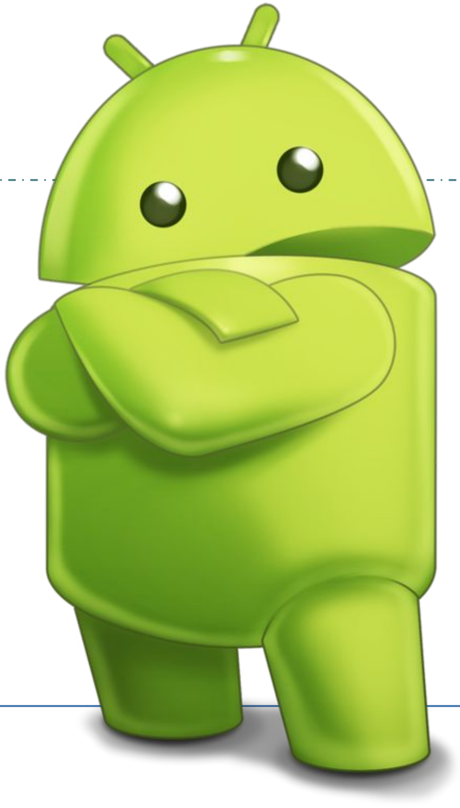


Android Development Tutorial

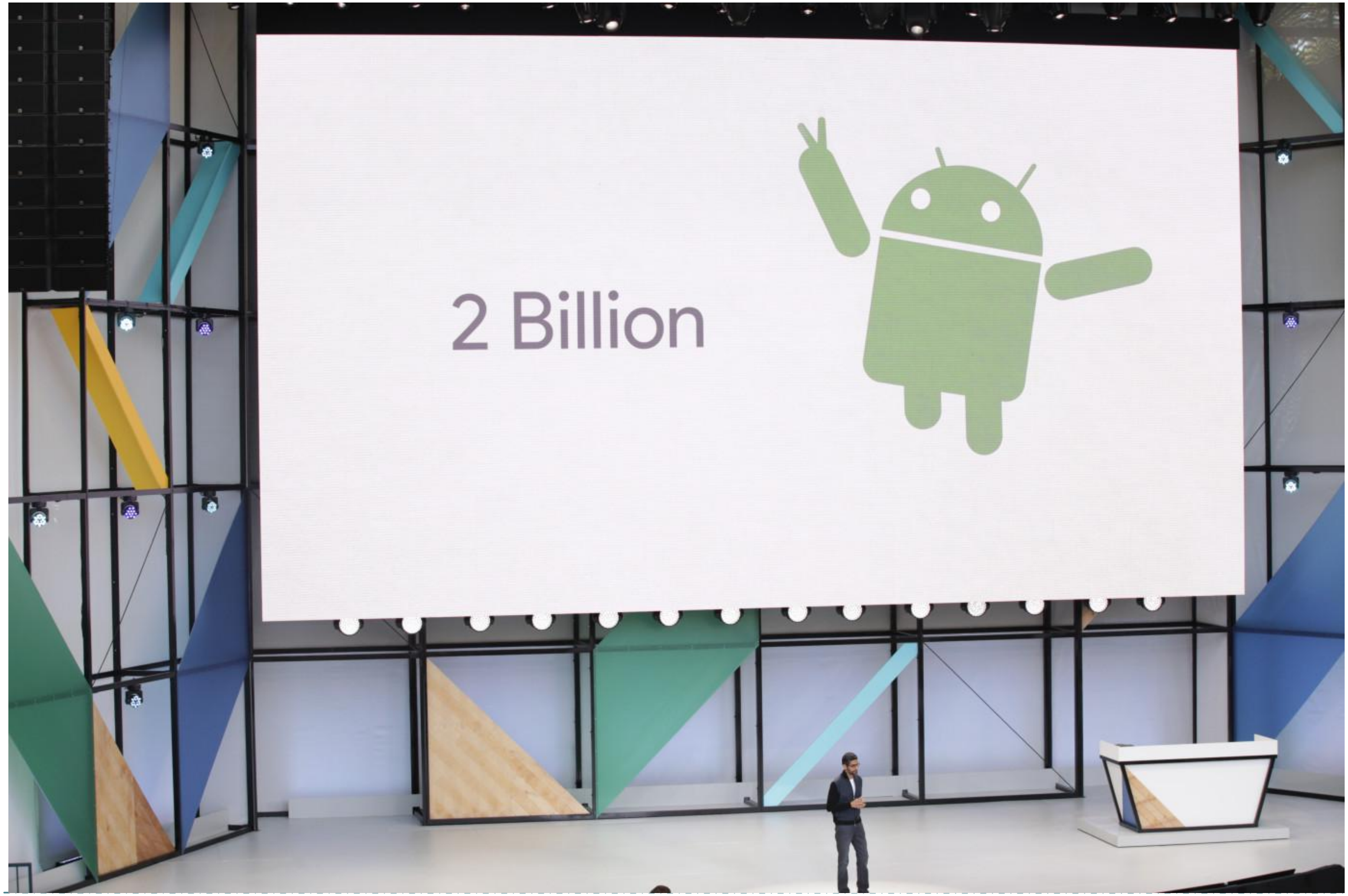
Chapter – I

Contents

- What’s Android
- History & Versions
- Android Architecture
- Exploring Android Studio

What’s Android

Google announced no of android users registered till March 2017 .



