The Android GUI Framework

Java User Group Switzerland
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Markus Pilz
mp@greenliff.com

Peter Wlodarczak
pw@greenliff.com

Agenda

1. Introduction
2. Anatomy
3. A real word example
4. Life cycle
5. Tools
6. Findings

The Google Phone

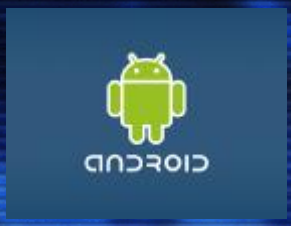
- Not a phone, but a software platform

- Open Handset Alliance
  - Mobile operators
  - Handset manufacturer
  - Esmertec
  - Noser
  - ...

- There will be many devices...
- But there is already an SDK

Why Android

- § Full phone software stack including applications
- § Designed as a platform for software development
- § Android is open
- § Android is free
- § Community support
- § Tool support
- § 100% Java Phone



Android Platform

Android GUI

§ Java 1.5 support

§ GUI is fully written in Java
  § but it is not AWT / Swing
  § and neither J2ME LCDUI

§ Widget toolkit

§ XML based GUI

§ (Touch) screen

§ Might have a keyboard

Android Widget-Set

Anatomy I

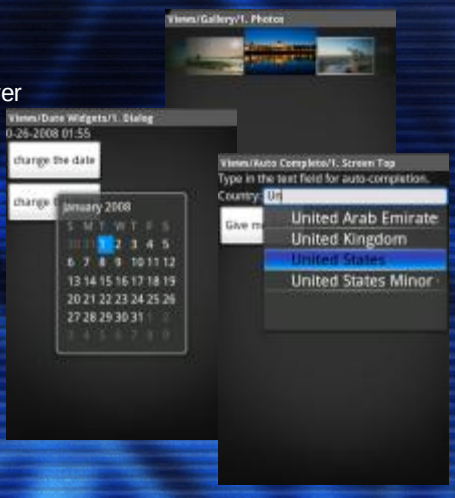
§ Activity

§ Intent, IntentFilter, IntentReceiver

§ View

§ Service

§ Content Provider



Activities and Screens

- Application consist of independent Screens
  - Includes resources and an XML manifest which describes and configures the screens
  - Each screen can open other screens in the same or another application
  - Screens are called Activities
- Activity
  - Backed by a single Java class
  - Handles events, displays UI, performs functions
  - Lives according to a predefined life cycle (like applets)
  - Creates an Intent to call another Activity

Intent, IntentFilter, IntentReceiver

- Calling Activity populates Intent
  - Data to process
  - Action to perform on it
  - MIME type of the data
  - Handler class
- Android searches the most suitable application to handle the request
  - Based on the XML manifest
  - Handler class if caller wants control

Content Providers and Services

- Applications can expose private date by implementing a public service called Content Provider
  - Standard methods to store and retrieve type of data
  - Image-, audio, video, contacts, ...
  - Respond to single requests
- Services
  - Run in the background to perform long tasks such a music playback

A real word example I

§ A translater for Android

§ If you are in a country where no one understands your language

§ You cannot read anything

§ You have your mobile phone always with you

§ No aditional device needed

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A real word example II

§ Uses the google translator

§ Uses XMPP for data transmission

§ Can be extended with new languages

§ Adaptive GUI

§ GUI fully defined in XML

§ Uses camera input and OCR

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A real word example III

Lets see it

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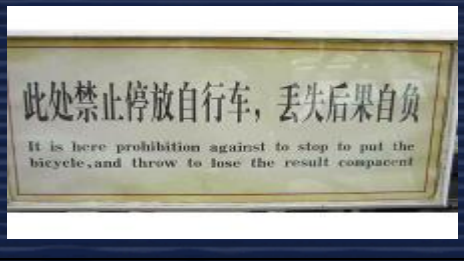
A real word example IV

§ Used Eclipse for development

§ ANT script and make for build

§ Uses persistence of user data

§ Uses touch screen and keyboard input



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A real word example V

The AndroidManifest.xml

```
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.greenliff.translator">
    <application android:icon="@drawable/logo">
        <activity android:label="@string/settings" android:name="Settings">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
            </intent-filter>
        </activity>
        <activity android:label="@string/app_name" android:name="Translate">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
        <activity android:label="@string/ocr" android:name="OCR">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
            </intent-filter>
        </activity>
    </application>
</manifest>
```

