



NOUVEAU

Status Report

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Agenda

- Kernel-space
 - NVIF
 - Power management
- User-space
 - OpenGL
 - Performance Counters
 - OpenCL/Vulkan
- Firmware overview
- Tegra & Maxwell support
- Cooperation with NVIDIA
- Who are we?

Introduction

- Last complete update was at XDC 2015
- Many improvements since then :)

Kernel / LibDRM

- Initial Pascal support merged (Linux 4.8)
 - Modesetting enabled for all Pascals
 - Acceleration requires firmwares from NVIDIA
 - Only GP100 available right now (\$10k GPU)...
- NVIF
 - Allows the userspace to access some kernel structures and functions
 - Would allow Nouveau to run in guest virtual machines, without Virgl.
 - Support now merged in the kernel (Linux 4.3) and libdrm

Kernel / LibDRM

- Power management
 - PCI-E link is now changed when setting a pstate
 - More GPUs can be reclocked
 - G94-G200 are now reclockable (Linux 4.4)
 - Initial steps for proper GPU boost on Fermi+ (Linux 4.9)
 - Initial Maxwell reclocking support (Linux 4.9)
 - Power consumption monitoring merged (Linux 4.9)
 - Work by Karol Herbst, presented tomorrow (see the program)

Mesa - Current Status

- Mesa 12.0:
 - Support GM20x GPUs
 - **OpenGL 4.3, ES 3.1** for Fermi/Kepler!
 - And... a bunch of various bugfixes and optimizations

- Next Mesa release:
 - Initial support GP10x GPUs
 - **OpenGL 4.1** for Maxwell/Pascal!
 - Work done by Ilia Mirkin, Samuel Pitoiset and Ben Skeggs

Mesa - Future Work

- OpenGL:
 - Ultimate goal: **OpenGL 4.5**
 - **OpenGL 4.3** for Maxwell/Pascal
 - Sched code data calculator (WIP)
 - Implement new features on GM200+
 - Vertex/tess shader viewport/layer setting
 - Post-depth coverage
 - Geometry broadcasting to multiple viewports
 - Conservative rasterization
 - New rectangle primitive
 - Configurable sample locations
 - More bugfixes
 - Perf, perf, perf!

Performance counter status

- Current status:
 - Libdrm-2.4.66: Expose the PM engine and NVIF interface
 - Graphics perf counters already RE'd for Fermi

- Plan:
 - Rework the queries in NVC0 (ie. allow batching) (WIP)
 - Monitor perf counters and expose them to the Gallium HUD (WIP)
 - RE more perf counters on Kepler+

- Development is stalled, GL features first!

Mesa

- OpenCL:
 - Cf. FOSDEM 2016 (https://archive.fosdem.org/2016/schedule/event/nv_compute/)
 - Updates for SPIR-V -> NV50 IR part:
 - Code updated to support Fermi, Kepler and Maxwell;
 - *clCreateProgramWithBinary* and *clCreateProgramWithIL* supported;
 - Improved support for *if* statements;
 - Basic phi-node removal pass;
 - Most atomic operations now supported;
 - Use the correct signedness for operations;
 - Future Work:
 - Textures/surfaces support (WIP);
 - ARB_gl_spirv support;
 - Code cleanup and upstreaming.

- Vulkan:
 - Don't expect something soon
 - See you at XDC'17! :)

Maxwell/Pascal Firmware Release

On GM20x+, FECS and PMU firmwares should be signed NVIDIA to work.

