

# Introduction to Android

## Lecture 1

Android Native Development Kit

9 February 2014

Rules and Grading

Android Architecture

Application components

IPC

Tools

Keywords

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Tools

Keywords

- ▶ Petre Eftime & Laura Gheorghe
- ▶ Course and lab: 17:00 - 20:00, Tuesdays
- ▶ Project: 20:00 - 21:00, Tuesdays
- ▶ Grading
  - ▶ 10% lecture and lab activity
  - ▶ 10% assignment
  - ▶ 40% project
  - ▶ 40% final exam
  - ▶ 10% bonus for feedback

Rules and Grading

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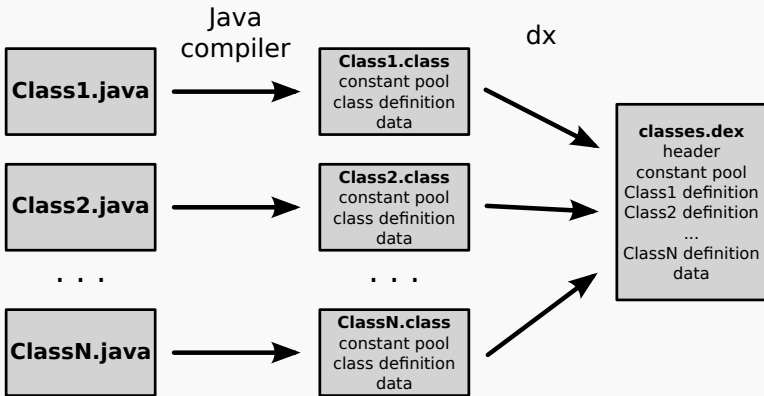
Source: <http://commons.wikimedia.org>



- ▶ Patches on top of mainline Linux
- ▶ Android Mainlining Project
- ▶ Wakelocks (also added to Linux 3.5)
- ▶ Low-Memory Killer, Binder, Alarm, Logger, etc.
- ▶ Only suspend to memory



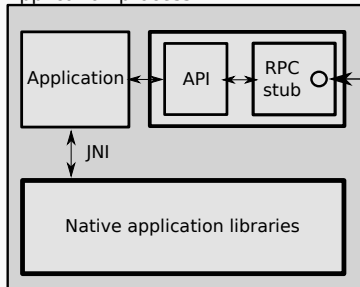
- ▶ Dalvik Virtual Machine (Java VM)
- ▶ Runs Dalvik-specific byte-code generated from Java-based apps, system components
- ▶ Apache Harmony project (implementation of Java libraries)
- ▶ Designed for embedded systems (slow CPU, small RAM, no swap, battery)
- ▶ Works with .dex files instead of .jar files
  - ▶ Dalvik Executable Format
  - ▶ .dex is 50% smaller than corresponding .jar



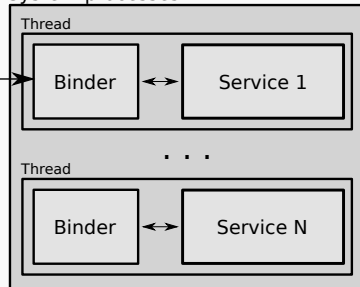
- ▶ bionic (libc)
  - ▶ Much smaller than glibc
- ▶ sqlite
  - ▶ Managing SQL databases
- ▶ OpenGL ES
  - ▶ Standard software interface for 3D processing hardware
- ▶ WebKit
  - ▶ Display web pages
  - ▶ Android, Apple iOS, BlackBerry, Tizen
- ▶ SSL
  - ▶ Securing the communication over Internet

- ▶ Services
- ▶ Managers
  - ▶ Telephony
  - ▶ Location
  - ▶ Activity
  - ▶ Package
  - ▶ Notification
- ▶ Content Providers

