SMART SENSORS FOR DOMOTICS AND HEALTH CARE
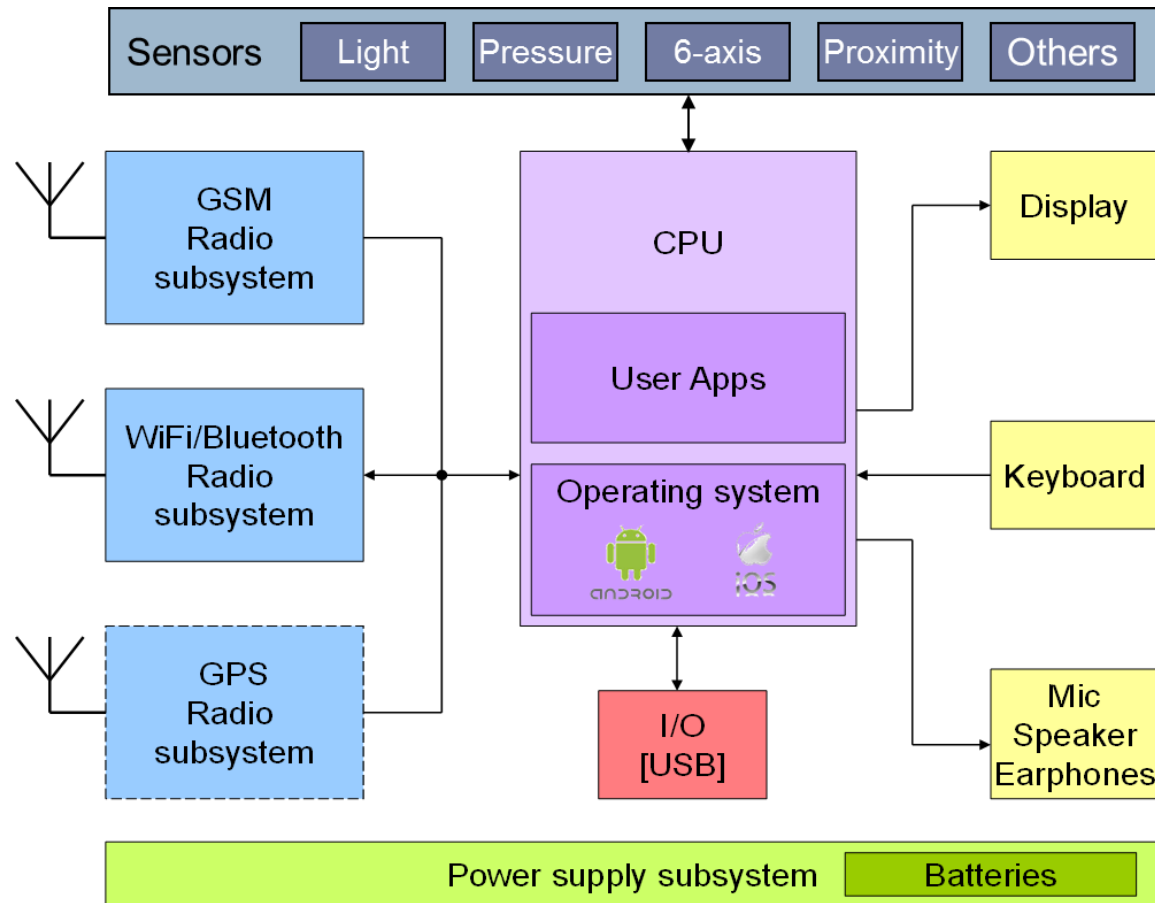
- Android, Google, Googlefit

A.A.   2018 / 2019

Alessandra Flammini

OPERATIVE SYSTEMS (OS)

Why a Smartphone needs an OS?
- To execute several programs and applications
- To manage memory and communication interfaces
- To manage its HW and its SW

ANDROID, Overview of OS for mobile

Android, open source, based on Linux, Samsung, LG, other
IOS, license, brand, guaranteed, powerful, Apple, iPhone, iPAD

