

Introduction to Android

CSG250 Wireless Networks
Fall, 2008

Outline



- Overview of Android
- Programming basics
- Tools & Tricks
- An example
- Q&A



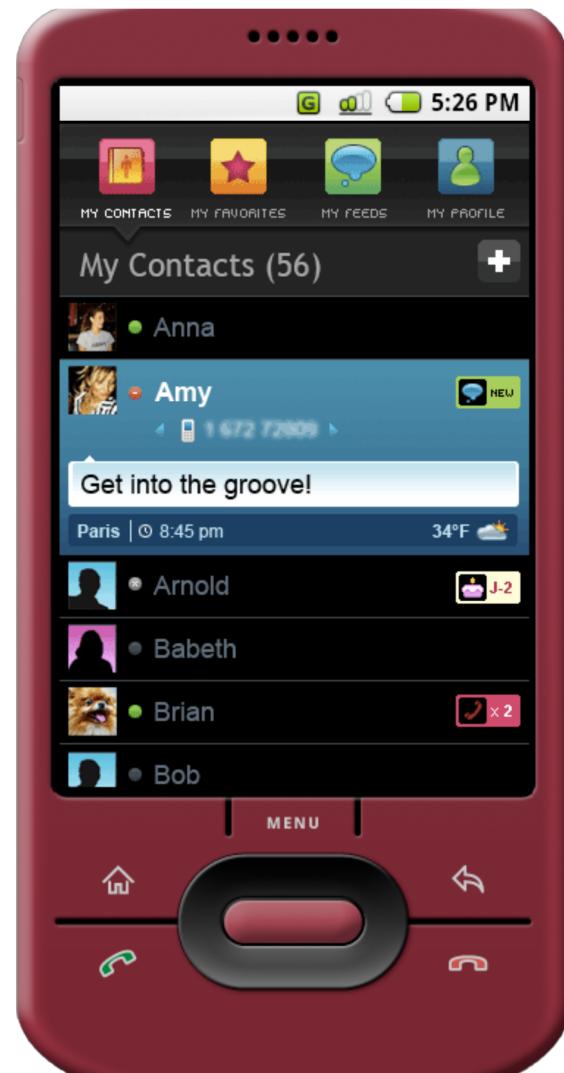
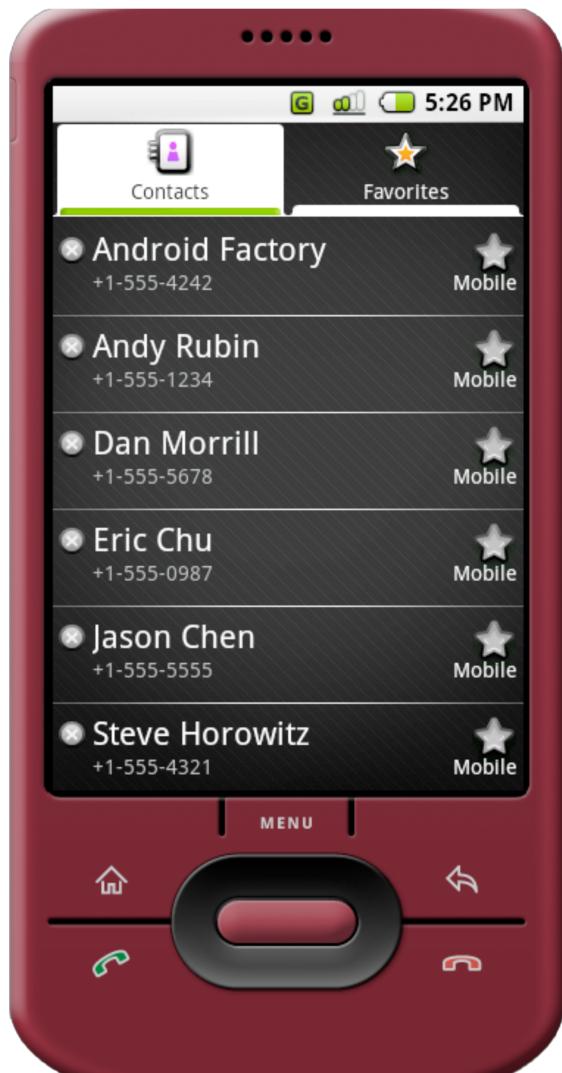
Android Overview

- Advanced operating system
- Complete software stack for fast development (mashups)
- Open platform
- Open source
- Equal opportunities



