MMI 2: Mobile Human-Computer Interaction

Android

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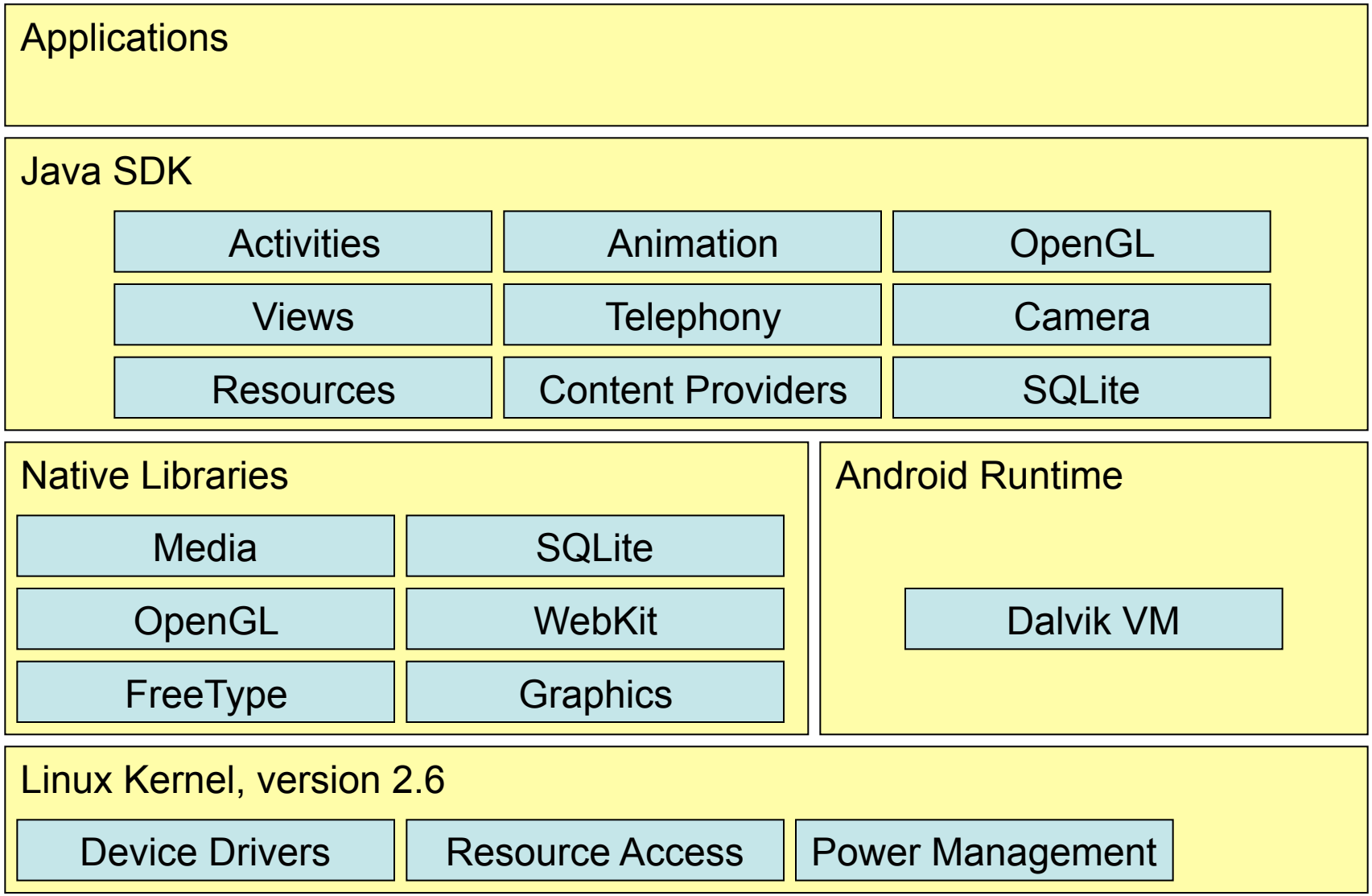
Mobile Interaction Lab, LMU München

Android Software Stack



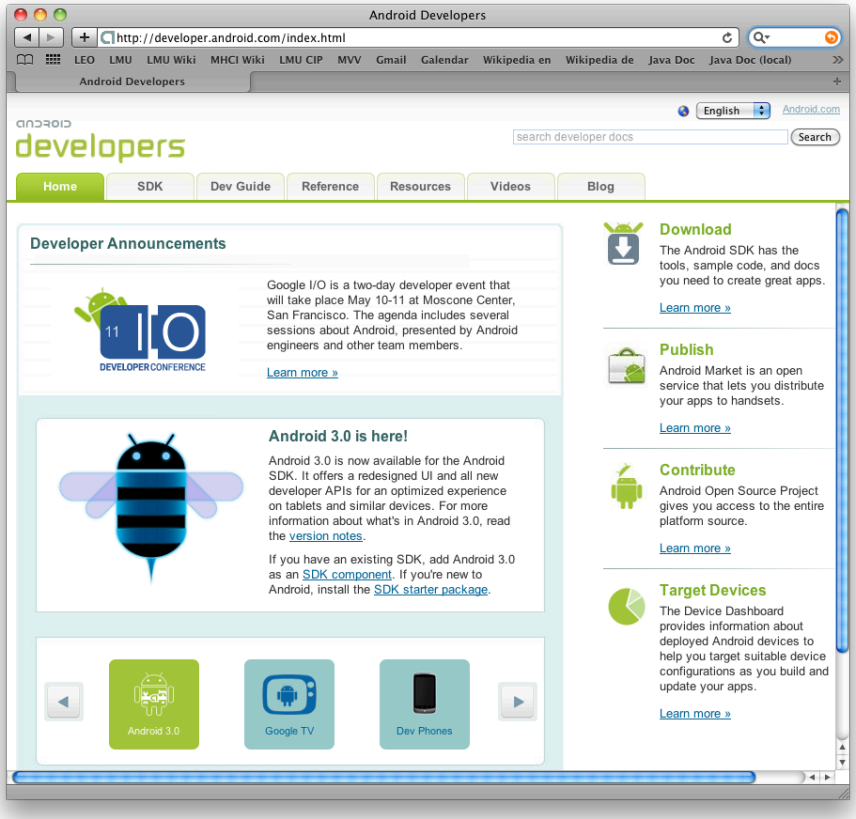
Android Characteristics

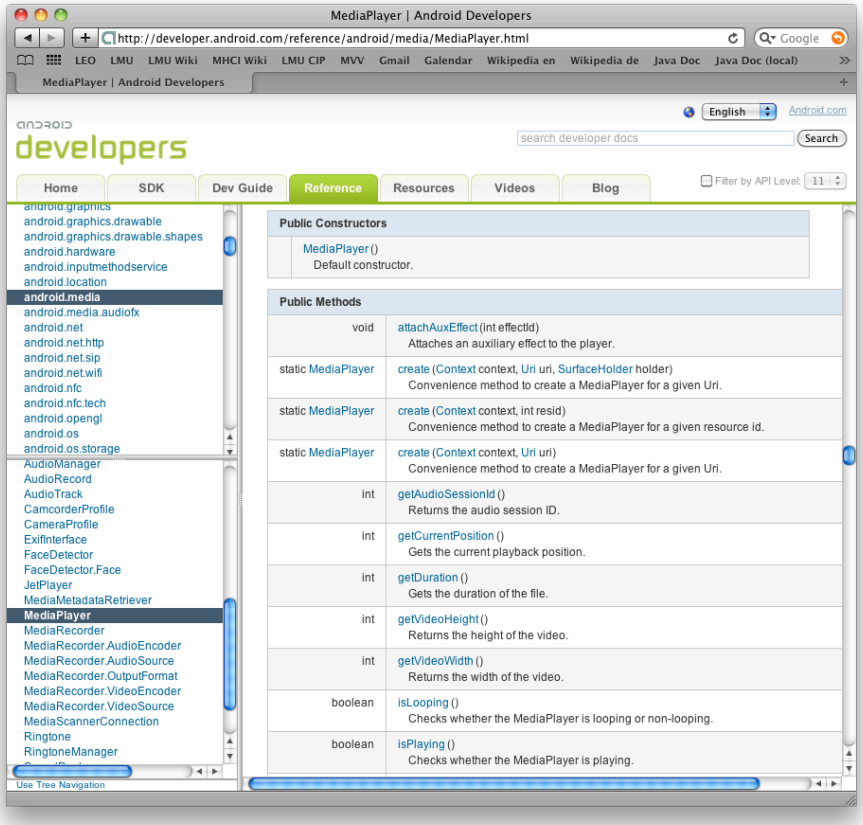
- Activity
  - Activities are the components of an application
  - Represent a logical unit of user action
  - Typically represented by a screen containing views
  - Can be invoked externally
- Declarative UI definition
  - XML files specify user interface resources
  - Resources (layout definitions, strings, bitmaps)
  - Separation of code and user interface
- “Teachable”
  - Clear semantics of Java, clear design & concepts, good emulator

Installing Android

Android Resources

- Android developer pages (platform documentation)
  - http://developer.android.com