- First mobile phone 1983, camera phones late '90, OS late '90

- Proprietary formats emerged to better take advantage of hardware capabilities:
  - Palm OS (became Garnet OS)
  - RIM Blackberry OS
  - Java Micro Edition
  - Symbian OS (Sony Ericsson, Motorola, Samsung)
  - Windows Phone (Nokia)
  - iPhone iOS

- Major players now:
  - iOS
  - Android
  - Windows Phone

Pagers — Mobile phones — Smart phones — Netbooks & tablets — ?
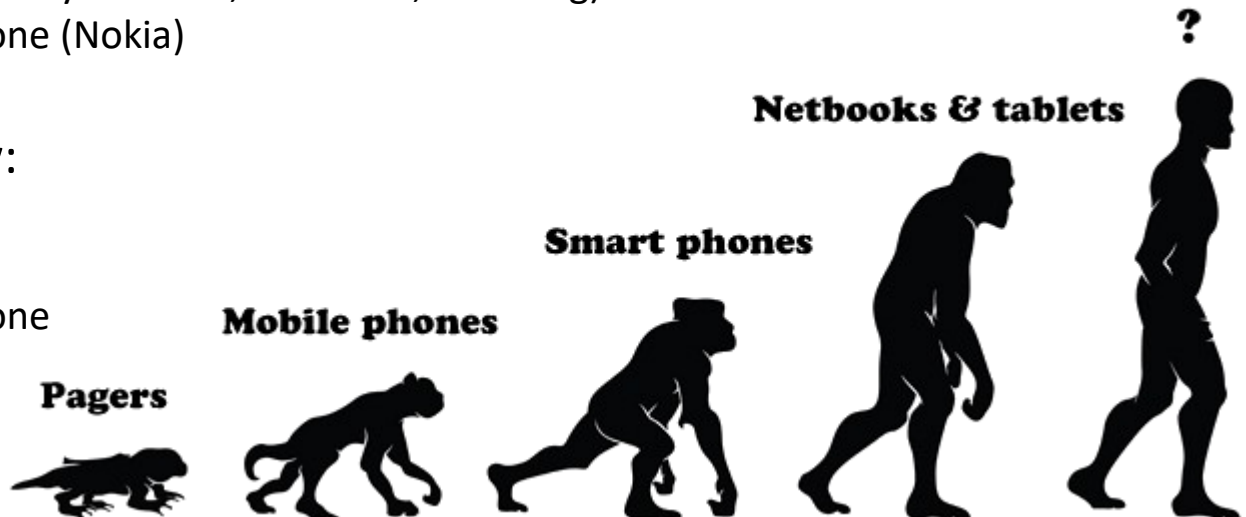
ANDROID: main differences with IOS

➢ Different device size (more HW manufactors)

➢ Expandable memory

➢ USB connection

➢ External HW easier to product

THE EVOLUTION OF ANDROID

ANDROID: History

▸ 2003: The project starts (OS for mobiles)
▸ 2005: Google purchased the initial developer of the OS, Android Inc.
  ▸ Start Dalvik VM development

▸ 2007: Open Handset Alliance (OHA) consortium announced (34 founding members)
  ▸ Mobile handset makers (i.e. HTC), software developers (Google), some mobile carriers (i.e. Telecom) and chip makers (i.e. Qualcomm)
  ▸ SDK development

ANDROID: History

- 2008: T-Mobile G1 announced
  - SDK 1.0 released
  - Google sponsors first Android Developer Challenge
  - Android Open Source Project (Apache license)
  - Android Dev Phone 1 released

- 2009: New SDK release
  - Cupcake (SDK 1.5)
    - Softkeyboard with autocomplete feature
    - Auto-rotation option
  - Donut (SDK 1.6)
    - New camera features
    - Search features improved (Quick/Voic
  - Éclair (SDK 2.0/2.0.1/2.1)
    - New camera features
    - Multiple accounts

