Lesson 4

Graphical User Interfaces

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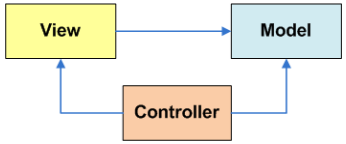
The Model-View-Control Pattern (MVC)

The *Model-View-Controller (MVC)* is an important software design pattern first introduced with the Xerox-Smalltalk80 system whose main goal is to separate the (1) user interface, (2) business, and (3) input logic.



How is this pattern seen by the Android developer?

- **Model**. Consists of the Java code and API objects used to represent the business problem and manage the behavior and data of the application.
- **View**. Set of screens the user sees and interacts with.
- **Controller**. Implemented through the Android OS, responsible for interpretation of the user and system inputs. Input may come from a variety of sources such as the trackball, keyboard, touch-screen, GPS chip, proximity sensor, accelerometer, etc, and tells the Model and/or the View (usually through callbacks and registered listeners) to change as appropriate.

Getting ready to create MVC conforming solutions

The Android developer should be aware of

- **Inputs** could be sent to the application from various physical/logical components. Reacting to those signals is typically handled by **callback methods**. Usually there are many of them, you want to learn how to choose the appropriate one.
- Moving to states in the **lifecycle** is tied to logic in the model. For instance, if forced to *Pause* you may want to save uncommitted data.
- A **notification** mechanism is used to inform the user of important events happening *outside* the current application (such as arrival of a text message or email, low battery, fluctuations of the stock market, etc) and consequently choose how to proceed.
- **Views** are unlimited in terms of aesthetic and functionality. However physical constraints such as size, and hardware acceleration (or lack of) may affect how graphical components are managed.

MVC Pattern: The View - User Interfaces (GUIs)

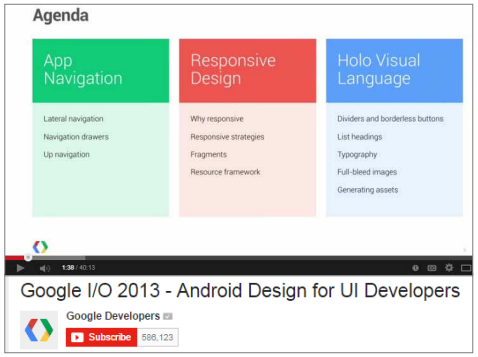
Android **graphical interfaces** are usually implemented as **XML** files (although they could also be dynamically created from Java code).

An Android UI is conceptually similar to a common HTML page

- **In a manner similar to a web page interaction**, when the Android user touches the screen, the controller interprets the input and determines what specific portion of the screen and gestures were involved. Based on this information it tells the model about the interaction in such a way that the appropriate "callback listener" or lifecycle state could be called into action.
- **Unlike a web application** (which refreshes its pages after explicit requests from the user) an asynchronous Android background service could quietly notify the controller about some change of state (such as reaching a given coordinate on a map) and in turn a change of the view's state could be triggered; all of these without user intervention.

Android UI Design Patterns

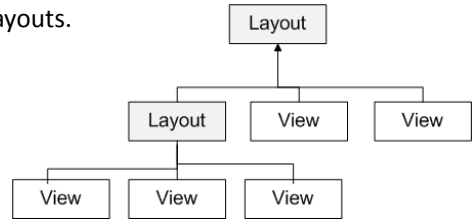
For a discussion of the newest **Android UI Design Patterns (2013)** see video:
https://www.youtube.com/watch?v=JI3-lzlzOJI



A collection of weekly instructional videos made by the same presenters can be obtained from the page (visited on Sept 6, 2014)
https://www.youtube.com/results?search_query=android+design+in+action

The VIEW Class

- The **View class** is the Android's most basic component from which users interfaces can be created. It acts as a container of displayable elements.
- A **View** occupies a rectangular area on the screen and is responsible for *drawing* and *event handling*.
- **Widgets** are subclasses of View. They are used to create interactive UI components such as buttons, checkboxes, labels, text fields, etc.
- **Layouts** are invisible structured containers used for holding other Views and nested layouts.



