Intro to Android Development

By Philip Peng, 2011-01-12
For PennApps Mobile 2011, University of Pennsylvania

Intro to Android Development

Why mobile?

- smartphones = “new thing”
- portable, powerful

Why Android? (over iOS)

- Linux → Open Source
- Consumer-driven apps
- Hardware/software choice
- Google <3 Devs

vs.

iOS 4

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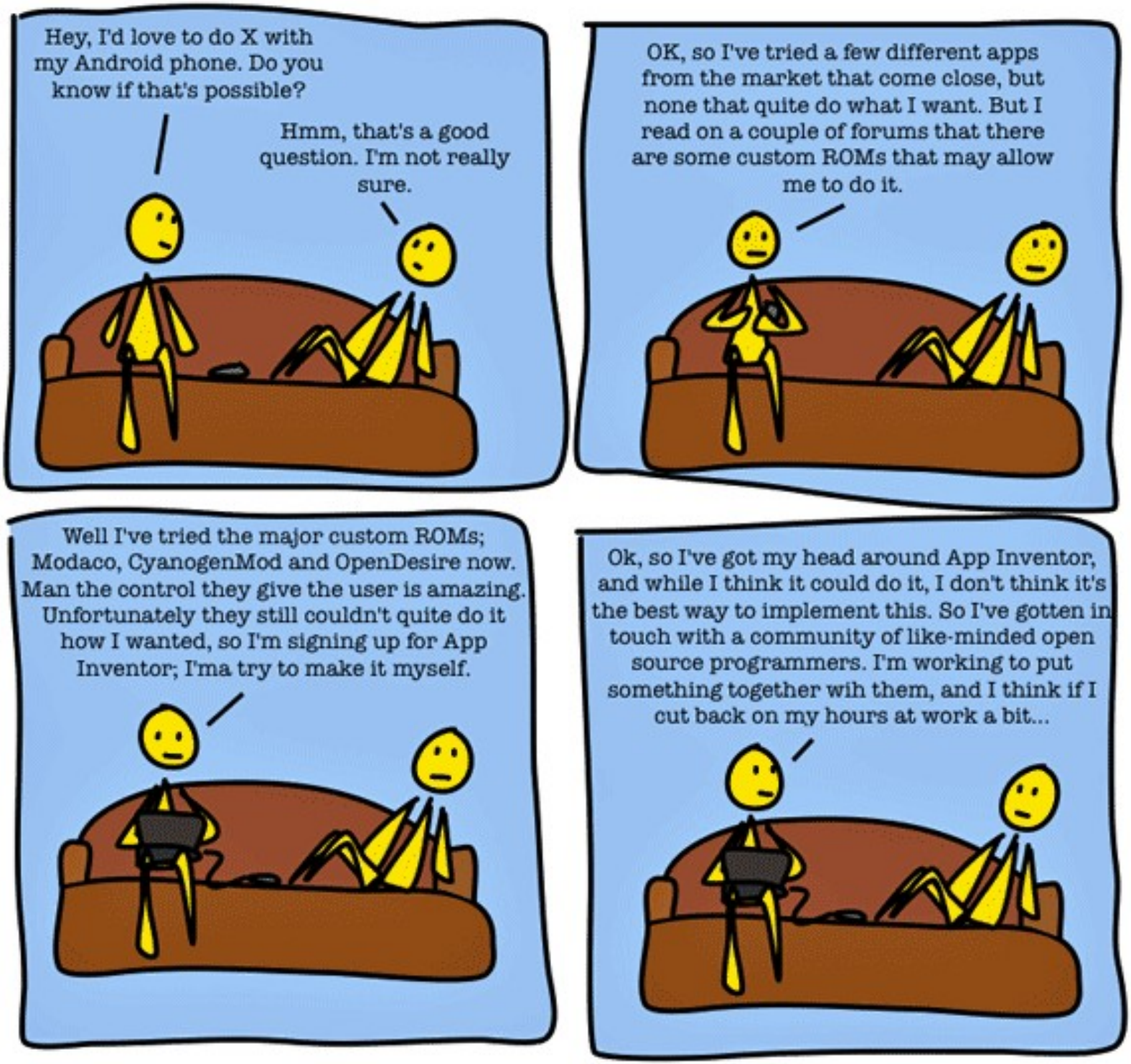
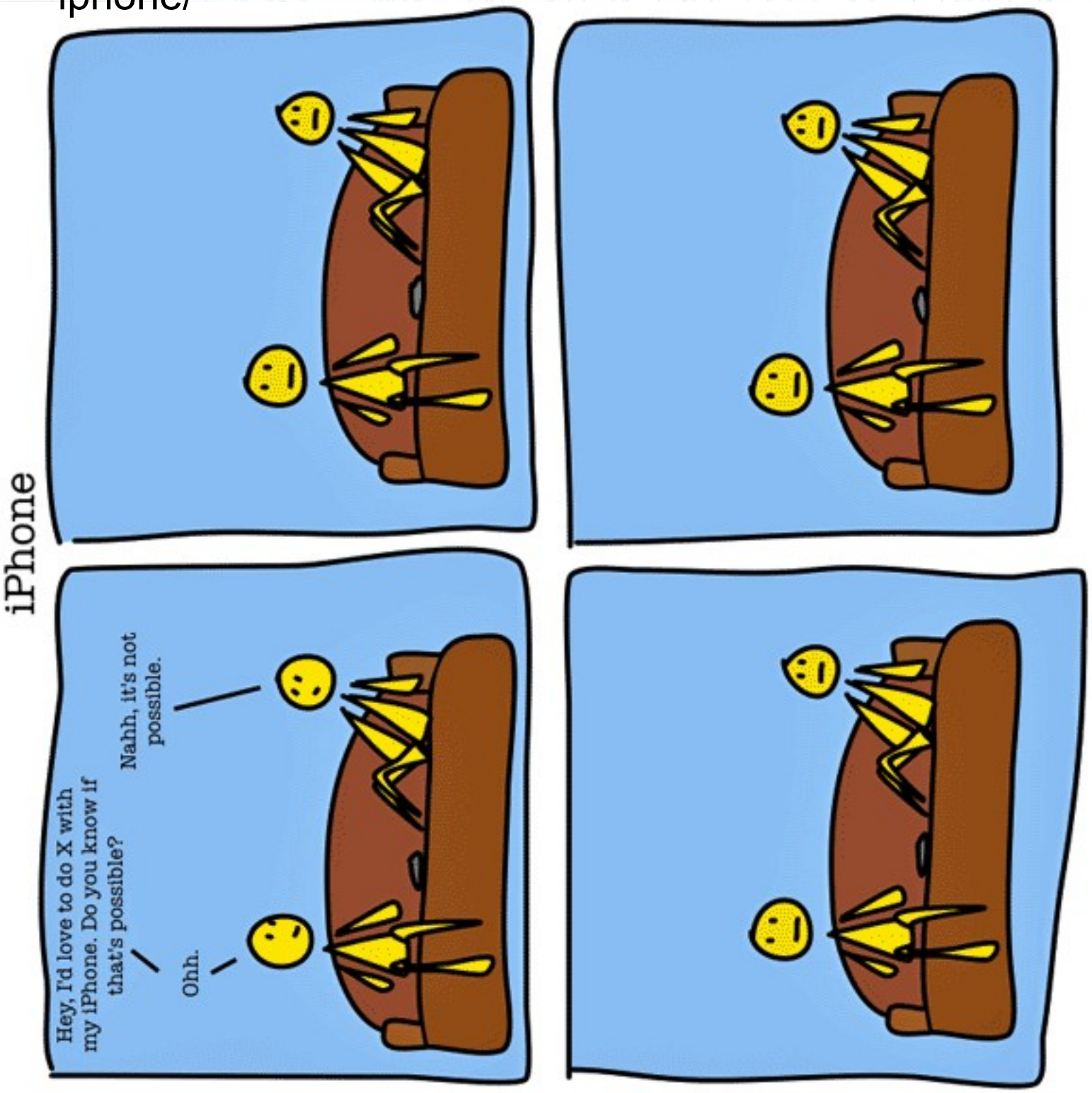
Android