ANDROID: History

- 2010: Nexus One released to the public
  - Froyo (SDK 2.2)
    - Expandable memory
    - USB tethering
  - Gingerbread (SDK 2.3)
    - UI update
    - NFC
- 2011: New SDK release
  - Honeycomb (SDK 3.0/3.1/3.2) for tablets only
    - New UI tablet oriented
    - Multi-core processor supporting
  - Ice Cream Sandwich (SDK 4.0/4.0.1/4.0.2/4.0.3)
    - WIFI direct
    - Changes to the UI
    - Face unlock
- 2012:
  - Ice Cream Sandwich (SDK 4.0.4)
    - Stability improvement
  - Jelly Bean (SDK 4.1)
    - Google Now

ANDROID: History

▸ 2013:

    ▸ Kit Kat (SDK 4.4)

        ▸ NFC capabilities through Host Card Emulation

        ▸ Wireless printing support

        ▸ Storage access framework, new framework

▸ 2014:

    ▸ Lollipop (SDK 5)

        ▸ Android RunTime (ART) with ahead-on-time (AOT) co

        ▸ 64-bit CPU

▸ 2015:

    ▸ Marshmellow (SDK 6)

        ▸ USB OTG, Access point for 5GHz

        ▸ Fingerprint recognition, new functionalities for Power management

ANDROID: History

▸ **2016:**

  ▸ Nougat (SDK 7)

    ▸ New graphic functionalities

    ▸ Dual window (multi-window for tablet)

    ▸ Auto-update

▸ **2017:**

  ▸ Oreo (SDK 8)

    ▸ Floating windows

    ▸ Text autofill

    ▸ Notification dots

    ▸ Power and memory management

▸ NOTE: Android Wear for SmartWatch

ANDROID: History

▸ 2018:

    ▸ Pie (SDK 9)

        ▸ Stereo Vision

        ▸ Battery management

        ▸ WiFi-RTT for Indoor positioning

        ▸ Digital wellbeing (Dependency from Smartphone)

