Introduction to Android Development Environment V1

ECOD - Aug 2015

Mobile-Cloud = bringing the combined power of CAMSS

- Customer's energy around CAMSS is not driven by 5 **distinct** parallel agendas
- Combining CAMSS in tandem **delivers agility** to create new business opportunities
- API-centric approach enable CAMSS to be **rapidly composed** as building blocks

C + **A** + **M** + **S** + **S**

Hybrid cloud | *Real-time big data analytics* | *Mobile & Internet of Things* | *Social Engagement* | *Perimeter Security*

e.g. Developer composes new app to address requirement from CMO

Mobile app drives increased retail sales by **analysis** (**SaaS**) of purchase history (**on prem**), shopping basket (**cloud**) and preferences of **social** circle and sends **secure** personalised offers based on proximity to stores and vending machines (**Internet of Things**)

What is Android?

- A software stack for mobile devices that includes
  - An operating system
  - Middleware
  - Key Applications
- Uses Linux to provide core system services
  - Security
  - Memory management
  - Process management
  - Power management
  - Hardware drivers

http://developer.android.com/guide/basics/what-is-android.html

Android Features

- **Application framework** enabling reuse and replacement of components
- **Dalvik virtual machine** optimized for mobile devices
- **Integrated browser** based on the open source WebKit engine
- **Optimized graphics** powered by a custom 2D graphics library; 3D graphics based on the OpenGL ES 1.0 specification (hardware acceleration optional)
- **SQLite** for structured data storage
- **Media support** for common audio, video, and still image formats (MPEG4, H.264, MP3, AAC, AMR, JPG, PNG, GIF)
- **GSM Telephony** (hardware dependent)
- **Bluetooth, EDGE, 3G, and WiFi** (hardware dependent)
- **Camera, GPS, compass, and accelerometer** (hardware dependent)
- **Rich development environment** including a device emulator, tools for debugging, memory and performance profiling, and a plugin for the Eclipse IDE

http://developer.android.com/guide/basics/what-is-android.html

Android Distribution Aug 2015

Version	Codename	API	Distribution
2.2	Froyo	8	0.3%
2.3.3 - 2.3.7	Gingerbread	10	4.6%
4.0.3 - 4.0.4	Ice Cream Sandwich	15	4.1%
4.1.x	Jelly Bean	16	13.0%
4.2.x		17	15.9%
4.3		18	4.7%
4.4	KitKat	19	39.3%
5.0	Lollipop	21	15.5%
5.1		22	2.6%

https://developer.android.com/about/dashboards/index.html

Data collected during a 7-day period ending on August 3, 2015.

Any versions with less than 0.1% distribution are not shown.

Screen Densities as of August 2015

	ldpi (~120dpi)	mdpi (~160dpi)	tvdpi (~240dpi)	hdpi (~320dpi)	xhdpi (~480dpi)	xxhdpi (~640dpi)	Total
Small	3.6%						3.6%
Normal		6.9%	0.1%	40.6%	20.4%	15.8%	83.8%
Large	0.3%	4.9%	2.3%	0.6%	0.6%		8.7%
Xlarge		3.0%		0.3%	0.6%		3.9%
Total	3.9%	14.8%	2.4%	41.5%	21.6%	15.8%	

Data collected during a 7-day period ending on August 3, 2015.

Any screen configurations with less than 0.1% distribution are not shown.

Android Runtime

Android Runtime: Dalvik VM

- Subset of Java developed by Google
- Optimized for mobile devices (better memory management, battery utilization, etc.)
- Dalvik runs .dex files that are compiled from .class files
- Introduces new libraries
- Does not support some Java libraries like AWT, Swing
- http://developer.android.com/reference/packages.html

Applications Are Boxed

- By default, each app is run in its own Linux process
  - Process started when app's code needs to be executed
  - Threads can be started to handle time-consuming operations
- Each process has its own Dalvik VM
- By default, each app is assigned unique Linux ID
  - Permissions are set so app's files are only visible to that app

Producing an Android App

Emulator

Emulator Basics

- Host computer's keyboard works
- Host's mouse acts as finger
- Uses host's Internet connection
- Other buttons work: Home, Menu, Back, Search, volume up and down, etc.
- Ctrl-F11 toggle landscape → portrait
- Alt-Enter toggle full-screen mode
- More info at http://developer.android.com/guide/developing/devices/emulator.html

Emulator Limitations

- No support for placing or receiving actual phone calls
  - Simulate phone calls (placed and received) through the emulator console
- No support for USB connections
- No support for camera/video capture (input)
- No support for device-attached headphones
- No support for determining connected state
- No support for determining battery charge level and AC charging state
- No support for determining SD card insert/eject
- No support for Bluetooth
- No support for simulating the accelerometer
  - Use OpenIntents's Sensor Simulator

Android Emulator or AVD

- Emulator is essential to testing app but is not a substitute for a real device
- Emulators are **Android Virtual Devices** (AVDs)
- Android SDK and AVD Manager allows you to create AVDs that target any Android API level
- AVD have configurable resolutions, RAM, SD cards, skins, and other hardware

Live Lab

Creating Hello World App

1. Create an Activity
2. Demonstrate resources created
3. show the Activity lifecycle within the Android OS
4. show the various debugging tools available
5. show how to start one Activity from another

Pre-Req for Mobile Lab

Ensure the AVD and DSK are confugired well

HelloWorld - [C:\Users\IBM_ADMIN\Desktop\rtpjavabootcamp\studioworkspace\HelloWorld] - [app] - ...\app\src\main\res\layout\activity_main.xml - Android Studio 1.3.2

File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help

- Tasks & Contexts
- Save File as Template...
- Generate JavaDoc...
- New Scratch File... Ctrl+Alt+Shift+Insert
- IDE Scripting Console
- XML Actions
- Groovy Console...
- Android
  - Navigation Editor
  - Sync Project with Gradle Files
  - Android Device Monitor
  - AVD Manager
  - SDK Manager
  - Enable ADB Integration

