

Conquering Embedded Devices with Erlang



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Quick overview

An **embedded system** is a computer system designed to perform one or a few dedicated functions often with real-time computing constraints.

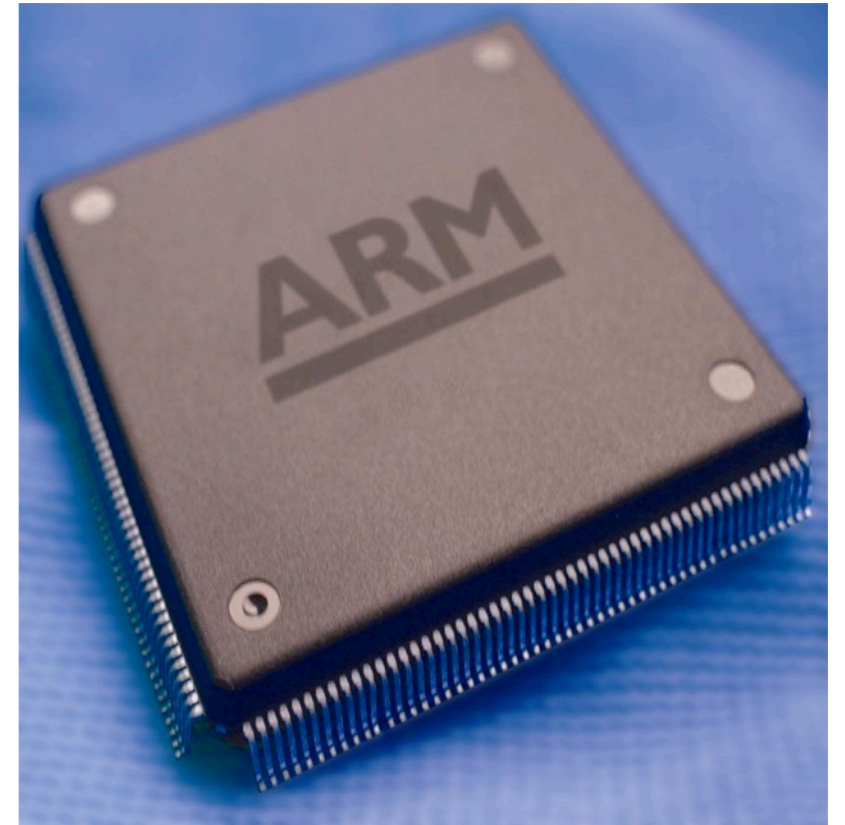
Wikipedia

- Embedded CPU
- Hardware
- Modern embedded software
- Erlang Embedded

The Erlang logo is written in a red, cursive script font.

ARM Architecture

- 32 bit RISC
- 98% of mobile phone market
- 90% of all embedded RISC processors
- licenses for external companies



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ARM - vendors

- Apple (A4)
- Alcatel-Lucent
- Atmel
- Intel
- Nvidia
- Texas Instruments
- Microsoft (support for ARM in Windows 8)
- Calxeda - 480 core ARM servers



<http://www.computerworld.com.au/article/379549/calxeda-arm-chips-designed-480-core-servers/#480cores>

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Development environment...

...done the hard way

- Prerequisites
- Device itself
- Development environment
- Crosscompiler
- Native libraries

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Crosscompiler

- Difference between host and target architectures
- What is crosscompilation toolchain?
 - assembler
 - compiler
 - linker
 - loader
 - autotools (optionally)

