

# MOBILE DEVELOPMENT

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ANDROID DEVELOPMENT INTRODUCTION  
(BASED ON CIS470 OF CLEVELAND STATE UNIVERSITY)

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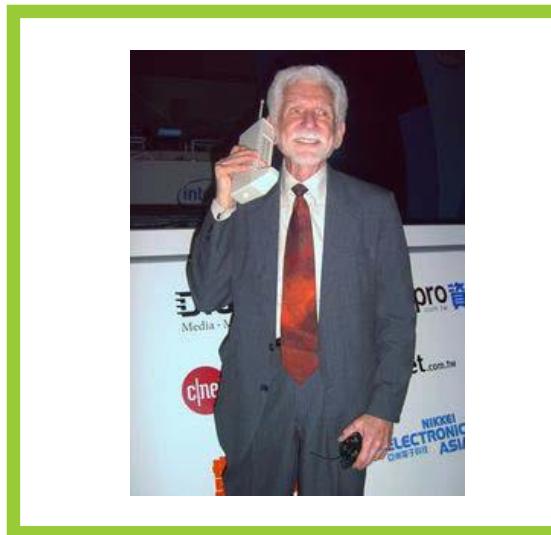
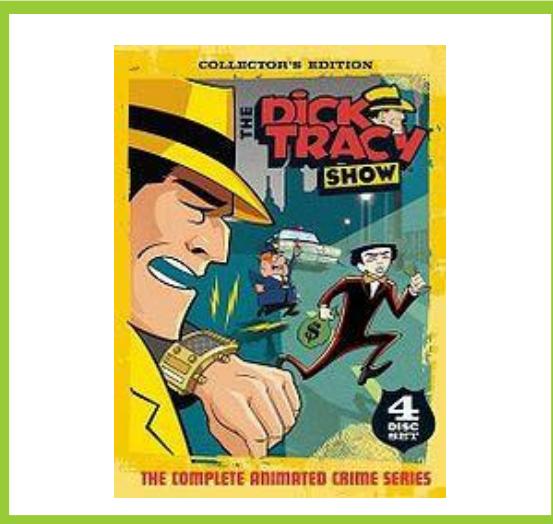
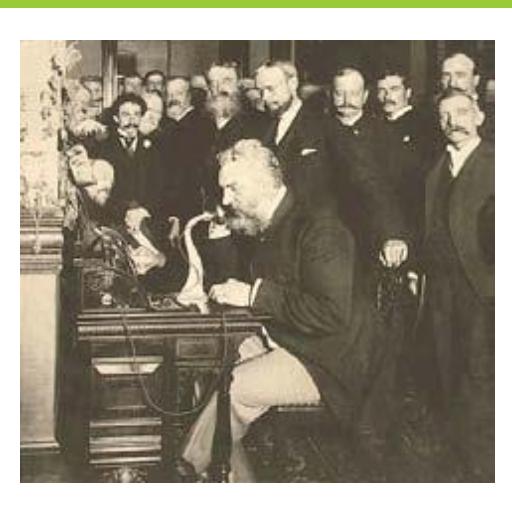
# MOBILE PHONE EVOLUTION

In 1876, Alexander Graham Bell became the first to receive a patent for the electric phone

In 1936, Alfred Gross. Case Tech OH (Case Western Reserve University). Invented/Patented Walkie-talkie, CB radio, Telephone Pager

In 1975, Dr. Martin Cooper invented first commercial portable Motorola radio phone