Project Files

- app
  - app
    - build
      - generated/source
        - buildConfig
        - r/debug
          - android/support/v7/appcompat
          - example/com/helloworld
            - R
      - intermediates
    - src
      - androidTest/java
      - main
        - java
          - example/com/helloworld
        - res
          - layout
            - activity_main.xml
          - menu
          - mipmap-hdpi
          - mipmap-mdpi
          - mipmap-xhdpi
          - mipmap-xxhdpi
          - values
          - values-w820dp
        - AndroidManifest.xml
    - .gitignore
    - app.iml
    - build.gradle
    - proguard-rules.pro
- HelloWorld
  - HelloWorld

Palette

- Layout
  - Frame
  - LinearL
  - LinearL
  - TableLayout
  - TableRow
  - GridLayout
  - RelativeLayout
- Widgets
  - Plain TextView
  - Large Text
  - Medium Text
  - Small Text
  - Button
  - Small Button
  - RadioButton
  - CheckBox
  - Switch
  - ToggleButton
  - ImageButton
  - ImageView
  - ProgressBar (Large)
  - ProgressBar (Normal)
  - ProgressBar (Small)
  - ProgressBar (Horizon
  - SeekBar
  - RatingBar
  - Spinner
  - WebView
- Text Fields

MainActivity 23

HelloWorld

Hello world!

Component Tree

- Device Screen
  - RelativeLayout
    - TextView - @string/hello_world

Properties

layout:width	match_parent
layout:height	match_parent
style	
accessibilityLiveR	
accessibilityTrave	
accessibilityTrave	
alpha	
background	
backgroundTint	
backgroundTintM	
clickable	☐
contentDescriptio	
contextClickable	☐
elevation	
focusable	☐
focusableInTouch	☐

Design Text

Terminal 6: Android 0: Messages TODO Event Log Gradle Console

Gradle build finished in 44s 411ms (6 minutes ago)

n/a n/a Context: <no context>

Start C:... G:... In... In... W... A... he... H... W... 1:15 PM 9/1/2015

Android Virtual Device Manager
Your Virtual Devices
Android Studio
Type
Name
Resolution
API
Target
CPU/...
Size on Disk
Actions
AndroidVirtualDevice
480 × 800: hdpi
N/A
N/A
arm
1 GB
Failed to load
Nexus 5 API 23
1080 × 1920: xxhdpi
23
Google APIs
x86
1 GB
+ Create Virtual Device...

HelloWorld - [C:\Users\IBM_ADMIN\Desktop\rtpjavabootcamp\studioworkspace\HelloWorld] - [app] - ...\app\src\main\res\layout\activity_main.xml - Android Studio 1.3.2

File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help

Tasks & Contexts
Save File as Template...
Generate JavaDoc...
New Scratch File... Ctrl+Alt+Shift+Insert
IDE Scripting Console
XML Actions
Groovy Console...
Android
- Navigation Editor
- Sync Project with Gradle Files
- Android Device Monitor
- AVD Manager
- SDK Manager
- Enable ADB Integration

Run ▶ AVD: Nexus_5_API_23

```
C:\Users\IBM_ADMIN\Desktop\rtpjavabootcamp\android-sdk\tools\emulator.exe -netdelay none -netspeed full -avd Nexus_5_API_23
```

Gradle build finished in 44s 411ms (7 minutes ago)

Default Settings

- **Appearance & Behavior**
  - Appearance
  - Menus and Toolbars
  - System Settings
    - Passwords
    - HTTP Proxy
    - Updates
    - Usage Statistics
    - Android SDK
  - Notifications
  - Quick Lists
- **Keymap**
- **Editor**
- **Plugins**
- **Build, Execution, Deployment**
- **Tools**

Appearance & Behavior › System Settings › Android SDK

Manager for the Android SDK and Tools used by Android Studio

Android SDK Location: C:\Users\IBM_ADMIN\Desktop\rtpjavabootcamp\android-sdk

SDK Platforms | SDK Tools | SDK Update Sites

Each Android SDK Platform package includes the Android platform and sources pertaining to an API level by default. Once installed, Android Studio will automatically check for updates. Check "show package details" to display individual SDK components.

Name	API Level	Revision	Status
Android 6.0 (Marshmallow)			
Android 6.0 Platform	23	1	Installed
Android TV ARM EABI v7a S	23	2	Not installed
Android TV Intel x86 Atom S	23	2	Not installed
ARM EABI v7a System Imag	23	3	Not installed
x86 System Image, Android	23	3	Installed
x86_64 System Image, Andr	23	3	Installed
Google Apis, Android 23	23	1	Update Available: 1
Google APIs ARM EABI v7a	23	7	Not installed
Google Inc. x86 System Imag	23	7	Installed
Google APIs Intel x86 Atom_	23	7	Not installed
Sources for Android 23	23	1	Installed
Android 5.1 (Lollipop)			

☑ Show Package Details

Launch Standalone SDK Manager

OK | Cancel | Apply | Help

Mobile Labs

1-7

Lab 1

Getting Hello World App Running

Create New Project

New Project
Android Studio

Configure your new project

Application name: HelloWorld

Company Domain: com.example

Package name: example.com.helloworld Edit

Project location: C:\Users\IBM_ADMIN\Desktop\rtpjavabootcamp\studioworkspace\HelloWorld

Previous Next Cancel Finish

Create New Project

Target Android Devices

Select the form factors your app will run on

Different platforms may require separate SDKs

☑ Phone and Tablet

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

Lower API levels target more devices, but have fewer features available. By targeting API 16 and later, your app will run on approximately **88.7%** of the devices that are active on the Google Play Store.

Help me choose

☐ Wear

Minimum SDK: API 21: Android 5.0 (Lollipop)

☐ TV

Minimum SDK: API 21: Android 5.0 (Lollipop)

☐ Android Auto

☐ Glass (Not Installed) Download

Minimum SDK:

Previous | Next | Cancel | Finish

Create New Project

Add an activity to Mobile

Add No Activity

Blank Activity

Blank Activity with Fragment

Fullscreen Activity

Google AdMob Ads Activity

Google Maps Activity

Google Play Services Activity

Login Activity

Master/Detail Flow

Navigation Drawer Activity

Previous | Next | Cancel | Finish

Create New Project

Customize the Activity

Blank Activity

Creates a new blank activity with an action bar.

