Thoughts and Experiences with the OpenGL Software Rasterizer

Because using *real* Graphics Hardware is BAD for teaching

Matthias Hopf

Professor for Applied Computer Science

NIT - Nuernberg Institute of Technology

Department of Electrical Engineering,
Precision Engineering, Information Technology

Obsolescence

f (plural obsolescences)

- (uncountable) The state of being obsolete — no longer in use; gone into disuse; disused or neglected.
- (countable) The process of becoming obsolete, outmoded or out of date.

Obsolescence in OpenGL

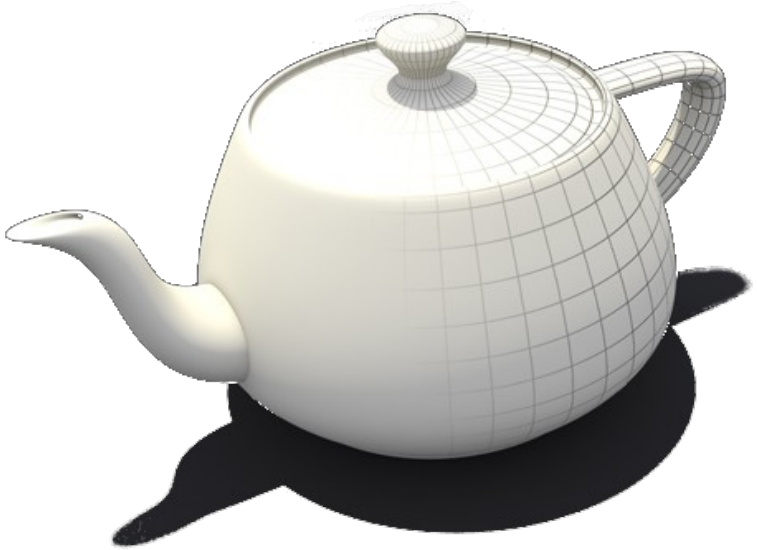
- OpenGL 3.1 (+ GLSL 1.40)
  - Current available max version in Mesa
  - Spec finished for more than 4 years now
  - Current version: (almost) 4.4...
  - Oldest(!) OpenGL quick reference docs: OpenGL 3.2
  - Oldest(!) GLSL quick reference docs: GLSL 3.30
- Differences in GLSL hurting more than in OpenGL
  - Most of functionality up to 4.0 already present
  - Attribute location binding
- Supported version also driver dependent...

Graphics Drivers? Nah...

- In real Life?
  Yes, everybody needs them
- For teaching?
  - Version differences between graphics stack vendors
  - In Mesa: even within one "vendor" for different drivers
  - Behavioral differences between different graphics hw vendors
  - Behavioral differences even between different graphics cards from the same vendor
  - Different bugs...
- Better use the Software Rasterizer...

Speed? Not an issue

- In teaching, the most complex Geometry usually is:



- Software rasterization is *almost always* fast enough

Speed: Amazing...

- Early times: flat shaded triangles was too slow
- Beginning of this century: flat shaded triangles in software faster than on most Gfx hardware
- Smooth shaded triangles reasonably fast for teaching
- Recently: textured triangles reasonably fast, even w/ interpolation
- Now: even Shaders reasonably fast, thanks LLVM!

Feature-wise: Only Recently an Option

- Before Mesa 9.2:
  - Hardware: GL 3.0 GLSL 1.30
  - Software: GL 2.1 GLSL 1.20
- Mesa 9.2:
  - GLSL version supported in HW *and* SW: 1.30
- Good idea to use MESA_GL_VERSION_OVERRIDE?!?
  - Which parts are just not announced, which are actually absent?
  - Feature matrices: current?
    - docs/GL3.txt
    - http://dri.freedesktop.org/wiki/MissingFunctionality/

OpenGL 4.4 not required soon-ish

- But OpenGL 3.3 (rather: GLSL 3.30) is:
  - `layout (location = 3) in vec3 normal;`
    so much nicer and semantically more reasonable than
    `in vec3 normal;` [...]
    `glBindAttribLocation (program, 3, "normal");`
  - Documentation on opengl.org
- Already pretty much implemented (at least layout stuff)
- Good idea to use MESA_GLSL_VERSION_OVERRIDE?!?
  - Probably better wait for 10.0...

OpenGL x.y with x.y > something

- Goal: create newest possible context within a certain range (e.g. at least 2.1, at most 4.0)
  - Typically wanted (decide about render paths afterwards)
  - Annoyingly much code required to do that
- Any best practice about that?

Results

- llvm software driver is in a reasonable state to use for teaching shaders
- Support for GLSL 3.30 out-of-the-box would be awesome for ease of attribute binding
- Really required to *not* expose GLSL levels that aren't typically available in the announced OpenGL level?
  - E.g. Announce OpenGL 3.0 but GLSL 3.30...
  - It's only about syntactic sugar...