



Lesson 1

Android Development Introduction

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Mobile Phone Evolution

1876

- **Alexander Graham Bell** became the first to receive a patent for the electric phone.

1936

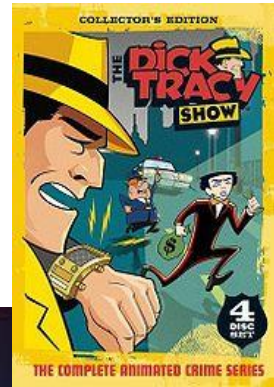
- **Alfred Gross.** Case Tech OH (Case Western Reserve University). Invented/Patented Walkie-talkie, CB radio, Telephone Pager.

1975

- **Dr. Martin Cooper** invented first commercial portable Motorola radio phone

2007

- iPhone
- Android



Chester Gould



Hardware: What is inside a Smart Cellular Phone?

Oversimplifying...

Smart cellular phone \geq radio + computer*



Industries $\leftarrow \sum$ Software + Telecom + Semiconductor + Marketing

Software: What is Android?

- 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 a number of native applications supporting telephony, messaging, emailing, contact management, calendar, entertainment, multimedia experience, location services, mapping, social interaction, etc.
- Third party Java developers can use the Android API to extend the functionality of the devices.
- Google provides an on-line electronic market for third-party developers to sell-distribute their custom applications.

What is the Open Handset Alliance?

A consortium of 80+ technology and mobile business companies.

Quoting from **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 ...”

Open Handset Alliance Members



Operators	Software Co.	Commercializat.	Semiconductor	Handset Manf
Bouygues Tele	Ascender Corp.	Accenture	ARM	ACER
China Mobile	Borqs	Aplix	Atheros	ASUS
China Telec.	eBay	Astonishing Tribe	Audience	Dell
China Unicom	Esmertec	Noser Engineering	Broadcom Corp.	Garmin
KDDI Corp.	Google	Omron Software	CSR Plc.	HTC
NTT DoCoMo	LivingImage	Sasken	Cypress	Kyocera
Softbank	NMS Comm.	Teleca	Freescale	Lenovo Mobile
Sprint Nextel	Nuance Comm.	...	Gemalto	LG
Telecom Italia	PacketVideo	Wind River Systems	Intel Corp.	Motorola
Telefónica	SkyPop		Marvell Tech	NEC
Telus	...		MediaTek	
T-Mobile	SONiVOX		MIPS Techn.	Samsung
...			Nvidia Corp	Sharp
Vodafone			Qualcomm	...
			Renesas Corp	Sony Ericsson
			ST-Ericsson	...
			Synaptics	Toshiba
			Texas Instrum.	
			Via Telecom	

The Mobile Revolution



Electronic tools commonly carried by a typical business warrior

Not so long ago ...	Today
<ol style="list-style-type: none">1. Phone2. Pager3. PDA Organizer4. Laptop5. MP3 Portable music player6. Wired modem7. No Internet access / limited access	<ol style="list-style-type: none">1. Smartphone2. Laptop (perhaps!)

Tomorrow ?

The Mobile Revolution



Dreaming aloud

I want my 2018 Smartphone to be ...

1. Phone
2. Pager
3. PDA Organizer
4. High Quality Camera (still & video)
5. Portable music player
6. Portable TV / Video Player / Radio
7. Laptop
8. Play Station
9. GPS / Compass / Navigation (road & inside buildings)
10. Golf Caddy (ball retriever too)
11. Book Reader (I don't read, It reads to me with passion!)
12. Electronic key (Car / Home / Office)
13. Remote Control (Garage, TV, ...)
14. Credit Card / Driver's License / Passport / Airplane Ticket
15. Cash
16. Cook, house chores
17. Psychologist / Mentor / Adviser
18. Personal trainer
19. Dance instructor
20. ????