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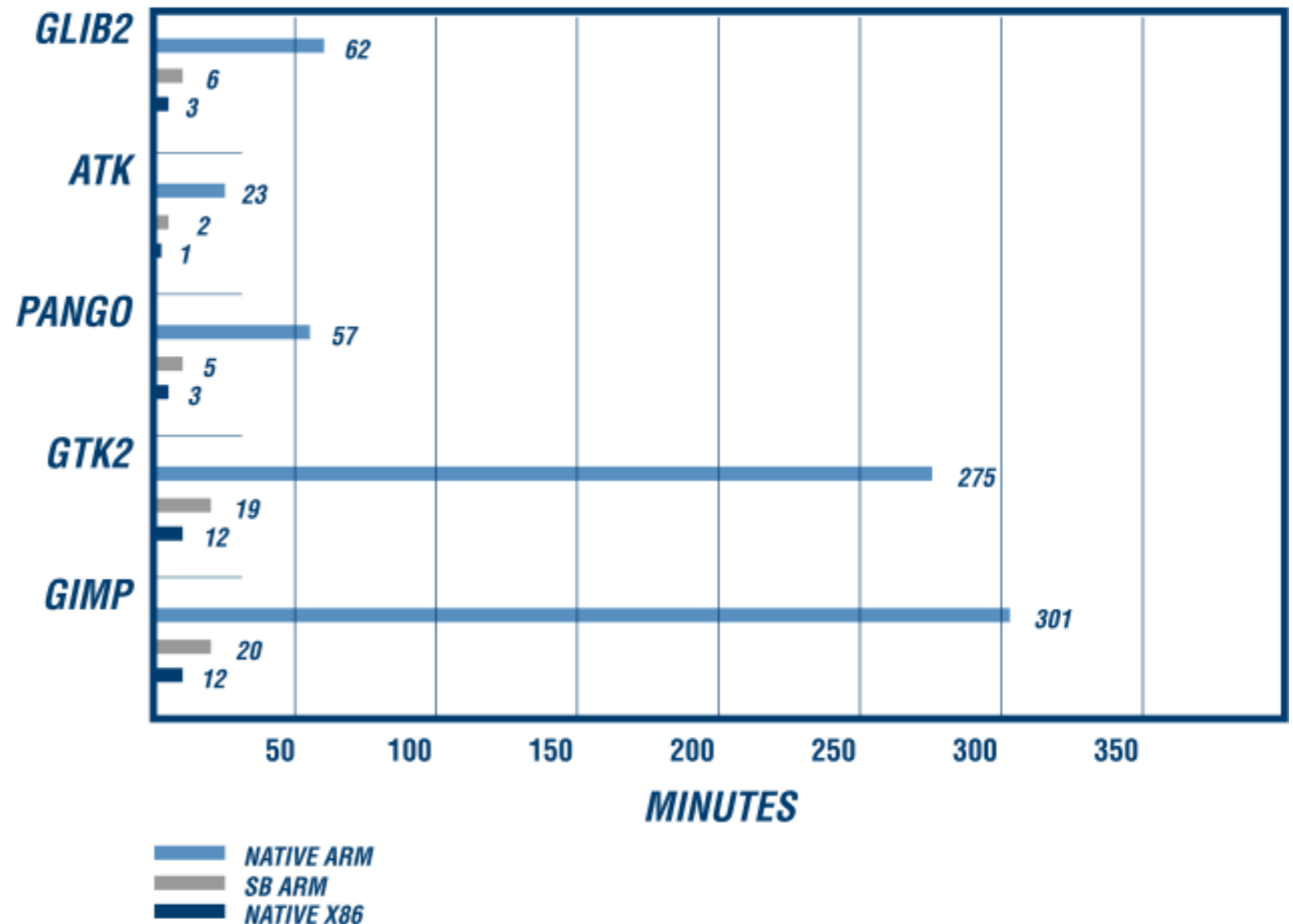
Why not native?

The native ARM machine used in comparing was:

- Intel SA110 CPU 233MHz
- 40GB IDE HDD
- 256MB RAM
- Debian Sarge with Linux kernel 2.4.25

and the X86 machine used was:

- Intel Xeon CPU 2.80GHz
- 80GB IDE HDD
- 2GB RAM
- Debian Sarge with Linux kernel 2.6.8-1-686



<http://www.scratchbox.org/documentation/docbook/tutorial.html>

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Crosscompiling Erlang

- distribution sources from <http://www.erlang.org>
- crosscompiler from <http://www.codesourcery.com>
- scratchbox as an alternative
- adjusting PATH environment variable:
`PATH_TO_CODESOURCERY/CodeSourcery/Sourcery_G++_Lite/bin/`
- create CFLAGS environment variable:
`CFLAGS=-I/home/development/otp_src_R13B04/lib/:-I/home/development/otp_src_R13B04/lib/public_key/include/:-Os`
- skip building of unnecessary applications:
`touch lib/*/SKIP`
- prepare for building linked-in ssl drivers (crypto and ssl applications)
provide ssl bin/ ,lib/ and include/ on HOST platform



Crosscompiling Erlang

- **configure it**

```
./configure -host=arm-linux --with-ssl=/home/development/arm-lib/ --prefix=/opt/  
erlangR13B04 --without-termcap --disable-hipe --disable-smp-support --disable-  
megaco-flex-scanner --disable-megaco-reentrant-flex-scanner
```

- **make!**

```
make noboot  
sudo make install
```



Make it smaller...

