

Understanding Heart and Body Status from a Smartphone

**– Introduction on how to collect, display, measure,
and communicate sensor signal –**



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Smartphone Sensor Web #1

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Self-Introduction

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Class #1

- ★. Lecture about wearable sensing technology for healthcare support
- ★. Introduction to Android platform
- ★. Examples of propositions about what can be done

Smartphone Sensor Web #2

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Class #2

- ★. Installation of the development environment and 1st application programming (tutorial provided)
- ★. Introduction to Java Programming
- ★. Consultation and decision of individual objectives (targeted application/demo...)

Smartphone Sensor Web #3

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Class #3 Smartphone Sensor Web practice

★. Sensor-based Twit using a smartphone

Smartphone Sensor Web #4~#11

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Class #4~#10 Individual projects

★. Sensor-based Twit using a smartphone

Class #? Industrial Visit

★.

Class #11 Final Demonstration

Smartphone Sensor Web #1

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★. **Introduction to Android platform**

★. Examples of propositions about what can be done

Brief History

- 2005
 - Google acquires startup Android Inc. to start Android platform
 - Work on Dalvik VM begins
- 2007
 - Open Handset Alliance announced
 - Early look at SDK
- 2008
 - Google sponsors 1st Android Developer Challenge
 - T-Mobile G1 announced
 - SDK 1.0 released
 - Android released open source (Apache License)
 - Android Dev Phone 1 released

What is the Open Handset Alliance (OHA)? (1)



Brief History cont.

- 2009
 - SDK 1.5 (Cupcake)
 - new soft keyboard with an "Autocomplete" feature
 - SDK 1.6 (Donut)
 - SDK 2.0/2.0.1/2.1 (Eclair)
 - SDK 2.2 (Froyo)
 - SDK 3.0 (G~)
 - Android runs on 3.5% of all smartphones
 - Gartner Inc. predicts 14% in 2012
- 2010
 - Nexus One (google phone) released to the public

REF: [http://en.wikipedia.org/wiki/Android_\(operating_system\)](http://en.wikipedia.org/wiki/Android_(operating_system))

REF: http://www.computerworld.com/s/article/9139026/Android_to_grab_No._2_spot_by_2012_says_Gartner

Key Differences: iPhone vs. Android

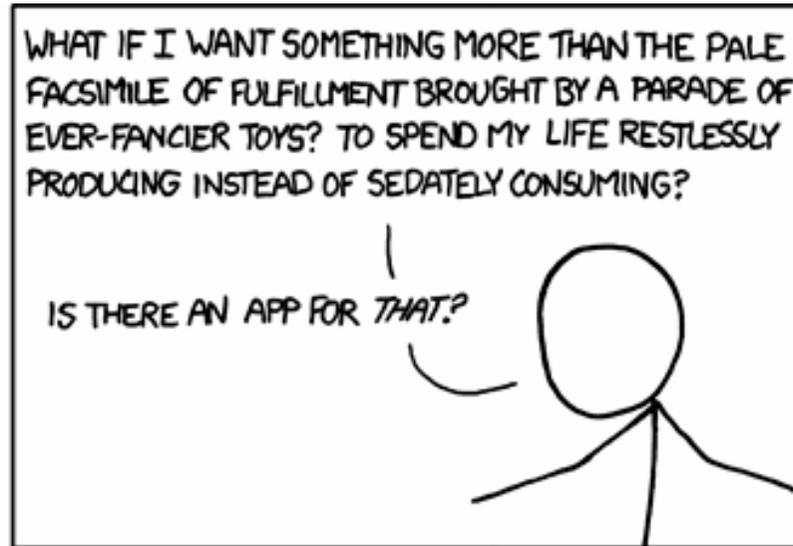
iPhone

- OS is proprietary
- OS runs on iPhone or iPod Touches only
- Applications written in Objective-C
- Apple must approve all applications before uploading to Application Store
- Some applications are more important than others (Safari is your browser)

Android

- OS is open source
- OS can be licensed for any mobile device
- Applications written in Java
- No approval process for applications before uploading to Android Market
- All applications are considered equal (choose your browser)