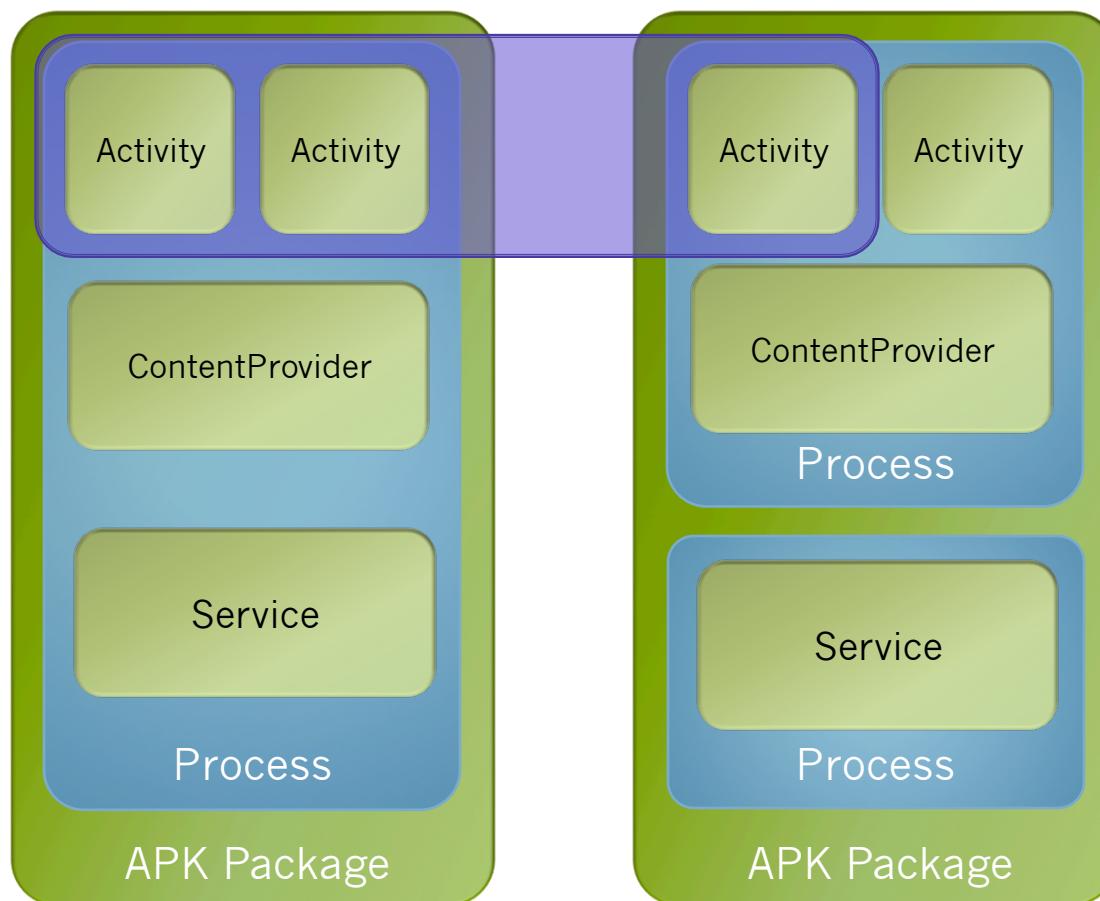


Customization



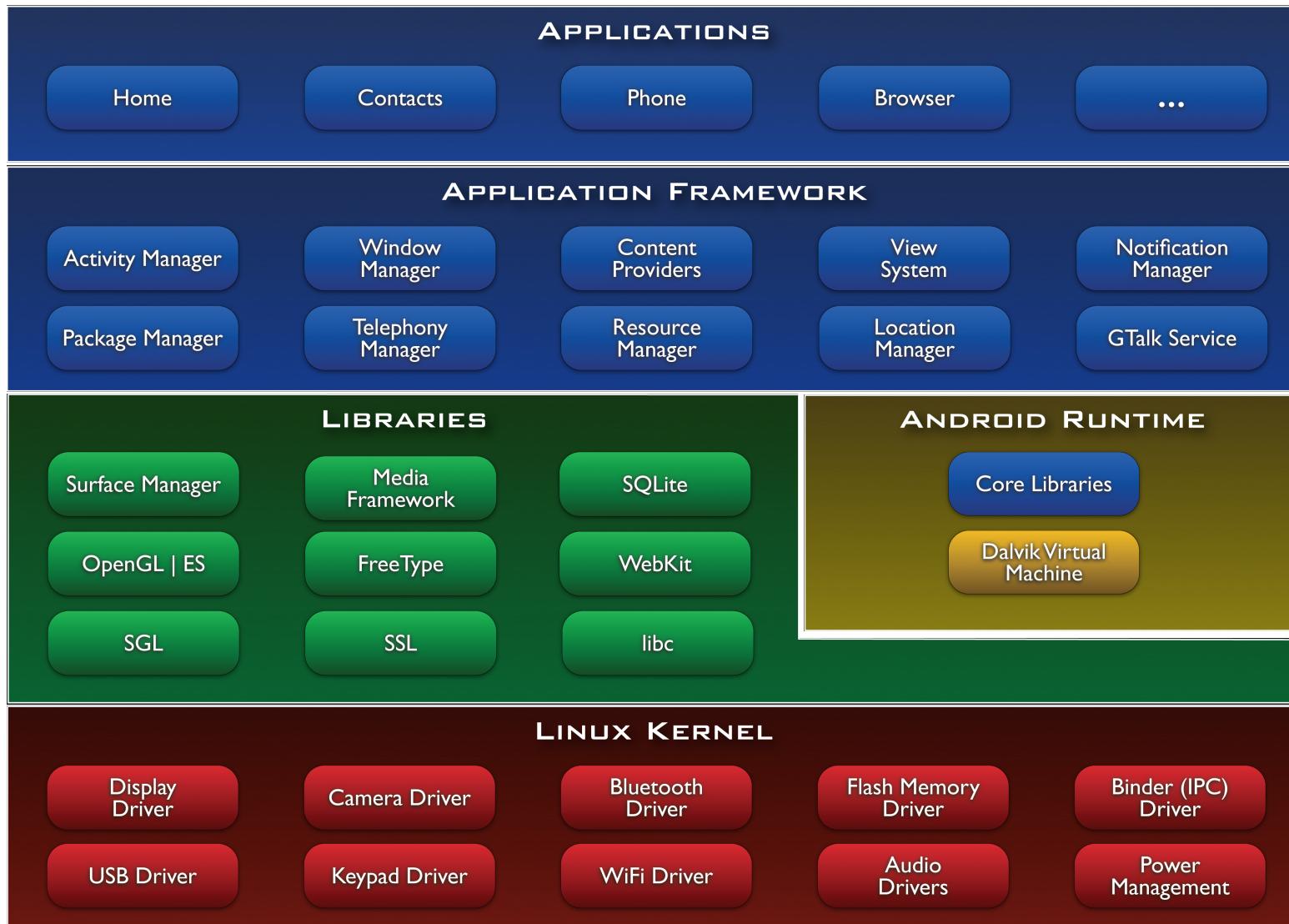


Application and Activities





Architecture of Android





Application Building Blocks

Activities

An Activity is a discrete chunk of functionality. It's typically corresponding to a set of UIs and logics.

Views & Widgets

A View is an object that knows how to draw itself to the screen. Android user interfaces are comprised of trees of Views.

Intents

