MODULE 1

INTRODUCTION

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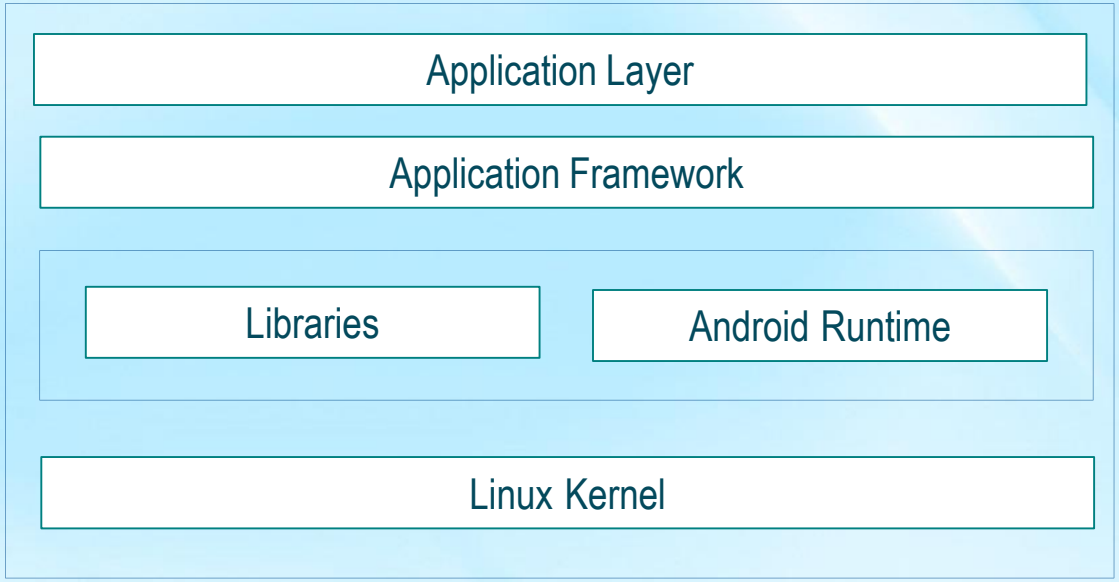
Android History

- Google's open source and free Java-based platform for mobile development
- Using the Android software development kit (SDK)
- To publish on the Android market
- First developped by Android (Palo Alto California)
- Google bought the company in November 2007

Android History

Platform Version	Code Name
Android 1.5	Cupcake
Android 1.6	Donut
Android 2.0 and 2.1	Eclair
Android 2.2	Froyo
Android 2.3	Gingerbread
Android 3	Honeycomb
Android 4.0	Ice Cream Sandwich
Android 4.1 ⇨ 4.3	Jelly Bean
Android 5.0	Lollipop
Android 6.0	Marshmallow
Android 7.0	Nougat

Android Software Stack



Android Software Stack

- Linux Kernel : Device drivers
  - Display
  - Camera
  - Keypad
  - Wi-Fi
  - Flash memory
  - Audio
- Libraries
  - WebKit library : browser support
  - FreeType library : font support
  - SQLite library : database support
  - Media library : recording and playback of audio and video formats
  - Surface Manager library : 2D and 3D graphics support
  - …

Android Software Stack

- Android Runtime
  - Enables developers to write Android applications using java
  - Contains
    - Core Android libraries
      - Providing most of the functionalities of the core Java libraries
    - Dalvik virtual machine
- Application Framework
  - Provides classes to manage
    - User interface
    - Application resources
    - Abstraction for hardware access

Android Software Stack

- Application Layer
  - Displays the application along with the built-in applications provided by the device itself

Android Studio

- To build Android applications
  - Automatically creates the necessary Android files such as
    - Java files
    - XML resource and layout files
    - Manifest files
  - ***http://developer.android.com/sdk/index.html***

Activity

- An application = one or more activities
- Activity
  - Usually represents a single screen
  - Consists of one or more user interface (GUI) controls
    - E.g, TextView, Button, EditText, …
  - Enables user interaction with the application
- Separation of the presentation layer (View) from business logic
  - Separation of the user interface from the action code