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A real word example V

The AndroidManifest.xml

```
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
  package="com.greenliff.translator">
  <application android:icon="@drawable/logo">
    <activity android:label="@string/settings" android:name="Settings">
      <intent-filter>
        <action android:name="android.intent.action.MAIN" />
      </intent-filter>
    </activity>
    <activity android:label="@string/app_name" android:name="Translate">
      <intent-filter>
        <action android:name="android.intent.action.MAIN" />
        <category android:name="android.intent.category.LAUNCHER" />
      </intent-filter>
    </activity>
    <activity android:label="@string/ocr" android:name="OCR">
      <intent-filter>
        <action android:name="android.intent.action.MAIN" />
      </intent-filter>
    </activity>
  </application>
</manifest>
```

Activity

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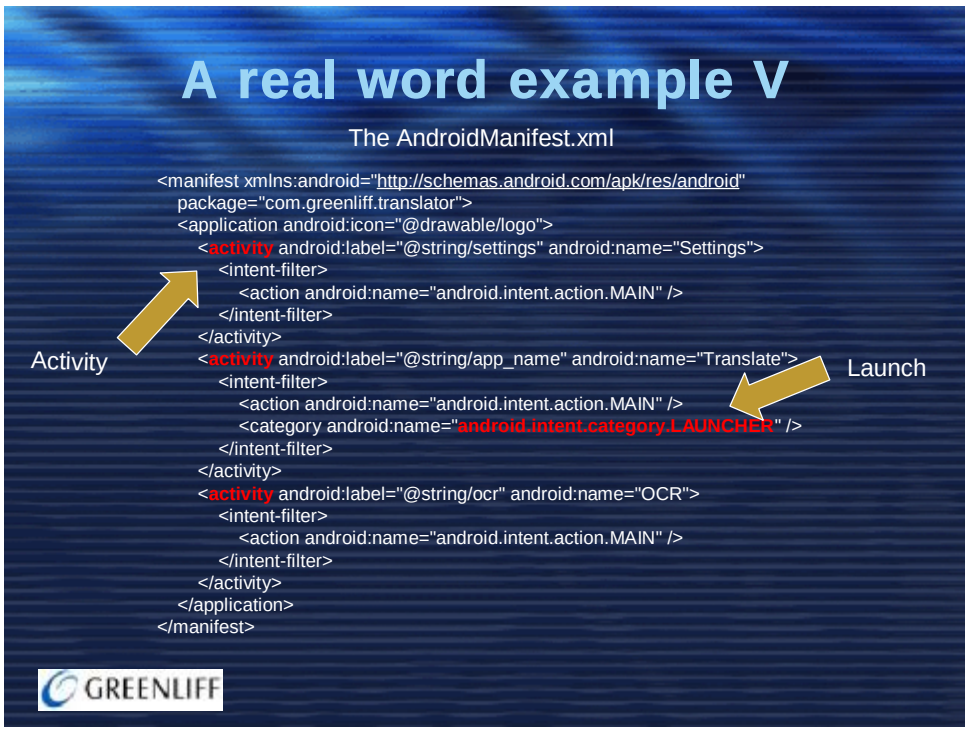
A real word example V

The AndroidManifest.xml



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A real word example VI

The AndroidManifest.xml

§ **Used for security**

§ **Define permissions, e. g.**

<uses-permission android:name="android.permission.RECEIVE_SMS" />

§ **Give other Activities access**

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A real word example VII

An XML snipped of the main Activity

```
<ScrollView xmlns:android="http://schemas.android.com/apk/res/android"
   android:layout_width="fill_parent"
   android:layout_height="wrap_content"
   android:scrollbars="vertical">
   <LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
            android:id="@+id/linLayout"
            android:orientation="vertical"
            android:layout_width="fill_parent"
            android:layout_height="wrap_content">
      <TextView
            android:layout_width="fill_parent"
            android:layout_height="wrap_content"
            android:background="@drawable/blu
            android:text="@string/translate_to_1"/>
      <EditText
            android:id="@+id/toTranslate"
            android:layout_width="fill_parent"
                  android:layout_height="wrap_content"
                  android:background="@android:drawable/editbox_background"
                  android:layout_below="@id/linLayout"
                 android:hint="Type here..." />
.....
```