Set and respond to notifications or status changes. Can wake up your app.

Services

Faceless task that runs in the background

ContentProvider

Enable applications to share data

Notification

Enables all applications to display custom alerts in the status bar

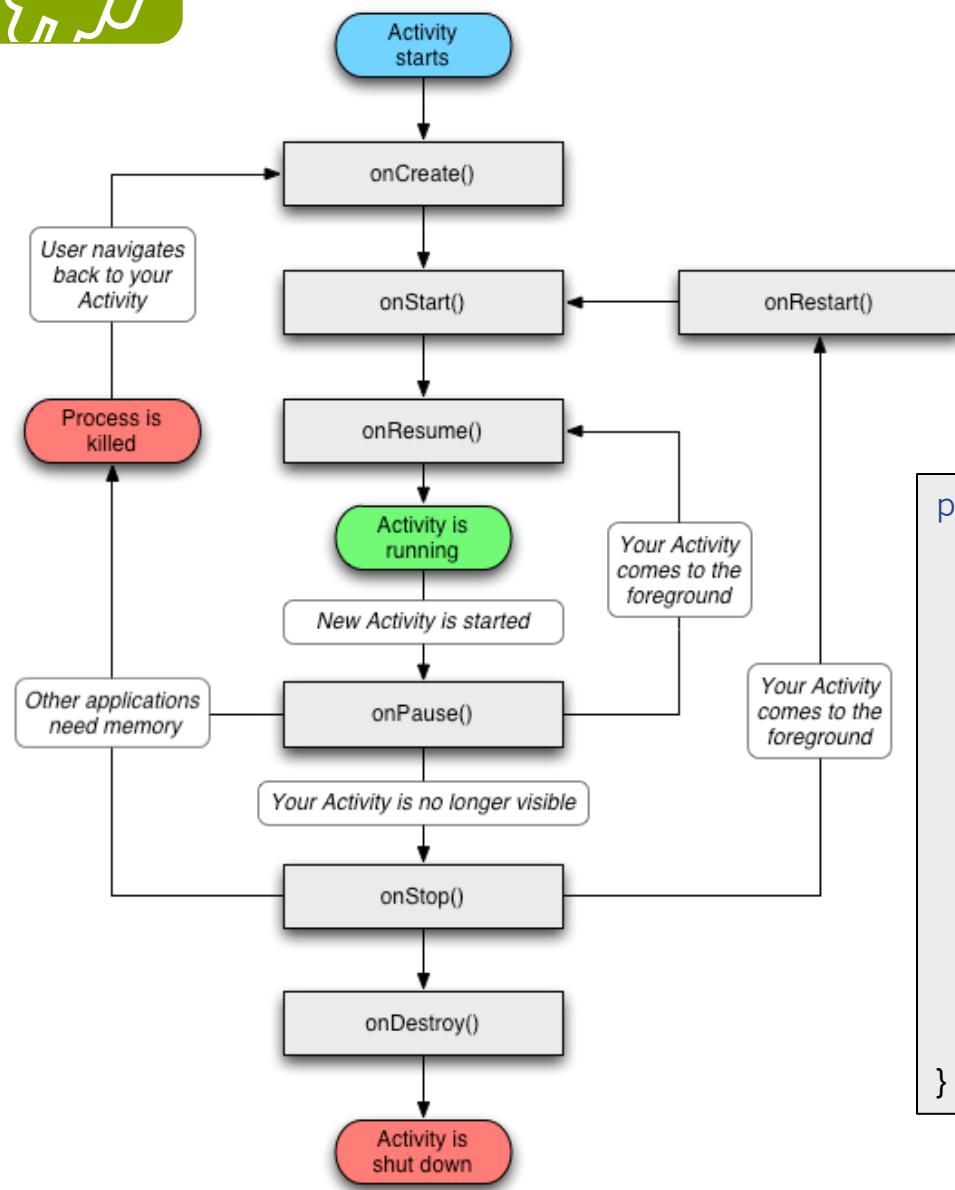


Mobile Application Paradigm

- Be energy efficient
- Use less RAM
- Always save the state
- Avoid Cancel button
- Minimize certain operations: memory transfers, division, modulus



