NDK
native API crunch

OpenGL on Android

Lecture 8

Android Native Development Kit

8 April 2014

NDK
native API crunch

OpenGL ES

OpenGL ES on Android

Demo

Debugging and Profiling

Outline

OpenGL ES

- Cut down version of OpenGL
- Fixed point support
- Found in many mobile platforms (Android, iOS, Blackberry, Symbian, 3DS, etc.)
- Designed for slower GPUs and CPUs

Version 1.x

- OpenGL ES 1.0 based on OpenGL 1.3 and OpenGL ES 1.1 based on OpenGL 1.5
- Common and Common-Lite (only fixed point) profile
- Fixed-function rendering pipeline
- Reduced features: no quad and polygon primitives, no stippling, only multisample AA, reduced drawing modes, no display lists, etc.
- OpenGL ES 1.1 adds better multitexture support, VBOs, clip planes, mipmap generation
- Android 1.0 and higher

Version 2.0

- Based on OpenGL 2.0, but reduced fixed-function pipeline support
- Not compatible with OpenGL ES 1.x
- OpenGL ES Shading Language
- ESSL only has forward branches and fixed iteration loops
- Transforming and Lighting functions replaced by shaders
- Better performance than OpenGL ES 1.x in many cases
- Android 2.2 and higher

Version 3.0

- Compatible with OpenGL ES 2.0 and OpenGL 4.3
- Standardized texture compression
- Better texturing support
- New Shading Language version with full support for integer and floating point
- Improved flow control
- Easier portability
- Android 4.3 and higher

Outline

GL Surface

- Manages a surface (a piece of memory which can be displayed on screen)
- Manages an EGL display (an OpenGL rendering context)
- Dedicated rendering thread
- Can provide debug information

EGL

- Virtual display which contains a rendering context
- 2D and 3D rendering
- Allows having multiple smaller surfaces on the actual screen or drawing to offscreen buffer
- Used by SurfaceFlinger and other compositors (Wayland, Mir) or libraries (SDL)

Outline

Demo

Outline

Android tools

- Logging
- Debugging Developer Options: Overdraw, Clipping
- Profiling Developer Options: Performance metrics on screen or through ADB, Traces
- Tracer for OpenGL ES: Visualize traces

Intel GPA

- Intel Atom processors
- More information: GPU, CPU, Battery usage
- More detailed analysis
- Identifies possible bottlenecks
- Realtime
- Works over Wifi

Vendor specific tools

- Low level information
- Different interface and capabilities for each vendor
- Optimizations not always portable
- PowerVR, Tegra, Adreno, etc