OpenKODE - Portable Native Mobile Media Applications

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Handheld Graphics Revolution

• Mobile Games are gaining market presence
  - BUT there have been many difficulties and obstacles – and many issues remain

• We are just beginning to understand the potential of handheld graphics
  - We can enable new categories of innovative rich media titles and applications

• BUT - it needs to be easier for handheld developers to make money!
  - The industry needs to enable you to innovate – and create applications never seen before

This slideset will explore this handheld graphics revolution ...

  - What are the issues holding the revolution back?
  - What we can do to make the revolution happen faster?
    - What opportunities it will create?

A call to action for everyone to help build this opportunity together
Pervasive Mobile Computing

- Mobile phones are the largest and fastest growing market - ever
  - The largest ever market opportunity for the graphics industry

- Handsets are becoming personal computing platform - not “just” phones
  - A real computer in your hand – mobility, connectedness and numerous sensors

- Sophisticated media processing will be central to this handheld revolution
  - Just like it has been on the PC
  - Games are one of the first handheld media applications
The State of Mobile Gaming

• Users are placing a premium on compelling games titles
  - Consumers are interested in more than just casual games

• Users pay more for accelerated premium 3D gaming content
  - 50-100% price increase for 3D games over 2D games is common

• Multi-user content encourages higher network usage
  - OTA provisioning 3D applications and levels, real-time multi-player networking

BUT – industry ecosystem issues are holding back the market for advanced media and games developers
Issue: Platform Fragmentation

• Every handset is unique from the programmers perspective
  - Differences in operating system functions, Java implementations and media functionality

• Severe platform fragmentation exists today
  - ISVs need to port to and support 100s (even 1000s) of source variants of each title
Issue: Need Increased Performance

- Java is widely available – but doesn’t provide the best media performance
  - Java applications benefit significantly from hardware acceleration

- Native acceleration enables still higher display quality and performance
  - A fact now recognized through benchmarks and real developer experience

"OpenGL ES is the technology of the future for 3D game development. The transition from 2D to 3D can be compared to that of black-and-white TV to color TV." Gameloft president Michel Guillemot

<table>
<thead>
<tr>
<th>Measured by Kishonti</th>
<th>Java (fps)</th>
<th>OpenGL ES (fps)</th>
<th>Native Advantage</th>
</tr>
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<tr>
<td>Nokia N93</td>
<td>18.6</td>
<td>77.8</td>
<td>x4.2</td>
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<tr>
<td>Sony Ericsson M600</td>
<td>6.0</td>
<td>30.6</td>
<td>X5.1</td>
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GLBenchmark – direct port of identical Java benchmark
Solution: Native Media API Set

- Fragmentation
- Need Consistent APIs on Every Handset
  - Reliably available functionality

- Lack of Performance
- C Native Programming Environment
  - Familiarity for developers
  - Eases ports from PCs, handhelds and consoles

“Native Media Acceleration APIs”
A cross-platform set of native APIs for media application development

OpenKODE

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Media APIs Enable Market Growth

- An API is a contract between hardware and software worlds
  - Enabling both - everyone wins

- ISVs see reduced variability across multiple platforms
  - More software can reach market faster at a better level of functionality and quality

- Hardware vendors can accelerate many applications
  - Adding value to their platform
Open Membership
Any company is welcome
Funded by membership dues - $6K / year

Open Standards
Publicly available on web-site
Royalty-free

Open Standards for Media Authoring and Acceleration

Khronos typically develops “Foundation-Level” APIs
High-performance “Close-to-the-metal” access to hardware acceleration
Good foundation for higher-level engines and middleware
Khronos Dynamic Media Ecosystem

Cross-platform graphics authoring/acceleration ecosystem

Cross-platform 2D/3D

Collada
3D Authoring

Dynamic Media Authoring

Embedded Media Acceleration APIs

OpenGL
2D/3D

OpenGL/ES
2D/3D

OpenVG
Vector 2D

OpenMAX
Streaming Media

OpenSLESES
Enhanced Audio

Safety Critical 2D/3D

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Adoption of Embedded Khronos APIs

- OpenGL ES 1.1 is widespread
- OpenVG is in rapid adoption
- OpenMAX is being implemented
- OpenSL ES is being designed

100%

Market adoption in media-accelerated handsets

Mid-2004
OpenGL ES 1.1
Spec release

Mid-2005
OpenVG 1.0
Spec release

Beginning-2006
OpenMax IL 1.0
Spec release

End-2007

OpenGL ES 2.0
1Q07: Specification Finalized

OpenMAX
Mid-2007
OpenSL ES 1.0
Spec release

OpenMAX
Mid07: OpenMAX AL 1.0 (Application Level)