Activity Name:	MainActivity
Layout Name:	activity_main
Title:	MainActivity
Menu Resource Name:	menu_main

The name of the activity class to create

Previous | Next | Cancel | Finish

Ready to Launch !

Hurray !

HelloWorld - [C:\Users\IBM_ADMIN\Desktop\rtpjavabootcamp\studioworkspace\HelloWorld] - [app] - ...\app\src\main\res\layout\activity_ma
File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help
app
HelloWorld app src main res layout activity_main.xml
Project Files
app
HelloWorld
MainActivity.java
activity_main.xml
Palette
Layouts
FrameLayout
LinearLayout (Horizor
LinearLayout (Vertica
TableLayout
TableRow
GridLayout
RelativeLayout
Widgets
Plain TextView
Large Text
Medium Text
Small Text
Button
Small Button
RadioButton
CheckBox
Switch
ToggleButton
Design
Text
Android
Emulator Nexus_5_API_23 Android 6.0 (API 23)
example.com.helloworld (2561)
logcat
ADB logs
Memory
CPU
Log level:
09-01 13:28:39.441 2561-2561/example.com.helloworld I/art: JIT created with code_cache_capacity=2MB compile_threshold=1000
09-01 13:28:39.455 2561-2561/example.com.helloworld W/System: ClassLoader referenced unknown path: /data/app/example.com.helloworld-1/lib/x86
09-01 13:28:40.169 2561-2576/example.com.helloworld D/OpenGLRenderer: Use EGL_SWAP_BEHAVIOR_PRESERVED: true
09-01 13:28:40.172 2561-2561/example.com.helloworld D/: HostConnection::get() New Host Connection established 0xabe348c0, tid 2561
09-01 13:28:41.208 2561-2561/example.com.helloworld I/Choreographer: Skipped 59 frames! The application may be doing too much work on its main thread.
09-01 13:28:41.281 2561-2576/example.com.helloworld D/: HostConnection::get() New Host Connection established 0xabe34a50, tid 2576
09-01 13:28:41.334 2561-2576/example.com.helloworld I/OpenGLRenderer: Initialized EGL, version 1.4
09-01 13:28:41.564 2561-2576/example.com.helloworld W/EGL_emulation: eglSurfaceAttrib not implemented

5554:Nexus_5_API_23
1:29
HelloWorld
Hello world!

Lab 2

Add some Code to onCreate method

Change MainActivity.java to this

MainActivity.java × | activity_main.xml ×

```java
package example.com.helloworld;

import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;
import android.view.Menu;
import android.view.MenuItem;
import android.widget.TextView; // LAB 2 NEW

public class MainActivity extends AppCompatActivity {

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        //setContentView(R.layout.activity_main);  // LAB 2 COMMENTED OUT

        // LAB 2 THREE NEW LINES ADDED
        TextView textView = new TextView(this);
        textView.setText("Hello New World!");
        setContentView(textView);

    }
```

Lab 2 Changes to Lab 1 Code

- Add
  import android.widget.TextView;

- In the OnCreate Method
  1. Comment out THIS LINE
     // setContentView(R.layout.activity_main);

  2. Add the lines
     - TextView textView = new TextView(this);
     - textView.setText("Hello New World!");
     - setContentView(textView);

HelloWorld - [C:\Users\IBM_ADMIN\Desktop\rtpjavabootcamp\studioworkspace\HelloWorld] - [app] - ...\app\src\main\java\ex

File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help

app

HelloWorld > app > src > main > java > example > com > helloworld > MainActivity

Android

MainActivity.java × | activity_main.xml ×

app

5554:Nexus_5_API_23

1:33

HelloWorld

Hello New World!

```java
package example.com.helloworld;

import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;
import android.view.Menu;
import android.view.MenuItem;
import android.widget.TextView; // LAB 2 NEW

public class MainActivity extends AppCompatActivity {

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        //setContentView(R.layout.activity_main);  // LAB 2 COMMENTED OUT

        // LAB 2 THREE NEW LINES ADDED
        TextView textView = new TextView(this);
        textView.setText("Hello New World!");
        setContentView(textView);
```

Lab 3

Change MainActivity.java to this

MainActivity.java × | activity_main.xml ×

```java
package example.com.helloworld;

import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;
import android.view.Menu;
import android.view.MenuItem;
import android.widget.TextView; // LAB 2 NEW
import android.util.Log;    // LAB 3 NEW

public class MainActivity extends AppCompatActivity {

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        //setContentView(R.layout.activity_main);  // LAB 2 COMMENTED OUT

        Log.i(this.getClass().getName(), "Here before LAB 2 code in onCreate");  // LAB 3 CODE

        // LAB 2 THREE NEW LINES ADDED
        TextView textView = new TextView(this);
        textView.setText("Hello New World!");
        setContentView(textView);

        Log.i(this.getClass().getName(), "Here After LAB 2 code in onCreate");  // LAB 3 CODE
    }
```

Lab 3 Changes to Lab 2 Code

- Add to Import

```
import android.util.Log;
```

- ADD THESE LINES to OnCreate Method

```
Log.i(this.getClass().getName(), “TEXT1");

    TextView textView = new TextView(this);  // 3 lines already exists from lab2
    textView.setText("Hello New World!");
    setContentView(textView);

Log.i(this.getClass().getName(), “TEXT2");
```

Run and Check the Logcat Filter

Android

Emulator Nexus_5_API_23 Android 6.0 (API 23) | example.com.**helloworld** (6015)

logcat | ADB logs | Memory | CPU | Log level: Verbose | Mai | Show only selected application

```
09-01 13:36:35.813    6015-6015/example.com.helloworld I/example.com.helloworld.MainActivity:  Here before LAB 2 code in onCreate
09-01 13:36:35.842    6015-6015/example.com.helloworld I/example.com.helloworld.MainActivity:  Here After LAB 2 code in onCreate
```

Terminal | 6: Android | 0: Messages | 4: Run | TODO | Event Log | Gradle Console

Session 'app': running (a minute ago) | 40:1 | CRLF | UTF-8 | Context: <no context>