Application Life Cycle



```
public class Activity extends ApplicationContext {  
    protected void onCreate();  
    protected void onStart();  
    protected void onRestart();  
    protected void onResume();  
    protected void onPause();  
    protected void onStop();  
    protected void onDestroy();  
}
```



Data Access

- Preferences
 - Store and retrieve key/value pairs of primitive data types
- Files
 - Access files on the device or on a removable storage medium
- Database (SQLite3)
- Content Providers
 - Read/write other applications' private data
- Network & Web services
 - Google Data APIs, Calendars, Document, Finance, Picasa ...
 - Amazon S3
 - Flickr
 - ...



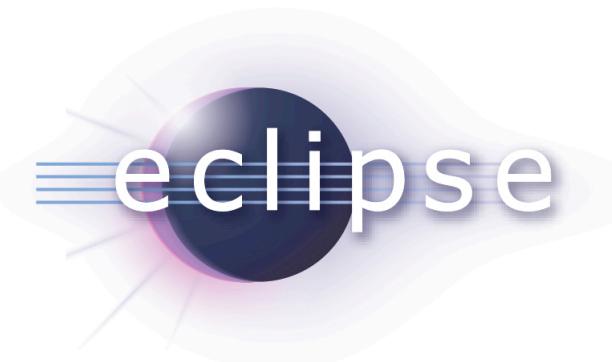
Security Model

- Application signing
 - Self-signed certificates. No need to be signed by a certificate authority
- Independent user ID for each Android package (.apk) file
 - Persistent storages can be set to private, world readable, or world writeable
- Applications are running in separate processes.
 - Explicitly declare the permissions for additional capabilities
 - Inter-process communications. (Binder)



Developing Environment

Java IDE

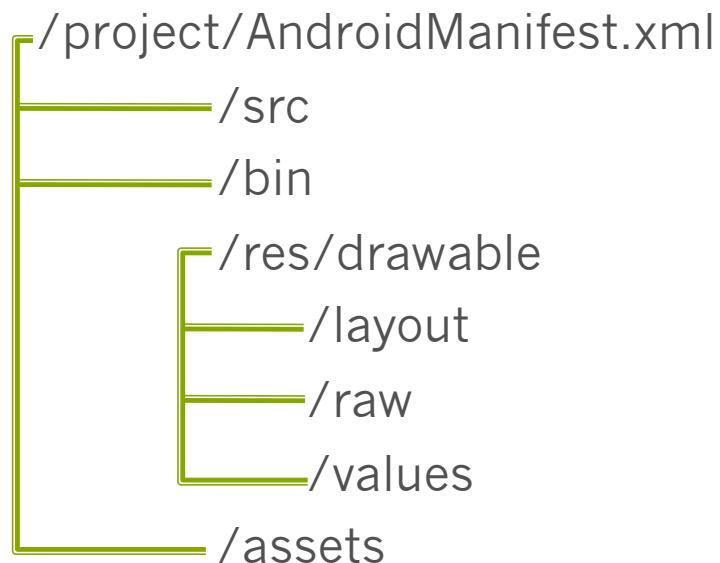


Android SDK suite

- Eclipse Plugin
- Libraries
- Emulator
- Tools
 - Dalvik Debug Monitor Service (ddms)
 - Android Debug Bridge (adb)
 - Android Asset Packaging Tool (aapt)
 - Traceview
 - Hierarchy Viewer
 - ...

