Topic Covered in Todays Class

Unit 1:
Android: Open Platform for Mobile Development
Android SDK features
Open Handset Alliance (OHA)
Android Software Stack
Dalvik Virtual Machine
Android Application Architecture
Android Libraries
Android Development Tools

Question

What does .apk stand for

- Android Application Kit
- Android Package
- Android Power Kit

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Android applications are written in

- Java and C++
- Java
- C++
- Python

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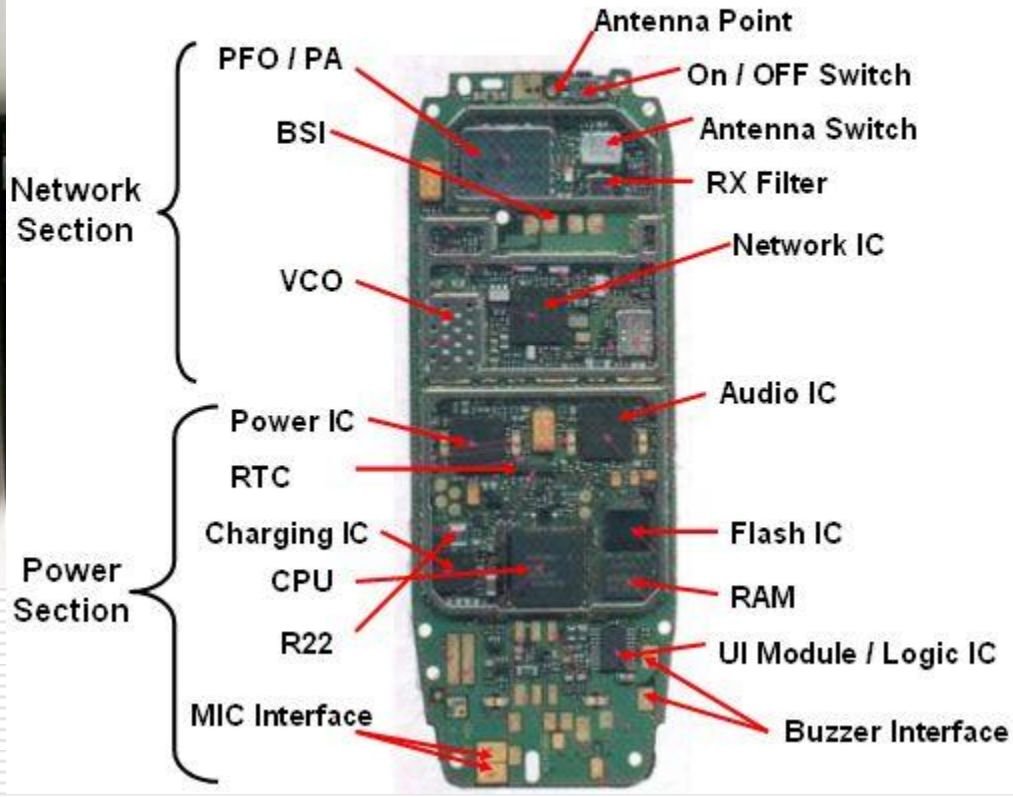
Check Android version on your Mobile Phone

On your mobile device goto
Settings -> MoreSettings
-> About Phone -> Version

Mobile Phone Internals

Mobile Phone PCB Diagram

www.mobilecellphonerepairing.com



NOTES:

1. **UEM** = Logic IC + Charging IC + Audio IC + Power IC
2. **PFO** = Antenna Switch + PFO
3. **Flash IC** = RAM + Flash IC

Smart Phone with Sensors

Role of Android

.apk files
User Developed Applications such as "Hello World App" etc.

Hardware

What is Android ?

Android

- Open, free software platform for mobile devices with a complete software stack
  - Operating system
  - Middleware
  - Key mobile applications
- Based on Linux operating system
- Made available as open source via the Apache v2 license
  - Industry can add proprietary functionality to their products without giving anything back to the platform
  - Companies can remove functionality if they choose

Android: Open Platform for Mobile Development

Android is an ecosystem made up of a combination of three components:

- A free, open-source operating system for embedded devices
- An open-source development platform for creating applications
- Devices, particularly mobile phones, that run the Android operating system and the applications created for it

Android: Open Platform for Mobile Development (Contd…)

Android is made up of several necessary and dependent parts:

- A **Compatibility Definition Document (CDD) and Compatibility Test Suite (CTS)** that describe the capabilities required for a device to support the software stack.
- A **Linux operating system kernel** that provides a low-level interface with the hardware, memory management, and process control, all optimized for mobile and embedded devices.
- **Open-source libraries** for application development, including SQLite, WebKit, OpenGL, and a media manager.
- A **run time** used to execute and host Android applications, including the Dalvik Virtual Machine (VM) and the core libraries that provide Android-specific functionality. The run time is designed to be small and efficient for use on mobile devices.
- An **application framework** that agnostically exposes system services to the application layer, including the window manager and location manager, databases, telephony, and sensors.
- A **user interface framework** used to host and launch applications.
- A set of core **pre-installed applications**.
- A **software development kit (SDK)** used to create applications, including the related tools, plug-ins, and documentation

NATIVE ANDROID APPLICATIONS

- An e-mail client
- An SMS management application
- A full PIM (personal information management) suite, including a calendar and contacts list
- A WebKit-based web browser
- A music player and picture gallery
- A camera and video recording application
- A calculator
- A home screen
- An alarm clock

What does *Android SDK* mean?

The Android **SDK (Software Development Kit)** is a set of development tools used to develop applications for Android platform.

Android SDK features

1. **Access to Hardware**, Including Camera, GPS, and Sensors
2. **Data Transfers** Using Wi-Fi, Bluetooth, and NFC
3. **Maps**, Geocoding, and Location-Based Services
4. **Background Services**
5. SQLite **Database** for Data Storage and Retrieval
6. **Shared Data** and Inter-Application Communication
7. Using **Widgets** and Live Wallpaper to Enhance the Home Screen
8. Extensive Media Support and **2D/3D Graphics**
9. **Cloud to Device** Messaging
10. Optimized **Memory** and **Process** Management

Question

List out different SDK features supported by Android

Unit 1: Open Handset Alliance (OHA)

What is OHA ? Why it was established ?

Open Handset Alliance (OHA)

Mobile Operators

中国移动通信 China Mobile
China Unicom
KDDI
NTT DoCoMo
Sprint
T-Mobile
vodafone
Telefónica

Handset Manufacturers

acer
ASUS
GARMIN
htc smart mobility
HUAWEI
lenovo 联想移动
LG Electronics
MOTOROLA
SAMSUNG
Sony Ericsson
TOSHIBA