Text reference

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A real word example VII

An XML snipped of the main Activity

```
<ScrollView xmlns:android="http://schemas.android.com/apk/res/android"
   android:layout_width="fill_parent"
   android:layout_height="wrap_content"
   android:scrollbars="vertical">
   <LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
            android:id="@+id/linLayout"
            android:orientation="vertical"
            android:layout_width="fill_parent"
            android:layout_height="wrap_content">
      <TextView
            android:layout_width="fill_parent"
            android:layout_height="wrap_content"
            android:background="@drawable/blu
            android:text="@string/translate_to_1"/>
      <EditText
            android:id="@+id/toTranslate"
            android:layout_width="fill_parent"
                  android:layout_height="wrap_content"
                  android:background="@android:drawable/editbox_background"
                  android:layout_below="@id/linLayout“
                 android:hint="Type here..." />
.....
```

Id

Text reference

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A real word example VIII

§ Could also be developed purely in Java

§ XML cannot be debugged

§ Not all the attributes can be defined in XML

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A real word example IX

A code snipped of the Translate Activity

```
@Override
  public void onCreate(Bundle icicle) {
     super.onCreate(icicle);
     Window wp = getWindow();
     mContext = wp.getContext();
     setTheme(android.R.style.Theme_Light);
     setContentView(R.layout.main);
     mLayout = (LinearLayout) this.findViewById(R.id.linLayout);
     mToTranslate = (EditText) this.findViewById(R.id.toTranslate);
     setShowLanguages();

     mEnge = (LinearLayout) this.findViewById(R.id.enge);
     LANGUAGE_LAYOUT[0] = mEnge;
     de2en = (Button) this.findViewById(R.id.de2en);
     de2en.setOnClickListener(new View.OnClickListener() {
        public void onClick(View view) {
           if(!connect()) {
              notLoggedInAlert();
           } else {
              doConnect("de2en@bot.talk.google.com");
              rearrange(mEnge);
           }
        }
     });
....
```

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A real word example IX

A code snipped of the Translate Activity

Set layout

```
@Override
  public void onCreate(Bundle icicle) {
     super.onCreate(icicle);
     Window wp = getWindow();
     mContext = wp.getContext();
     setTheme(android.R.style.Theme_Light);
     setContentView(R.layout.main);
     mLayout = (LinearLayout) this.findViewById(R.id.linLayout);
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           if(!connect()) {
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           } else {
              doConnect("de2en@bot.talk.google.com");
              rearrange(mEnge);
           }
        }
     });
....
```

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A real word example IX

A code snipped of the Translate Activity

Set layout

Find elements

```
@Override
public void onCreate(Bundle icicle) {
    super.onCreate(icicle);
    Window wp = getWindow();
    mContext = wp.getContext();
    setTheme(android.R.style.Theme_Light);
    setContentView(R.layout.main);
    mLayout = (LinearLayout) this.findViewById(R.id.linLayout);
    mToTranslate = (EditText) this.findViewById(R.id.toTranslate);
    setShowLanguages();

    mEnge = (LinearLayout) this.findViewById(R.id.enge);
    LANGUAGE_LAYOUT[0] = mEnge;
    de2en = (Button) this.findViewById(R.id.de2en);
    de2en.setOnClickListener(new View.OnClickListener() {
        public void onClick(View view) {
            if(!connect()) {
                notLoggedInAlert();
            } else {
                doConnect("de2en@bot.talk.google.com");
                rearrange(mEnge);
            }
        }
    });
....
```

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A real word example IX

A code snipped of the Translate Activity

Set layout

Find elements

Add behavior

```
@Override
public void onCreate(Bundle icicle) {
    super.onCreate(icicle);
    Window wp = getWindow();
    mContext = wp.getContext();
    setTheme(android.R.style.Theme_Light);
    setContentView(R.layout.main);
    mLayout = (LinearLayout) this.findViewById(R.id.linLayout);
    mToTranslate = (EditText) this.findViewById(R.id.toTranslate);
    setShowLanguages();

    mEnge = (LinearLayout) this.findViewById(R.id.enge);
    LANGUAGE_LAYOUT[0] = mEnge;
    de2en = (Button) this.findViewById(R.id.de2en);
    de2en.setOnClickListener(new View.OnClickListener() {
        public void onClick(View view) {
            if(!connect()) {
                notLoggedInAlert();
            } else {
                doConnect("de2en@bot.talk.google.com");
                rearrange(mEnge);
            }
        }
    });
....
```