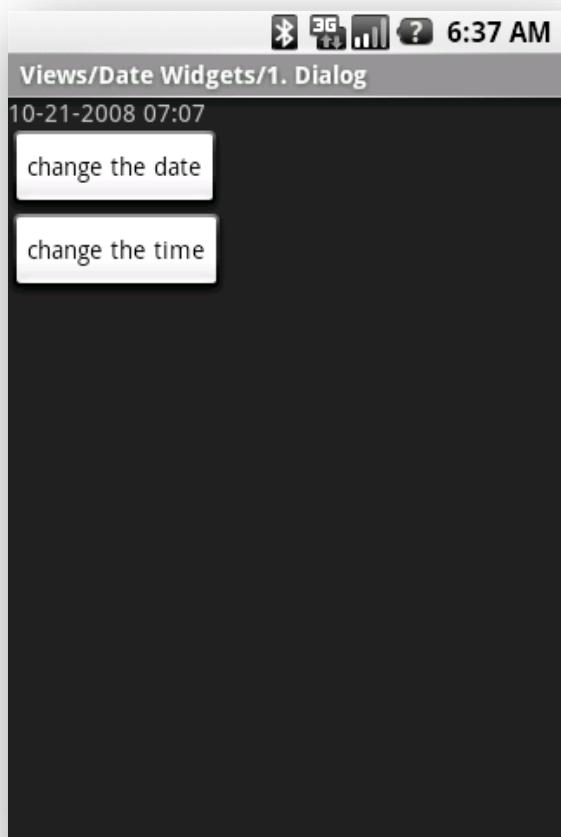


Project Structure





Define UI in XML



```
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:orientation="vertical">

    <TextView android:id="@+id/dateDisplay"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="@string/date_widgets_example_dateDisplay_text"/>

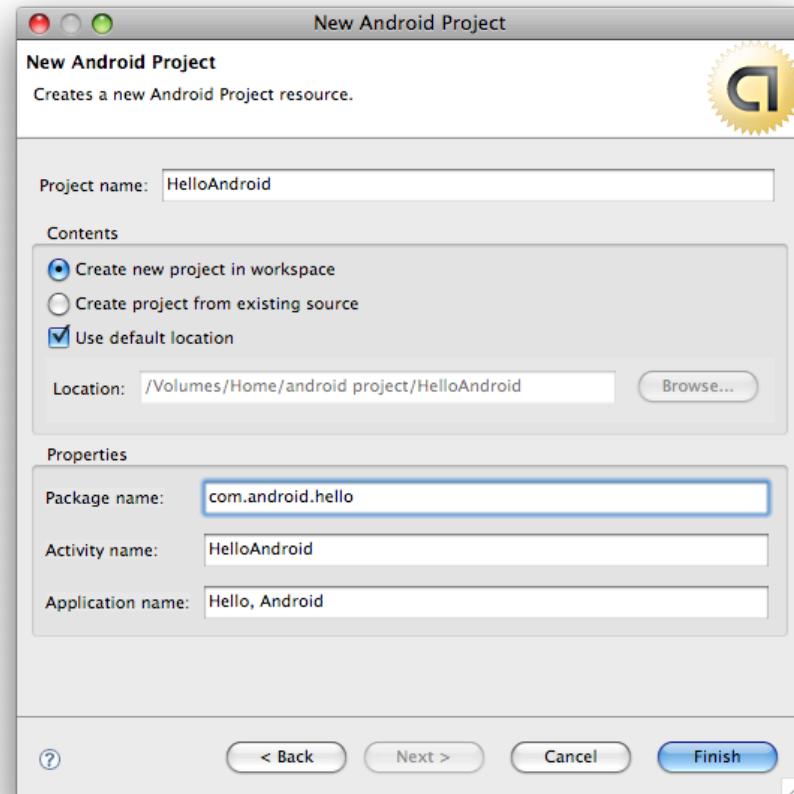
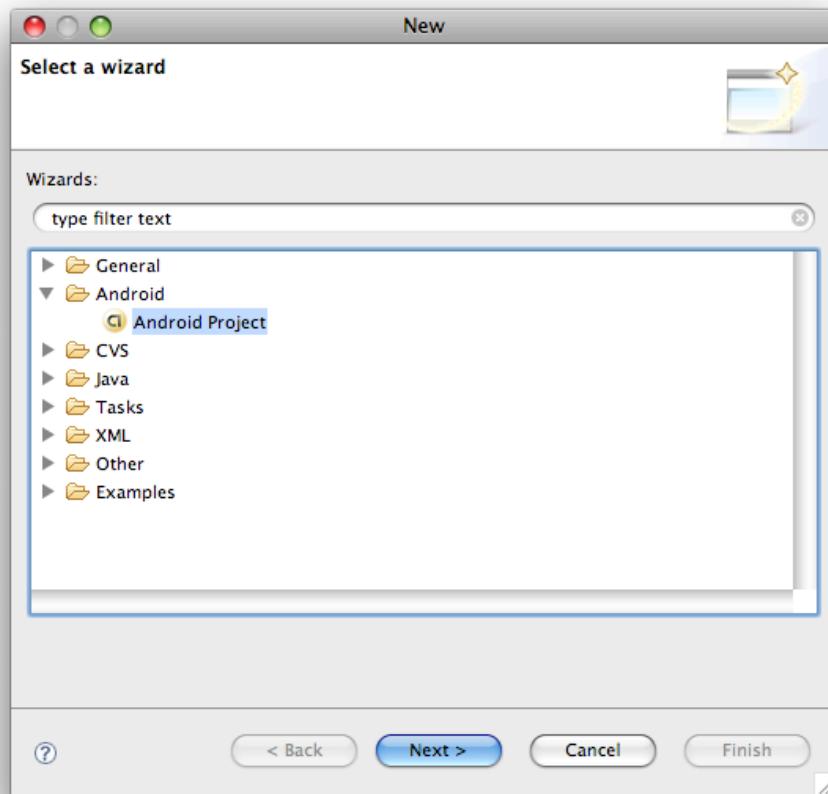
    <Button android:id="@+id/pickDate"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="@string/date_widgets_example_pickDate_text"/>

    <Button android:id="@+id/pickTime"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="@string/date_widgets_example_pickTime_text"/>

</LinearLayout>
```



