# CS 646 Android Mobile Application Development
Spring Semester, 2015
Doc 2 Android Introduction
Jan 22, 2015

# Android

# Android

Googles mobile phone OS and SDK

Java only
- Special VM
- Nonstandard byte code

Development IDE
- Eclipse
- Android Studio

Linux

Application framework
2D & 3D graphics
Audio, video and still image support
SQLite database
Embeddable web browser

Hardware dependent

GSM, CDMA
Bluetooth, EDGE, 3G, WIFI
Camera, GPS, compass
accelerometer, NFC

# Android IDE - Eclipse

IDE - Eclipse

- http://www.eclipse.org/downloads/
- Eclipse Classic recommended by Google
- But any of three types of Eclipse for Java works

Android SDK

- http://developer.android.com/sdk/installing.html
- Follow instruction at that site

# Android Eclipse - Emulator and Device

Emulator

- Can be slow to start at times
- Good for basic testing of code

But

- Emulator does not have sensors - accelerometer etc
- Emulator has different set of bugs than devices
- Emulator performance & constraints different than device
- Emulator does not give you feel of how app runs on device

# Android Studio

The future of Android development

Faster emulator

GUI builder works better

The preferred IDE for the class

# Android Versions

| Version | Name | API Level | % of Devices | Release Date | Notes |
|---|---|---|---|---|---|
| 2.2.x | Froyo | 8 | 0.4% | May 2010 | |
| 2.3.x | Gingerbread | 9-10 | 7.8% | Dec 2010 | Kindle Fire |
| 3.x | Honeycomb | 11-13 | | Feb 2011 | Tablets only |
| 4.0 | Ice Cream Sandwich | 14-15 | 6.7% | Oct 2011 | Kindle Fire HD |
| 4.1 | Jelly Bean | 16 | 19.2% | Summer 2012 | |
| 4.2 | | 17 | 20.3% | Oct 2012 | Kindle Fire HD 2nd Gen |
| 4.3 | | 18 | 6.5% | July 2013 | |
| 4.4 | KitKat | 19-20 | 39.1% | Oct 2013 | |
| 5.0 | Lollipop | 21 | | Nov 2014 | |

% devices that accessed Android Market for 7 day period ending January 8, 2014

Reference: http://en.wikipedia.org/wiki/Android_(operating_system), referenced 1/19/12. http://developer.android.com/resources/dashboard/platform-versions.html, referenced 1/20/15. http://en.wikipedia.org/wiki/Android_version_history referenced 1/20/15

# Android Fragmentation

Fragmentation on different axes

| | |
|---|---|
| User Interface | Motoblur,<br>HTC Sense UI<br>Kindle Fire<br>etc |
| Device | Over 70 devices in US<br>Different shapes<br>Different hardware |
| Operating System | 2.3<br>3.x<br>4.x<br>5.x |
| Marketplace | 50+ Android App stores |
| Service | Manufactures & venders provide services to increase revenue |

Reference:s http://ceklog.kindel.com/2012/01/14/fragmentation-is-not-the-end-of-android/, http://www.android-markets-info.com/android-markets-list, http://www.quora.com/How-many-Android-Phones-models-are-currently-available-in-the-US-Market

