

Nouveau

Recap, on-going and future work

Karol Herbst, Pierre Moreau & Martin Peres

Nouveau developers

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Summary

- 1 Introduction
- 2 Pascal support
- 3 Power management
- 4 Userspace
- 5 Community
- 6 Conclusion

Introduction

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- Nouveau is Linux's OSS driver for NVIDIA GPUs;
- We want to provide a good out-of-the-box desktop experience;
- We wish to run games and compute workloads too!

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Support

- All NVIDIA desktop GPUs since 1998 (partial support);
- 2D and 3D acceleration on all recent GPUs (2003+);
- OpenGL 4.5 (non official) & Direct X 9 (through Wine);
- Video decoding on GPUs between 2004 and 2013.

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Pascal support

Pascal GPUs

- Current generation of desktop GPUs, released in March 2016;
- Most locked down NVIDIA GPUs to date;

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 - Modesetting: Complete support (Linux 4.14);
 - 2D/3D acceleration: Yes, but firmwares came after 1+ year;
 - Temperature reading: Yes;

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- Supported features:
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 - 2D/3D acceleration: Yes, but firmwares came after 1+ year;
 - Temperature reading: Yes;
 - Fan management: Impossible (locked down);
 - Reclocking: Impossible (locked down);
 - Video BIOS uploading: Impossible (locked down);
 - Power reading: Impossible (locked down).

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Power Management

Clock gating (Lyude Paul)

- Increases the battery life of laptops without performance loss;
- Experimental version for Kepler about to land in Nouveau.

Fan management (Martin Peres)

- Adjusts the fan speed based on the temperature;
- Full support for most GPUs since Linux 3.13;
- Some GPUs require a weird calibration: Loud fans!
- NVIDIA is about to release some documentation for this.

Power Management

Reclocking (Karol Herbst, Ben Skeggs & Roy Splet)

- Support: Tesla & Kepler is mostly good, Fermi is coming
- Thermal throttling: Adjust perf. to limit the temperature;
- On demand reclocking: Adjust the perf. based on the load;

Power monitoring (Karol Herbst)

- Power consumption exposed when available;
- Able to get the power budget on a few cards

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Graphics

History: GL version support (NVC0: Fermi+)

- OpenGL 4.1 support in Mesa 11.0
- OpenGL 4.3 support in Mesa 12.0
- OpenGL 4.5 support in Mesa 13.0 (unofficial, 4.3 by default)

Graphics

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Vulkan

- NIR to NVIR started for Vulkan SPIR-V support
- Also helps for OpenGL 4.6 (ARB_gl_spirv and ARB_spirv_extensions)
- Hopefully some basic Vulkan driver ready this year

Quick overview of SPIR-V

SPIR-V usage

Used as intermediate language for

- OpenCL (via extension for 1.2 and 2.0, core \geq 2.1);
- OpenGL (core 4.6, or via an extension before);
- Vulkan.

OpenCL: Try out the SPIR-V support on radeon

Prerequisites

- SPIRV-Tools:
<https://github.com/KhronosGroup/SPIRV-Tools>
- llvm-spirv:
<https://gitlab.collabora.com/tomeu/llvm-spirv>
- LLVM \geq 5.0
- Mesa: <https://github.com/pierremoreau/mesa> (branch: clover_spirv_series_v3)

How to use/test it?

- Set `CLOVER_USE_SPIRV=1`;
- Use `clCreateProgramWithILKHR()`, `clCreateProgramWithIL()`;
- Or for AMD owners, use `clCreateProgramWithSource()`.

Overview of SPIR-V to NVIR

Status for OpenCL 1.2 support for Nouveau

- Supported:
 - Most arithmetic/relational/bit/etc. operations;
 - Most atomics and convert operations;
 - Function calling and control flow.
- Work in progress:
 - Image support;
 - Finishing off the various memory operations.
- Still missing:
 - Group operations;
 - Most OpenCL specific operations.

OpenCL CTS 1.2 passing rates for test_basic: 36/95 (27 of the failing ones are image tests)

Try out OpenCL on Nouveau

Prerequisites

- Same as for testing the SPIR-V support;
- except for Mesa, for which the branch is `nouveau_spirv_support`.

Hardware status

- Tesla: needs changes to the memory management code;
- Fermi: should work;
- Kepler: should work;
- Maxwell: partially works;
- Pascal: partially works;

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 - History with NVIDIA
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Community - members

Red Hat developers working on Nouveau

- Ben Skeggs: maintainer and long time contributor;
- Lyude Paul: part time on power management;
- Karol Herbst: full time on reclocking, mesa and Compute.

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Community

- Rhys Kidd: Tooling (IGT, shader-db), Thermal management;
- Ilia Mirkin: Mesa developer, OpenGL;
- Pierre Moreau: SPIR-V, OpenCL, compiler opts;
- Martin Peres: Fan management, power management;
- Roy Spliet: DVFS (reclocking), compiler opts;
- You? Join us!

Community - Relationship with NVIDIA

Recent History with NVIDIA

- Sept 2013: First real contact
 - NVIDIA released public vbios documentation (DCB);
 - Offered us a contact email to answer questions;
 - Are willing to improve the out-of-the-box experience of users;
- 2015-2017: NVIDIA hired someone to work on Nouveau
 - Added Tegra K1/X1/X2 support to Nouveau;
 - Led to a Nouveau-based product (Pixel-C);
 - Wrote secure-boot support for Maxwell+;
- 2018: New documentation dump for the vbios tables.

Community - What we need from NVIDIA

Locked GPUs affect development and user experience

- 2015: The Maxwell 2+ GPU are locked, signed FWs prevent:
 - Accelerated graphics: usually given a year after release;
 - Fan management: no FW provided;
 - Reclocking: no FW provided;
 - Power reading: no FW provided;
 - VBIOS reverse engineering: prevented by software.
- 2018: Some VBIOS documentation landed:
 - A website appeared to sign some vbios;
 - Some signs of opening?

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Conclusion

Nouveau is improving

- Nouveau is still the default driver in all distributions;
- The GL driver is in good shape: OpenGL 4.4 and 4.5 coming;
- Performance needs to improve for 4K displays: relocking!;
- Power efficiency for laptop users need to be improved too.

Join the fun?

- Why not join the team? We have lots of challenges!
- GSoC/EVoC students: we'll have projects for you!