What is Android

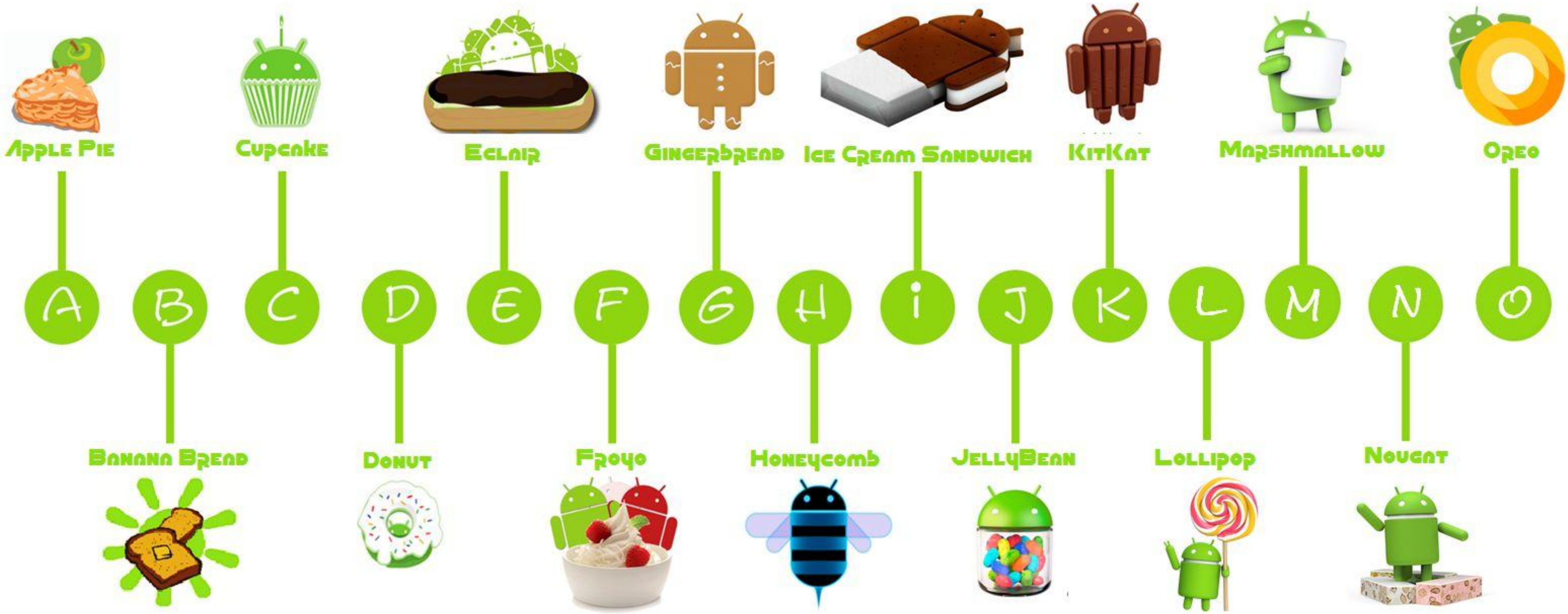
- **Android** is a mobile **operating system** based on the linux and kernel for mobile devices such as *smartphones* and *tablet* computers. It is developed by the Open Handset Alliance led by Google.

- Android has beaten Apple iOS, being the leading mobile operating system from first quarter of 2011

OHA and Android

- OHA(Open Handset Alliance) is a group of 71 technology and mobile companies, including Google, Intel, Dell, HTC and China Mobile…
- OHA's aim：
  - accelerate innovation in mobile phones
  - offer consumers a richer, less expensive, and better mobile experience
- OHA developed Android™, the first complete, open, and free mobile platform
- Android was founded by **Andy Rubin**, **Rich Minner**, and **Charris White**
- OHA was initially called up by Google, and Google is the 'captain'

Versions


Apple Pie
Cupcake
Eclair
Gingerbread
Ice Cream Sandwich
KitKat
Marshmallow
Oreo
A
B
C
D
E
F
G
H
i
J
K
L
M
N
O
Banana Bread
Donut
Froyo
Honeycomb
JellyBean
Lollipop
Nougat

