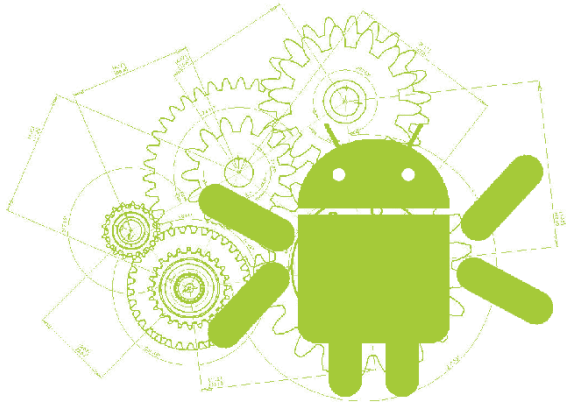
POZITRON



Android
Developer Days


# Can Elmas
***Android Team Leader***
# İsmail Ceylan
***Android Developer***

# Mehmet Arıkan
***Android Developer***


# Agenda

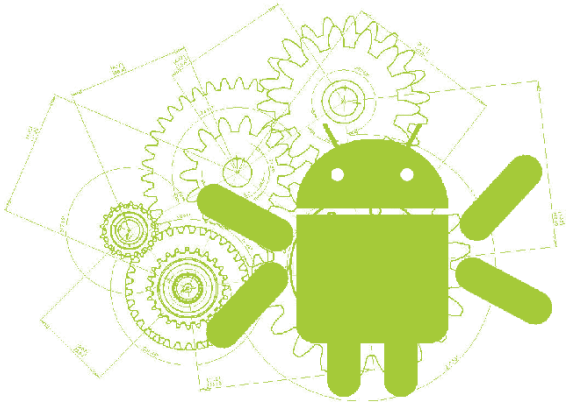
- Android Fundemantals
- Sample Projects
- Coding Contest!

POZITRON®

- Leader in Mobile App Development
- Many native apps in Turkey, and also in other markets: Middle East, Europe, Russia, USA

- 60% of Pozitron = Computer Sci./Eng. Grads

- IsCep, YKB, THY, Bilyoner, HepsiBurada, Biletix, DohaBank (Middle East), Milo (USA), Brands4Friends (Germany) and more...



# Introduction to Android Platform

# T-Mobile G1 / HTC Dream - 2008

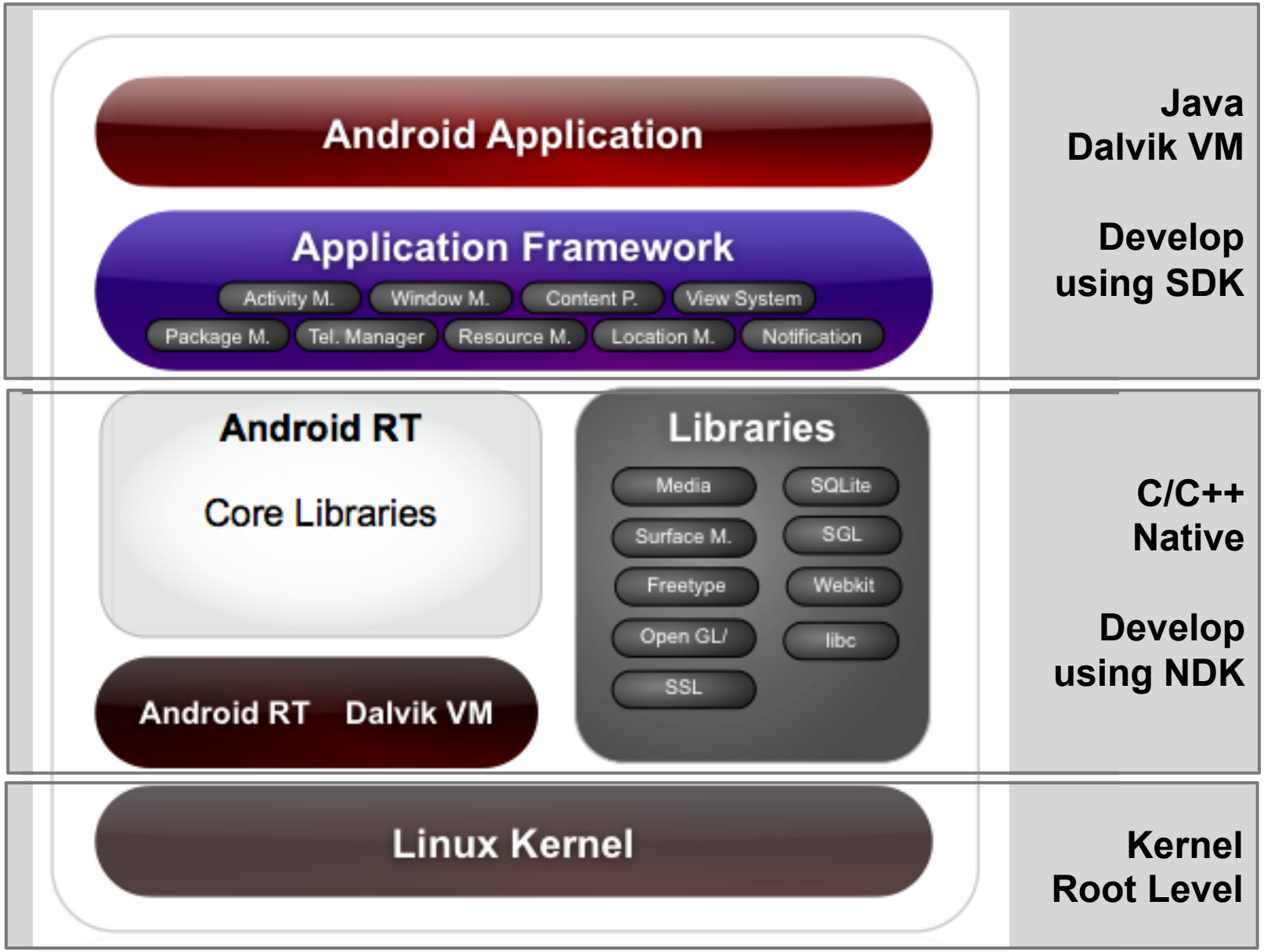
# What is Android ?

Android is an **open-source** software stack **for mobile devices**, and a corresponding **open-source project** led by Google.

http://source.android.com

- you can get the code
- you can modify if you want
- you can build and deploy to your device

# Android Software Stack



# Android Architecture

- A multi user Linux system. Each application is a different user : Kernel level Application Sandbox
- Every app run in its own Linux process, each process has its own VM
- Permissions set at the install time
- Complete isolation

For more on Security,

http://source.android.com/tech/security/index.html

# What is Dalvik Virtual Machine (VM) ?

- Software that runs the anroid apps
- **java > class > dex**

  *javac* *dx*
- More suitable in terms of memory and processor speed

*class* is run by Java Virtual Machine

*dex* is run by Dalvik Virtual Machine

For more on DVM, http://davidehringer.com/software/android/The_Dalvik_Virtual_Machine.pdf

# http://developer.android.com/sdk

Developers | Design | Develop | Distribute

Android Training | API Guides | Reference | Tools

- Developer Tools
- Download
- Installing the SDK
- Exploring the SDK
- NDK
- Workflow
- Tools Help
- Revisions
- Extras
- Samples
- ADK

## Get the Android SDK

The Android SDK provides you the API libraries and developer tools necessary to build, test, and debug apps for Android.

**SDK is for Java targeting Dalvik VM.**

**NDK is for C/C++ targeting native environment.** ***You will probably need only SDK.***

| Platform | Package | Size | MD5 Checksum |
|---|---|---|---|
| Windows | android-sdk_r20.0.3-windows.zip | 90379469 bytes | cd895c79201f7f02507eb3c3868a1c5e |
| | installer_r20.0.3-windows.exe (Recommended) | 70495456 bytes | cf23b95d0c9cd57fac3c3be253171af4 |
| Mac OS X (intel) | android-sdk_r20.0.3-macosx.zip | 58218455 bytes | 07dc88ba2c0817ef178a665d002831bf |
| Linux (i386) | android-sdk_r20.0.3-linux.tgz | 82616305 bytes | 0d53c2c31d6b5d0cf7385bccd0b06c27 |

# Android Developer Documentation

Extensive documentation at

**http://developer.android.com**

Check also Google IO Conference

**https://developers.google.com/events/io/**

# API Levels

Android versions are mapped to API Levels.
e.g. Android 4.1 is API Level 16

API features are available or not for a specific API Level. Some features are back-ported with
Android Support Library.

4.0+ (API Level 14+) is 22%
2.3.3 - 2.3.7 (API Level 10) is 57%

# API Levels

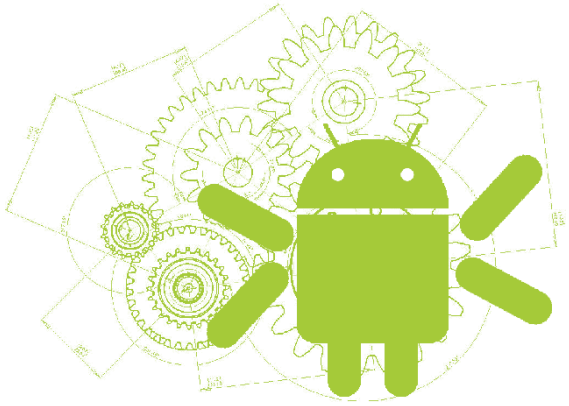
- Cupcake (1.5 - API Level 3)
- Donut
- Eclair
- Froyo
- Gingerbread
- Honeycomb (3.0 - API Level 11)
- ICS (4.0 - API Level 14)
- JellyBean (4.2 - API Level 17)
- Key Lime Pie ???