Hey, I'd love to do X with my Android phone. Do you know if that's possible?
Hmm, that's a good question. I'm not really sure.
OK, so I've tried a few different apps from the market that come close, but none that quite do what I want. But I read on a couple of forums that there are some custom ROMs that may allow me to do it.
Well I've tried the major custom ROMs; Modaco, CyanogenMod and OpenDesire now. Man the control they give the user is amazing. Unfortunately they still couldn't quite do it how I wanted, so I'm signing up for App Inventor; I'ma try to make it myself.
Ok, so I've got my head around App Inventor, and while I think it could do it, I don't think it's the best way to implement this. So I've gotten in touch with a community of like-minded open source programmers. I'm working to put something together wih them, and I think if I cut back on my hours at work a bit...

http://icantdrawfeet.com/2010/08/02/android-vs-iphone/



Intro to Android Development

Overview

- Java
- Eclipse
- Hello World
- Activity Cycle
- Try API Demos
- Stopwatch Example
- Logcat/DDMS Debugging
- Market Publishing and more...
- Beats and Useful Resource Links

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Android Java

- Linux, but apps in Java
- Dalvik Virtual Machine – DVM
- .apk format ← Eclipse
- Standard java.* packages
- Custom graphics/UI code
- NDK – C/C++ for ARM
  (OpenGL ES 2.0, libraries, etc.)

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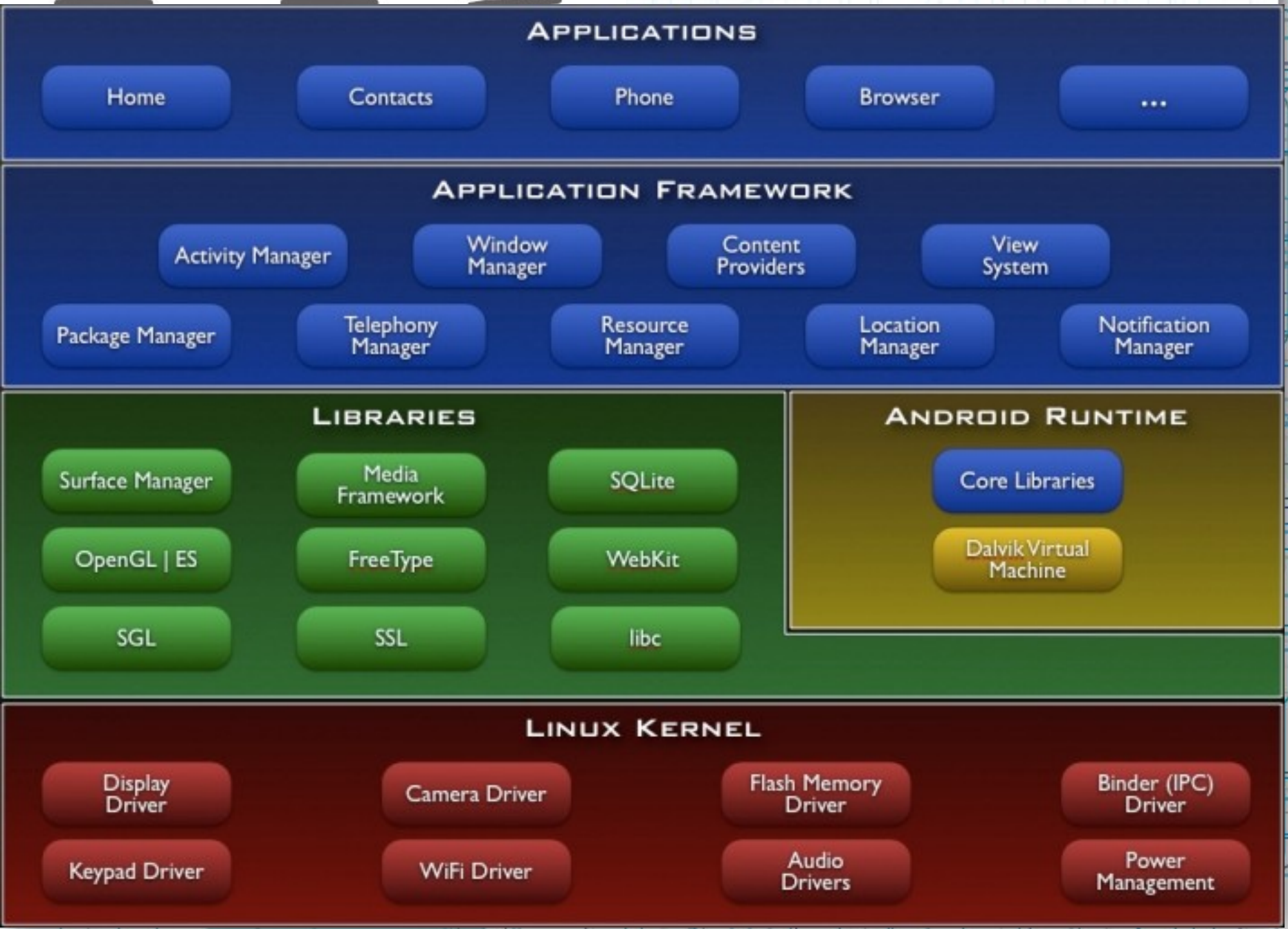

