Intro to Android

Uniforum meeting @ IIT's Rice Campus

July. 2009

(by Roberto C. Serrano)

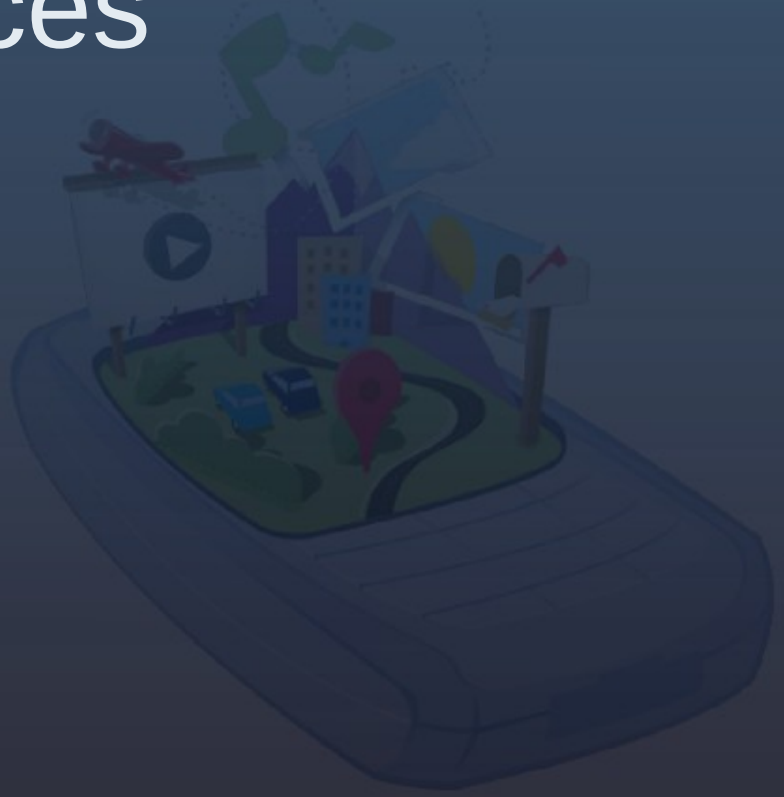
Who am I?

- Roberto C. Serrano
- Software engineer at Motorola
- Android Platform
- Multimedia and Graphics Team
- Developer Advocate for the Platform team
  - Community Initiatives and Engagement:
    - Flourish 2009
    - MADg
    - Chicago Android Developers group
- Newbie Android Developer
- Contact: ohrock@gmail.com or twitter.com/ohrock

In this presentation

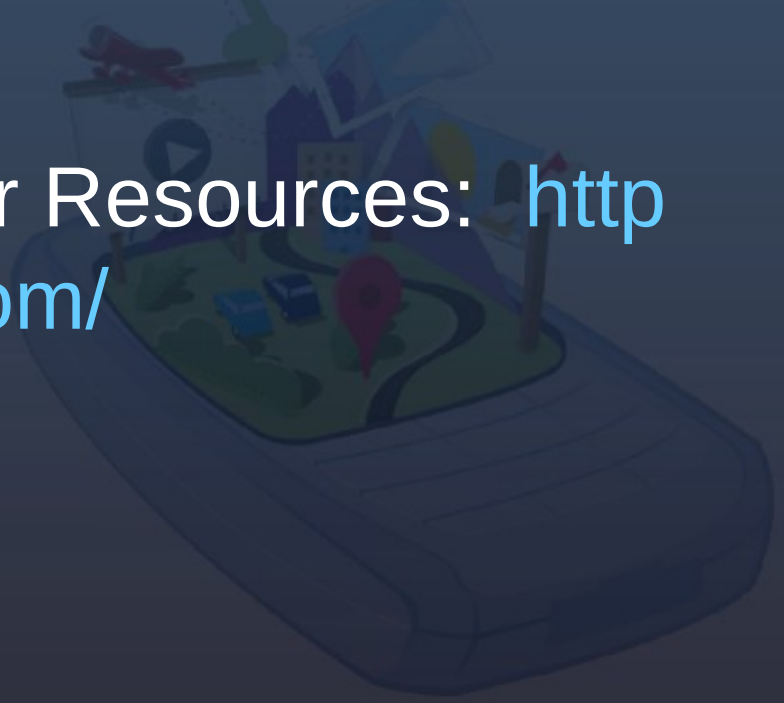
- How to Install the Android SDK
- Introduction to the Android Env.
  - Java View in Eclipse
  - The emulator
  - DDMS
- Introduction to the Android OS
- Quick intro to an Android App.
- Introduction to an android Activity/App.
  - Layouts
  - The manifest.xml
  - Intro. to Intents

Resources



Important Developer Resources:

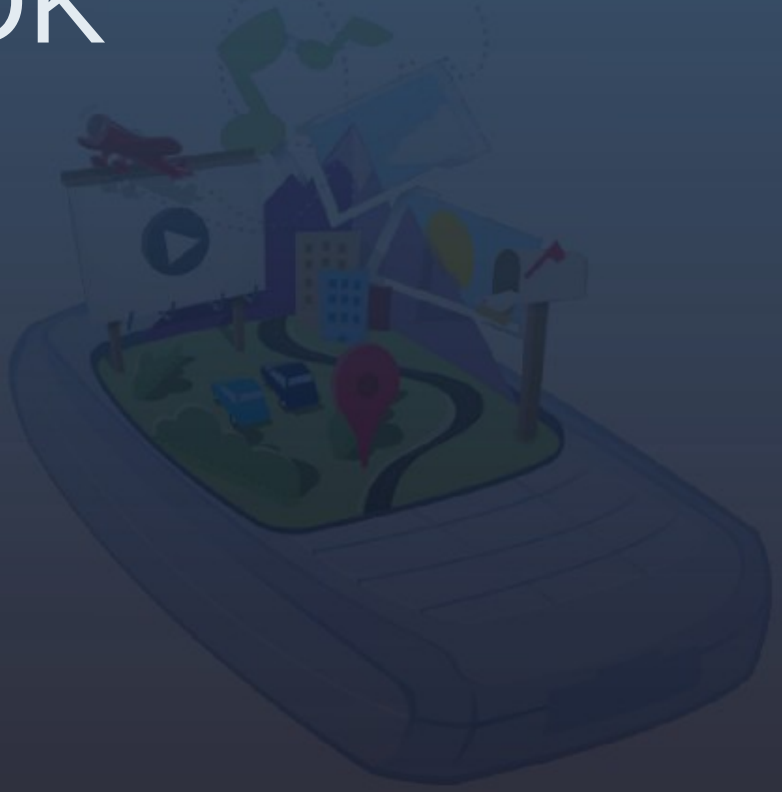
- SDK: http://developer.android.com
- Android Source: http://source.android.com/
- Moto Android Developer Resources: http://developer.motorola.com/



Additional Website

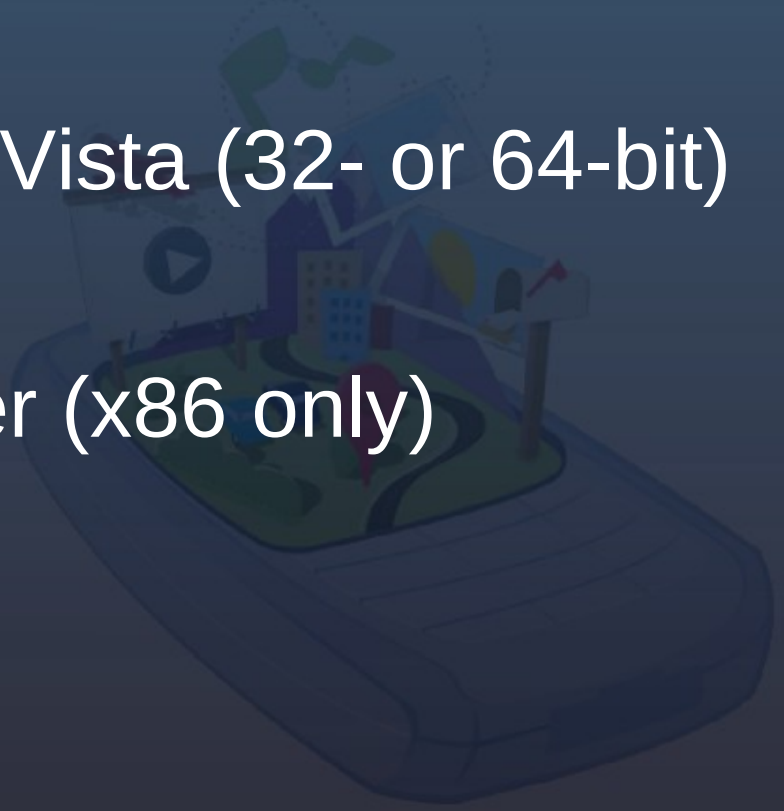
- Google groups: http://groups.google.com
  - Chicago Androids
  - Android Developers
  - android-platform

The SDK



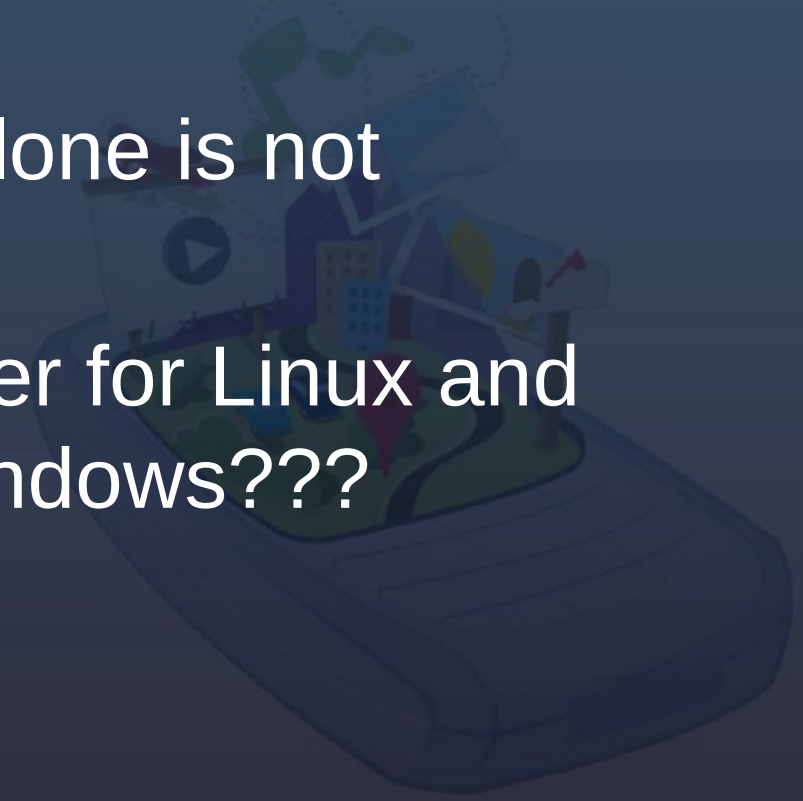
Supported Operating Systems

- Linux (tested on Linux Ubuntu Dapper Drake)
- Windows XP (32-bit) or Vista (32- or 64-bit)
- Mac OS X 10.4.8 or later (x86 only)



Pre install Requirements

- Eclipse 3.3 (Europa), 3.4 (Ganymede)
- Eclipse Classic IDE package is not supported.
- JDK 5 or JDK 6 (JRE alone is not sufficient)
- Apache Ant 1.6.5 or later for Linux and Mac, 1.7 or later for Windows???



Install SDK

- http://developer.android.com/sdk/1.5_r2/index.html

Download Android 1.5 SDK, Release 2

May 2009

Before downloading, please read the System Requirements document. As you start the download, you will also need to review and agree to the Terms and Conditions that govern the use of the Android SDK.