In 2007, iPhone and Android appeared



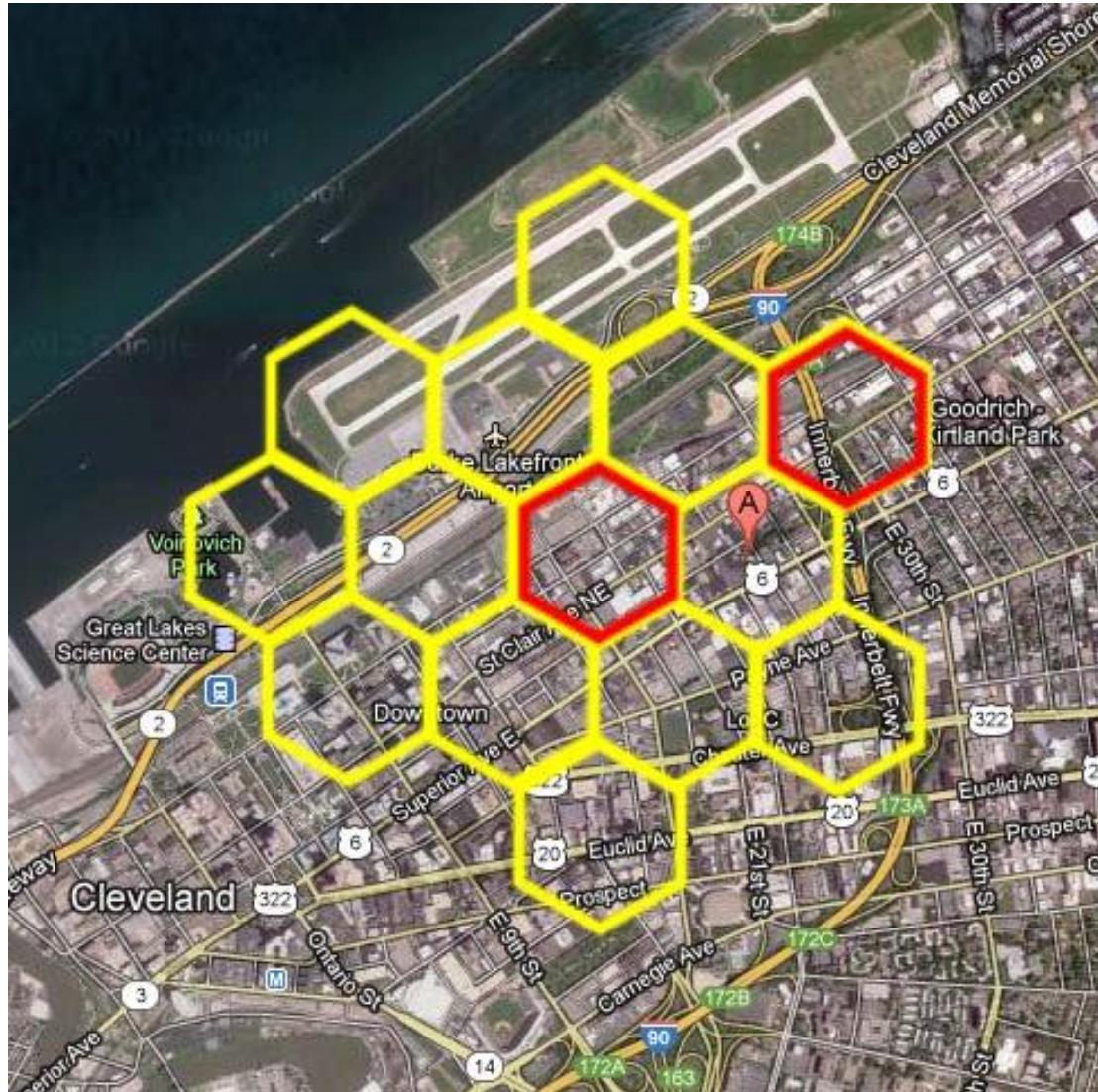
# MOBILE PHONE EVOLUTION

## (What is inside a smart cellular phone?)

Smart cellular phone  $\geq$  radio + computer



Industries  $\leftarrow \Sigma$  Software + telecom + semiconductor + marketing



## MOBILE PHONE EVOLUTION (Reusing cell phone frequencies)

The main idea behind cellular communications is the division of a large city into small areas called cells each hosting a Base-Station

Base-Stations operate with just enough power to reach only the users inside their individual cells

Each hexagonal cell covers approximate 10 square miles ( $26 \text{ km}^2$ )

Base stations use low-power transmitters, so the same frequencies can be reused in non-contiguous cells

# SOFTWARE: WHAT IS ANDROID?

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Android OS is an open-source Linux-based operating system for mobile devices

It is being developed by the Open Handset Alliance and Google Inc

The operating system has several native applications supporting telephony, messaging, etc.

3<sup>rd</sup> party Java developers can use Android API to extend functionality of the devices

Google provides an on-line electronic market for third-party developers to sell-distribute their applications

Open Handset Alliance is a consortium of 80+ technology and mobile business companies

Quoting from [www.OpenHandsetAlliance.com](http://www.OpenHandsetAlliance.com) site (2/25/2012)

Today, there are 1.5 billion television sets in use around the world. 1 billion people are on the Internet. But nearly 3 billion people have a mobile phone, making it one of the world's most successful consumer products. Building a better mobile phone would enrich the lives of countless people across the globe. The Open Handset Alliance™ is a group of mobile and technology leaders who share this vision for changing the mobile experience for consumers.

# SOFTWARE: WHAT IS ANDROID?

## (Open handset alliance members)

Mobile operators	Handset manufacturers	Semiconductor companies	Software companies	Commercialization companies
1. Bouygues Telecom China Mobile	1. Acer 2. Alcatel mobile phones	1. AKM 2. Audience	1. Ándago Ingeniería S.L. 2. ACCESS	1. Accenture
2. Communications Corporation	3. ASUSTeK Computer	3. ARM	3. Ascender	2. Aplix Corporation
3. China Telecommunications	4. CCI 5. Dell	4. Atheros Communications 5. Broadcom Corporation	4. Cooliris 5. eBay	3. Borqs
4. China United Network Communications	6. Foxconn International Holdings Limited	6. Cypress Semiconductor Corporation	6. Google	4. Intrinsic Software International
5. KDDI	7. Fujitsu limited	7. Freescale Semiconductor	7. LivingImage	5. L&T Infotech
6. LG Uplus	8. Garmin International	8. Gemalto	8. Myriad	6. Noser Engineering
7. NTT Docomo	9. Haier Telecom (Qingdao)	9. Imagination Technologies	9. MOTOYA	7. Sasken Communication Technologies
8. Softbank mobile	10. HTC	10. Intel Corporation	10. Nuance Communications	8. SQLStar International
9. Sprint Nextel	11. Huawei Technologies	11. Marvell Semiconductor	11. NXP Software	9. The Astonishing Tribe AB
10. T-Mobile	12. Kyocera	12. MediaTek	12. OMRON Software	10. Teleca AB
11. Telecom Italia	13. Lenovo Mobile	13. MIPS Technologies	13. PacketVideo	11. Wind River
12. Telefónica	Communication Technology	14. NVIDIA Corporation	14. SkyPop	12. Wipro Technologies
13. Telus	14. LG Electronics	15. Qualcomm	15. SONiVOX	
14. Vodafone	15. Motorola	16. Renesas Electronics Corporation	16. SVOX	
	16. NEC	17. ST-Ericsson	17. VisualOn	
	17. OPPO Mobile	18. Synaptics		
	Telecommunications	19. Texas Instruments Incorporated		
	18. Pantech	20. Via Telecom		
	19. Samsung Electronics...			