Activity

- View: Activity XML file
  - Defines the user interface of the application
  - Contains GUI controls
- Business logic: Activity Java file
  - Contains action code of the GUI controls
    - Event handling
    - Processing of data entered by the user

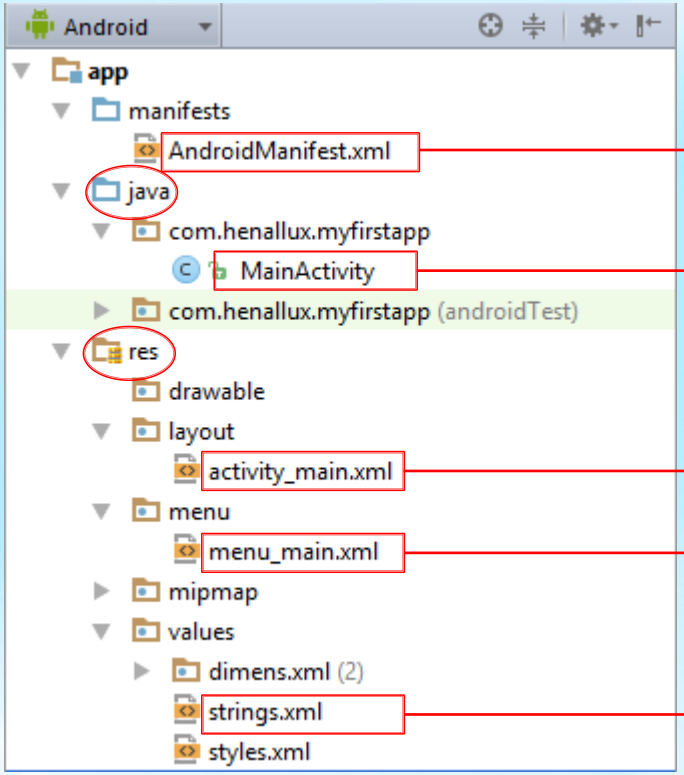
Creating an Android Application

- Application name and Company domain
  - Must be unique
  - Once an application is published, cannot be changed
  - E.g,
    - Application name: MyHelloApp
    - Company domain: henallux.com
    - ⇨Package name: *com.henallux.myHelloApp*

Creating an Android Application

- Target Android Devices
  - Different platforms
    - Phone and Tablet
    - Wear
      - Small powerful devices worn on the body
    - TV
    - Android Auto
      - To be operated in automobiles through the dashboard's head unit
    - Glass
      - Wearable technology with an optical head-mounted display
  - Minimum SDK
    - The minimum version of the Android platform required by the application to run

Android Project Structure



Android Manifest

Java class of the Activity

XML file of the Activity

Menu XML file of the Activity

Value resources of String type

Android Project Structure

- manifests folder
  - Contains AndroidManifest.xml
    - Central configuration file for the application
- java folder
  - Contains a directory corresponding to the package name
    - Containing Java source files of activities

Android Project Structure

- res folder
  - All application resources
    - Images
    - Layout files
    - String files
  - Rather than hard coding image or string into the application, better
    - To create respective resource in the res folder
    - To include its reference in the application (ID included in the R.file, see further)
  - drawable folders
    - Icons and graphics resources according to the screen resolutions
      - Drawable-xhdpi folder : for 320dpi
      - Drawable-hdpi folder : for 240dpi
      - Drawable-mdpi folder : for 160dpi
      - Drawable-ldpi folder : for 120dpi

Android Project Structure

- res folder (continue)
  - layout folder
    - Stores the activity layout files
    - One XML file per activity
  - menu folder
    - Stores the menu layout files
    - One XML file per activity
  - values folder
    - Stores all the values resources
    - Many types : dimensions, strings, color, …