# Android Fragmentation

Good for some people, not for others

Causes more effort for developers

# Android Books & Documentation

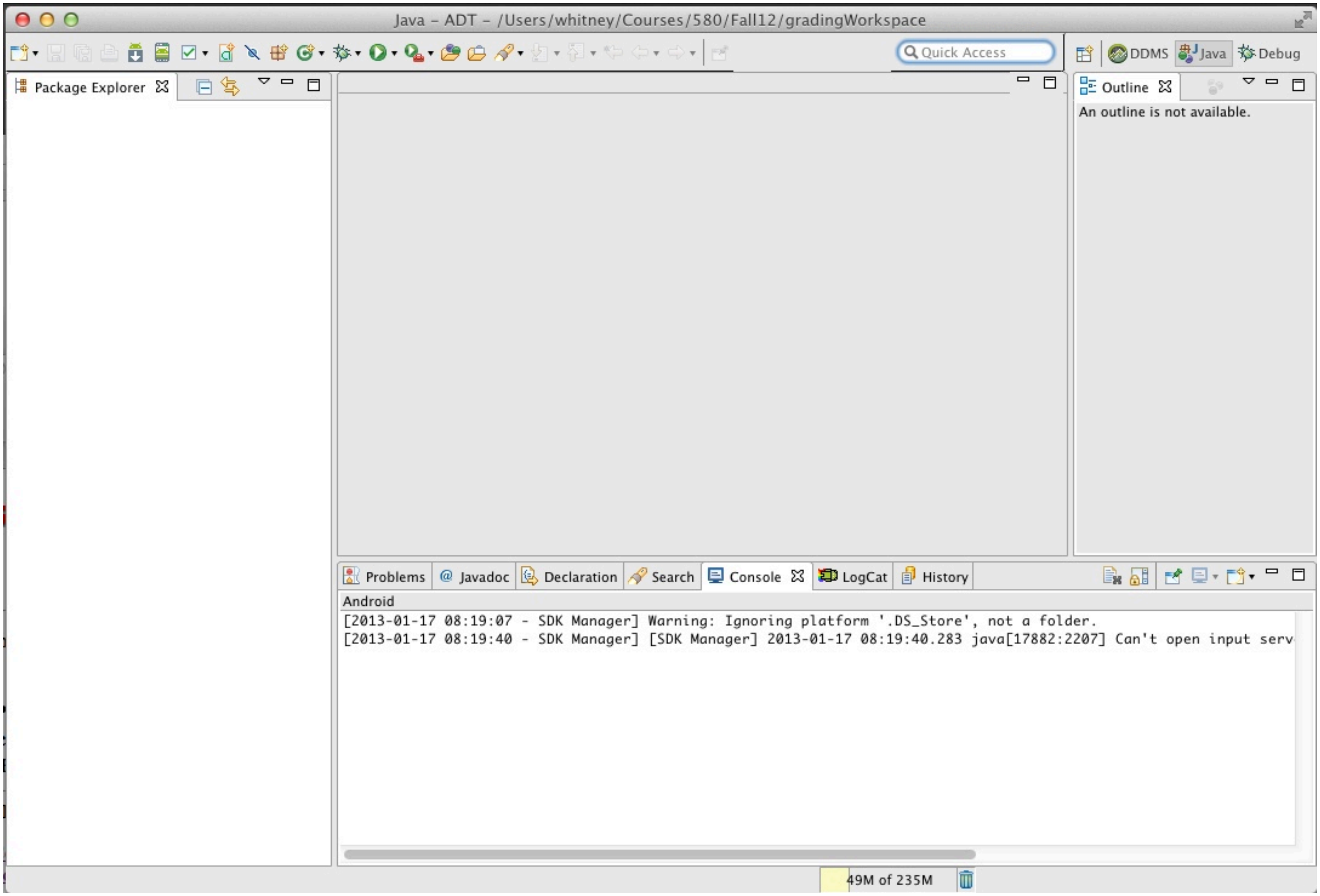
At least once a year

- New version of Android
- New version of Android tools

So books don't ways have lasted information

Googles tutorials on using Android are often out of date

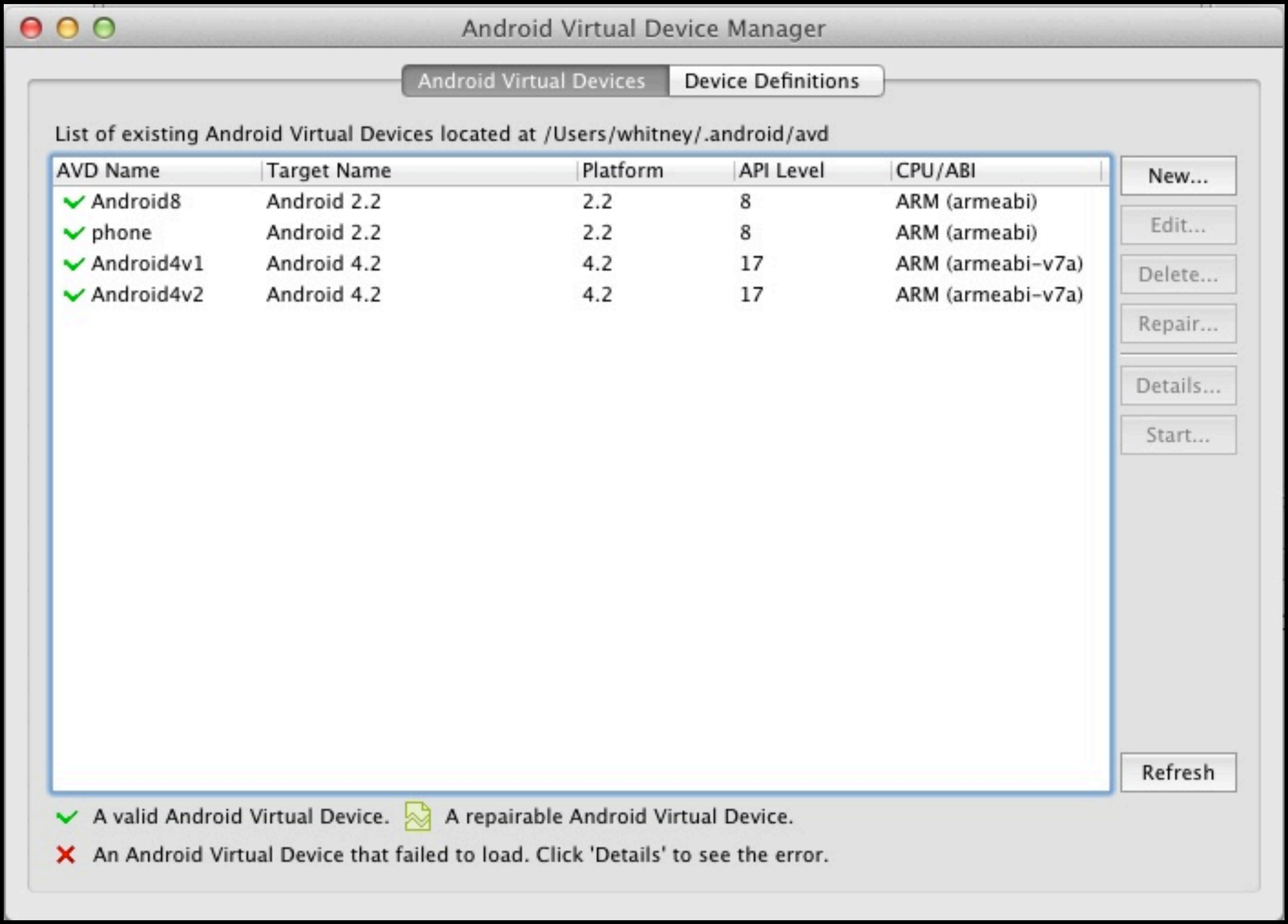
# Eclipse Demo



An outline is not available.

```
[2013-01-17 08:19:07 - SDK Manager] Warning: Ignoring platform '.DS_Store', not a folder.
[2013-01-17 08:19:40 - SDK Manager] [SDK Manager] 2013-01-17 08:19:40.283 java[17882:2207] Can't open input serv
```

# Virtual Devices with AVD Manager



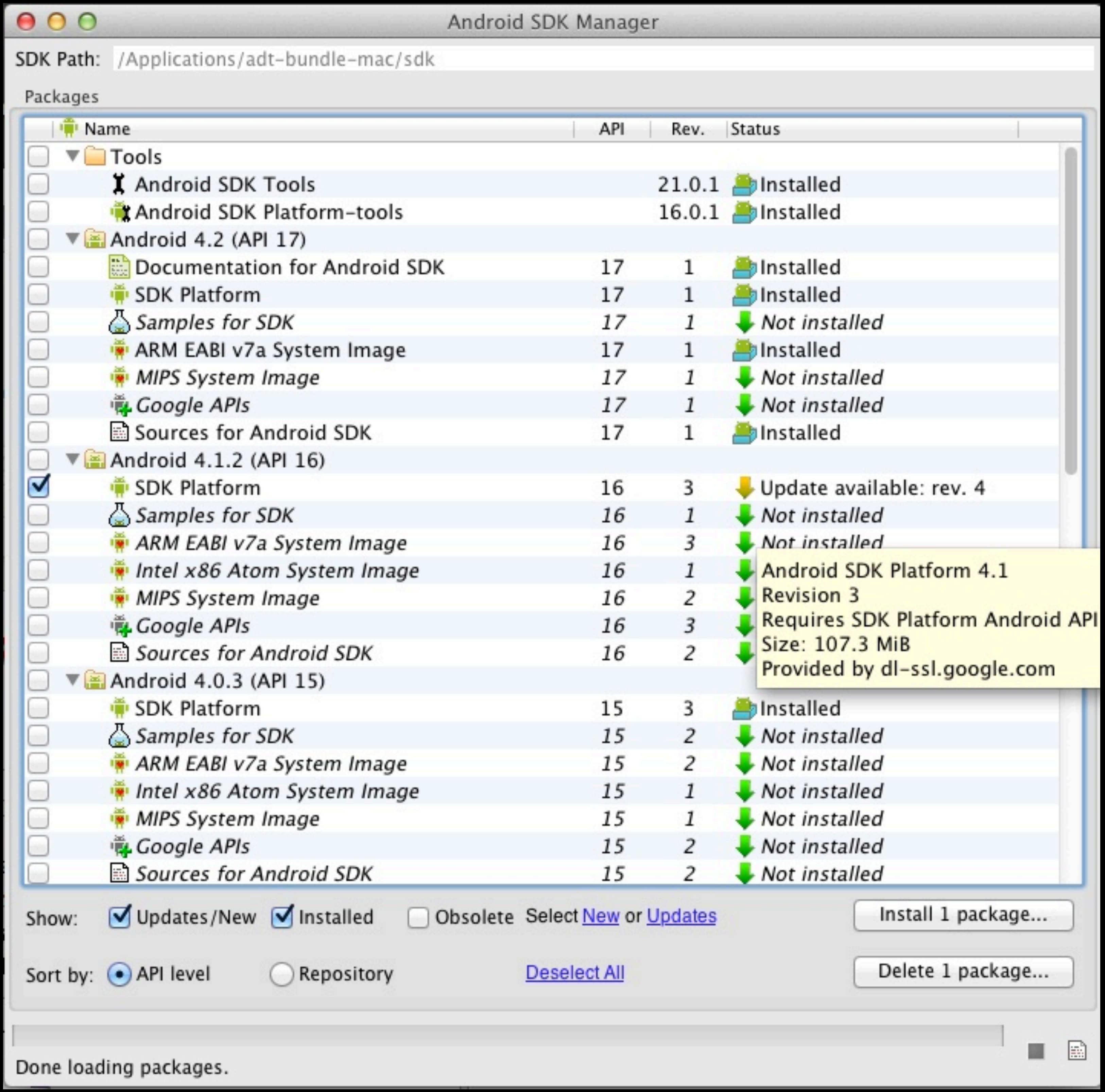
List of existing Android Virtual Devices located at /Users/whitney/.android/avd

| AVD Name | Target Name | Platform | API Level | CPU/ABI |
|---|---|---|---|---|
| ✓ Android8 | Android 2.2 | 2.2 | 8 | ARM (armeabi) |
| ✓ phone | Android 2.2 | 2.2 | 8 | ARM (armeabi) |
| ✓ Android4v1 | Android 4.2 | 4.2 | 17 | ARM (armeabi-v7a) |
| ✓ Android4v2 | Android 4.2 | 4.2 | 17 | ARM (armeabi-v7a) |

✓ A valid Android Virtual Device. A repairable Android Virtual Device.

✗ An Android Virtual Device that failed to load. Click 'Details' to see the error.

# Android SDK Manager



Android SDK Manager

SDK Path: /Applications/adt-bundle-mac/sdk

Packages

| | Name | API | Rev. | Status |
|---|---|---|---|---|
| □ | ▼ Tools | | | |
| □ | Android SDK Tools | | 21.0.1 | Installed |
| □ | Android SDK Platform-tools | | 16.0.1 | Installed |
| □ | ▼ Android 4.2 (API 17) | | | |
| □ | Documentation for Android SDK | 17 | 1 | Installed |
| □ | SDK Platform | 17 | 1 | Installed |
| □ | *Samples for SDK* | *17* | *1* | *Not installed* |
| □ | ARM EABI v7a System Image | 17 | 1 | Installed |
| □ | *MIPS System Image* | *17* | *1* | *Not installed* |
| □ | *Google APIs* | *17* | *1* | *Not installed* |
| □ | Sources for Android SDK | 17 | 1 | Installed |
| □ | ▼ Android 4.1.2 (API 16) | | | |
| ☑ | SDK Platform | 16 | 3 | Update available: rev. 4 |
| □ | *Samples for SDK* | *16* | *1* | *Not installed* |
| □ | *ARM EABI v7a System Image* | *16* | *3* | *Not installed* |
| □ | *Intel x86 Atom System Image* | *16* | *1* | |
| □ | *MIPS System Image* | *16* | *2* | |
| □ | *Google APIs* | *16* | *3* | |
| □ | *Sources for Android SDK* | *16* | *2* | |
| □ | ▼ Android 4.0.3 (API 15) | | | |
| □ | SDK Platform | 15 | 3 | Installed |
| □ | *Samples for SDK* | *15* | *2* | *Not installed* |
| □ | *ARM EABI v7a System Image* | *15* | *2* | *Not installed* |
| □ | *Intel x86 Atom System Image* | *15* | *1* | *Not installed* |
| □ | *MIPS System Image* | *15* | *1* | *Not installed* |
| □ | *Google APIs* | *15* | *2* | *Not installed* |
| □ | *Sources for Android SDK* | *15* | *2* | *Not installed* |