        ▸ Gesture-recognition

ANDROID: Current releases distribution

ANDROID is growing fast
- More than 50% of smartphone market
- More than 70% of tablet market
- Not only smartphone and tablet
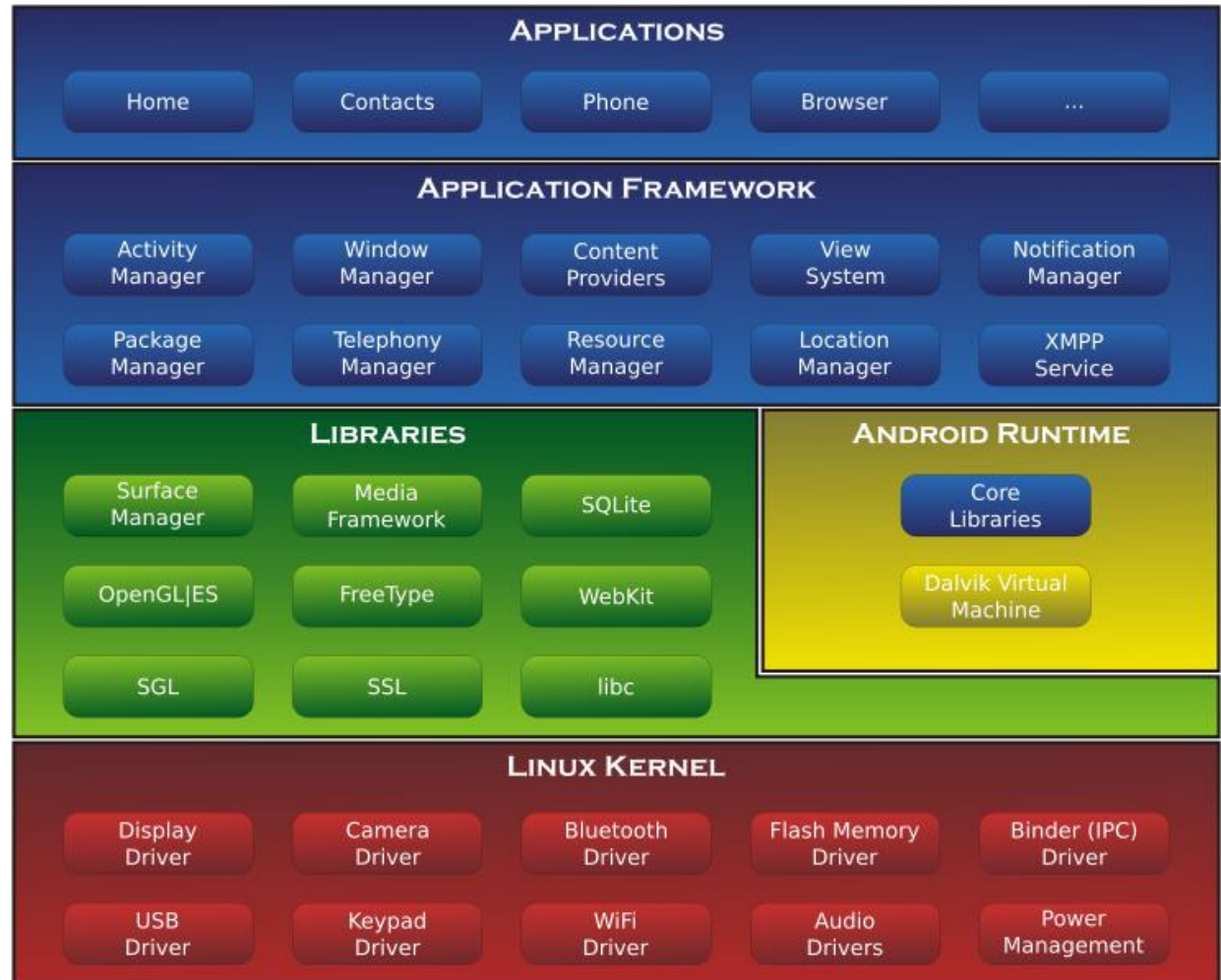 - Smart watch
  - Smart TV
  - IoT

Version	Codename	API	Distribution
2.3.3 - 2.3.7	Gingerbread	10	0.2%
4.0.3 - 4.0.4	Ice Cream Sandwich	15	0.3%
4.1.x	Jelly Bean	16	1.1%
4.2.x		17	1.5%
4.3		18	0.4%
4.4	KitKat	19	7.6%
5.0	Lollipop	21	3.5%
5.1		22	14.4%
6.0	Marshmallow	23	21.3%
7.0	Nougat	24	18.1%
7.1		25	10.1%
8.0	Oreo	26	14.0%
8.1		27	7.5%
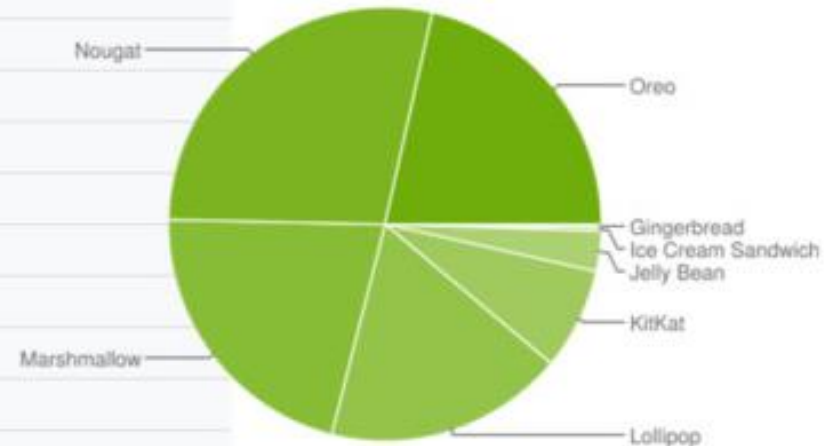
ANDROID: ARCHITECTURE