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Eclipse

- FOSS, customizable, industry-standard
- Android-ready

Download these (if you haven't already)

- Eclipse Classic 3.6.1
  http://www.eclipse.org/downloads/packages/eclipse-classic-361
- Android SDK R8 (get the .zip)
  http://developer.android.com/sdk/index.html
- Java SE Development Kit 6u23 (JDK)
  http://www.oracle.com/technetwork/java/javase/downloads/inde
- Code Samples used
  http://www.stwing.upenn.edu/~pengp/Files/PennApps/PennApp

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Setup (Live Demo!)

- Install JDK (run installer)
- Extract Eclipse (e.g. *C:/Android/eclipse*)
- Install Android SDK
  - Extract Android SDK (e.g. *C:/Android/android-sdk-windows*)
  - Run SDK Manager
  - Select packages
    (only need Platform-tools, API 9, document, and samples)
  - Download and wait (long)
  - Virtual Devices > New
  - Name: “TestPhone2.3”, Target: Android 2.3 – API Level 9, SD Card Size: 64 MiB
  - Create AVD > Start... > Launch
  - A virtual Android 2.3 phone for testing! Yay \o/

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Setup (Live Demo! Continued)

- Install ADT Plugin for Eclipse:
  - *http://developer.android.com/sdk/eclipse-adt.html#installing*
  - Help > Install New Software.... > Add
  - *https://dl-ssl.google.com/android/eclipse/* → "ADT"
  - Select All > Next > Next > Accept Terms > Finish > Restart
  - Windows > Preferences... > Android
  - Browse (find "*android-sdk-windows*" folder) > Apply > OK
  - Eclipse is now ready for Android development!

Ready for your Android "Hello World"?

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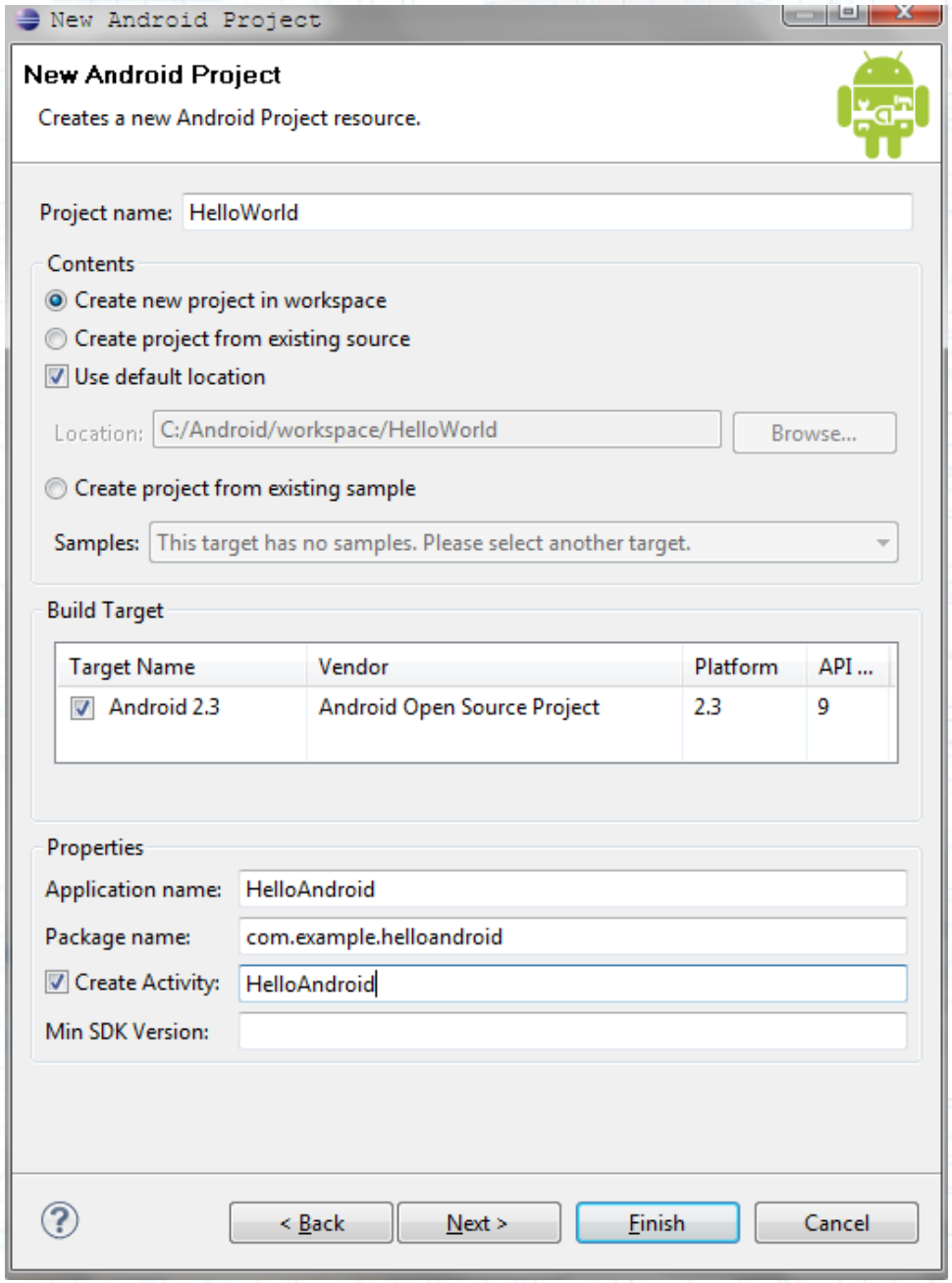
Hello World