Android SDK Platform 4.1
Revision 3
Requires SDK Platform Android API
Size: 107.3 MiB
Provided by dl-ssl.google.com

Show: ☑ Updates/New ☑ Installed □ Obsolete Select New or Updates

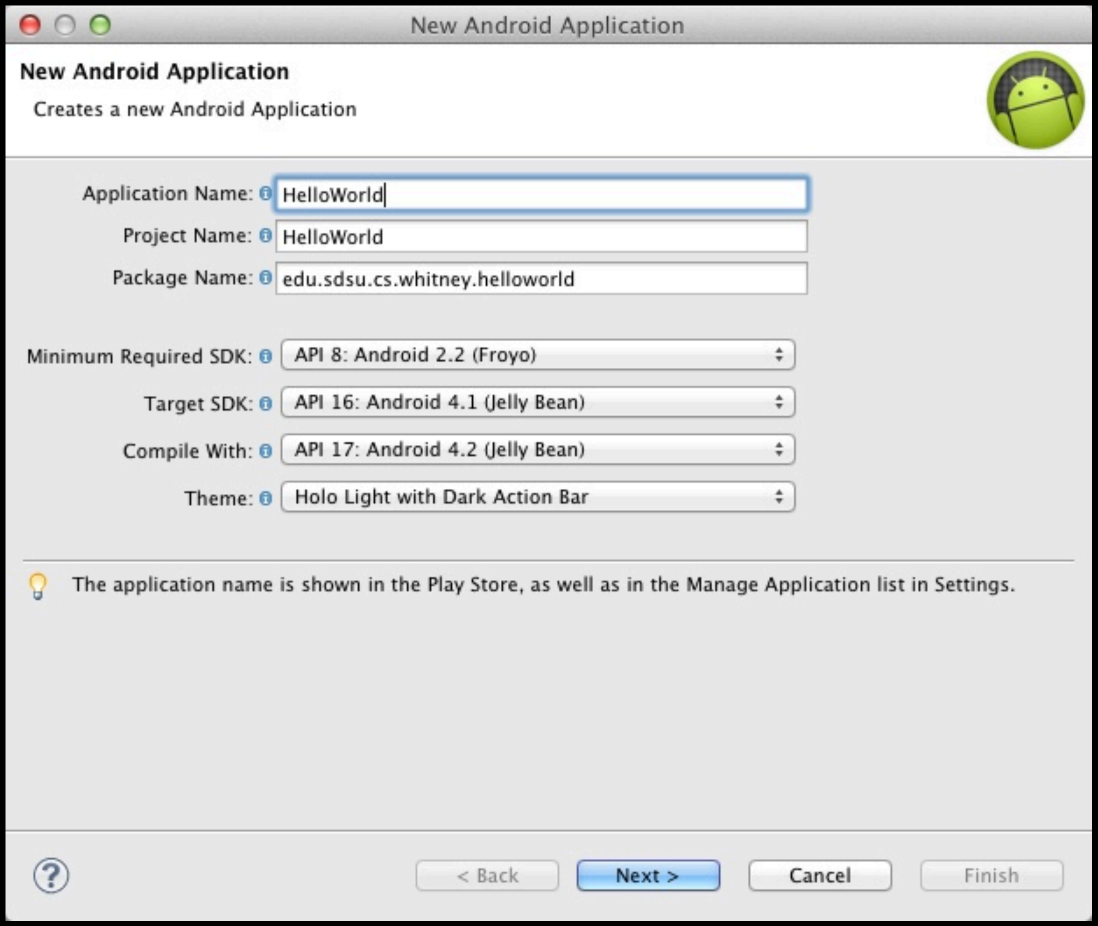
Sort by: ● API level ○ Repository Deselect All

Done loading packages.

# Run Hello World

http://developer.android.com/training/basics/firstapp/index.html

# Creating Android Project



New Android Application

**New Android Application**

Creates a new Android Application

Application Name: HelloWorld

Project Name: HelloWorld

Package Name: edu.sdsu.cs.whitney.helloworld

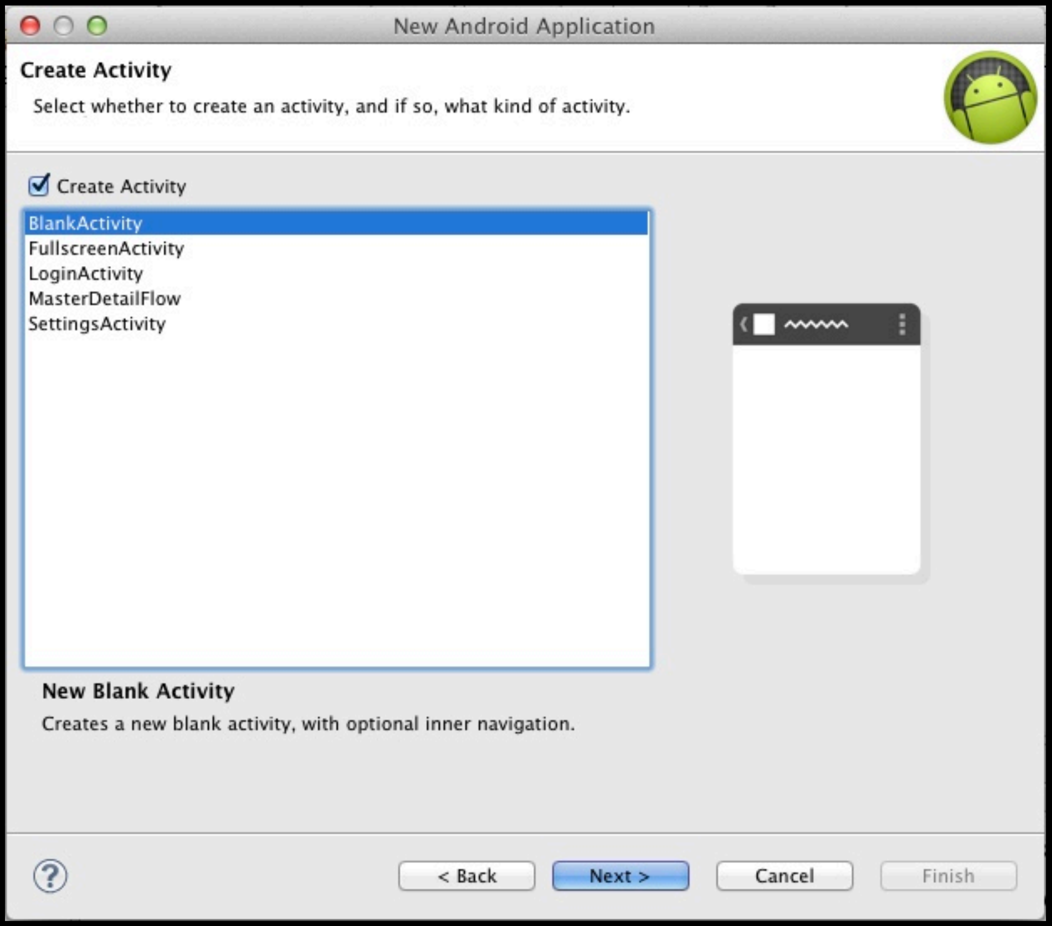
Minimum Required SDK: API 8: Android 2.2 (Froyo)

Target SDK: API 16: Android 4.1 (Jelly Bean)

Compile With: API 17: Android 4.2 (Jelly Bean)

Theme: Holo Light with Dark Action Bar

The application name is shown in the Play Store, as well as in the Manage Application list in Settings.



New Android Application

**Create Activity**

Select whether to create an activity, and if so, what kind of activity.