Semiconductor Companies

AKM
Audience
ARM
intel
ATHEROS
BROADCOM
MIPS
NVIDIA
ST ERICSSON

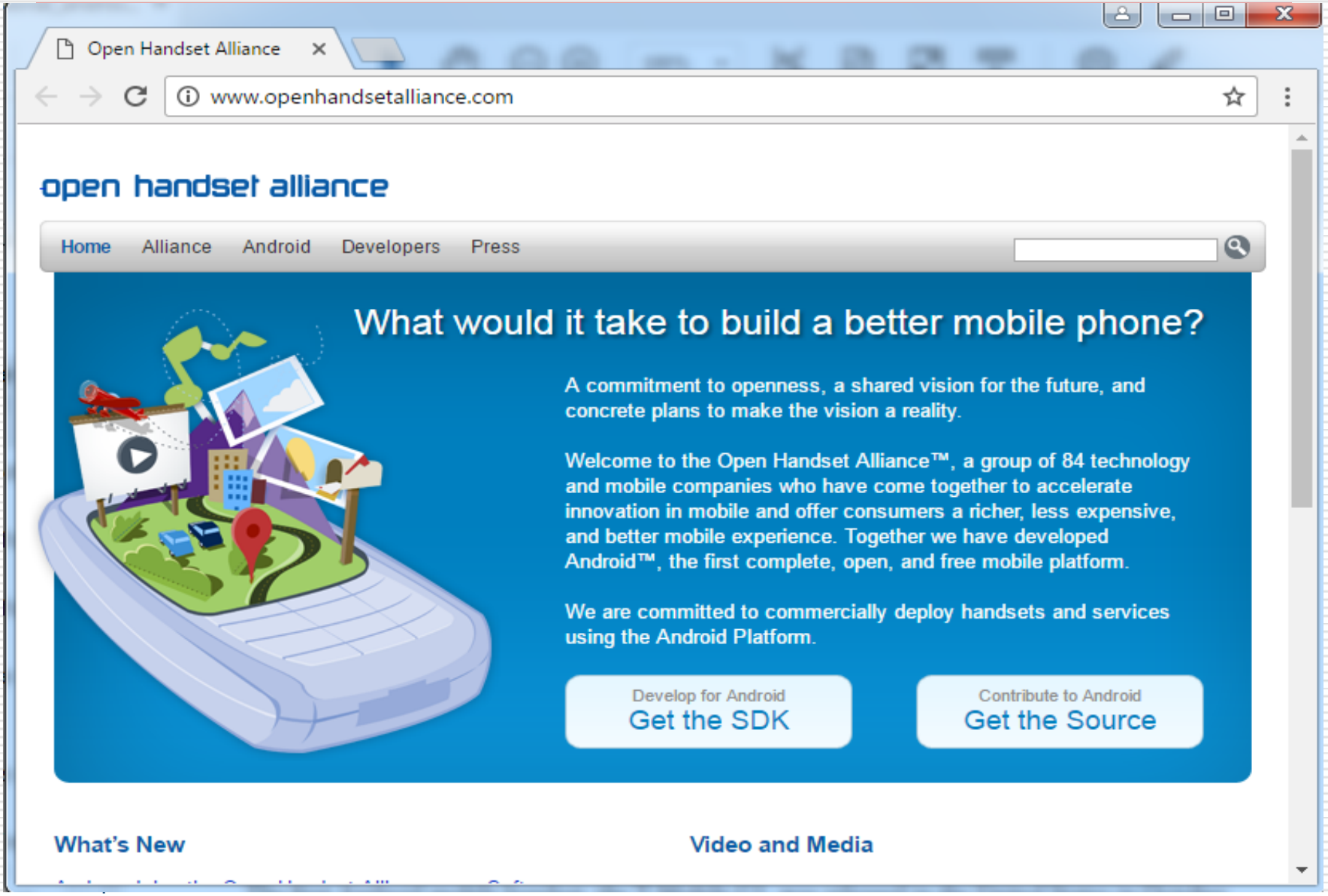
Software Companies

Ascender Corporation
ebay
Google
Living Image
myriad
NUANCE
OMRON
PV
SkinPop

Commercialization Companies

Aplix Corporation
BORQS
noser
tat
TELECA
WIND RIVER

Open Handset Alliance (OHA)



Open Handset Alliance (OHA)

- The Open Handset Alliance (OHA) is a collection of more than 84 technology companies, including hardware manufacturers, mobile carriers, software developers, semiconductor companies, and commercialization companies. Of particular note are the prominent mobile technology companies, including Samsung, Motorola, HTC, T-Mobile, Vodafone, ARM, and Qualcomm.
- The OHA hopes to deliver a better mobile software experience for consumers by providing the platform needed for innovative mobile development at a faster rate and with higher quality than existing platforms, without licensing fees for either software developers or handset manufacturers.

Question to Think Over

iOS is the iPhones mobile platform.

Why iPhone has not made iOS the open source ?