File > New > Project > Android > Android Project



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Hello World

Add the following lines marked by "// <-----"

HelloAndroid.java

```
package com.example.helloandroid;

import android.app.Activity;
import android.os.Bundle;
import android.widget.TextView; // <-----

public class HelloAndroid extends Activity {
    /** Called when the activity is first created. */
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.main);
        TextView tv = new TextView(this); // <-----
        tv.setText("Hello, Android"); // <-----
        setContentView(tv); // <-----
    }
}
```

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Hello World

Run > Run > Android Application

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Hello World Inspection

- Package naming convention?
- Activity, Layout, TextView?
- R, src, res, AndroidManifest?

HelloAndroid.java

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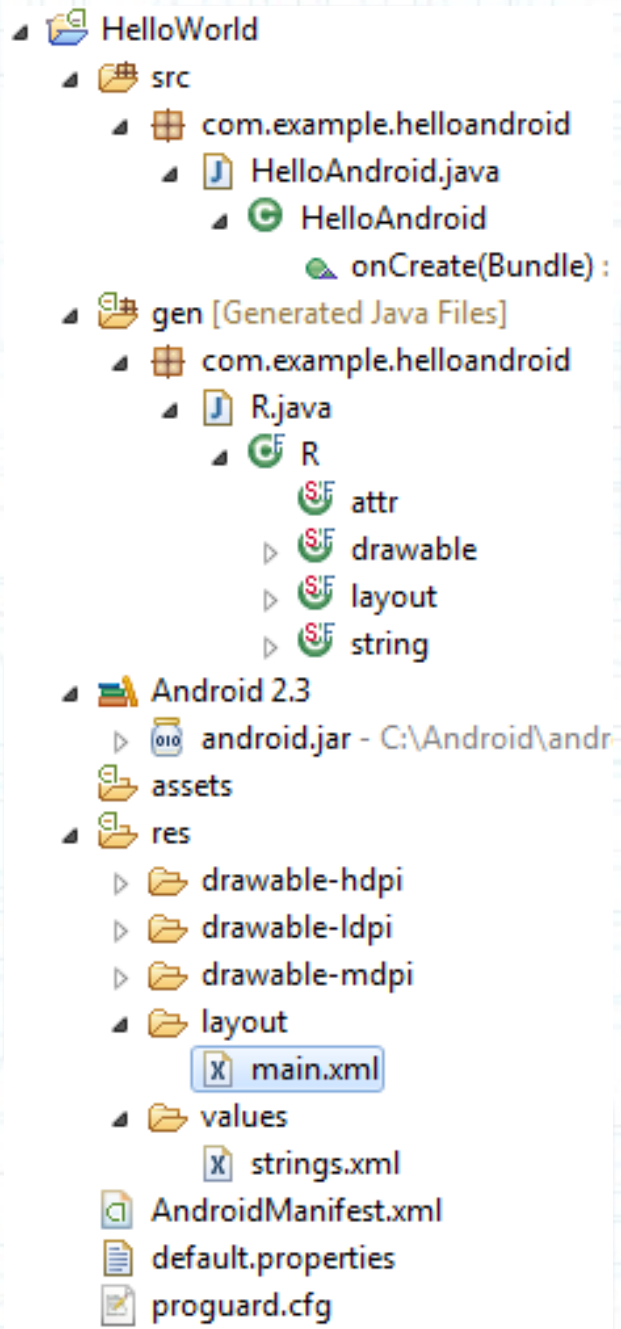
        tv.setText("Hello, Android"); // <-----
        setContentView(tv); // <-----
    }
}
```



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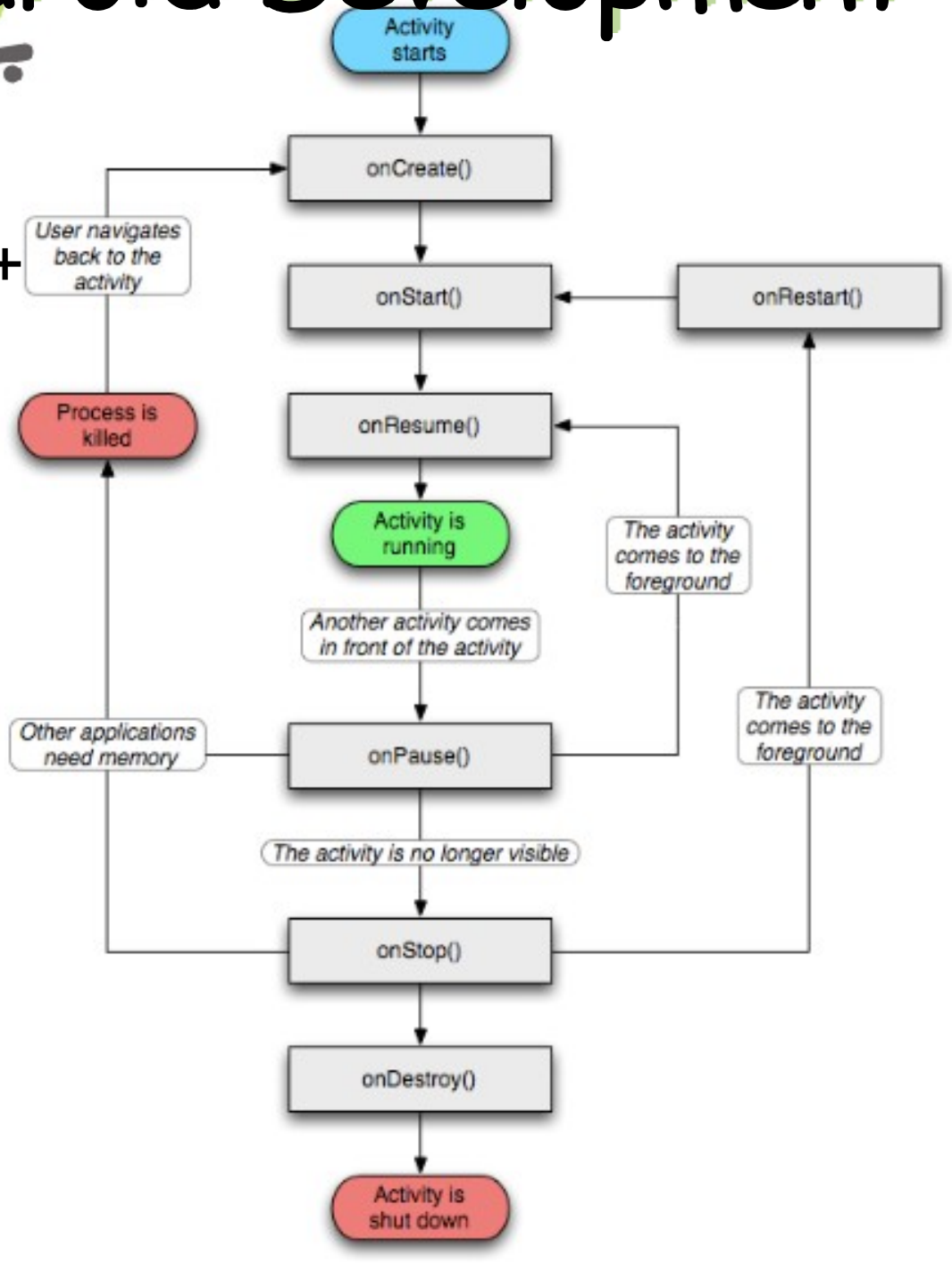
Activity Cycle

- Activity = *methods + Layout + Dialogs*
- Layout = *Views, Buttons, etc.*
- App = *many Activities*
- Task = *stack of Activities from one app*
- Also: *Services, Broadcast Receivers, Content Providers*



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API Demos

- File > New > Projects > Android Project
- Create project from existing source *(C:\Android\android-sdk-windows\samples\android-9\ApiDemos)*
- Right click ApiDemos project > Refresh
- src > com.examples.android.apis > ApiDemosApplication
- Run > Run > Android Application (or Ctrl+F5)
- Explore the demos!

Ready to try it yourself?

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Stopwatch 1

- Hello World, but need time and screen updating
- *FormattedTime.java* and *RefreshHandler.java*

FormattedTime

- *start()* - starts timer, returns “00:00:00”
- *stop()* - stops timer, returns time “MM:SS:mm”
- *reset()* - resets timer, returns “00:00:00”
- *update()* - returns time “MM:SS:mm”

RefreshHandler

- *start(delay)* - starts calling *update()* every *delay* ms
- *stop()* - stops calling *update()*
- *update()* - override this with your code

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Stopwatch A

- Hello World, with *FormattedTime* and *RefreshHandler*
- But this just keeps running, what about stopping or resetting?