Using XML to represent UIs

Actual UI displayed by the app

Text version: *activity_main.xml* file ⟶

```
<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:paddingBottom="@dimen/activity_vertical_margin"
    android:paddingLeft="@dimen/activity_horizontal_margin"
    android:paddingRight="@dimen/activity_horizontal_margin"
    android:paddingTop="@dimen/activity_vertical_margin"
    tools:context="csu.matos.gui_demo.MainActivity" >

    <EditText
        android:id="@+id/editText1"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_alignParentTop="true"
        android:layout_centerHorizontal="true"
        android:layout_marginTop="36dp"
        android:text="@string/edit_user_name"
        android:ems="12" >
        <requestFocus />
    </EditText>

    <Button
        android:id="@+id/button1"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_below="@+id/editText1"
        android:layout_centerHorizontal="true"
        android:layout_marginTop="48dp"
        android:text="@string/btn_go"  />
</RelativeLayout>
```


Nesting XML Layouts

- An Android's **XML view** file consists of a **layout** design holding a hierarchical arrangement of its contained elements.
- The inner elements could be basic widgets or user-defined nested layouts holding their own viewgroups.
- An Activity uses the `setContentView(R.layout.xmlfilename)` method to render a view on the device's screen.

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

    Widgets and other nested layouts

</LinearLayout>
```

Setting Views to Work

Dealing with widgets & layouts typically involves the following operations

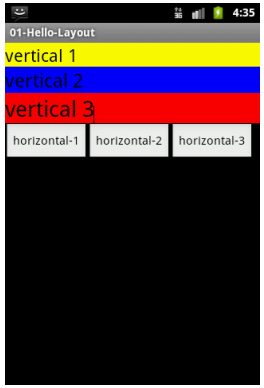