See if you can Find Method for Options Settings menu via Logging

HelloWorld - [C:\Users\IBM_ADMIN\Desktop\rtpjavabootcamp\studioworkspace\HelloWorld] - [app] - ...\app\src\main\java\example\com\helloworld\MainActivity.java - Android Studio 1.3.2

File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help

app

HelloWorld > app > src > main > java > example > com > helloworld > MainActivity

Android

- app
  - manifests
    - AndroidManifest.xml
  - java
    - example.com.helloworld
      - MainActivity
    - example.com.helloworld (androidTest)
  - res
    - drawable
    - layout
      - activity_main.xml
    - menu
      - menu_main.xml
    - mipmap
    - values
- Gradle Scripts

MainActivity.java × activity_main.xml ×

```
    @Override
    public boolean onCreateOptionsMenu(Menu menu) {
        // Inflate the menu; this adds items to the action bar if it is present.
        getMenuInflater().inflate(R.menu.menu_main, menu);
        return true;
    }

    @Override
    public boolean onOptionsItemSelected(MenuItem item) {
        // Handle action bar item clicks here. The action bar will
        // automatically handle clicks on the Home/Up button, so long
        // as you specify a parent activity in AndroidManifest.xml.
        int id = item.getItemId();

        //noinspection SimplifiableIfStatement
        if (id == R.id.action_settings) {

            // ADD Lab 3 - Challenge !!!

            return true;
        }

        return super.onOptionsItemSelected(item);
    }
}
```

Emulator Nexus_5_API_23 Android 6.0 (API 23) | example.com.helloworld (6015)

logcat | ADB logs | Memory | CPU | Log level: Verbose | Show only selected application

```
09-01 13:36:36.489    6015-6029/example.com.helloworld W/EGL_emulation:  eglSurfaceAttrib not implemented
09-01 13:36:36.489    6015-6029/example.com.helloworld W/OpenGLRenderer:  Failed to set EGL_SWAP_BEHAVIOR on surface 0xad6daa60, error=EGL_SUCCESS
09-01 13:37:31.040    6015-6015/example.com.helloworld W/art:  Before Android 4.1, method int android.support.v7.internal.widget.ListViewCompat.lookForSelectablePosition(int, boolean) would have incorrectly overridden the package-private method in android.
09-01 13:37:31.156    6015-6029/example.com.helloworld W/EGL_emulation:  eglSurfaceAttrib not implemented
09-01 13:37:31.156    6015-6029/example.com.helloworld W/OpenGLRenderer:  Failed to set EGL_SWAP_BEHAVIOR on surface 0xad6db540, error=EGL_SUCCESS
09-01 13:37:33.354    6015-6022/example.com.helloworld W/art:  Suspending all threads took: 8.038ms
09-01 13:37:33.557    6015-6029/example.com.helloworld E/Surface:  getSlotFromBufferLocked: unknown buffer: 0xabe3ac00
09-01 13:37:33.566    6015-6029/example.com.helloworld D/OpenGLRenderer:  endAllStagingAnimators on 0xaf7aa900 (ListPopupWindow$DropDownListView) with handle 0xa2d37160
```

Terminal | 6: Android | 0: Messages | 4: Run | TODO | Event Log | Gradle Console

Session 'app': running (2 minutes ago) | 38:62 | CRLF | UTF-8 | Context: <no context>

Lab 4

Creating ERROR

Lab 4 – MainActivity.java

HelloWorld - [C:\Users\IBM_ADMIN\Desktop\rtpjavabootcamp\studioworkspace\HelloWorld] - [app] - ...\app\src\main\java\example\com\he

File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help

app

HelloWorld > app > src > main > java > example > com > helloworld > MainActivity

Android

app
- manifests
  - AndroidManifest.xml
- java
  - example.com.helloworld
    - MainActivity
  - example.com.helloworld (androidTest)
- res
  - drawable
  - layout
    - activity_main.xml
  - menu
    - menu_main.xml
  - mipmap
  - values
- Gradle Scripts

MainActivity.java × | activity_main.xml ×

```
    @Override
    public boolean onCreateOptionsMenu(Menu menu) {
        // Inflate the menu; this adds items to the action bar if it is present.
        getMenuInflater().inflate(R.menu.menu_main, menu);
        return true;
    }

    @Override
    public boolean onOptionsItemSelected(MenuItem item) {
        // Handle action bar item clicks here. The action bar will
        // automatically handle clicks on the Home/Up button, so long
        // as you specify a parent activity in AndroidManifest.xml.
        int id = item.getItemId();

        //noinspection SimplifiableIfStatement
        if (id == R.id.action_settings) {

            // ADD Lab 3 - Challenge !!!


            // LAB 4 CODE
            int i = 0;
            int j = 0;
            int k = i / j;

            return true;
        }

        return super.onOptionsItemSelected(item);
    }
}
```

Emulator Nexus_5_API_23 Android 6.0 (API 23) | example.com.helloworld (8041)

logcat | ADB logs | Memory | CPU | Log level: Verbo

```
09-01 13:41:10.246   8041-8041/? D/:  HostConnection::get() New Host Connection established 0xad6a2c70, tid 8041
09-01 13:41:10.354   8041-8059/? D/:  HostConnection::get() New Host Connection established 0xad6a2e10, tid 8059
09-01 13:41:10.380   8041-8059/? I/OpenGLRenderer:  Initialized EGL, version 1.4
09-01 13:41:10.972   8041-8059/example.com.helloworld W/EGL_emulation:  eglSurfaceAttrib not implemented
09-01 13:41:10.972   8041-8059/example.com.helloworld W/OpenGLRenderer:  Failed to set EGL_SWAP_BEHAVIOR on surface 0xad6daa60, error=EGL_SUCCESS
09-01 13:41:20.696   8041-8041/example.com.helloworld W/art:  Before Android 4.1, method int android.support.v7.internal.widget.ListViewCompat.lookForSelectablePosition(
09-01 13:41:20.832   8041-8059/example.com.helloworld W/EGL_emulation:  eglSurfaceAttrib not implemented
09-01 13:41:20.832   8041-8059/example.com.helloworld W/OpenGLRenderer:  Failed to set EGL_SWAP_BEHAVIOR on surface 0xad6db4e0, error=EGL_SUCCESS
```

Session 'app': running

Terminal | 6: Android | 0: Messages | 4: Run | TODO

Session 'app': running (moments ago)

5554:Nexus_5_API_23

1:41

HelloWorld | Settings

Hello New World!