- remove +debug_info flag

```
./make/otp.mk.in:86:      #ERL_COMPILE_FLAGS += +debug_info  
./make/arm-unknown-linux-gnu/otp.mk:86:      #ERL_COMPILE_FLAGS += +debug_info  
./make/x86_64-unknown-linux-gnu/otp.mk:85:      #ERL_COMPILE_FLAGS += +debug_info
```

- remove emulator symbols from beam files

```
beam_lib:strip_release(code:root_dir()).
```

- use -Os compiler flag

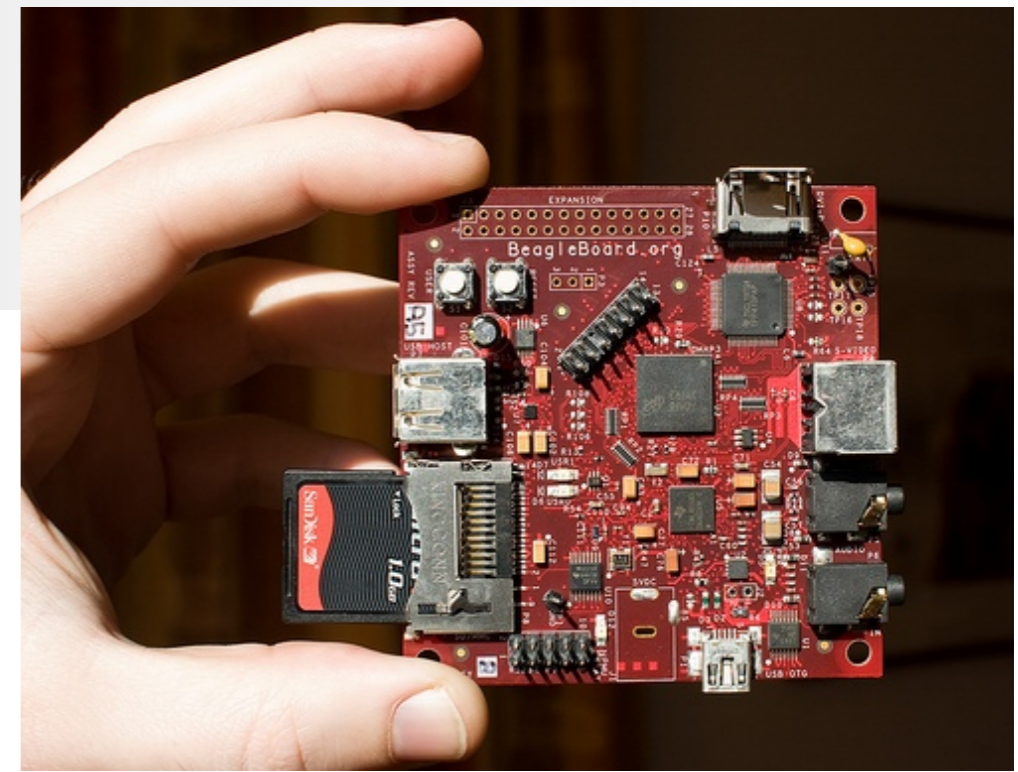
- skip unused applications (proceed with caution!)

Result: entire Erlang Runtime fits in 10MB



Beagleboard

- ARM Cortex A8 600MHz
- OpenGL 2D/3D graphics accelerator
- 256MB RAM
- 256MB Flash
- SD Card slot
- DVI-D, S-Video, Stereo Audio In/Out
- USB 2.0 and mini USB 2.0
- DSP chipset for HD video support