1. **Set properties:** For instance, when working with a *TextView* you set the background color, text, font, alignment, size, padding, margin, etc.

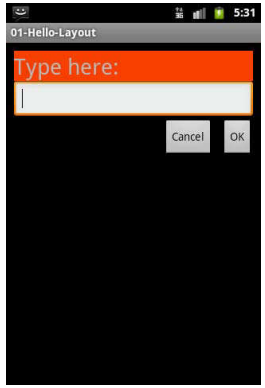
2. **Set up listeners:** For example, an image could be programmed to respond to various events such as: click, long-tap, mouse-over, etc.

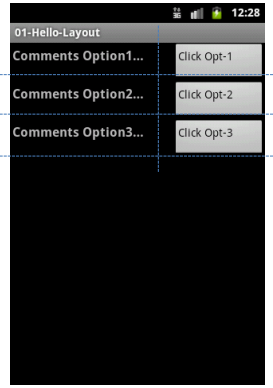
3. **Set focus:** To set focus on a specific view, you call the method **.requestFocus()** or use XML tag **<requestFocus />**

4. **Set visibility:** You can hide or show views using **setVisibility(…)**.

A Sample of Common Android LAYOUTS







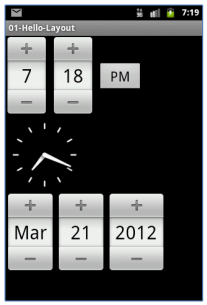
Linear Layout
A LinearLayout places its inner views either in horizontal or vertical disposition.

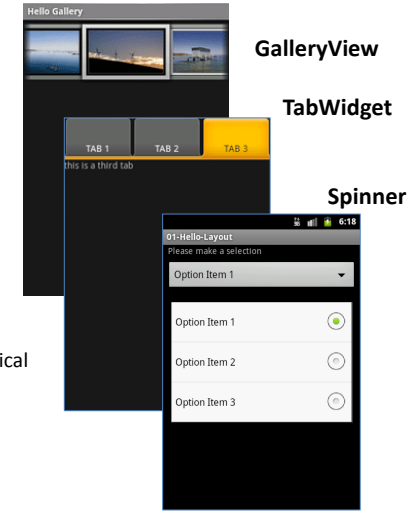
Relative Layout
A RelativeLayout is a ViewGroup that allows you to position elements relative to each other.

Table Layout
A TableLayout is a ViewGroup that places elements using a row & column disposition.

Reference: http://developer.android.com/guide/topics/ui/layout-objects.html

A Sample of Common Android WIDGETS





GalleryView

TabWidget

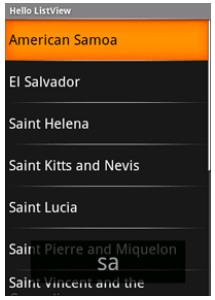
Spinner

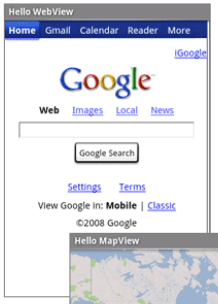
TimePicker
AnalogClock
DatePicker
A *DatePicke* is a widget that allows the user to select a month, day and year.

Form Controls
Includes a variety of typical form widgets, like:
image buttons,
text fields,
checkboxes and
radio buttons.

Reference: http://developer.android.com/guide/topics/ui/layout-objects.html

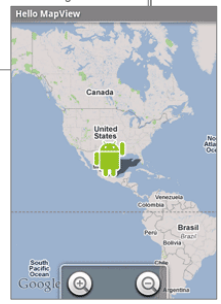
A Sample of Common Android WIDGETS





WebView

MapView



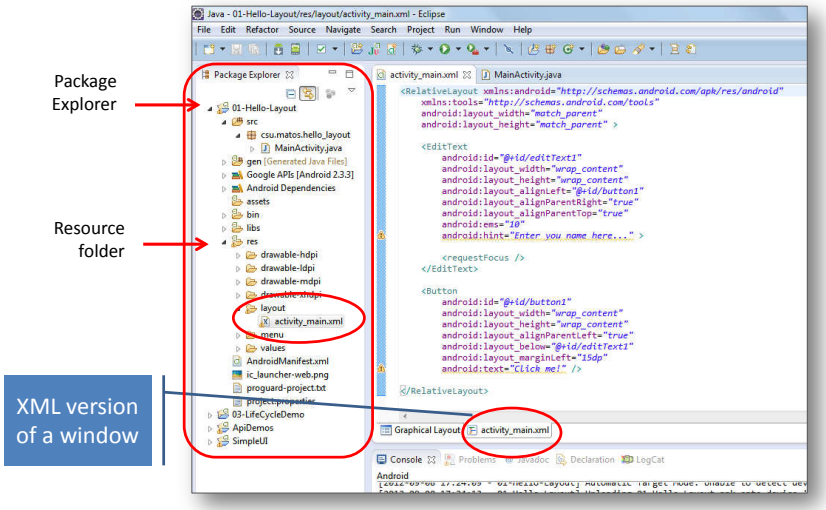