Platform	Package	Size	MD5 Checksum
Windows	android-sdk-windows-1.5_r2.zip	178346828 bytes	ba54ac6bda45921d442b74b6de6ff6a9
Mac OS X (intel)	android-sdk-mac_x86-1.5_r2.zip	169945128 bytes	f4e06a5194410243f213d0177713d6c9
Linux (i386)	android-sdk-linux_x86-1.5_r2.zip	165035130 bytes	1d3c3d099e95a31c43a7b3e6ae307ed3

For more information on this SDK release, read the Release Notes.

- Example I created directory called android...
- /home/neal/android/android-sdk-linux_x86-1.5_r1

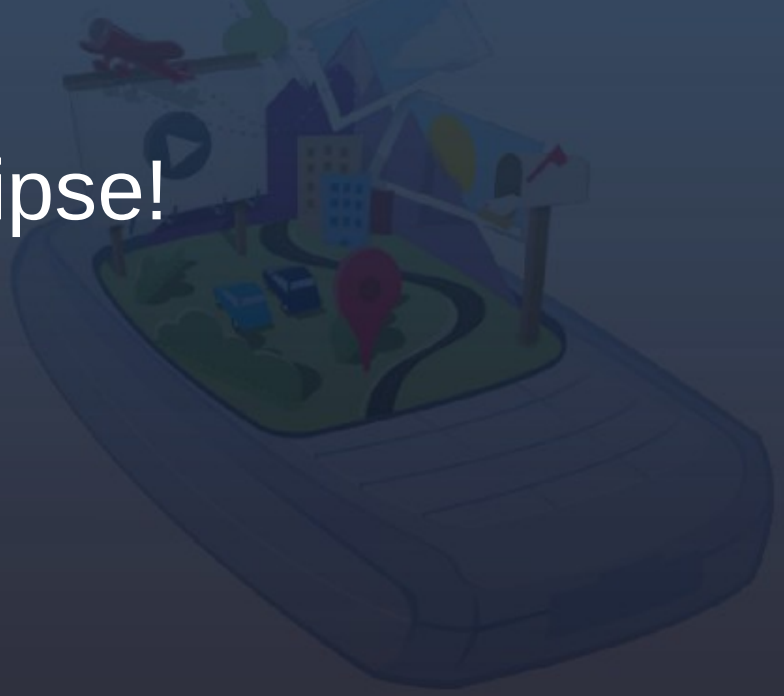
Setup development env.

- On Linux, edit your ~/.bash_profile or ~/.bashrc file. Look for a line that sets the PATH environment variable and add the full path to the tools/ directory to it. If you don't see a line setting the path, you can add one: export PATH=${PATH}:<your_sdk_dir>/tools
- On a Mac, look in your home directory for .bash_profile and proceed as for Linux. You can create the .bash_profile if you haven't already set one up on your machine.
- On Windows, right-click on My Computer, and select Properties. Under the Advanced tab, hit the Environment Variables button, and in the dialog that comes up, double-click on Path (under System Variables). Add the full path to the tools/ directory to the path.

Test your setup

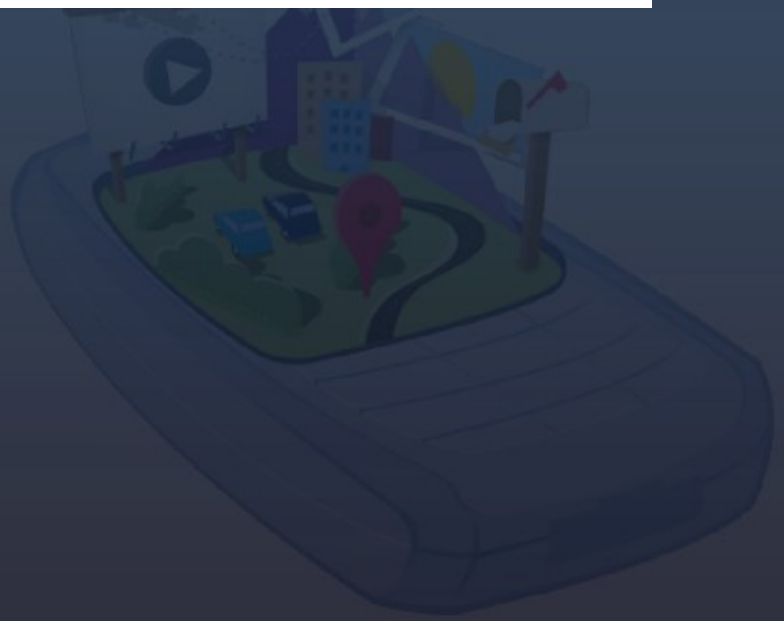
- In the command window type adb
- You should see the following
- Android Debug Bridge version 1.0.20 ....

- Now we're ready for eclipse!



Install Eclipse

- http://www.eclipse.org/downloads/



Eclipse 3.4 (Ganymede) setup

- After you install eclipse:
  - Start Eclipse, then select Help > Software Updates....
  - In the dialog that appears, click the Available Software tab.
  - Click Add Site...
  - Enter the Location:
  - https://dl-ssl.google.com/android/eclipse/
  - If you have trouble aqcuiring the plugin, try using "http" in the Location URL, instead of "https" (https is preferred for security reasons).
  - Click OK.

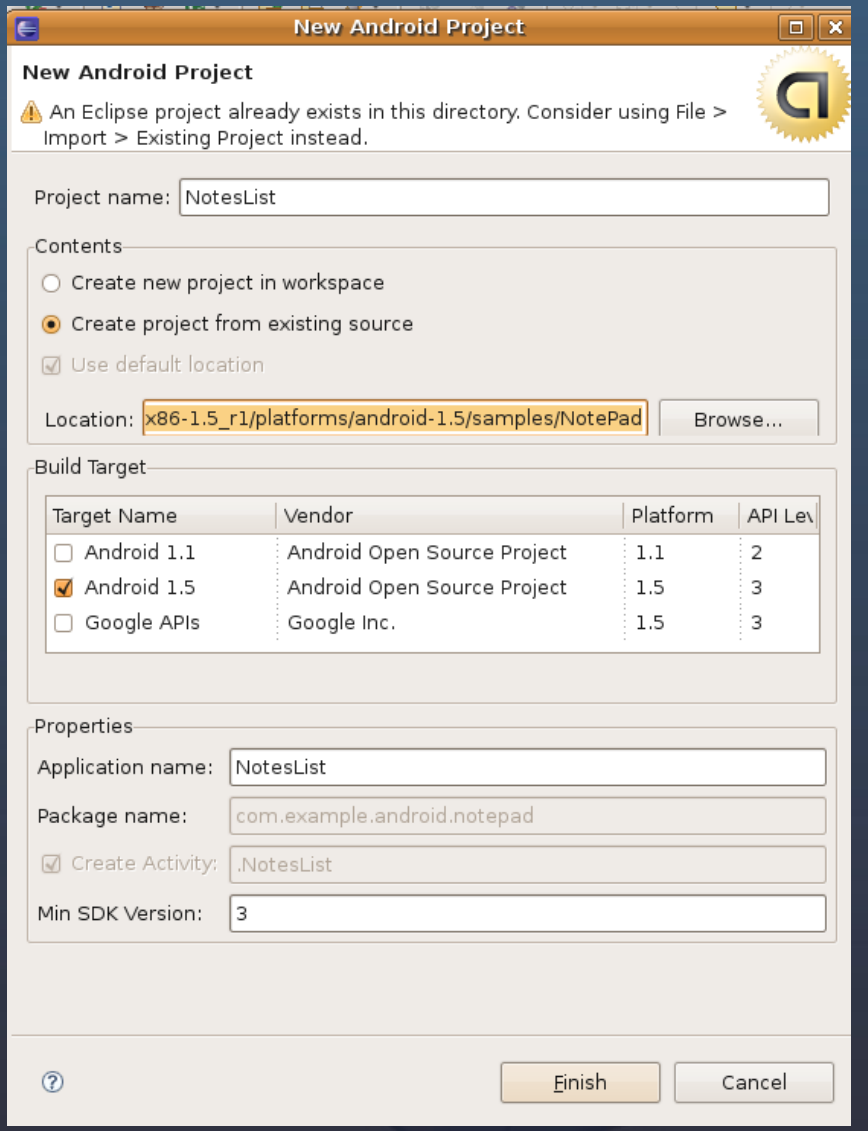
Eclipse 3.4 setup

- Back in the Available Software view, you should see the plugin listed by the URL, with "Developer Tools" nested within it. Select the checkbox next to Developer Tools and click Install...
- On the subsequent Install window, "Android DDMS" and "Android Development Tools" should both be checked. Click Next.
- Read and accept the license agreement, then click Finish.
- Restart Eclipse.

Introduction to the Android Environment

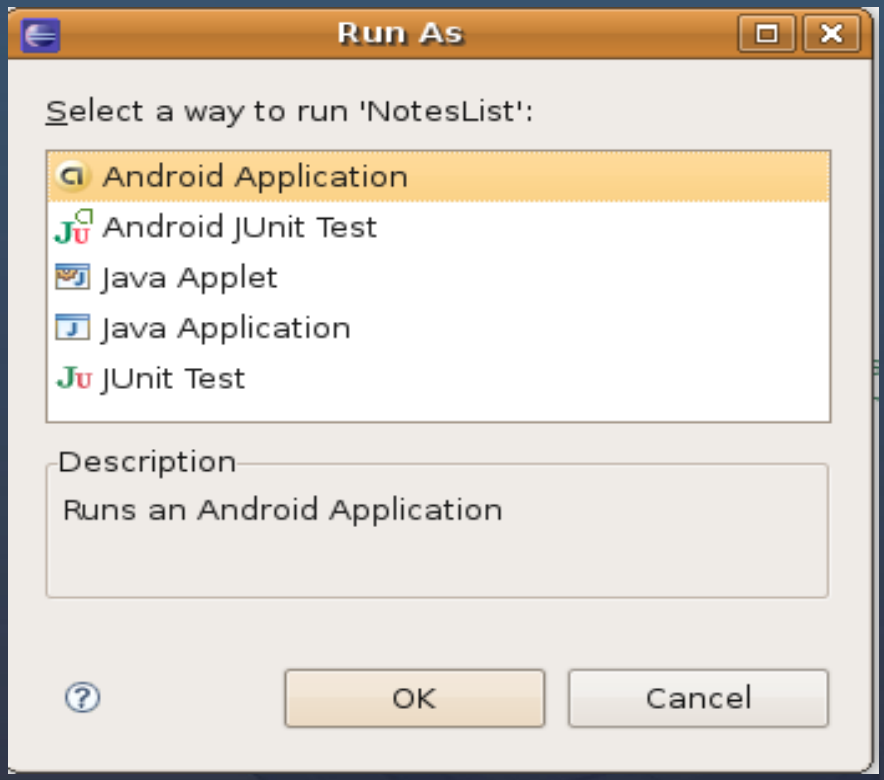
Compile Android Example

- Start Eclipse.
- Click File->New->android project
- Click Create project from existing
- Location : <SDK>platforms/android-1.5/samples/NotePad
- Click Android 1.5 If its not selected
- Click Finish
- Project is created