# Android Development Workflow

- Setup development environment (SDK)
- Build / Debug / Test (in your favorite IDE)
  - Virtual Device Setup / Physical Device
  - DDMS (Dalvik Debug Monitor Server)
  - LogCat
  - Lint
- Publish (to Google Play)

# First Android Project

- Folders
- Layouts and Views
- R class
- Android Manifest
- Activity
- Intent



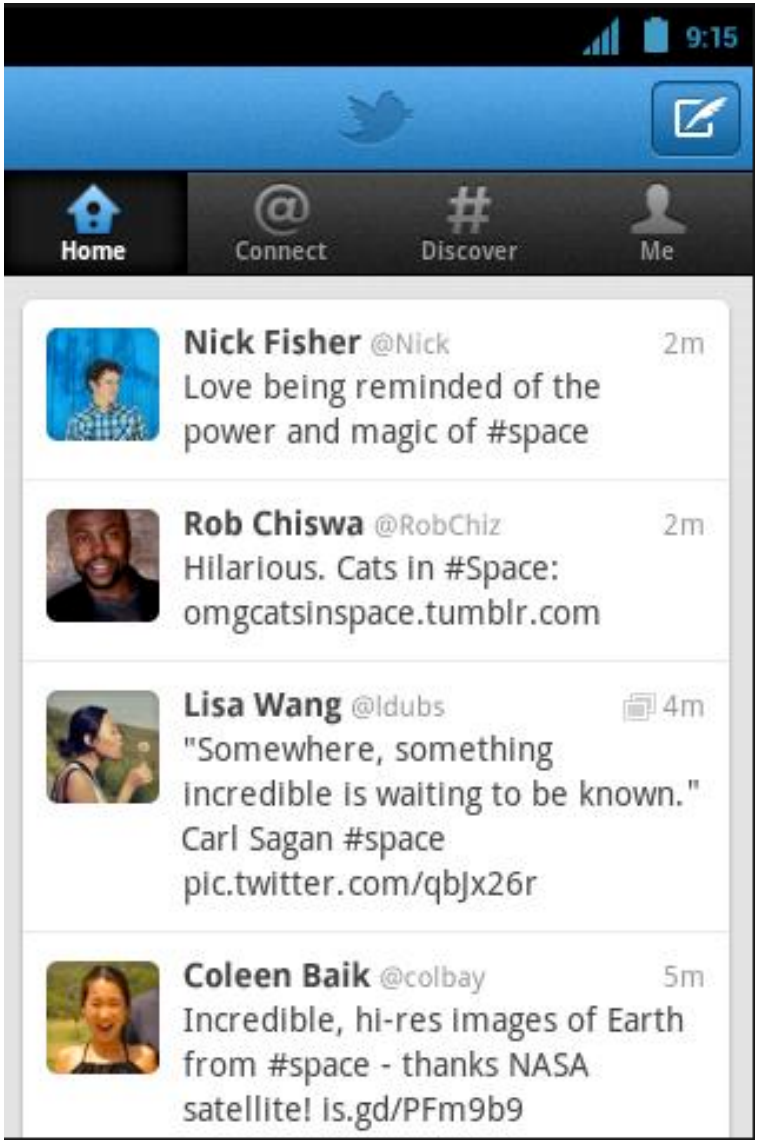
# Application Fundamentals

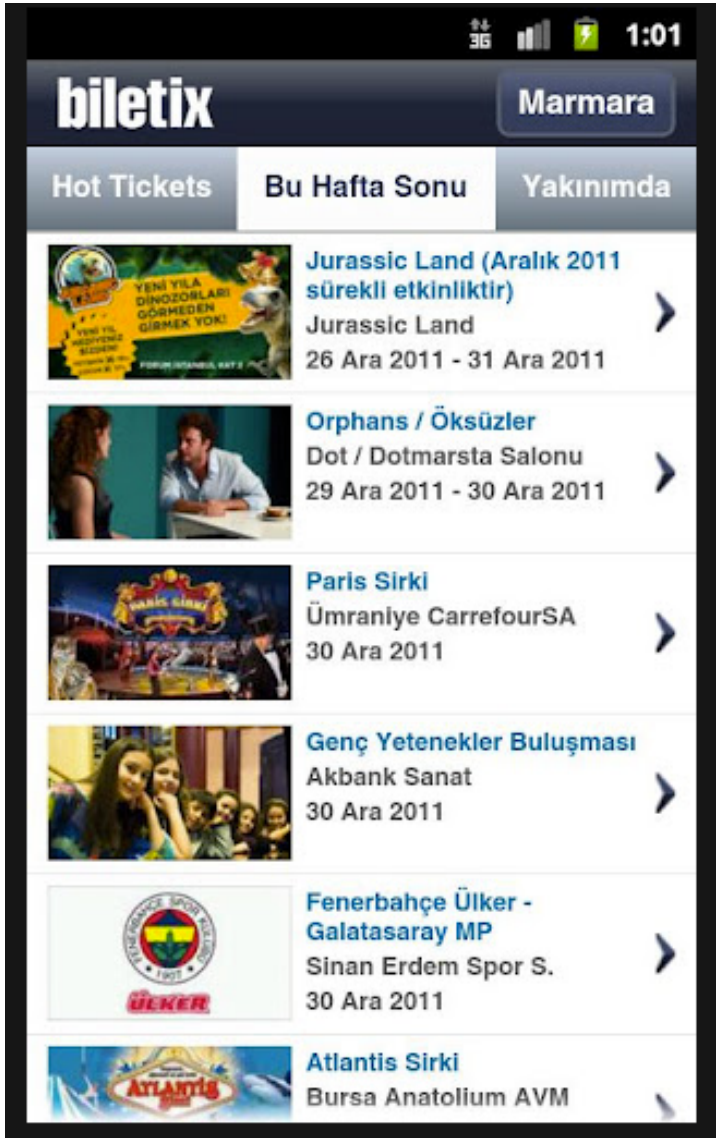
Activities
Intents and Intent Filters
Services
Content Providers
Broadcast Receivers
Fragments
Android Manifest - Permissions

# Activity

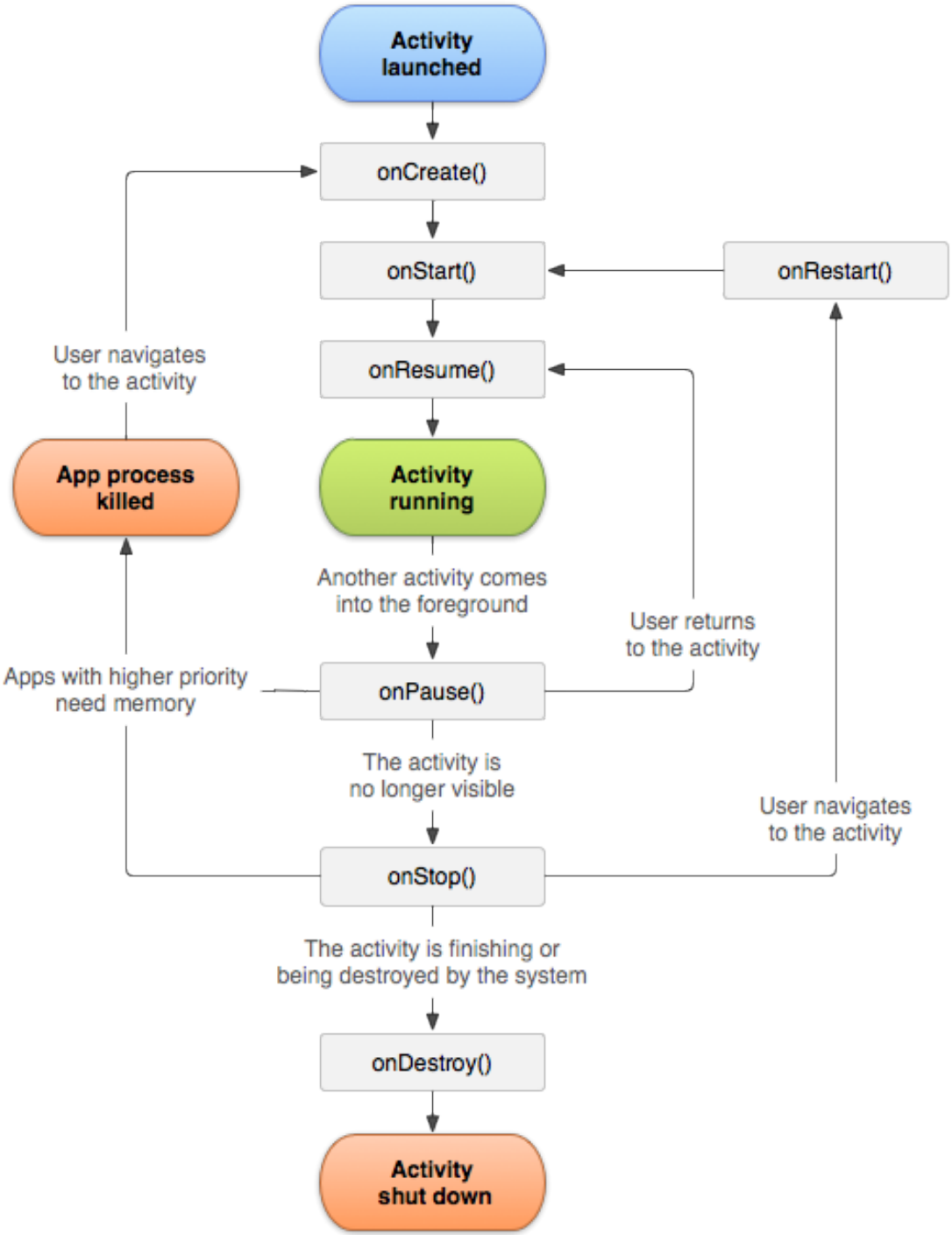
* Typically correspond to one screen in a UI
* But, they can:
  - be faceless
  - return a value
* An application with User Interface, consist of one or more Activities
* Managed as an *activity stack (LIFO)*

# Activity


9:15
Home
Connect
Discover
Me
Nick Fisher @Nick 2m
Love being reminded of the power and magic of #space
Rob Chiswa @RobChiz 2m
Hilarious. Cats in #Space: omgcatsinspace.tumblr.com
Lisa Wang @ldubs 4m
"Somewhere, something incredible is waiting to be known." Carl Sagan #space pic.twitter.com/qbJx26r
Coleen Baik @colbay 5m
Incredible, hi-res images of Earth from #space - thanks NASA satellite! is.gd/PFm9b9