Error

```
09-01 13:41:39.073    8041-8041/example.com.helloworld E/InputEventReceiver:  Exception dispatching input event.
09-01 13:41:39.073    8041-8041/example.com.helloworld E/MessageQueue-JNI:  Exception in MessageQueue callback: handleReceiveCallback
09-01 13:41:39.074    8041-8041/example.com.helloworld E/MessageQueue-JNI:  java.lang.ArithmeticException: divide by zero
            at example.com.helloworld.MainActivity.onOptionsItemSelected(MainActivity.java:50)
            at android.app.Activity.onMenuItemSelected(Activity.java:2908)
            at android.support.v4.app.FragmentActivity.onMenuItemSelected(FragmentActivity.java:325)
            at android.support.v7.app.AppCompatActivity.onMenuItemSelected(AppCompatActivity.java:147)
```

Lab 5

Toasting

Change onOptionsSelectedItem Method

MainActivity.java × | activity_main.xml ×

```
        // Handle action bar item clicks here. The action bar will
        // automatically handle clicks on the Home/Up button, so long
        // as you specify a parent activity in AndroidManifest.xml.
        int id = item.getItemId();

        //noinspection SimplifiableIfStatement
        if (id == R.id.action_settings) {

            // ADD Lab 3 - Challenge !!!

            Toast toast = Toast.makeText(this, "CLICKED SETTINGS !!!", Toast.LENGTH_LONG);
            toast.show();

            // LAB 4 CODE - COMMENTED in LAB 5
            //int i = 0;
            //int j = 0;
            //int k = i / j;

            return true;
        }

        return super.onOptionsItemSelected(item);
    }
}
```

Lab 5 Changes to Lab 4 Code

- Add to Import

```
import android.widget.Toast;
```

- REMOVE – int Lines

- ADD THESE LINES

```
Toast toast = Toast.makeText(this, "Created !!!",
                                                    Toast.LENGTH_LONG);
toast.show();
```

5554:Nexus_5_API_23
1:33
HelloWorld
Hello New World!

1:45
HelloWorld
Settings
Hello New World!

1:45
HelloWorld
Hello New World!
CLICKED SETTINGS !!!

Lab 6

Adding DEBUG Breakpoint

HelloWorld - [C:\Users\IBM_ADMIN\Desktop\rtpjavabootcamp\studioworkspace\HelloWorld] - [app] - ...\app\src\main\java\example\com\he

File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help

app

HelloWorld > app > src > main > java > example > com > helloworld > MainActivity

Android

app
- manifests
  - AndroidManifest.xml
- java
  - example.com.helloworld
    - MainActivity
  - example.com.helloworld (androidTest)
- res
  - drawable
  - layout
    - activity_main.xml
  - menu
    - menu_main.xml
  - mipmap
  - values
- Gradle Scripts

MainActivity.java × activity_main.xml ×

```
        // as you specify a parent activity in AndroidManifest.xml.
        int id = item.getItemId();  id: 2131492954  item: "Settings"

        //noinspection SimplifiableIfStatement
        if (id == R.id.action_settings) {  id: 2131492954

            // ADD Lab 3 - Challenge !!!

            Toast toast = Toast.makeText(this, "CLICKED SETTINGS !!!", Toast.LENGTH_LONG);  toast: Toast@4256
            toast.show();

            // LAB 4 CODE - COMMENTED in LAB 5
            //int i = 0;
            //int j = 0;
            //int k = i / j;

            return true;
        }

        return super.onOptionsItemSelected(item);
    }
}
```

Debug app

Debugger | Console | Logcat

Frames

"main"@3,972 in group "mai...

onOptionsItemSelected():48, MainActivity (example.com.helloworld)

onMenuItemSelected():2908, Activity (android

onMenuItemSelected():325, FragmentActivity

onMenuItemSelected():147, AppCompatActivit

onMenuItemSelected():100, WindowCallbackW

onMenuItemSelected():583, AppCompatDeleg

dispatchMenuItemSelected():811, MenuBuilde

invoke():153, MenuItemImpl (a

Variables

this = {MainActivity@4253}

emImpl@4255} "Settings"

id = 2131492954

toast = {Toast@4256}

Session 'app': running

Terminal | 6: Android | 0: Messages | 4: Run | 5: Debug | TODO

5554:Nexus_5_API_23

1:46

HelloWorld

Settings

Hello New World!

HelloWorld - [C:\Users\IBM_ADMIN\Desktop\rtpjavabootcamp\studioworkspace\HelloWorld] - [app] - ...\app\src\main\java\

File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help

app

HelloWorld > app > src > main > java > example > com > helloworld > MainActivity

Android

app
- manifests
  - AndroidManifest.xml
- java
  - example.com.helloworld
    - MainActivity
  - example.com.helloworld (androidTest)
- res
  - drawable
  - layout
    - activity_main.xml
  - menu
    - menu_main.xml
  - mipmap
  - values
- Gradle Scripts

MainActivity.java × | activity_main.xml ×

```
        // as you specify a parent activity in AndroidManifest.xml.
        int id = item.getItemId();  id: 2131492954  item: "Settings"

        //noinspection SimplifiableIfStatement
        if (id == R.id.action_settings) {  id: 2131492954

            // ADD Lab 3 - Challenge !!!

            Toast toast = Toast.makeText(this, "CLICKED SETTINGS !!!", Toast.LENGTH_LONG);  toast:
            toast.show();

            // LAB 4 CODE - COMMENTED in LAB 5
            //int i = 0;
            //int j = 0;
            //int k = i / j;

            return true;
        }

        return super.onOptionsItemSelected(item);
    }
}
```

Debug Mode Screenshot

Debug app

Debugger | Console | Logcat

Frames

"main"@3,972 in group "mai...