AutoCompleteTextView
It is a version of the *EditText* widget that will provide auto-complete suggestions as the user types. The suggestions are extracted from a collection of strings.

ListView
A *ListView* is a View that shows items in a vertically scrolling list. The items are acquired from a *ListAdapter*.

Reference: http://developer.android.com/guide/topics/ui/layout-objects.html

GUI Editing: XML Version

Android considers XML-based layouts to be ***resources***, consequently layout files are stored in the **res/layout** directory inside your Android project.



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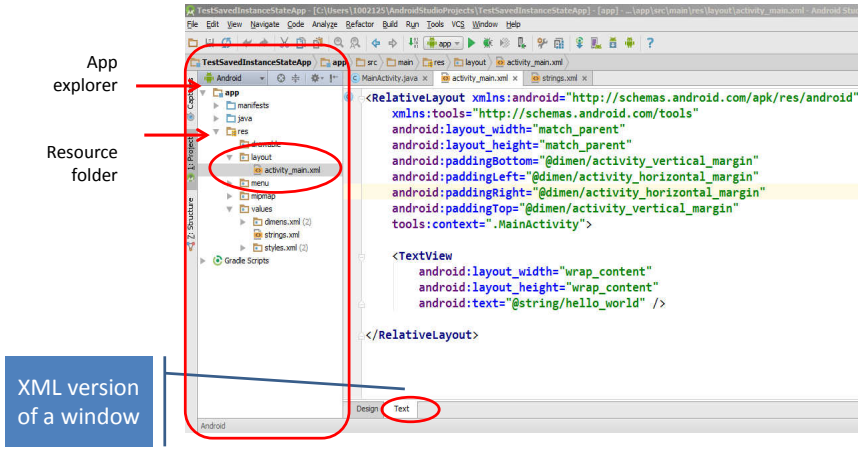
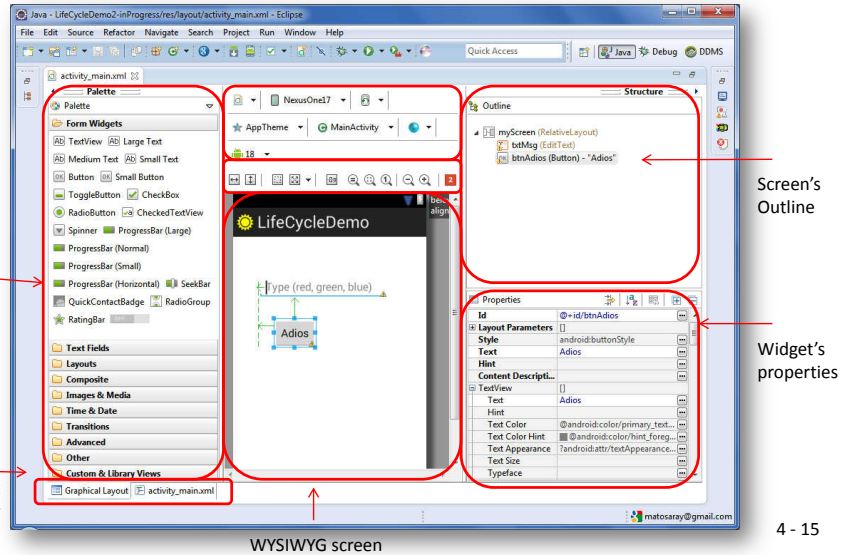


GUI Editing: WYSIWYG Version

The **Screen Designer Tool** included in Eclipse+ADT allows you to operate each screen using either a **WYSIWIG** or **XML** editor.



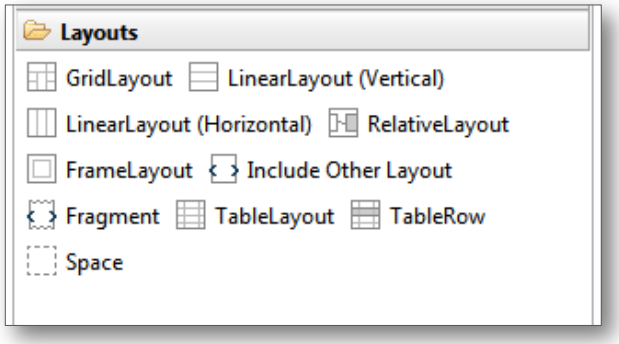
Aside… Tools you can use to create an Android GUI

Alternative tools for creating Android apps and GUIs:

- **Android Studio.** Based on IntelliJ IDEA IDE. Functionally equivalent to Eclipse with the ADT Plugin. http://developer.android.com/sdk/installing/studio.html
- **Android SDK**. Streamlined workbench based on Eclipse+ADT in a simpler to install package. http://developer.android.com/sdk/index.html
- **NBAndroid.** Workbench based on NetBeans+ADT. http://www.nbandroid.org/2014/07/android-plugin-for-gradle-011012.html
- **DroidDraw** Very simple GUI designer, incomplete, not integrated to the Eclipse IDE, aging! http://www.droiddraw.org/
- **App Inventor** (educational, very promising & ambitious, 'hides' coding …) http://appinventor.mit.edu/