1:01
biletix
Marmara
Hot Tickets
Bu Hafta Sonu
Yakınımda
Jurassic Land (Aralık 2011 sürekli etkinliktir)
Jurassic Land
26 Ara 2011 - 31 Ara 2011
Orphans / Öksüzler
Dot / Dotmarsta Salonu
29 Ara 2011 - 30 Ara 2011
Paris Sirki
Ümraniye CarrefourSA
30 Ara 2011
Genç Yetenekler Buluşması
Akbank Sanat
30 Ara 2011
Fenerbahçe Ülker - Galatasaray MP
Sinan Erdem Spor S.
30 Ara 2011
Atlantis Sirki
Bursa Anatolium AVM

```java
public class MyActivity extends Activity {
    /**
     * Called when the activity is first created.
     */
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
    }

    @Override
    protected void onStart() {
        super.onStart();

        //  YOU ARE ON THE RUN LIST
        // YOU CAN START EXECUTION ON ANY MOMENT
    }

    @Override
    protected void onResume() {
        super.onResume();

        //  YOU NOW HAVE FOCUS
        // YOU ARE THE TOP LEVEL APPLICATION
    }

    @Override
    protected void onPause() {
        super.onPause();

        //  YOU ARE NO LONGER THE TOP OF THE STACK
        // AND NO LONGER HAVE FOCUS
    }

    @Override
    protected void onStop() {
        super.onStop();

        //  NO LONGER RUN IN FUNCTIONS
    }

    @Override
    protected void onRestart() {
        super.onRestart();

        //  YOU ARE BACK ON THE RUN LIST
    }

    @Override
    protected void onDestroy() {
        super.onDestroy();
    }
}
```



# Activity

- Activity States managed by the Android system
- Declaration in the android manifest file
- "Main Activity" must be set

http://developer.android.com/guide/components/activities.html

# Activity

- Activity with UI content

```
public class MainActivity extends Activity {

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);

        setContentView(R.layout.main_act);

    }
}
```

# Intent

- Intention
- Passive data structure holding an abstract description of an operation to be performed
- A message to the OS that you want to do something

# Intent

- Primary Attributes :
  - action : General action to be performed (ACTION_VIEW, ACTION_MAIN etc..)
  - data : Data to operate on, expressed as a URI

- Depending on how Intent is constructed, Android system determines what to do e.g finds the appropriate activity, service, or set of broadcast receivers

# Intent - Explicit

- Used to navigate from one Activity to another in app

- Daha transfer between Activities

```
Intent intent = new Intent(ActHome.this, BrowserActivity.class);

intent.putExtra("url",  "http://wwww.google.com");

startActivity(intent);
```

# Intent - Implicit

- Used to open other applications
  - Ex : Open a specific URL in a user's preferred browser

```
String url = "http://www.example.com";
Intent i = new Intent(Intent.ACTION_VIEW);
i.setData(Uri.parse(url));
startActivity(i);
```

# Intent

- IPC mechanism

- Depending on how Intent is constructed, Android system finds the appropriate activity, service, or set of broadcast receivers to respond the intent

# Intent Filter

- Description of what intent an activity is capable of handling
- "Main" Activity :

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
          package="com.gsuandroid">

    <application android:icon="@drawable/icon" android:label="@string/app_name">

        <activity android:name=".activities.MainActivity">
            <intent-filter>
                <action android:name="android.intent.action.MAIN"/>
                <category android:name="android.intent.category.LAUNCHER"/>
            </intent-filter>
        </activity>

        <activity android:name=".activities.ActTwo"/>

    </application>

</manifest>
```

# Intent Filter

- Depending on how Intent is constructed, Android system finds the appropriate activity, service, or set of broadcast receivers to respond the intent

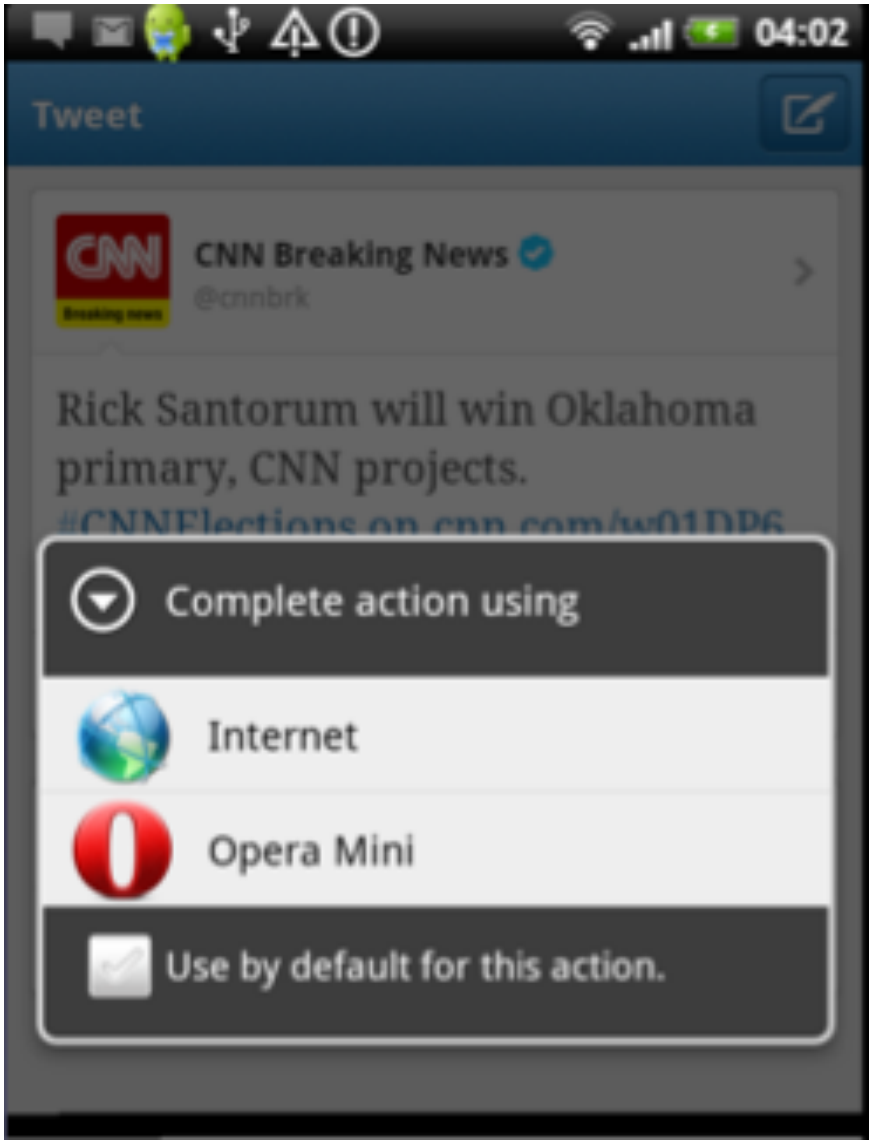
# Intent Filter - Crappy Browser

- Register for intent

```
<activity android:name=".ui.activities.BrowserActivity">

    <intent-filter>
        <action android:name="android.intent.action.VIEW" />
        <category android:name="android.intent.category.DEFAULT" />
        <data android:scheme="http"/>
    </intent-filter>

</activity>
```

# Intent Filter

- Receive Intent



# Broadcast Receiver

- Component which allows to register for system or application events

- You cannot trigger system Broadcasts, Android will prevent it; you can define your own actions

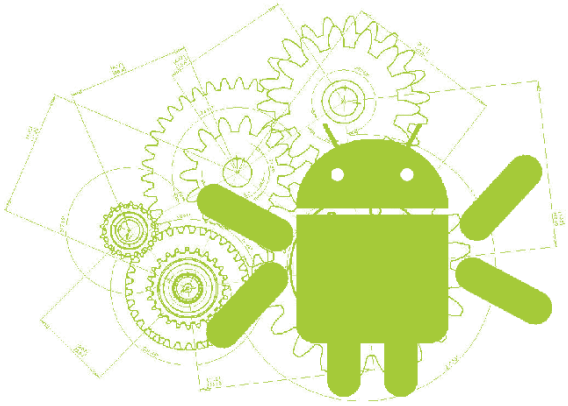
- System Broadcasts:
  - Intent.ACTION_BOOT_COMPLETED
  - Intent.ACTION_BATTERY_LOW
  - Intent.ACTION_POWER_DISCONNECTED

# Services

- Faceless
- Runs in the background
- Pre-defined Services :
  - Context.LAYOUT_INFLATOR_SERVICE
  - Context.LOCATION_SERVICE
- Might run on its own thread or in activity

# Content Provider

- Access to a central repository of data
- Intended to be used by other applications with provider client objects
- IPC
- Contacts, Calendar, your own custom provider etc.



# User Interface @ Android

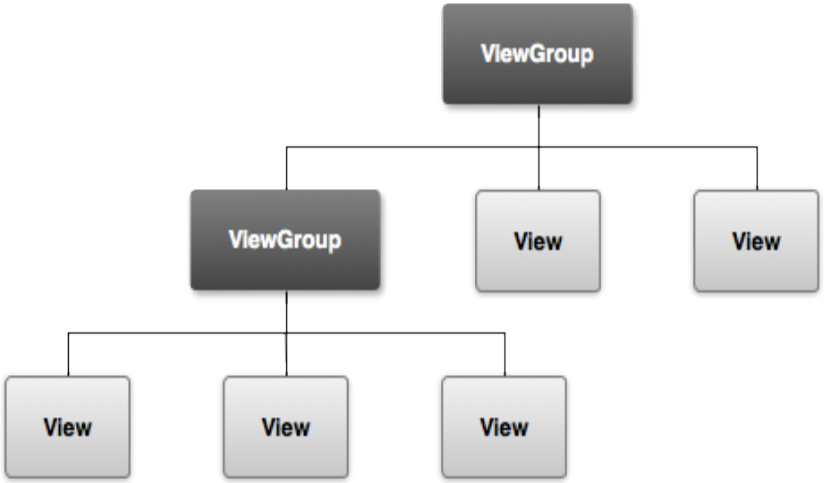
# Overview

* UI is defined by hierarchy of *View*'s and *ViewGroup*'s.

* Views are highly customizable. You can even create your own custom views.

* Layouts can be created from code programmatically or can be defined in XML files.

* Both methods have advantages



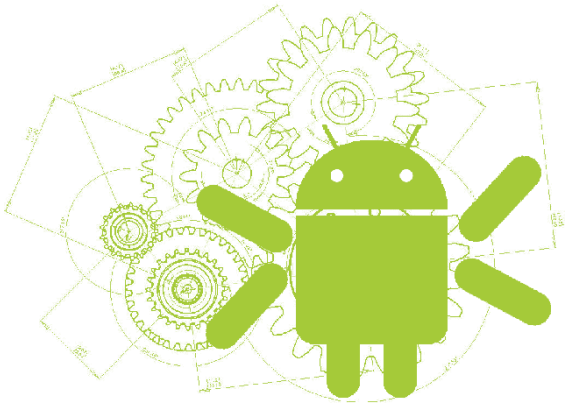
# Overview

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
              android:layout_width="fill_parent"
              android:layout_height="fill_parent"
              android:orientation="vertical" >
    <TextView android:id="@+id/text"
              android:layout_width="wrap_content"
              android:layout_height="wrap_content"
              android:text="I am a TextView" />
    <Button android:id="@+id/button"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:text="I am a Button" />
</LinearLayout>
```