Android Manifest File

- Defines the overall structure and information to run the application
  - Each activity
    - The entry point: the first activity to launch
  - Services
    - Tasks in the background
  - Intents
  - Needed permissions
  - Meta data
    - Icons
    - Labels
  - Information required in building and packaging
    - For installing and deploying the application

Android Manifest File

```xml
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.henallux.myfirstapp" >

    <application
        android:allowBackup="true"
        android:icon="@mipmap/ic_launcher"
        android:label="@string/app_name"
        android:theme="@style/AppTheme"
        android:name="MyApplication"
        >
        <activity
            android:name=".MainActivity"
            android:label="@string/app_name" >
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />

                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
    </application>

</manifest>
```

Application ID

For each activity

Android Manifest File

- Other tags
  - service tag
    - For each process running in the background
  - uses-permission tag
    - To declare permissions that the application needs to run
    - E.g, `<uses-permission android:name="android.permission.CAMERA" />`
      - If the application needs to use camera

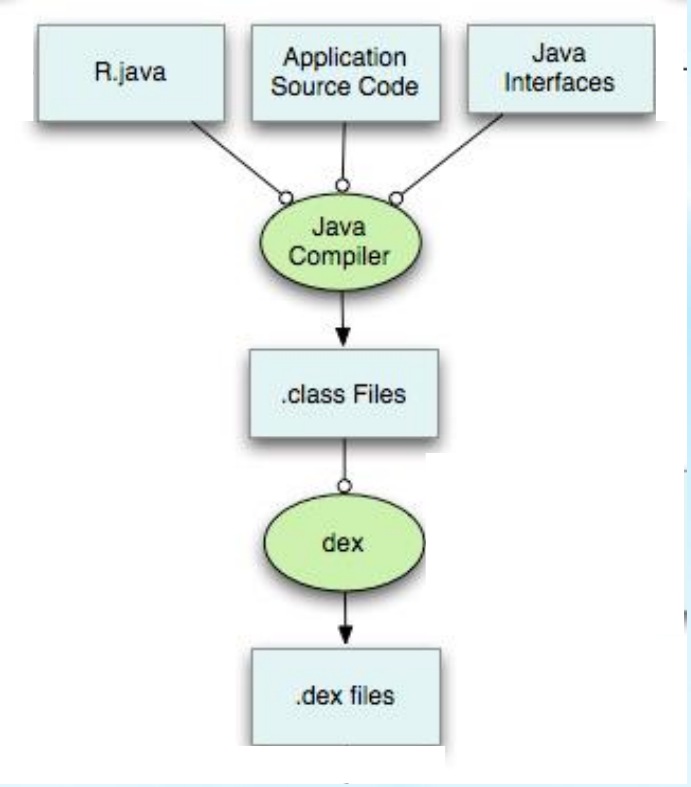
Dalvik Virtual Machine

- The Android platform's virtual machine
  - Provides environment to deploy and run Android applications
- Optimized for mobile devices with limited
  - Battery
  - Memory
  - Computation capability

Dalvik Virtual Machine

- When running an application
  1. Android SDK accesses all layout and variable information in XML files
     ↳ converts it into Java source code placed in R.java file
  2. R.java file compiled into Java byte code files (.class files)
     ↳ + the dx tool converts it into Dalvik byte code :
     Dalvik Executable format (.dex) optimized for
     - Efficient Storage
     - Low memory consumption