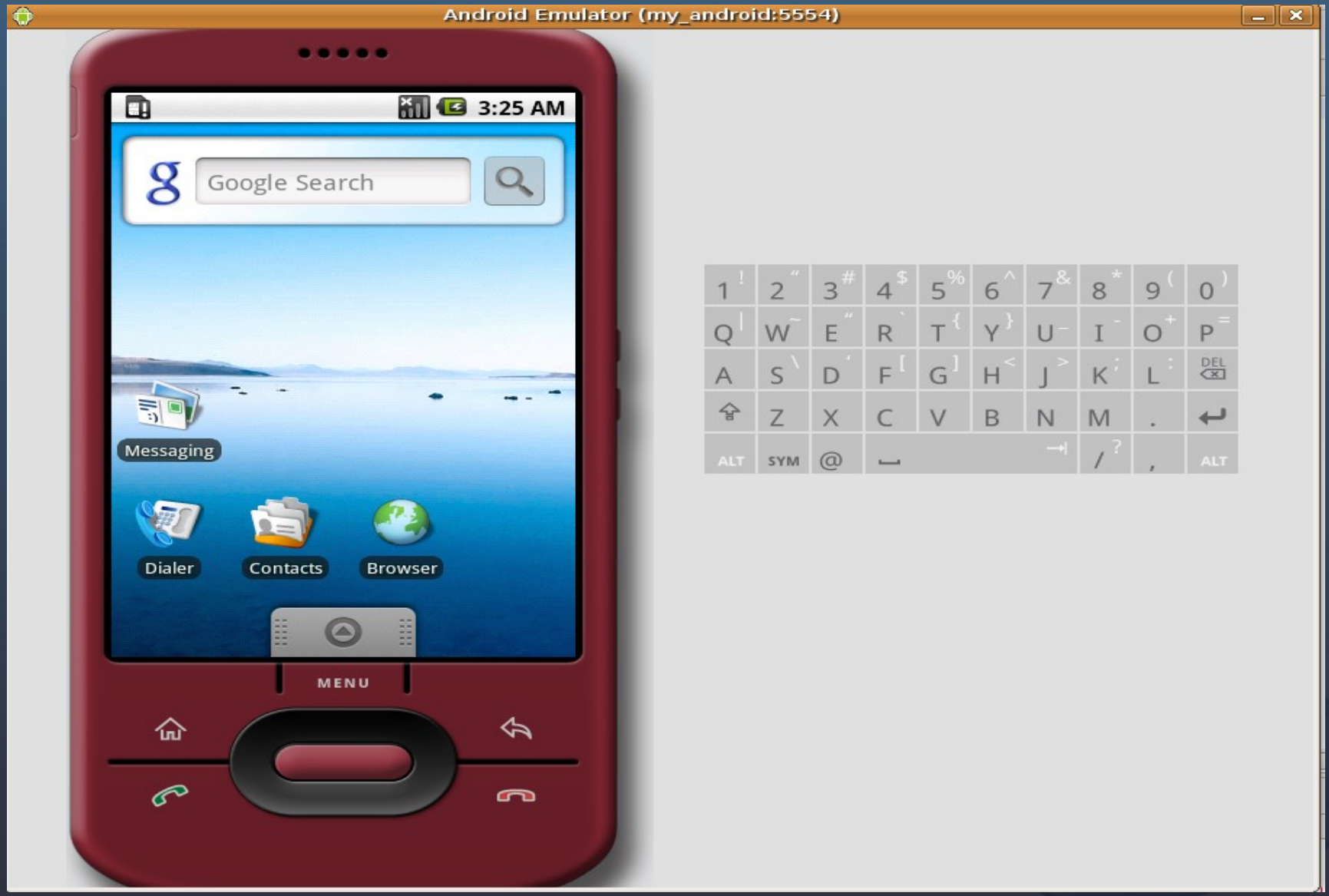


Starting the emulator

- Click Run->Run
- Select Android app click ok



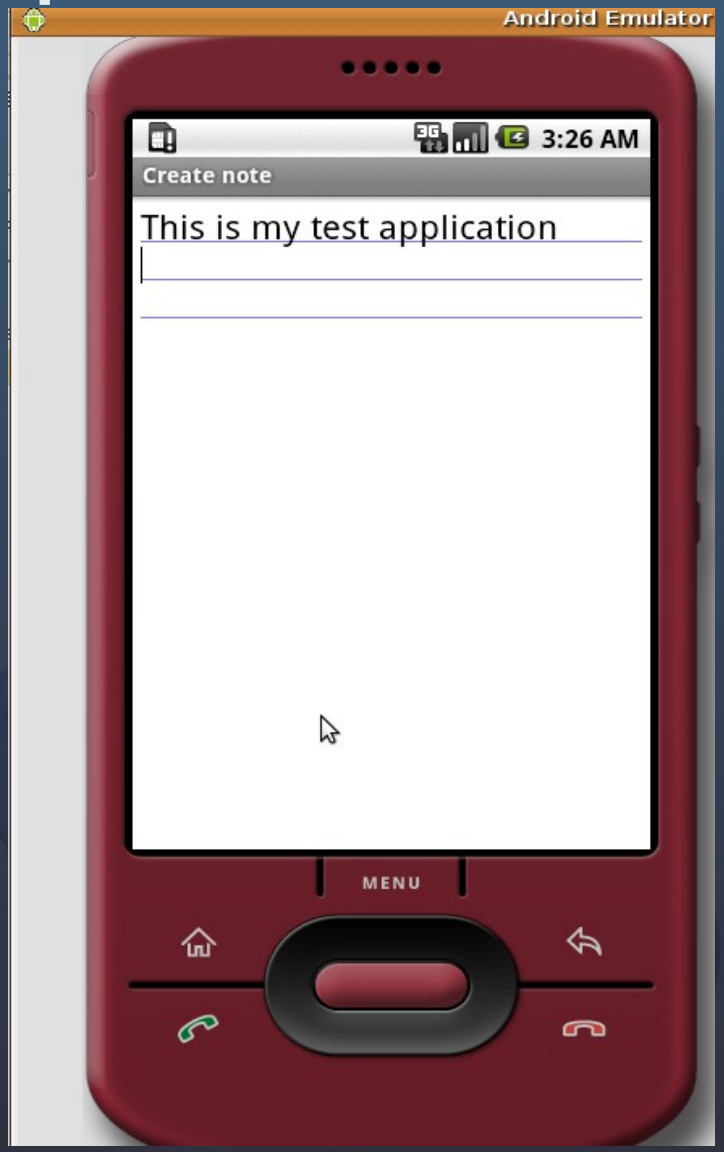
Emulator Starts



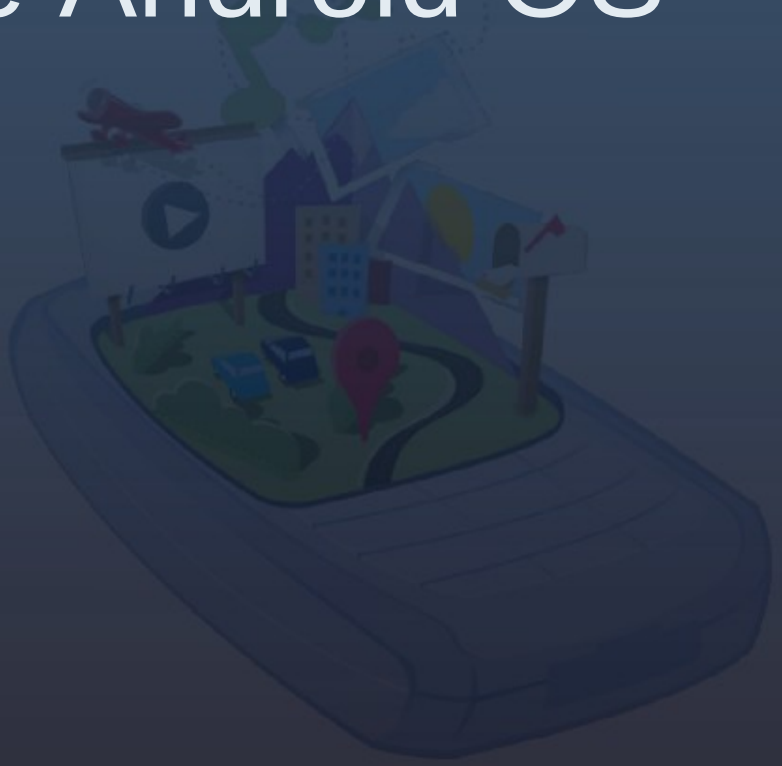
Running your application

- Once the application launches select menu.
- Click on add note

- Thats It.....

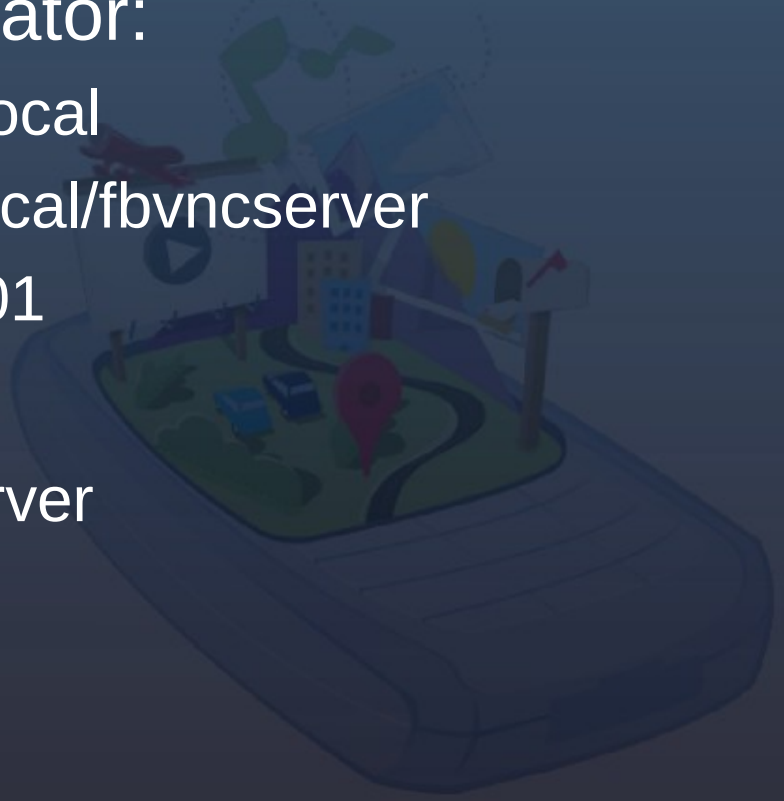


Introduction to the Android OS



Quick shell demo

- http://code.google.com/p/android-vnc/
- Get fbvncserver binary
- Load it into the phone/emulator:
  - adb push fbvncserver /data/local
  - adb shell chmod 777 /data/local/fbvncserver
  - adb forward tcp:5901 tcp:5901
- Run the vnc server:
  - adb shell /data/local/fbvncserver

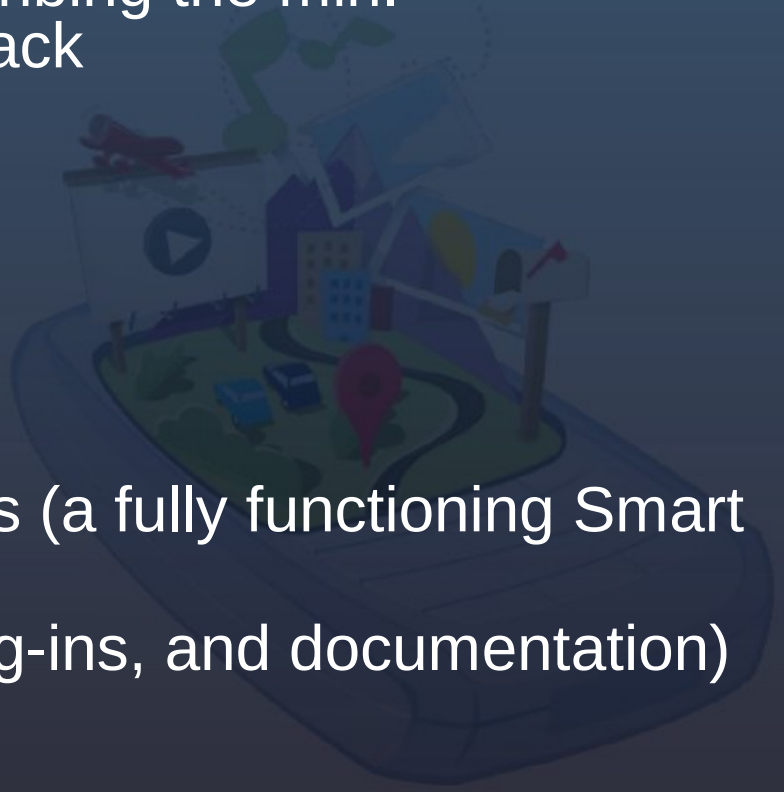


What Android is not

- A Java ME implementation
- An application Layer (UIQ or S60)
- A handset
- Google’s Answer to iPhone…
- … nor a way of locking people into Google apps.