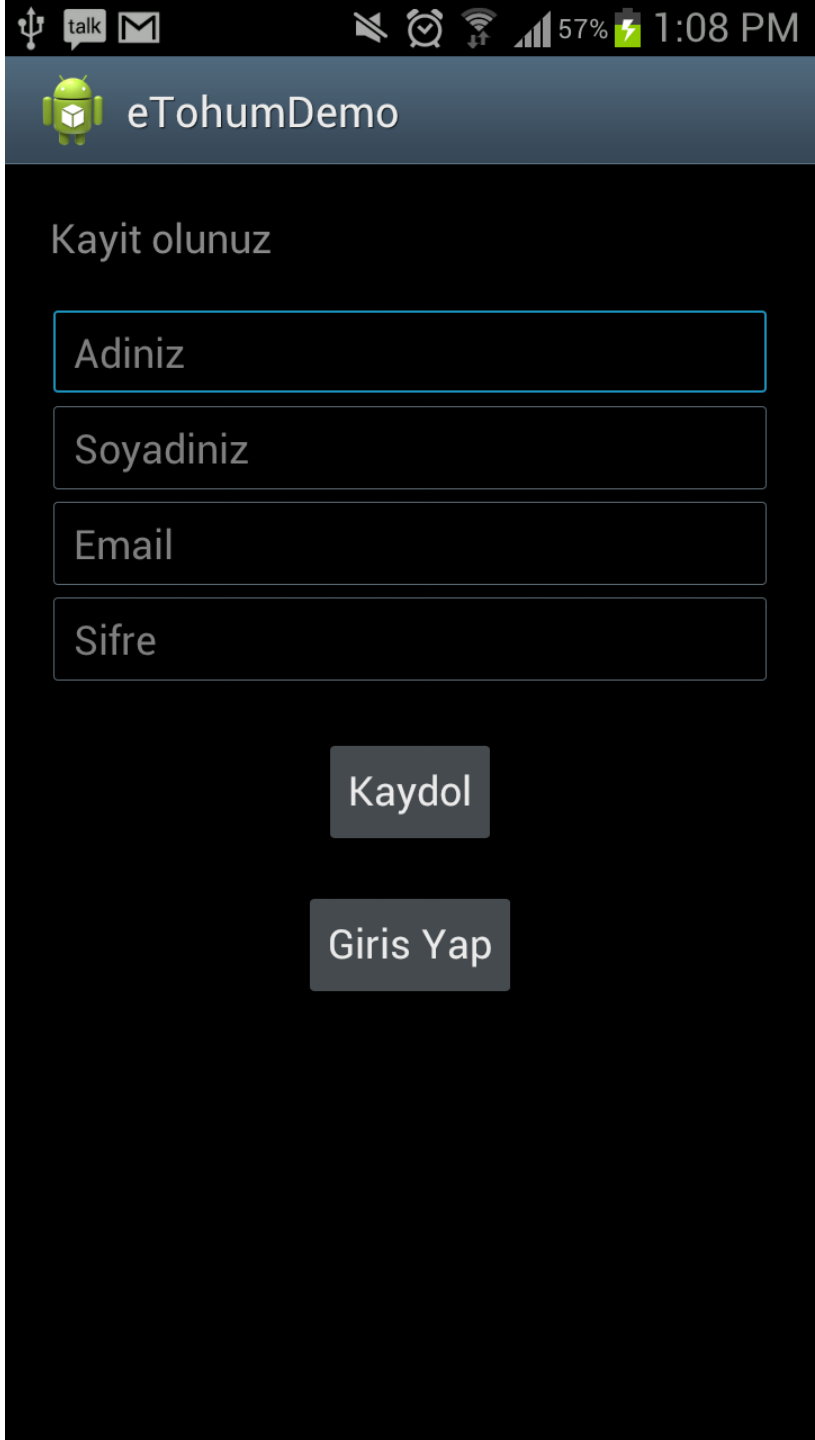
* View's created in XML files can be referenced from code via ID's.

* We should set content view if layout is defined in XML file:

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



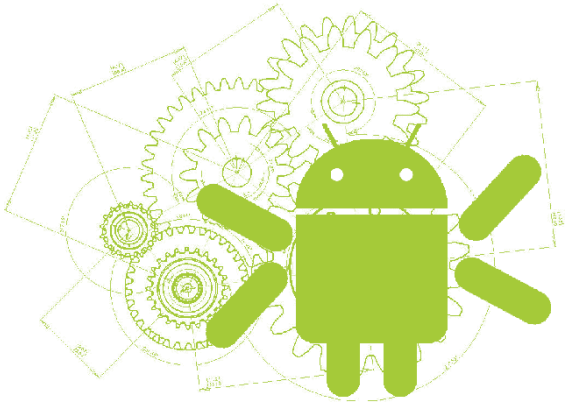
# User Interface Demo



# UI - Dialogs

* Small windows used for notifying user or perform small actions(confirmation, login etc)

```
new AlertDialog.Builder(this)
       .setTitle("uyari")
       .setMessage("doldurulmamis alanlar var. yine de kayit yapilsin mi")
       .setCancelable(false)
       .setPositiveButton("evet", new DialogInterface.OnClickListener() {
           public void onClick(DialogInterface dialog, int id) {
                register();
           }
       })
       .setNegativeButton("hayir", null).show();
```



# Dialogs Demo

# UI - ActionBar

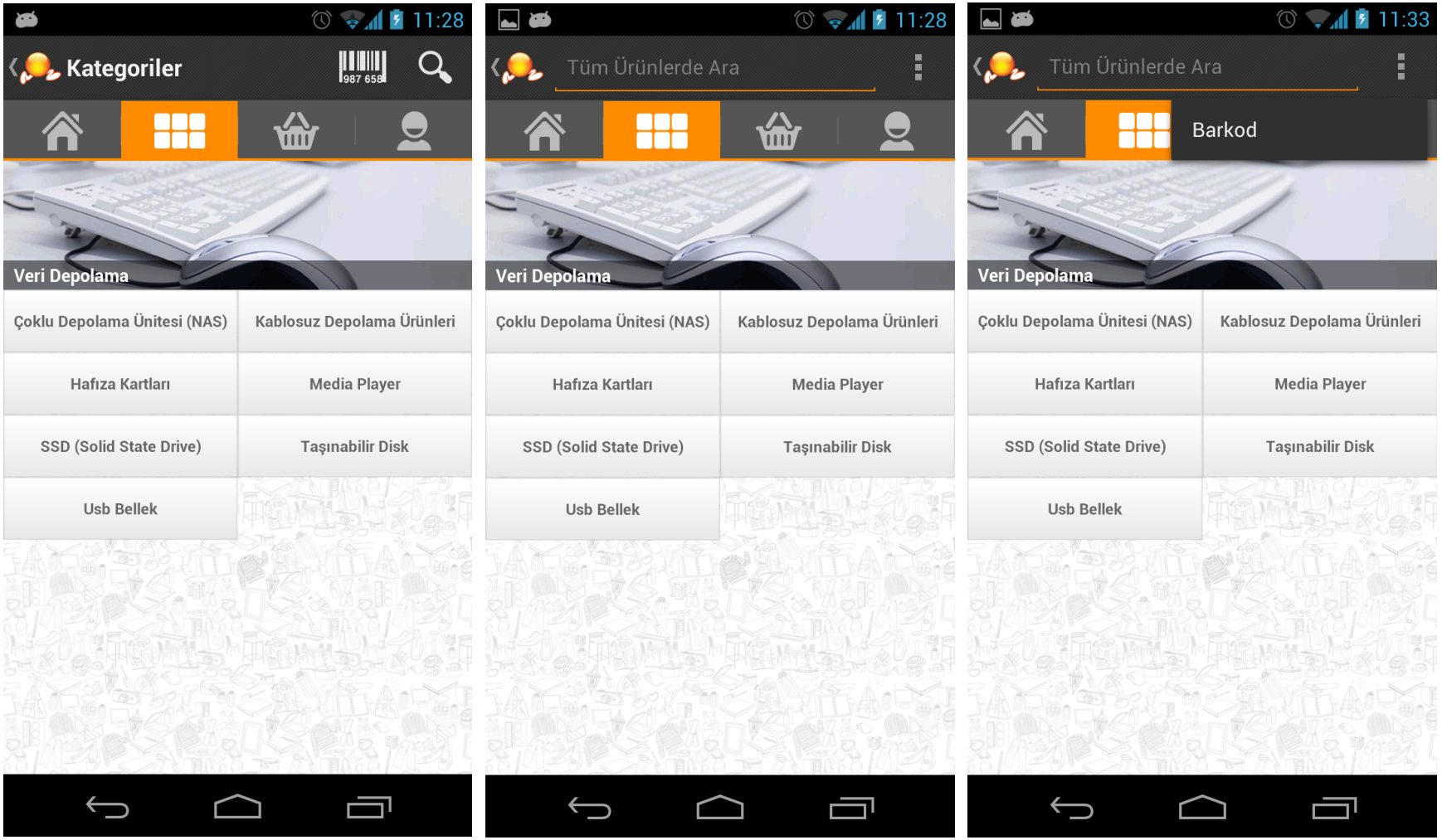
* Introduced in Honeycomb (API 11)
* Powerful widget used for navigation and perform user actions

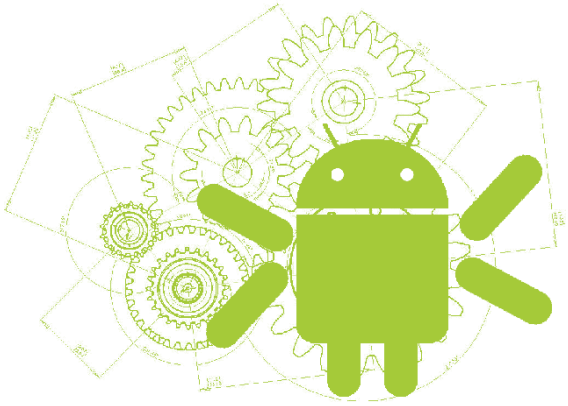
* Backward compatible via SherlockActionBar: 3rd party library developed by Jake Wharton

http://actionbarsherlock.com/

* Enables standardization between applications.