Dalvik Virtual Machine



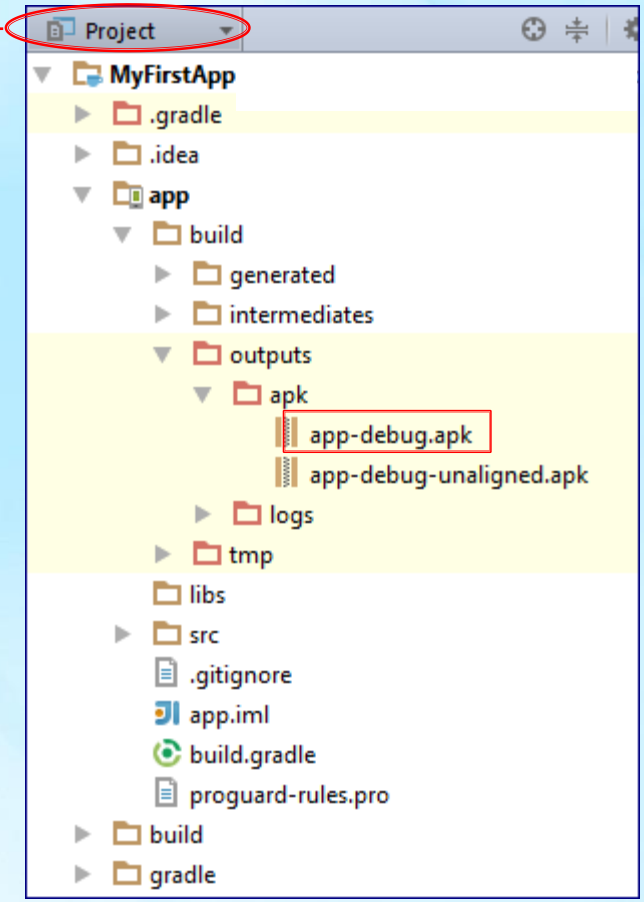
Source: developer.android.com/sdk/installing/studio-build.html

Application Package File

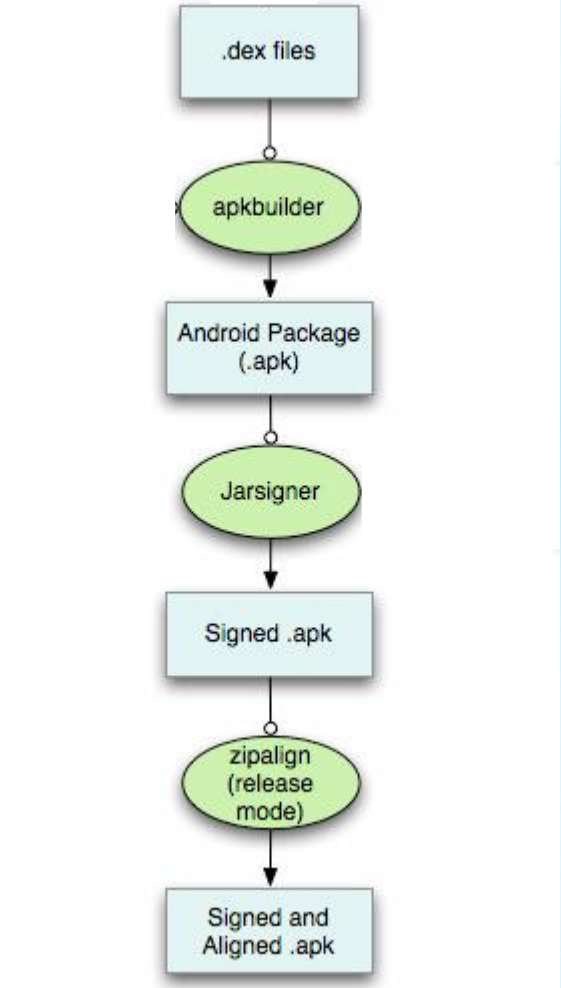
- The Android applications are not deployed in .dex format
- The dex code is bundled into an APK file
  - With required data and resources
  - Including the AndroidManifest.xml
  - apk file extension
- APK file used to distribute Android application
  - To install it on mobile device or emulator

Application Package File

In Android studio: change to Project view



Application Package File



Source: developer.android.com/sdk/installing/studio-build.html

Gradle

- Build automation tool
  - Determines the order in which tasks can be run
- Designed for multi-project builds which can be quite large
- Incremental builds
  - Intelligently determines which parts of the build tree are up-to-date

    ⇨those parts will not be re-executed

Genymotion

- Much more efficient emulator
  - To test applications with best performance
  - User-friendly interface
- www.**genymotion**.com