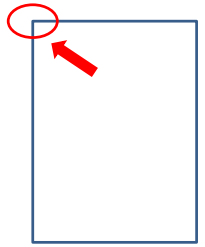
GUI Elements: The LAYOUT

- Android GUI *Layouts* are containers having a predefined structure and placement policy such as relative, linear horizontal, grid-like, etc.
- **Layouts can be nested**, therefore a cell, row, or column of a given layout could be another layout.
- The Eclipse+ADT workbench offers the following base types:



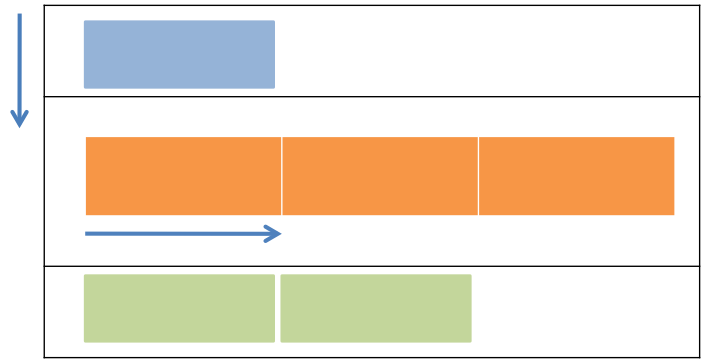
FrameLayout

- The **FrameLayout** is the simplest type of GUI container.
- It is useful as an *outermost* container holding a window.
- Allows you to define how much of the screen (high, width) is to be used.
- All its children elements are *aligned to the top left corner of the screen.*;



LinearLayout

- The **LinearLayout** supports a filling strategy in which new elements are stacked either in a horizontal or vertical fashion.
- If the layout has a vertical orientation new *rows* are placed one on top of the other.
- A horizontal layout uses a side-by-side *column* placement policy.



LinearLayout

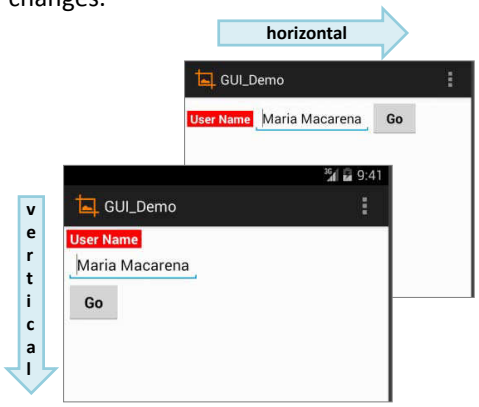
Setting Attributes

Configuring a **LinearLayout** usually requires you to set the following attributes:

- **orientation** (*vertical, horizontal)*
- **fill model** (*match_parent, wrap_contents*)
- **weight** (*0, 1, 2, …n*)
- **gravity** (*top, bottom, center,…*)
- **padding** (*dp – dev. independent pixels*)
- **margin** (*dp – dev. independent pixels*)

LinearLayout : Orientation

The **android:orientation** property can be set to: **horizontal** for columns, or **vertical** for rows.
Use *setOrientation()* for runtime changes.

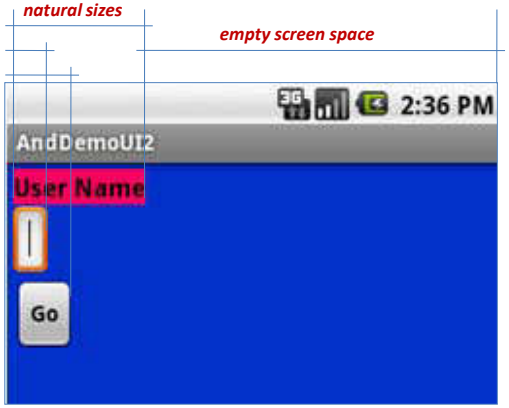


Shown on a Kitkat device