# UI - ActionBar





# Notifications @ Android

# Toast Notification

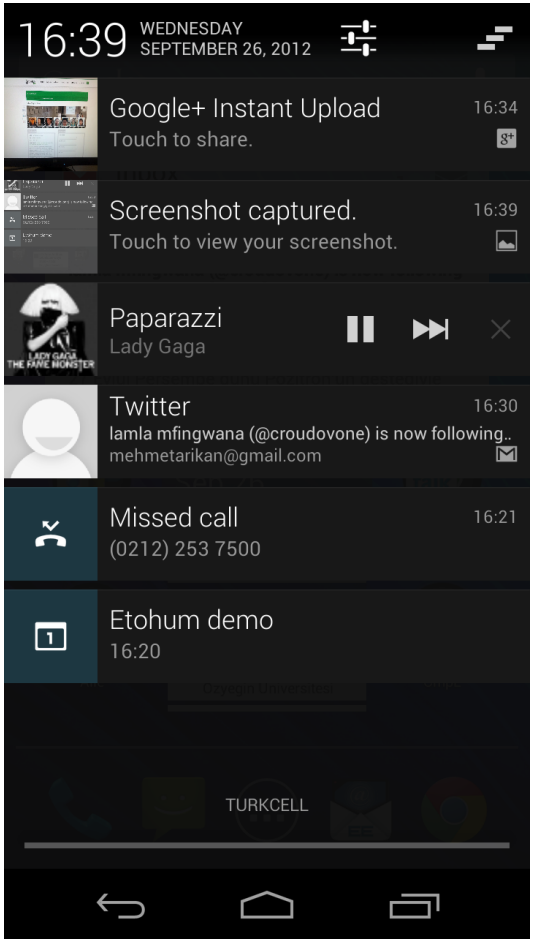
Simple non-persistent popup text notifications to inform user and doesn't require user response.

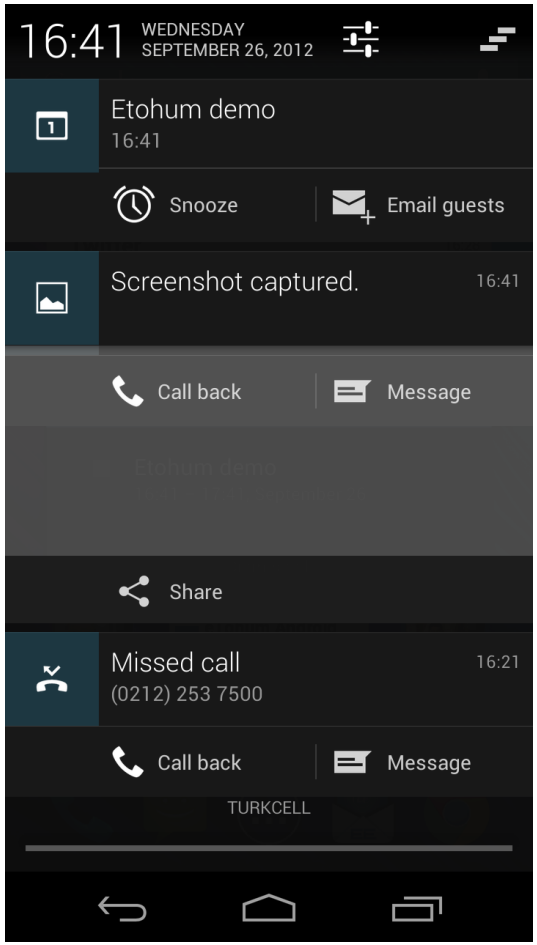
```
Toast.makeText(context, context.getString
    (R.string.welcome) + " " + name,
    Toast.LENGTH_LONG).show();
```

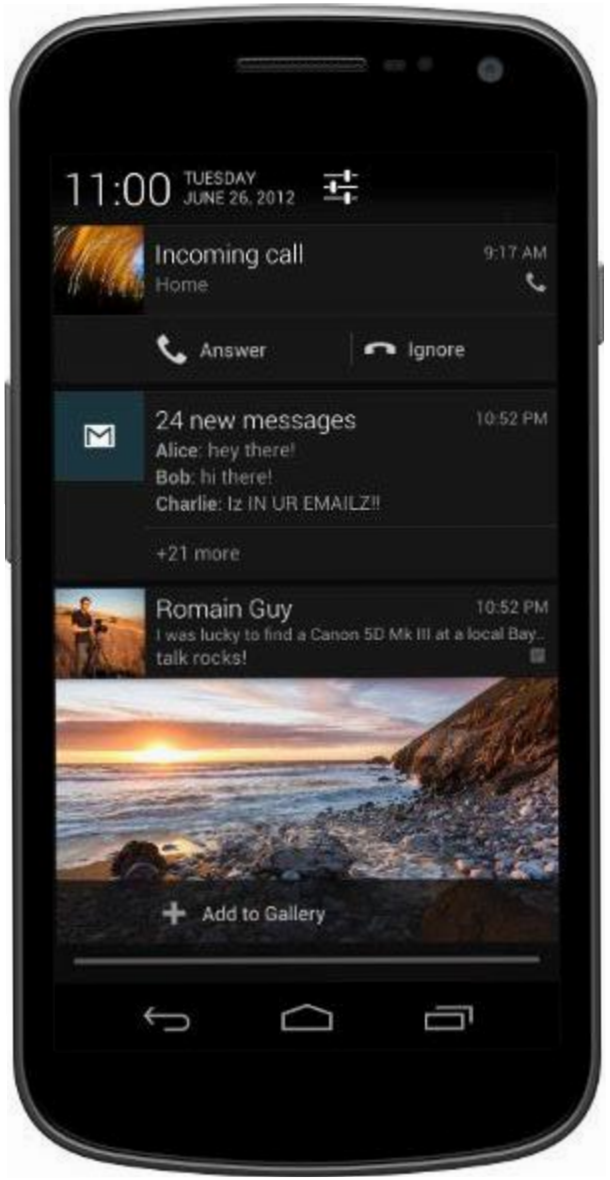
## Status Notification

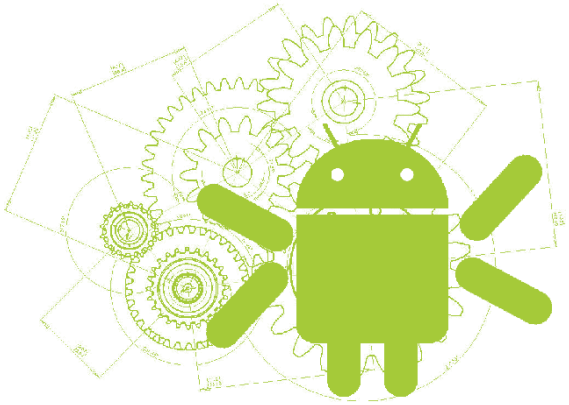
- Adds an icon and ticker message to the status bar.
- Shows a message in the notification window
- Can send intent to application, if user clicks.
- Can perform actions without opening application.

# Status Notification

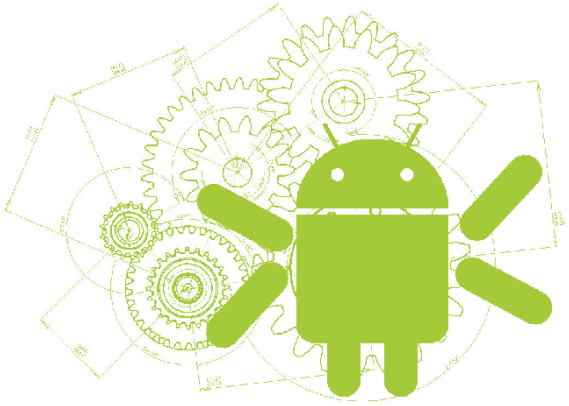




# Toast Notification Demo



# Supporting Different Devices @ Android

- Language
- Android Versions
- Screens (density, resolution, size)

# Resources - Overview

- Externalization of resources (strings, images, animations) from source code.
- Improves maintainability of project.
- Allows easily support different device types

```
MyProject/
    src/
        MyActivity.java
    res/
        drawable/
            icon.png
        layout/
            main.xml
            info.xml
        values/
            strings.xml
```

# Resources

- We can provide alternative resources for different devices.

```
res/
    drawable/
        icon.png
        background.png
    drawable-hdpi/
        icon.png
        background.png
```

- Possible configurations: screen width, screen height, screen density, screen size, screen orientation, API level, language and region etc...

```
drawable/
drawable-en/
drawable-fr-rCA/
drawable-en-port/
drawable-en-notouch-12key/
drawable-port-ldpi/
drawable-port-notouch-12key/
```

# Accessing Resources

- On compile time a *R* class containing id's for resources is generated.
- Can be referenced from both xml and code.

```
<string name="hello">Hello!</string>
```

- **In code :** `R.string.hello`
- **IN XML :** `@string/hello`

```
EditText editText= (ImageView) findViewById(R.id.editText);
    editText.setText(R.string.hello);
    or
editText.setText(context.getResources.getString(R.string.hello));
```

```
<EditText xmlns:android="http://schemas.android.com/apk/res/android"
        android:id="@+id/editText"
        android:layout_width="fill_parent"
        android:layout_height="fill_parent"
        android:textColor="@android:color/secondary_text_dark"
```