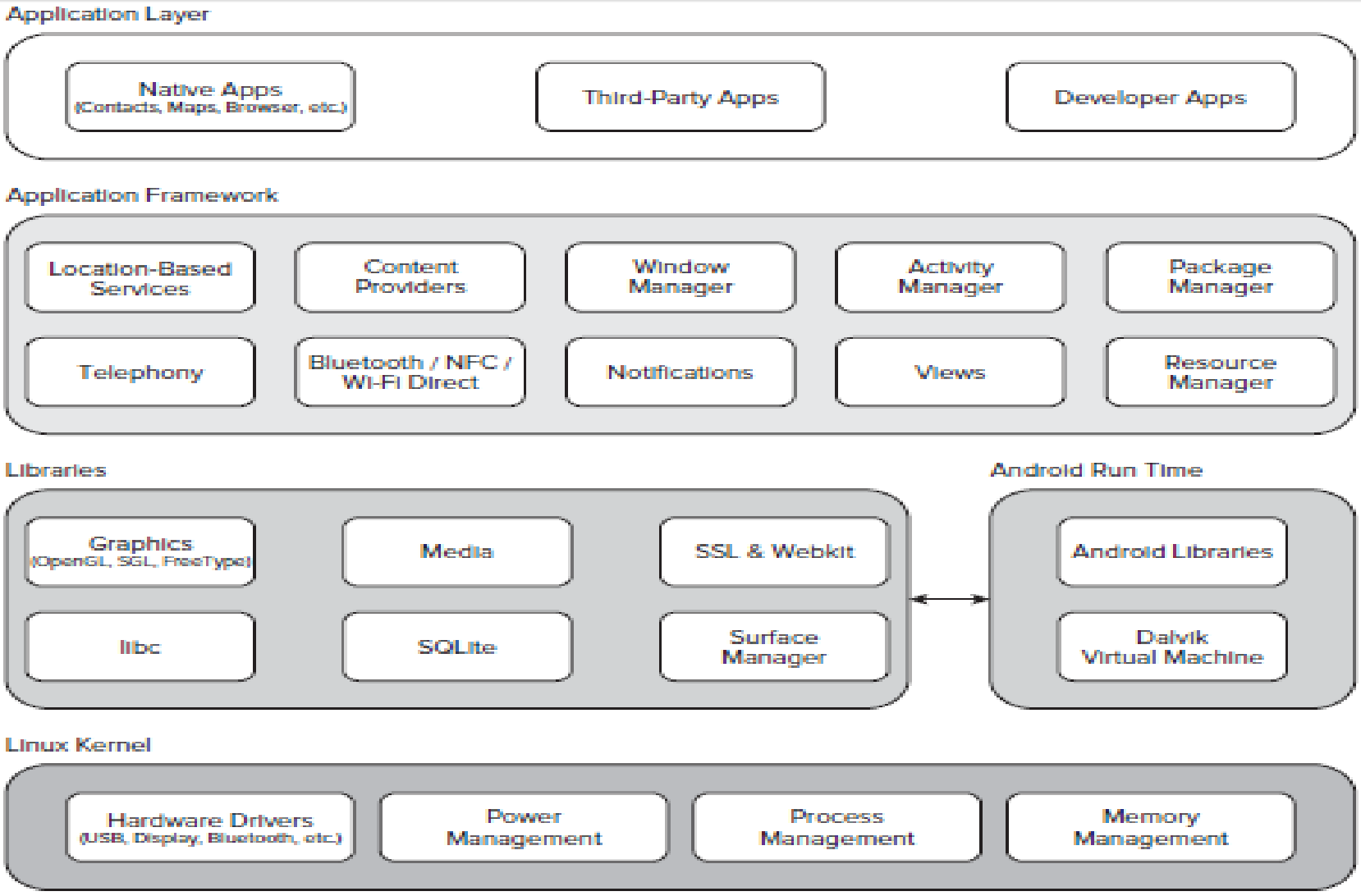
But Android is open source mobile platform.

Think over the MERITS and DEMERITS of iOS and Android.

Unit 1: Introducing Development Framework

Android Software Stack
Dalvik Virtual Machine
Android Application Architecture
Android Libraries
Android Development Tools

Android Software Stack or Android Architecture



Android Software Stack or Android Architecture

Android architecture or Android software stack is categorized into five parts:

1. Linux kernel
2. Native libraries (middleware)
3. Android Runtime
4. Application Framework
5. Applications

Android Software Stack or Android Architecture

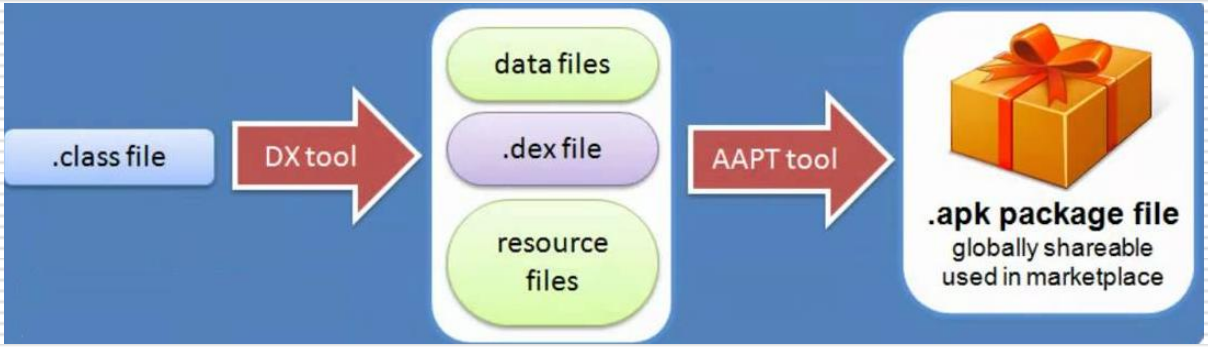
1. **Linux kernel:** It is the heart of android architecture that exists at the root of android architecture. **Linux kernel** is responsible for device drivers, power management, memory management, device management and resource access.
2. **Native Libraries:** On the top of linux kernel, their are **Native libraries** such as WebKit, OpenGL, FreeType, SQLite, Media, C runtime library (libc) etc. The WebKit library is responsible for browser support, SQLite is for database, FreeType for font support, Media for playing and recording audio and video formats.
3. **Android Runtime:** In android runtime, there are core libraries and DVM (Dalvik Virtual Machine) which is responsible to run android application. DVM is like JVM (Java Virtual Machine) but it is optimized for mobile devices. It consumes less memory and provides fast performance.
4. **Android Framework:** On the top of Native libraries and android runtime, there is android framework. Android framework includes **Android API's** such as UI (User Interface), telephony, resources, locations, Content Providers (data) and package managers. It provides a lot of classes and interfaces for android application development.
5. **Applications:** On the top of android framework, there are applications. All applications such as home, contact, settings, games, browsers are using android framework that uses android runtime and libraries. Android runtime and native libraries are using linux kernal.

Question

Describe with neat diagram Android Architecture or Android Software Stack

Unit 1: Dalvik Virtual Machine

DVM is written specifically for efficiently running programs on devices which have limited battery, limited memory and limited CPU



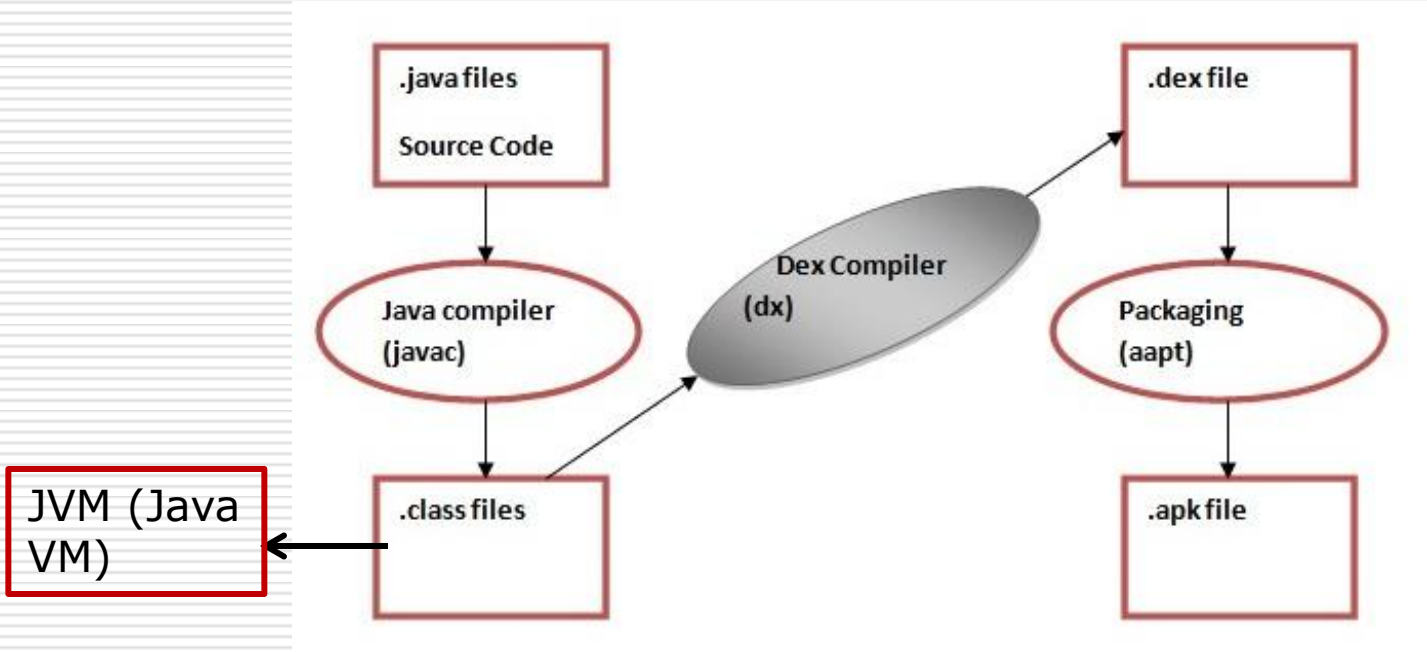
Android Runtime

Dalvik Virtual Machine (DVM)