Required Software

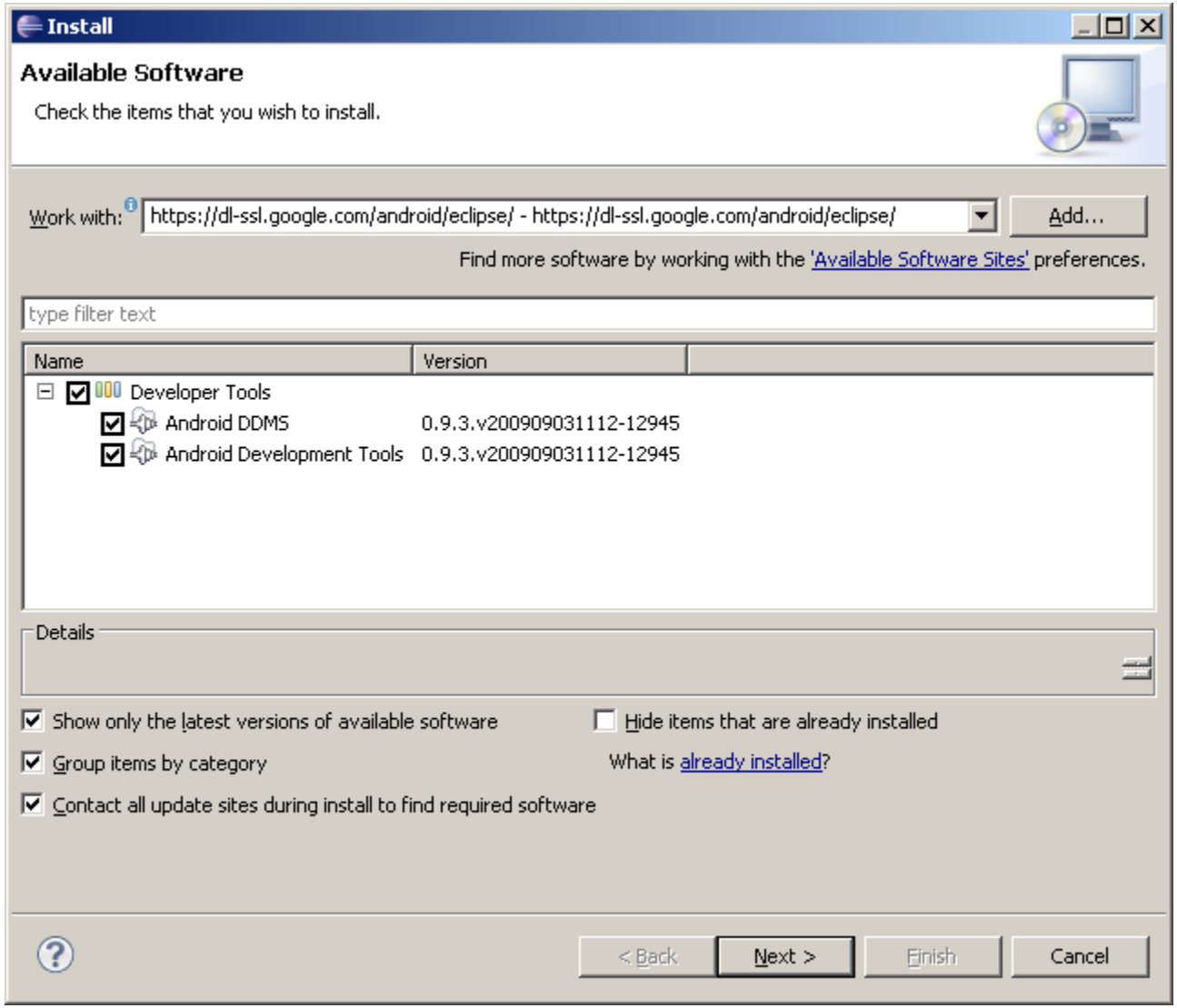
- Java JDK 6, Standard Edition (not only JRE)
  - http://java.sun.com/javase/downloads/index.jsp
- Eclipse IDE (3.4 or newer)
  - http://www.eclipse.org/downloads/
  - Eclipse IDE for Java Developers
- Android SDK starter package (depending on your platform)
  - http://dl.google.com/android/android-sdk_r08-windows.zip
  - http://dl.google.com/android/android-sdk_r08-mac_86.zip
  - http://dl.google.com/android/android-sdk_r08-linux_86.tgz
- See also: “Quick Steps”
  - http://developer.android.com/sdk/index.html

Installation

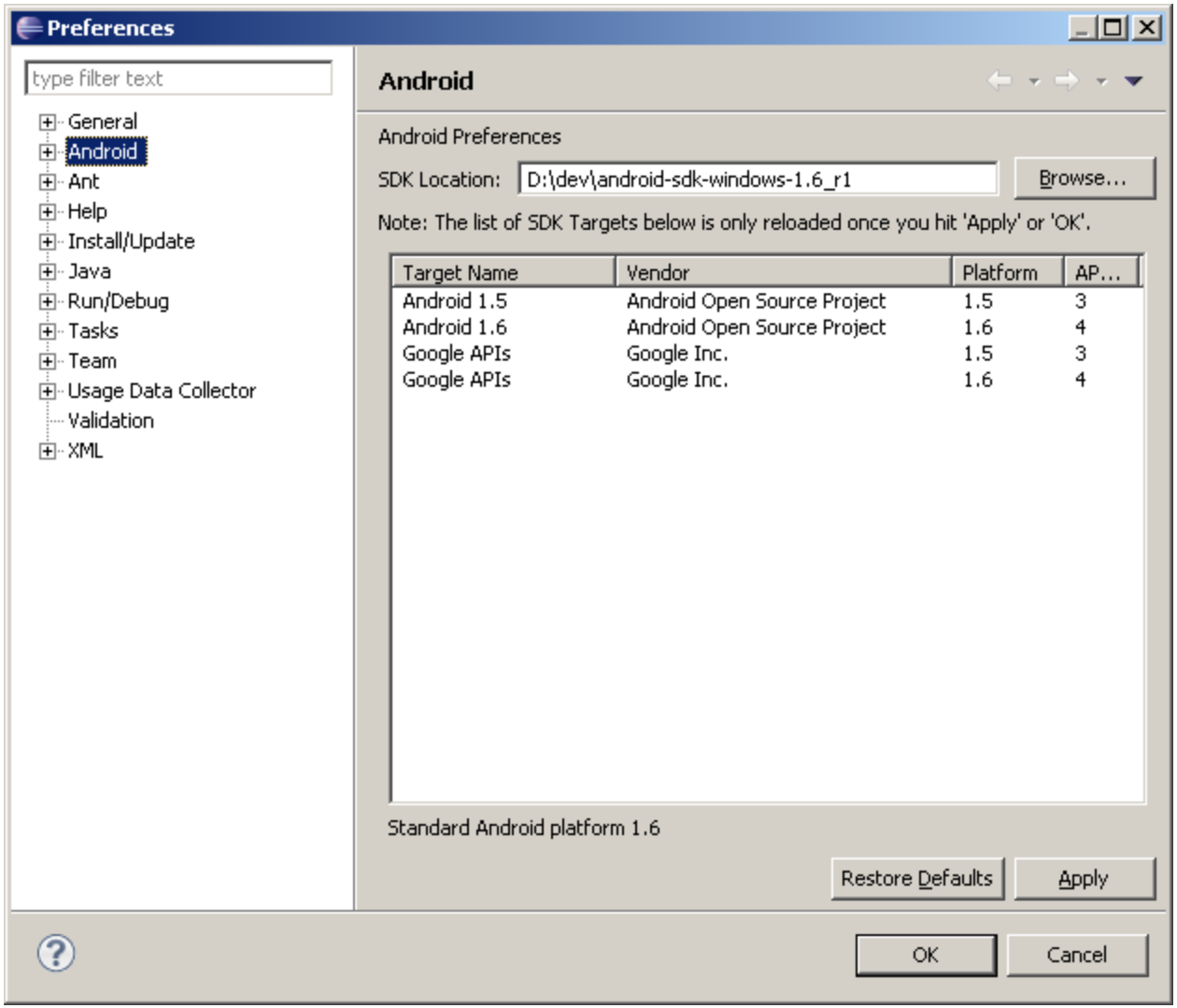
- Start Eclipse
- In Eclipse: Install Android SDK
  - Menu: Help, Install New Software…
  - https://dl-ssl.google.com/android/eclipse/
- Point Eclipse to the Android SDK starter package
  - Menu: Window, preferences, Android, SDK Location
  - /soft/IFI/lang/android-sdk-r10/iX86-unknown-linux
- In Eclipse: Android SDK and AVD Manager
  - Window / Android SDK and AVD Manager
  - New... / Virtual Devices / 2.2 (oder 1.6) mit Google API
- Mobile Phone
  - Anwendungen, Entwicklung: USB-Debugging, ...

In Eclipse: Install New Software...