Android vs. OS Competitors

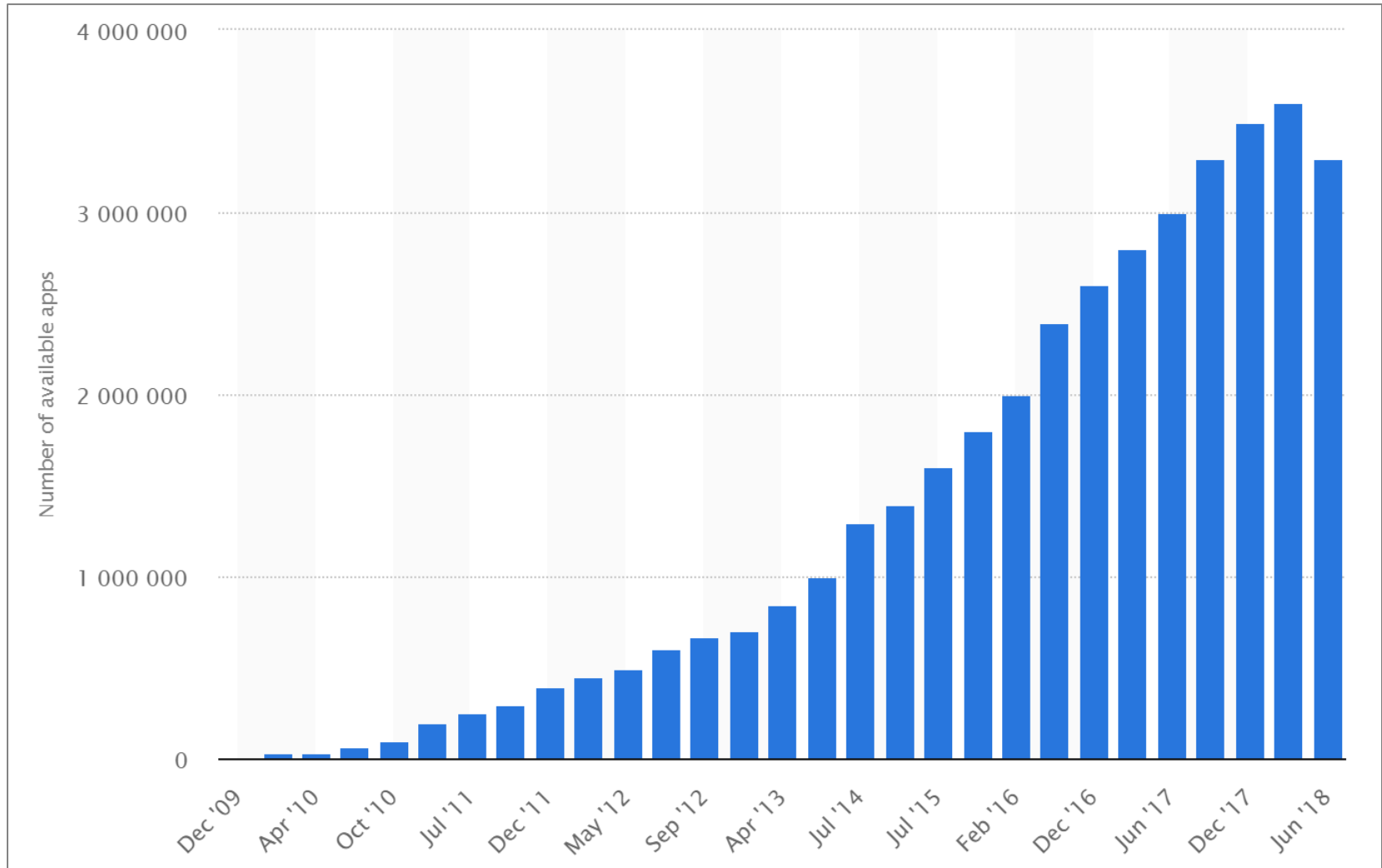


vs.