# SOFTWARE: WHAT IS ANDROID?

## (The mobile revolution)

Electronic tools commonly carried by a typical business warrior

Not so long ago ...	Today
<ol style="list-style-type: none"><li>1. Phone</li><li>2. Pager</li><li>3. PDA Organizer</li><li>4. Laptop</li><li>5. MP3 Portable music player</li><li>6. Wired modem</li><li>7. No internet access / limited access</li></ol>	<ol style="list-style-type: none"><li>1. Smartphone</li><li>2. Laptop</li></ol>

Tomorrow?

I want my 2015 Smartphone to be: Phone, Pager, PDA Organizer, high quality camera, laptop, cash, ...

# SOFTWARE: WHAT IS ANDROID?

## (Android vs. OS competitors)

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1. Apple
2. Microsoft
3. Nokia Symbian
4. Palm & webOS
5. Research in motion



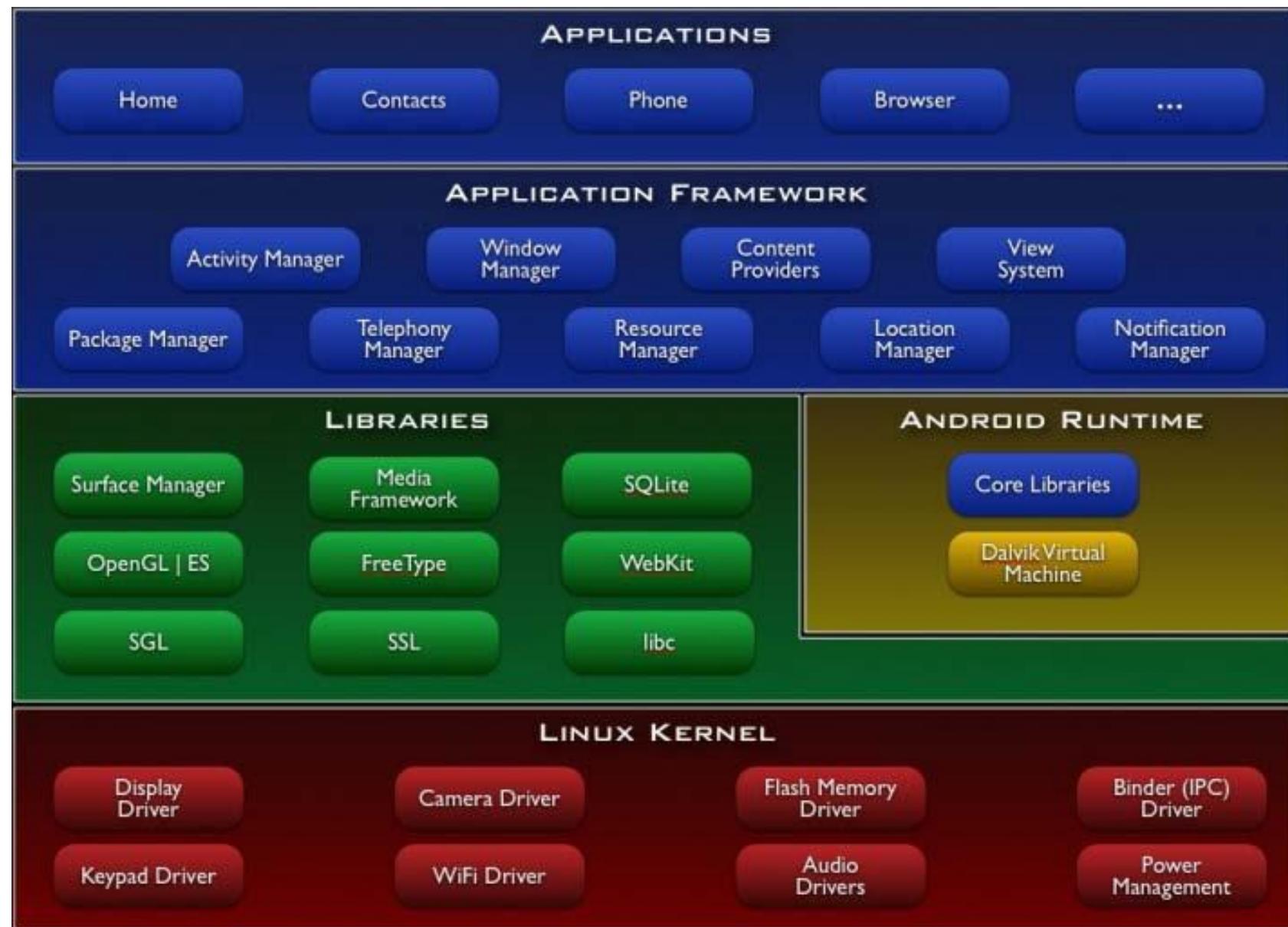
# SOFTWARE: WHAT IS ANDROID?