Current status:

- NVIDIA did provide code for loading them on Tegra and dGPUs
- GRAPH signed firmwares released for GM20x (Feb. 2016) and GP100 (Jul. 2016)

Needed firmwares:

- FECS (PGRAPH)
 - Performs context switching
 - Blocks 2D/3D/Video acceleration
- PMU (PDAEMON):
 - Performs power management
 - Blocks fan management, efficient dynamic reclocking and power gating

Tegra Support

- GK20A (Tegra K1), released in January 2014
 - Continuous effort by NVIDIA ever since
 - March 2014: support for non-PCI(e)/AGP platforms (Linux 3.15)
 - June 2014: Initial support for 2D/3D rendering (Linux 3.16)
 - July 2014: support for manual reclocking (Linux 3.17)
 - October 2014: Mesa support
 - July 2015: FECS/GPCCS firmware merged into linux-firmware
- GM20B (Tegra X1), released in January 2015
 - August 2015: Basic kernel support merged (Linux 4.3)
 - Reclocking, power management in the pipe
 - Advanced features (framebuffer compression, ...) also planned
 - February 2016: Signed firmware released

Applications still require support to display properly on Tegra

Maxwell and Pascal Support

- GM10x (Released in February 2014)
 - September 2014: Initial support (Linux 3.15)
 - June 2015: Out of the box acceleration support (Linux 4.1)
 - November 2016: Full manual reclocking support (Linux 4.9)

- GM20x (Released in September 2014)
 - February 2016: NVIDIA released the firmwares
 - March 2016: Acceleration support (Linux 4.6)
 - Power management stalled! Waiting on NVIDIA's signed PMU firmware

- GP10x (Released in July 2016)
 - October 2016: Initial support for GP100/GP104 (Linux 4.8)
 - October 2016: Acceleration support for GP100 (Linux 4.8)
 - Stalled! Waiting on NVIDIA's signed GRAPH firmwares (GP102+)

Relationship with NVIDIA, since 2013

- NVIDIA side
 - Official support of Tegra GPUs
 - Register dumps for the TK1 provided
 - Implemented secure boot on Nouveau
 - Some open documentation (download.nvidia.com/open-gpu-doc/)
 - Mailing-list where Nouveau developers can ask questions to NVIDIA engineers [github](#).
- Nouveau side
 - Waiting for signed firmwares, ... for years ...
 - Preventing fan management, and therefore reclocking on GM2xx
 - No acceleration on Pascal
 - Waiting for the BIOS documentation ... since REing is blocked by the signed vbios ...
 - Losing interest in new platforms

NVIDIA, please allow us to help you...

What we would need

- Early access to hardware and firmwares:
 - NDAs are fine as long as they expire the day hardware ships!
 - Documentation for firmwares' ABI
- Rights to redistribute firmwares...
 - On the day of release
- VBIOS documentation
 - And a way to disable signature checking for the bios (to verify the documentation)
- Adapt internal FW policy to public releases (?)
 - Do we really need to do this? We know this is not gonna happen and we could live with changes anyway due to the architecture of Nouveau.

Failing this:

- The Nouveau community will shrink as the driver becomes irrelevant for users
- NVIDIA will have to write support for newer chips and convince us that they will actually maintain the code.

Who are we?

Special thanks to the following Nouveau developers for their work:

- Ben Skeggs (Red Hat) - Main kernel developer and maintainer of nouveau-drm
- Ilia Mirkin and Samuel Pitoiset - Main developers of the mesa driver
- And, in alphabetic order:
 - Alexandre Courbot (NVIDIA) - Tegra K1+ development and maintenance
 - Hans de Goede and Pierre Moreau - OpenCL support
 - Karol Herbst and Roy Spliet - Power management and performance
 - Martin Peres - Power and thermal management (drm-side)
 - Emil Velikov - Fixes and robustness of the mesa code
- You? We are looking for:
 - Compiler developer enthusiasts to write compiler optimisations
 - Quality Assurance contributors - Grab the code from git and test it!

Useful status links

- General news: <http://nouveau.freedesktop.org/>
- Feature matrix: <https://nouveau.freedesktop.org/wiki/FeatureMatrix/>
- Video decoding: <http://nouveau.freedesktop.org/wiki/VideoAcceleration/>
- OpenGL status: <https://people.freedesktop.org/~imirkin/glxinfo/>
- Task list: <https://trello.com/b/ZudRDiTL/nouveau>