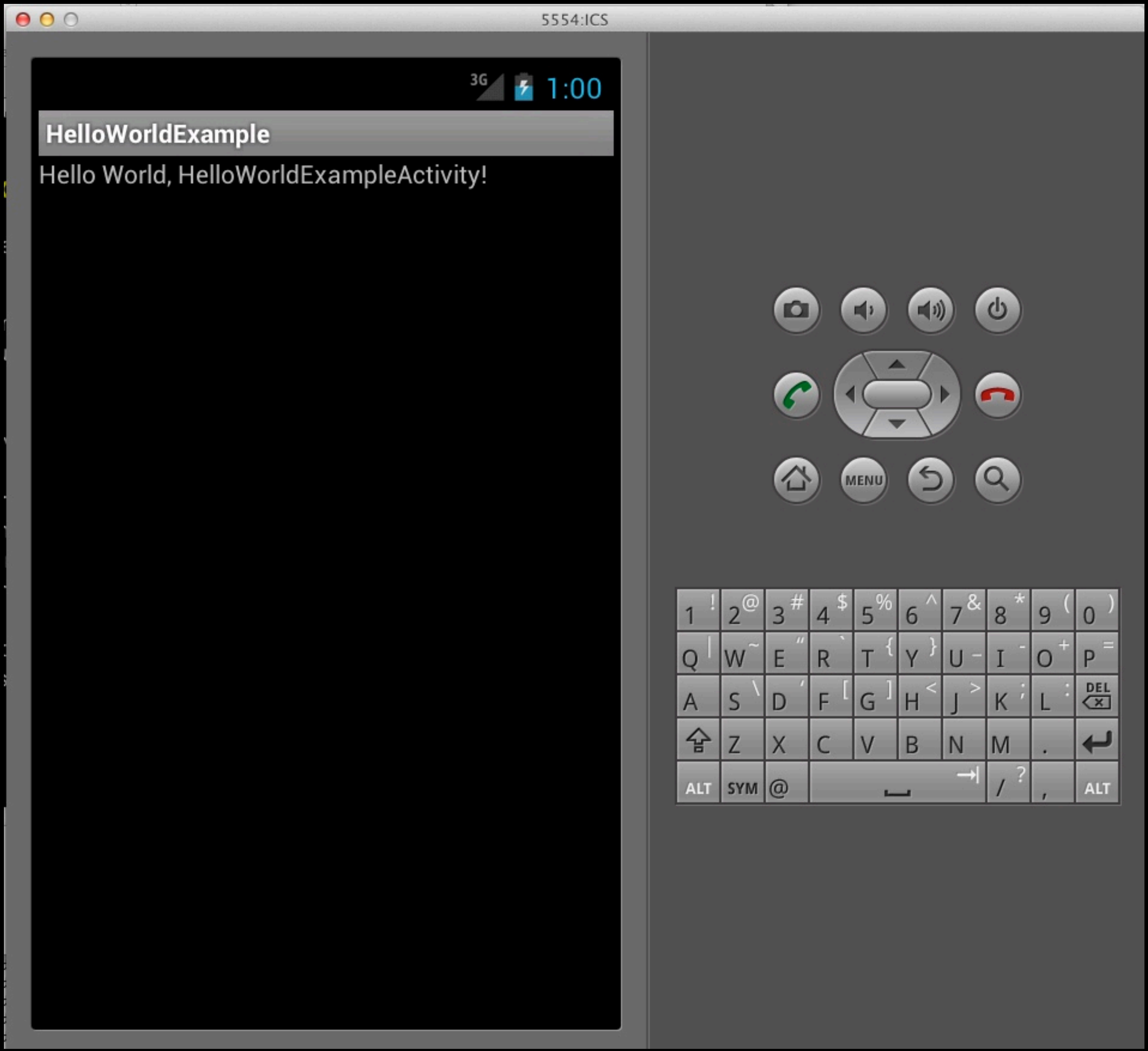
☑ Create Activity

- BlankActivity
- FullscreenActivity
- LoginActivity
- MasterDetailFlow
- SettingsActivity

**New Blank Activity**

Creates a new blank activity, with optional inner navigation.

# Hello World - Demo

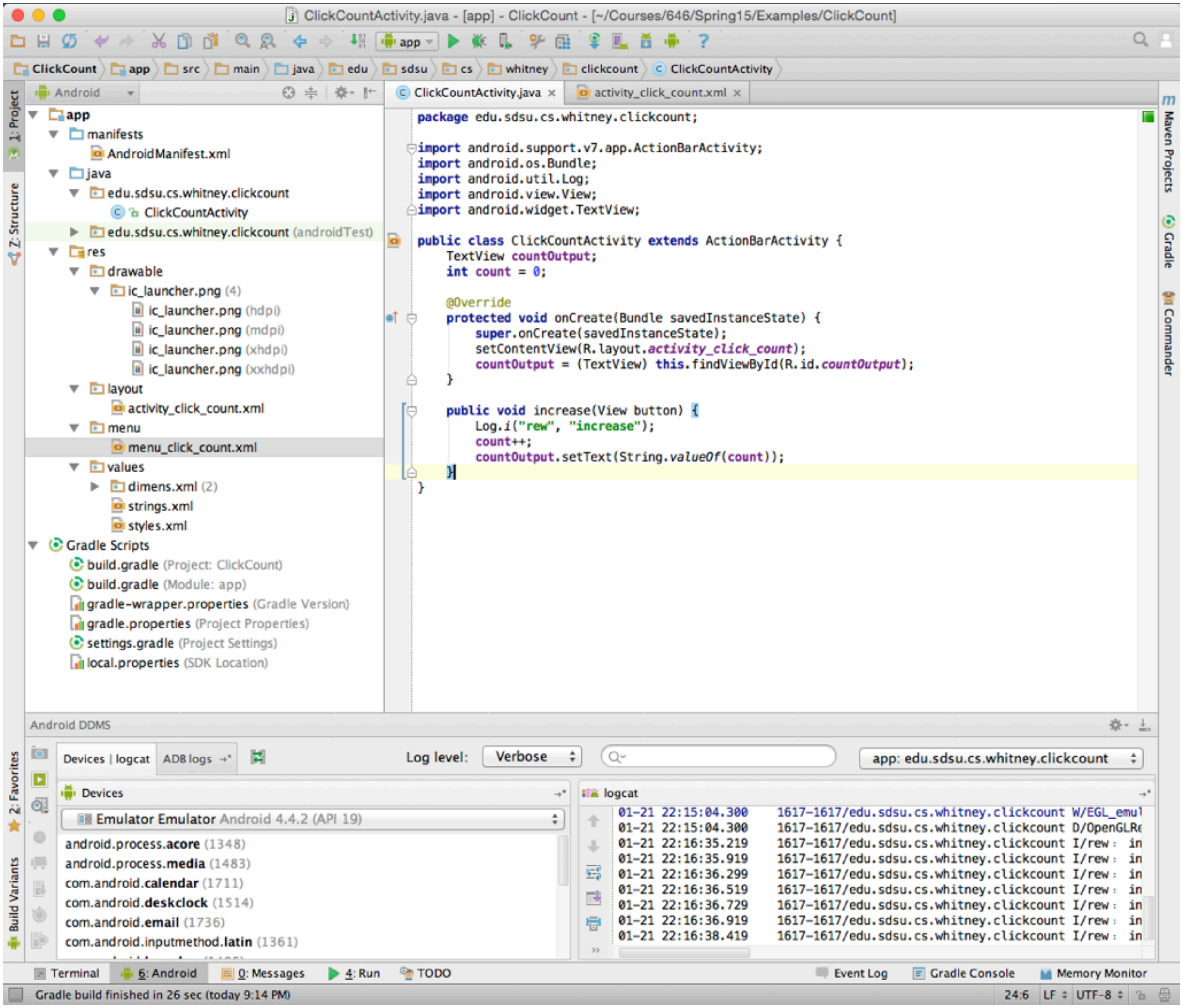


5554:ICS

HelloWorldExample

Hello World, HelloWorldExampleActivity!

# Android Studio - Demo



ClickCountActivity.java - [app] - ClickCount - [~/Courses/646/Spring15/Examples/ClickCount]

ClickCount › app › src › main › java › edu › sdsu › cs › whitney › clickcount › ClickCountActivity

```
app
  manifests
    AndroidManifest.xml
  java
    edu.sdsu.cs.whitney.clickcount
      ClickCountActivity
    edu.sdsu.cs.whitney.clickcount (androidTest)
  res
    drawable
      ic_launcher.png (4)
        ic_launcher.png (hdpi)
        ic_launcher.png (mdpi)
        ic_launcher.png (xhdpi)
        ic_launcher.png (xxhdpi)
    layout
      activity_click_count.xml
    menu
      menu_click_count.xml
    values
      dimens.xml (2)
      strings.xml
      styles.xml
Gradle Scripts
  build.gradle (Project: ClickCount)
  build.gradle (Module: app)
  gradle-wrapper.properties (Gradle Version)
  gradle.properties (Project Properties)
  settings.gradle (Project Settings)
  local.properties (SDK Location)
```

```java
package edu.sdsu.cs.whitney.clickcount;

import android.support.v7.app.ActionBarActivity;
import android.os.Bundle;
import android.util.Log;
import android.view.View;
import android.widget.TextView;

public class ClickCountActivity extends ActionBarActivity {
    TextView countOutput;
    int count = 0;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_click_count);
        countOutput = (TextView) this.findViewById(R.id.countOutput);
    }

    public void increase(View button) {
        Log.i("rew", "increase");
        count++;
        countOutput.setText(String.valueOf(count));
    }
}
```

Android DDMS

Log level: Verbose

app: edu.sdsu.cs.whitney.clickcount

Devices

Emulator Emulator Android 4.4.2 (API 19)