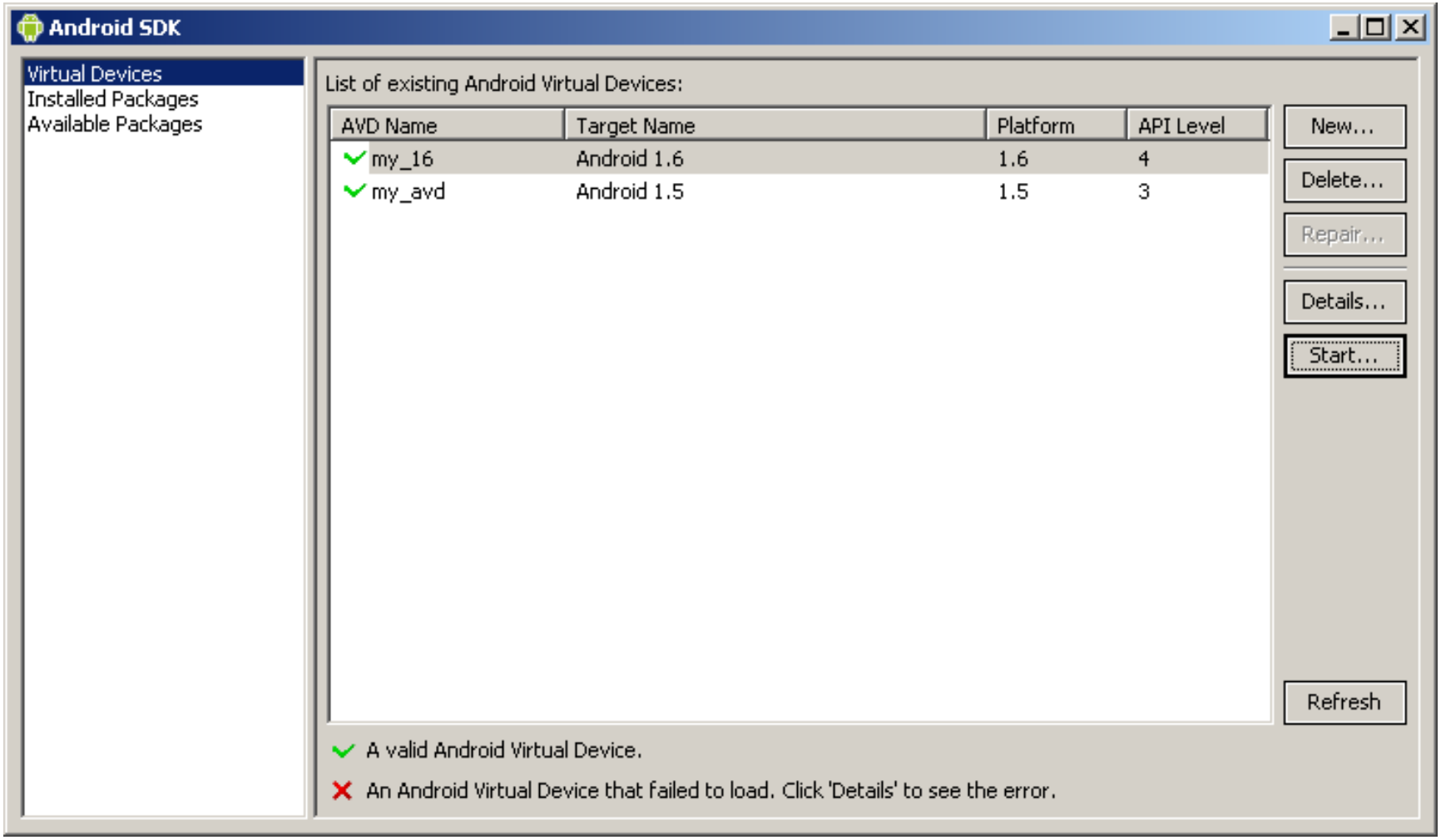
Android Plugin – https://dl-ssl.google.com/android/eclipse/



Set Path to Android SDK Starter Package



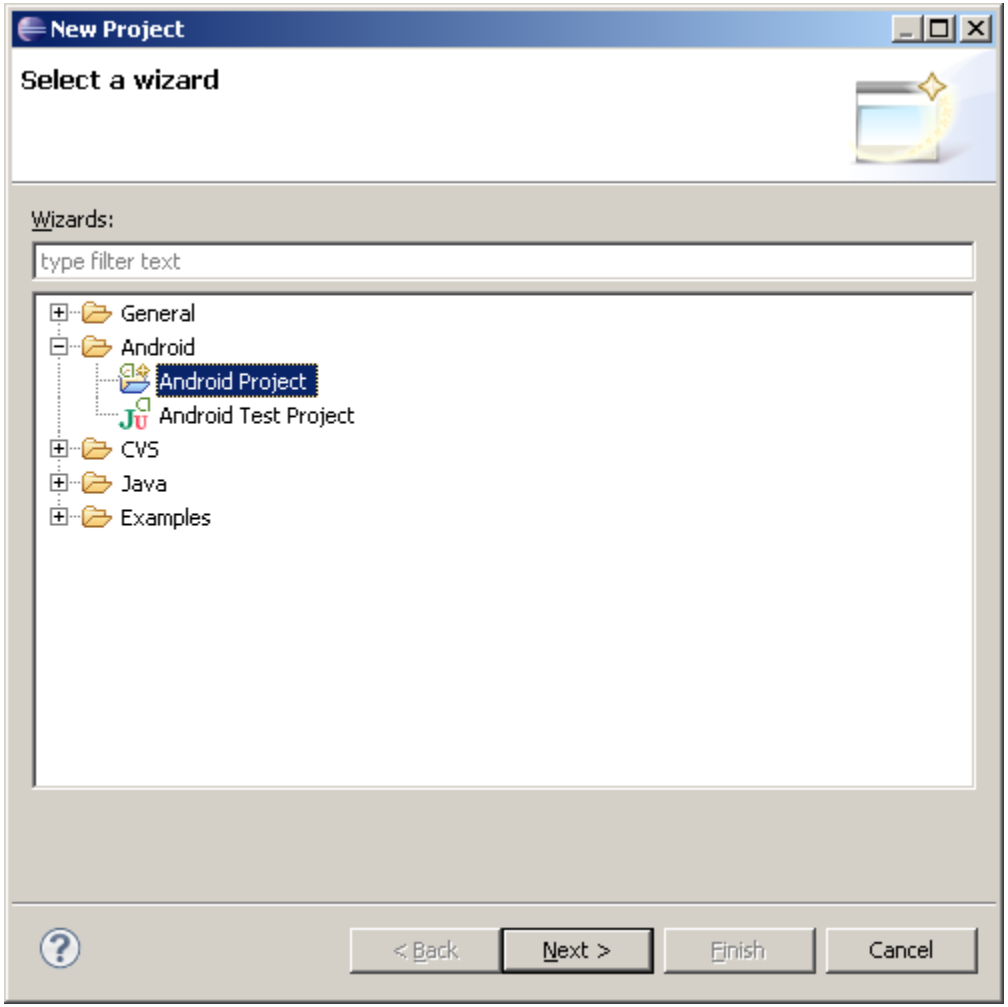
Define Android Virtual Device

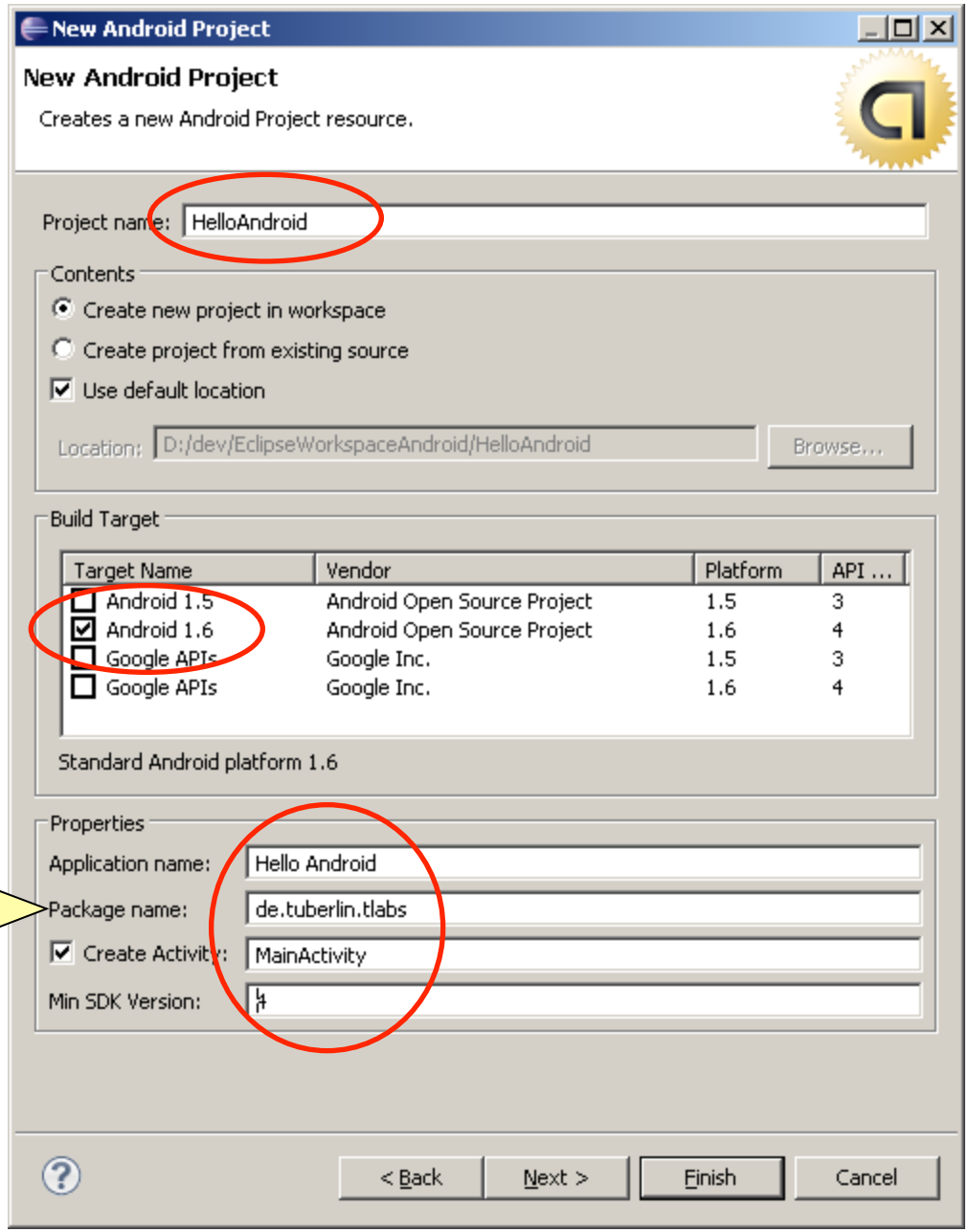


“Hello World”