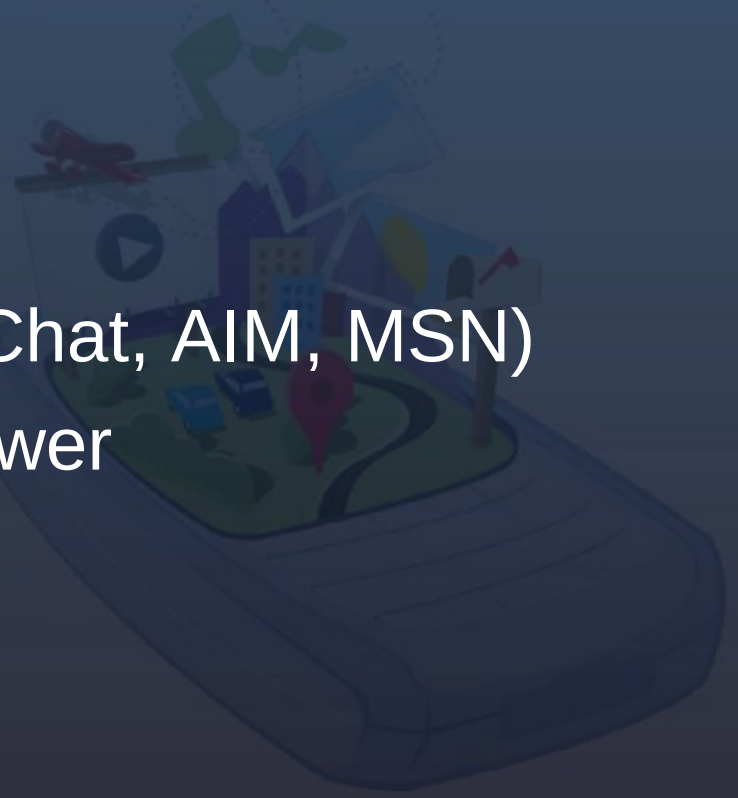
Openness of Android

- “The first truly open and comprehensive platform for mobile devices…”
- Android Components:
  - A hrdw. reference design describing the min. requirements to support the stack
  - Linux Kernel
  - Open Source Libraries
  - Run time environment (Dalvik)
  - Application Framework
  - A user interface framework
  - Set of pre-installed applications (a fully functioning Smart Phone)
  - Software devel. kit (Tools, plug-ins, and documentation)



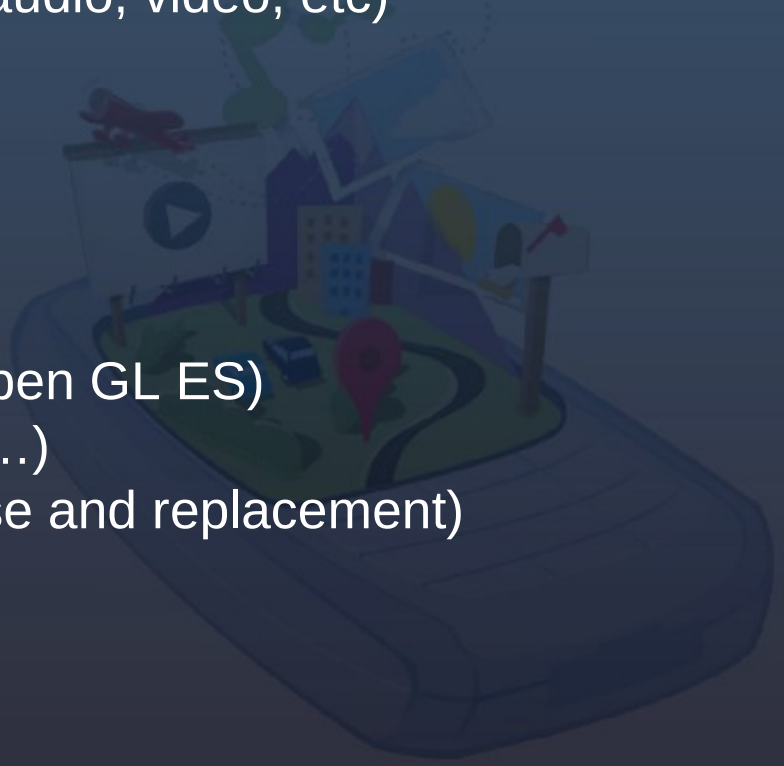
Android Applications

- An eMail client (GMail)
- SMS management app.
- PIM (Google calendar, etc)
- Google Maps App.
- WebKit based browser
- Instant Messaging Client (GChat, AIM, MSN)
- Music Player and Picture viewer
- Android Market Place



Android SDK Features

- Open platform (no fees, no licensing)
- Wi-fi hrdw. acess
- Full comm. stack (GSM, EDGE, 3G, Bluetooth)
- GPS
- Multimedia (playback and recording of audio, video, etc)
- APIs to accel. And compass hrdwr.
- IPC messaging
- Share Data stores
- Web-Kit browser
- P2P via Google Talk
- Eventually hwrd. accel. 3D graphics (Open GL ES)
- Media Libraries (Licensed for MP3, etc…)
- And open Application Framework (reuse and replacement)



Android NDK Features
(release June ‘09)

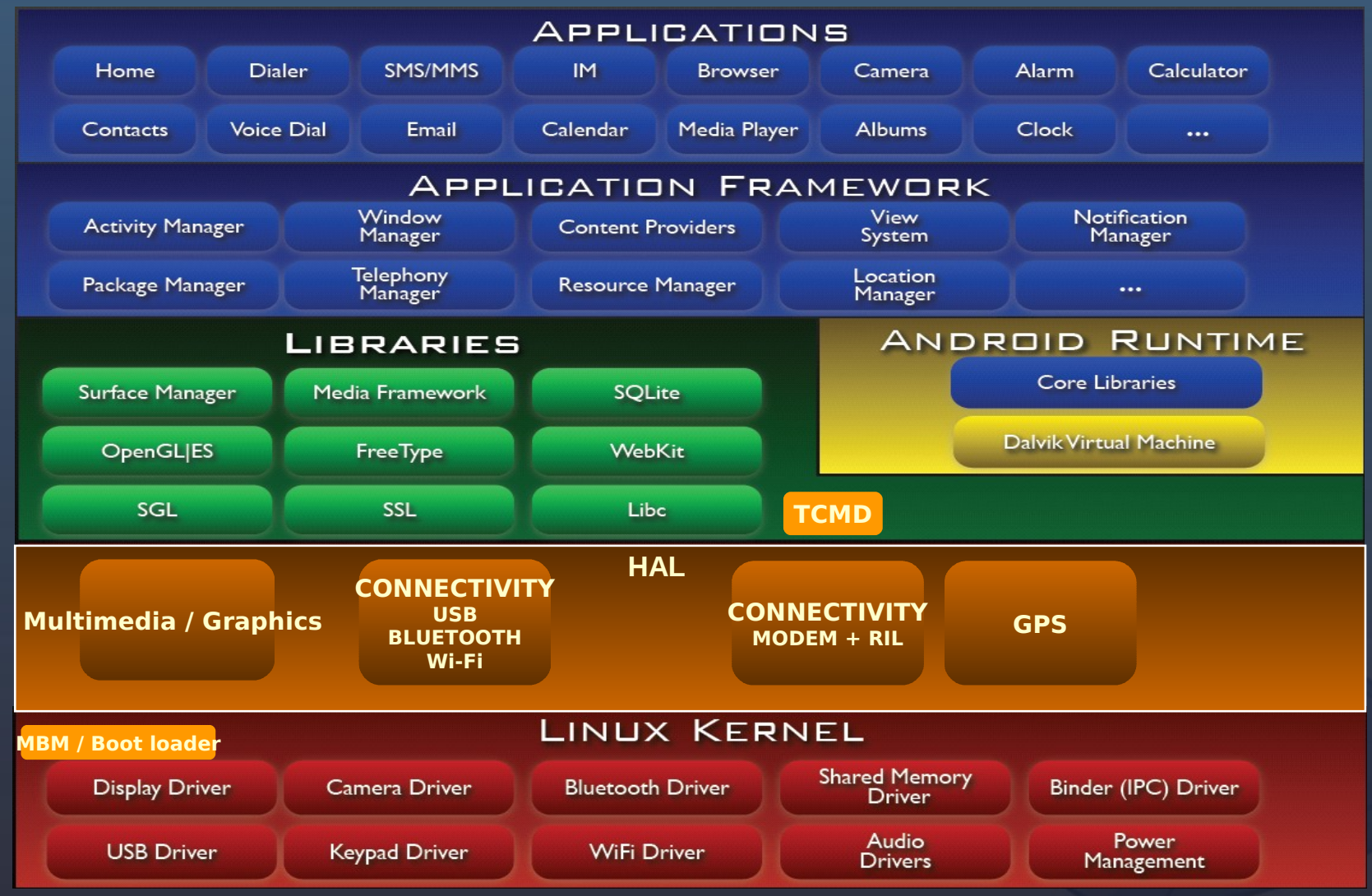
- The initial goal is to support JNI shared libraries written in C or C++ that link with the Android versions of libc and libm.
- In a future release we hope to support linking with OpenGL ES and audio libraries, which should enable high-performance games.
- The NDK can also be used to compile Linux executables and shared libraries that only require the subset of Linux APIs that are supported by the NDK. This might be useful for developers wishing to port utility programs to help develop and test their Android applications.

(http://groups.google.com/group/android-ndk for more info.)

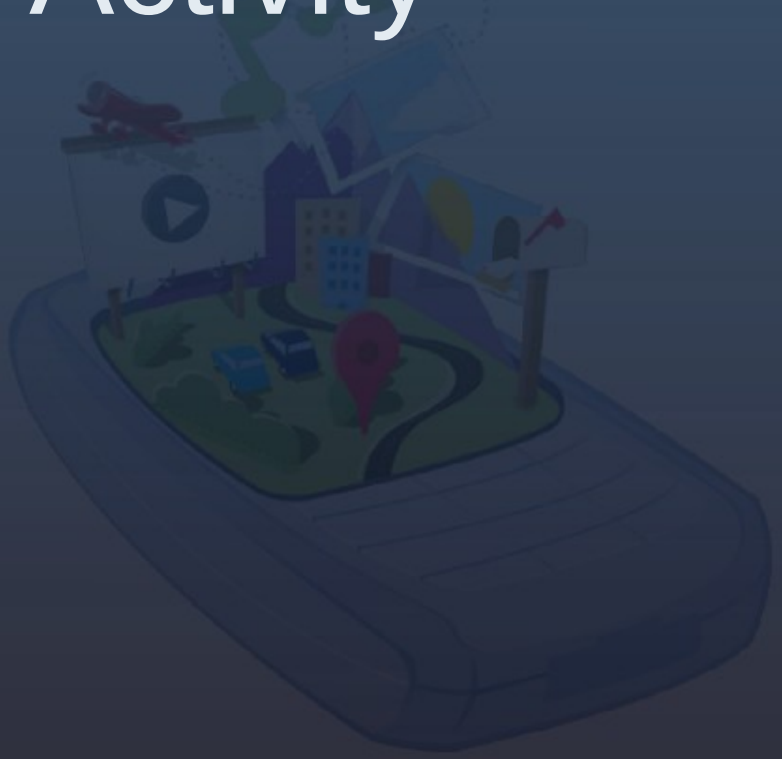
Platform Features

- Agnostic Access to Hardware (GPS, accel., 3D, Geocoding, etc.)
- Background services
- SQLite DB
- Share data and Interapp. Communication
- P2P service with Google Talk
- Extensive Media Support
- Optimized Mem. and Process Mngmnt.