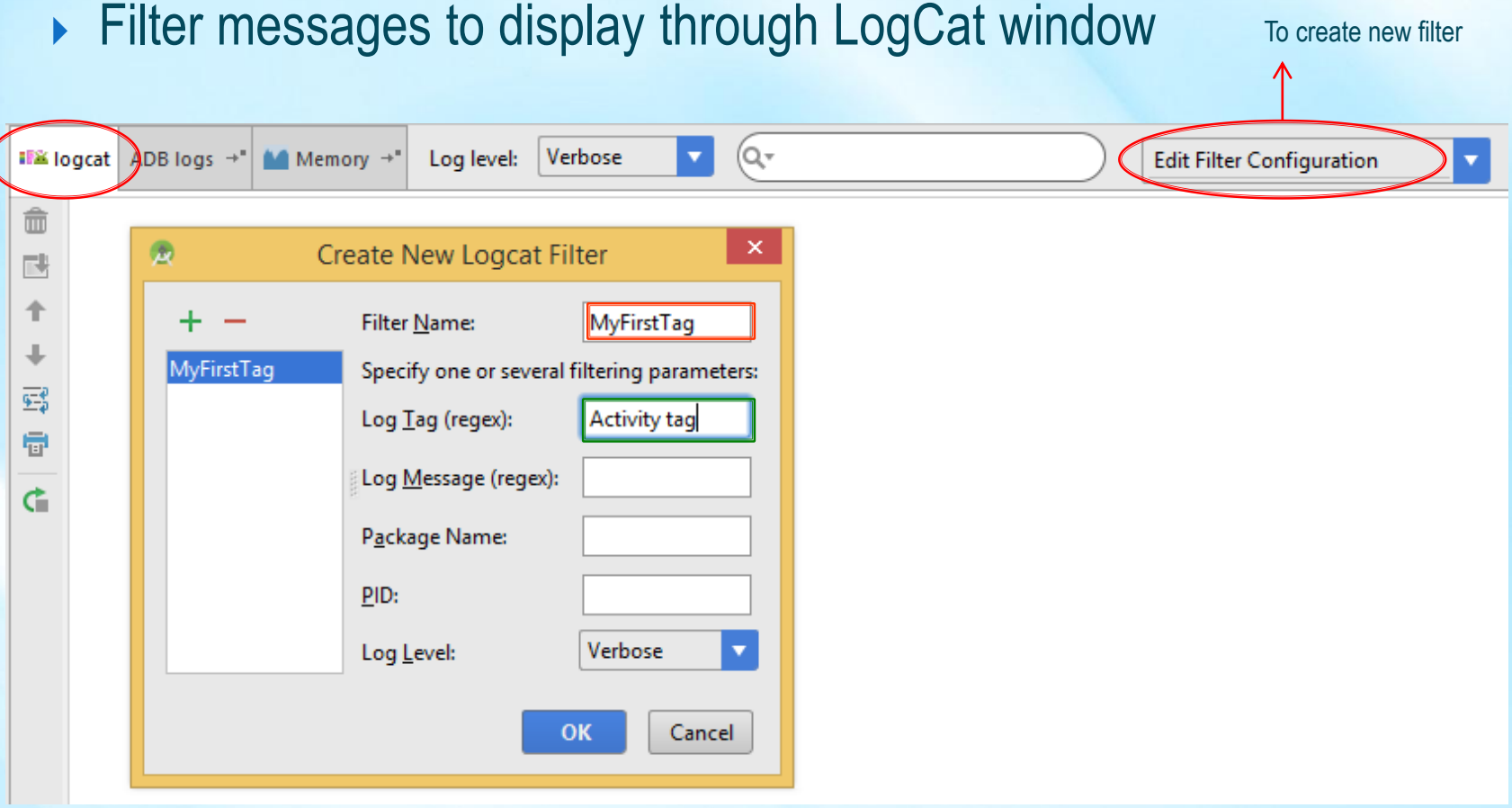
LogCat

- Commonly used to debug an android application
- Through **android.util.Log** class
  - Using **Log.i** ("Tag Id", "Message to display in the LogCat window")
  - E.g,