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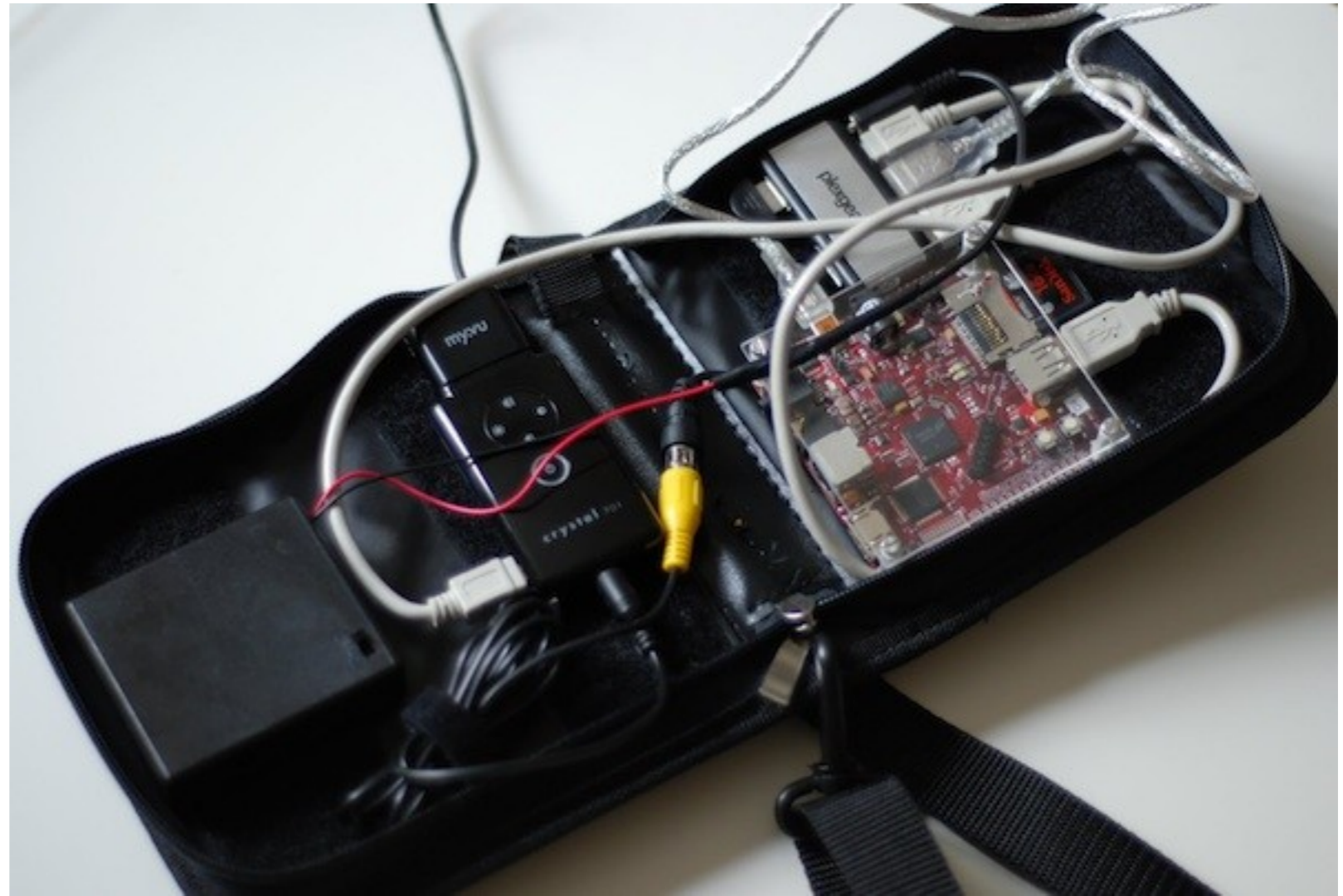
What you can do with it



http://gpspp.sakura.ne.jp/rtklib/rtklib_beagleboard.htm

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What you can do with it



<http://blog.inesun.com/2010/07/28/beagleboard-finds-new-purpose-in-diy-wearable-computer/>