OpenVG
Mid07: OpenVG 1.1 - enhanced Flash and Font acceleration

1Q07: OpenVG 1.0 Conformance Tests and open source implementation
Mid07: OpenVG 1.1 - enhanced Flash and Font acceleration

4Q06: OpenMAX IL 1.0
1Q07: OpenMAX IL 1.1 and Conformance Tests
Mid07: OpenMAX AL 1.0 (Application Level)

Enhanced Audio

Streaming Media

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APIs Enable Mobile Acceleration

Faster Performance at Higher Quality
Hardware delivers at least 10 times the performance of software – even on low-cost systems with low-end CPUs

POWER EFFICIENCY

Less Power
Hardware accelerators exploit parallelism in a media pipeline to give a x10 increase in power efficiency over software

State of the art user interfaces
Smaller screens need more advanced graphics processing per pixel
OpenKODE

It's like DirectX™ for mobile phones!
Except it's an open standard, cross-platform, royalty-free and streamlined for handheld devices

OpenKODE is a set of C-native APIs for handheld games and media applications

2D, 3D, video and audio media types are all seamlessly accelerated by OpenKODE

OpenKODE minimizes source changes when porting games and applications from phone to phone
Native Fragmentation

Handheld devices increasingly need advanced graphics and media acceleration for user interfaces, 3D gaming, Flash, TV...

Severe API fragmentation to access OS resources and media acceleration = HUNDREDS of source variants per game
The OpenKODE Solution

System Abstraction (OpenKODE Core)

Media Accelerator Silicon
GPU / DSPs / CPUs

Kernel Operating System
(e.g. Rex, Symbian OS, Windows Mobile, Linux, Nucleus, Synergy)

CPU

Software Platform (e.g. Brew, Symbian UIQ, S60, WIPI)

Native Applications

User Interface

3D Game Engines

Flash/SVG Players

TV/Video/Audio Players

Java Applications

Java JVM

Bindings

Media APIs

Trans-API communication (EGL)

The OpenKODE Solution

- Selected Khronos media APIs for state-of-the-art media acceleration
- Trans-API data and event coordination - WITH full trans-API Conformance Tests (EGL)
- System Abstraction APIs for portable access to operating system resources, input devices and displays (OpenKODE Core)

= A coherent, cross-platform API set for NATIVE portable media applications
OpenKODE Participation

- 40 companies participating in OpenKODE working group
  - Core participants include Acrodea, Aplix, ARM, Ericsson, Freescale, Futuremark, Ideaworks 3D, Intel, Nokia, NVIDIA, Samsung, SUN, Symbian, Tao, TI
- Working for industry adoption on many platforms
  - Symbian, WIPI, Linux, Windows, Brew
  - Any platform can use royalty-free, open-standard, vendor-neutral, media acceleration API layer
  - Incorporates significant design expertise from leading industry media companies
OpenKODE provides foundation-level acceleration for advanced user interfaces and media applications that mix multiple media types.
Leveraging and Accelerating Java

Existing provisioning, billing and security systems can be used to OTA provision native OpenKODE applications.

Native applications will need certification – as Brew does today

CHAPI (Content Handler API) - Java standard to register handlers for media types. A native API enables mixing Java and native applications and services
OpenKODE Milestones

- **OpenKODE 1.0 Provisional released at 3GSM 2007**
  - 12 month schedule from start to finish
  - Encouraging developer feedback before spec finalization mid-2007

- **Full conformance tests will be released in 2Q07**
  - Written by Futuremark – tests OpenKODE Core AND trans-API operation

If you are a developer – download the spec and give us your feedback!
Spec at [www.khronos.org/openkode/](http://www.khronos.org/openkode/)
Feedback forums at [www.khronos.org/message_boards/](http://www.khronos.org/message_boards/)
OpenKODE Roll-Out

- Simple build out of existing OpenGL ES adoption
  - Expecting rapid industry momentum

- OpenKODE 1.0 allows media API selection
  - To enable widespread early adoption

- OpenKODE does NOT preclude other media APIs
  - OEMs can pace their own transition from proprietary APIs
  - E.g. can ship alongside DirectShow

OpenGL ES is everywhere today

OpenKODE Core API has no silicon dependency and takes <50KB.
OpenKODE provides enhanced 2D/3D mixed mode operation

Full DirectX functional equivalence. Robust trans-API functionality and testing
Implementation Announcements

We are three weeks after OpenKODE 1.0 announced
Momentum is already building quickly

