AlexVG: OpenVG Software Implementation

OpenVG Software Implementation with Acceleration on HW

Hwanyong LEE
CRO and Technical Marketing Director

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Vector Graphics & Other Technologies

- **Carriers Requirements**
- **Qualcomm uiONE**
- **Adobe Flash Lite Player**
- **Acrodea VividUI**

**CPU’s**
- General CPU’S
  - ARM, Cortex
  - Intel, Marvell, MIPS

**GPU’s**
- VG or GL ES HW
  - nVidia, imagenation, AMD, ARM, Samsung

**MM HW**
- Multimedia HW
  - mTekVision, Corelogic, NXP, TI

**Operating Systems**
- Linux Cairo

**Hardware**
- CPU: ARM, Cortex, Intel, Marvell, MIPS
- GPU: nVidia, imagenation, AMD, ARM, Samsung
- Multimedia: mTekVision, Corelogic, NXP, TI

MS SilverLight
Mobile GUI – Vector Graphic or Bitmap Graphics?
Who cares?

Choice of Bitmap or Vector Graphics?

Issues are
- User Experience
  - Performance
  - Drawing Quality
- Development
  - Easy to port, Scalability
  - Development Tool

Motivation
- Image related functions are CPU intensive work in OpenVG
- Most of GUI requirements are high performance image functions
Functions Required for OpenVG

Double Buffer - Two Frame Buffer memory supports
- Transfer Front buffer to Display when Renderer Access (draw on) back buffer
- Partial Update (if it is possible and efficient) – Redraw only changes or clipping purpose

Image Copy - Fast Block Copy between Image Buffer
- Fast Clear of memory and Fast block copy
- Bitblt functions

Blending with alpha value
- Porter-Duff blending and Additive blending

Masking and Scissoring

Color Conversion and Color Transform

Fast Image Transform with Image Re-sampling
Why we try to accelerate OpenVG on MM HW?

• Market
  • Adopt OpenVG HW for Phone – Well... Expensive
  • Adopt OpenGL + OpenVG HW for phone – Of course, Expensive
  • Adopt OpenVG SW – Well... Too Slow
  • Adopt OpenGL ES HW + OpenVG SW → AlexVG™ FORGE
    - more narrow market

• Multimedia function is essential for Mobile Phone
Really works?

Yes it works! – NXP Example

- NXP’s new chip is for Mid-tier cell phone (Low Price) with 2DGfx function
- We achieved about 20 frames/second Image based GUI with 20% CPU use.

Yes it works! – mTekVision Example

- mTekVision’s new chip is for Camera Control Chip with MM Function
- We achieved about 15 frames/second Image based GUI

Demo (on mTekVision)

- Vector Based GUI (UFO : UI For Kids)
- Bitmap Based GUI (Samsung Touch UI)
NXP+HUONE solution to boost Samsung GUI

Set-up: PNX6516 with CPU @ 156MHz & AHB @ 78MHz

OpenVG processing measurements

<table>
<thead>
<tr>
<th>Software</th>
<th>CPU used</th>
<th>Frame rate</th>
<th>CPU used</th>
<th>Frame rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Translation</td>
<td>100%</td>
<td>4,6</td>
<td>20%</td>
<td>21&lt; fps &lt;24</td>
</tr>
<tr>
<td>Scaling</td>
<td>100%</td>
<td>3&lt; fps &lt;10</td>
<td>20%</td>
<td>21&lt; fps &lt;24</td>
</tr>
<tr>
<td>Rotation</td>
<td>100%</td>
<td>4,5</td>
<td>20%</td>
<td>18&lt; fps &lt;21</td>
</tr>
<tr>
<td>Page</td>
<td>100%</td>
<td>2,6&lt; fps &lt;4</td>
<td>20%</td>
<td>22&lt; fps &lt; 33</td>
</tr>
</tbody>
</table>

➔ Frame rate improved by a factor 4 & 80% CPU free with HW acceleration!
Conclusion

Accelerating OpenVG on MM HW

• Cost Effective
• High Performance
• Big Market
• for Future Market (IPTV market)

OpenVG Relation & Comment

• 100% of OpenVG Functions can be supported
• Partially HW accelerated
• Image related OpenVG command is accelerated well

Limitations

• Hardware Dependency
• NXP Examples
  • Blending – Only Src-Over & Src
  • Transformation – Only for Affine Transformation
  • No Masking / No Scissoring (must be implement with other methods)
  • All image width size must be 16x (convertible but some waste of memory)
  • Batch Image Processing / Not one by one
  • Automatically Re-sampling – NO NAA Supports
AlexVG™ References

**Croix GUI**
- Ex) SGH-P520, SGH-F700

**Magic Touch GUI**
- Ex) SGH-U900 (Soul)

**TouchWiz GUI**
- Ex) SGH-F488E

**Operator’s Requirement (MyFaves)**
- Ex) SGH-U700, SGH-T229

**Various GUI’s**

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**30 models shipped as of Nov. 2008**
AlexVG of HUONE

**ENGINE**
VG Render on General CPU

**FORGE**
VG Render on Graphics Process Unit

**FORMA**
VG Render on Multimedia HW

**PLAYER**
SVG Tiny 1.1 / 1.2 Player

**EGL**
OpenKODE EGL 1.3 Hardware Abstraction Layer

**Software Platform**
Windows XP/Vista/CE/Mobile, Symbian, Linux, WIP, BREW

**Hardware Platform**
- General CPU
  - ARM 9, 11, Cortex
  - Intel x86
  - Marvell 2xx, 3xx
  - MIPS
- GPU supports
  - OpenGL
  - OpenGL ES 1.1
  - OpenGL ES 2.0
- Devices with Multimedia
  - Bitmap Graphics
  - Image Processing
  - Vector Processing
- General CPU or Any OpenVG Devices
THANK YOU

Hwanyong LEE

Email: hylee@hu1.com | Phone: +82-53-325-4956 | Fax: +82-53-325-4951
WWW: http://www.hu1.com
573-13 Boghyun Bukgu Mobile Techno Bldg 6F
Daegu Korea 702-020