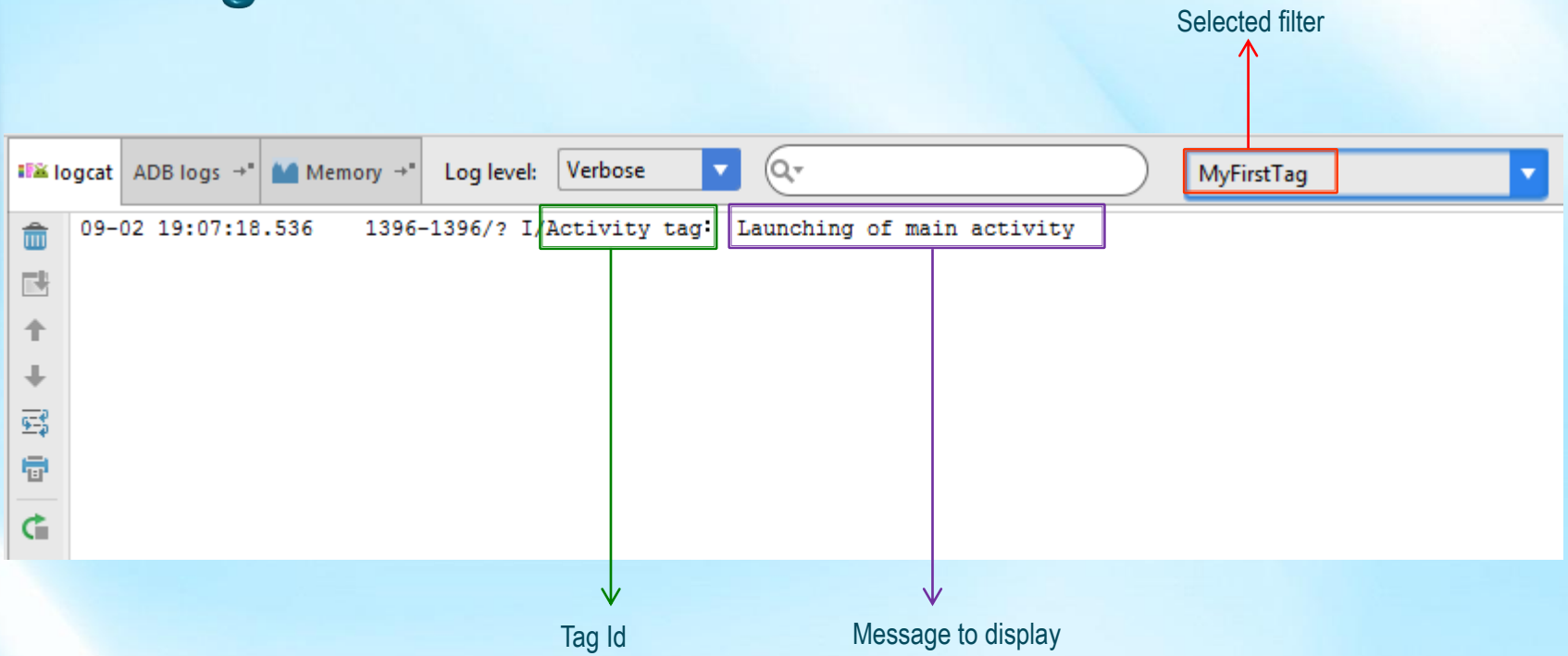
```
Log.i("Activity tag","Launching of main activity");
```

LogCat

- Filter messages to display through LogCat window



LogCat


Selected filter
logcat
ADB logs
Memory
Log level:
Verbose
MyFirstTag
09-02 19:07:18.536 1396-1396/? I/Activity tag:
Launching of main activity
Tag Id
Message to display

Webography

- www.android.com
- developer.android.com
  - http://developer.android.com/training/index.html