```
<LinearLayout
xmlns:android="http://schemas.android.com/apk/res/android"
    android:id="@+id/myLinearLayout"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="horizontal"
    android:padding="4dp" >

    <TextView
        android:id="@+id/labelUserName"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:background="#ffff0000"
        android:text=" User Name "
        android:textColor="#ffffffff"
        android:textSize="16sp"
        android:textStyle="bold" />

    <EditText
        android:id="@+id/ediName"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Maria Macarena"
        android:textSize="18sp" />

    <Button
        android:id="@+id/btnGo"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Go"
        android:textStyle="bold" />
</LinearLayout>
```


LinearLayout : Fill Model

- Widgets have a "natural size" based on their included text (*rubber band* effect).
- On occasions you may want your widget to have a specific space allocation (height, width) even if no text is initially provided (as is the case of the empty text box shown below).



Shown on a Gingerbread device

LinearLayout : Fill Model

All widgets inside a LinearLayout **must** include 'width' and 'height' attributes.

android:layout_width
android:layout_height

Values used in defining height and width can be:

1. A specific dimension such as **125dp** (device independent pixels **dip**)
2. **wrap_content** indicates the widget should just fill up its natural space.
3. **match_parent** (previously called '**fill_parent**') indicates the widget wants to be as big as the enclosing parent.

LinearLayout : Fill Model

Medium resolution is: 320 x 480 dpi.
Shown on a Gingerbread device

```
<LinearLayout
xmlns:android="http://schemas.android.com/apk/res/android"
    android:id="@+id/myLinearLayout"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="#ff0033cc"
    android:orientation="vertical"
    android:padding="6dp" >

    <TextView
        android:id="@+id/labelUserName"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:background="#ffff0066"
        android:text="User Name"
        android:textColor="#ff000000"
        android:textSize="16sp"
        android:textStyle="bold" />

    <EditText
        android:id="@+id/ediName"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:textSize="18sp" />

    <Button
        android:id="@+id/btnGo"
        android:layout_width="125dp"
        android:layout_height="wrap_content"
        android:text="Go"
        android:textStyle="bold" />
</LinearLayout>
```

Row-wise

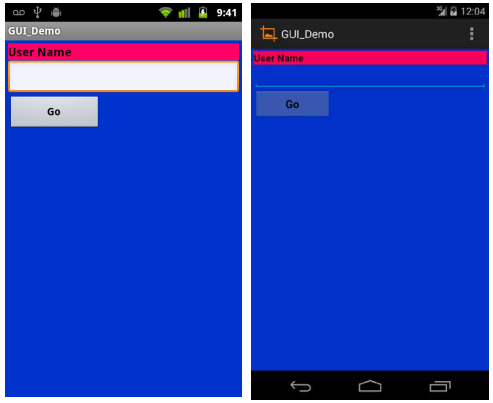
Use all the row

Specific size: 125dp

Warning ! Same XML different rendition…

Since the introduction of Android 4.x, changes in the SDK make layouts to be more *uniformly* displayed in all 4.x and newer devices (the intention is to provide a seamless Android experience independent from provider, hardware, and developer).

The XML spec used in the previous example *looks* different when displayed on a 4.x and older devices (see figures on the right, please also notice the *color bleeding* occurring on top of the GO button, more on this issue in the Appendix)



Same XML layout shown on a Gingerbread (left) and Kitkat (right) device.

LinearLayout : Weight

The extra space left unclaimed in a layout could be assigned to any of its inner components by setting its **Weight** attribute. Use **0** if the view should not be stretched. The bigger the weight the larger the extra space given to that widget.

Example
The XML specification for this window is similar to the previous example.

The TextView and Button controls have the additional property

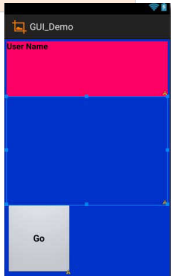
```
android:layout_weight="1"
```

whereas the EditText control has