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A real word example X

Call an other Activity

```
@Override
public boolean onOptionsItemSelected(Menu.Item item) {
   switch (item.getId()) {
   case 0:
        showLogin();
        break;
   case 1:
        Intent intent = new Intent(Translate.this, Settings.class);
        intent.putExtras(mShownLanguages);
        startSubActivity(intent, SETTINGS);
        break;
   } // switch
  return true;
}
```

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A real word example X

Call an other Activity

Start an Activity

```
@Override
public boolean onOptionsItemSelected(Menu.Item item) {
   switch (item.getId()) {
   case 0:
        showLogin();
        break;
   case 1:
        Intent intent = new Intent(Translate.this, Settings.class);
        intent.putExtras(mShownLanguages);
        startSubActivity(intent, SETTINGS);
        break;
   } // switch
  return true;
}
```

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A real word example X

Call an other Activity

```
@Override
public boolean onOptionsItemSelected(Menu.Item item) {
   switch (item.getId()) {
   case 0:
       showLogin();
       break;
   case 1:
       Intent intent = new Intent(Translate.this, Settings.class);
       intent.putExtras(mShownLanguages);
       startSubActivity(intent, SETTINGS);
       break;
   } // switch
   return true;
}
```

Start an Activity

Pass data to new Activity

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A real word example XI

Store user data

```
@Override
  protected void onPause() {
     super.onPause();
     SharedPreferences.Editor ed = mPrefs.edit();
     for(int i = 0; i < SUPPORTED_LANGUAGES.length; i++) {
           ed.putBoolean(SUPPORTED_LANGUAGES[i],
           mShownLanguages.getBoolean(SUPPORTED_LANGUAGES[i]));
     }
     ed.commit();
  }
```

Persistent store

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A real word example XII

Store user data

- § Preferences
- § Database
- § Files
- § Content provider
- § Network

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Life cycle

- § Life cycle not directly controlled by application
- § System can kill an application to free up memory
- § Controll through onCreate(), onPause(), onStop() ... methods
- § Android has different types of processes, visible processes, service processes, background processes ...
- § Services can be used for longe-lived background processes

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Tools I

§ The Android SDK comes with a ADT (Android Development Tools) plugin for Eclipse

§ Android has two debuggers, adb, ddms

§ adb (Android Debug Bridge)
  § install, shell, log dump

§ ddms (Dalvik Debug Monitor Server)

§ Android has on device debugging
  § But currently no devices available

§ Android has a packager, aapk

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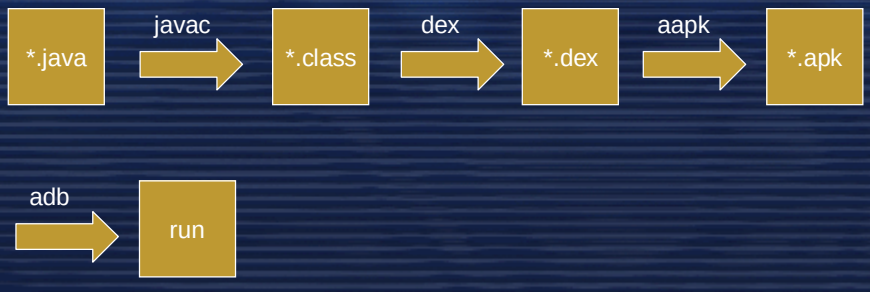
Tools II



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Tools III

§ Android has an emulator with different skins
  § Hardware support is very limited
  § No messaging and call support

§ Other IDEs can be used

§ javac 1.5 and 1.6 are supported

§ activityCreator.py creates AndroidManifest.xml, build.xml and directory structure

§ Applications aren‘t signed (yet)

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Findings

§ Android uses proven technology like Java, XML and Linux

§ It offers a rich API for application development

§ There is an initial learning effort

§ Android doesn‘t have many of the limitations of current mobile platforms

§ Android is still in beta

§ Android development is fun

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Thank you for the attention

Questions?

Find out more at:
http://code.google.com/android

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