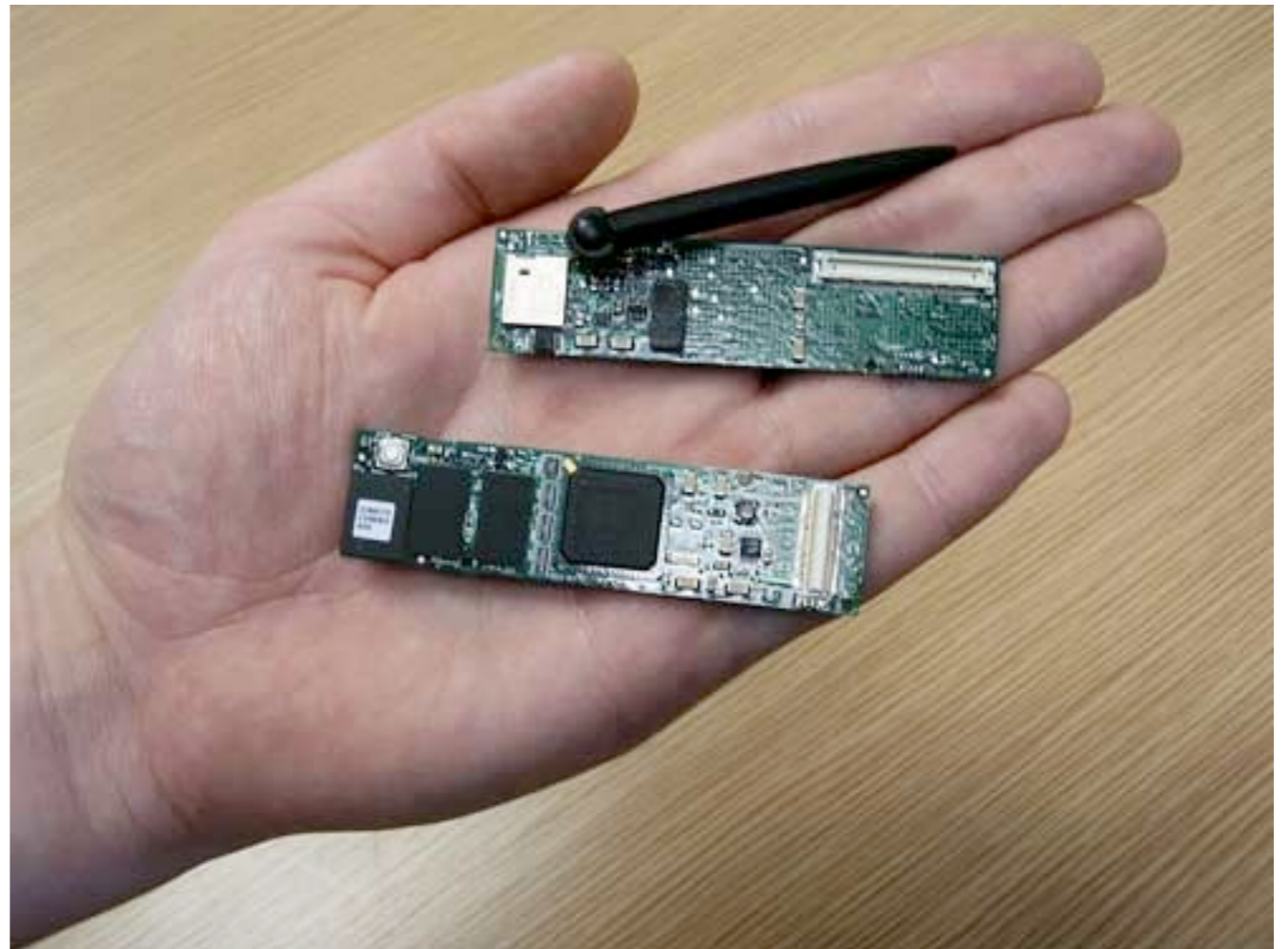
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Gumstix

HW specs very similar to
Beagleboard

additional modules:

- Bluetooth 2.0
- WiFi 802.11g



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Google Android

- mobile operating system
- acquired by Google in 2005
- very large community
- running on top of Linux
- not only for smartphones
- Android 3.0 only for tablets