- onOptionsItemSelected():48, MainActivity (ex
- onMenuItemSelected():2908, Activity (android
- onMenuItemSelected():325, FragmentActivity
- onMenuItemSelected():147, AppCompatActivit
- onMenuItemSelected():100, WindowCallbackW
- onMenuItemSelected():583, AppCompatDeleg
- dispatchMenuItemSelected():811, MenuBuilde

Variables

- this = {MainActivity@4253}
- item = {MenuItemImpl@4255} "Settings"
- id = 2131492954
- toast = {Toast@4256}

Stopping the Debbuger

Dalvik Debug Monitor Server

- DDMS
- debugging tool
- "provides, screen capture on the device, thread and heap information on the device, logcat, process, and radio state information, incoming call and SMS spoofing, location data spoofing, and more."
- can interact with DDMS via Eclipse plugin, another view in Eclipse

DDMS

DDMS - AndroidTicTacToe-Tutorial2/res/layout/main.xml - Eclipse SDK

File Edit Refactor Run Navigate Search Project Window Help

DDMS Java

Devices

Name			
com.android.settings	147		8605
android.process.acore	169		8606
com.android.deskclock	184		8607
com.android.protips	203		8608
com.android.music	214		8609
com.android.quicksearchbo	230		8612
com.android.defcontainer	238		8614
android.process.media	246		8616
com.android.mms	261		8618
com.android.email	282		8620
com.svox.pico	302		8622
scottmd3.tictactoe	322		8624 / 8700
scott.examples.lifeCycleTest	333		8625

Threads | Heap | Allocation Tracker | File Explorer

Heap updates will happen after every GC for th

ID	Heap Size	Allocated	Free	% Used	# Objects
1	5.254 MB	2.551 MB	2.703 MB	48.56%	48,634

Cause GC

Display: Stats

Type	Count	Total Size	Smallest	Largest	Median	Average
free	5,338	2.691 MB	16 B	78.516 KB	176 B	528 B
data object	33,061	996.391 KB	16 B	672 B	32 B	30 B
class object	2,042	586.086 KB	168 B	26.836 KB	168 B	293 B
1-byte array (byte[], boolean[])	1,563	228.414 KB	24 B	1.977 KB	40 B	149 B
2-byte array (short[], char[])	8,957	564.203 KB	24 B	28.023 KB	48 B	64 B
4-byte array (object[], int[], float[])	2,789	227.836 KB	24 B	16.023 KB	40 B	83 B
8-byte array (long[], double[])	222	9.352 KB	32 B	1.000 KB	32 B	43 B

Allocation count per size

Count: 15,000 12,500 10,000 7,500 5,000 2,500 0

Size: 16 24 32 40 48 56 64 72 80 88 96 104 112 120 128 152 160 168 176 200 208 304 328 336 344 360 368 384 624 672

Emulator Control

Telephony Status

Voice: home Speed: Full

Data: home Latency: None

Telephony Actions

Incoming number:

Voice

SMS

Message:

LogCat

Saved Filters

All messages (no filters)

life cycle 2

Search for messages. Accepts Java regexes. Prefix with pid:, app:, tag: or text: to limit scope.

verbose

L...	Time	PID	Application	Tag	Text
W	01-29 19:31:23.124	61	syste...	InputManagerService	Window already focused, ignoring focus gain of: c...
D	01-29 19:31:24.194	322	scott...	TicTacToeGame	Computer moving to 5 as a random move.
D	01-29 19:31:27.865	322	scott...	TicTacToeGame	Computer moving to 6 to block win.
D	01-29 19:31:29.875	322	scott...	TicTacToeGame	Computer moving to 1 to block win.
D	01-29 19:32:26.682	322	scott...	dalvikvm	+++ active profiler count now 1
I	01-29 19:32:26.682	322	scott...	dalvikvm	TRACE STARTED: '[DDMS]' 8192KB
I	01-29 19:32:32.656	322	scott...	dalvikvm	dvmDdmHandleHpsgChunk(when 1, what 0, heap 0)

Lab 7

Adding Button and OnClickEvent

On Activity_main.xml - 1

add a button and change properties to Submit

On Activity_main.xml - 2

HelloWorld - [C:\Users\IBM_ADMIN\Desktop\rtpjavabootcamp\studioworkspace\HelloWorld] - [app] - ...\app\src\main\res\layout\activity_main.xml - Android Studio 1.3.2

File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help

HelloWorld > app > src > main > res > layout > activity_main.xml

Android

app
- manifests
  - AndroidManifest.xml
- java
  - example.com.helloworld
    - MainActivity
  - example.com.helloworld (androidTest)
- res
  - drawable
  - layout
    - activity_main.xml
  - menu
    - menu_main.xml
  - mipmap
  - values
- Gradle Scripts

MainActivity.java | activity_main.xml

Palette

Layouts
- FrameLayout
- LinearLayout (Horizor
- LinearLayout (Vertica
- TableLayout
- TableRow
- GridLayout
- RelativeLayout

Widgets
- Plain TextView
- Button
- Small Button
- RadioButton
- CheckBox

Button

Represents a push-button widget.

Nexus 4 | AppTheme | MainActivity | 23

Design | Text

MainActivity.java | activity_main.xml

Palette

Layouts
- FrameLayout
- LinearLayout (Horizor
- LinearLayout (Vertica
- TableLayout
- TableRow
- GridLayout
- RelativeLayout

Widgets
- Plain TextView
- Large Text
- Medium Text
- Small Text
- Button
- Small Button
- RadioButton
- CheckBox

Nexus 4 | AppTheme | MainActivity | 23

Component Tree
- Device Screen
  - RelativeLayout
    - TextView - @string/hello_world
    - **button** - "Submit"

Properties

stateListAnimator

text Submit

Integer, Enum

textAlignment

textAppearance

textColor

textColorHighlight

textColorHint

textColorLink

textSize

Design | Text

Create a new Java Class

HelloWorld - [C:\Users\IBM_ADMIN\Desktop\rtpjavabootcamp\studioworkspace\HelloWorld] - [app] - ...\