Android Layer Cake



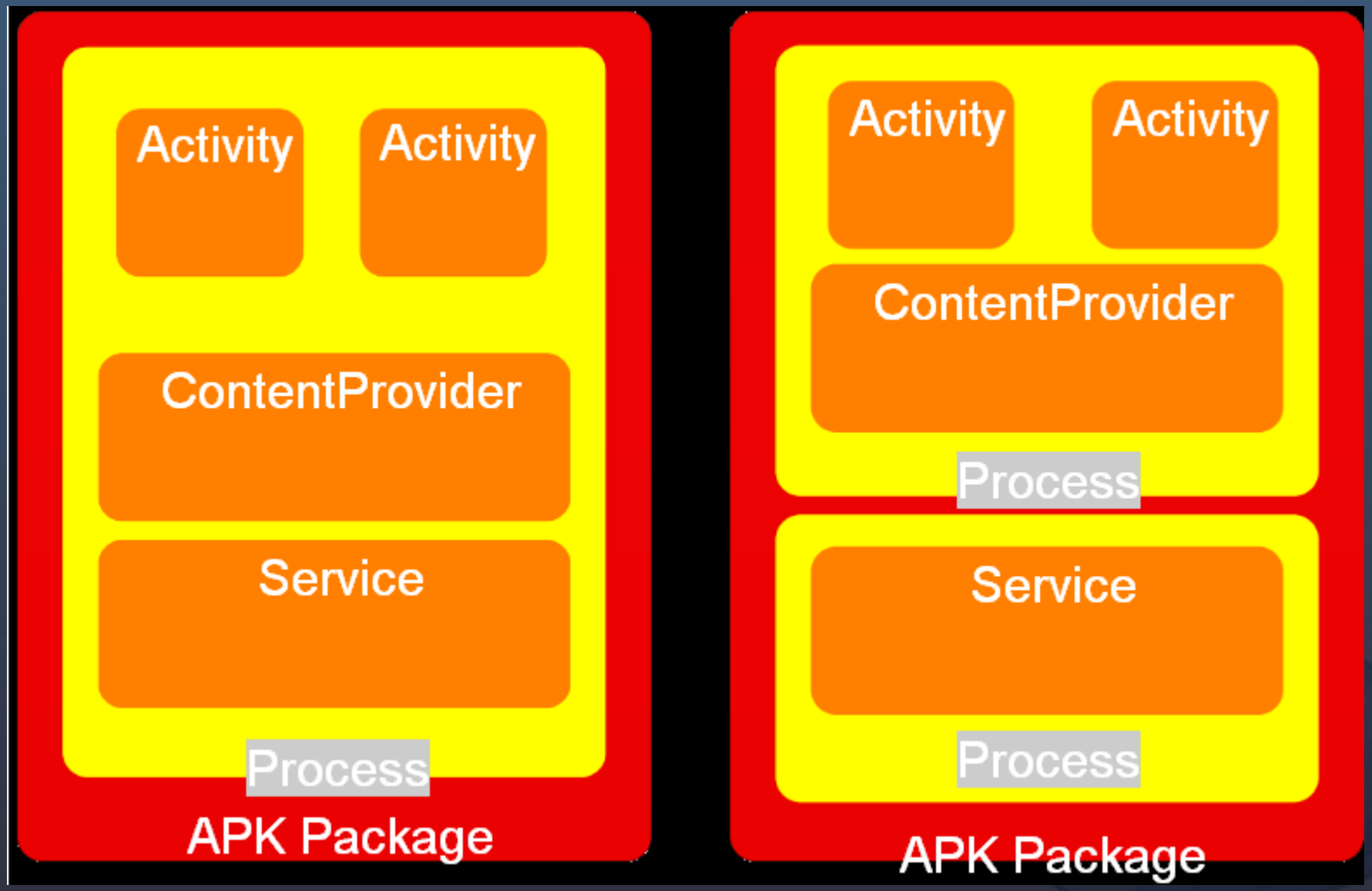
The Android Activity



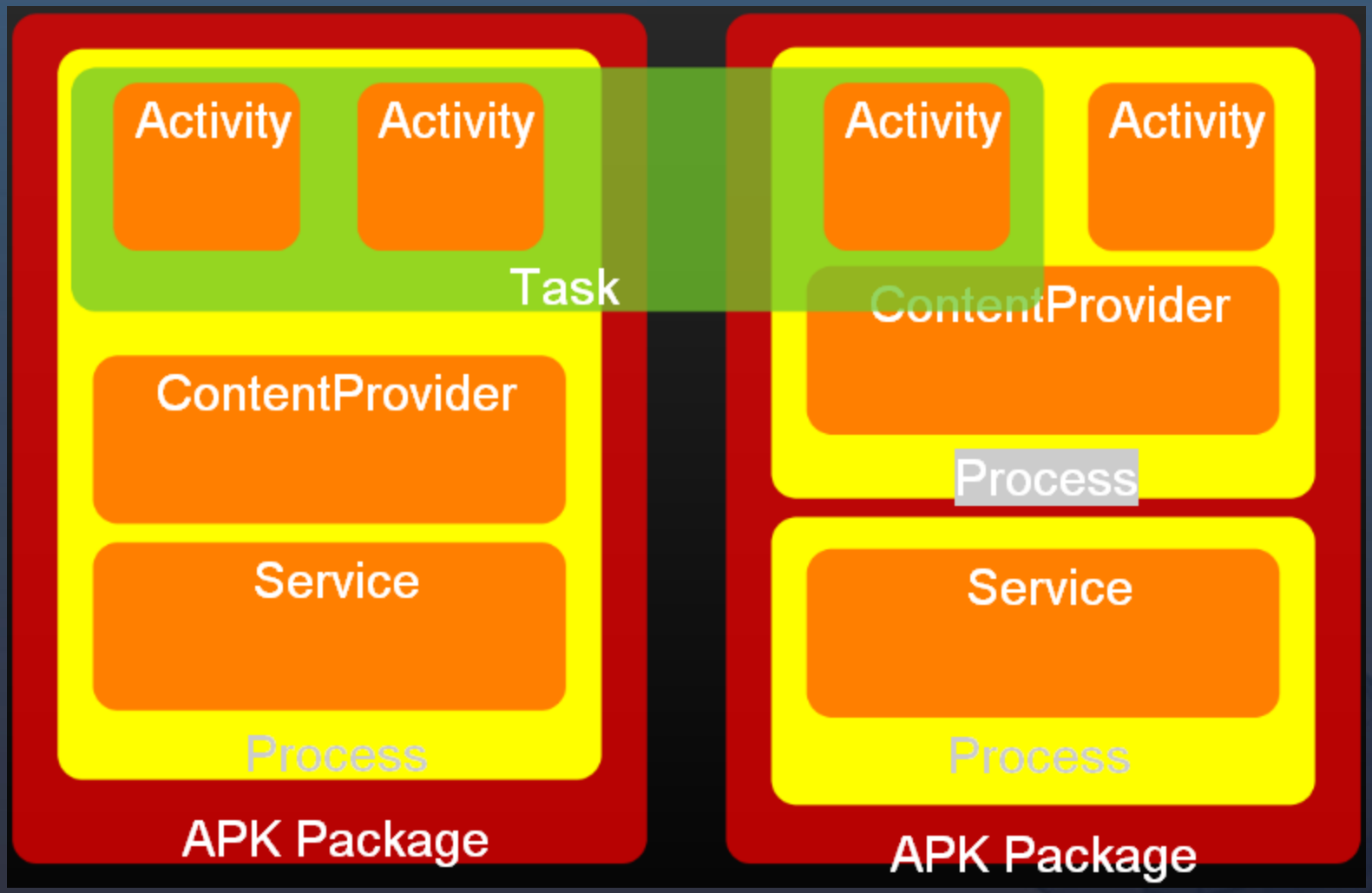
Activities and Tasks

- Dan Morrill's definition:
  - An Activity is a "molecule": a discrete chunk of functionality
  - A task is a collection of Activities
  - A "process" is a standard Linux process

Activities (continue)



Activities (continue)



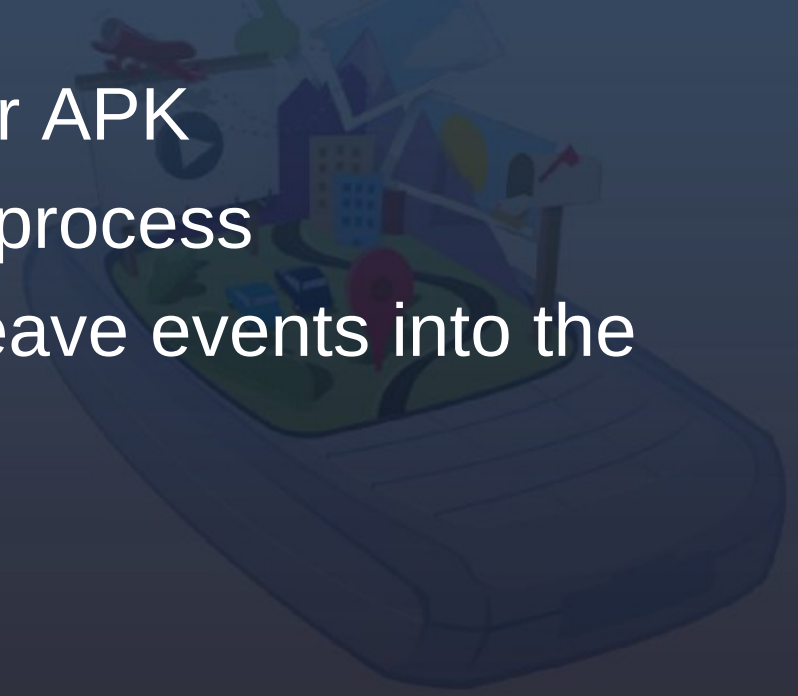
Activities vs Tasks (Apps)

- A concrete class in the API
- An encapsulation of a particular operation
- They run in the process of the .APK which installed them
- Optionally associated with a window (UI)
- An execution Context

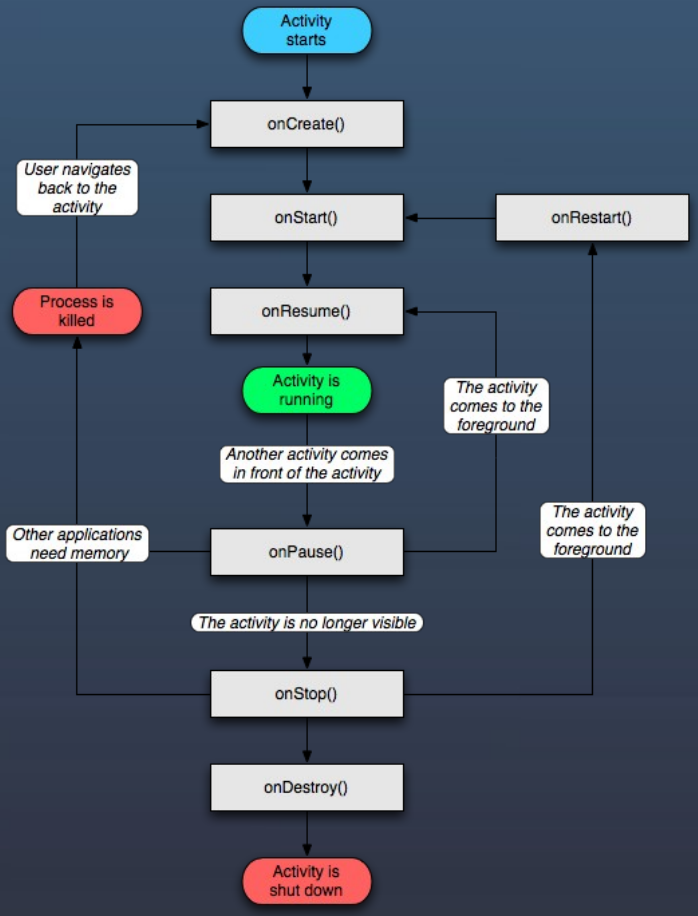
- More of a notion than a concrete API entity
- A collection of related Activities
- Capable of spanning multiple processes
- Associated with their own UI history stack
- What users on other platforms know as “applications”