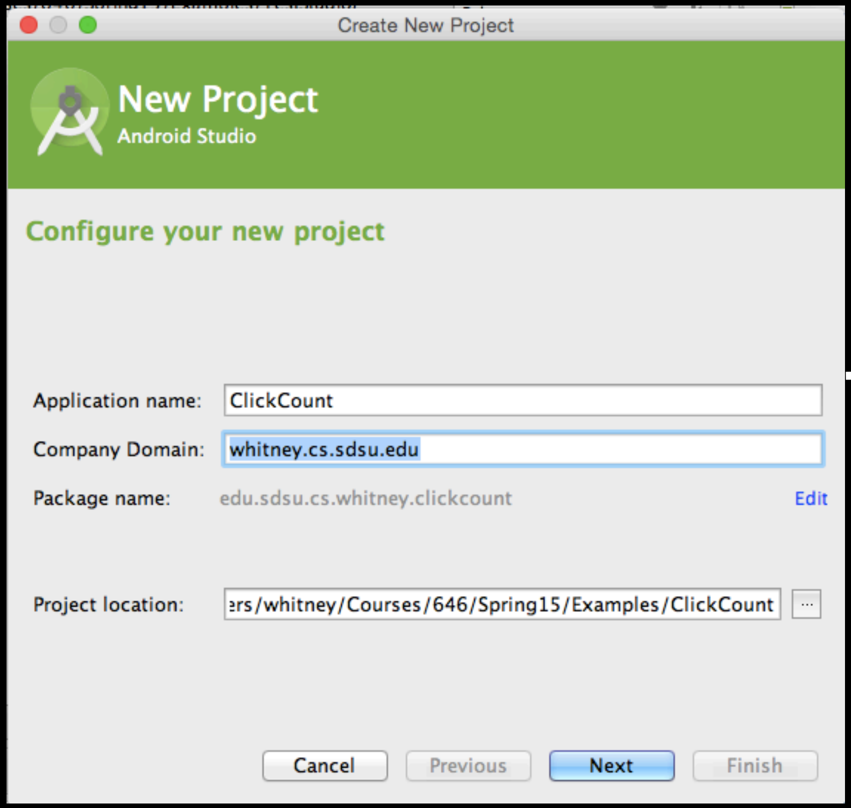
android.process.acore (1348)
android.process.media (1483)
com.android.calendar (1711)
com.android.deskclock (1514)
com.android.email (1736)
com.android.inputmethod.latin (1361)

logcat

```
01-21 22:15:04.300    1617-1617/edu.sdsu.cs.whitney.clickcount W/EGL_emul
01-21 22:15:04.300    1617-1617/edu.sdsu.cs.whitney.clickcount D/OpenGLRe
01-21 22:16:35.219    1617-1617/edu.sdsu.cs.whitney.clickcount I/rew :  in
01-21 22:16:35.919    1617-1617/edu.sdsu.cs.whitney.clickcount I/rew :  in
01-21 22:16:36.299    1617-1617/edu.sdsu.cs.whitney.clickcount I/rew :  in
01-21 22:16:36.519    1617-1617/edu.sdsu.cs.whitney.clickcount I/rew :  in
01-21 22:16:36.729    1617-1617/edu.sdsu.cs.whitney.clickcount I/rew :  in
01-21 22:16:36.919    1617-1617/edu.sdsu.cs.whitney.clickcount I/rew :  in
01-21 22:16:38.419    1617-1617/edu.sdsu.cs.whitney.clickcount I/rew :  in
```

Gradle build finished in 26 sec (today 9:14 PM)

24:6  LF  UTF-8



Create New Project

New Project

Android Studio

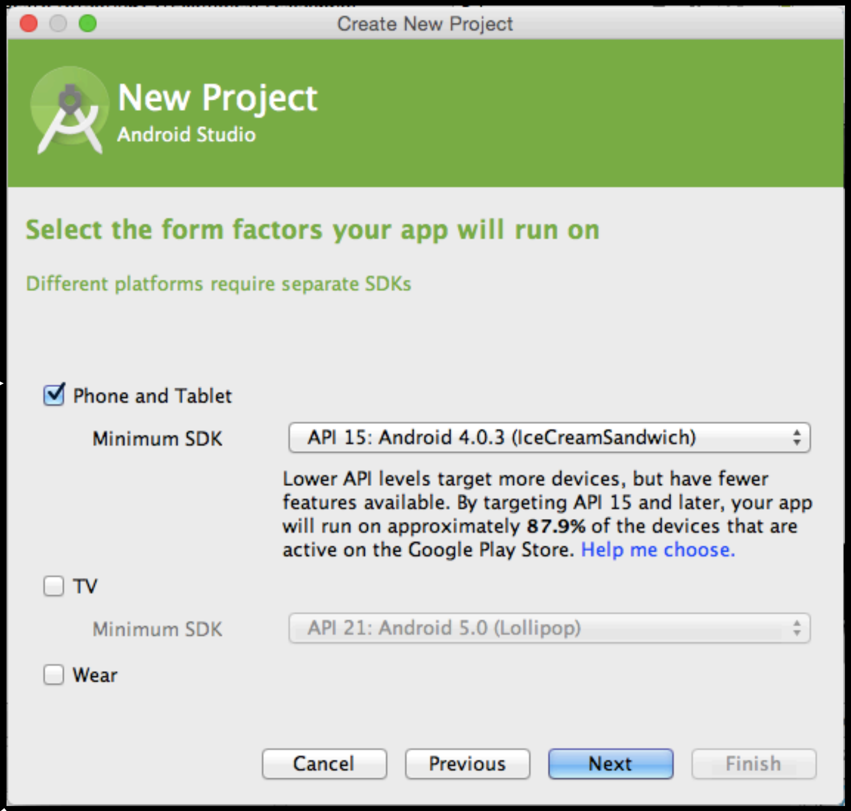
Configure your new project

Application name: ClickCount

Company Domain: whitney.cs.sdsu.edu

Package name: edu.sdsu.cs.whitney.clickcount

Project location: ers/whitney/Courses/646/Spring15/Examples/ClickCount



Create New Project

New Project

Android Studio

Select the form factors your app will run on

Different platforms require separate SDKs

☑ Phone and Tablet

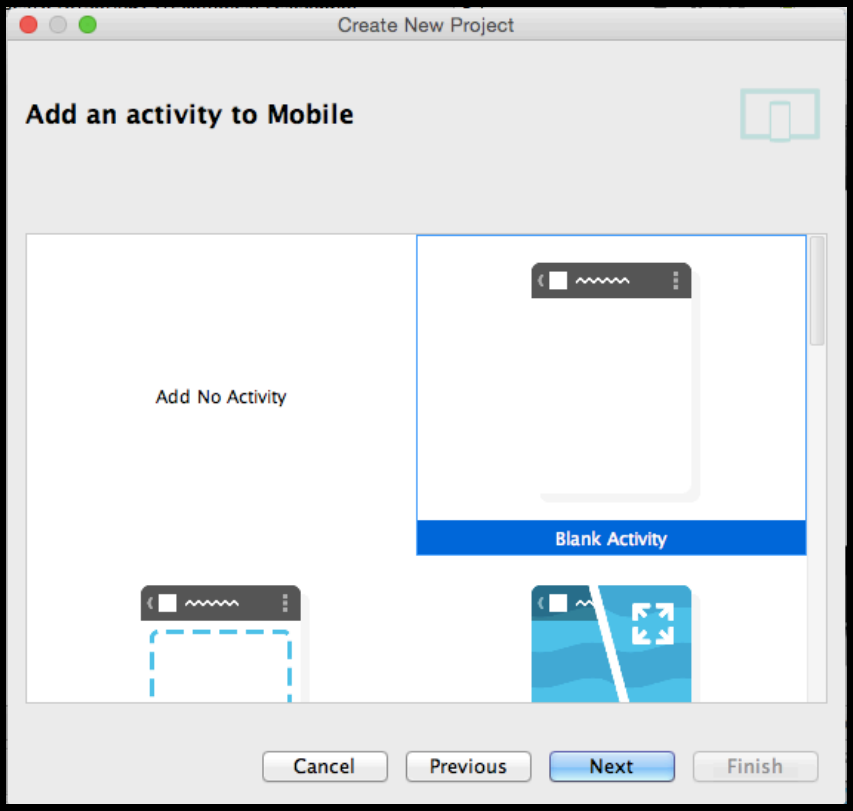
Minimum SDK: API 15: Android 4.0.3 (IceCreamSandwich)

Lower API levels target more devices, but have fewer features available. By targeting API 15 and later, your app will run on approximately **87.9%** of the devices that are active on the Google Play Store. Help me choose.

