Lecture 14 (Android)

Design goals:

- Provide a complete open-source platform for mobile devices
- Strongly support proprietary third-party applications with a robust and stable API
- Allow all third-party applications, including those from Google, to compete on a level playing field
- Provide an application security model in which users do not have to deeply trust third-party applications
- Support typical mobile user interaction: spending short amounts of time in many apps
- Manage application processes for users, simplifying the user experience around applications

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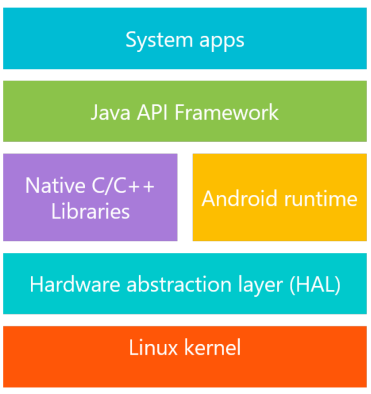
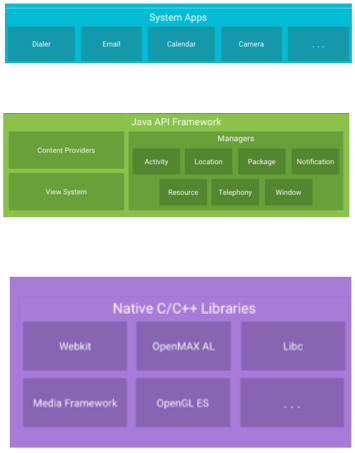
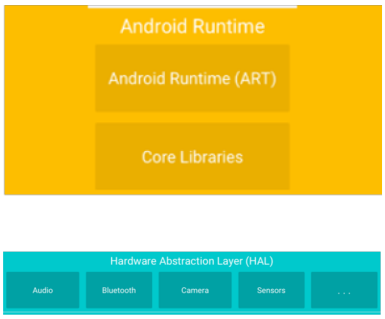
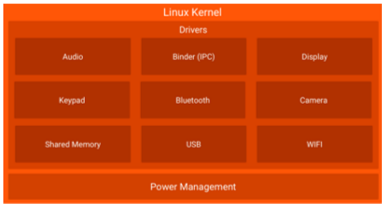
Architecture



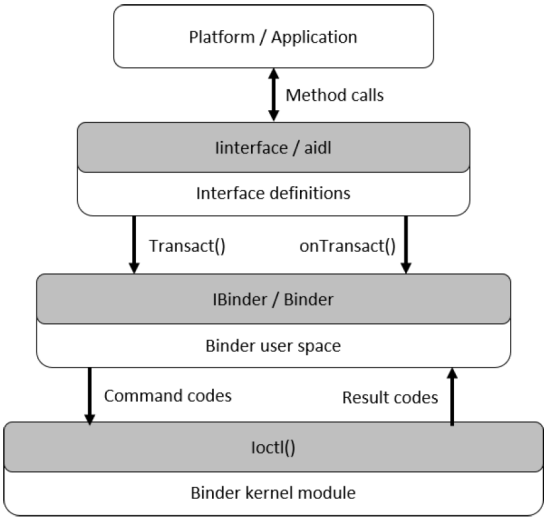






Power management: Built on top of Linux Power Management (PM); using wake locks for components to keep power.

Binder IPC:

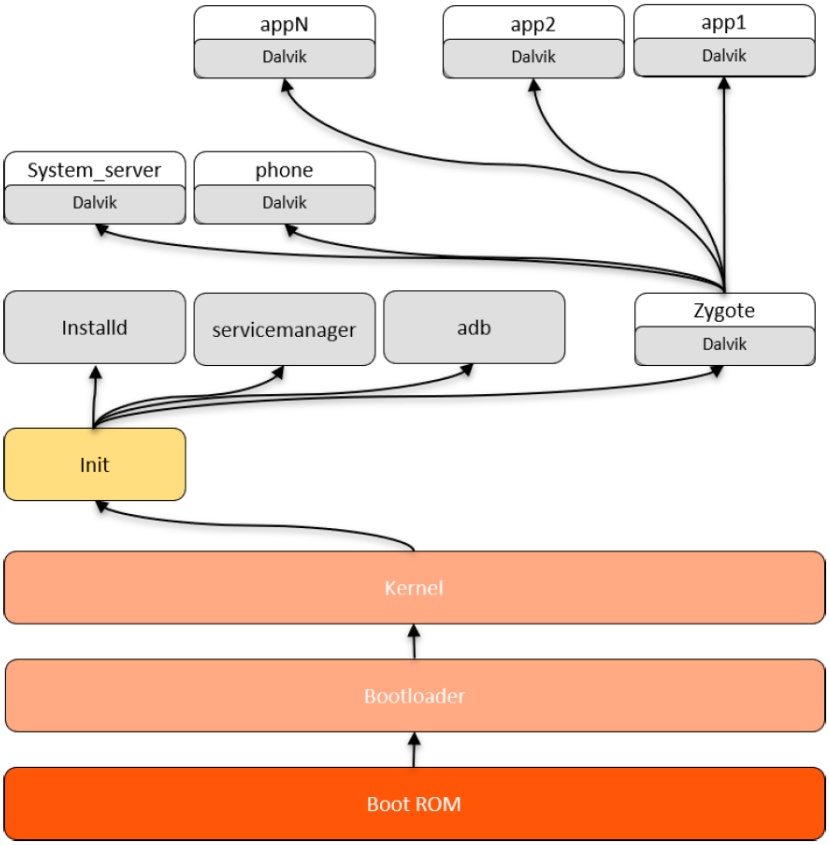


Low memory killer(LMK) is called when device has low memory. Linux Kernel has OOM (Out of Memory) killer, which examines all processes. Each process gets a number Process with the highest score will be killed. While LMK scans the list of running processes according to certain groups every time when called and kills one process in the lowest group.

Ashmem is an acronym for **anonymous shared memory**. Allows processes which are not related by ancestry to share memory maps by name, which are cleaned up automatically.

Android debug bridge(ADB) - protocol that runs over a USB link (or via WiFi TCP/IP connection) between hardware device running Android and developer writing applications on his desktop PC.

System boot



Installd receive request from Package Manager Service. **Servicemanager** - Binder Context Manager, index of all Binder services running in the system. **Adbd** manages all aspects of connection between target and host's adb command.

Zygote process warming up the system's cache and starting the System Server. First process zygote always starts is called **system server**, which contains all the core operating system services. Each new Zygote process is a child of the original Zygote process and includes a VM. Thus with each new request to launch an application a new process is forked and a new VM is created

Dalvik Virtual Machine's features:

- Low memory requirements
- Allows multiple instances to run at once
- Slimmed to use less storage space
- It does not have a just-in-time (JIT) compiler

Speedier replacement for Dalvik is Android RunTime(ART). ART compiles Java to native machine language, eliminating the need to spin up a VM for each new app and to interpret byte code.

Ahead-of-time compilation improve garbage collection, which can impair an app's performance, resulting in choppy display, poor UI responsiveness, and other problems.

Android application - APK extension; it is a container of: manifest, resources, code, signing info

Package manager keep track of all application packages & parses each manifest.

Android application's components:

- Activities (Activity - interaction between user & app)
- Services (Service perform long-running operations in background)
  Foreground - for user, background - hidden, bound - client-server interface
- Receivers (recipient of events that happen, generally in the background and outside of normal user interaction)
- Content providers (supplies data from one application to others on request)

Intent - Android's mechanism to discover and identify activities, receivers, and services:

- Explicit (directly identifies a single specific application component)
- Implicit (describes characteristics of component, but not component itself ⇒ no match, single unique, multiple match