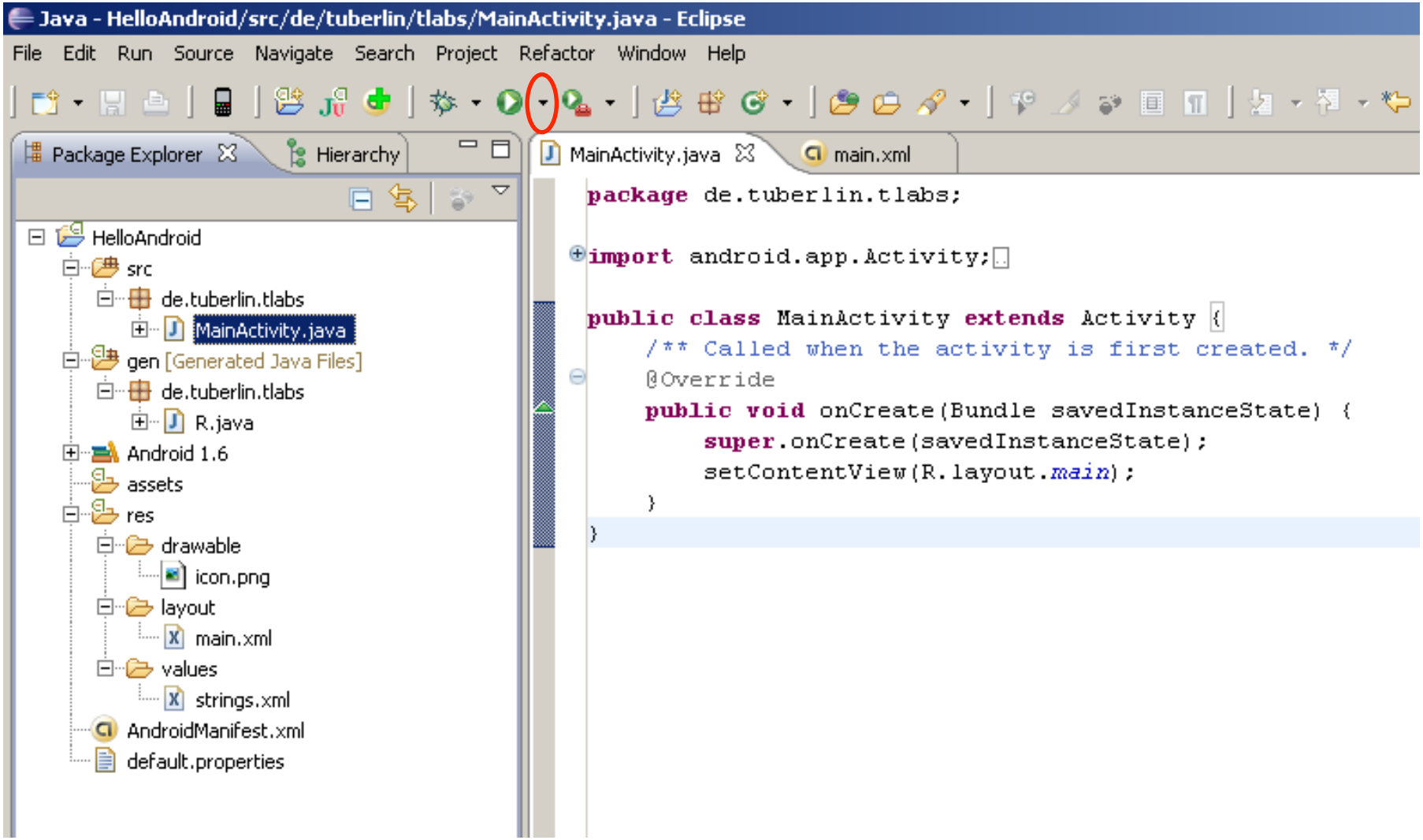
Creating Your First Android Project

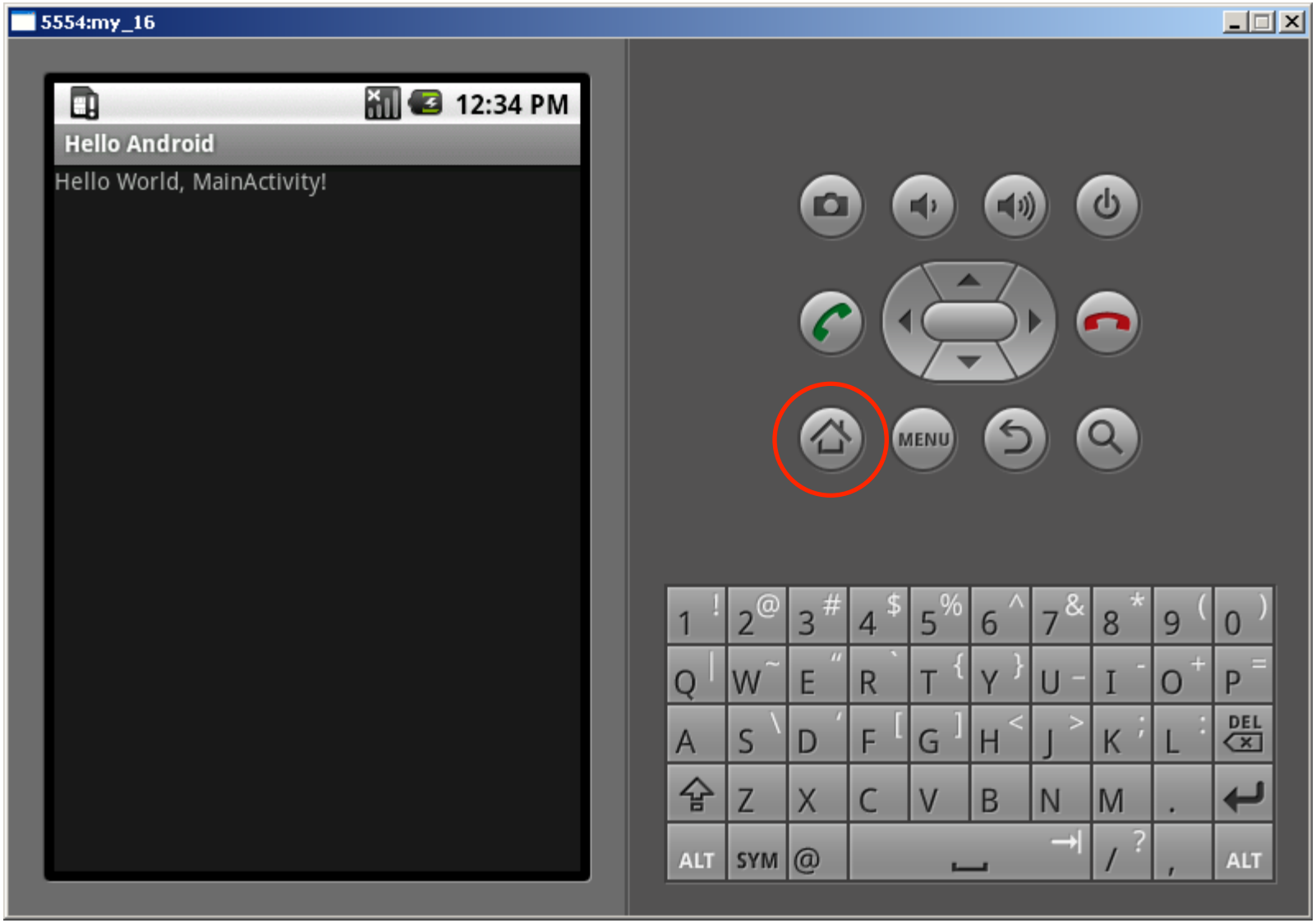
File → New Project → Android → Android Project