☐ TV

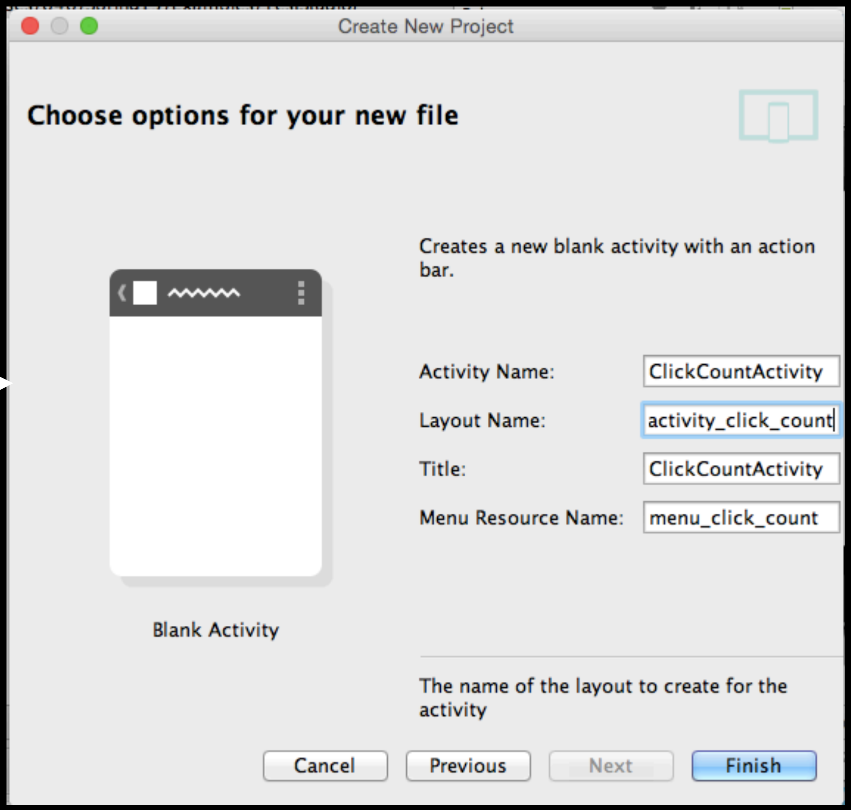
Minimum SDK: API 21: Android 5.0 (Lollipop)

☐ Wear



Create New Project

Add an activity to Mobile



Create New Project

Choose options for your new file

Blank Activity

Creates a new blank activity with an action bar.

Activity Name: ClickCountActivity

Layout Name: activity_click_count

Title: ClickCountActivity

Menu Resource Name: menu_click_count

The name of the layout to create for the activity

# Lots of parts

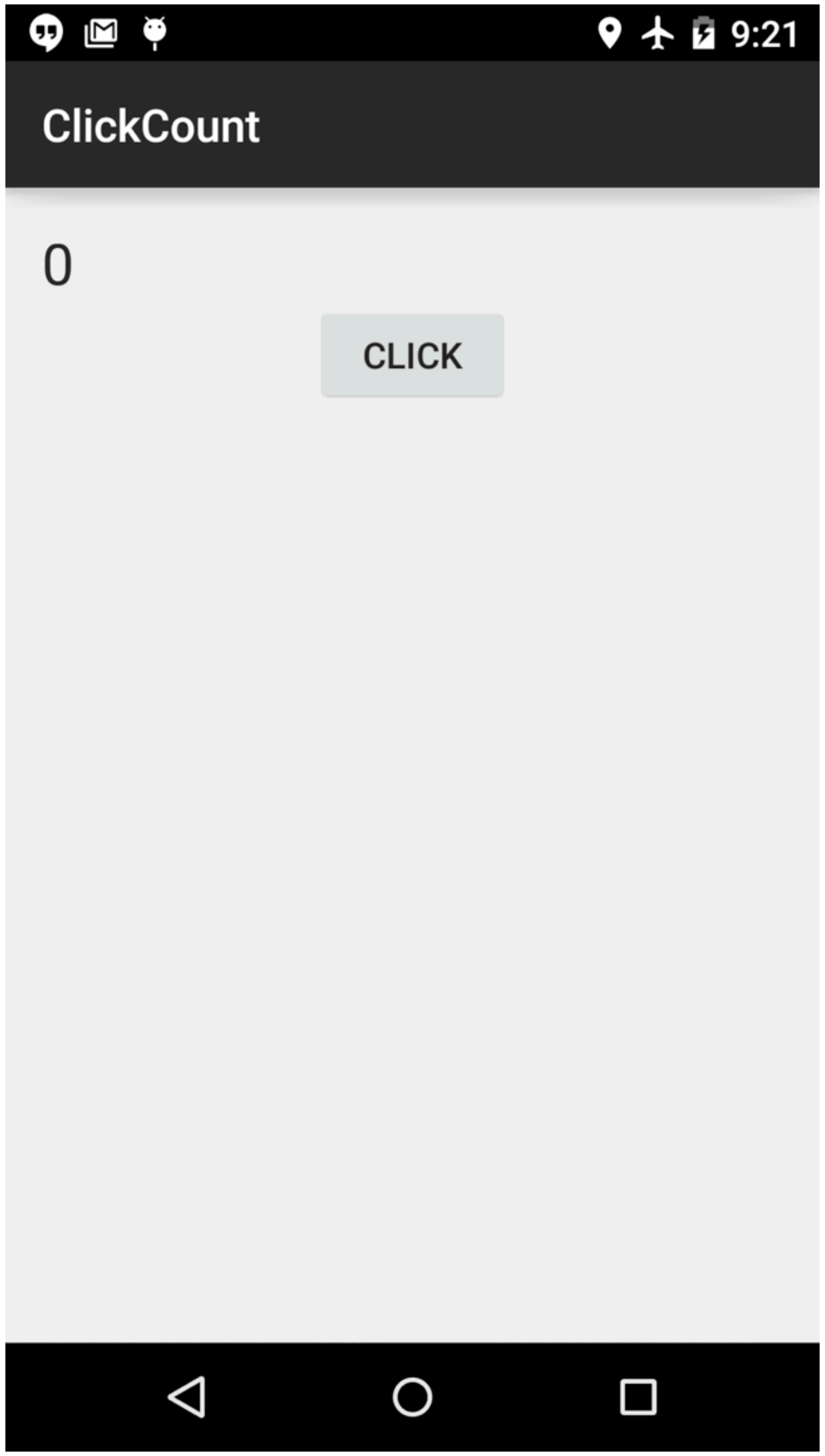
Android apps have lots of parts

Bit intimidating at first, but each part not hard

Difficult to show entire example

# Click Count Example

# Click Count



Clicking on button increases count

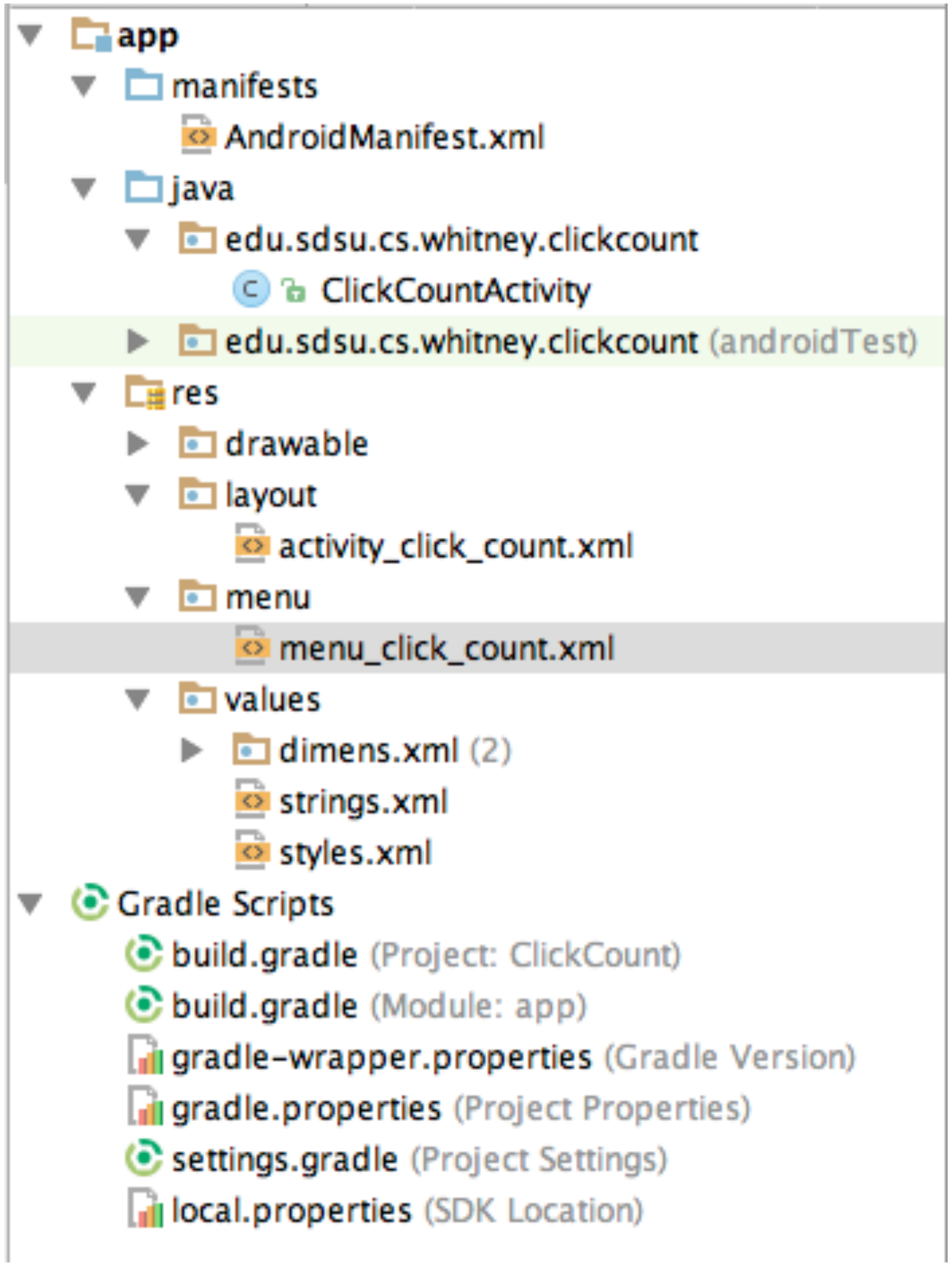
Issues

Adding GUI widgets
Code accessing GUI widgets
Code responding to widget events
Debugging