```
1  package com.pennapps.stopwatch;
2
3  import android.app.Activity;
4  import android.os.Bundle;
5  import android.widget.TextView;
6
7  public class Stopwatch extends Activity {
8
9      private FormattedTime timer;
10     private TextView tv;
11
12     private RefreshTime refresh;
13     class RefreshTime extends RefreshHandler {
14         public void update() {
15             tv.setText("Time is: " + timer.update());
16         }
17     };
18
19     /** Called when the activity is first created. */
20     @Override
21     public void onCreate(Bundle savedInstanceState) {
22         super.onCreate(savedInstanceState);
23         setContentView(R.layout.main);
24         tv = new TextView(this);
25         tv.setText("Hello, Android");
26         setContentView(tv);
27
28         timer = new FormattedTime();
29         timer.start();
30         refresh = new RefreshTime();
31         refresh.start();
32     }
33 }
```

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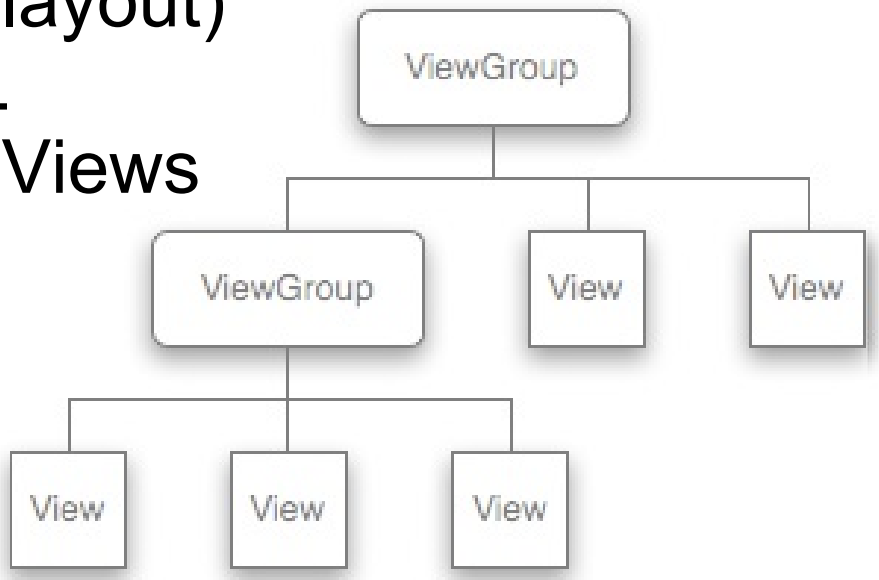
Views, Images and Buttons, Oh My!

- Activity.setContextView(layout)
- Graphical layout → XML
- Add in Widgets or more Views



ViewGroups:

LinearLayout, TableLayout, RelativeLayout, ScrollView, ListView, GridView

Widgets/Content Views:

TextView, WebView,ImageView ImageButton, Button, Checkbox, EditText, RadioButton

See Android documentation for details and more
http://developer.android.com/guide/topics/ui/index.html

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Stopwatch B

- Buttons for Start, Stop, Reset
- Give *TextView* an *id* for reference
- Good practice: use *strings.xml*
- *onClick* → method
- Use *GridView* or other *ViewGroups* for nicer layout

```
1  <?xml version="1.0" encoding="utf-8"?>
2  <LinearLayout xmlns:android="http://schema
3      android:orientation="vertical"
4      android:layout_width="fill_parent"
5      android:layout_height="fill_parent"
6      >
7  <TextView
8      android:id="@+id/time"
9      android:layout_width="fill_parent"
10     android:layout_height="wrap_content"
11     android:text="@string/hello"
12     />
13 <Button
14     android:layout_height="wrap_content"
15     android:layout_width="wrap_content"
16     android:text="@string/start"
17     android:onClick="start"
18     />
19 <Button
20     android:layout_height="wrap_content"
21     android:layout_width="wrap_content"
22     android:text="@string/stop"
23     android:onClick="stop"
24     />
25 <Button
26     android:layout_height="wrap_content"
27     android:layout_width="wrap_content"
28     android:text="@string/reset"
29     android:onClick="reset"
30     />
31 </LinearLayout>
32
```

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Stopwatch B

- Cross-reference TextView (recast)
- *onClick* must be *public void foo(View view)*

```
20      /** Called when the activity is first created. */
21      @Override
22      public void onCreate(Bundle savedInstanceState) {
23          super.onCreate(savedInstanceState);
24          setContentView(R.layout.main);
25          tv = (TextView) findViewById(R.id.time);
26
27          timer = new FormattedTime();
28          timer.start();
29          refresh = new RefreshTime();
30          refresh.start();
31      }
32
33      public void start(View view) { timer.start(); }
34      public void stop(View view) { timer.stop(); }
35      public void reset(View view) { timer.reset(); }
36  }
```

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Stopwatch C

- Lets add unnecessary stuff!