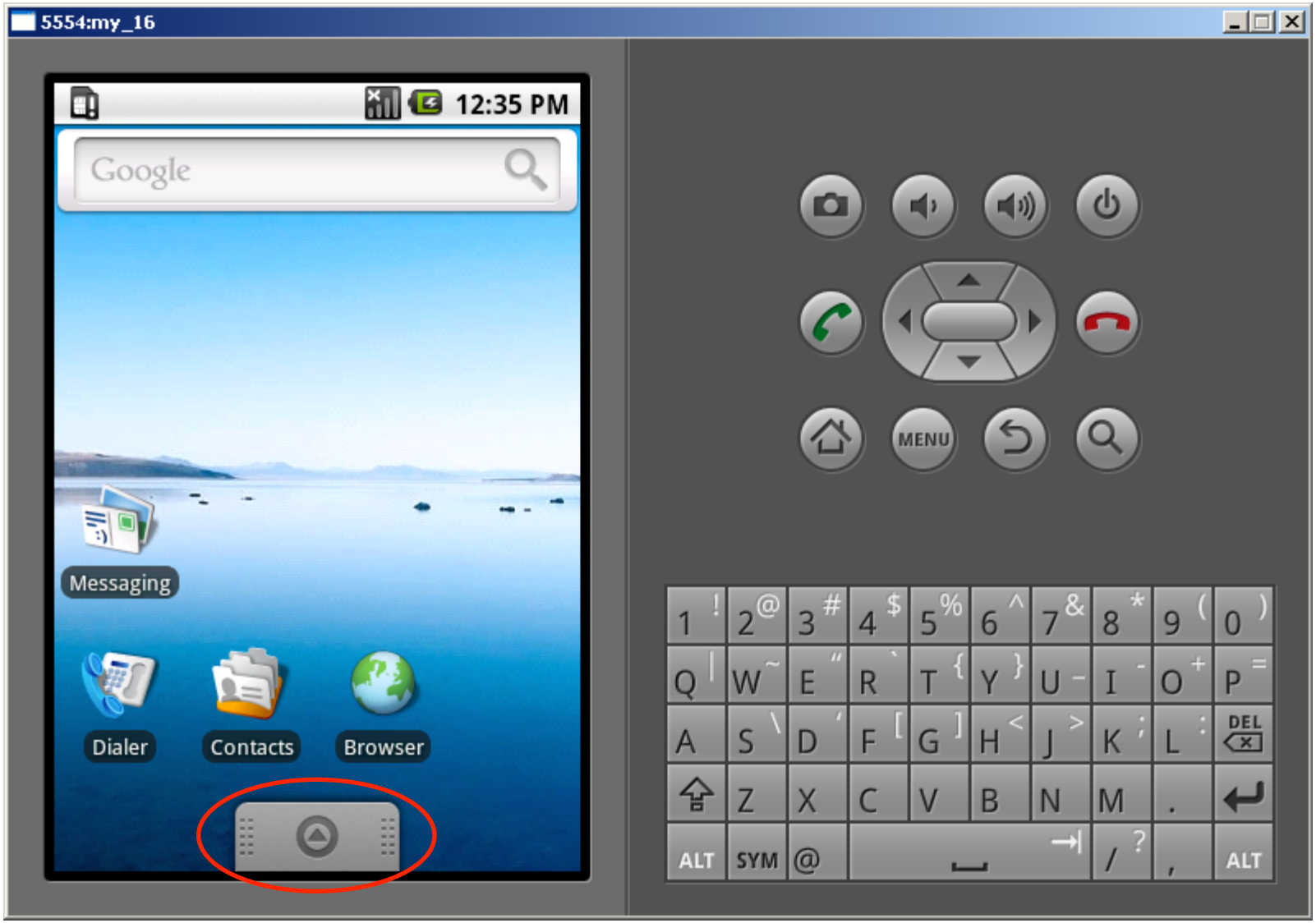


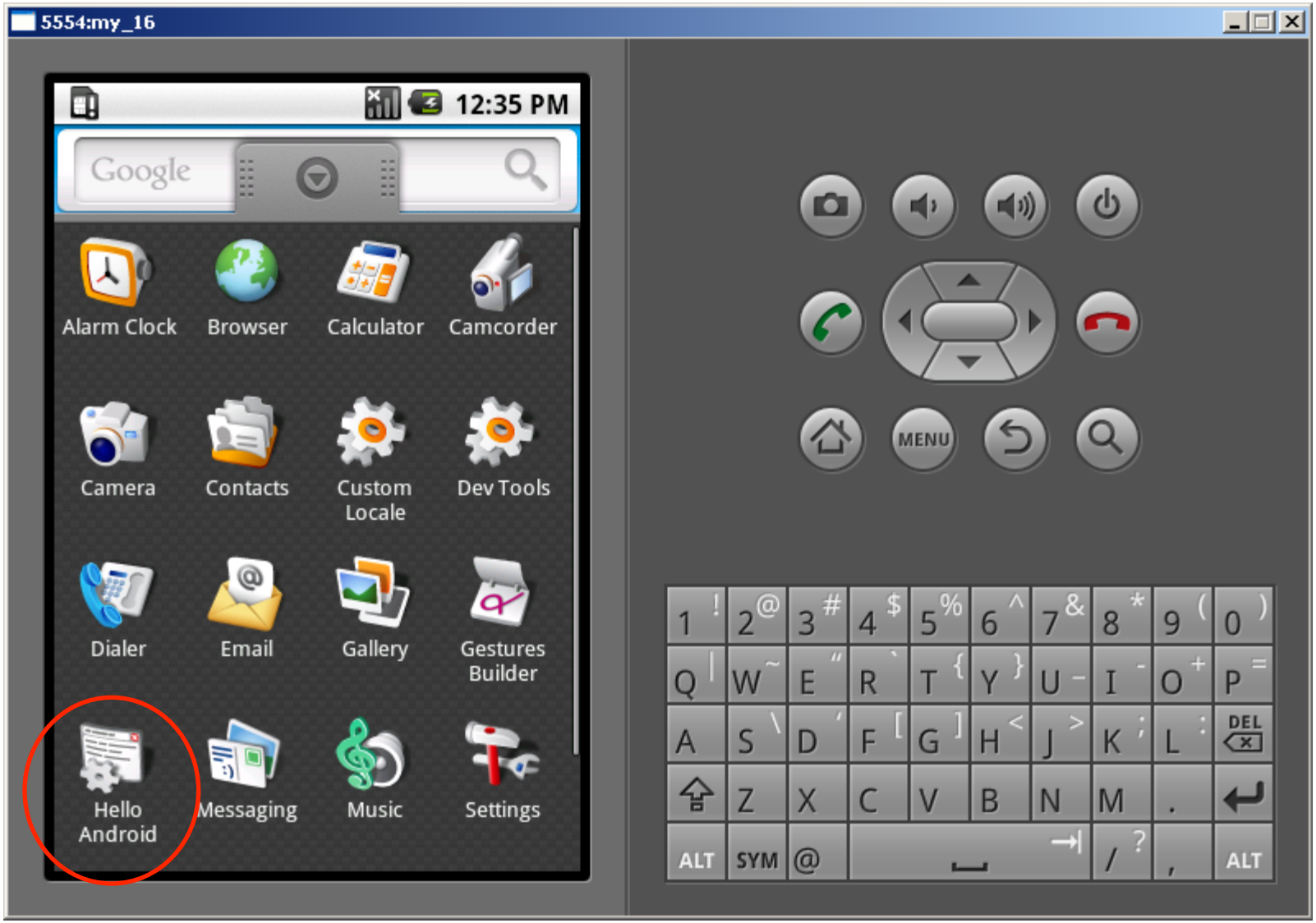


Uniquely identifies the application!


Java - HelloAndroid/src/de/tuberlin/tlabs/MainActivity.java - Eclipse
File Edit Run Source Navigate Search Project Refactor Window Help
Package Explorer
Hierarchy
HelloAndroid
src
de.tuberlin.tlabs
MainActivity.java
gen [Generated Java Files]
de.tuberlin.tlabs
R.java
Android 1.6
assets
res
drawable
icon.png
layout
main.xml
values
strings.xml
AndroidManifest.xml
default.properties
MainActivity.java
main.xml
package de.tuberlin.tlabs;
import android.app.Activity;
public class MainActivity extends Activity {
/** Called when the activity is first created. */
@Override
public void onCreate(Bundle savedInstanceState) {
super.onCreate(savedInstanceState);
setContentView(R.layout.main);
}
}