## (The mobile revolution)

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### Android Software/Hardware Components

- Dalvik virtual machine (soon to be replaced by ART )
- Integrated browser (WebKit)
- Graphic Capabilities (hardware acceleration)
- SQLite for structured data storage
- Media support (audio/video)
- GSM Telephony (hardware dependent)
- Bluetooth, EDGE, 3G, 4G, NFC, and Wi-Fi (hardware manufacturer dependent)
- Camera, GPS, compass, accelerometer, gyroscope, proximity/ambient light, barometric pressure, fingerprint reader, heart rate sensor (hardware dependent)
- Software Development Tools & Application framework (device emulator, debugging, profiling, plugin for the Eclipse IDE, resource managers, Android Studio)



# ANDROID'S SOFTWARE ARCHITECTURE

1. Software Layers: <https://www.youtube.com/watch?v=QBGFUs9mQYY>
2. Application's Life Cycle: <https://www.youtube.com/watch?v=fL6gSd4ugSI&feature=channel>
3. Android's API: <https://www.youtube.com/watch?v=MPukbH6D-IY&feature=channel>

4. Android Application Framework: <https://sites.google.com/site/inside-the-android-application-framework>
5. Introduction to Android: [https://www.youtube.com/watch?v=x1ZZ-R3p\\_w8](https://www.youtube.com/watch?v=x1ZZ-R3p_w8)
6. Dalvik Virtual Machine Internals: <https://www.youtube.com/watch?v=ptjedOZEXPM>

# ANDROID INTENTS

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An Intent is a request for services offered by an Android based device

An Intent is made up of various pieces including:

- desired action or service
- data
- category of component that should handle the intent and instructions on how to launch a target activity

Action	Data
The general action to be performed, such as: ACTION_VIEW, ACTION_EDIT, ACTION_MAIN, etc.	The data to operate on, such as a person record in the contacts database, expressed as a Uri

# ANDROID INTENTS (Some examples)

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Some examples of Intent's action/data pairs are:

- ACTION\_VIEW content://contacts/1 -- Display information about the person whose identifier is "1".
- ACTION\_DIAL content://contacts/1 -- Display the phone dialer with the person filled in.
- ACTION\_VIEW tel:123 -- Display the phone dialer with the given number filled in
- ACTION\_DIAL tel:123 -- Display the phone dialer with the given number filled in.
- ACTION\_EDIT content://contacts/1 -- Edit information about the person whose identifier is "1".
- ACTION\_VIEW content://contacts/ -- Display a list of people, which the user can browse through.

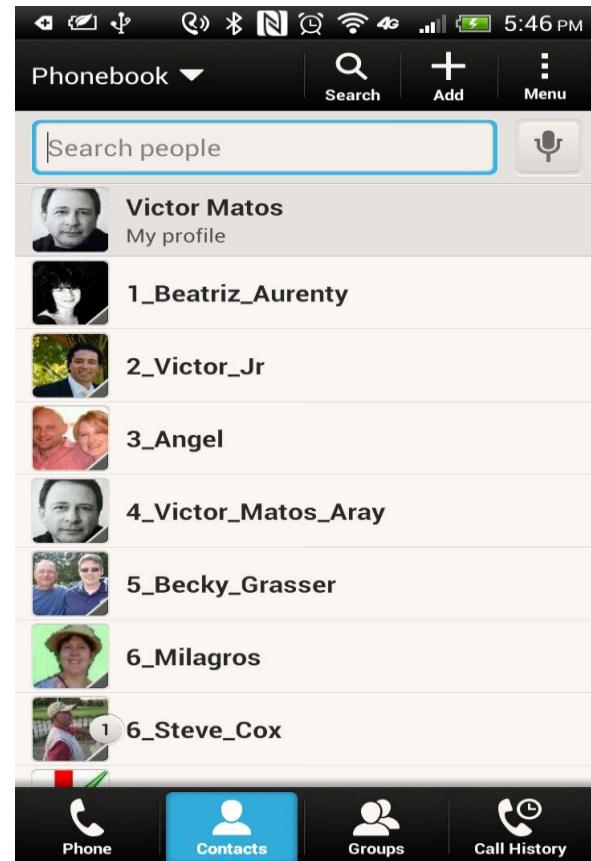
The following code fragment calls an Intent whose job is to invoke a built-in task (ACTION\_VIEW) and explore the Contacts available in the phone.