1. Apple Inc.
- ~~2. Microsoft~~
- ~~3. Nokia Symbian~~
- ~~4. Palm & webOS~~
- ~~5. Research In Motion~~

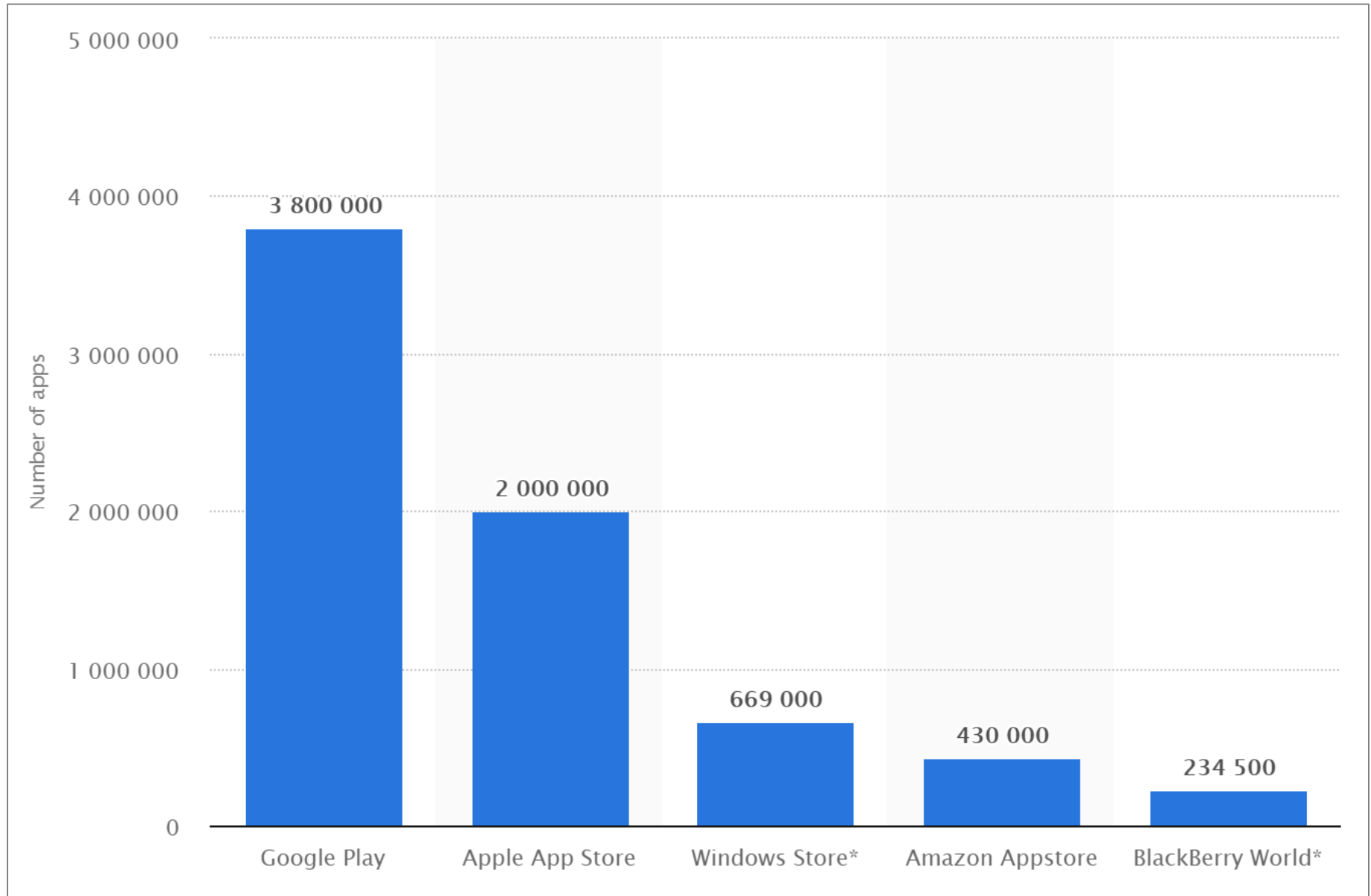


Number of Android applications



The number of available apps in the Google Play Store was most recently placed at **3.8 million** apps in March 2018

Number of apps available in leading app stores (Mar 2018)



Number of Android Devices



Android 
@Android



10 years and now over 2.5 billion active devices. Thanks for joining us on this journey. [#io19](#)