Issues for Future

Better layout

# Lots of Parts



```
▼ app
    ▼ manifests
          AndroidManifest.xml
    ▼ java
        ▼ edu.sdsu.cs.whitney.clickcount
              ClickCountActivity
        ▶ edu.sdsu.cs.whitney.clickcount (androidTest)
    ▼ res
        ▶ drawable
        ▼ layout
              activity_click_count.xml
        ▼ menu
              menu_click_count.xml
        ▼ values
            ▶ dimens.xml (2)
              strings.xml
              styles.xml
▼ Gradle Scripts
      build.gradle (Project: ClickCount)
      build.gradle (Module: app)
      gradle-wrapper.properties (Gradle Version)
      gradle.properties (Project Properties)
      settings.gradle (Project Settings)
      local.properties (SDK Location)
```

# Basic parts

- Activity
    - Controller

- Resources
    - R.java
        - Runtime location of view

    - layouts (res/layouts/main.xml)
        - View

    - strings (res/values/strings.xml)
        - Text display on screen

    - menu (res/menu)

    - styles (res/values/styles.xml

# Separation of Concerns

Activity

- Handle events related to View

layouts

- Generates view from xml
- Separates View organization from code

strings

- Text displayed in view
- Separates text & language used from code and view

# Main Class

```
package edu.sdsu.cs.whitney;
import android.app.Activity;        import android.os.Bundle;
import android.util.Log;            import android.view.View;
import android.widget.TextView;

public class ClickCountActivity extends Activity {
    TextView countOutput;
    int count = 0;

  @Override
   public void onCreate(Bundle savedInstanceState) {
     super.onCreate(savedInstanceState);
     setContentView(R.layout.main);
     countOutput = (TextView) this.findViewById(R.id.countOutput);
  }

  public void increase(View button) {
    Log.i("rew", "increase");
    count++;
    countOutput.setText(String.valueOf(count));
  }
}
```

# R.java

R = Resource

```
/* AUTO-GENERATED FILE.  DO NOT MODIFY. */
package edu.sdsu.cs.whitney;
public final class R {
    public static final class attr {
    }
    public static final class drawable {
        public static final int ic_launcher=0x7f020000;
    }
    public static final class id {
        public static final int clickButton=0x7f050001;
        public static final int countOutput=0x7f050000;
    }
    public static final class layout {
        public static final int main=0x7f030000;
    }
    public static final class string {
        public static final int app_name=0x7f040000;
        public static final int clickButtonLabel=0x7f040001;
        public static final int initialCount=0x7f040002;
    }
}
```

Maps

Names to runtime locations of resources

Generated from ids in main.xml

Generated from files in res/layout

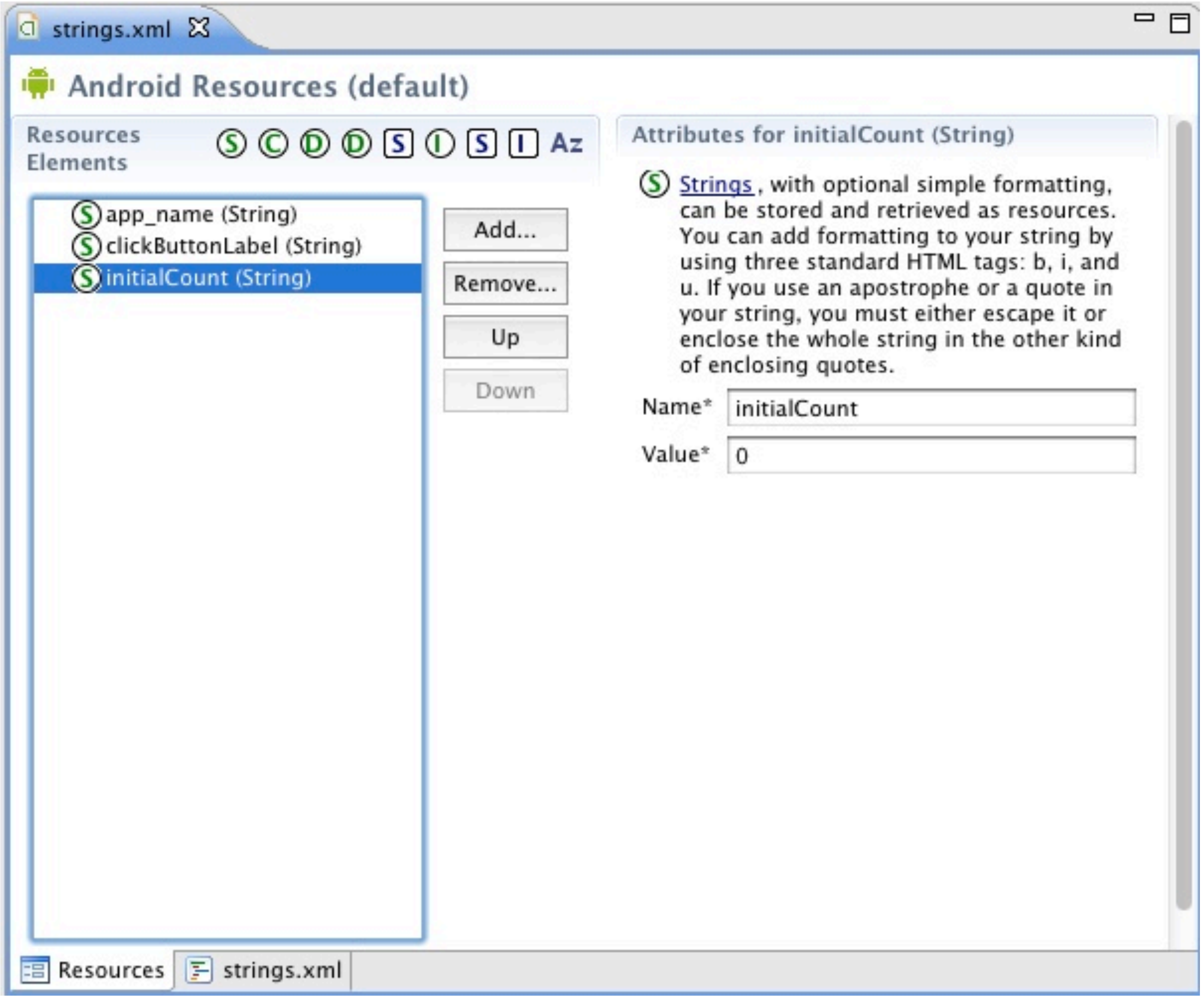
Generated from strings.xml

This is the R file generated by Eclipse. The R file generated by Android Studio is 5,000 lines long, which is part of the reason compiles take longer using Android Studio.

# res/values/strings.xml

```
<?xml version="1.0" encoding="utf-8"?>
<resources>
    <string name="app_name">ClickCount</string>
    <string name="clickButtonLabel">Click</string>
    <string name="initialCount">0</string>
</resources>
```

# Two Eclipse views of res/values/strings.xml



Strings, with optional simple formatting, can be stored and retrieved as resources. You can add formatting to your string by using three standard HTML tags: b, i, and u. If you use an apostrophe or a quote in your string, you must either escape it or enclose the whole string in the other kind of enclosing quotes.