Process Basics

- How does it all of this relate to the Unix roots of Android?
  - Android process == Linux process (w/ its own unique UID)
  - By default, 1 process per APK
  - By default, 1 thread per process
  - Most components interleave events into the main thread



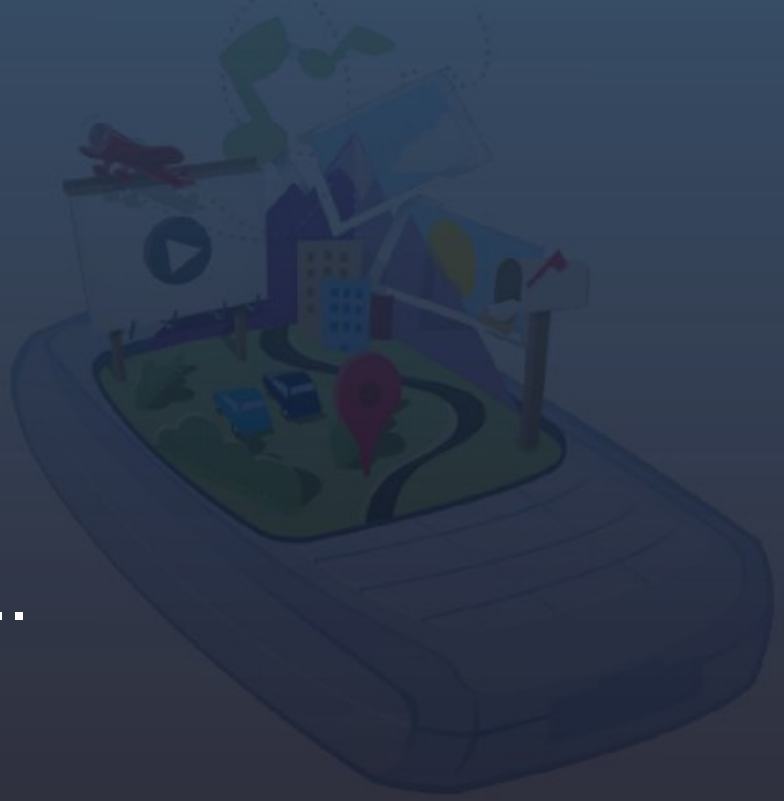
Android Activity Life Cycle



- Activities have several states
- Lifecycle methods are called on transitions
- You typically don’t need to use them all, but they are there

Life Cycle example (Child Activity)

- Call sequence:
  - onCreate()
  - onStart()
  - onResume()
  - onFreeze()
  - onPause()
  - onStop()
  - onRestart()
  - onStart(), onResume(), ...

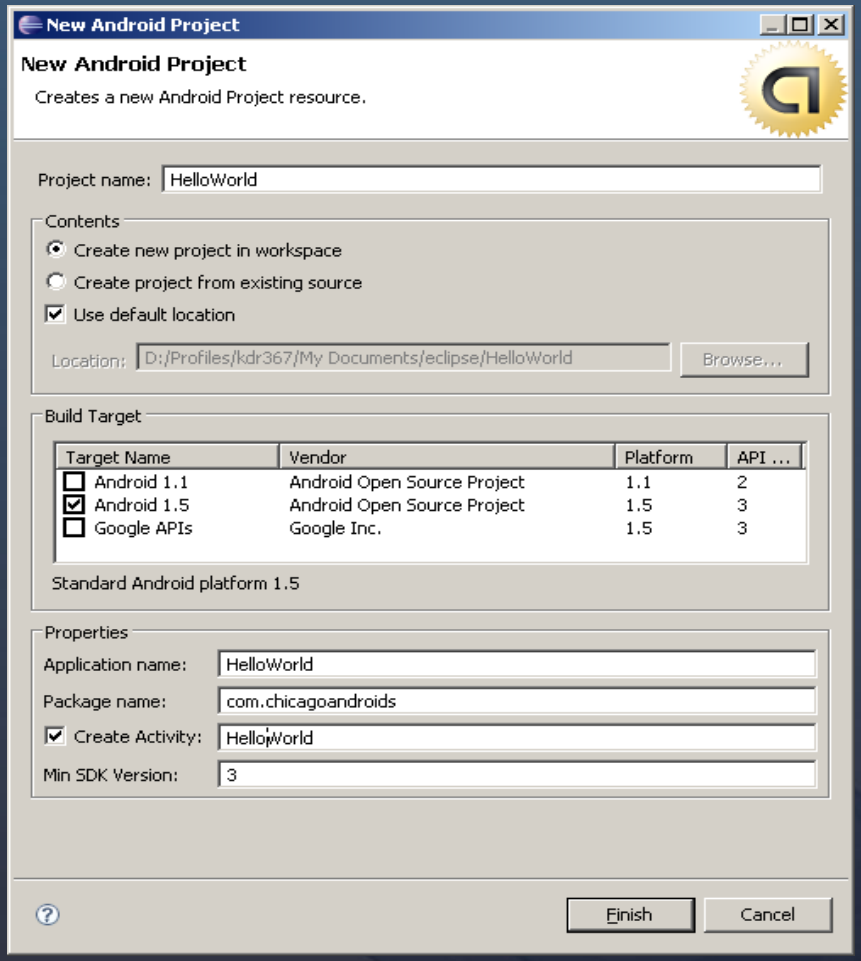


Android Application Building Blocks

- **Activities:** Building block of the UI. Every screen in your application will be an extension of the Activity class. You can think of an activity as being analogous to a window or dialog in a desktop environment.
- **Services:** Headless (non-UI) application that runs in the background. They are designed to keep running independent of any activity.
- **Content Providers:** Provide a level of abstraction for any data stored on the device that is accessible by multiple applications.
- **Intents**: A simple message passing framework. Using intents you can broadcast messages system-wide or to a target Activity or Service.
- **Broadcast Receivers:** Intent broadcast consumers. By registering a broadcast receiver your application an listen for broadcast Intents that match specific filter criteria.
- **Notifications:** User notification framework. Let you signal users without interrupting their current activity. For instance an incoming call can alert you with flashing lights, making sounds, or showing a dialog.

Hello World!!

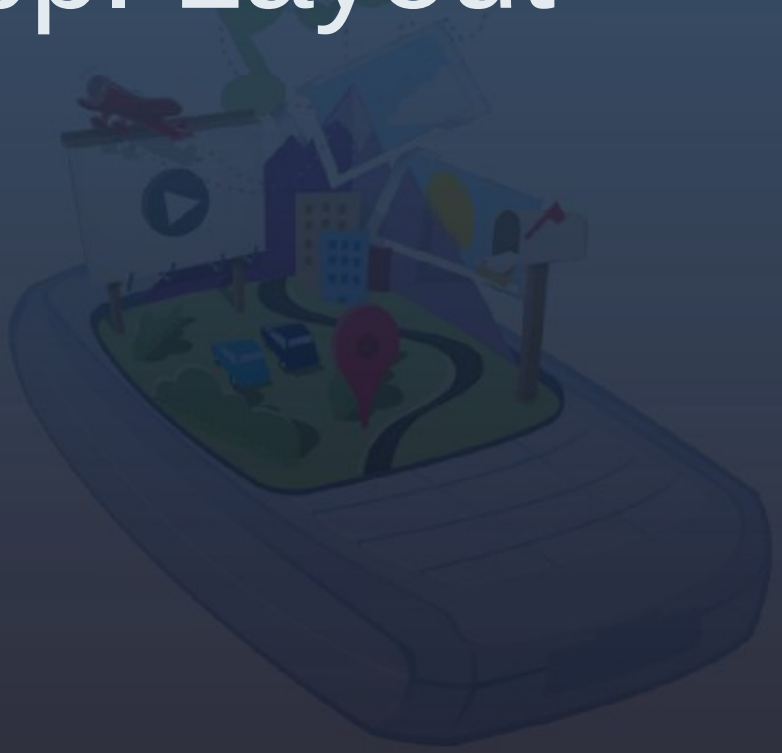
1. Create a new Android Project
   - Select **File** > **New** > **Android Project**
2. Fill out the project details
   - Enter *HelloWorld* for **Project Name**
   - Select **“Create new project in workspace”**
   - Enter HelloWorld in App name.
   - Enter *com.chicagoandroids.HelloWorld* in **Package Name**
   - Enter *HelloWorld* in **Activity name** (and yes we want to create an Activity)



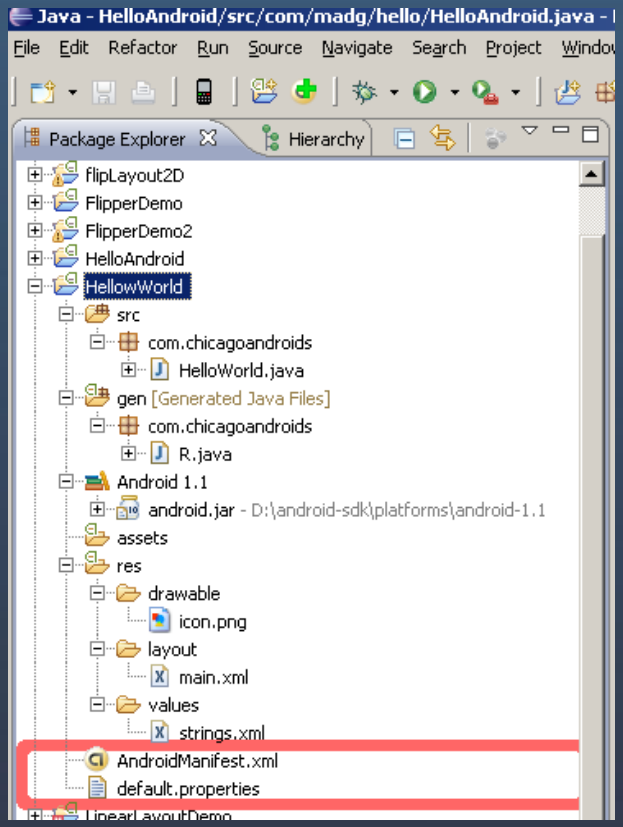
Project Properties

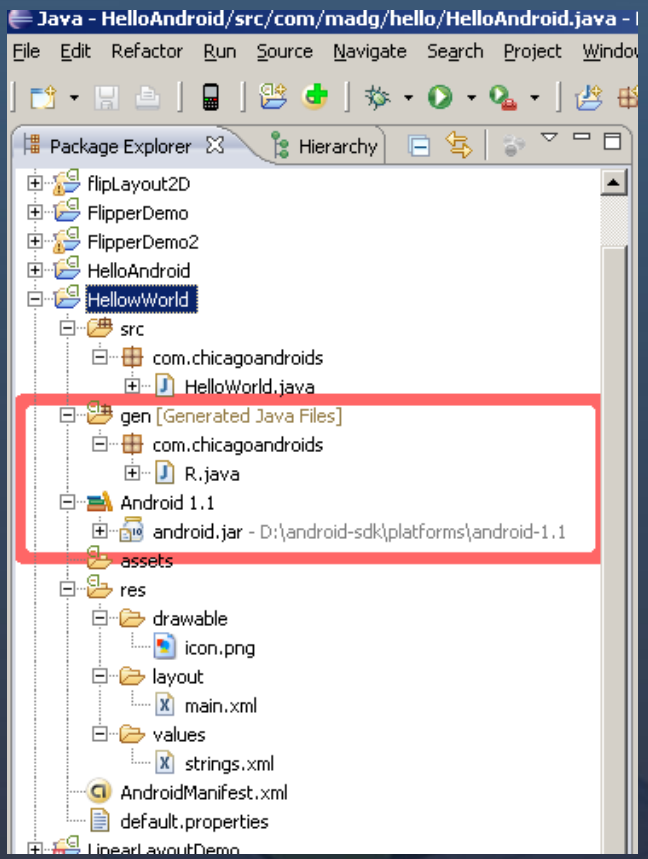
Project Name	This is the name of the directory or folder on your computer that you want to contain the project.
Package Name	This is the package namespace (following the same rules as for packages in the Java programming language) that you want all your source code to reside under. This also sets the package name under which the stub Activity will be generated. The package name you use in your application must be unique across all packages installed on the system; for this reason, it's very important to use a standard domain-style package for your applications. In the example above, we used the package domain "com.chicagoandroids".
Activity Name	This is the name for the class stub that will be generated by the plug-in. This will be a subclass of Android's Activity class. An Activity is simply a class that can run and do work. It can create a UI if it chooses, but it doesn't need to.
Application Name	This is the human-readable title for your application.

