

Android Unveiled (I)

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Background

- Past:
 - Mobile phones were just that, phones
 - Increasingly including new hardware
- Not-so-distant past
 - Programmers had to know the specific hardware (C,C++)
 - Some abstractions: Symbian, Java...
- Present & Future
 - Operating systems designed for mobile hardware
 - Proprietary: Windows, Apple, Palm
 - Open Source: Android, Maemo



What is Android?

- Open platform for mobile development
- A combination of three components
 - Free & open-source OS for mobile devices
 - Open-source development platform for mobile applications
 - Devices that run the OS & apps



Some Features

- No fees (licensing, distribution, development)
- No approval process
- Full hardware access
- Background apps and processes
- SQLite or Data Storage
- Native Google Maps, Geocoding and Location-Based services
- Shared data and interapplication communication
- Widgets
- Support for 2D and 3D graphics
- Optimized memory & process management
- Support for large variety of hardware



Some Statistics

Year	2008	2009	2010
Devices	1 (G1)	18	40 (confirmed)
Manufacturers	1 (HTC)	8	14



Why develop for mobile?

- New multifunction devices
- Number of phones > Number computers
- Flatrates - Affordable data plans
- Phone user installs more apps



Why Android?

- Based on the reality of modern devices
- Simple & powerful SDK
- No certification - No approval process
- Unique features:
 - Google Maps integration
 - Background services & applications -> Multitasking
 - Shared data & interprocess communication
 - Equality between apps
 - Total access to phone resources



The Development Framework (I)

- Java programming language
- Dalvik VM
- Architecture
 - Each app runs a separated VM
 - Android runtime manages resources
 - Both sit on top of a Linux kernel -> Low-level hardware interaction
 - API provides access to: services, features and hardware
- SDK
 - Android APIs
 - Development tools
 - Virtual Device Manager and Emulator
 - Documentation + Sample Code + Online Support



The Development Framework (II)

- Android Software Stack
 - Linux 2.6 Kernel
 - C/C++ Libraries: libc, SSL, media, graphics, SQLite, Webkit...
 - Android Runtime
 - Core Libraries
 - Dalvik virtual machine
 - Application Framework
 - Application Layer



Android Architecture



Dalvik Virtual Machine (I)

- Designed by to run efficiently multiple instances on a single device
- Not strictly a JVM: runs its own bytecode
- Optimized for low memory requirements
- Features:
 - Dalvik bytecode
 - Registered-based architecture
 - From Android 2.2 -> Just-in-time compiler
- Optimizations
 - VM was slimmed down to use less space
 - Constant pool uses only 32-bit indexes to simplify the interpreter
 - Own bytecode
- Apache Harmony open source class library implementation



Dalvik Virtual Machine (II)

- Compilation
 - Dx tool converts .java classes into .dex format
 - One .dex files contains several .java classes
 - .dex file is optimized to use less space
 - .dex file < .jar file for the same group of classes
 - Java bytecode converted into specific instruction set used by Dalvik VM
 - Executables modified during installation process
 - Byte order may be changed
 - Function libraries and data structures may be inlined



Application Architecture

- Main services:
 - Activity Manager: controls the life cycle of the Activities
 - Views: Used to construct the user interfaces
 - Notification Manager: mechanism to signal the users
 - Content Providers: Share data between apps
 - Resource Manager: Support for non-code resources



Main Releases (I)

- Android 1.5 -April 2009
 - Performance:
 - Camera start-up and image capture
 - Acquisition of GPS location
 - Page scrolling and Gmail list scrolling
 - On-screen soft keyboard
 - Widgets & Live folders
 - Video recording & playback
 - Improved bluetooth, browser and contacts app
 - System
 - New Linux Kernel (2.6.27)
 - SD card filesystem auto-checking and repair
 - SIM Application Toolkit 1.0



Main Releases (II)

- Android 1.6 - September 2009
 - New features
 - Quick search box
 - Camera, camcorder and gallery
 - VPN, 802.1x support
 - Battery usage indicator
 - Accessibility framework
 - Android Market updates
 - New technologies
 - Search framework
 - Text-to-speech engine
 - Gestures
 - Expanded support for screen densities and resolutions
 - More: CDMA, OpenCore, Linux Kernel upgrade...



Main Releases (III)

- Android 2.0 - January 2010
 - New features
 - Multiple contacts and accounts
 - Combined email and Exchange support
 - Improved messaging
 - Camera: flash, digital zoom, scene mode...
 - Improved virtual keyboard
 - Improved browser
 - Improved calendar
 - New technologies
 - Bluetooth 2.1
 - New framework API 2.0



Main Releases (IV)

- Android 2.2 - May 2010
 - New features
 - Multiple home screen configurations
 - Portable WIFI hotspot
 - Multiple keyboard languages (at the same time)
 - Performance
 - V8 engine: faster Javascript
 - Dalvik Performance Boost: 2x-5x speedup over 2.1 with Dalvik JIT
 - Kernel Memory Management Boost: improved memory reclaim by 20x
 - New technologies
 - New media framework: Stagefright
 - Kernel upgrade 2.6.32
 - New Developer APIs



Developing Android Apps

"Android Unveiled (II)"
coming soon to theatres...



Sources

- Professional Android 2 Application Development - Reto Meier - 2010
- <http://developer.android.com/sdk/>
- <http://www.android.com/>
- <http://www.androphones.com>
- <http://www.dalvikvm.com/>
- <http://sites.google.com/site/io/dalvik-vm-internals>
- http://en.wikipedia.org/wiki/Dalvik_%28software%29