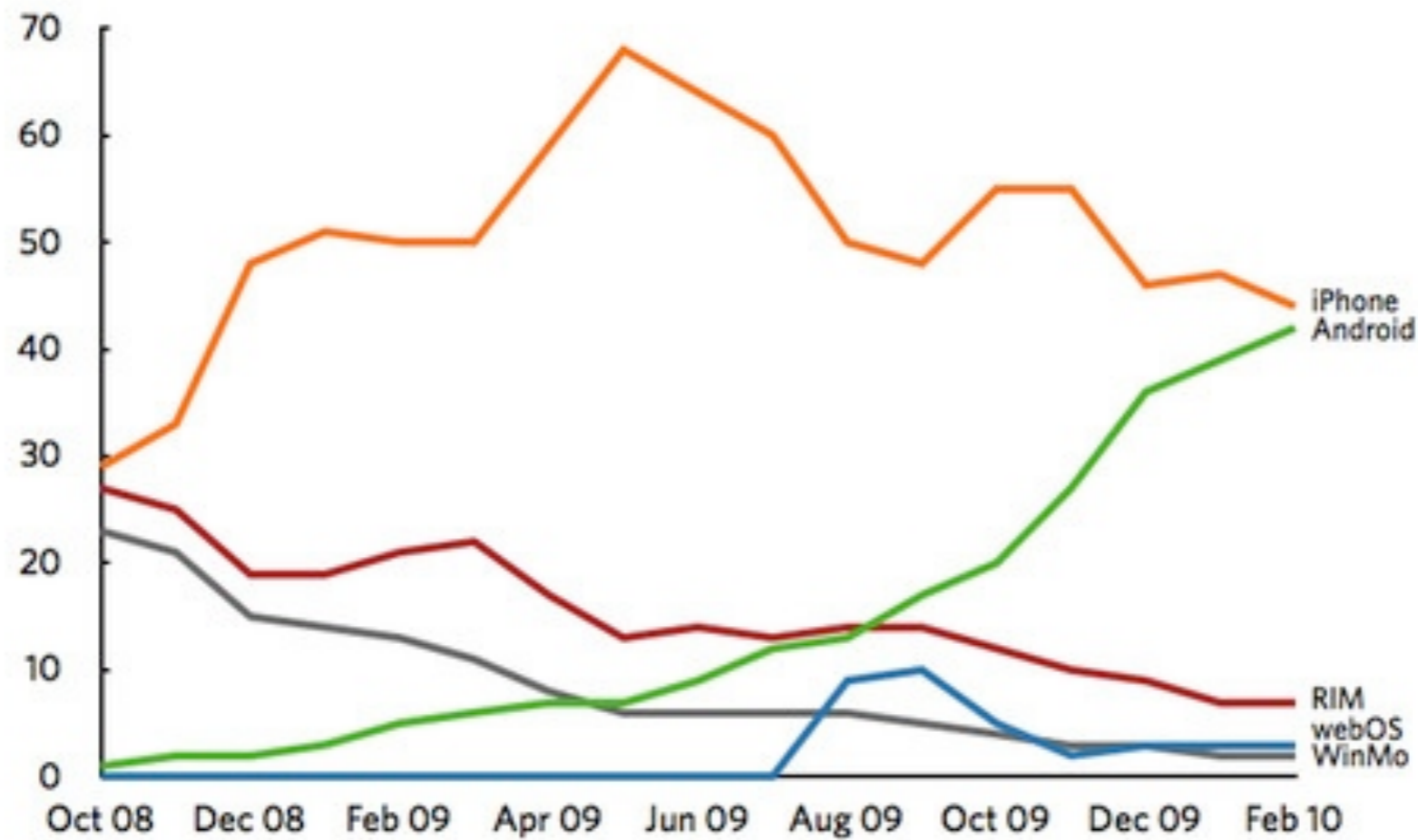


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Why Android is interesting?