- OpenKODE Core can “drop-in” alongside OpenKODE media stacks. Typically middleware solutions provide native OTA provisioning over Java networks – sometimes with portable binary capability

- Futuremark developing Conformance Tests for OpenKODE. Graphic Remedy developing OpenKODE profiling tools

- Announced OpenKODE media stacks with OpenGL ES and increasingly OpenVG

Tools

OpenKODE Core and Middleware

Silicon Acceleration
Innovative Mixed Media Applications

- Breakthrough mobile games and applications will not treat mobile devices as small consoles or PCs
- They will take advantage of the unique capabilities of mobile devices:
  - Use of handset sensors
    - Cameras for video and images, sound
  - Mobility
    - With GPS location awareness
  - Connectedness
    - Unique information flow and social interactions
- An advanced media stack enables innovative applications that mix many kinds of media acceleration

A GPS phone processes OpenMAX video to recognize buildings and landmarks
OpenKODE: Acceleration Foundation

- Advanced UI – OpenVG
  - OpenGL ES for special effects

- Accelerated Java Applications
  - OpenGL ES – 184/239, OpenVG - 287

- Augmented Reality – OpenMAX AL
  - Video processed & rotoscoped with OpenGL ES 3D

- Advanced Navigation - OpenVG
  - 3D terrain/satellite data using OpenGL ES

- Video Telephony – OpenMAX AL
  - OpenGL ES lip-synch 3D avatar

- PVR Application – OpenMAX AL
  - OpenVG-based UI and subtitles

- Music Visualizer - OpenSL ES
  - OpenGL ES 3D synchronized to music beat

- 3D Game – OpenGL ES
  - OpenSL ES positional audio & OpenVG HUD/menus

- 3D TV Channel Selector – OpenMAX AL
  - OpenGL ES 3D multi-channel visualization

OpenKODE creates the opportunity to create new applications and user interfaces that use multiple media types.
Khronos - New Working Groups

- New Working Groups

**glFX**
- FX Framework for OpenGL / OpenGL ES
- Run-time API to portably use COLLADA FX visual effects in OpenGL and OpenGL ES applications

**glFX**

**COLLADA**
- 3D Authoring

**OpenML**
- Dynamic Media Authoring

**OpenGL ES**
- 2D/3D

**OpenVG**
- Vector 2D

**OpenMAX**
- Streaming Media

**OpenSLES**
- Enhanced Audio

**OpenKODE**

**Composition Working Group**

**System Graphics APIs for Window Manager**
- Enables full acceleration of advanced compositing window systems and user interfaces
Application traverses scene data, uses the glFX Runtime API to extract effects information to setup the rendering pipeline.
Composition API

Portable applications use OpenKODE Core to interface to Windowing System

Window System uses Composition APIs to accelerate advanced composited user interface

Probably will be subset of OpenGL ES and OpenVG – so can run on existing silicon

Multi-tasking GPU accelerates multiple applications and window system UI and transitions

OpenKODE provides portable application-level media functionality
OpenKODE Native Ecosystem

Carriers

- Open standards to simply specify a native, cross-platform media API stack
- Compelling media applications increase revenue through existing provisioning, billing, DRM certification infrastructure
- Native OTA provisioning uses existing certification, security, billing, lifecycle management infrastructure

Handset OEMs

- Proven media stack architecture based on multi-vendor open-standards - reduces risk
- Cross-platform native APIs reduce source fragmentation and increase performance

Content Providers

- Native, cross-platform media API stack
Industry Call to Action

• We now have a forward-looking, multi-threaded media stack architecture
  - That is an open, royalty-free standard to encourage industry innovation

• Foundation for new-generation interfaces and mixed-media applications
  - Driving new market and revenue opportunities

• OpenKODE is a open-standard, multi-vendor native media-stack
  - Helping to solve industry fragmentation and performance issues

• If you are an handset OEM.. Embed an OpenKODE 1.0 media stack!
• If you are a carrier.. Specify OpenKODE 1.0 for your native games!
• If you are a developer.. Demand OpenKODE 1.0 for development!

OpenKODE is a significant opportunity for the handheld industry
to help evolve handheld devices into the most pervasive
media-capable computing devices the world has yet seen
If you are a developer – download the spec and give us your feedback!
Specification at www.khronos.org/openkode/
Feedback forums at www.khronos.org/message_boards/

Watch for upcoming free OpenKODE PC development versions and
OpenKODE Coding Contest at www.KhronosOpenSpace.com

These slides and Khronos membership details at www.khronos.org