Android Briefly

- Generally, Android is a software stack for mobile devices that includes an operating system, middleware and key applications
- Android is based on JAVA and all its applications are developed in JAVA
- The JAVA VM, known as Dalvik, is highly customized and optimized for mobile devices

The core of Android

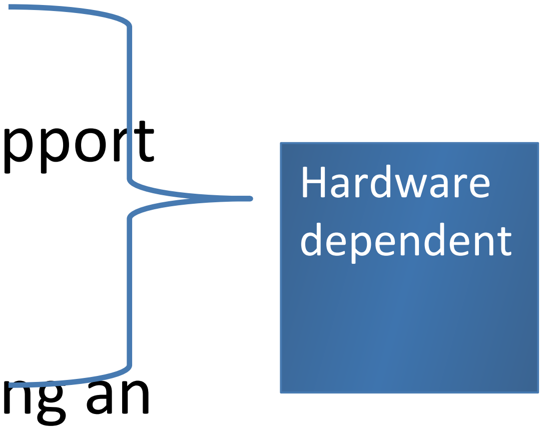
- **Android SDK** offers rich tools for android application development and many useful APIs。

Android Features #1

- Application framework enabling reuse and replacement of components
- Optimized Java virtual machine: Dalvik
- Optimized Graphics Processing, supporting 2D and 3D graphics(OpenGL ES 1.0)
- Integrated open source web browser: WebKit
- SQLite for structured data storage