Develop with Eclipse Plugin





Debug with Eclipse Plugin

LogCat output:

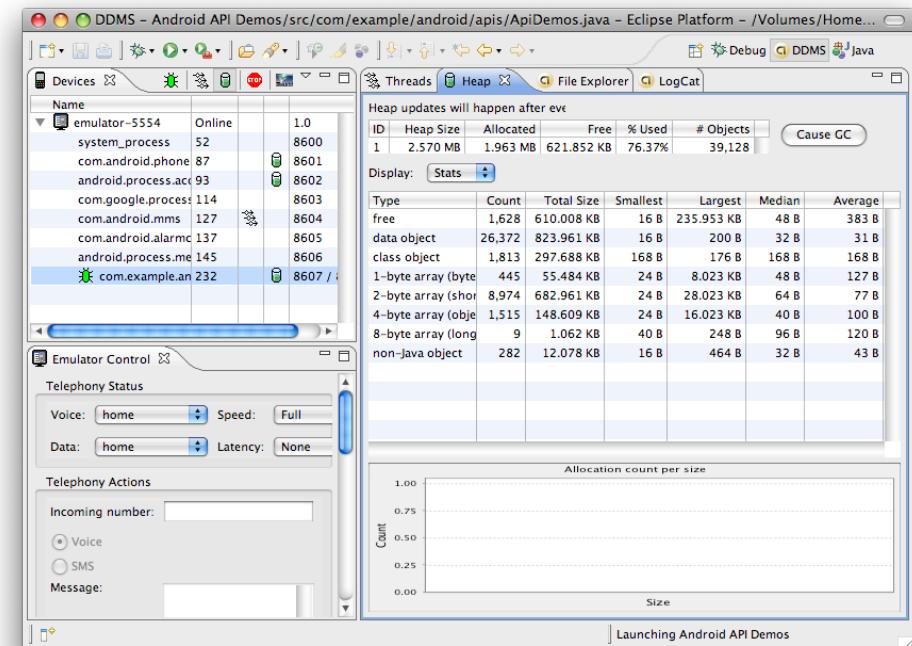
```
10-21 06:40:08.1 232 System.out Message
10-21 06:40:08.1 232 ActivityI Publishing provider com.example.android.apis
10-21 06:40:11.1 93 dalvikvm GC free 868 objects / 44776 bytes in
10-21 06:43:07.1 52 GpsLocationNetworkKThread out of wake loop
10-21 06:43:07.1 52 GpsLocationRequesting time from NTP server pool.
10-21 06:43:11.1 93 dalvikvm dvmHandlePngChunk(when 1, what 0,
10-21 06:43:12.1 87 dalvikvm dvmHandlePngChunk(when 1, what 0,
10-21 06:43:13.1 232 dalvikvm dvmHandlePngChunk(when 1, what 0,
10-21 06:43:14.1 232 dalvikvm GC free 1792 objects / 36224 bytes i
10-21 06:43:14.2 1 52 ActivityI Displayed activity com.example.android.apis
10-21 06:44:03.1 52 SntpClient request time failed: java.net.UnknownHostException: ntp1.eurodns.com
10-21 06:44:03.1 52 GpsLocationRequestTime failed
10-21 06:44:15.1 52 GpsLocationNetworkKThread wait for 30000ms
10-21 06:44:15.8 232 dalvikvm Calling exit(1)
10-21 06:44:15.8 1 52 ActivityI Process com.example.android.apis (pic
10-21 06:44:15.8 1 52 WindowManager WIN DEATH Window(4341d468 com.example.android.apis)
```