The Activity/App. Layout



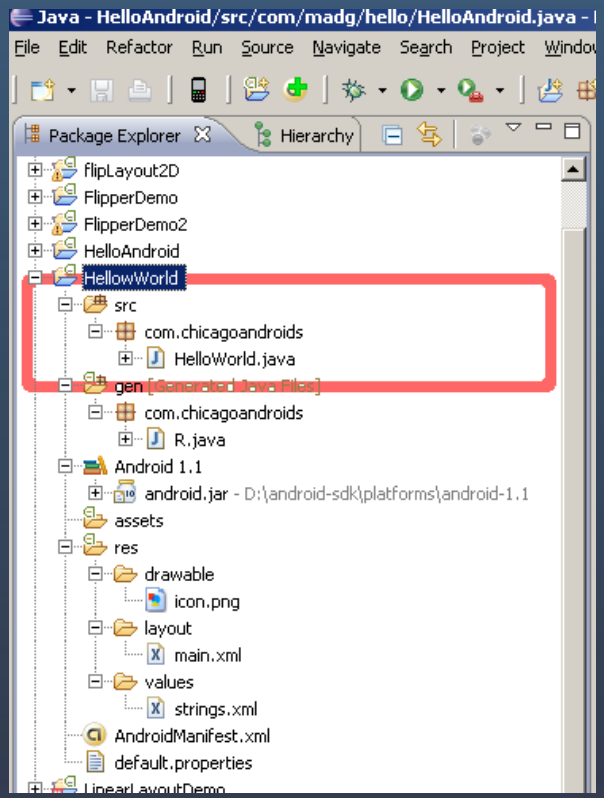
The Automatic* Portions…

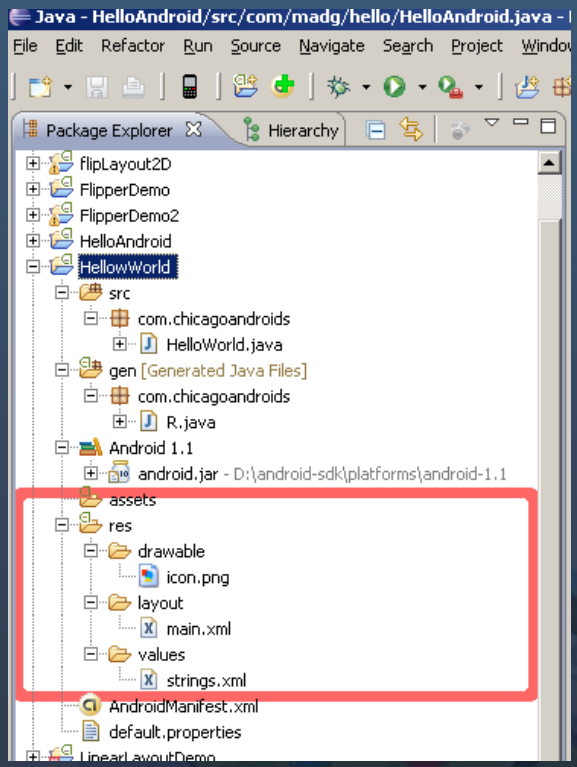




- Left: Manifest (* not that automatic)
- Right: R class and the android library (no need to touch)

The Automatic* Portions…

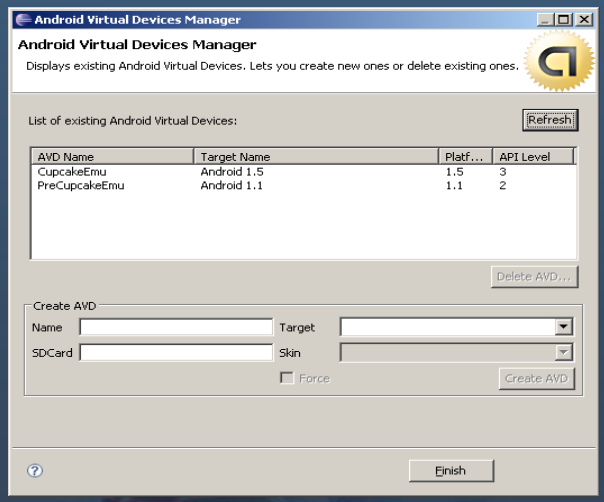


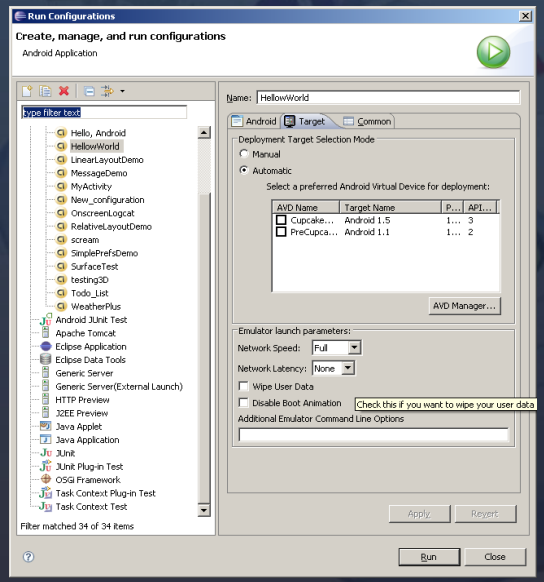


- Left: Source directories, where your classes go…
- Right: Resources (this is what gets automatically build into the R class)

A word about the emulator

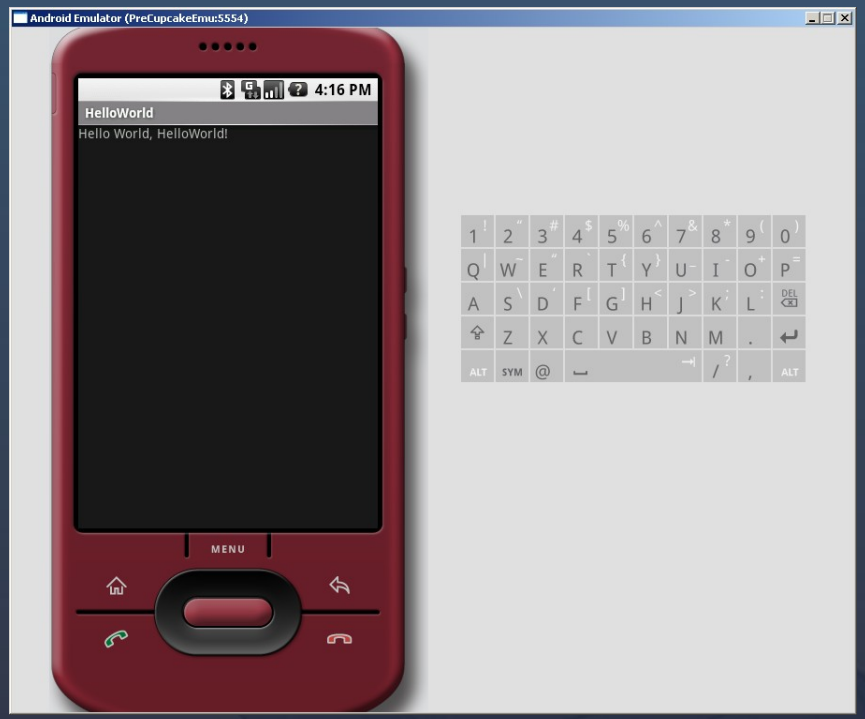
- You can create different Run configurations for different target devices.
- It is possible to target different resolutions (HVGA, HVGA-P, HVGA-L, etc)
- Network speed and latency, etc.
- Use the AVD manager and the ‘Run->Run configurations’ to manipulate





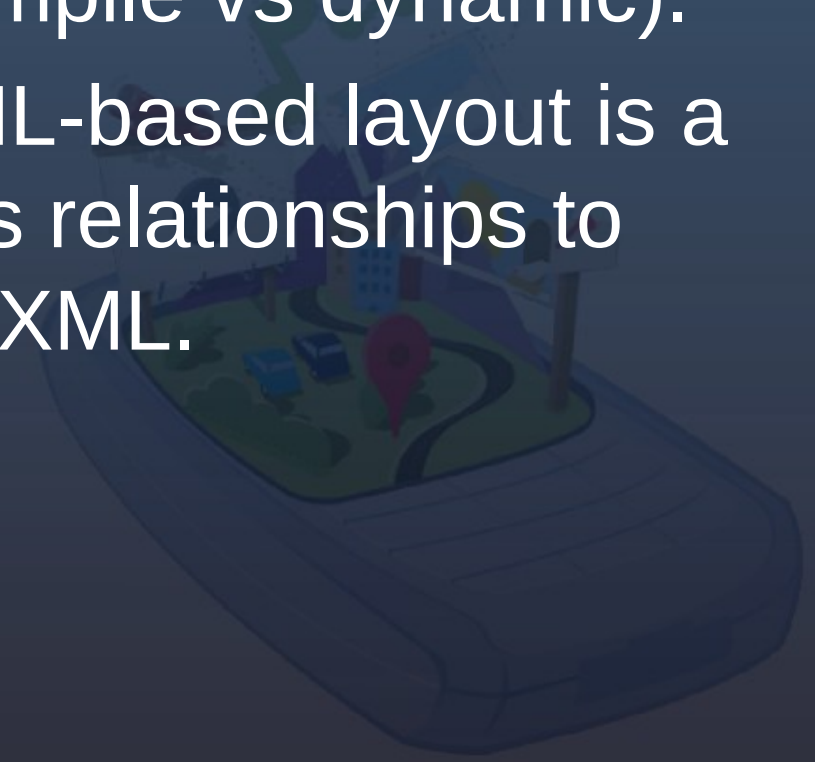
Run hello world

- Select the root of the project.
- Click in the ‘green play icon’.
- Pick Android Project
- That will get the emulator going…



Activity Layouts

- Where do they live?
- Why? Dynamic instantiation is possible, but it is discourage (compile vs dynamic).
- What are they? An XML-based layout is a specification of widget's relationships to each other encoded in XML.