```
41    public boolean onKeyDown(int keyCode, KeyEvent event) {
42        switch (keyCode) {
43            case KeyEvent.KEYCODE_MENU:
44                AlertDialog.Builder builder = new AlertDialog.Builder(this);
45                builder.setMessage("Do you want to exit this ugly StopWatch?")
46                    .setCancelable(false)
47                    .setPositiveButton("Yes", new DialogInterface.OnClickListener() {
48                        public void onClick(DialogInterface dialog, int id) {
49                            Toast.makeText(
50                                    Stopwatch.this, "Goodbye!", Toast.LENGTH_SHORT).show();
51                            Stopwatch.this.finish();
52                        }
53                    })
54                    .setNegativeButton("No", new DialogInterface.OnClickListener() {
55                        public void onClick(DialogInterface dialog, int id) {
56                            dialog.cancel();
57                        }
58                    });
59                AlertDialog alert = builder.create();
60                alert.show();
61                return true;
62            default:
63                return super.onKeyDown(keyCode, event);
64        }
65    }
66 }
```

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More Common Stuff

http://developer.android.com/ →

Graphics:

- Static → XML layouts
- Active → Canvas
- 3D → OpenGL ES 1.x or 2.0 (NDK)

Audio/Video:

- Playback → MediaPlayer
- Recording → MediaRecorder

Data:

- Settings → PreferenceActivity & PreferenceManager
- Storage → External Storage, SQLite

Network:

- Connectivity → ConnectivityManager
- Locations → Uri*

Interactivity:

- Multiple activities → Intents
- Other apps/Content handling → Intent Filters

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Debugging!

Logcat!!! (and DDMS later)

- Log.v(String tag, String msg)
- Also Log.v, .w, .d, .wtf

ADB

- *android-sdk-*/platform-tools/adb*
- *adb push/pull/install*
- *adb shell*
- *adb logcat*

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DDMS (Dalvik Debug Monitor Server)

- Eclipse integrated Android debugger
- Windows > Open Perspective > Other... > DDMS
- Select device, select process
- Debug, Update Heap, Update Threads
- Allows inspection of threads, heap, allocation, files, etc.