Java code (ApiDemos.java):

```
Intent intent = getIntent();
String path = intent.getStringExtra("com.example.android.apis.Path");

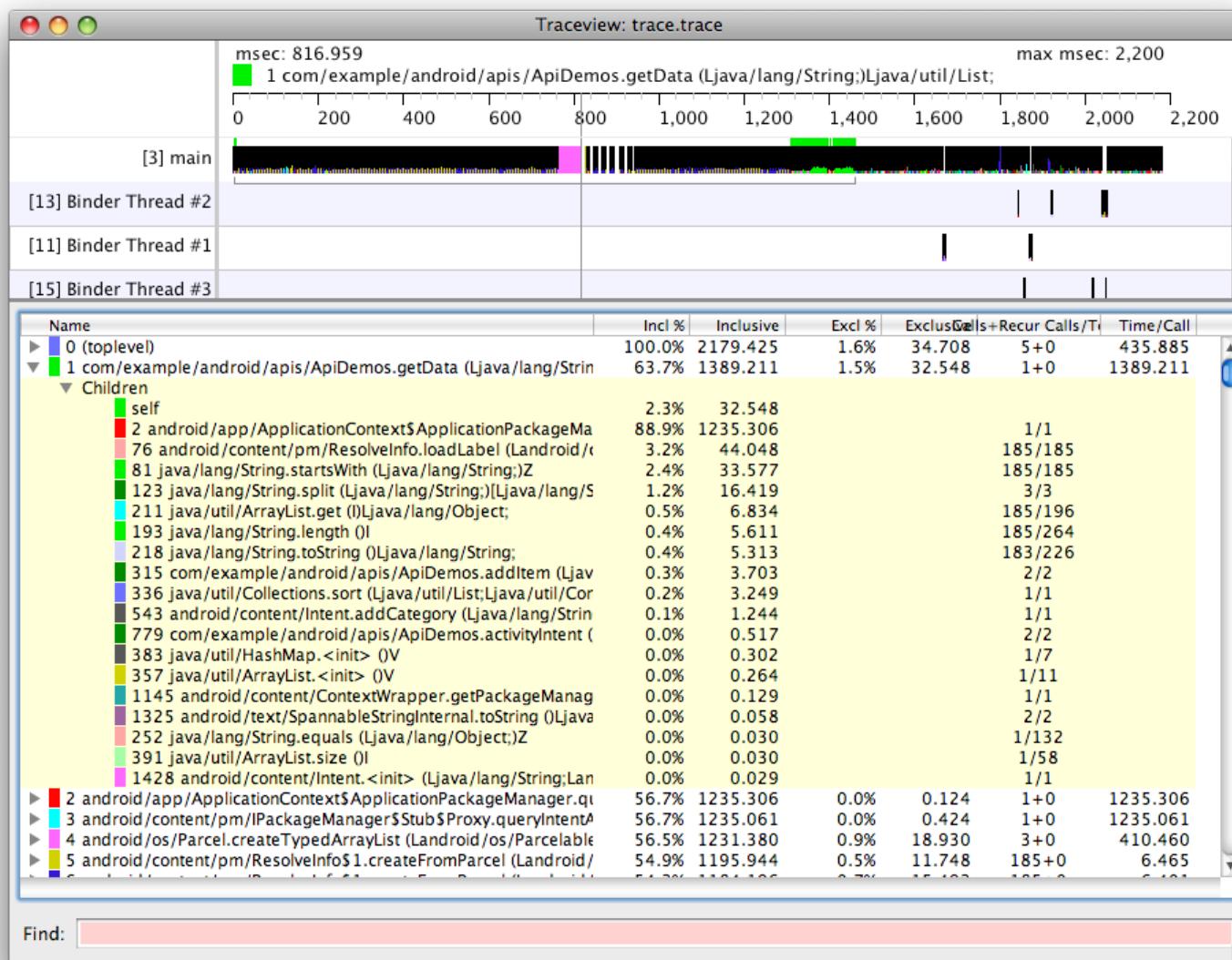
if (path == null) {
    path = "";
}

setListAdapter(new SimpleAdapter(this, getData(path),
        android.R.layout.simple_list_item_1, new String[] { "title" },
        new int[] { android.R.id.text1 }));
getListView().setTextFilterEnabled(true);
}
```



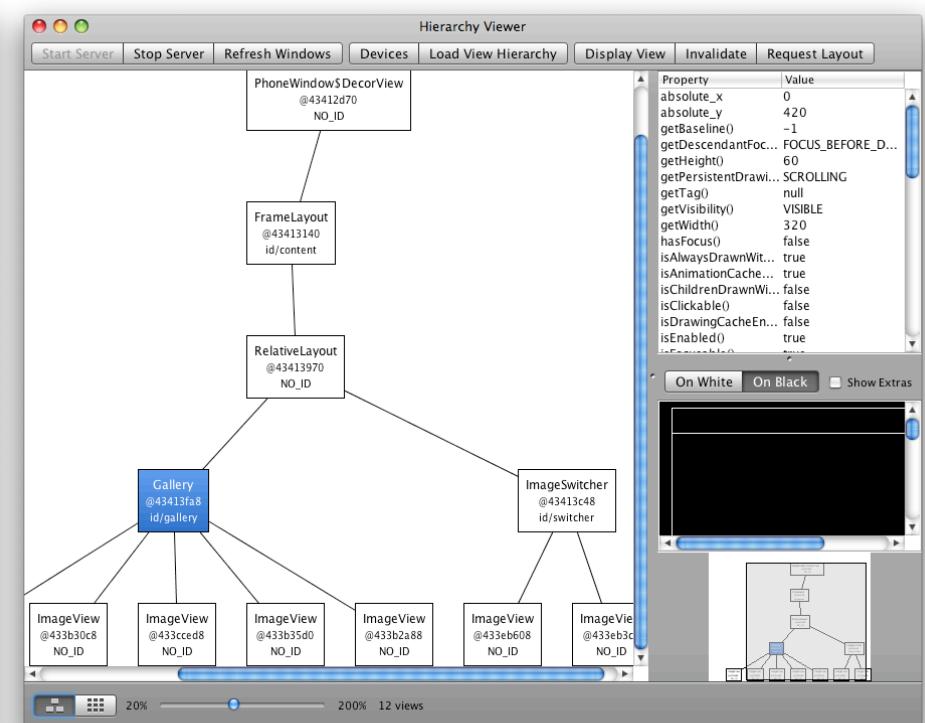
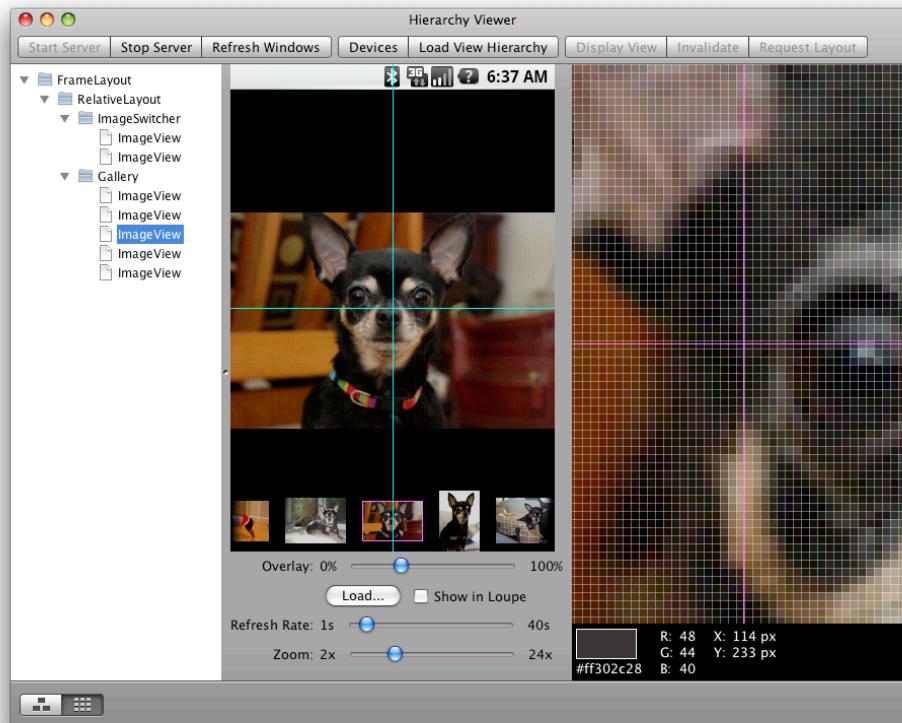