♡ 2,848 12:58 AM - May 8, 2019



💬 681 people are talking about this



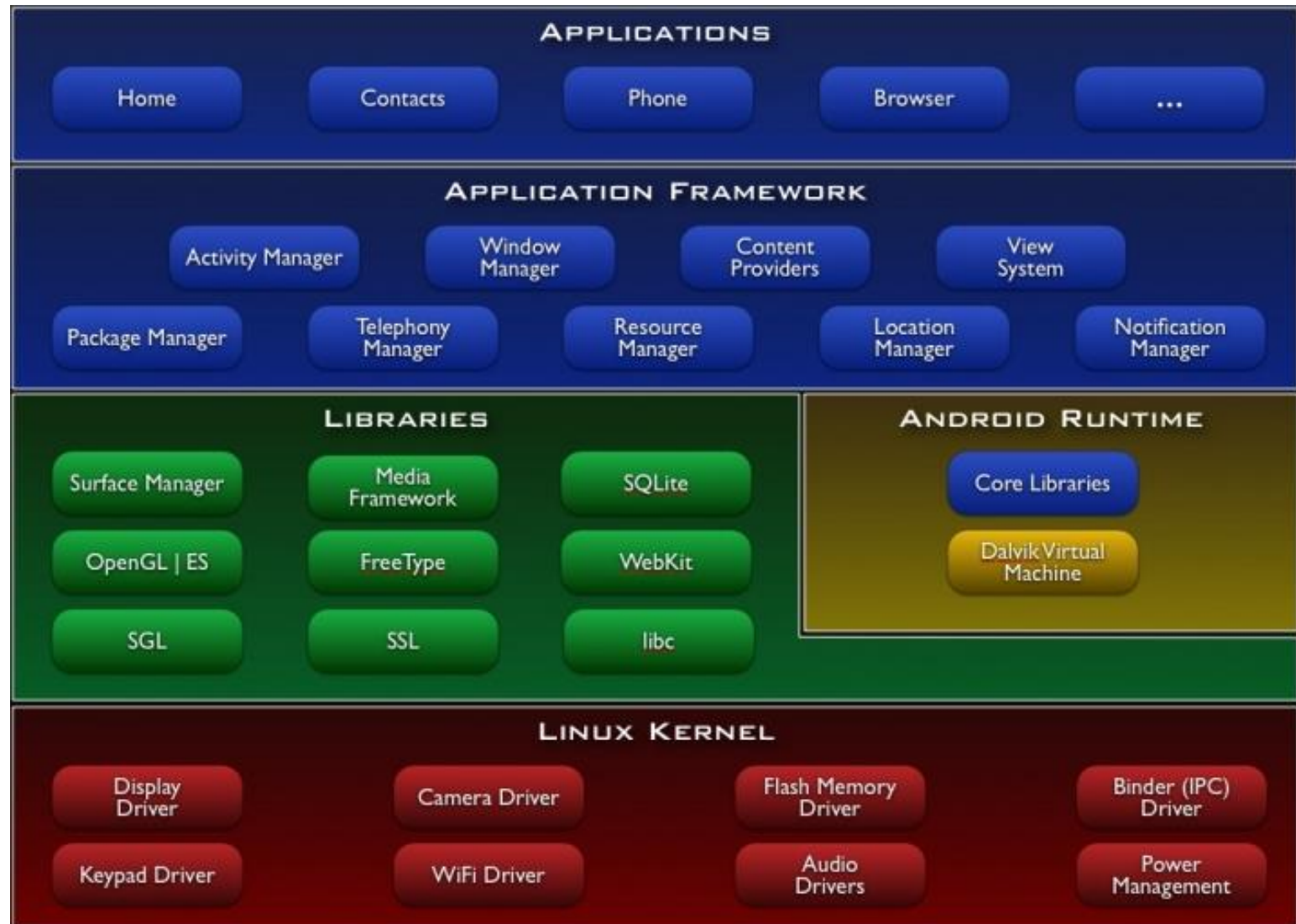
Type of Android Devices

- **Smartphone, Tablet**
- **Wear OS**
- **TV**
- **Android Auto**
- **Android Things**

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)