- Also displays Logcat and allows for screenshots!

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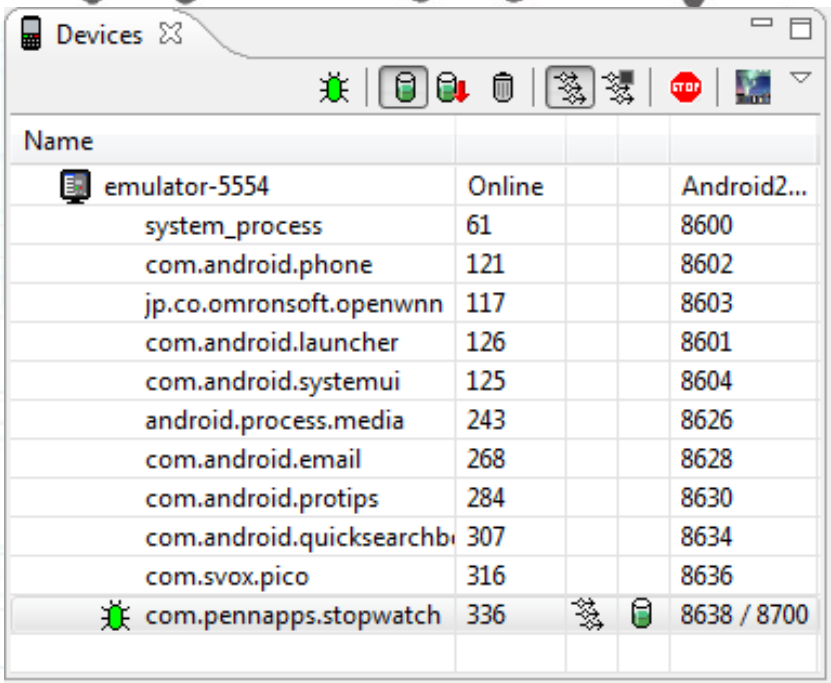

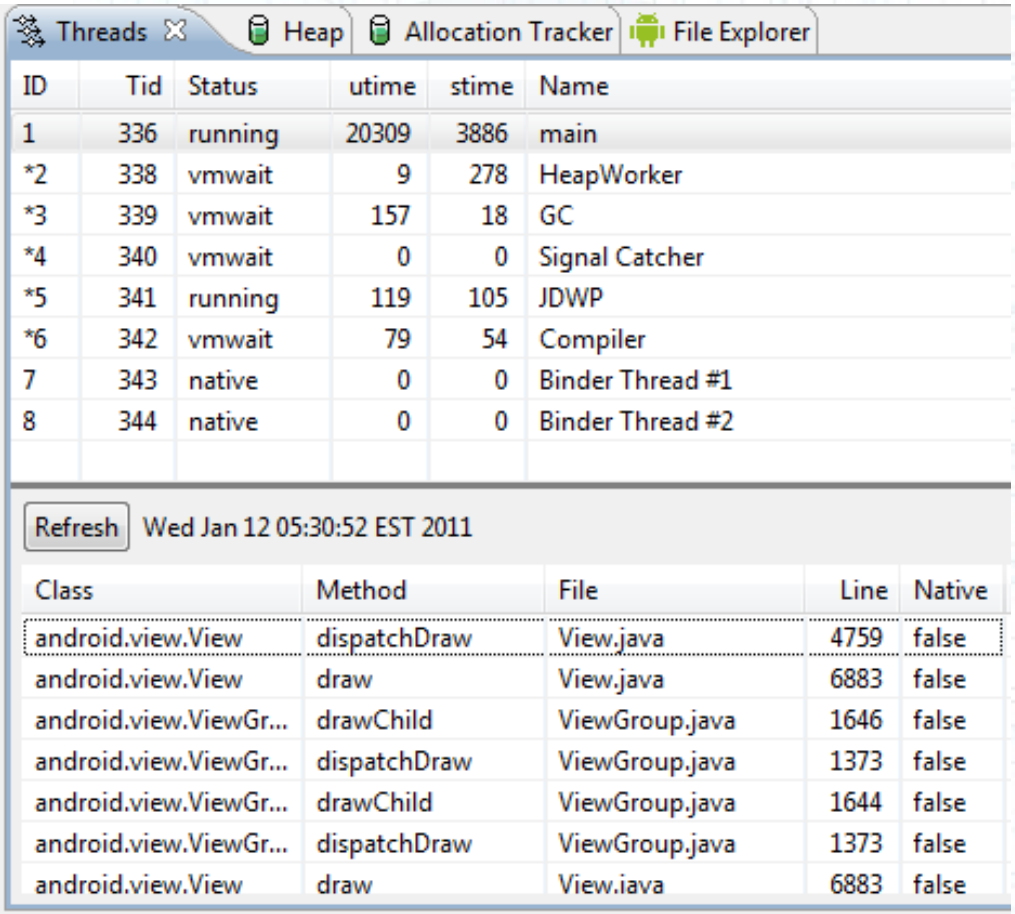

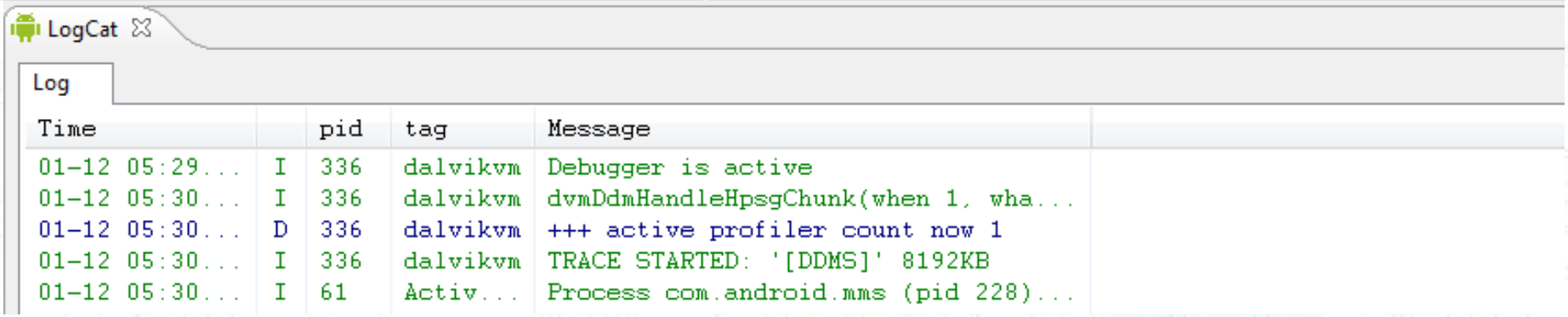

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Market and Actual Testing?

- Windows > Android SDK & AVD Manager
- Available packages > Third party Add-ons
- Google Usb Driver and Market Licensing

On your actual phone:

- MENU > Settings > Applications > Development > USB debugging ON
- Plug in, compile and run your Android app, select your actual phone (or might auto-select)

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Publishing on the Market

- *http://market.android.com/publish/Home*
- *http://developer.android.com/guide/publishing/publis*
- $25 one-time fee for a developer account
- Make money back via either paid app or advertisements (AdMob)
- Compare to iOS's $99/YEAR and content filtering/approval-based system
- Need to make sure to check support for different screen sizes, Android OS (current is 2.3 but lots still run 1.5/1.6), etc. in *AndroidManifest.xml* file

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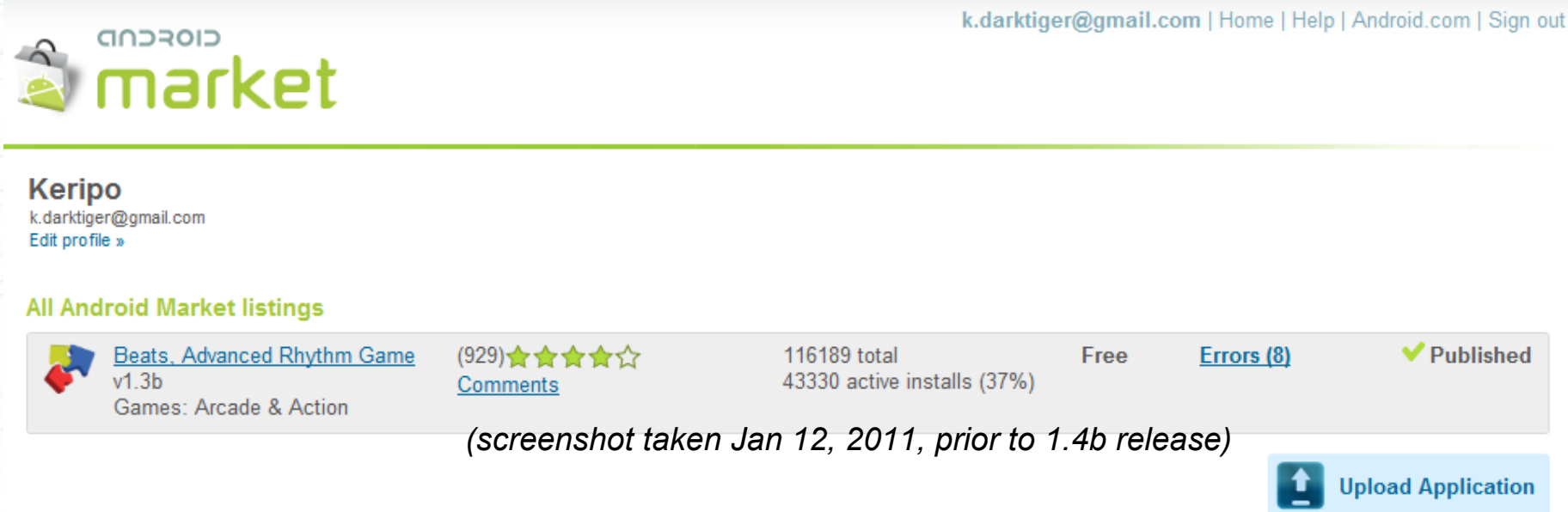
Beats, Advanced Rhythm Game

- Website: *http://beatsportable.com*
- Try it: *http://www.tinyurl.com/beatspre14b*
- Examples of: graphics, multi-touch, synchronized audio, menus, settings, dialogs, intent-filters, multiple activities, persistent data, multi-threading, file browser, and more...



(screenshot taken Jan 12, 2011, prior to 1.4b release)

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- Useful Links/Resources
  - *#android-dev* at freenode.irc.net
  - Android Developers
    http://developer.android.com/index.html
    - Dev Guide = fundamentals
    - Reference = Google's Javadocs
    - Resources = Tips and conventions
    - Blog = Newest updates, code examples
  - android-developers@googlegroups.com
    http://www.mail-archive.com/android-developers@googlegroups.com
  - StackOverflow – public Q&A
    http://stackoverflow.com/questions/tagged/android
  - anddev.org – forums with lots of tutorials
    http://www.anddev.org/
  - App Inventor Beta – Google's test project
    http://appinventor.googlelabs.com/about/index.html

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Questions? Office Hours 8-10pm, Sat. Jan 16