TraceView





Hierarchy Viewer





Useful Commands

- emulator
 - emulator -wipe_data
folder: {home}/.android/
 - emulator -sdcard <file>

- adb (Android debug bridge)
 - adb install <.apk file>
 - adb uninstall
 - adb push/pull
 - adb shell



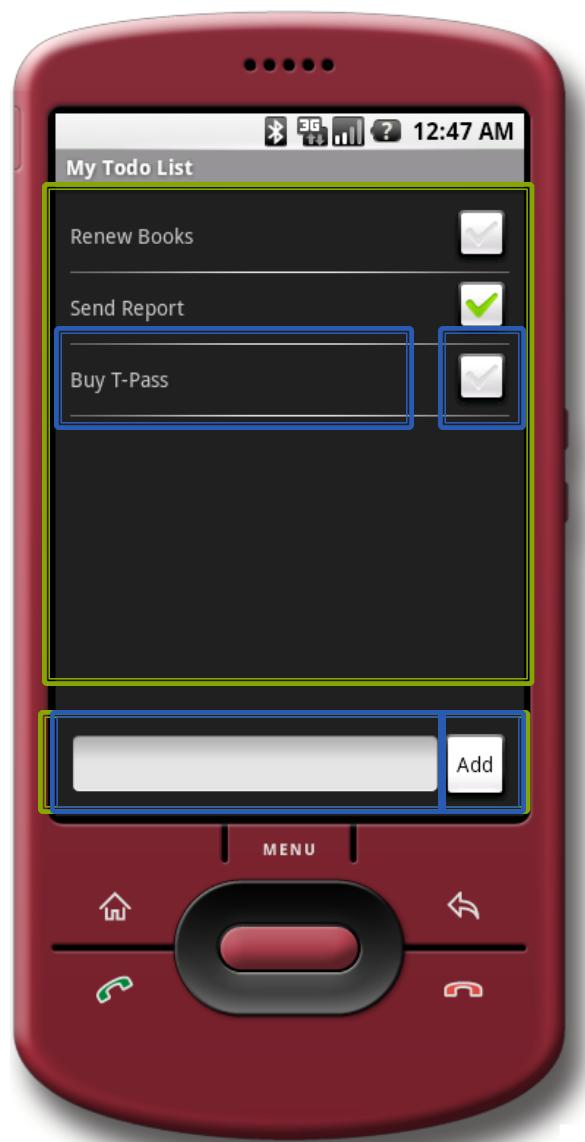
Resources

- API demos
- Get source <http://source.android.com/>
- Android code page <http://code.google.com/android/>
- Google groups <http://groups.google.com/group/android-developers>
- Communities e.g. <http://www.anddev.org/>
- YouTube



Example

Todo List





Q&A

References



- Some of the contents and images are used from others' work.
- <http://sites.google.com/site/io/introduction-to-android>
- <http://sites.google.com/site/io/dalvik-vm-internals>
- <http://sites.google.com/site/io/inside-the-android-application-framework>