File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help

app

HelloWorld > app > src > main > java > example > com > helloworld

Android

app
- manifests
- java
  - example.com.helloworld
    - MainAc
  - example.co
- res
- Gradle Scripts

MainActivity.java | activity_main.xml

```
package example.com.helloworld;

import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;
import android.view.Menu;
```

New
- Cut Ctrl+X
- Copy Ctrl+C
- Copy Path Ctrl+Shift+C
- Copy as P
- Copy Refe
- Paste
- Find Usag
- Find in Pa
- Replace i
- Analyze

Java Class
- Android resource file
- Android resource directory
- File

Create New Class

Name: OurOnClickListener

Kind: Class

OK Cancel

New OnCreate Method

HelloWorld - [C:\Users\IBM_ADMIN\Desktop\rtpjavabootcamp\studioworkspace\HelloWorld] - [app] - ...\app\

File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help

app

HelloWorld > app > src > main > java > example > com > helloworld > MainActivity

Android

- app
  - manifests
  - java
    - example.com.helloworld
      - MainActivity
      - OurOnClickListener
    - example.com.helloworld (androidTest)
  - res
- Gradle Scripts

MainActivity.java | OurOnClickListener.java | activity_main.xml

```java
package example.com.helloworld;

import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;
import android.view.Menu;
import android.view.MenuItem;
import android.widget.TextView; // LAB 2 NEW
import android.util.Log;    // LAB 3 NEW
import android.widget.Toast; // LAB 5 NEW
import android.widget.Button; // LAB 7 NEW

public class MainActivity extends AppCompatActivity {

    // OVER WROTE OnCreate Method in LAB 7
    @Override
    protected void onCreate(Bundle bundle) {
        super.onCreate(bundle);
        setContentView(R.layout.activity_main);

        textView = (TextView) findViewById(R.id.textView1);

        button = (Button) findViewById(R.id.button1);
        button.setOnClickListener(new OurOnClickListener(this));

    }
```

New OnCreate Method

```
package com.example.helloandroid;

import android.app.Activity;
import android.os.Bundle;
import android.os.StrictMode;
import android.util.Log;
import android.view.Menu;
import android.view.MenuItem;
import android.widget.Button;
import android.widget.TextView;
import android.widget.Toast;

public class MainActivity extends AppCompatActivity {
   TextView textView;
   Button ourButton;
   // OVER WRITE OnCreate Method in LAB 7
   @Override
   protected void onCreate(Bundle bundle) {
      super.onCreate(bundle);
      setContentView(R.layout.activity_main);
      textView = (TextView) findViewById(R.id.textView);
      ourButton = (Button) findViewById(R.id.button);
      ourButton.setOnClickListener(new OurOnClickListener(this));
   }
...
```

New OurOnClickListener Class

HelloWorld - [C:\Users\IBM_ADMIN\Desktop\rtpjavabootcamp\studioworkspace\HelloWorld] - [app] - ...\app\src\

File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help

app

HelloWorld > app > src > main > java > example > com > helloworld > OurOnClickListener

Android

- app
  - manifests
  - java
    - example.com.helloworld
      - MainActivity
      - OurOnClickListener
    - example.com.helloworld (androidTest)
  - res
- Gradle Scripts

MainActivity.java | OurOnClickListener.java | activity_main.xml

```java
import org.w3c.dom.Document;
import org.xml.sax.SAXException;

import com.alchemyapi.api.AlchemyAPI;
import com.alchemyapi.api.AlchemyAPI_RelationParams;


import android.view.View;
import android.view.View.OnClickListener;

public class OurOnClickListener implements OnClickListener {

    MainActivity caller;
    private int count;

    public OurOnClickListener(MainActivity activity) {
        this.caller = activity;
        this.count = 0;
    }

    @Override
    public void onClick(View v) {
        count++;
        String countstr = Integer.toString(count);
        caller.textView.setText("Clicked " + countstr + " times");
    }

}
```

NEW CLASS CREATED IN LAB 7

```
package com.example.helloandroid;
import android.view.View;
import android.view.View.OnClickListener;
public class OurOnClickListener implements OnClickListener {

MainActivity caller;
private int count;

public OurOnClickListener(MainActivity activity) {
        this.caller = activity;
        this.count = 0;
}

@Override
public void onClick(View v) {
        count++;
        String countstr = Integer.toString(count);
        caller.textView.setText("Clicked " + countstr + " times");
}

}
```

Important Files

1. src/**MainActivity.java**
    1. Activity which is started when app executes
2. gen/**R.java** (DO NOT MODIFY!)
    1. Auto-generated, auto-updated file with identifiers from main.xml, strings.xml, and elsewhere
3. res/layout/**activity_main.xml**
    1. Defines & lays out widgets for the activity
4. res/values/**strings.xml**
    1. String constants used by app
5. **AndroidManifest.xml**
    1. Declares all the app's components
    2. Names libraries app needs to be linked against
    3. Identifies permissions the app expects to be granted

1 - src/**MainActivity.java**

```
package com.example.helloworld;

import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;
import android.view.Menu;
import android.view.MenuItem;

public class MainActivity extends AppCompatActivity {

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
    }

    @Override
    public boolean onCreateOptionsMenu(Menu menu) {
        // Inflate the menu; this adds items to the action bar if it is present.
        getMenuInflater().inflate(R.menu.menu_main, menu);
        return true;
    }

    @Override
    public boolean onOptionsItemSelected(MenuItem item) {
        // Handle action bar item clicks here. The action bar will
        // automatically handle clicks on the Home/Up button, so long
        // as you specify a parent activity in AndroidManifest.xml.
        int id = item.getItemId();

        //noinspection SimplifiableIfStatement
        if (id == R.id.action_settings) {
            return true;
        }

        return super.onOptionsItemSelected(item);
    }
}
```

2 - gen/**R.java**

- Auto-generated file with identifiers from main.xml, strings.xml, and elsewhere

- *\/* 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 com.example.helloworld;

  public final class R {
  public static final class anim {
  public static final int ***abc_fade_in***=0x7f050000;
  public static final int ***abc_fade_out***=0x7f050001;
  public static final int ***abc_grow_fade_in_from_bottom***=0x7f050002;
  public static final int ***abc_popup_enter***=0x7f050003;
  public static final int ***abc_popup_exit***=0x7f050004;
  public static final int ***abc_shrink_fade_out_from_bottom***=0x7f050005;
  public static final int ***abc_slide_in_bottom***=0x7f050006;
  public static final int ***abc_slide_in_top***=0x7f050007;
  public static final int ***abc_slide_out_bottom***=0x7f050008;
  public static final int ***abc_slide_out_top***=0x7f050009;
  }
  public static final class attr {
  *\/** <p>Must be a reference to another resource, in the form*
  "<code>@[+][package:]type:name</code>"
  or to a theme attribute in the form "<code>?[package:][type:]name</code>".