```
android:layout_weight="2"
```

Remember, default value is 0

Gingerbread

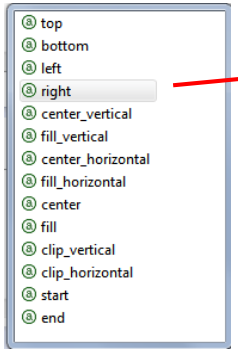


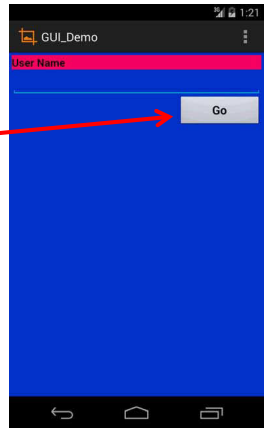
Kitkat

Takes: 2 /(1+1+2) of the screen space

LinearLayout : Gravity

- **Gravity** is used to indicate how a control will align on the screen.
- By default, widgets are ***left***- and ***top***-aligned.
- You may use the XML property `android:layout_gravity="…"` to set other possible arrangements: ***left, center, right, top, bottom,*** etc.





Button has **right** layout_gravity

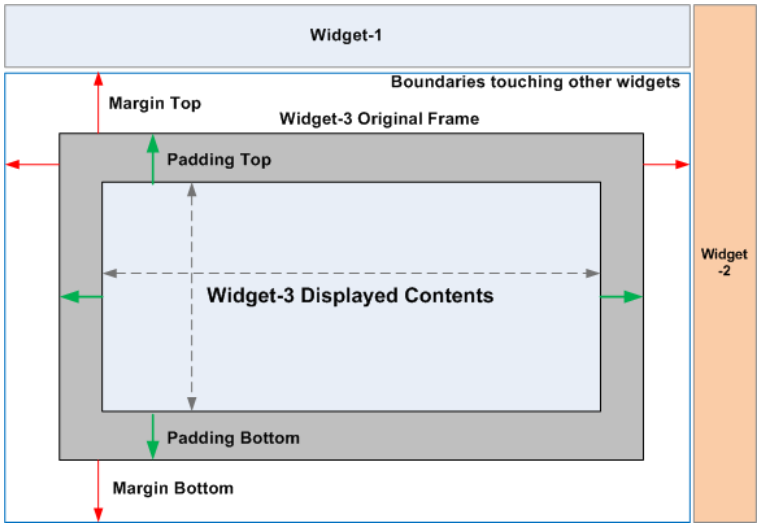
LinearLayout : Padding

- The **padding** attribute specifies the widget's internal margin (in **dp** units).
- The internal margin is the extra space between the borders of the widget's "cell" and the actual widget contents.
- Either use
  - `android:padding` property
  - or call method `setPadding()` at runtime.

The 'blue' surrounding space around the text represents the inner view's padding

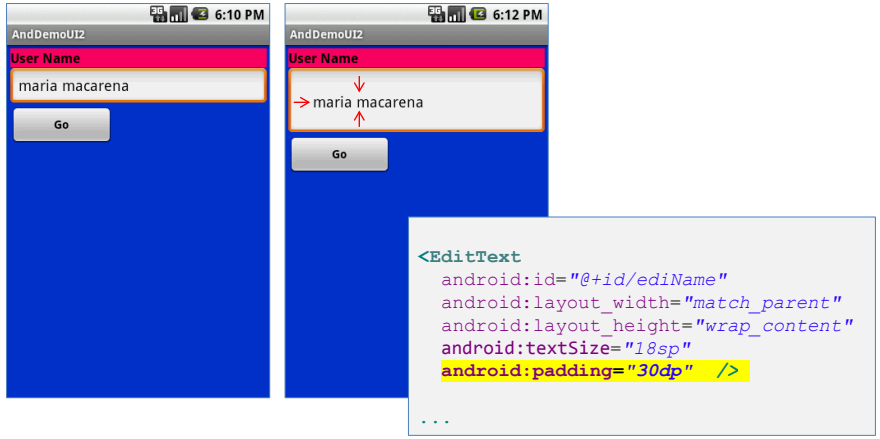
LinearLayout : Padding and Margin

Padding and Margin represent the *internal* and *external* spacing between a widget and its included and surrounding context (respectively).



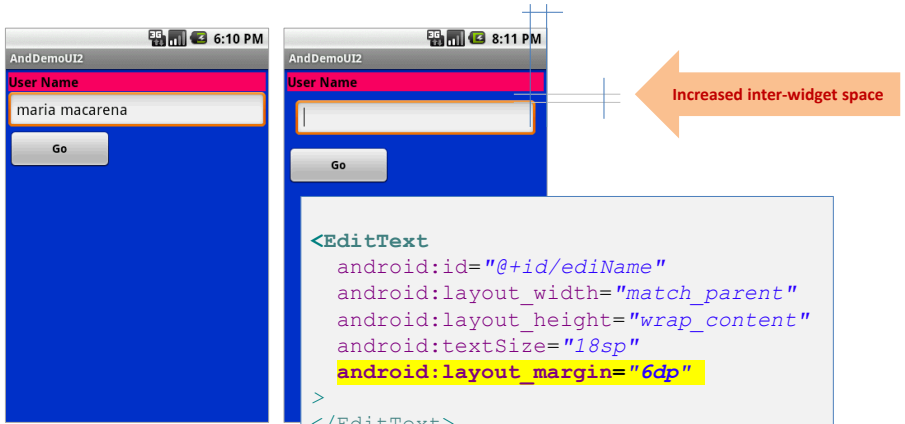
