Exploiting the Multimedia Capability of ARM NEON
- Using the OpenMAX Standards

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Agenda

- What is Multimedia?
- What is OpenMAX
- NEON
- Multimedia Frameworks
- The UI
- Conclusion
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What are multimedia devices?

Devices which support
- Audio and Video
- Text and Numeric

What is common about them?
- Most have menus of some sort from which the user is able to make selections
- Apart from that - Very little !!
  - Different screen sizes
  - Different user input – buttons, touch screen, remote etc.
  - Different User Interfaces
  - Different languages and standards – Dolby, MP3 etc.
  - Even physically identical cell phones from different operators will behave differently
A selection of multimedia devices
Building a multimedia device

Application

Operating System

Codecs & libraries

Hardware

Many vendors
Building a multimedia device

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What is OpenMAX™?

- Open, royalty-free Application Programming Interface (API)
- Targets media codecs and applications
- Common interface (API) meant to increase portability
- Meant to work across silicon and OS platforms
- Created by the Khronos Group
OpenMAX

OpenMAX IL
Portability Across Operating Systems
Abstracted interfaces for media libraries into OS media frameworks

OpenMAX DL
Portability Across Processors
Hotspot primitives to enable easy porting across hardware architectures

Application

Operating System Media Framework

IL – “Integration Level”
Media Primitives – provide portability to different operating systems

MP3 | AMR | H.264 | MPEG4 | More Media Libraries

DL – “Development Level”
Media Primitives – provide portability of silicon acceleration

Media Engines
CPUs, DSP, Hardware Accelerators etc.
OpenMAX Layers

mentor Graphics works at the OpenMAX IL (Integration Layer)
- Provides codec abstraction across OSs and software stacks
- Integrates with major OS frameworks:

ARM works at the OpenMAX DL (Development Layer)
- Provides standardized interface to media primitives across hw platforms
- Primitives are a set of “hotspots” covering 80% of codec processing

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NEON

Media engine within the ARM core
- Single code development environment/tool chain
- More than 100 instruction types in ARM and Thumb-2
- Instructions run mixed with standard ARM instructions
- 2-4x acceleration for typical media applications
- Multipurpose: media acceleration, signal processing, graphics

Architecture
- Separate register file and execution pipelines from ARM
- Hybrid 64/128-bit SIMD architecture
- Integer and floating point arithmetic
Why NEON?

Multimedia is more than capture and playback of fixed standards based content

- Must handle a wide range of formats
  - May not even be defined today
  - YouTube uses Flash
    - What formats will contain the viral content in 2009?

- Need to manipulate the multimedia
  - Video editing
    - Enhancing
    - Fun effects
  - Photo editing
    - 5MP + resolution
    - PC type features
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- OpenMAX Integration Layer
- Codecs & libraries
- OpenMAX Development Layer

Hardware

Partner Logo Here

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Adding a Multimedia Framework

Application

media Framework

Operating System

OpenMAX Integration Layer

Codecs & libraries

OpenMAX Development Layer

Hardware
What is a Multimedia Framework?

- Implements industry standard OpenMAX IL:
  - portable & efficient MM
  - supports multiple OSs
  - component model
- Supports any OpenMAX-compliant components
  - S/W and H/W codecs
  - audio processors…
- RTSP & RTP for streaming

![Multimedia Framework Diagram]

**Multimedia Framework**

**OpenMAX Components**

- Network Reader
- File Reader
- Audio/Video

- RTSP
- RTP

Third Party Codecs

- H.264
- MP3

OS

Hardware

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Nucleus Multimedia Framework

- Implements industry standard OpenMAX IL:
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Nucleus Multimedia Framework

OpenMAX Components

- Network Reader
- File Reader
- Audio/Video
- Nucleus RTSP
- Nucleus RTP

Third Party Codecs

Nucleus OS

H.264 MP3

Hardware

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An example of OpenMAX IL interoperability

Component by Vendor B

Components by Vendor A

File Reader

MP3 Decoder

Volume Control

Audio Output

File Reader

MP3 Decoder

Volume Control

Audio Output
What other challenges do we have?

- Multimedia Frameworks can use OpenMAX components to ease interoperability.
- To make use of the Framework and make users want to use the end product, a good User Interface (UI) is required.
- Changing an embedded UI for different devices is not trivial as the UI is normally application centric.
  - Changing the screen size may entail major software development.
  - Most UIs are constructed with graphical components ‘glued’ together by software.
  - New standards being introduced may have to be ‘bolted on’.
- This can result in project overspend and delays.
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The UI

Inflexion Platform UI

Nucleus Multimedia Framework

OpenMAX Components

Network Reader  File Reader  Audio/Video

Nucleus RTSP  Nucleus RTP

Third Party Codecs

Nucleus OS

H.264  MP3

Hardware

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Putting it all together

Development Tools

- EDGE
  - IDE
  - Compiler
  - Debugger
  - Simulation & Testing
  - Profiler
  - JTAG

Inflexion Platform

- Inflexion Platform UI
- Multimedia
- Camera
- Telephony
- VoIP
- Customer Application
- Customer Application

Operating System

Nucleus OS

- Networking
- GUI
- File System
- USB
- Bus Support
- Security

Kernel

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Inflexion Platform UI

- It is menu driven
  - Provides an easy to use ‘browse and select’ model for accessing all device features, content & services

- It is Customizable
  - All aspects of the UI’s presentation (appearance, behavior, and structure) may be altered with XML (you do not have to do any programming)

- It is Flexible
  - A simple C callback API facilitates re-use of and rapid integration with any on-device software
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Conclusion

- NEON provides flexible, platform-portable media acceleration for emerging applications
- OpenMAX provides the open APIs to enable mix and match of components, codecs and hardware
- Nucleus Multimedia Framework supports any OpenMax IL compliant components
- Inflexion Platform encapsulates the Nucleus Multimedia Framework and allows easy access to Inflexion Platform UI
- Inflexion Platform UI allows appearance, behaviour and structure to be easily customised
Thank you

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