# Supporting Different Devices


**Figure 1**. Two different devices, each using the default layout (the app provides no alternative layouts).


**Figure 2**. Two different devices, each using a different layout provided for different screen sizes.

# Views - XML

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
              android:layout_width="fill_parent"
              android:layout_height="fill_parent"
              android:orientation="vertical" >
    <TextView android:id="@+id/text"
              android:layout_width="wrap_content"
              android:layout_height="wrap_content"
              android:text="I am a TextView" />
    <Button android:id="@+id/button"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:text="I am a Button" />
</LinearLayout>
```

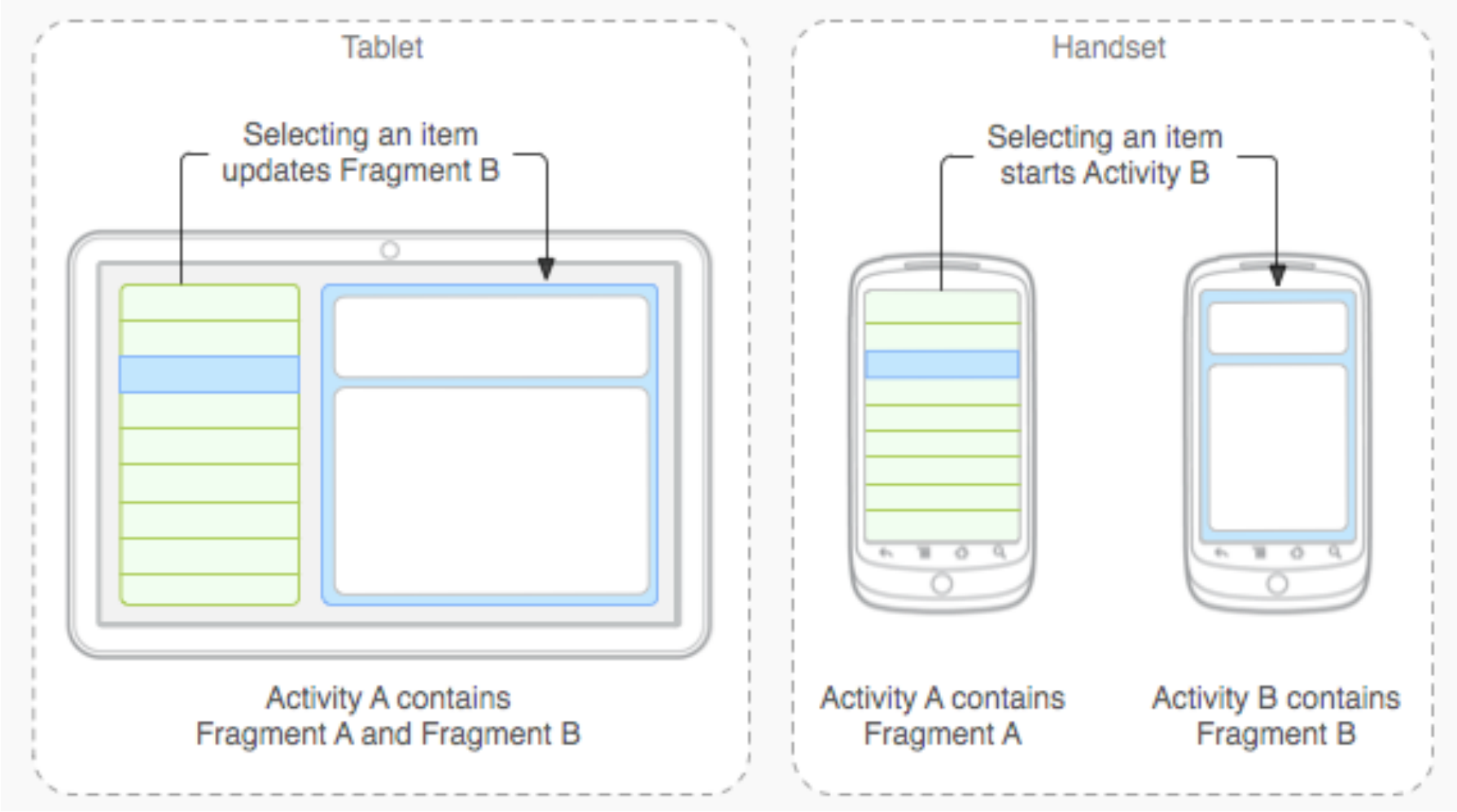
# Views

- Common Layouts:
  - Linear Layout
  - Relative Layout
  - List View
  - Grid View

# Fragments

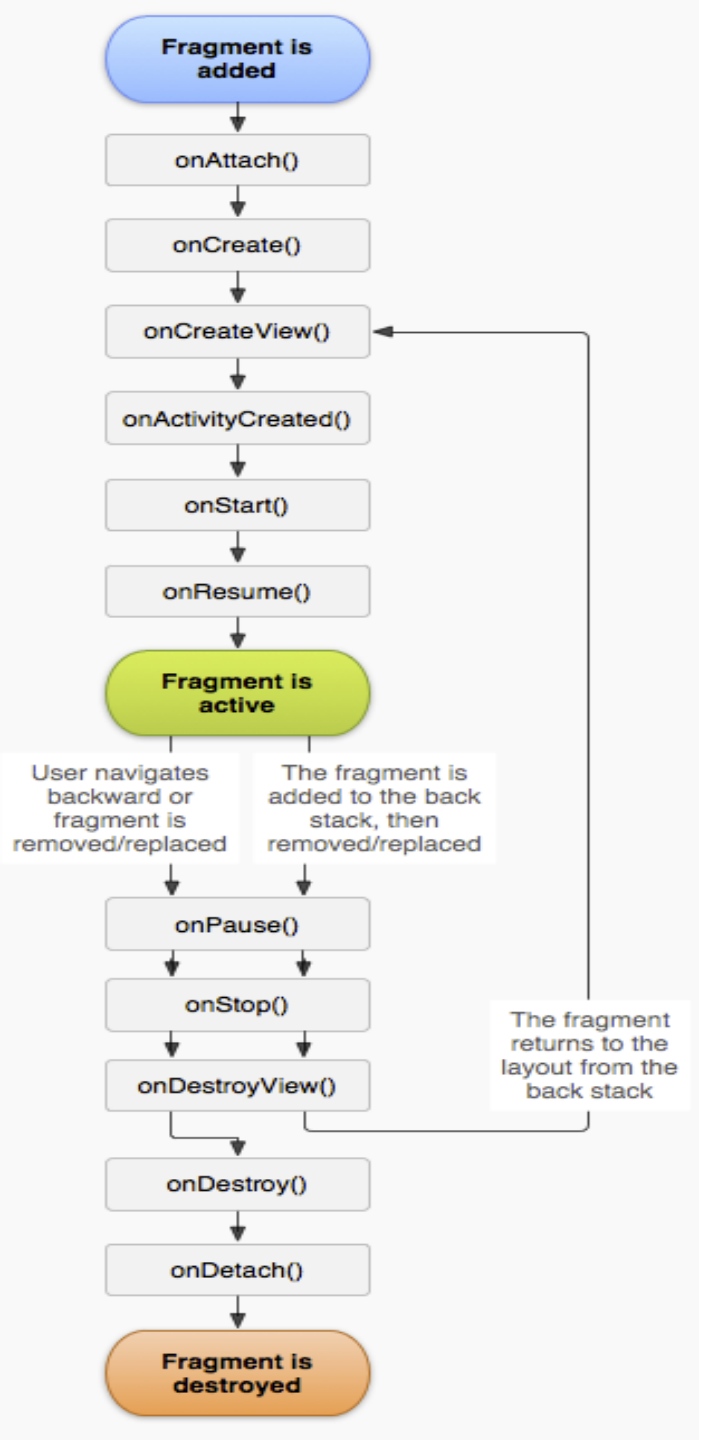
- Reusable UI modules
- Avoid switching between activities; use Fragments instead
- Introduced with Honeycomb
- Dynamic and Flexible UI
- Backward Compatible via Support Library

# Fragments


Tablet
Selecting an item
updates Fragment B
Activity A contains
Fragment A and Fragment B
Handset
Selecting an item
starts Activity B
Activity A contains
Fragment A
Activity B contains
Fragment B

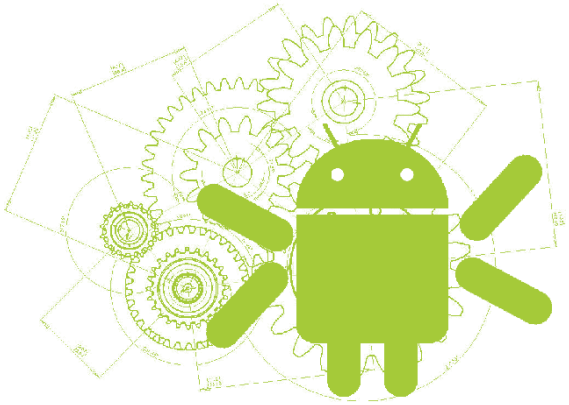
# Fragments

- Has its own lifecycle, consumes input events
- Embedded in activities and lifecycle directly affected by the host activity's lifecycle
- Back stack managed by the activity



# Android Manifest

* Presents essential information about the application to the Android system
  - Names the Java package
  - Describes the components:
    * activities, services, content providers
  - Declares which permission the application must have, the minimum level of the Android API, libraries etc...
  - Declares hardware and software features used



# Application Fundamentals Demo

# Localization

- Provide resources for each language you want to support. Make sure there is *default* resources as well.

```
res/
        values/
            strings.xml
              <string name="hello">Merhaba!</string>
              <string name="goodbye">Güle güle!</string>
             arrays.xml
      values-en/
            strings.xml
              <string name="hello">Hello!</string>
              <string name="welcome">Welcome!</string>
```

# Localization

- Uses device's region.
- For custom language :

```
Locale locale = new Locale("en");
Locale.setDefault(locale);
Configuration config = new Configuration();
config.locale = locale;

context.getResources().updateConfiguration(config, context.getResources()
        .getDisplayMetrics());
```

# UI - Styling and Theming

* **Style:** collection of properties specify the look and format of a View.
* Styles are defined in a separate file from layouts.
* Can be reused for different views.
* Can be inherited from other styles
* Reduces code duplication.

**Theme:** A Style applied to entire application or activity.

# UI - Styles

* Create an XML file under /res/values directory.
* Each style should be defined via <style> tag.

```
<?xml version="1.0" encoding="utf-8"?>
<resources>
    <style name="CodeFont" parent="@android:style/TextAppearance.Medium">
        <item name="android:layout_width">fill_parent</item>
        <item name="android:layout_height">wrap_content</item>
        <item name="android:textColor">#00FF00</item>
        <item name="android:typeface">monospace</item>
    </style>
</resources>
```

```
<style name="GreenText" parent="@android:style/TextAppearance">
    <item name="android:textColor">#00FF00</item>
</style>
<style name="CodeFont.Red">
    <item name="android:textColor">#FF0000</item>
</style>
```

# UI - Styles

* Now we can use our styles.