Mobile OS Traffic Share: US

Percent



Source: Admob

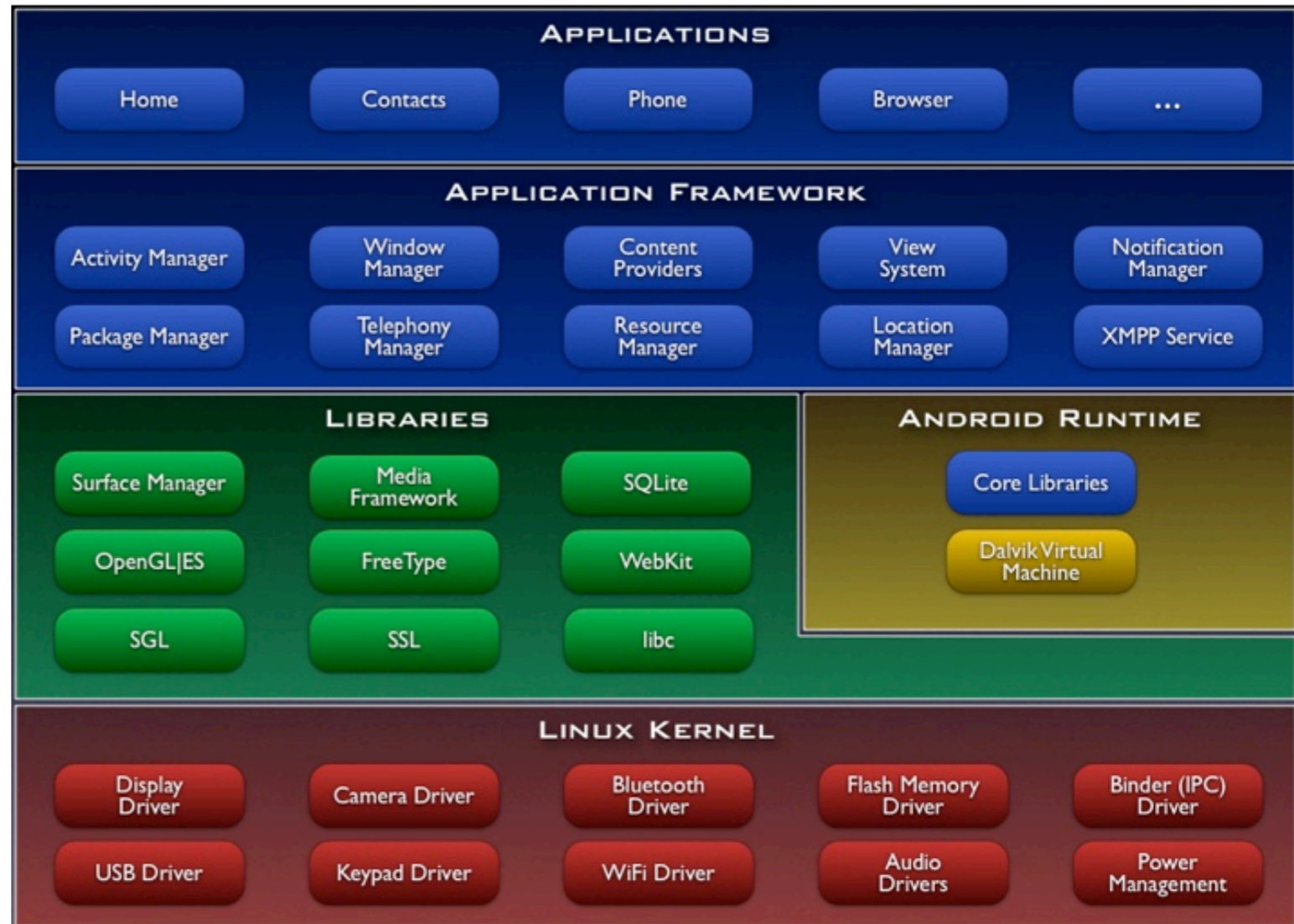


<http://erictric.com/2010/03/29/android-approaching-iphone-os-in-mobile-web-market-share/>

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Dalvik VM - where Erlang fits?

- Dalvik overview:
 - Register based
 - Single DEX file
 - each app in separate VM
- Installing erlang on Android
- Communication between Erlang and Dalvik
- Erlang strenghts



<http://developer.android.com/guide/basics/what-is-android.html>

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Scripting for Android and Erlang

<http://code.google.com/p/android-scripting/>

- scripting layer that allows running different languages than Java
- provides API to android via RPC JSON requests
- provides various scripting languages:
 - JRuby
 - BeanShell
 - Python (native)
 - Lua (native)
 - Perl (native)
 - JavaScript (native)
 - Tcl (native)
- Opportunity to interface Erlang and Android
- Erlang backend and Android GUI
- Utilize strenghts of Erlang
- abstract application logic in Erlang
- performance!
- CouchOne already doing it

<http://arandomurl.com/2011/02/13/developing-with-couchdb-on-android.html>



Rowboat - Android on Beagleboard



Who might be interested in this project

- Groups planning to use Android with OMAP35x, AM/DM37x and/or AM35x
- BeagleBoard users with an interest in Android
- Android OS and Android application developers
- Everyone considering Android beyond handsets



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Thank you.

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Questions?