Do not modify!

3 - res/layout/activity_main.xml

```
<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=".MainActivity">

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

   <Button
      android:layout_width="wrap_content"
      android:layout_height="wrap_content"
      android:text="Submit"
      android:id="@+id/button"
      android:layout_below="@+id/textView"
      android:layout_toRightOf="@+id/textView"
      android:layout_toEndOf="@+id/textView"
      android:layout_marginTop="68dp" />

</RelativeLayout>
```

3 contd. - Understanding Layout

- Declares layouts & widgets for the activity

```
<?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" >

    <EditText
        android:id="@+id/name"
        android:layout_width="fill_parent"
        android:layout_height="wrap_content"
        android:text="@string/hello" />

    <Button
        android:id="@+id/hello_button"
        android:layout_height="wrap_content"
        android:layout_width="wrap_content"
        android:text="Press Me" />

</LinearLayout>
```

Tree from: http://developer.android.com/guide/topics/ui/index.html

3 Contd - Available Layouts

LinearLayout

RelativeLayout

TableLayout

http://developer.android.com/resources/tutorials/views/index.html

3 Layout and Available Widgets

MapView

WebView

DatePicker

Spinner

AutoComplete

ListView

http://developer.android.com/resources/tutorials/views/index.html

4 - res/values/**strings.xml**

- String constants used by app

```
<resources>
<string name="app_name">HelloWorld</string>

<string name="hello_world">Hello world!</string>
<string name="action_settings">Settings</string>
</resources>
```

- Used for supporting Localization
  - res/values-**es**/values/strings.xml to support Spanish
  - res/values-**fr**/values/strings.xml to support French
  - Etc.

5 - AndroidManifest.xml

- Declares all the app's components
- Names libraries app needs to be linked against
- Identifies permissions the app expects to be granted

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

<application
android:allowBackup="true"
android:icon="@mipmap/ic_launcher"
android:label="@string/app_name"
android:theme="@style/AppTheme" >
<activity
android:name=".MainActivity"
android:label="@string/app_name" >
<intent-filter>
<action android:name="android.intent.action.MAIN" />

<category android:name="android.intent.category.LAUNCHER" />
</intent-filter>
</activity>
</application>

</manifest>
```

5 contd - AndroidManifest.xml

All Activities that are part of application must be registered in M

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="scott.examples.lifeCycleTest"
    android:versionCode="1"
    android:versionName="1.0" >

    <uses-sdk android:minSdkVersion="10" />

    <application
        android:icon="@drawable/ic_launcher"
        android:label="@string/app_name" >
        <activity
            android:name=".LifeCycleTestActivity"
            android:label="@string/app_name" >
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
                <activity
            android:name=".NameGetter"
            android:label="@string/getName"/>
    </application>
```

Specify Activity to start w

Some other topics covered

- onCreate() in Activity
- Adding Text and Changing Properties from Code
- Use the log to v, d, i, w, e

  VERBOSE, DEBUG, INFO, WARN, ERROR
- Create a TAG so we can filter
- Toast a message
- Debug BreakPoint
- ScreenShot of the APP
- Adding component
- Adding an Event and Setting Properties

Understanding the Essence of Lifecycle

Necessary to overload callback methods so you app behaves well:

1. App should not crash if the user receives a phone call or switches to another app while using your app.
2. App should not consume valuable system resources when the user is not actively using it.
3. App should not lose the user's progress if they leave your app and return to it at a later time.
4. App should not crash or lose the user's progress when the screen rotates between landscape and portrait orientation.

http://developer.android.com/training/basics/activity-lifecycle/starting.html

Understanding Activity Stack

Activity Stack

Most recently created is at Top

User currently interacting with me

Pressing Back or destroying A1 will bring me to the top

If Activities above me use too many resources, I'll be destroyed!

Typical Game

Conder & Darcey (2010), Fig 4.1, p. 74

Starting Activities

- Android applications don't start with a call to main(String[])
- instead a series of callback methods are invoked
- each corresponds to specific stage of the Activity / application lifecycle
- callback methods also used to tear down Activity / application

Simplified Lifecycle Diagram

ready to interac
with user

Primary States

- Active
  - activity is in the foreground and user can interact with it
- Paused
  - activity partially obscured by another activity and user cannot interact with it (for example when working with a menu or dialog)
- Stopped
  - activity completely hidden and not visible to user. It is in the background.
  - Activity instance and variables are retained but no code is being executed by the activity
- Dead, activity terminated (or never started)
- Two other states, Created and Started, but they are transitory onCreate -> onStart -> onResume

Application Components List

five primary components - different purposes

1. Activity
   - single screen with a user interface, app may have several activities, subclass of Activity
   - Most of early examples will be activities

2. Intents
   - used to pass information between applications

3. Service
   - Application component that performs long-running operations in background with no UI
   - example, an application that automatically responds to texts when driving

Application Components List..contd

4. Content Providers
   - a bridge between applications to share data
   - for example the devices contacts information
   - we tend to use these, but not create new ones

5. Broadcast Receivers
   - component that responds to system wide announcements
   - battery low, screen off, date changed
   - also possible to initiate broadcasts from within an application

References

- Android Dev Guide http://developer.android.com/guide/topics/fundamentals.html

- http://developer.android.com/guide/topics/fundamentals/activities.html