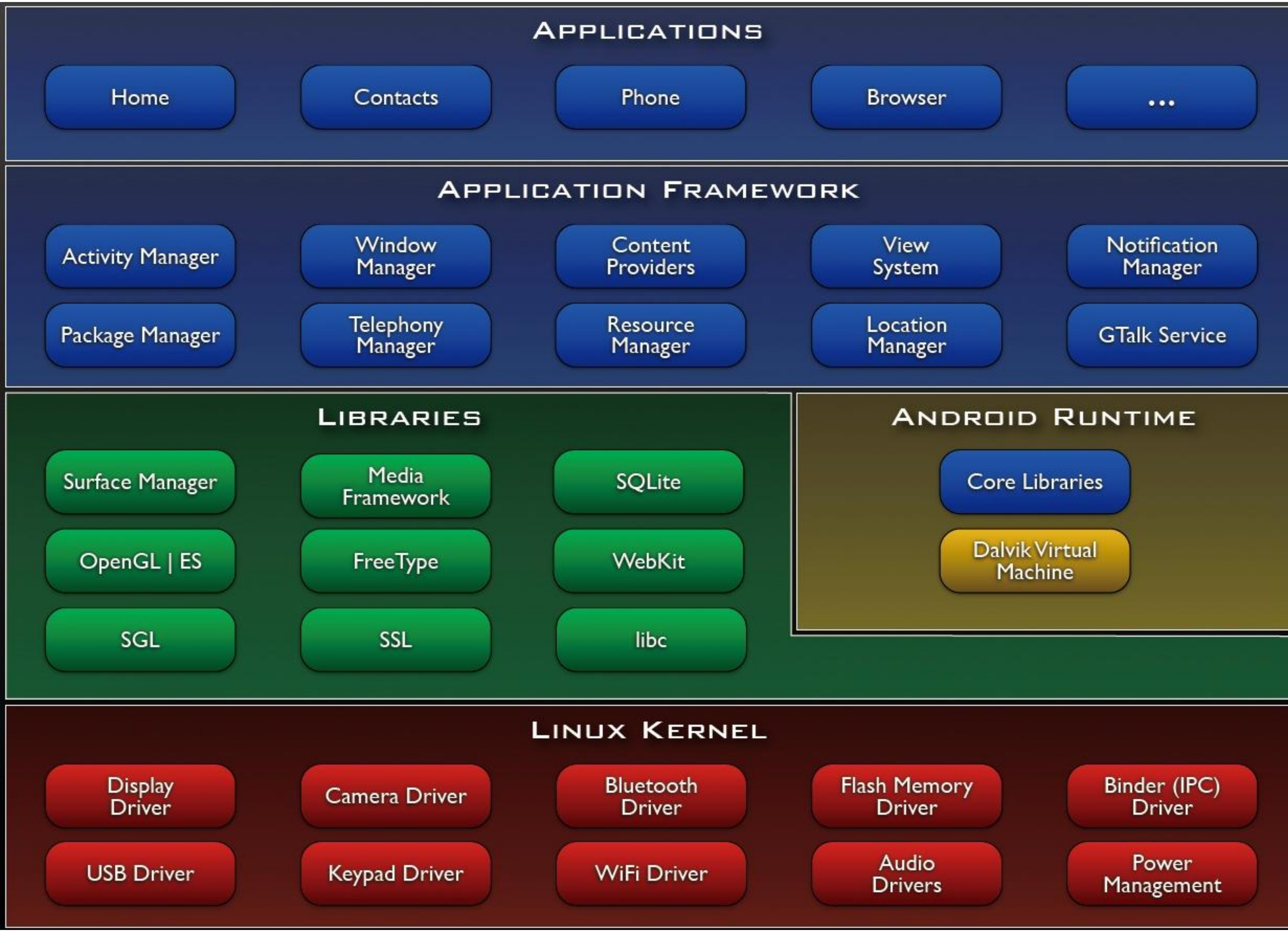
Android Features #2

- Multimedia capability, supporting varieties of audio, video and still image formats
- GSM Telephony
- Bluetooth, EDGE, 3G/4G/.. and Wi-Fi support
- Camera, GPS, compass, accelerometer and other sensors support
- Rich development environment, including an emulator, debugging tools, memory probe tools, log tools and powerful eclipse plugins



Hardware dependent

Android architecture



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

GTalk 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

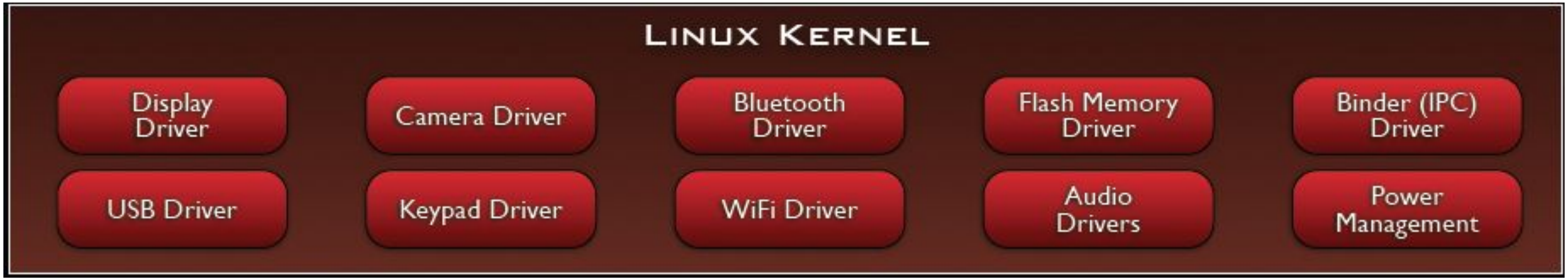
WiFi Driver

Audio Drivers

Power Management

Linux Kernel

- Note that Android based on a Linux kernel not a Linux OS
- Supplies Security, Memory management, Process management, Network stack and Driver model
- Acts as an abstraction layer between the hardware and the rest of the software stack

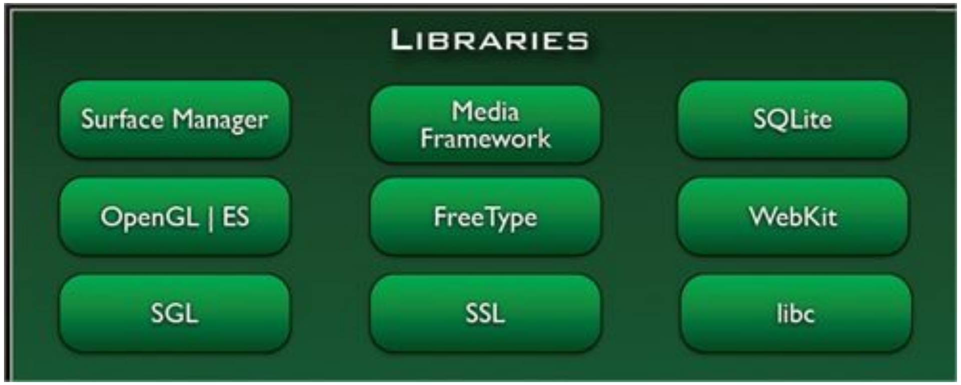


LINUX KERNEL

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

Libraries

- Run in system background
- Using C/C++ Language
- 4 types of Libraries
  - Bionic Libc, system C libraries
  - Function Libraries, supporting multimedia, web browser, SQLite...
  - Native Servers
  - Hardware Abstraction Libraries