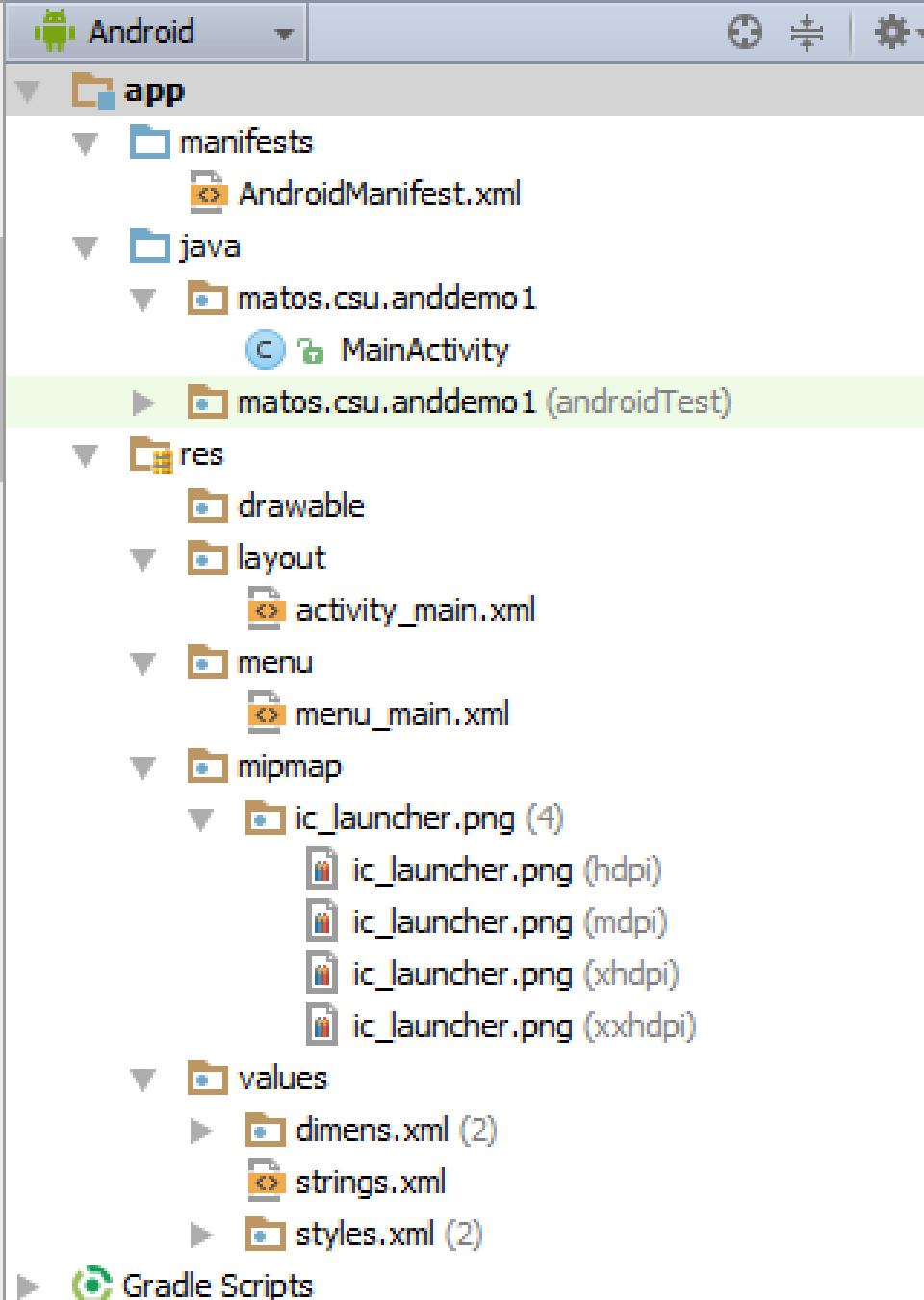
```
Intent myIntent = new Intent(Intent.ACTION_VIEW, Uri.parse("content://contacts/people"));  
startActivity(myIntent);
```

# ANDROID INTENTS (Java + Built-in intent)

Java class including invocation to an Intent to display Contacts

```
public class AndDemo1 extends Activity {  
    /** show contact list */  
    @Override  
    public void onCreate(Bundle savedInstanceState) {  
        super.onCreate(savedInstanceState);  
        setContentView(R.layout.main);  
        Intent myIntent = new Intent(Intent.ACTION_VIEW,Uri.parse("content://contacts/people"));  
        startActivity(myIntent);  
    }  
}
```





# DISSECTING AN ANDROID APPLICATION

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Structure of a typical Android application (Android studio)

Every application must have an `AndroidManifest.xml` file in its root directory.

The manifest presents essential information about the application to Android system, for instance it has an entry for each activity, library request, and special permissions needed to assemble the app.

# DISSECTING AN ANDROID APPLICATION

This is a list of the <XML-elements> allowed in the Manifest file

1. <action>
2. <activity>
3. <activity-alias>
4. <application>
5. <category>
6. <data>
7. <grant-uri-permission>
8. <instrumentation>
9. <intent-filter>
10. <manifest>
11. <meta-data>
12. <permission>
13. <permission-group>
14. <permission-tree>
15. <provider>
16. <receiver>
17. <service>
18. <uses-configuration>
19. <uses-library>
20. <uses-permission>
21. <uses-sdk>