Apple's iPhone vs. Motorola's Droid

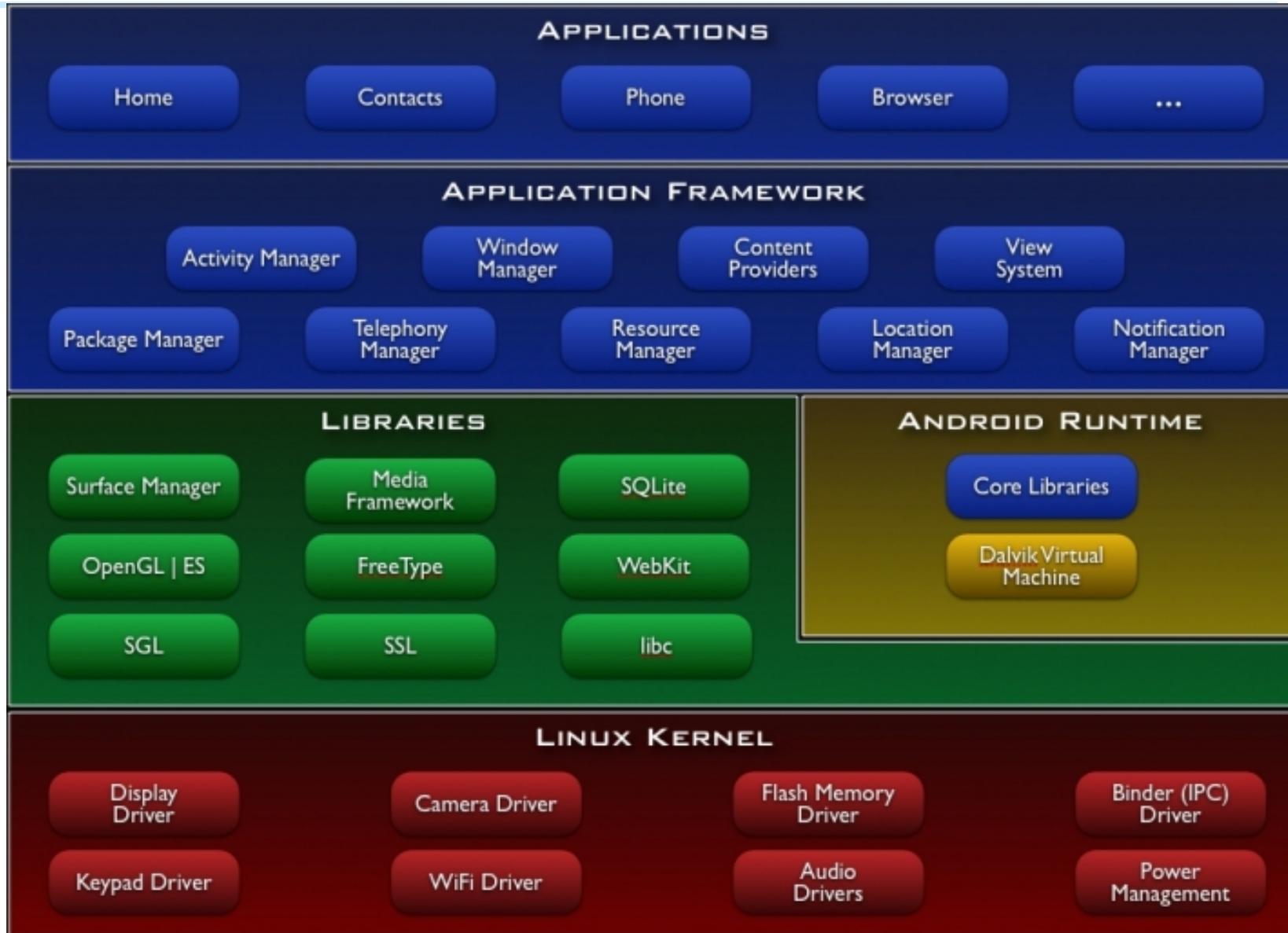


REF: <http://www.xkcd.com/662/>

What is Google Android?

- A software stack for mobile devices that includes
 - An operating system
 - Middleware
 - Key Applications
- Uses Linux to provide core system services
 - Security
 - Memory management
 - Process management
 - Power management
 - Hardware drivers