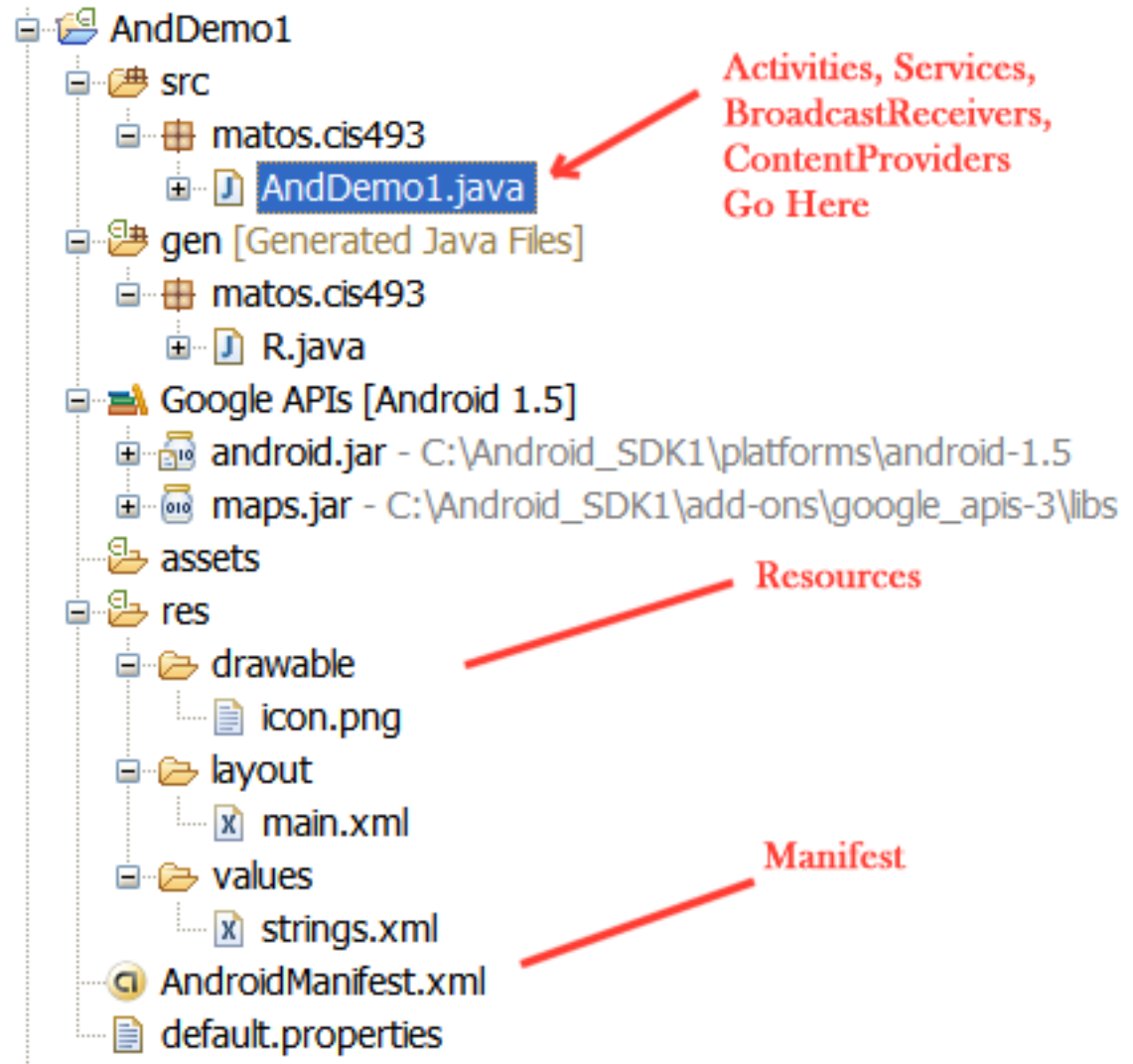
Android's Software Architecture



Dissecting an Android Application

Structure of a
typical Android
Application

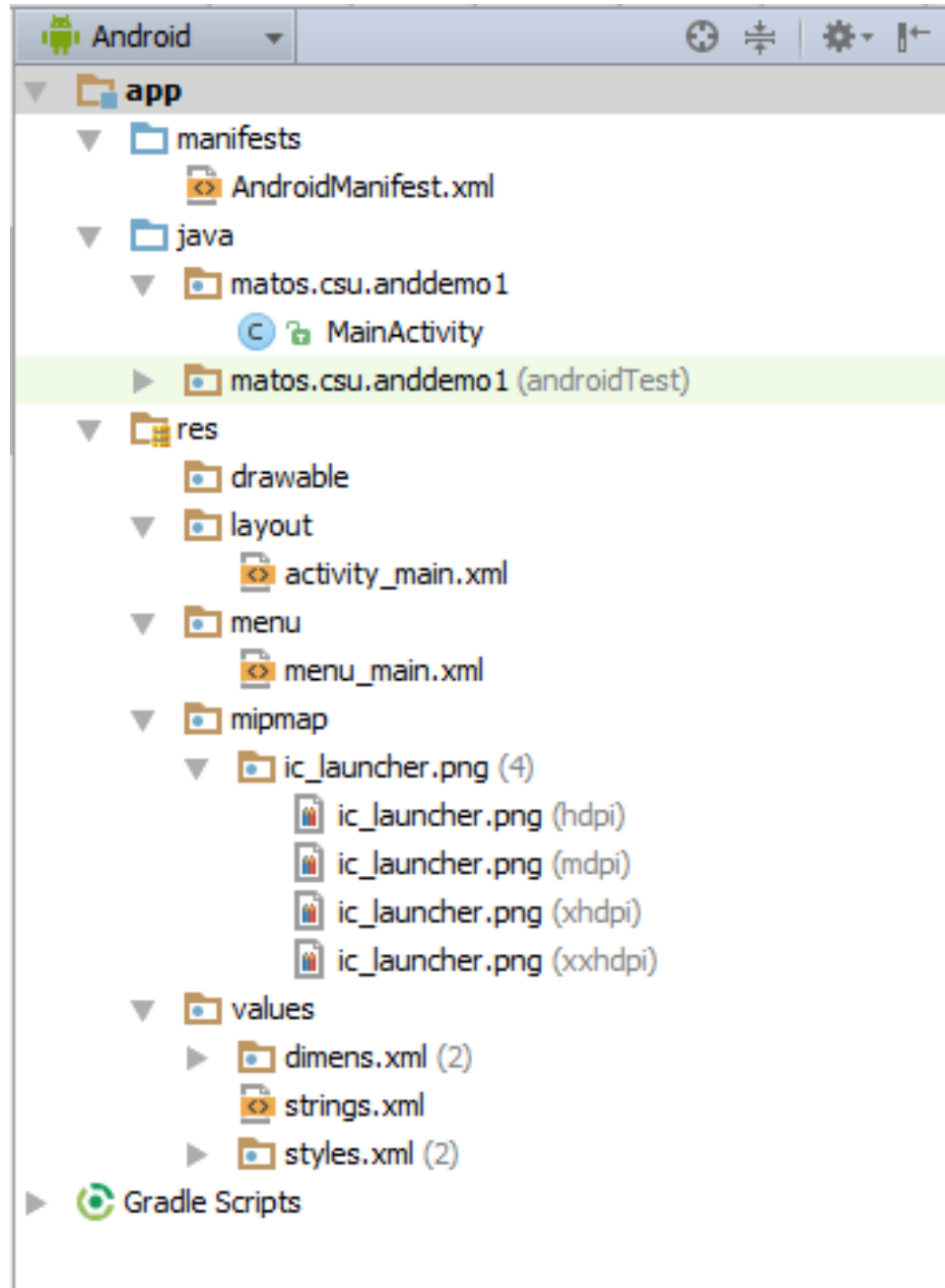
(Shown by Eclipse's
Project Explorer)



Dissecting an Android Application

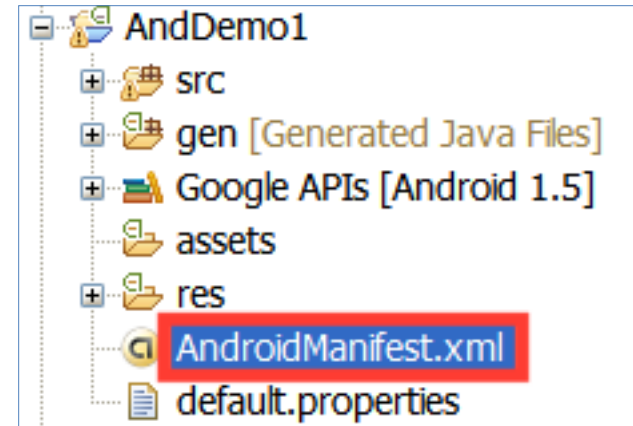
Structure of a
typical Android
Application

(Android Studio)



Android Manifest XML File

- Every application must have an [AndroidManifest.xml](#) file in its root directory.
- The manifest presents essential information about the application to the Android system, for instance it has an entry for each activity, library request, and special permissions needed to assemble the app.



Android Manifest XML File

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

<action>	<permission>
<activity>	<permission-group>
<activity-alias>	<permission-tree>
<application>	<provider>
<category>	<receiver>
<data>	<service>
<grant-uri-permission>	<uses-configuration>
<instrumentation>	<uses-library>
<intent-filter>	<uses-permission>
<manifest>	<uses-sdk>
<meta-data>	

Android Manifest XML File

```
<?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"> </activity>

        <service android:name="AndQuakeService" android:enabled="true" >
        </service>

        <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>
```

Example2. 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

The screenshot shows a mobile application interface for a currency converter. At the top, the status bar displays various icons and the time 11:27 AM. The app title 'Currency Converter' is at the top of the screen. Below the title, there are three input fields for currency conversion. The first field is labeled 'US Dollars' and contains the value '100'. The second field is labeled 'Euros' and contains the value '€74.07'. The third field is labeled 'Colon CR' and contains the value '₡52,631.58'. Below these fields are two buttons: 'Clear' and 'Convert'. At the bottom of the screen, there is a numeric keypad with digits 0-9, symbols like !, @, #, \$, %, &, +, ?, /, *, -, ", ', (,), -, :, and arrows for navigation.