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android" package="matos.earthquake" android:versionCode="1" android:versionName="1.0.0">
<application android:icon="@drawable/yellow_circle" android:label="@string/app_name">
<activity android:name=".AndQuake" android:label="@string/app_name">
<intent-filter>
<action android:name="android.intent.action.MAIN" />
<category android:name="android.intent.category.LAUNCHER" />
</intent-filter>
</activity>
<activity android:name=".SatelliteMapping" />
<service android:name="AndQuakeService" android:enabled="true" />
<receiver android:name="AndQuakeAlarmReceiver" >
<intent-filter>
<action android:name = "ALARM_TO_REFRESH_QUAKE_LIST"/>
</intent-filter>
</receiver>
</application>
<uses-library android:name="com.google.android.maps" />
<uses-permission android:name="android.permission.INTERNET" />
</manifest>
```

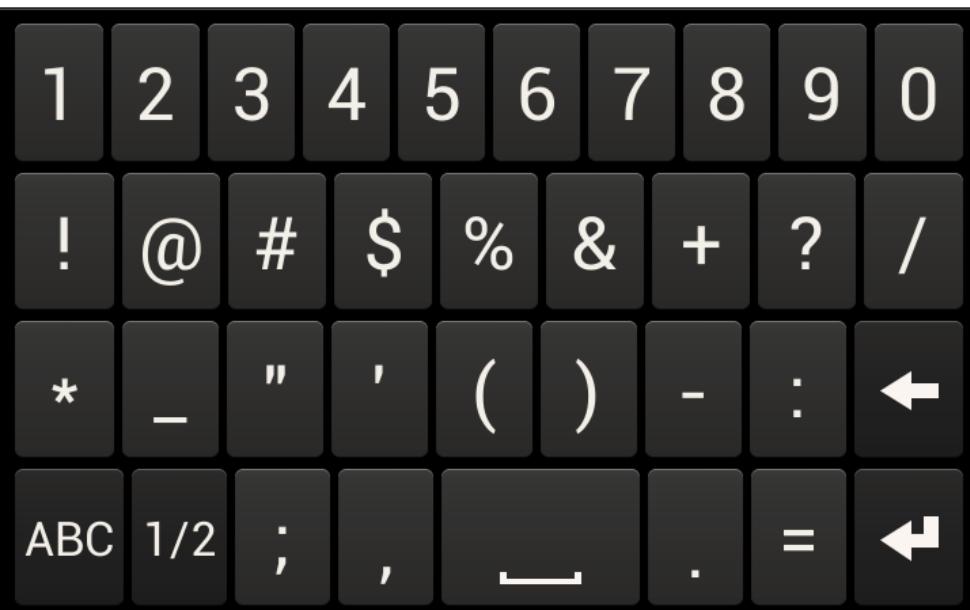
US Dollars

Euros

Colon CR

Clear

Convert



# EXAMPLES (Currency converter)

Implementing a currency converter: USD → Euro → Colon (CR)

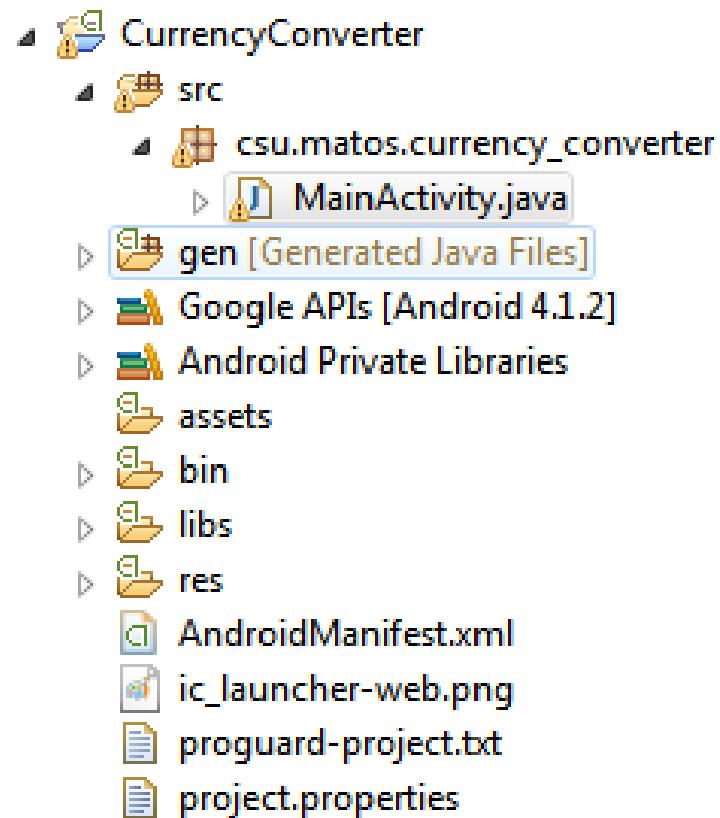
Note:

- Naive implementation using a fixed
- Exchange rate:
  - 1 Costa Rican Colon = 0.0019 U.S. dollars
  - 1 Euro = 1.35 U.S. dollars

# EXAMPLES (Currency converter)

---

