)
- X-Video

Mesa: 3D acceleration

- Nouveau_vieux: 3D for NV04-NV30 (mesa classic)
- NVFX: 3D for the nv30/40 families (gallium)
- Nouveau: 3D for NV50/C0 families (gallium)

NV30/40 microcodes

- HWSQ: very limited use (LVDS)
- CtxProgs on nv40

NV50 microcodes

- CtxProgs: Context-switching microcode
- HWSQ v2(formerly PMS): memory reclocking, no flow control
- nv98+ Flexible MicroCode($F_{\mu}c$): a general-purpose microcode. Broad usage (PCrypt, PDaemon, Vdec, ...)

NVC0

- $F_{\mu}c$: PGRAPH (the central engines) is converted to $F_{\mu}c$

NVD0

- $F_{\mu}c$: A bunch of remaining engines are converted to $F_{\mu}c$

Summary

- 1 History
- 2 Architecture
- 3 **Current status**
 - Modesetting, 2D
 - 3D support
 - Power management
 - HW video decoding
- 4 Current work
- 5 Demos
- 6 The Nouveau community

ModeSetting - Done

- NV04: TNT2
- NV10: Geforce2/4 MX
- NV20: Geforce 3, Geforce 4 Ti
- NV30: Geforce 5/FX
- NV40: Geforce 6/7
- NV50: Geforce 8/9/200/300 (the biggest family)
- NVC0: Geforce 400/500, AKA Fermi

3D Drivers and support

- nouveau_vieux (nvXX-30): classic mesa driver. Unsupported.
- nvfx (nv30-50): gallium driver. Works but no maintainer.
- nouveau (nv50-d0): gallium driver. Supported!

Application support

- nvfx: Any app that runs with OpenGL 2.1 (NPOT software emulation)
- nouveau: Any app that runs with OpenGL 2.1

Power management

- Readings: Temperature & clocks
- vbios parsing: mostly
- fan management: left untouched
- AGP/PCIE: left untouched
- clock gating: left untouched
- setting clocks: unreliable and potentially dangerous

HW video decoding

- mpeg1/2: Kernel support, no userland support
- mpeg4: No support

Why MPEG4 hw decoding is hard

- involves at least 3 engines
- microcodes are not all in $F\mu c$
- qsdg
- codecs needs to be implemented

Summary

- 1 History
- 2 Architecture
- 3 Current status
- 4 Current work**
 - Modesetting, 2D
 - 3D support
 - Power management
 - HW video decoding
- 5 Demos
- 6 The Nouveau community

ModeSetting - TODO

- NVD0: Kepler, nvd9 is the first partial version

Current 3D-related work

- add support for nvc1
- improve performance

Application support

- some crashes with Unigine Tropics & Heaven

Current work on power management

- nvc0: setting clocks
- nv30/40/50: memory timings (almost ready)
- nv30/40/50: reliable clock changes (almost ready)
- AGP/PCIE: reverse engineering
- clock gating: almost ready
- performance counters: WIP
- dynamic reclocking: WIP

HW video decoding

- mpeg1/2: mergeable
- mpeg4: no support

Summary

- 1 History
- 2 Architecture
- 3 Current status
- 4 Current work
- 5 Demos**
- 6 The Nouveau community

mpeg1/2 video decoding

- using MPlayer
- soon to be merged into mesa

Dynamic reclocking

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

Summary

- 1 History
- 2 Architecture
- 3 Current status
- 4 Current work
- 5 Demos
- 6 The Nouveau community
 - Composition

The nouveau community

- The largest xorg-related IRC channel
- Composed of:
 - One paid developer
 - Former developers
 - Student developers
 - Enthusiasts

The nouveau maintainer

Nouveau is maintained by Ben Skeggs(darktama):

- Hired by Red Hat in 200X
- Located in Brisbane, Australia (GMT+10)
- Works on almost everything

Gallium's nouveau maintainer

Christoph Bumiller (calim) maintains the nv50-c0 gallium driver:

- Physics master student at the University of Vienna (Austria, GMT+1)
- Main Gallium contributor
- nvc0 3D support
- performance improvements

Marcin Kościelnicki (mwk)

- Polish master student at the university of Warsaw (GMT+1)
- Implemented most of the GPGPU-oriented PSCNV nouveau fork
- Reversed most of the Fermi's architecture and video decoding

Pekka Paalanen (pq)

- Finnish (GMT+2)
- Worked on mmioitraces, a register DB
- Does some communication-related work

Francisco Jerez (curro)

- Spanish Physics student (GMT+1)
- Worked on page-flipping and nouveau_vieux

Marcin Slusarz (joi)

- Polish SQL/C++/Java developer (GMT+1)
- Fixes software bugs (mesa + kernel)

Emil Velikov (xexaxo)

- Bulgarian student at the University of Nottingham (England, GMT+0)
- Reverse engineering of some PM-related vbios table
- Other PM-related implementation work
- Debugging/Testing

Roy Splet (RSplet)

- Dutch master student at the Delft University (GMT+1)
- Memory timings reverse engineering

Martin Peres (mupuf)

- Engineer, Ph.D. student at LaBRI (France, GMT+1)
- Reclocking process
- Thermal-zones & thermal management
- Minor reverse engineering

Maxim Levitsky (MaximLevitsky)

- Student at the Technion University of Haifa (GMT+2)
- Important reverse engineering work on reducing power consumption
- Stability-related reverse engineering
- New-comer

Maarten Lankhorst (mlankhorst)

- Netherlands (GMT+1)
- Implemented XVMC support
- Work towards an open VDPAU
- New-comer