Android is:
- an OS (Linux kernel) for HW interface
- A Library set to be used in APPs
- A Java Virtual Machine for APPs porting and executing (all Apps are written in **Java language**)
- A framework for APPs development
- An Applications containers
  - general Apps (Phone)
  - specific Apps (FB)

APPLICATIONS

| Home | Contacts | Phone | Browser | ... |

APPLICATION FRAMEWORK

| Activity Manager | Window Manager | Content Providers | View System | Notification Manager |
| Package Manager | Telephony Manager | Resource Manager | Location Manager | XMPP Service |

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 | Bluetooth Driver | Flash Memory Driver | Binder (IPC) Driver |
| USB Driver | Keypad Driver | WiFi Driver | Audio Drivers | Power Management |

Application: a Java-based program for ANDROID

ANDROID: Linux Kernel

▸ Android Linux Kernel has differentiated from Linux Kernel

  ▸ From 2.6 ver to 3.8

▸ Basic SO services

  ▸ Abstraction between hardware and software

  ▸ Security

  ▸ Memory management

  ▸ Process management

ANDROID: APPLICATIONS

▸ Contain a set of core applications including an email client, SMS program, calendar, maps, browser, contacts, …

▸ All yours Apps will belong to this layer

▸ All applications are written in Java programming language

ANDROID: Traditional vs APP programming

▸ Only one APP at a time ("multitasking")

▸ Only one window →Simplified UI (User Interface)

▸ Limited system access ("sandboxing")

▸ Limited resources and memory

▸ Instant APP opening and closing: application should start and quit instantaneously.

▸ APP has her own lifecycle….

▸ Code must apply to many kind of devices

APP design first of all! Then code programming

ANDROID: SDK

▸ Software Development Kit (SDK) enables developers to create applications for the Android platform

▸ Sample projects source code

▸ Custom virtual machine

▸ Development tools:

  ▸ Dalvik Debug Monitor Service (DDMS)

  ▸ Android Debug Bridge (ADB)

  ▸ Android Emulator

▸ SDK emulator: allows to develop and test apps on PC without a physical device (simulate the mobile)

▸ SDK download link: http://developer.android.com/sdk/index.html

ANDROID APP BASIC: ACTIVITY

▸ Activity = components of an Android App using the screen

▸ Activities have a event-driven life-cycle (event -> callback)
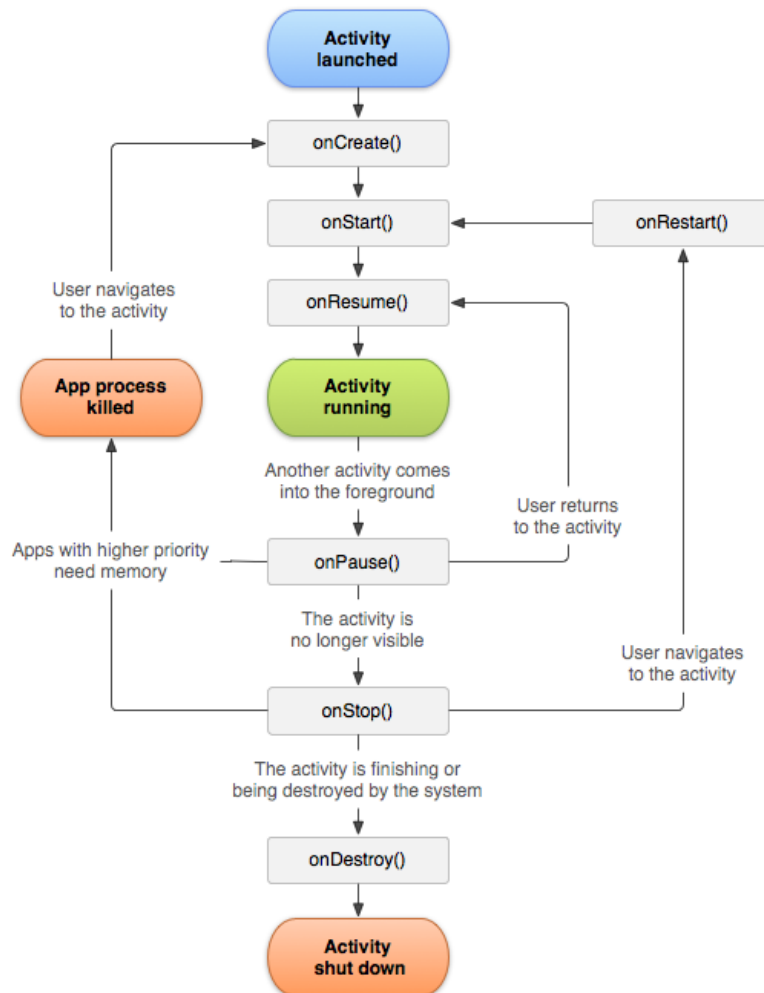
Callback	When
onCreate()	App creation
onStart()	Activity visible
onResume()	after onStart
onRestart()	after onStop
onPause()	another Activity called
onStop()	Activity invisible
onDestroy()	Before Activity destruction