```
package csu.matos.currencyconverter;
import android.app.Activity;
import android.os.Bundle;
import android.view.View;
import android.view.View.OnClickListener;
import android.widget.Button;
import android.widget.EditText;
public class Currency1 extends Activity {
    //USA money format (12 digits, 2 decimals)
    DecimalFormat usaDf = new DecimalFormat("###,###,###,###.##");
    // naive currency converter (USD to Euros & Colones)
    private final double EURO2USD = 1.35;
    private final char EUROSYM = '\u20AC';
    private final double COLON2USD = 0.0019;
    private final char COLONSYM = '\u20A1';
    // GUI widgets
    Button btnConvert, btnClear;
    EditText txtUSDollars, txtEuros, txtColones;
```



# EXAMPLES (Currency converter)

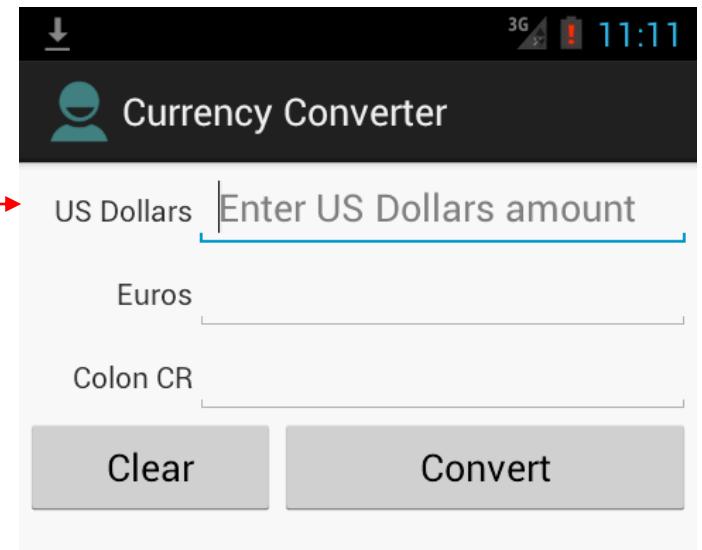
```
@Override  
public void onCreate(Bundle savedInstanceState) {  
    super.onCreate(savedInstanceState);  
    setContentView(R.layout.activity_main_linear);  
    // bind local controls to GUI widgets  
    txtUSDollars = (EditText)findViewById(R.id.txtUSDollars);  
    // make 'Euros' box not-editable (no user input)  
    txtEuros = (EditText)findViewById(R.id.txtEuros);  
    txtEuros.setInputType(EditorInfo.TYPE_NULL);  
    // No user input. See layout: android:editable="false"  
    txtColones = (EditText)findViewById(R.id.txtColones);  
    // attach click behavior to buttons  
    btnClear = (Button)findViewById(R.id.btnClear);  
    btnClear.setOnClickListener(new OnClickListener() {  
        // clear the text boxes  
        @Override  
        public void onClick(View v) {  
            txtColones.setText(""); txtEuros.setText(""); txtUSDollars.setText("");  
        }  
    }); // setOnClick...
```

```
// do the conversion from USD to Euros and Colones  
btnConvert = (Button) findViewById(R.id.btnConvert);  
btnConvert.setOnClickListener(new OnClickListener() {  
    @Override  
    public void onClick(View v) {  
        try {  
            String usdStr = txtUSDollars.getText().toString();  
            double usd = Double.parseDouble(usdStr);  
            String euros = EUROSYM + String.valueOf(usaDf.format(usd / EURO2USD));  
            String colones = COLONSYM + String.valueOf(usaDf.format(usd / COLON2USD));  
            txtEuros.setText(euros);  
            txtColones.setText(colones);  
        }  
        catch (NumberFormatException e) { /*ignore errors*/ }  
    }  
}); // setOnClick...  
// onCreate  
// class
```

# EXAMPLES (Currency converter – layouts)

LAYOUT: res/layout/activity\_main\_linear.xml

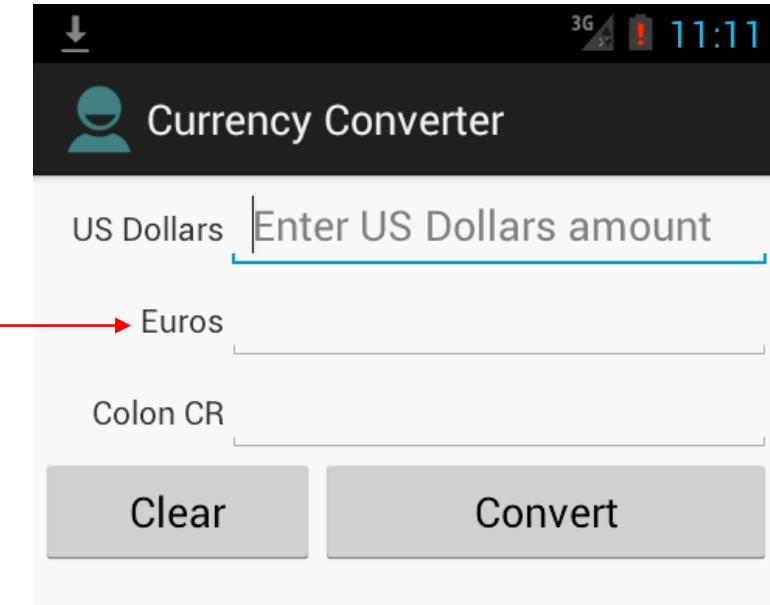
```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent" android:layout_height="match_parent"
    android:orientation="vertical" android:padding="2dp" >
<LinearLayout android:layout_width="match_parent" android:layout_height="wrap_content" >
<TextView android:id="@+id/textView2" android:layout_width="wrap_content"
    android:layout_height="wrap_content" android:ems="5"
    android:gravity="right" android:text="US Dollars" />
<EditText android:id="@+id/txtUSDollars" android:layout_width="wrap_content"
    android:layout_height="wrap_content" android:layout_weight="2"
    android:hint="Enter US Dollars amount" android:inputType="numberDecimal" />
<requestFocus />
</LinearLayout>
...
```



# EXAMPLES (Currency converter – layouts)

LAYOUT: res/layout/activity\_main\_linear.xml

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent" android:layout_height="match_parent"
    android:orientation="vertical" android:padding="2dp" >
<LinearLayout android:layout_width="match_parent" android:layout_height="wrap_content" >
    ...
</LinearLayout>
<LinearLayout android:layout_width="match_parent" android:layout_height="wrap_content" >
    <TextView android:id="@+id/textView3" android:layout_width="wrap_content"
        android:layout_height="wrap_content" android:ems="5"
        android:gravity="right" android:text="Euros" />
    <EditText android:id="@+id/txtEuros" android:layout_width="wrap_content"
        android:layout_height="wrap_content" android:layout_weight="2" />
</LinearLayout>
...
...
```