From	To	Value
US Dollars	Euros	100
Euros	Colon CR	€74.07
Colon CR	US Dollars	₡52,631.58

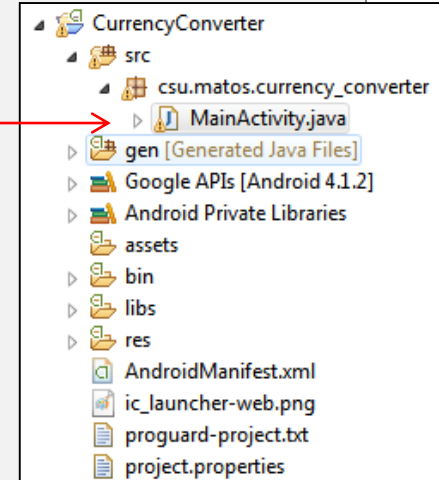
Example2. Currency converter

```
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;
    Button btnClear;
    EditText txtUSDollars;
    EditText txtEuros;
    EditText txtColones;
```



Example2. 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("");
        }
    });
});
```

Example2. Currency converter

```
// 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 = EUROS_SYM +
                String.valueOf(usd * EURO2USD);
            String colones = COLON_SYM +
                String.valueOf(usd * COLON2USD);
            txtEuros.setText(euros);
            txtColones.setText(colones);
        } catch (NumberFormatException e) {
            // ignore errors
        }
    }
}); // setOnClick...

} // onCreate

} // class
```


Example2. Currency converter

11:40 AM

Currency Converter

US Dollars

Euros

Colon CR

Clear Convert

11:27 AM

Currency Converter

US Dollars

Euros

Colon CR

Clear Convert

1 2 3 4 5 6 7 8 9 0

! @ # \$ % & + ? /

* _ " ' () - : ←

ABC 1/2 ; , _ . = →

▲ ▼ ◀ ▶

Example2. Currency converter

LAYOUT: res/layout/activity_main_linear.xml (1 of 3)

```
<?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" >

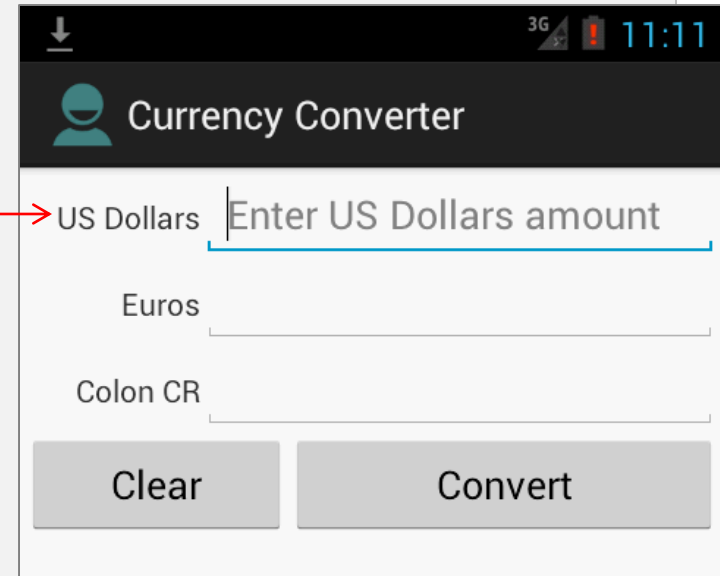
    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="wrap_content" >

        <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" />

    </LinearLayout>

    <requestFocus />
</LinearLayout>
```



Example2. Currency converter

LAYOUT: res/layout/activity_main_linear.xml (2 of 3)

```
<LinearLayout
    android:layout_width="match_parent"
    android:layout_height="wrap_content" >