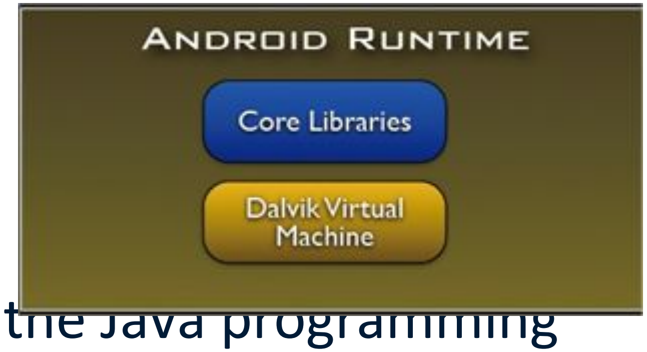


Core Libraries

- **System C library,** the standard C system library, tuned for embedded Linux-based devices
- **Media Libraries,** support playback and recording of many popular audio and video formats, as well as image files, including MPEG4, H.264, MP3, AAC, AMR, JPG, and PNG
- **Surface Manager,** manages access to the display subsystem and seamlessly composites 2D and 3D graphic layers from multiple applications
- **WebKit,** a modern web browser engine which powers both the Android browser and an embeddable web view
- **SGL**, the underlying 2D graphics engine
- **3D libraries,** an implementation based on OpenGL ES 1.0 APIs
- **FreeType** , bitmap and vector font rendering

Runtime Environment

- **The core of Android platform**
- Dalvik Virtual Machine
  - Register-based
  - Executes files in the Dalvik format
- Java core Libraries
  - Provides most of the functionality of the Java programming language.



Runtime (cont.)

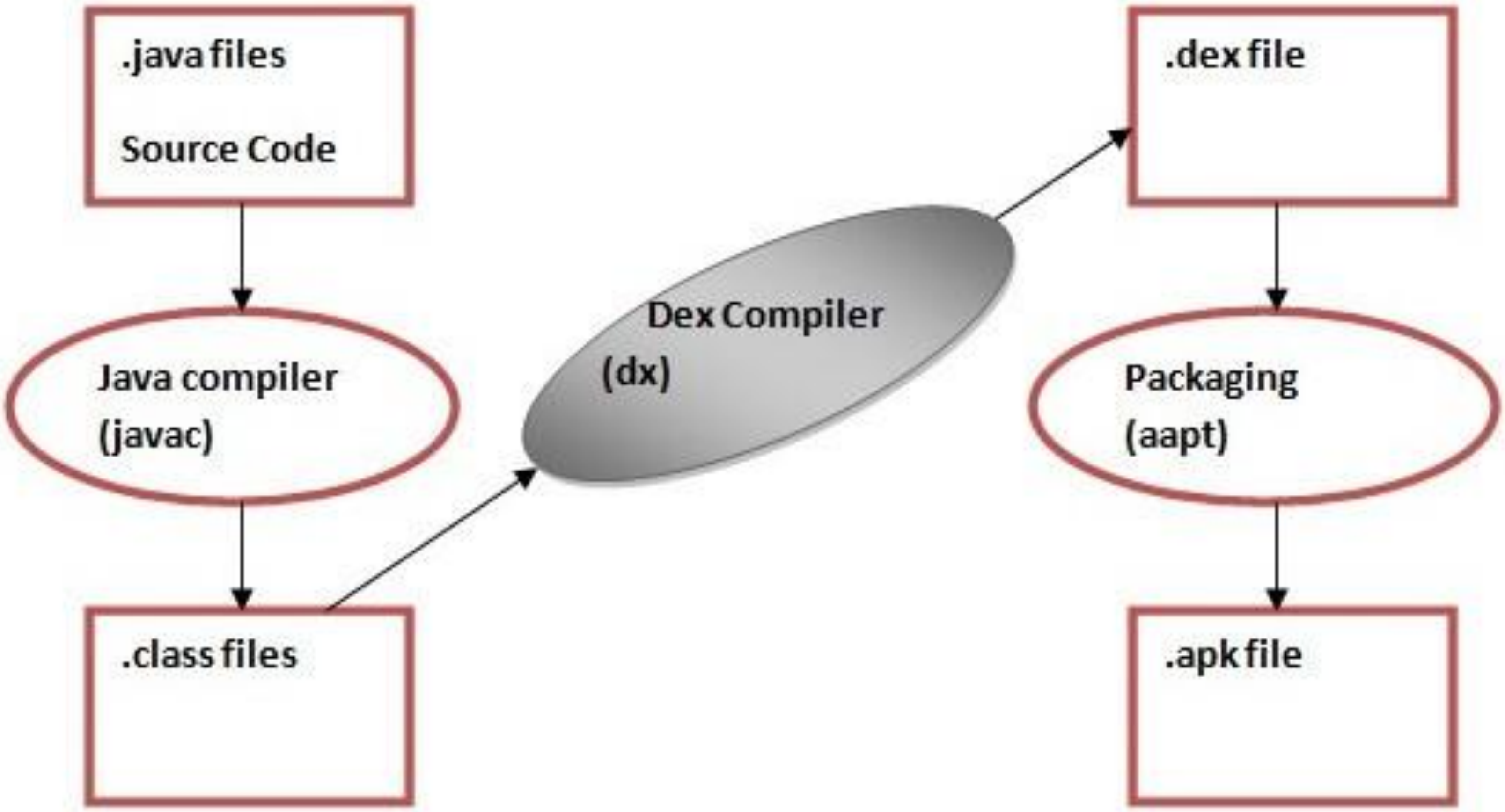
- The functions of Java core libraries rely on the Dalvik VM and the underlying Linux kernel
- Multiple Dalvik VMs may run at the same time
- Every Android application runs in its own process, with its own instance of the Dalvik virtual machine
  - The "dx" tool in Android SDK can transform compiled JAVA class into the .dex format