5554:my_16
12:34 PM
Hello Android
Hello World, MainActivity!
MENU


5554:my_16
12:35 PM
Google
Messaging
Dialer
Contacts
Browser
MENU
ALT
SYM
ALT


5554:my_16
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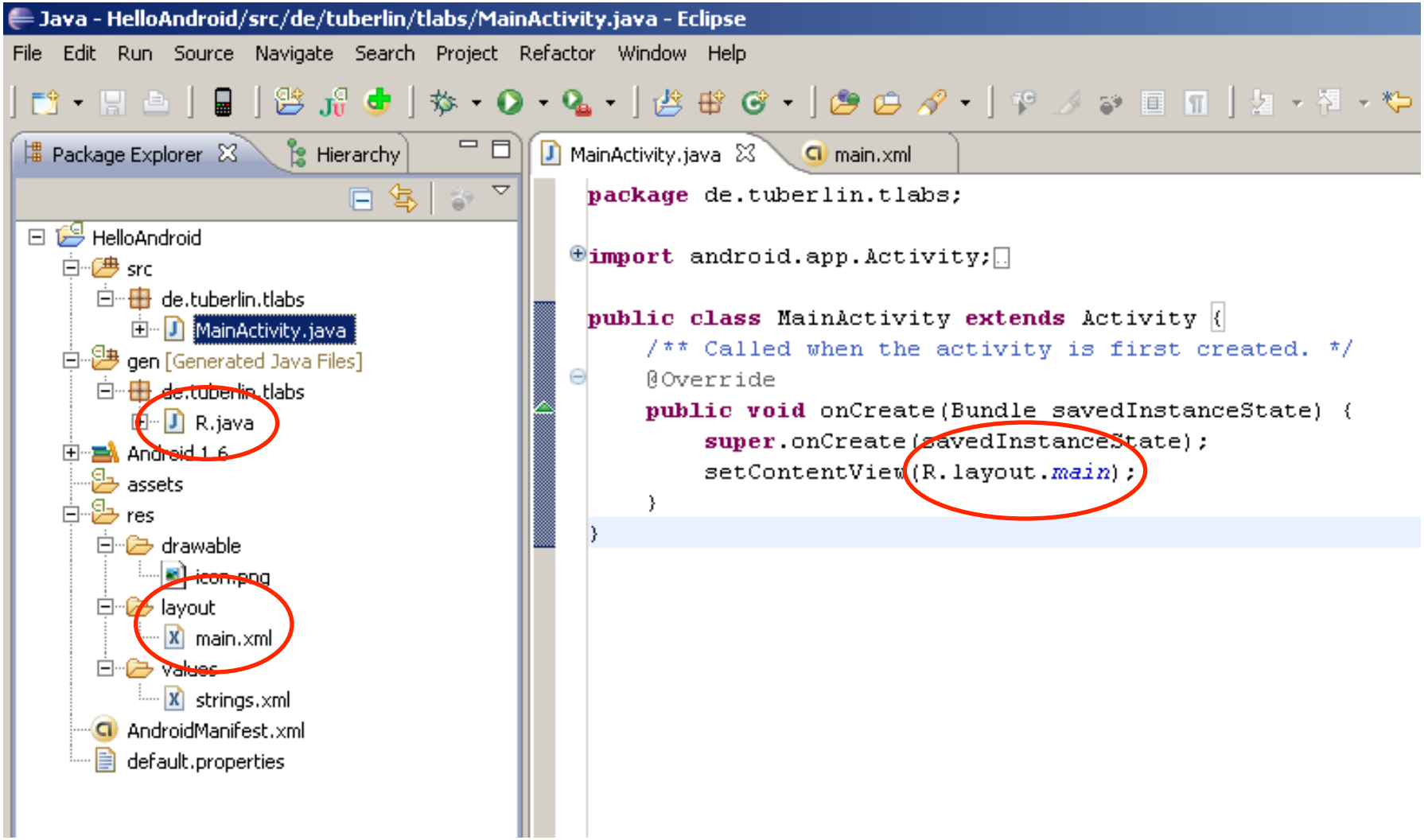
Google
Alarm Clock
Browser
Calculator
Camcorder
Camera
Contacts
Custom Locale
Dev Tools
Dialer
Email
Gallery
Gestures Builder
Hello Android
Messaging
Music
Settings
MENU
ALT
SYM
DEL

Exercise:

Install Android + Create “Hello World”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de.tuberlin.tlabs
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de.tuberlin.tlabs
R.java
Android 1.6
assets
res
drawable
icon.png
layout
main.xml
values
strings.xml
AndroidManifest.xml
default.properties
MainActivity.java
main.xml
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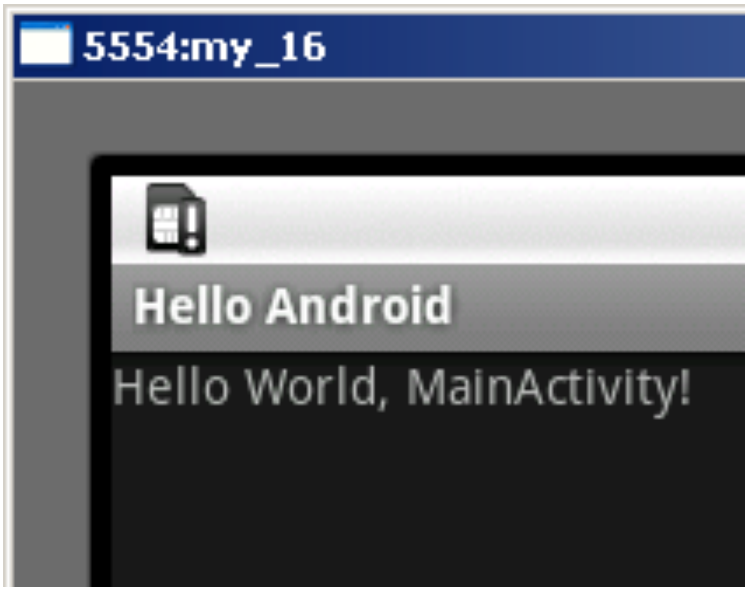
import android.app.Activity;
public class MainActivity extends Activity {
/** Called when the activity is first created. */
@Override
public void onCreate(Bundle savedInstanceState) {
super.onCreate(savedInstanceState);
setContentView(R.layout.main);
}
}

Declarative definition of UIs
main.xml

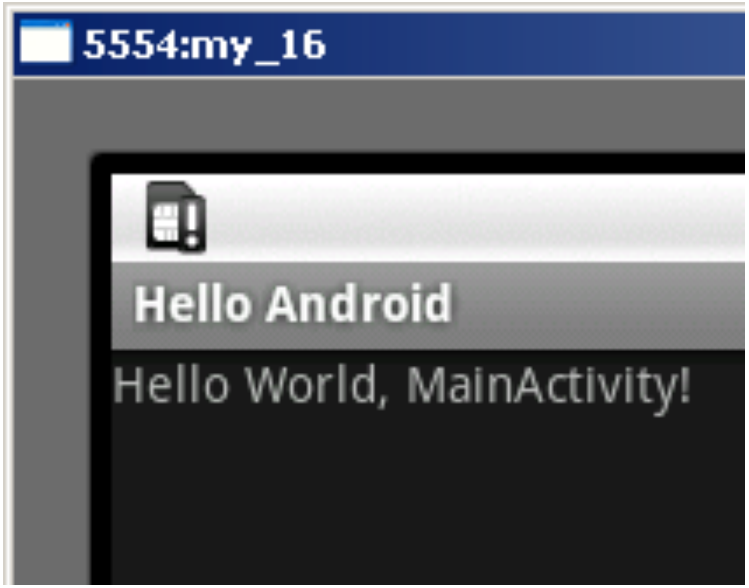
```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:orientation="vertical"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
    >
<TextView
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:text="@string/hello"
    />
</LinearLayout>
```



Separating text strings from source code strings.xml

```
<?xml version="1.0" encoding="utf-8"?>
<resources>
    <string name="hello">Hello World, MainActivity!</string>
    <string name="app_name">Hello Android</string>
</resources>
```

- Default language in res/values/strings.xml
- Localized languages in res/values-xx ← language qualifier
  - French in res/values-fr/strings.xml
  - Hindi in res/values-hi/strings.xml
  - etc.