```
<TextView
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:textColor="#00FF00"
    android:typeface="monospace"
    android:text="@string/hello" />
```

is reduced to

```
<TextView
    style="@style/CodeFont"
    android:text="@string/hello" />
```

and can be applied to other TextView's.

# UI - Theme

* Similar to styles

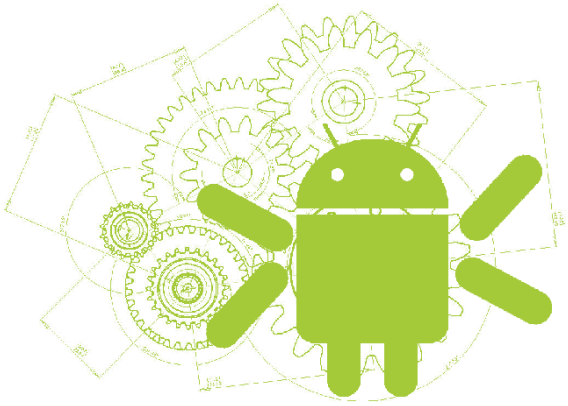
```
<color name="custom_theme_color">#b0b0ff</color>
<style name="CustomTheme" parent="android:Theme.Light">
    <item name="android:windowBackground">@color/custom_theme_color</item>
    <item name="android:colorBackground">@color/custom_theme_color</item>
</style>
```

but should be applied to application or activity in manifest file

```
<application android:theme="@style/CustomTheme">
```

or

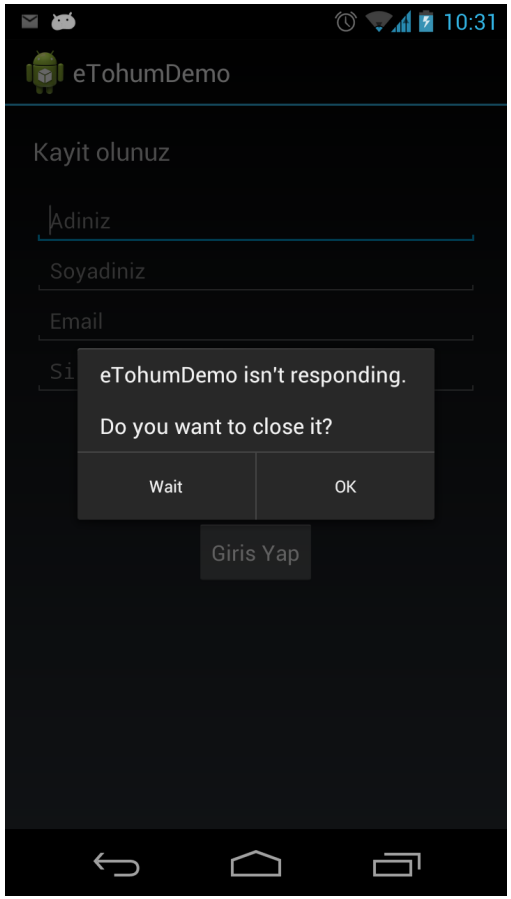
```
<activity android:theme="@android:style/Theme.Translucent">
```



# Threads @ Android

# Asynchronous Tasks

Do **NOT** block UI (main) thread




* ANR(Application not responding) :
  - No response to user input within 5 seconds
  - A BroadcastReciever hasn't finished executing in 10 seconds

* Conventional Solution: Threads
* Android approach: **AsyncTasks**

* Runs on background and notifies you when you need to update the UI.

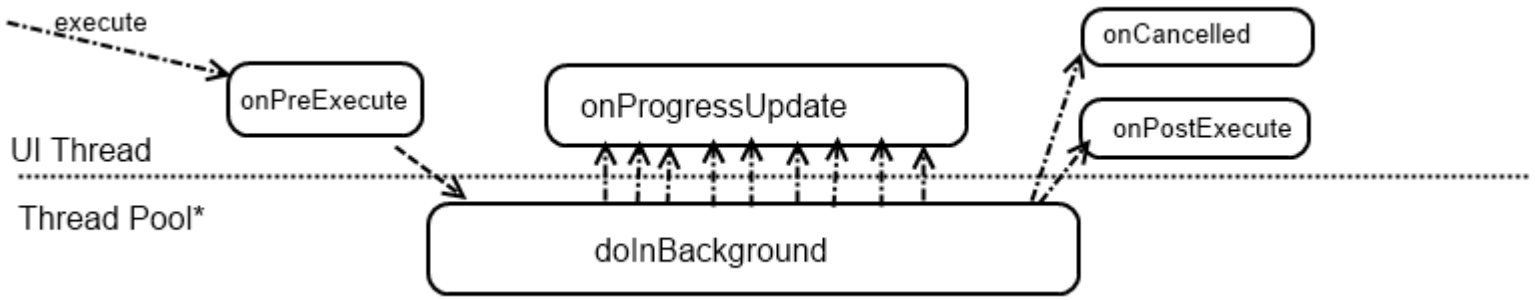
# Asynchronous Tasks

```
private class DownloadFilesTask extends AsyncTask<URL, Integer, Long> {
    protected Long doInBackground(URL... urls) {
        int count = urls.length;
        long totalSize = 0;
        for (int i = 0; i < count; i++) {
            totalSize += Downloader.downloadFile(urls[i]);
            publishProgress((int) ((i / (float) count) * 100));
            // Escape early if cancel() is called
            if (isCancelled()) break;
        }
        return totalSize;
    }

    protected void onProgressUpdate(Integer... progress) {
        setProgressPercent(progress[0]);
    }

    protected void onPostExecute(Long result) {
        showDialog("Downloaded " + result + " bytes");
    }
}
```

```
new DownloadFilesTask().execute(url1, url2, url3);
```

# Asynchronous Tasks

- Workflow of AsyncTask :




* When first introduced, AsyncTasks were executed serially on a single background thread. Starting with **DONUT**, this was changed to a pool of threads allowing multiple tasks to operate in parallel. Starting with **HONEYCOMB**, tasks are executed on a single thread to avoid common application errors caused by parallel execution.

* For parallel execution `executeOnExecutor(java.util.concurrent.Executor, Object[])` with `THREAD_POOL_EXECUTOR`.

# Network Connection

```
try {
    URL url = new URL(myurl);
    HttpURLConnection conn = (HttpURLConnection) url.openConnection();
    conn.setReadTimeout(10000 /* milliseconds */);
    conn.setConnectTimeout(15000 /* milliseconds */);
    conn.setRequestMethod("GET");
    conn.setDoInput(true);
    // Starts the query
    conn.connect();
    int response = conn.getResponseCode();
    Log.d(DEBUG_TAG, "The response is: " + response);
    is = conn.getInputStream();

    // Convert the InputStream into a string
    String contentAsString = readIt(is, len);
    return contentAsString;