Dalvik Virtual Machine

- Android custom implementation virtual machine
  - Provides application portability and runtime consistency
  - Runs optimized file format (.dex) and Dalvik bytecode
  - Java .class / .jar files converted to .dex at build time
- Designed for embedded environment
  - Supports multiple virtual machine processes per device
  - Highly CPU-optimized bytecode interpreter
  - Efficiently Using runtime memory
- Core Libraries
  - Core APIs for Java language provide a powerful, yet simple and familiar development platform

DVM vs. JVM

- DVM
  - Google
  - Dalvik executable
  - Only supports a subset of standard Java Library
- JVM
  - Sun
  - Java bytecode
- Some worries that Java world may be divided into different communities, each has its own Java standard



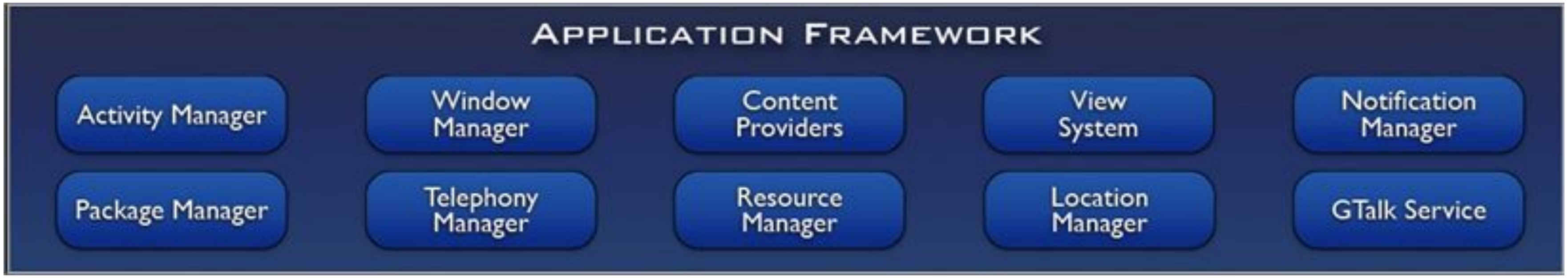
Dalvik now unsupported Android versions 4.4 "KitKat" and earlier. Dalvik is open-source software, originally written by Dan Bornstein, who named it after the fishing village of Dalvík in Eyjafjörður, Iceland

ART (Android Runtime)

- **Android Runtime** (**ART**) is an application runtime environment used by the Android operating system. Replacing Dalvik, the process virtual machine originally used by Android, ART performs the translation of the application's bytecode into native instructions that are later executed by the device's runtime environment
- ART brings faster execution of applications, improved memory allocation and garbage collection (GC) mechanisms, new applications debugging features

Application Framework

- Simplify the reuse of components
  - Applications can publish their capabilities and any other application may then make use of those capabilities
- Applications is a set of services and systems, include
  - Views system, content providers, resources manager and so on

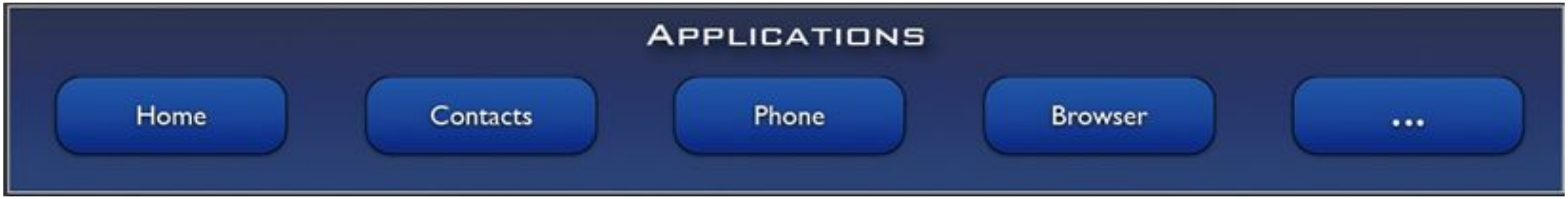


Application Framework (cont.)

