

Do Androids Dream Of Electric Sheep?

The Google Android
Open Source Phone Stack

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What is Android?

- Android™ is a complete set of software for mobile devices:
 - An operating system
 - Middleware
 - Key mobile applications.

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Who Develops Android?



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Why Google Created Android?

- *"We want people out there to use the Internet on their phones a lot. It actually doesn't matter if it is Android, the iPhone or something else."*
 - Sergey Brin (<http://tr.im/kqoA>)

It's Working!

- 2 phones on sale from HTC
- G1 sold 1 mil units in US in 1 quarter.
- Half of users come from legacy phones.
- 80 percent of G1 owners browse the web daily.
- An average G1 owner consumes 50 times the data of the average voice-centric phone user.

Conclusions

- Android does not compete with iPhone, it serves a different market segment.
- Android will drive phone prices down.
- The mobile phone is the Internet platform in BRIC – huge market.
- It's like the PC revolution all over again, with Android as Windows.

Android Principles

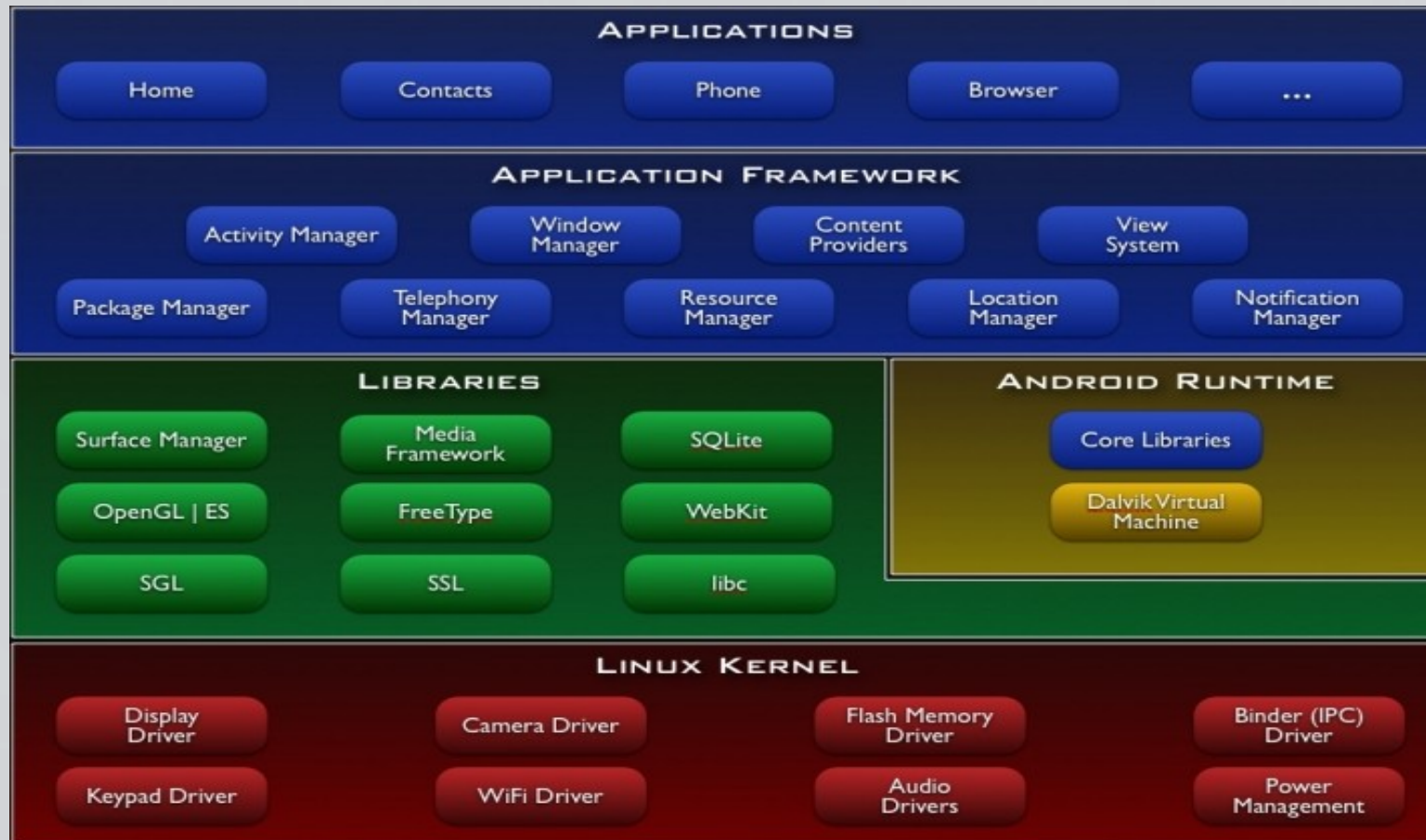
- Open
- All applications are created equal
- Breaking down application boundaries
- Fast & easy application development



Android Features

- Application Framework
- Dalvik virtual machine
- Integrated (webkit) browser
- 2D and 3D graphics APIs with HW
- SQLite
- Video and audio codecs
- Bluetooth, EDGE, 3G, and WiFi
- Camera, GPS, compass, and accelerometer

Android Structure



APPLICATIONS

Home

Contacts

Phone

Browser

...

APPLICATION FRAMEWORK

Activity Manager

Window Manager

Content Providers

View System

Package Manager

Telephony Manager

Resource Manager

Location Manager

Notification Manager

LIBRARIES

Surface Manager

Media Framework

SQLite

OpenGL | ES

FreeType

WebKit

SGL

SSL

libc

ANDROID RUNTIME

Core Libraries

Dalvik Virtual Machine

LINUX KERNEL

Display Driver

Camera Driver

Flash Memory Driver

Binder (IPC) Driver

Keypad Driver

WiFi Driver

Audio Drivers

Power Management

Linux Kernel

- 2.6 foundation with some “enhancements”
 - Alarm
 - Ashmem
 - Binder
 - Power Management
 - OOM Killer
 - Debugging & logging

Bionic C library

- BSD License
- 200K size
- Custom pthread and other speed tweaks
- Missing:
 - C++ exceptions
 - wide chars
 - pthread_cancel

What Is the Dalvik VM?

- It is a Java like virtual machine to...
 - Run on a slow CPU
 - With relatively little RAM
 - On an OS without swap space
 - While powered by a battery

Dalvik VM features

- Register based
- Dex file format
- Private byte code format
- No JIT
- Private VM per application / process.
- GC understands memory sharing semantics

Android Application Framework

- Activities
 - UI that responds to events
- Intents
 - Application requests for activities
- Services
 - Long running background processing

Process Model

- Every application is wrapped in a APK file.
- Application runs in separate Linux processes.
- Applications share code and data via Linux Copy on Write semantics.
 - Applications forks of a preinitialized Zygote process
- Shared memory is used for communication.

Security Model

- Each application runs as a separate Linux user.
- Security is enforced by OS and MMU, not VM.
- Applications asks for specific permissions during installation:
 - `android.permission.VIBRATE`
 - `android.permission.CALL`
 - `android.permission.DELETE_PACKAGES` ...