// Makes sure that the InputStream is closed after the app is
// finished using it.
} finally {
    if (is != null) {
        is.close();
    }
}
```

# Lists and Adapters

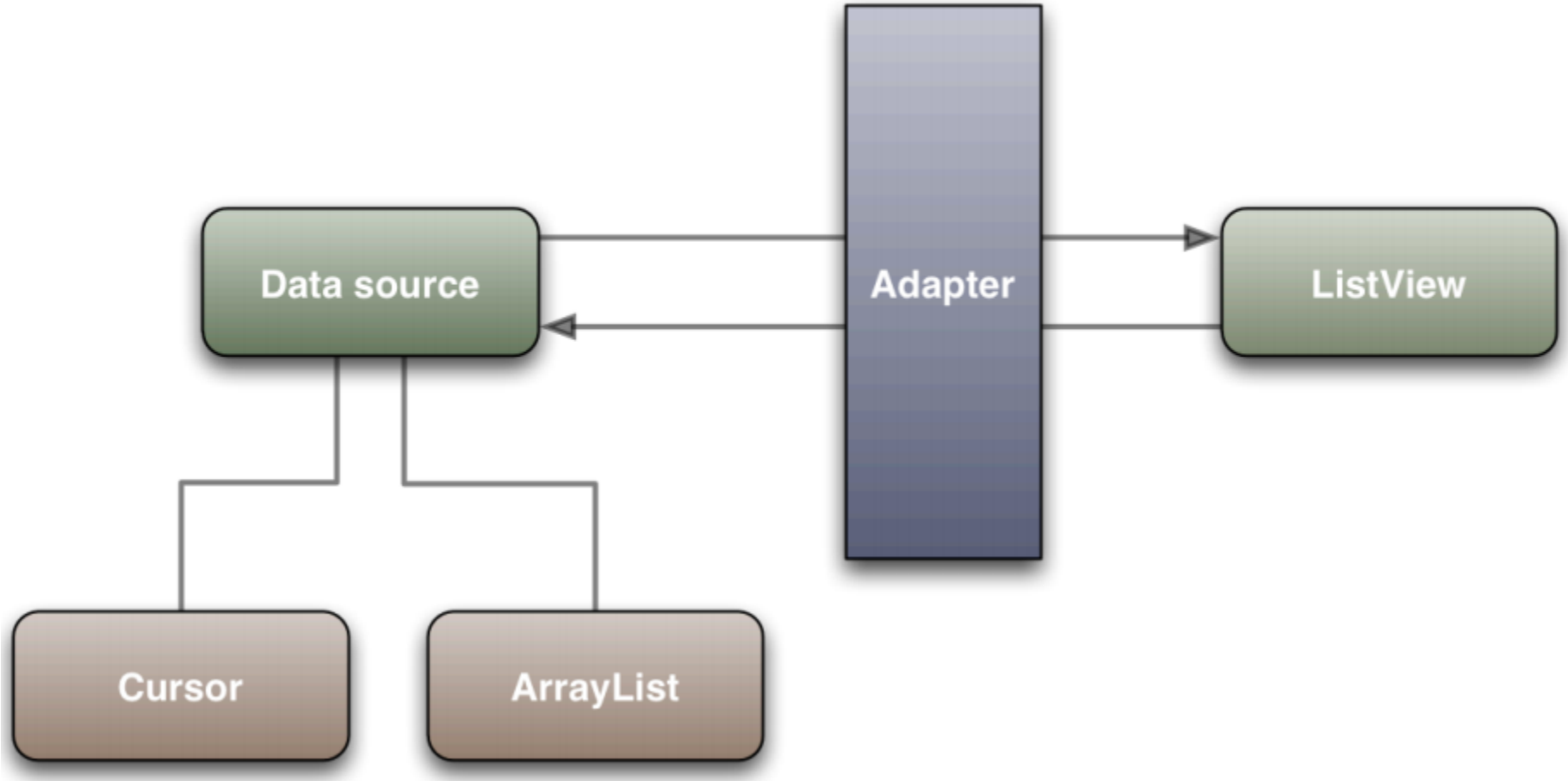
ListView
Adapters

# ListView

* View group to display a list of scrollable items
* Large data set - performance
* Handling data changes

* *¿ Smooth scrolling*
* *¿ Fetching data efficiently*

# Adapters - man in the middle



# Adapters

* Terminology
    - index: Child views
    - position: Data in Adapter
    - id: Unique identifier for data

    - Local view cache
    - Accessing views from the adapter
    - Change convertView’s structure
    - Assumptions about getView calls

# Adapters

getView(int position, View convertView,
ViewGroup parent)

- Full data presentation control
- Optimization

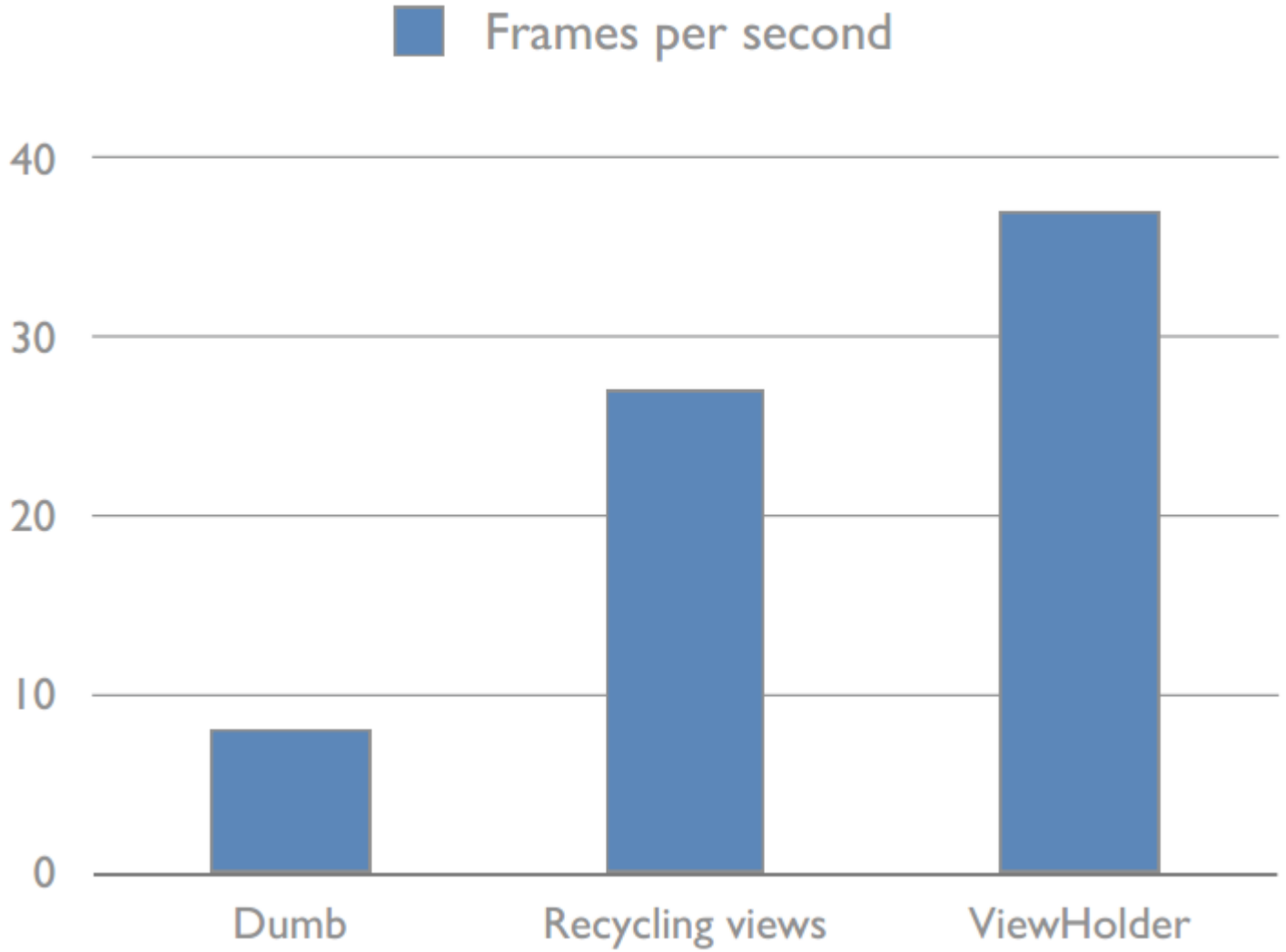
* ListView is smart
* convertView
  - Supplied by ListView
  - Matches item types

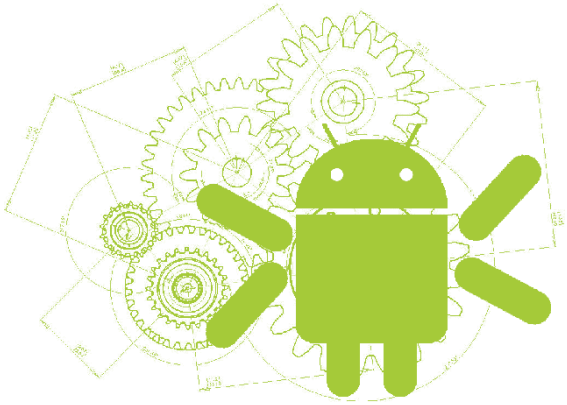
- Reuse it

# Adapters - DON'T

```
1 public View getView(int position, View convertView, ViewGroup parent) {
2     if (convertView == null) {
3         convertView = mInflater.inflate(R.layout.item, parent, false);
4     }

5     ((TextView) convertView.findViewById(R.id.text)).setText(DATA[position]);
6     ((ImageView) convertView.findViewById(R.id.icon)).setImageBitmap(
7             (position & 1) == 1 ? mIcon1 : mIcon2);

8     return convertView;
9 }
```

# Performance





# ListView Demo

# Location @ Android

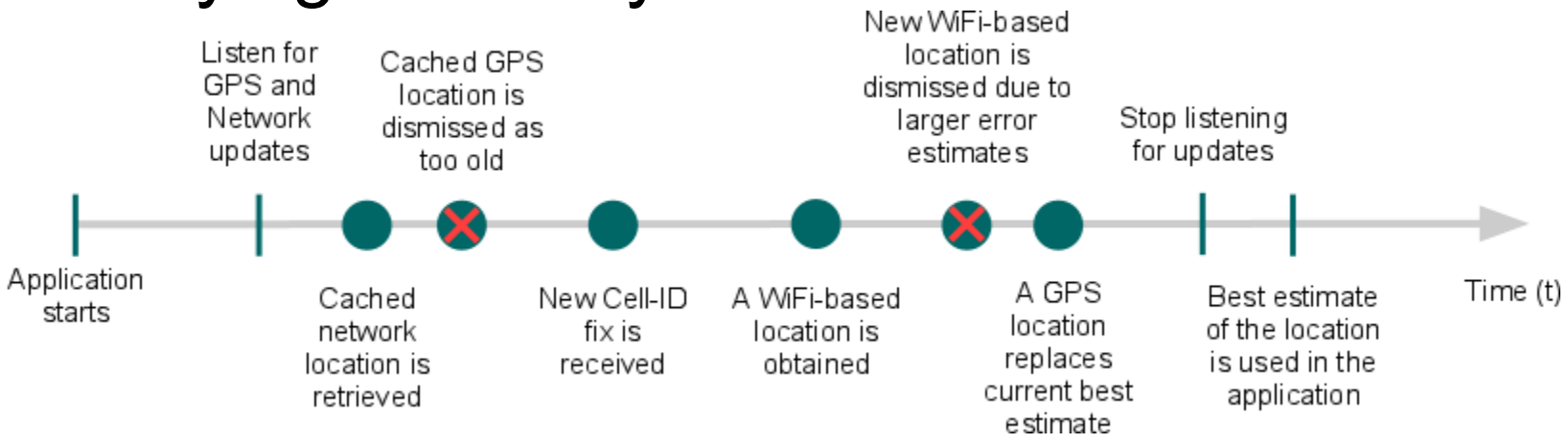
# Location Strategies

* GPS
  - *pros:* most accurate
  - *cons:* only works outdoors, consumes battery, and slow

* Android Network Location Provider
  - *pros:* fast, less battery consumption
  - *cons:* uses cell towers and Wi-Fi signals

# ¡ Challenges !

* Multitude of location sources
  - trade-offs (gps, cell-id, Wi-Fi)
* User movement
  - people walks, drives....
* Varying accuracy

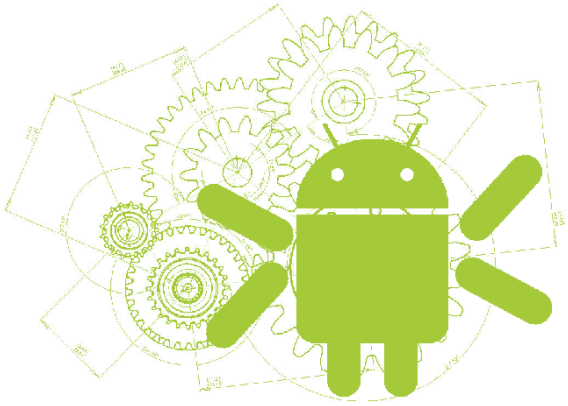


# Requesting Location Updates

```
// Acquire a reference to the system Location Manager
LocationManager locationManager = (LocationManager) this.getSystemService
(Context.LOCATION_SERVICE);

// Define a listener that responds to location updates
LocationListener locationListener = new LocationListener() {
    public void onLocationChanged(Location location) {
      // Called when a new location is found by the network location provider.
      makeUseOfNewLocation(location);
    }

    public void onStatusChanged(String provider, int status, Bundle extras) {}

    public void onProviderEnabled(String provider) {}

    public void onProviderDisabled(String provider) {}
  };

// Register the listener with the Location Manager to receive location updates
locationManager.requestLocationUpdates(LocationManager.NETWORK_PROVIDER, 0, 0,
locationListener);
```

## *lastKnownLocation:*

```
LocationProvider locationProvider = LocationManager.NETWORK_PROVIDER;
// Or use LocationManager.GPS_PROVIDER

Location lastKnownLocation = locationManager.getLastKnownLocation(locationProvider);
```



# Data Storage @ Android

# Data Storage

- Shared Preferences
  - Store private primitive key-value pairs
- Internal/External Storage
  - Store private data in internal storage
  - Public data in external storage
- SQLite
  - Private database
  - SQLite 3
- Data Backup
  - Backup data to cloud and restore when application is reinstalled


# Publishing the Application

# Publishing the Application

- All applications must be signed
- Special debug key created by SDK
- Self signed certificates; no certificate authority needed

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# Rotten Android Project

- Movie stuff (reviews, cast info, ratings, critics etc.)
- Access over a public API
- http://developer.rottentomatoes.com/docs