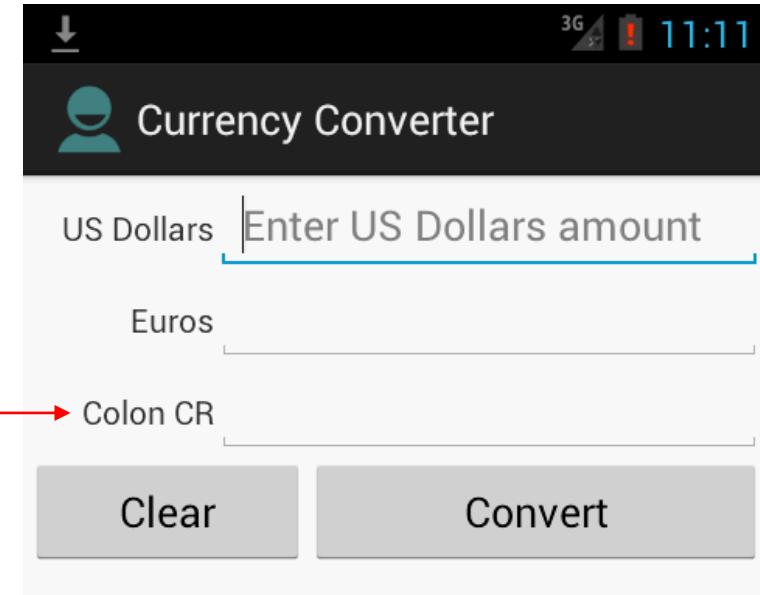


# EXAMPLES (Currency converter – layouts)

LAYOUT: res/layout/activity\_main\_linear.xml

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent" android:layout_height="match_parent"
    android:orientation="vertical" android:padding="2dp" >
<LinearLayout android:layout_width="match_parent" android:layout_height="wrap_content" >
    ...
</LinearLayout>
<LinearLayout android:layout_width="match_parent" android:layout_height="wrap_content" >
    ...
</LinearLayout>
<LinearLayout android:layout_width="match_parent" android:layout_height="wrap_content" >
    <TextView android:id="@+id/textView4" android:layout_width="wrap_content"
        android:layout_height="wrap_content" android:ems="5"
        android:gravity="right" android:text="Colon CR" />
    <EditText android:id="@+id/txtColones" android:layout_width="wrap_content"
        android:layout_height="wrap_content" android:layout_weight="2" android:editable="false" />
</LinearLayout>
...

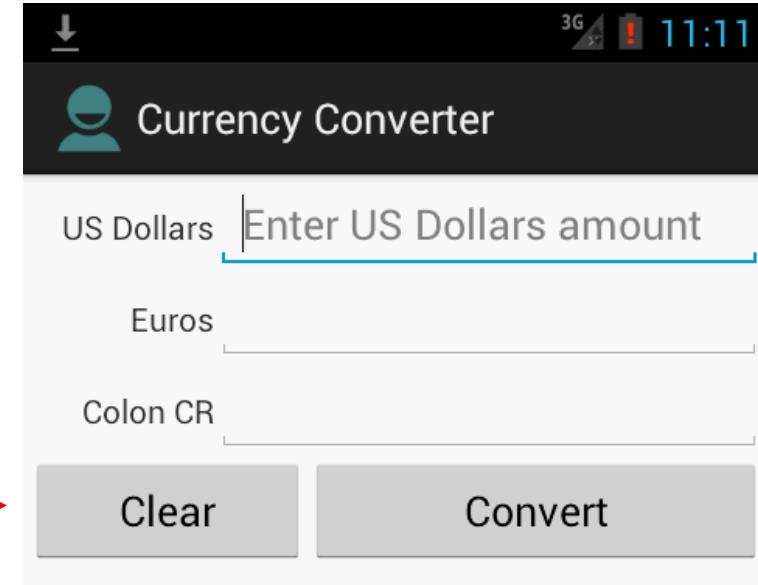
```



# EXAMPLES (Currency converter – layouts)

LAYOUT: res/layout/activity\_main\_linear.xml

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent" android:layout_height="match_parent"
    android:orientation="vertical" android:padding="2dp" >
<LinearLayout android:layout_width="match_parent" android:layout_height="wrap_content" >
    ...
</LinearLayout>
<Button android:id="@+id/btnClear" android:layout_width="wrap_content"
    android:layout_height="wrap_content" android:layout_weight="1" android:text="Clear" />
<Button android:id="@+id/btnConvert" android:layout_width="wrap_content"
    android:layout_height="wrap_content" android:layout_weight="2" android:text="Convert" />
</LinearLayout>
```



# EXERCISES

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**Survey** and **analyze** the size of market year...

- Mobile search market
- Content accessed from smartphone
- Mobile market compared to other technologies, such as papers, internet or TV
- Mobile operating system market share
- Some new products-ideas for 2020...
- Cell-Phone diffusion

Some references:

- <https://techcrunch.com/>
- <https://www.openautoalliance.net/>
- <http://gizmodo.com/>
- ...