Smart Sensors for Domotics and Health Care, Alessandra Flammini, Brescia University

PRE-INSTALLED APPLICATIONS

• A smartphone has normally Android pre-installed APPs (Google APPs also available on Google Play Store)
   – popular APPs (e.g. Messenger, Gmail, Google Maps, Google Play Music, YouTube)
   – see https://en.wikipedia.org/wiki/List_of_Google_apps_for_Android

• Android pre-installed APPs concerning Health&Wealth
   – Support for Android Wear and MyGlass
   – step Counter (Pacer Health, tayutau and others)

• Samsung pre-installed APPs concerning Health&Wealth
   – S-Health (personal trainer suggesting exercises), also supported by smart watches

• Huawai pre-installed APPs concerning Health&Wealth
   – Hi-Care, Health (step-counter and other)

• Other popular sensor-based APPs concerning Health&Wealth
   – Instant heart-rate (Azumio inc.), based on main camera and flash

PLATFORMS AND APPLICATIONS

- A Platform is a set of Application Programming Interfaces
    - is developed for an OS
    - allow APPs to share data in a standard way (e.g. the user can share data or allow access from a community or a part of it, can track data,…)

- Google fit (June 2014) is health-tracking platform developed by Google for the Android OS (>4.0)
    - supported by most of smart watches
    - partnership with activity tracker, scales, cardio belt, Apps providers…(Nike, HTC, LG, Withings, Motorola, Runtastic, Polar,…)
    - Healthkit is a similar platform developed for IOS (Spring 2014)

- MyFitnessPAL
    - free smartphone app that tracks diet and exercise to determine optimal nutrients and caloric intake for the users' goals
    - large database of over 5 million foods

- Runtastic (makes sport fantastic)
    - Runtastic is a company providing devices and Apps for sports
    - Runtastic is a free App to manage training plans and provide activity tracking

ANDROID, GOOGLE, GOOGLE FIT, APPs: tests

Tests

1) Android is based on [b]:
a. Windows   b. Linux   c. IOS   d. DOS

2) Android release of 2016 is [d]
a. Marshmellow   b. Kit Kat   c. Lollipop   d. Nougat

3) Android with respect to IOS supports: [c]
a. A Healty Platform   b. Accelerometers
c. Memory expansion   d. Applications for fitness

4) Apps for Android are written in language… [a]
a. Java   b. C   c. Visual Basic   d. Phyton

5) Internal memory management is a function of…. [d]
a. Activities   b. SDK   c. Library set   d. Kernel Linux

6) Google Fit is… [a]
a. A platform   b. An Operative Systems   c. An APP   d. A Library