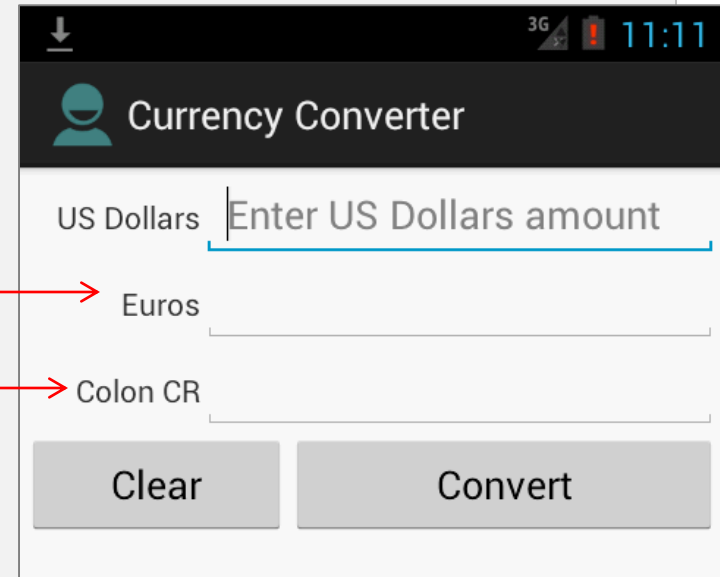
    <TextView
        android:id="@+id/textView3"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:ems="5"
        android:gravity="right"
        android:text="Euros" />

    <EditText
        android:id="@+id/txtEuros"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_weight="2" />

</LinearLayout>

<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" />
```



Example2. Currency converter

LAYOUT: res/layout/activity_main_linear.xml (3 of 3)

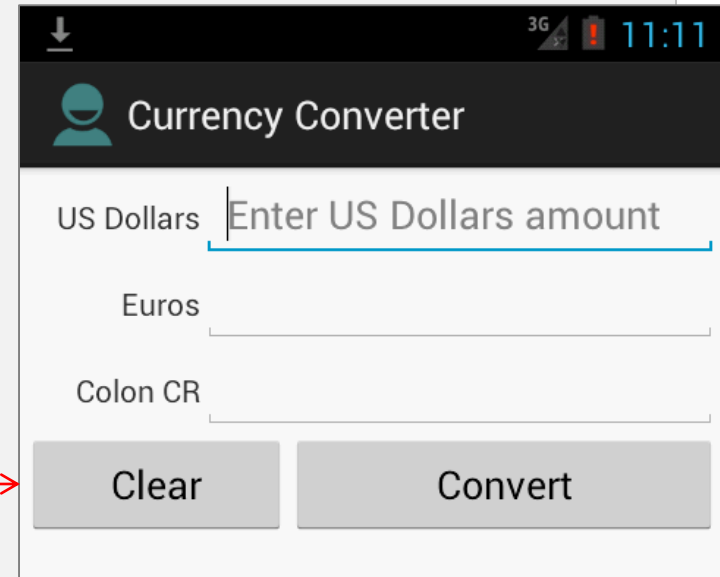
```
<EditText
    android:id="@+id/txtColones"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_weight="2"
    android:editable="false" />
</LinearLayout>

<LinearLayout
    android:layout_width="match_parent"
    android:layout_height="wrap_content" >

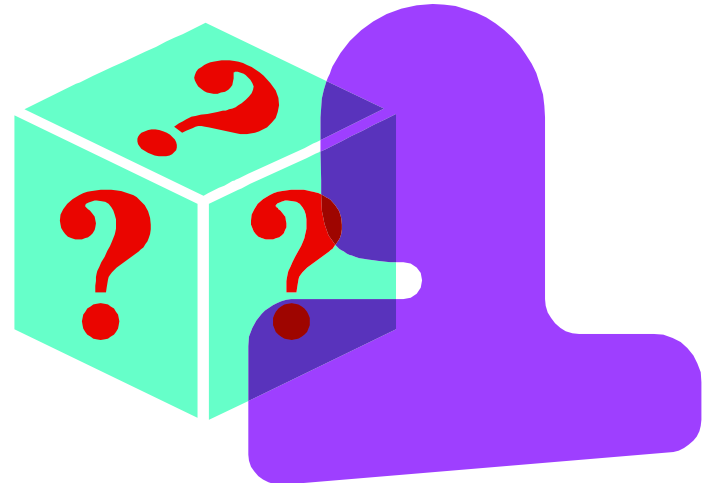
    <Button
        android:id="@+id/btnClear"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_weight="1"
        android:text="Clear" />

    <Button
        android:id="@+id/btnConvert"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_weight="2"
        android:text="Convert" />
</LinearLayout>

</LinearLayout>
```



Thanks for being here



Questions?

Mobile Software Development