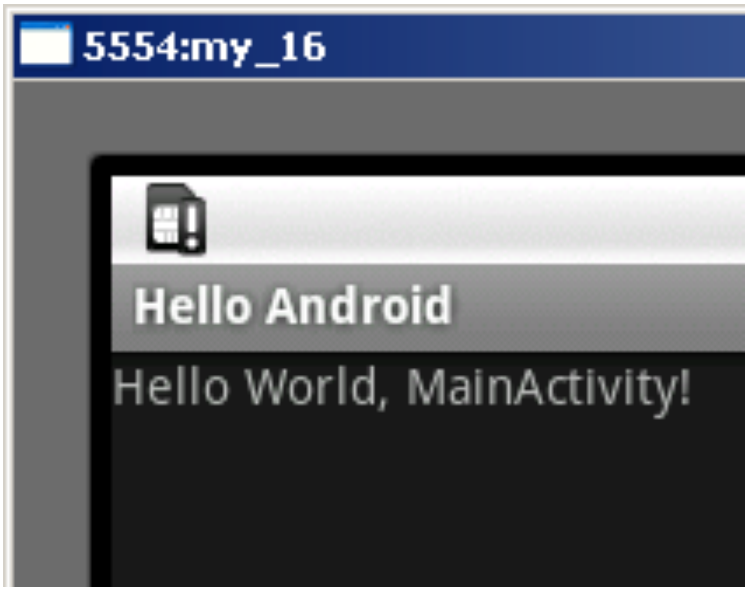
R.java

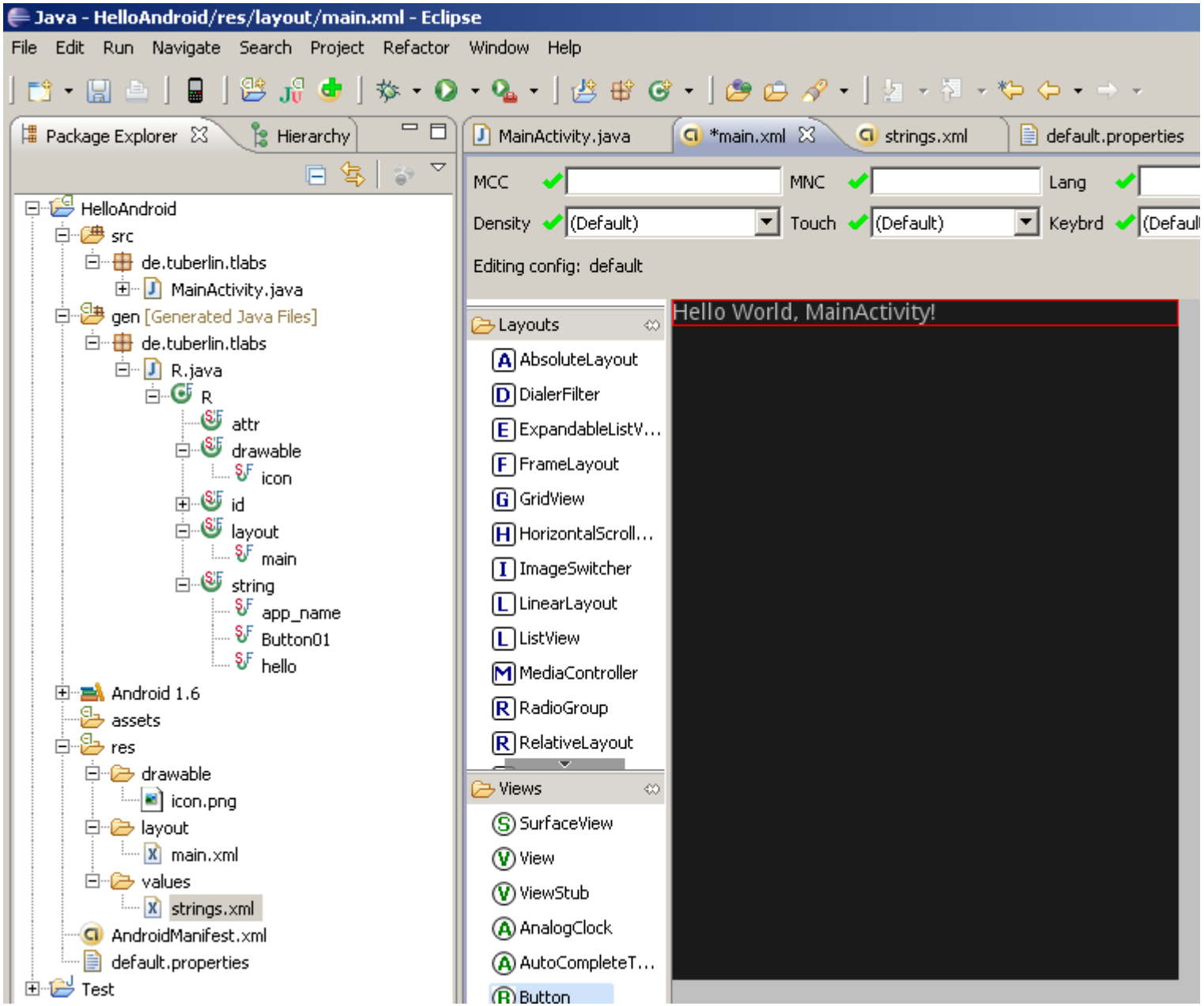
```
/* AUTO-GENERATED FILE.  DO NOT MODIFY.
 *
 * This class was automatically generated by the
 * aapt tool from the resource data it found.  It
 * should not be modified by hand.
 */

package de.tuberlin.tlabs;

public final class R {
    public static final class attr {
    }
    public static final class drawable {
        public static final int icon=0x7f020000;
    }
    public static final class id {
        public static final int Button01=0x7f050000;
    }
    public static final class layout {
        public static final int main=0x7f030000;
    }
    public static final class string {
        public static final int Button01=0x7f040002;
        public static final int app_name=0x7f040001;
        public static final int hello=0x7f040000;
    }
}
```

Never ever edit R.java!!!

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Button01
hello
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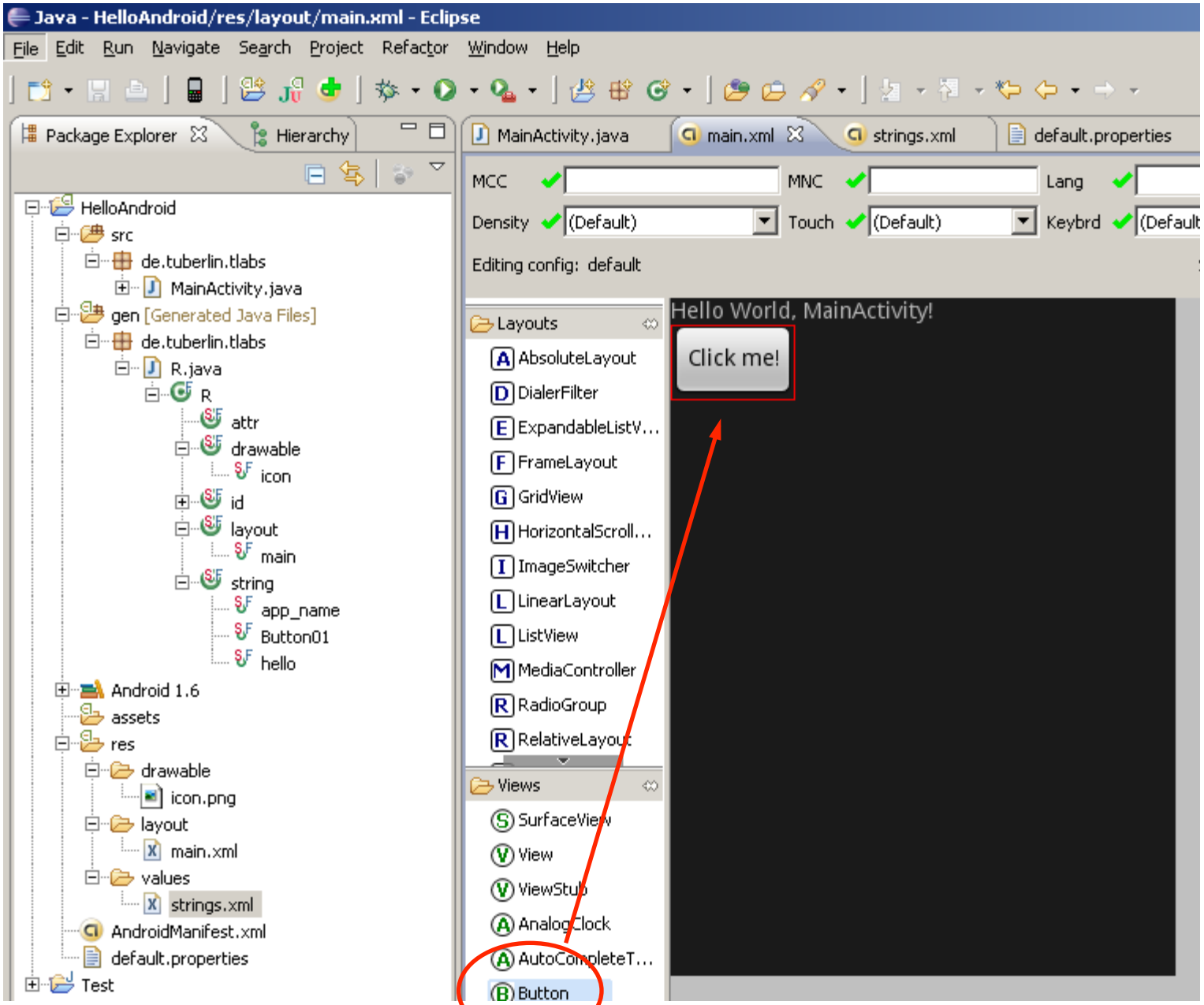
AndroidManifest.xml
default.properties
Test
MCC
MNC
Lang
Density
(Default)
Touch
(Default)
Keybrd
Editing config: default
Layouts
AbsoluteLayout
DialerFilter
ExpandableListV...
FrameLayout
GridView
HorizontalScroll...
ImageSwitcher
LinearLayout
ListView
MediaController
RadioGroup
RelativeLayout
Views
SurfaceView
View
ViewStub
AnalogClock
AutoCompleteT...
Button
Hello World, MainActivity!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RadioGroup
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Button
Hello World, MainActivity!
Click me!