- **Activity Manager,** manages the lifecycle of applications and provides a common navigation backstack
- **Notification Manager,** enables all applications to display custom alerts in the status bar
- **Resource Manager**, providing access to non-code resources such as localized strings, graphics, and layout files
- **Content Providers,** access data from other applications (such as Contacts), or to share their own data
- **Views,** used to build an application, including lists, grids, text boxes, buttons, and even an embeddable web browser

Applications

- A set of core applications shipped with Android platform
  - an email client, SMS program, calendar, maps, browser, contacts, and others
- All written in Java
- Our applications are in the same level as these applications



Android Programming

Tools

- Java Runtime >1.7
- Android SDK
- An IDE (Android Studio/ Eclipse / Xamarin)

Android Studio

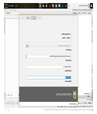
Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development. It is available for download on Windows, macOS and Linux based operating systems. It is a replacement for the Eclipse Android Development Tools (ADT) as primary IDE for native Android application development.

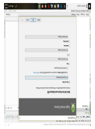
Features

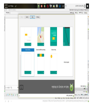
- Gradle-based build support.
- Android-specific refactoring and quick fixes.
- Lint tools to catch performance, usability, version compatibility and other problems.
- ProGuard integration and app-signing capabilities
- Template-based wizards to create common Android designs and components
- A rich layout editor that allows users to drag-and-drop UI components, option to preview layouts on multiple screen configurations.
- Support for building Android Wear apps.
- Built-in support for Google Cloud Platform, enabling integration with Firebase Cloud Messaging (Earlier 'Google Cloud Messaging') and Google App Engine.

Exploring Android Studio

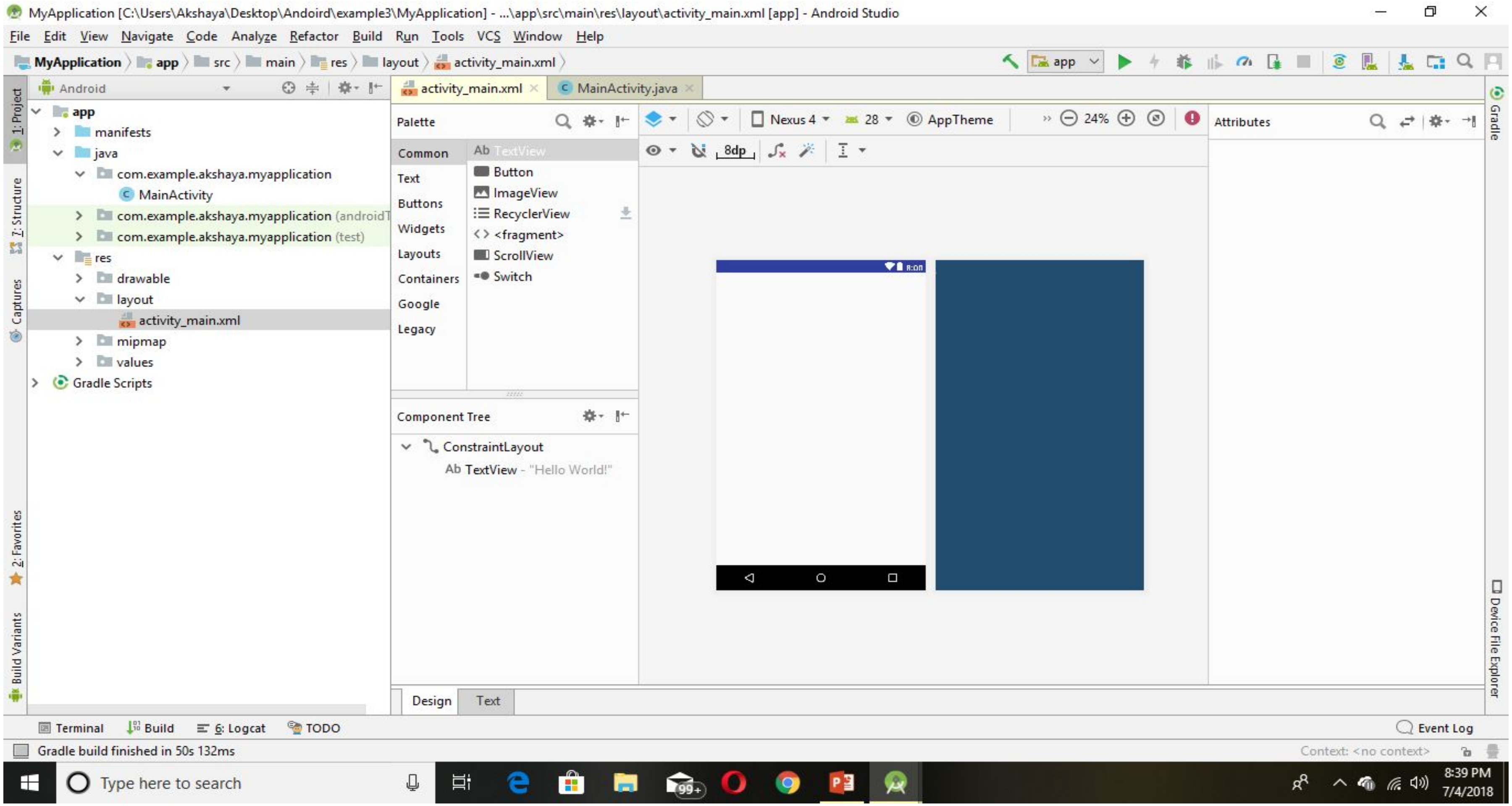
Creating a new App (Project)