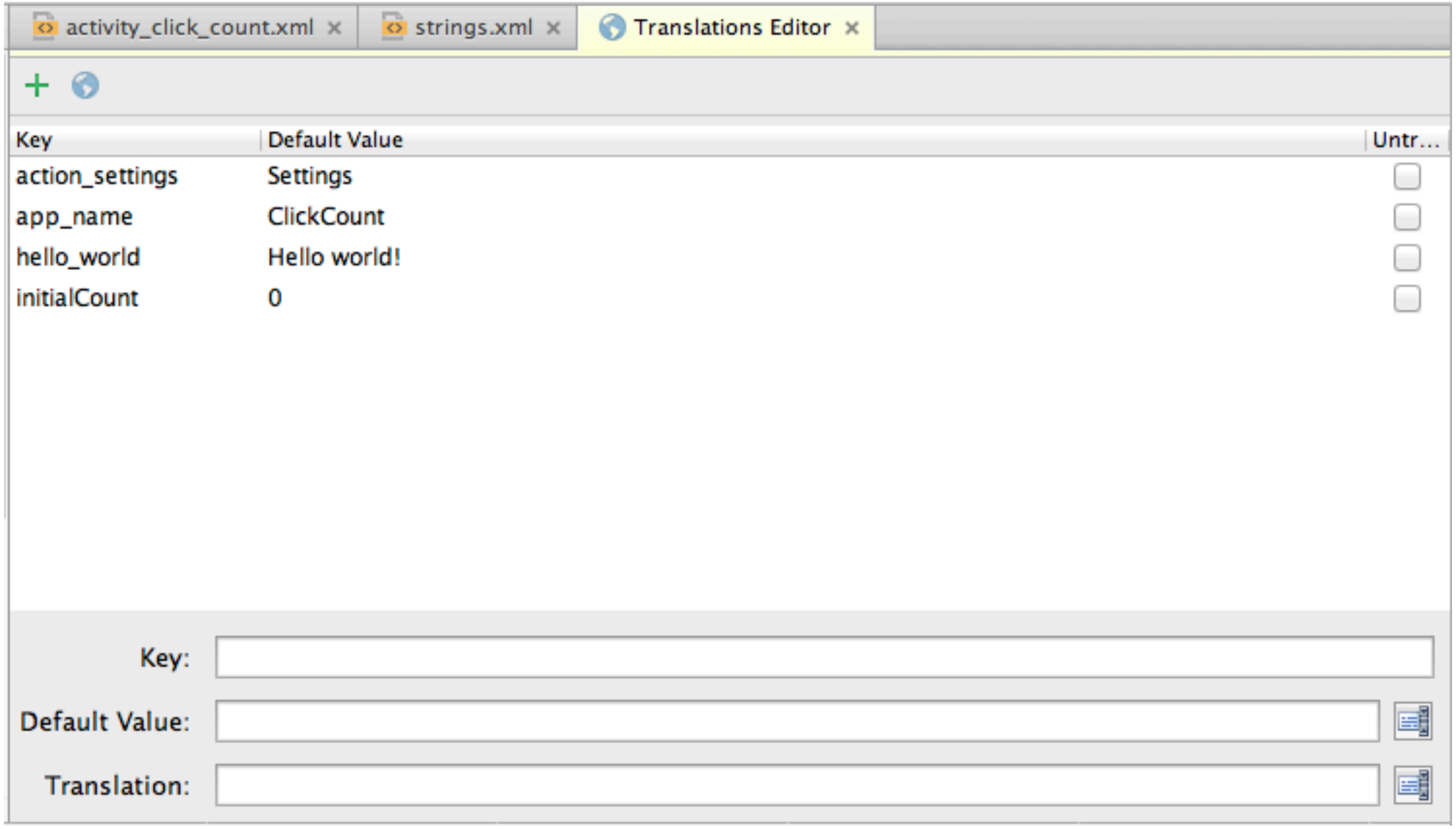
Name* initialCount

Value* 0

You can edit file directly

Or use this visual editor

# Android Studio Has two Views



| Key | Default Value | Untr… |
|---|---|---|
| action_settings | Settings | □ |
| app_name | ClickCount | □ |
| hello_world | Hello world! | □ |
| initialCount | 0 | □ |

Key:

Default Value:

Translation:

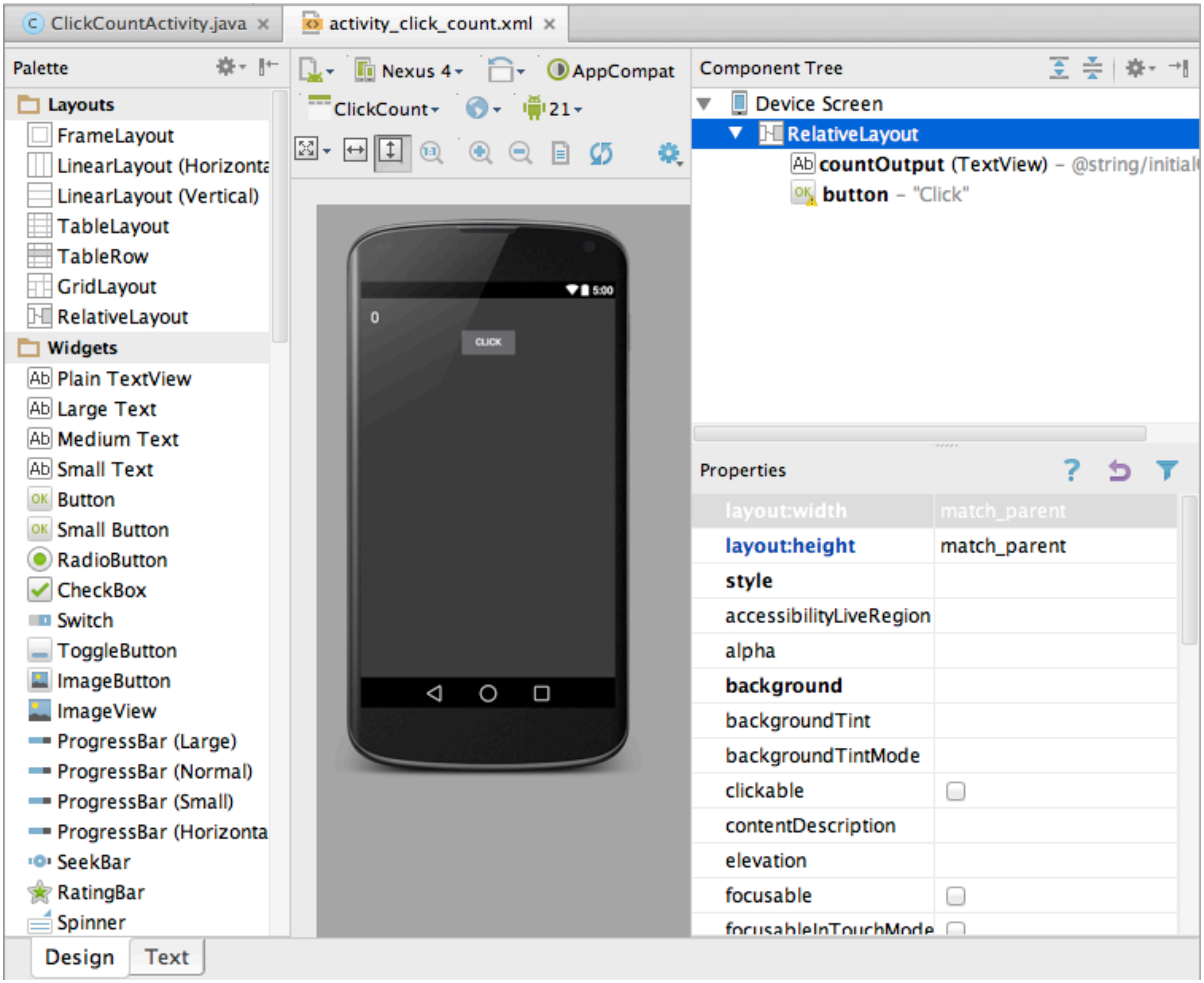
# res/layout/main.xml - Source View

```
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools" android:layout_width="match_parent"
    android:layout_height="match_parent" android:paddingLeft="@dimen/activity_horizontal_margin"
    android:paddingRight="@dimen/activity_horizontal_margin"
    android:paddingTop="@dimen/activity_vertical_margin"
    android:paddingBottom="@dimen/activity_vertical_margin" tools:context=".ClickCountActivity">

    <TextView
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:textAppearance="?android:attr/textAppearanceLarge"
        android:text="@string/initialCount"
        android:id="@+id/countOutput"
        android:layout_alignParentTop="true"
        android:layout_alignParentLeft="true"
        android:layout_alignParentStart="true" />

    <Button
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Click"
        android:id="@+id/button"
        android:layout_below="@+id/countOutput"
        android:layout_centerHorizontal="true"
        android:onClick="increase" />
</RelativeLayout>
```

# res/layout/main.xml - Graphical Editor View



- Device Screen
  - RelativeLayout
    - countOutput (TextView) – @string/initial
    - button – "Click"

Properties

| | |
|---|---|
| layout:width | match_parent |
| layout:height | match_parent |
| style | |
| accessibilityLiveRegion | |
| alpha | |
| background | |
| backgroundTint | |
| backgroundTintMode | |
| clickable | □ |
| contentDescription | |
| elevation | |
| focusable | □ |
| focusableInTouchMode | □ |