Android Platform Architecture



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

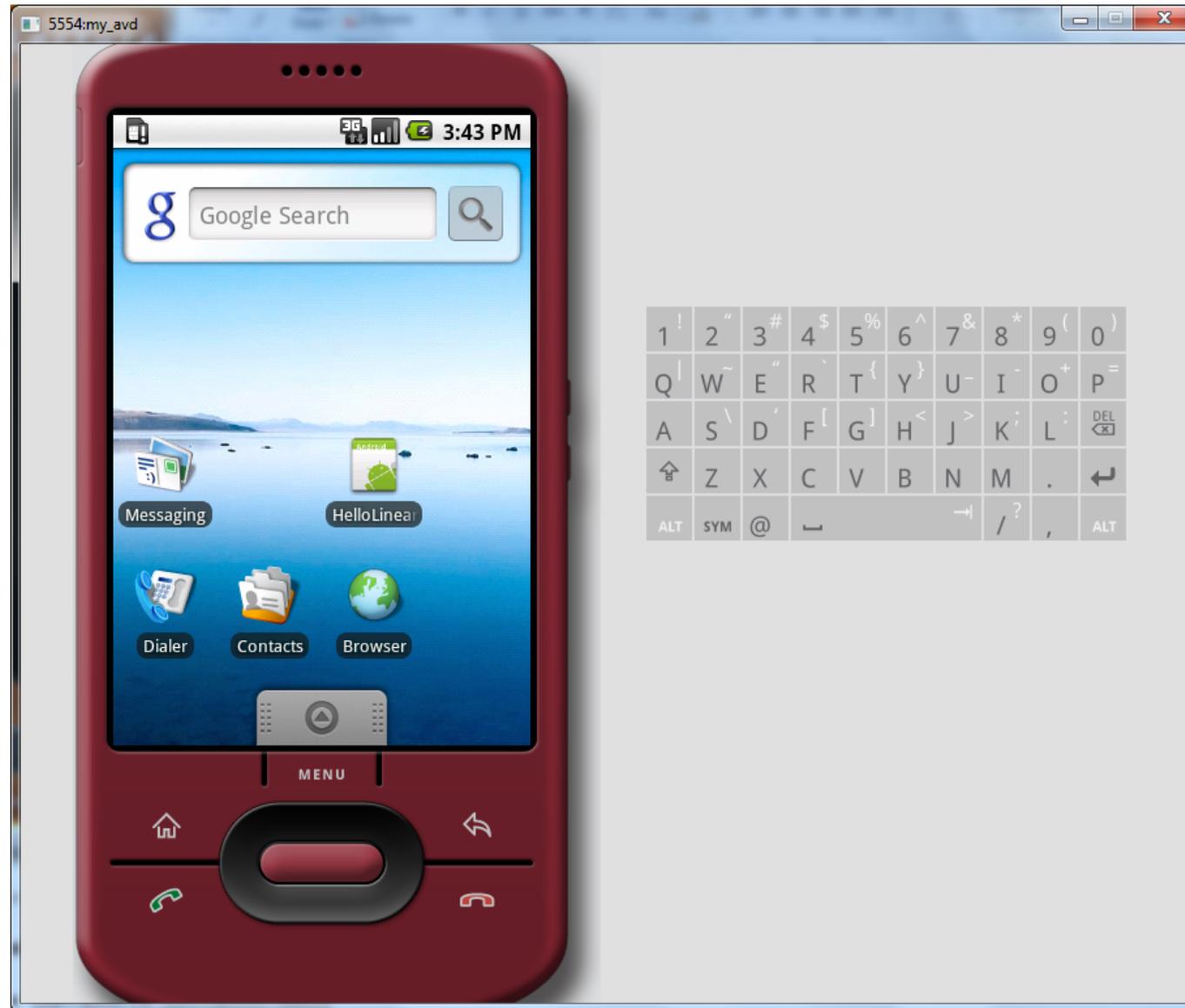
Android Runtime: Dalvik VM

- Subset of Java developed by Google
- Optimized for mobile devices (better memory management, battery utilization, etc.)
- Dalvik runs .dex files that are compiled from .class files
- Introduces some new libraries
- Does not support some Java libraries like AWT

Applications Are Boxed

- By default, each app is run in its own Linux process
 - Process started when app's code needs to be executed
 - Threads can be started to handle time-consuming operations
- Each process has its own Dalvik VM
- By default, each app is assigned unique Linux ID
 - Permissions are set so app's files are only visible to that app

Android Emulator



Emulator Hardware

- An ARMv5 CPU and the corresponding memory-management unit (MMU)
- A 16-bit LCD display
- One or more keyboards (a Qwerty-based keyboard and associated Dpad/Phone buttons)
- A sound chip with output and input capabilities
- Flash memory partitions (emulated through disk image files on the development machine)
- A GSM modem, including a simulated SIM Card

REF: <http://developer.android.com/guide/developing/tools/emulator.html>

Emulator Limitations

- No support for placing or receiving actual phone calls. You can simulate phone calls (placed and received) through the emulator console, however.
- No support for USB connections
- No support for camera/video capture (input)
- No support for device-attached headphones
- No support for determining connected state
- No support for determining battery charge level and AC charging state
- No support for determining SD card insert/eject
- No support for Bluetooth

REF: <http://developer.android.com/guide/developing/tools/emulator.html>

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「Introduction to Android Platform/Smartphone」

. References

- ★. Dr. Frank McCown,, Harding University, "A Developer's Introduction to Google Android", Spring 2010.
- ★. Android Introduction by Marko Gargenta,
<http://www.lecturemaker.com/2009/10/android-software-platform/>
- ★. Android Dev Guide
<http://developer.android.com/guide/topics/fundamentals.html>
- ★. Pro Android by Hashimi & Komatineni (2009)

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★. **Examples of propositions about what can be done**

What can be done ?

スマートフォン搭載センサを活用してみる

他の無線センサを接続する

例:心電センサからの心拍数と血圧計算
加速度センサの信号と体動による変化

Embedded sensors

- ✓ Automatic motion detection from accelerometers (sit, walk, run)
- ✓ Speaking/Listening time count from microphone
- ✓ Location sensitive (GPS) sensing application
- ✓ ...

Outside sensors (wireless)

- ✓ Simple stress checker from ECG and/or Pulse
- ✓ Chewing real-time counting from bone-conduction microphone
- ✓ ...

