ATI Radeon Driver for Plan 9
Implementing R600 Support

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  Project Goal

Radeon Specifics
  Available Documentation
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Radeon Numbering System

- ATI has released many cards under the Radeon label.
- Modern cards are prefixed with "HD".

### Rough Mapping from Chipset to Marketing Name

<table>
<thead>
<tr>
<th>Chipset</th>
<th>Marketing Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>R200</td>
<td>Radeon {8500, 9000, 9200, 9250}</td>
</tr>
<tr>
<td>R300</td>
<td>Radeon {9500, 9600, 9700, 9800}</td>
</tr>
<tr>
<td>R420</td>
<td>Radeon {X700, X740, X800, X850}</td>
</tr>
<tr>
<td>R520</td>
<td>Radeon {X1300, X1600, X1800, X1900}</td>
</tr>
<tr>
<td>R600</td>
<td>Radeon HD {2400, 3600, 3800, 3870 X2}</td>
</tr>
<tr>
<td>R700</td>
<td>Radeon HD {4300, 4600, 4800, 4800 X2}</td>
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Each family roughly coincides with a DirectX version bump.

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- R600 supports the Unified Shader Model.
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- R700 is an optimized R600.
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- Include an ATOMBIOS parser.
- Drive the R600 family (≈ Radeon HD 3850).
- Provide 2D acceleration via the 3D engine.
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The rest of this talk expands on these ideas in greater detail.
Available Documentation

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In order to facilitate supporting new cards, the Plan 9 driver must be updated to make use of two features present since R520.

▶ ATOMBIOS (discovered from RadeonHD)
▶ Command Processor (discovered from ATI documentation)
What is ATOMBIOS?

ATOMBIOS is:

▶ A collection of card-specific data tables and scripts stored in ROM on Radeon cards since R520.
▶ Accessible via a common interface regardless of card family or model.
▶ $\approx 10,000$ line parser provided in part by ATI, in part by reverse-engineering from the RadeonHD team.
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This is a very nice substitute for register twiddling, at the price of dragging along (and porting) an enormous codebase.

- Also, Plan 9 can’t use most of the provided features.
- But without ATOMBIOS, we have to discover and hardcode undocumented defines for BIOS data, for each card.
Sample ATOMBIOS Commands

Example ATOMBIOS Exercising Code from Radeon

RHDAtomBiosFunc(pScrn->scrnIndex, NULL, ATOMBIOS_INIT, &atomBiosArg)

A sampling of available commands:

- ATOMBIOS_ALLOCATE_FB_SCRATCH
- GET_DEFAULT_ENGINE_CLOCK
- ATOM_SET_VOLTAGE
- ..hundreds more. (Radeon has a smaller list than RadeonHD.)
What other abstraction layers are there?

There are three supported options for talking to the Graphics Controller in the R5xx documentation:

1. Conduct a sequence of register writes to setup a processing engine on the graphics controller, and then start it by toggling the trigger register.
2. Push command packets to the graphics controller, and have the hardware translate the packets into register writes.
3. Construct a ring buffer shared between host and GPU, and have the graphics controller pull from it asynchronously.

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Ring Buffer Implementation

http://developer.amd.com/gpu_assets/RRG-216M56-03oOEM.pdf
What about the rest of needed functionality?

Well, there’s no documentation on that.

▶ A great component of this project is copying logic from the Radeon driver.

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Structure of Plan 9 Graphics Drivers

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Logically, aux/vga executes first.
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4. load()
   - Write the Ctrl’s modified registers out to the card.
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- Setting the dedicated mmio regions.
- Calling the appropriate functions to drop the card and vga driver into linear mode (unless you want segmented mode).
- Providing hardware acceleration functions.
  - In our case, that means using the 3D engine.
Figures and Estimates

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Only about 1,500 lines of actual logic, hopefully.
Order of Operations

The project is being completed in roughly the following order:

1. Read BIOS data from card (aux/vga).
2. Implement snarf(), then init(), then load().
3. Test that VGA modesetting works, even if we see garbage.
4. Figure out what kernel bits need to be changed, if any, to get into linear mode.
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