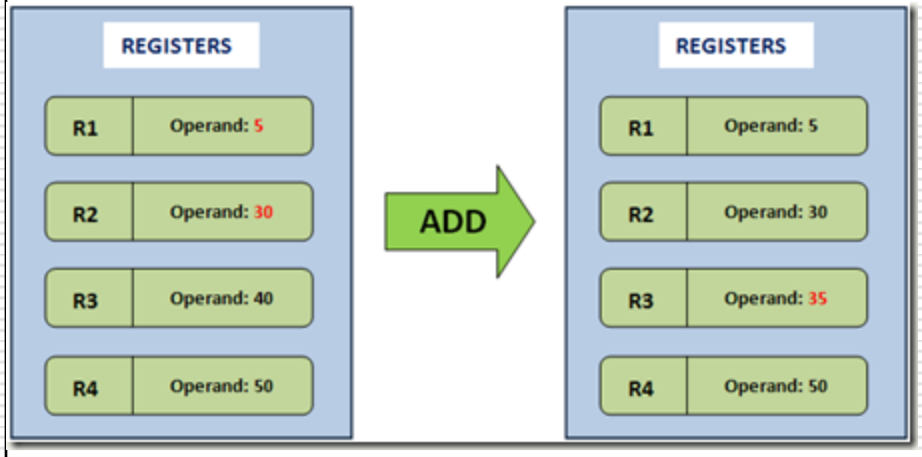
- As we know the modern JVM is high performance and provides excellent memory management. But it needs to be optimized for low-powered handheld devices as well.
- The **Dalvik Virtual Machine (DVM)** is an android virtual machine optimized for mobile devices. It optimizes the virtual machine for *memory*, *battery life* and *performance*.
- Dalvik is a name of a town in Iceland. The Dalvik VM was written by Dan Bornstein.
- The Dex compiler converts the class files into the .dex file that run on the Dalvik VM. Multiple class files are converted into one dex file.

Dalvik Virtual Machine (Contd…)

- The **javac tool** compiles the java source file into the class file.
- The **dx tool** takes all the class files of your application and generates a single .dex file. It is a platform-specific tool.
- The **Android Assets Packaging Tool (aapt)** handles the packaging process.



Difference between JVM and DVM

Java Virtual Machine (JVM)	Dalvik Virtual Machine (DVM)
JVM is **Stack based** which uses java byte code and runs .class file having JIT.	DVM is **Register based** which is designed to run on low memory, uses its own byte code and runs .Dex file
Stack based VM	Registered based VM
	
POP 20 **POP 7** **ADD 20, 7, result** **PUSH result**	**ADD R1, R2, R3**

Android Libraries

- Android offers a number of APIs for developing your applications.
- http://developer.android.com/reference/packages.html,

which gives a complete list of packages included in the Android SDK.

- Android is intended to target a wide range of mobile hardware.

Developing for Android

The Android design philosophy demands that applications be designed for:

- Performance
- Responsiveness
- Freshness
- Security
- Seamlessness
- Accessibility

Android Development Tool (ADT)

The Android SDK includes several tools and utilities to help you create, test, and debug your projects.

- **The Android Virtual Device and SDK Managers** — Used to create and manage AVDs and to download SDK packages, respectively. The AVD hosts an Emulator running a particular build of Android, letting you specify the supported SDK version, screen resolution, amount of SD card storage available, and available hardware capabilities (such as touchscreens and GPS).
- **The Android Emulator** — An implementation of the Android VM designed to run within an AVD on your development computer. Use the Emulator to test and debug your Android applications.
- **Dalvik Debug Monitoring Service (DDMS)** — Use the DDMS to monitor and control the Emulators on which you're debugging your applications.
- **Android Debug Bridge (ADB)** — A client-server application that provides a link to virtual and physical devices. It lets you copy fi les, install compiled application packages (.apk), and run shell commands.
- **Logcat** — A utility used to view and filter the output of the Android logging system.
- **Android Asset Packaging Tool (AAPT)** — Constructs the distributable Android package fi les (.apk).