Declarative Definition of UIs
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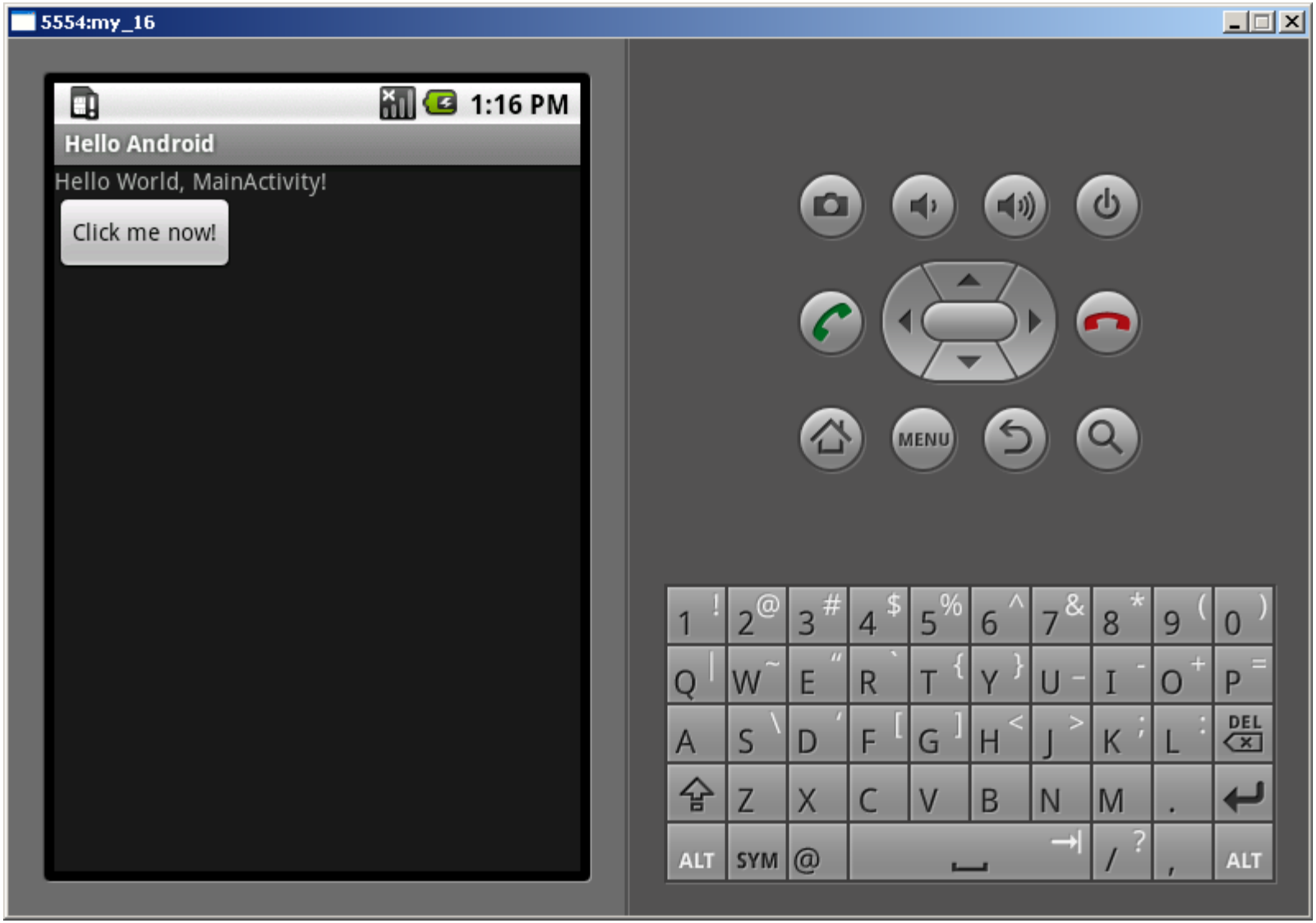
    android:orientation="vertical"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
    >
<TextView
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:text="@string/hello"
    />
<Button
    android:text="@string/Button01"
    android:id="@+id/Button01"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    />
</LinearLayout>
```

strings.xml

```
<?xml version="1.0" encoding="utf-8"?>
<resources>
    <string name="hello">Hello World, MainActivity!</string>
    <string name="app_name">Hello Android</string>
    <string name="Button01">Click me now!</string>
</resources>
```


5554:my_16
1:16 PM
Hello Android
Hello World, MainActivity!
Click me now!
MENU

Handling Button Click Events

- XML

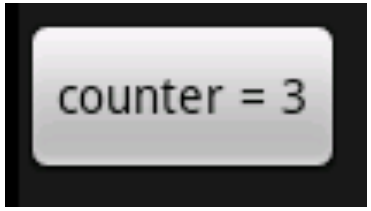
```
<Button android:id="@+id/button1" android:text="Basic Button"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content" />
```

- Java

```
public class MainActivity extends Activity implements
                                                View.OnClickListener {
    public void onCreate(Bundle savedInstanceState) {
        ...
        Button b = (Button) findViewById(R.id.button1);
        b.setOnClickListener(this);
    }

    private int counter = 0;

    public void onClick(View v) {
        Button b = (Button)v;
        b.setText("counter = " + (++counter));
    }
}
```



Exercise:

- Add a button to “Hello World”

UI from XML resources
MainActivity.java

```
import android.app.Activity;
import android.os.Bundle;

public class MainActivity extends Activity {

    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.main);
    }
}
```

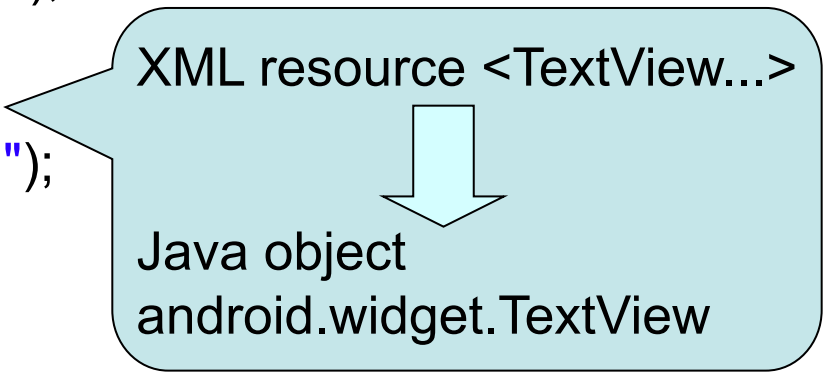
UI programmatically defined MainActivity.java

```
import android.app.Activity;
import android.os.Bundle;
import android.widget.TextView;

public class MainActivity extends Activity {

    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
//        setContentView(R.layout.main);
        TextView tv = new TextView(this);
        tv.setText("Hello World (TextView)!");
        setContentView(tv);
    }

}
```



Touch Input: MotionEvent

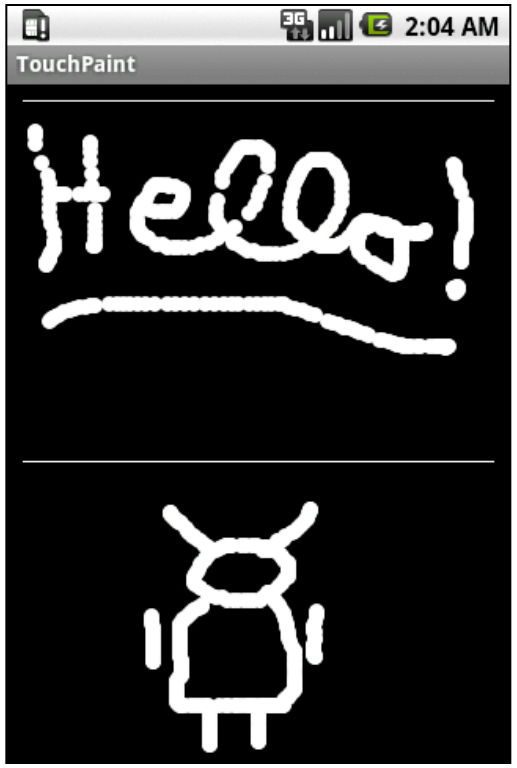
- Method View.onTouchEvent(MotionEvent e)
- Motion event data
  - x, y, time, action, source, pressure, size
- Sources depend on hardware
  - Mouse, pen, finger, trackball
- Actions
  - ACTION_DOWN
  - ACTION_MOVE
  - ACTION_UP
  - ACTION_CANCEL
- Motion history
  - Sequence of coordinates between events

Touch Input Painting

```
public class TouchPaint extends Activity {

    private MyView myView;

    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        myView = new MyView(this);
        setContentView(myView);
    }
}
```



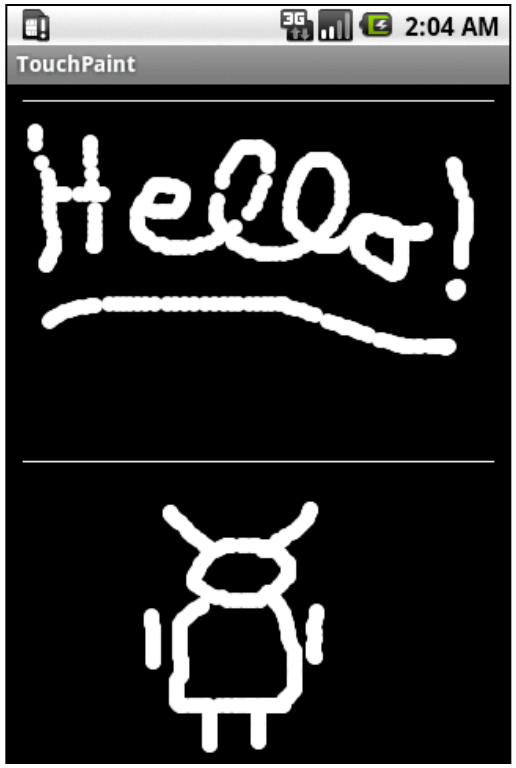
Touch Input Painting

```
public class MyView extends View {
    private final Paint paint = new Paint();
    private int x = 0, y = 0;

    public MyView(Context c) {
        super(c);
        paint.setARGB(255, 255, 255, 255);
    }

    protected void onDraw(Canvas c) {
        c.drawCircle(x, y, 3, paint);
    }

    public boolean onTouchEvent(MotionEvent e) {
        x = (int)e.getX(); y = (int)e.getY();
        invalidate();
        return true;
    }
}
```



Concepts so far

- Project directory structure
  - src, gen, res, AndroidManifest.xml
- Resources
  - Declarative view definitions in XML
  - Localization of string resources
  - Resource identifiers
- Touch input
  - Motion events