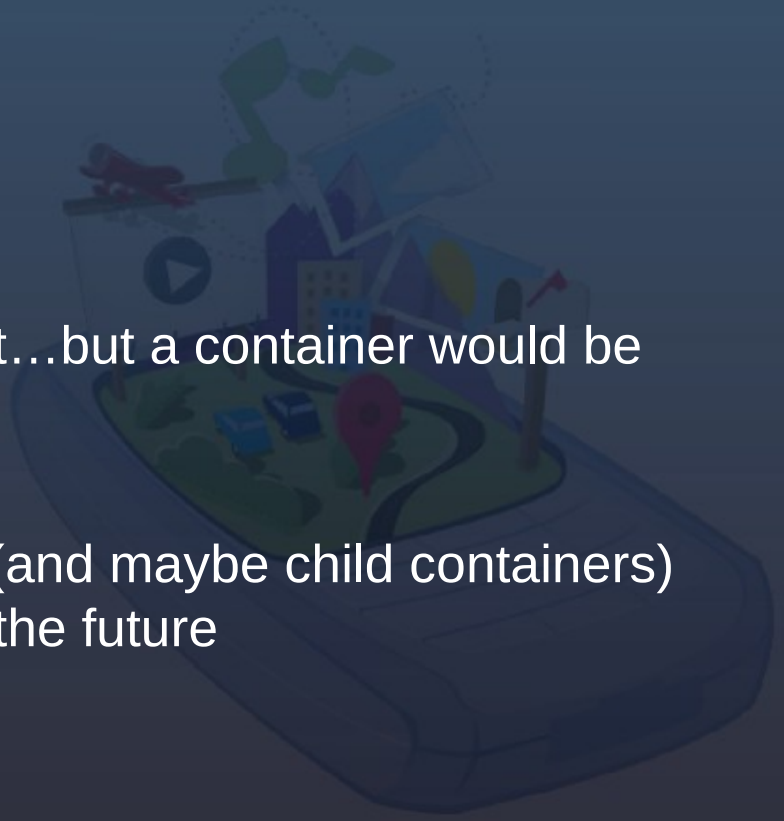


Layout’s most basic example…

```
<?xml version="1.0" encoding="utf-8"?>
<Button xmlns:android="http://schemas.android.com/apk/res/android"
   android:id="@+id/button"
   android:text=""
   android:layout_width="fill_parent"
   android:layout_height="fill_parent"/>
```

In this example Button is the root element…but a container would be more typical.

Containers pour a collection of widegets (and maybe child containers) into a specific layout. More on that in the future



Intents (The Basics)

So, what can you Intent to do?

Intents are system messages that notify applications of various events:

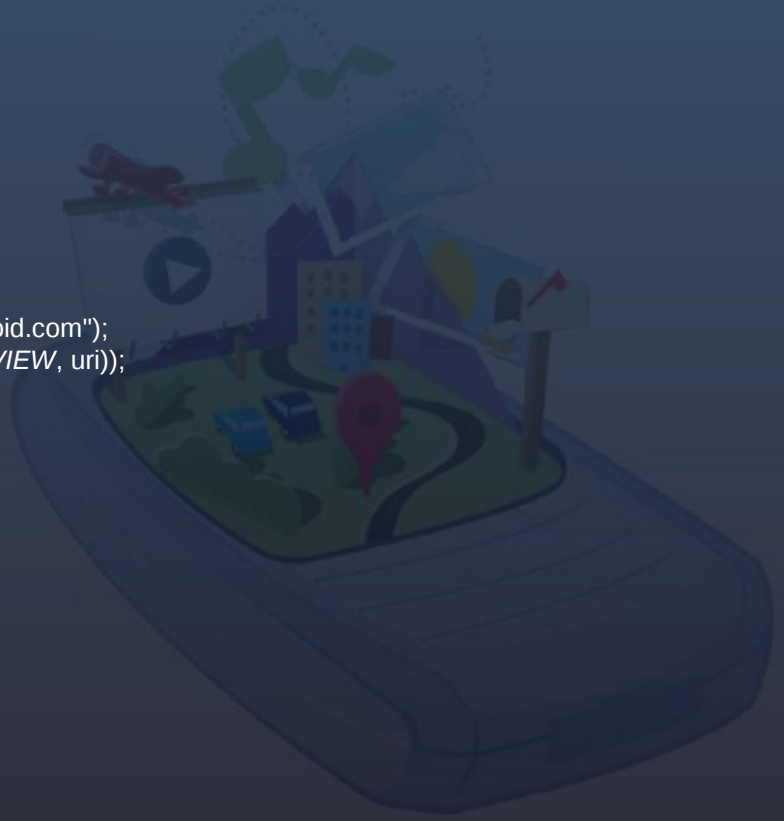
- Activity events (launch app, press button)
- Hardware state changes (acceleration change, screen off, etc)
- Incoming data (Receiving call, SMS arrived)

You can also create your own to launch applications, etc.

- Inter-activity communications (open an app when you get to a location, etc)

Intent most basic example…

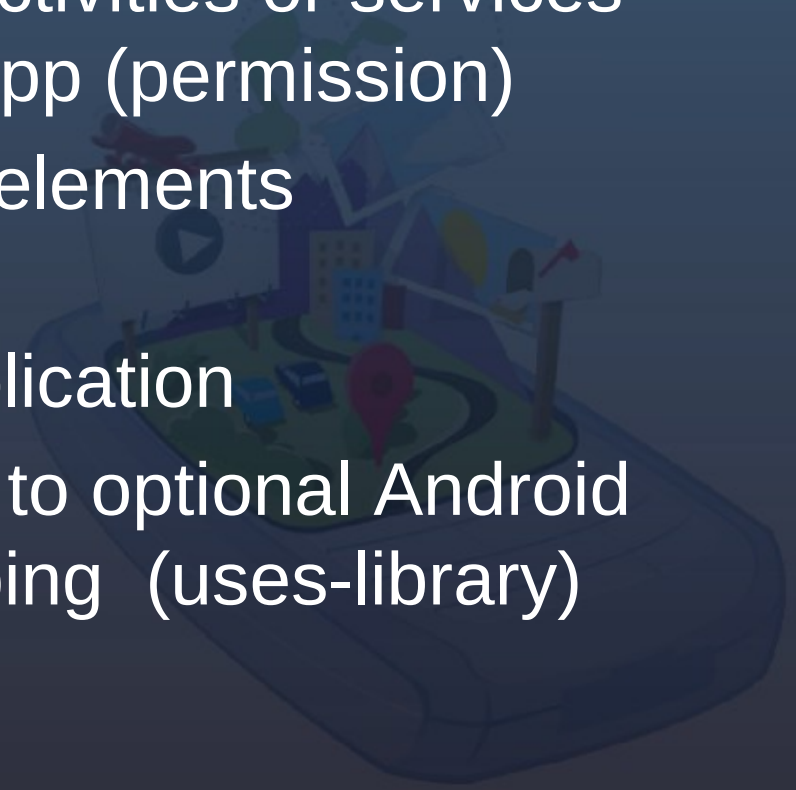
```
public class NowRedux extends Activity
implements View.OnClickListener {
Button btn;

        @Override
        public void onCreate(Bundle icicle) {
                super.onCreate(icicle);

                setContentView(R.layout.main);

                btn=(Button)findViewById(R.id.button);
                btn.setOnClickListener(this);
                updateTime();
        }

        public void onClick(View view) {
                updateTime();
                //Uri uri = Uri.parse("http://developer.android.com");
                //startActivity(new Intent(Intent.ACTION_VIEW, uri));
        }

        private void updateTime() {
                btn.setText(new Date().toString());
        }
}
```



The Application’s Manifest

The manifest

- Declares the permissions the application will need (uses-permission)
- Declare permissions that activities or services might require to use your app (permission)
- Provides instrumentations elements (instrumentation)
- Defines the guts of the application
- Provides hooks to connect to optional Android components such as mapping (uses-library)



Default AndroidManifest.xml

- One application node. Application properties include icon and application label in home screen.
- One Activity node. Activity name is abbreviated to .Sample. Tells Android which Java class to load. The activity label is the title for that activity in the titlebar.
- Intent-filter tags specify which Intents launch the Activity. In order for an application to be available from the launcher it must include an Intent Filter listening for the MAIN action and the LAUNCHER category.

```
<manifest xmlns:android-http://schemas.android.com/apk/res/android
    package=“com.motorola.Sample”>

     <application android:icon="@drawable/icon“
                  android:label="@string/app_name">
         <activity android:name=".Sample"
                   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>
```

Android Manifest (cont)

```
<manifest xmlns:android-http://schemas.android.com/apk/res/android
    package="com.mydomain.myapp">

    <application android:icon="@drawable/icon"
                 android:theme="@style/my_theme">

        <activity android:name=".MyActiv" android:label="@string/app_name">
                 <intent-filter> . . . </intent-filter>
        </activity>

        <service android:enables="true" android:name="MyService">
                 <intent-filter> . . . </intent-filter>
        </service>

        <provider android:permission="com.paad.MY_PERMISSION" . . .>
        </provider>

        <receiver android:enabled="true"
                 android:label="My Broadcast Receiver"
                 android:name=".MyBroadcastReceiver">
        </receiver>
    </application>
</manifest>
```

Android Manifest (cont)

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
      package="com.bikerolas"
      android:versionCode="30"
      android:versionName="1.2">
    <uses-permission android:name="android.permission.RECEIVE_BOOT_COMPLETED" />
    <uses-permission android:name="android.permission.ACCESS_LOCATION />
    <uses-permission android:name="android.permission.ACCESS_GPS" />
    <uses-permission android:name="android.permission. ACCESS_CELL_ID />

    <application android:icon="@drawable/flingicn1" android:label="@string/app_name" android:debuggable="false">
        <activity android:name=".Fling"
                  android:label="@string/app_name">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
<service android:name=".FlingService" />
<receiver android:name=".FlingServiceManager"
        android:permission="android.permission.RECEIVE_BOOT_COMPLETED">
<intent-filter>
    <action android:name="android.intent.action.BOOT_COMPLETED" />
</intent-filter>
</receiver>
</application>

<uses-sdk android:minSdkVersion="2"></uses-sdk>
</manifest>
```

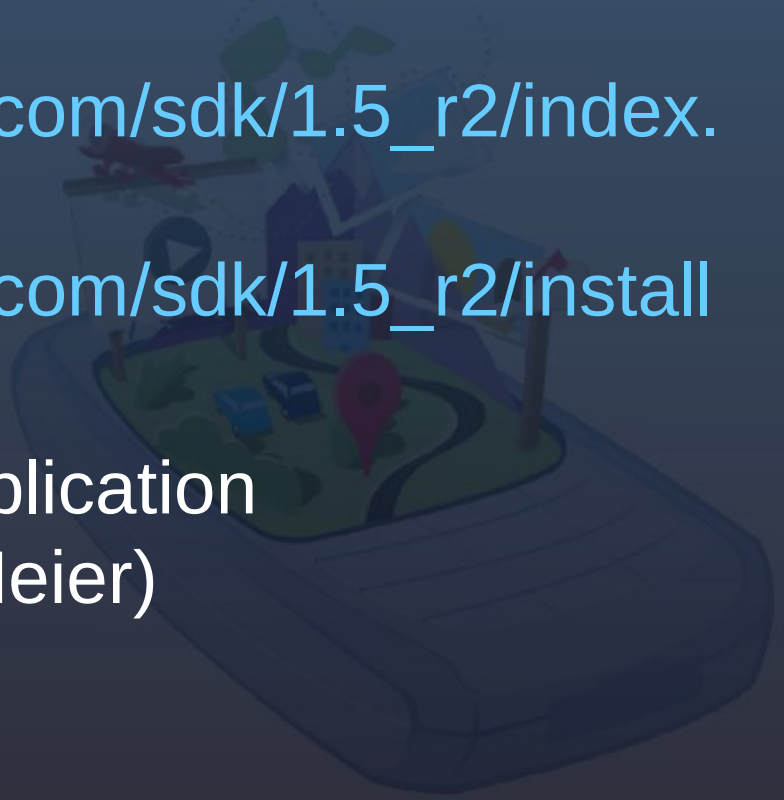
Q&A

we ❤ android

Citation I

- This presentation contains references from the following sources:
  - Android Developer's site
    http://developer.android.com/sdk/1.5_r2/index.

    http://developer.android.com/sdk/1.5_r2/install
  - Professional Android Application Development (by Reto Meier)



Citation II

- This presentation contains references from the following sources:
  - The Busy Coder's Guide to Android Development (by Mark L. Murphy)
  - Inside the Android Application Framework (by Dan Morrill) http://sites.google.com/site/io/inside-the-android-applic
  - Dalvik VM Internal (by Dan Bornstein) http://sites.google.com/site/io/dalvik-vm-internals