System-level optimization in the embedded graphics system.

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DMP products

IP cores

Tiny 3D graphics core
(OpenGL ES 1.1)
PICA200 Lite
PICA200 for FPGA

Advanced 3D graphics core
(OpenGL ES 1.1 + DMP extension)
PICA200

Programmable graphics IP core
(OpenGLES1.1, 2.0, OpenVG1.1)
SMAPH-S

Vector graphics IP core
(OpenVG1.1)
SMAPH-F

Hybrid graphics core
(OpenGLES1.1 and OpenVG1.1)
SMAPH-H

OpenGL ES Learning Kit for Android
USD $49 (Academic License)
USD $98 (Personal License)
Embedded graphics system

- Embedded system applications
  - Not only mobile phone
  - There are many devices such as...

- Three key issues in embedded graphics systems
  - Performance
  - Power consumption
  - Software environment
Use case is different in each application

- Use case identification is very important for system optimization.

Amusement and gaming

Consumer electronics

Automotive
Performance

- Ideal situation
  - Low memory access latency and high bandwidth availability
  - Dedicated SRAM-like memory for graphics system
  - Enough CPU power

- Reality
  - Large memory access latency and limited bandwidth
  - DRAM-type main memory shared between CPU and GPU (UMA) due to system cost reduction
  - Restricted CPU power for graphics core control

- Solutions – Memory architecture and cache optimization.
Power consumption

Low power consumption techniques

- SoC power management
  - Power domain
  - Multi-Vth
  - Optimized clock and power control in synthesis and backend layout work. (including CTS optimization)
  - Automatic frequency control.

- Graphics module level optimization
  - Function level automatic clock gating
  - Automatic clock gating based on module activity
  - Root level clock gating
  - Driver software optimization
Software environment

- 3D graphics applications in embedded systems
  - Expanding from 3D gaming to user interface applications

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Customer application and tools

Middleware
  Graphics engine

SDK
  Graphics Driver (OpenGLES1.1/2.0, OpenVG1.1)

OS
  Target HW
  Desktop emulator
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In conclusion

- Three key issues in embedded graphics systems
  - Performance
  - Power consumption
  - Software environment

- Demand for graphics IP cores
  - Easy to achieve desired rendering performance in implemented system
    - Performance of catalog spec doesn't provide any information about that.
  - Easy to integrate into SoC
  - High quality, optimized software environment
Questions?