

Why is Android the way it is ...

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Navin Kabra

navin@punetech.com

About me

- Navin Kabra
- Background:
 - ▶ Computer Science
 - ▶ B.Tech, IIT-Bombay
 - ▶ Ph.D, Univ of Wisconsin-Madison, USA
- Currently
 - ▶ CTO, BharatHealth.com
 - ▶ Also founder of PuneTech
- Links:
 - ▶ <http://punetech.com>
 - ▶ <http://punetech.com/navin>
 - ▶ <http://smriti.com>
- Twitter: @_navin, @punetech
- Email: navin@punetech.com



What's Android

- **Operating system**
 - Initially targeting mobile phones
 - Now on more and more devices
- **By: Open Handset Alliance**
 - Primarily Google
 - Also: HTC, Motorola, Intel, T-mobile, TI, Samsung
 - And: 47 others...
- **Stack**
 - Linux Kernel
 - Java programming language
 - OpenGL graphics
 - Android's own app development framework



Photo Credit: Android Home by Unnamed 102 (via wikipedia)

What does Android Have

- Kernel
 - Drivers: display, camera, bluetooth, flash memory, binder(IPC), usb, keypad, wifi, audio, power mgmt
- Libraries
 - Surface, media, sqlite, opengl|es, freetype(fonts), webkit(browser), libc, ssl, sgl
- Java
 - Dalvik Virtual Machine, Core java libraries
- Application Framework
 - Window manager, Activities, Content Providers, View System, Notification Mgr, Package manager, Telephony manager, Resources, Location, Gtalk
- Applications
 - Home, Contacts, Phone, Browser



Why another mobile stack?!

- Re-design for mobile
 - i.e. CPU and memory constrained systems
- Re-design for open-ness
 - Everything is open source
 - Open-ness friendly license
- Re-design for reuse
 - Framework encourages mashups/interoperability



Re-design for mobile

- Brand new Virtual Machine: Dalvik VM
- Optimized for low-memory requirements
- No JARs – use DEX files
 - Regular DEX file smaller than compressed JAR
- No JIT yet
 - but (so?) lots of native code
- Allow multiple VMs
 - one per app
 - better security
- Better use of OS kernel features
 - Process isolation, memory mgmt, threading



Re-design for open-ness

- Use Apache license
- GPL scares off device manufacturers
 - Android kernel = linux kernel = LGPL
 - Not as scary
- Java wants centralized control (JCP)
 - Another reason why no JVM
 - And Java standard libraries missing
- Everything is replaceable/rewriteable
 - Including contacts, sms, telephony...



Re-design for re-use

- App development framework encourages mashups
- Activities
- Intents
- Content Providers



Re-design for reuse: Activities

- Apps broken up into activities
- Each activity independently invocable
- Example - email activities:
 - Show one email
 - Show email list
 - Create an email
 - Pick an email recipient
- Share these across different apps



Re-design for re-use: Intents

- Inter-app communication via “intents”
- Specify what you want
 - Don't specify how or who
- System picks who does it
 - Other apps register with system
 - Indicate which intents they're interested in handling
- Loose coupling allows ease of replacement
 - Intents = XML format



Re-design for re-use: Content Providers

- Abstract, high-level API for storing/retrieving data
- Level of indirection between app & data storage
- Content provider chooses data storage mechanism
 - File-system, database, cloud (internet)
 - (By the way, SQLite is in-built)



Android is not Java

- Java programming language used
- But not the Java Runtime
 - No JVM
 - No standard Java libraries
 - No JCP (Java community process)
 - No Java license
 - No JARs (i.e. no byte-code compatibility)



Android is not Linux

- Linux Kernel
- No native windowing support
 - *i.e.* no Xwindows/Xfree86/Xorg/GNOME/KDE
- No standard C library
 - *i.e.* no glibc
 - “Bionic” – customized, partial libc implementation
 - Only 200k (half of glibc)
 - Designed for low CPU devices
 - Customized High performance pthread library
- No standard linux utilities
 - Some are there, most are missing



Miscellaneous – 1

- In addition to Java:
 - C, C++, Python, Lua, Scala
- Supports GSM (not CDMA?)
- Touch, but not multi-touch (yet)



Miscellaneous – 2

- Targeted Machine
- CPU: 250-500MHz
- Bus: 100MHz
- Data-cache: 16-32K
- Memory: 64MB
 - Low-level startup takes up 24MB
 - High-level startup takes up another 20MB
 - System library takes up another 10MB
 - Only 10MB available for apps



Miscellaneous – 3

- Resources Alternatives by:
 - MCC=mobile country code
 - Language and region
 - screen orientation: port, land, square
 - screen pixel density: 92dpi, 108dpi,
 - touchscreen type: notouch, stylus, finger
 - keyboard: keysexposed, keyshidden, keyssoft
 - primary input type: nokeys, qwerty, 12keys
 - primary navigation method: nonav, dpad, trackball, wheel
 - screen dimensions: 320x240, 640x480
 - sdk version: v1 (1.0), v2 (1.1), v3(1.5)