Thanks for Listening

TO DO Over the Weekend

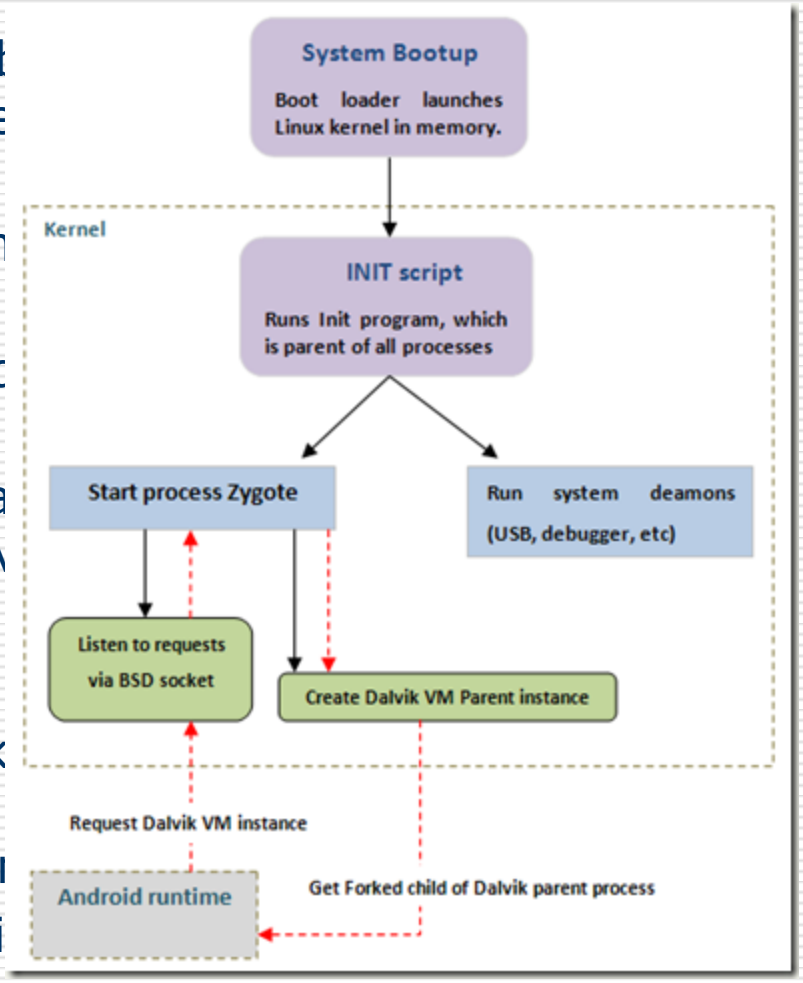
- Installing Android Studio on your personal computers
- Check whether you can upgrade your phone Android OS to current "Android version 7 Nougate" released during the year 2016
- MERITS and DEMRITS of iOS and Android

Dalvik Virtual Machine

- The Dalvik virtual machine is implemented by Google for the Android OS, and functions as the Interpreter for Java code running on Android devices.
- It is a process virtual machine, whereby the the underlying Linux kernel of the Android OS spawns a new Dalvik VM instance for every process.
- Each process in Android has its own Dalvik VM instance. This reduces the chances of multi-application failure if one Dalvik VM crashes.
- Dalvik implements the register machine model, and unlike standard Java bytecode (which executes 8 bit stack instructions on the stack based JVM), uses a 16 bit instruction set.The registers are implemented in Dalvik as 4 bit fields.

DVM

- When the system boots up, the k into memory and initializes syste this,
- The kernel runs the Init program for all processes in the system.
- The Init program starts system c important 'Zygote' service.
- The Zygote process creates a Da parent Dalvik process for all Dalv
- The Zygote process also sets up for incoming requests.
- When a new request for a Dalvik Zygote process forks the parent the child process to the requesti
- This is in essence, how the Dalvi and used in the Android system.



DVM (Contd…)

- Dalvik differs from the Java virtual machine in that it executes Dalvik byte code, and not the traditional Java byte code. There is an intermediary step between the Java compiler and the Dalvik VM, that converts the Java byte code to Dalvik byte code, and this step is taken up by the DEX compiler. The difference between the JVM and Dalvik is depicted in the following diagram