Application process



System processes



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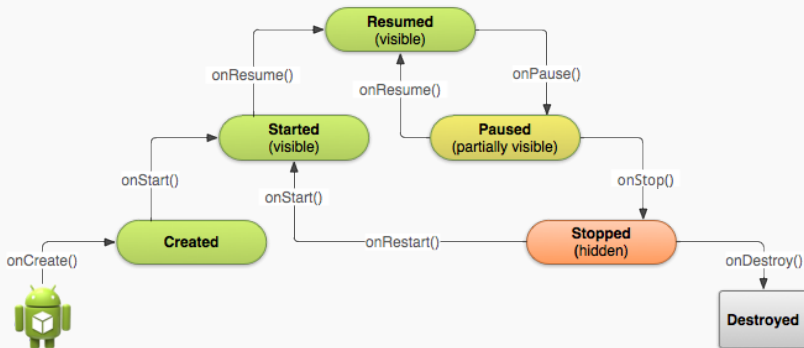
Tools

Keywords



- ▶ User interface
- ▶ Similar to a window from window-based GUIs
- ▶ Cannot be minimized, maximized, resized
- ▶ Uses the whole visual area
- ▶ User interacts with a single activity at a time
- ▶ Activities stack
  - ▶ Activities launch other activities
  - ▶ Back button for returning to the previous activity
  - ▶ No forward button
- ▶ Start activities with intents





Source: <http://developer.android.com>

- ▶ Background thread
- ▶ Runs in the same process as the application
  - ▶ Can be configured to run in another process
- ▶ Provide services to the other applications
- ▶ Communication through the Binder

- ▶ Receive broadcast announcements
  - ▶ Low battery
  - ▶ Reboot
  - ▶ Application state changes
- ▶ Can receive global or local broadcasts
- ▶ Choose which broadcasts to receive
  - ▶ Intent filters
- ▶ Intents
- ▶ Active only when receiving a broadcast

- ▶ Store and share application data
- ▶ Required for sharing data
- ▶ Relational database
- ▶ URI for identifying the provider and the table
- ▶ Content Resolver uses the URI to send a query to the provider
- ▶ Active only when responding to a request

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- ▶ Send message, determine action execution
- ▶ Purpose
  - ▶ Start activities, start or bind services
  - ▶ Delivering broadcast messages to receivers
- ▶ Dispatched by the Android system
- ▶ Includes action and data
  - ▶ *ACTION\_DIAL content://contacts/people/1*
- ▶ Types
  - ▶ Explicit: directed towards a specific receiver
  - ▶ Implicit: a receiver which can resolve the action



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- ▶ Android SDK Manager
  - ▶ Download SDK packages
- ▶ AVD Manager
  - ▶ Manages Android Virtual Devices (for emulator)
- ▶ Emulator
  - ▶ Virtual mobile devices running on a PC
- ▶ Dalvik Debug Monitor Server (ddms)
  - ▶ Debugging tool
  - ▶ Port forwarding, screen capture, call and SMS spoofing, location spoofing, etc.

- ▶ Android Debug Bridge (adb)
  - ▶ Communication between the development tools and (virtual) device
- ▶ dx
  - ▶ Generates the *classes.dex* file from several *.class* files
- ▶ Android Interface Definition Language (aidl)
  - ▶ To allow clients from another application to access your service
  - ▶ Generates interfaces and stubs that are used by the Binder
- ▶ Android Asset Packaging Tool (aapt)
  - ▶ Create, update and view Zip-compatible archives (zip, apk, jar)
  - ▶ Compile resources into binary assets (XML files, etc.)
- ▶ dexdump
  - ▶ Disassembler tool
  - ▶ Obtain the Dalvik bytecode from *classes.dex*

- ▶ Three components
  - ▶ Client: runs on the development machine
  - ▶ Server: background process on the development machine
  - ▶ Daemon: background process on the (virtual) device
- ▶ Copy files
- ▶ Install applications
- ▶ Debug
- ▶ Shell on the (virtual) device

- ▶ QEMU
- ▶ Screen, Keyboard, Network, Audio, GPS, Radio
- ▶ Can be acceleration through virtualization
  - ▶ x86 System Image
  - ▶ Intel Hardware Accelerated Execution Manager (HAXM) on Windows
  - ▶ KVM on Linux
- ▶ GPU accelerated

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- ▶ Linux kernel
- ▶ AOSP
- ▶ Android Runtime
- ▶ Libraries
- ▶ Activities
- ▶ Services
- ▶ Broadcast Receivers
- ▶ Content Providers
- ▶ Intents
- ▶ Binders
- ▶ ADB
- ▶ Emulator