Android Studio IDE

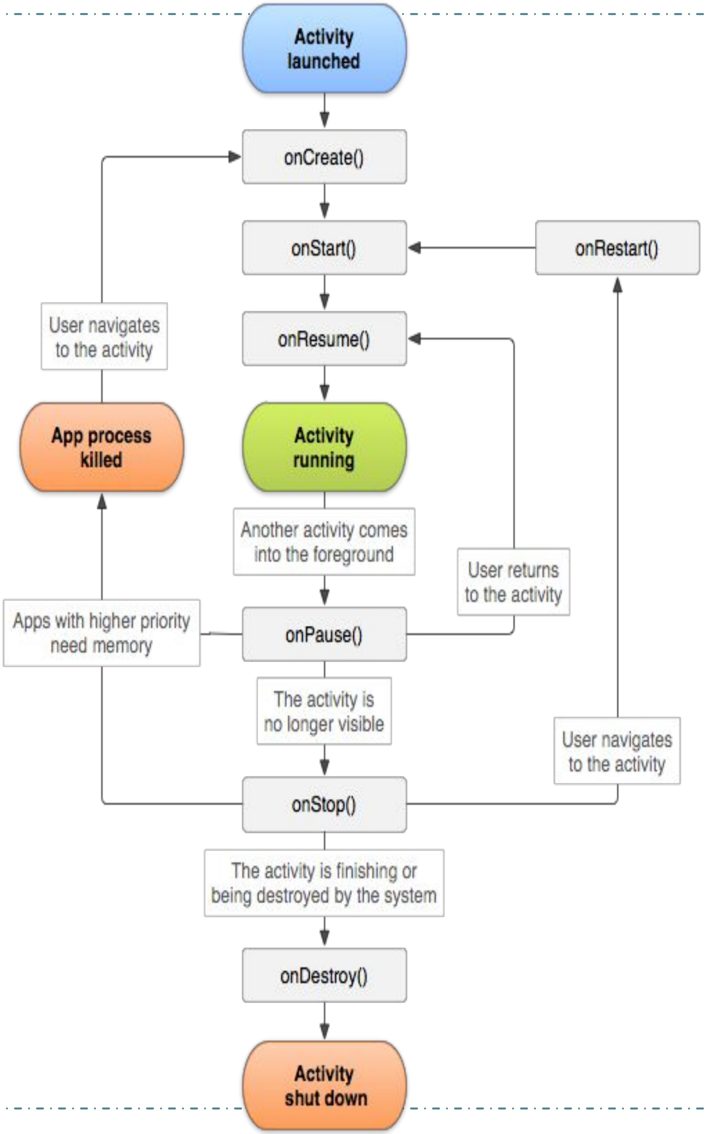


MyApplication [C:\Users\Akshaya\Desktop\Andoird\example3\MyApplication] - ...\app\src\main\res\layout\activity_main.xml [app] - Android Studio

Gradle build finished in 50s 132ms

Activity Lifecycle

- `Activity`: key building block of Android apps
- Extend `Activity` class, override `onCreate()`, `onPause()`, `onResume()` methods
- Dalvik VM/ART can stop any `Activity` without warning, so saving state is important!
- Activities need to be “responsive”, otherwise Android shows user “App Not Responsive” warning:
  - Place lengthy operations in `Runnable Threads`, `AsyncTasks`


Activity launched
onCreate()
onStart()
onRestart()
User navigates to the activity
onResume()
App process killed
Activity running
Another activity comes into the foreground
User returns to the activity
Apps with higher priority need memory
onPause()
The activity is no longer visible
User navigates to the activity
onStop()
The activity is finishing or being destroyed by the system
onDestroy()
Activity shut down

Directory Structure

- Myapplication (Android Project Name)
  - src : . java files
  - gen : generated file (r.java)
  - bin : -apk files
  - libs : external library, jars files
  - assets : extremal file fonts, video, audio etc.
  - res
    - drawable : images/icons
    - layout : app design layout in xml format
    - values : string values
    - menu : app menus
  - manifesto
    - androidmanifact.xml

Thank You