LinearLayout : Set Internal Margins Using Padding

Example:
The EditText box has been changed to include 30dp of padding all around



LinearLayout : Set External Margins

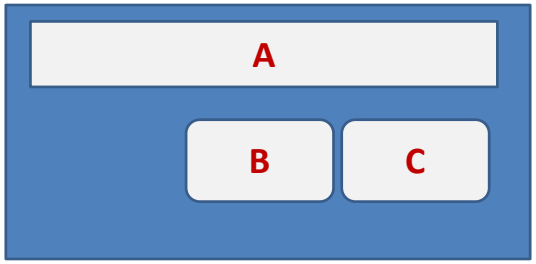
- Widgets –by default– are closely displayed next to each other.
- To increase space between them use the **android:layout_margin** attribute



Using default spacing between widgets

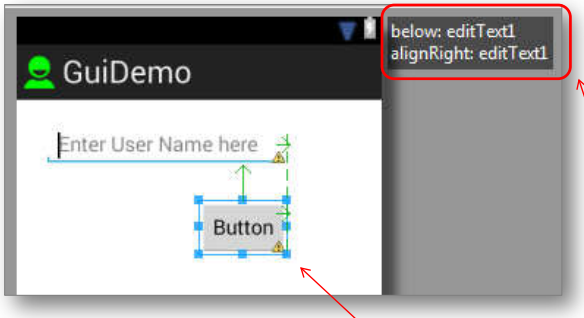
Relative Layout

The placement of a widget in a **RelativeLayout** is based on its *positional relationship* to other widgets in the container as well as the parent container.



Example:
A is by the parent's top
C is below **A**, to its right
B is below **A**, to the left of **C**

Relative Layout - Example: Using Eclipse+ADT WYSIWYG Editor

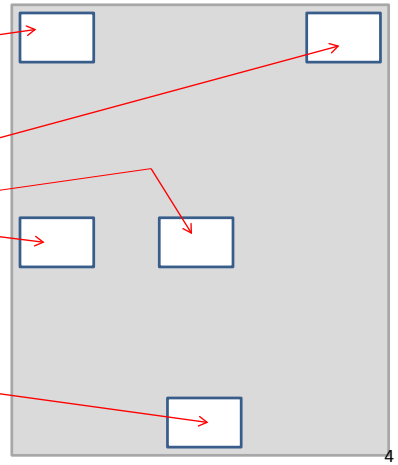


Location of the button is expressed in reference to its *relative* position with respect to the EditText box.

Relative Layout - Referring to the container

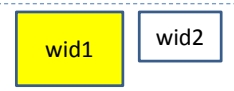
Below there is a sample of various positioning *XML boolean properties* (**true/false**) which are useful for collocating a widget based on the location of its **parent** container.

```
android:layout_alignParentTop
android:layout_alignParentBottom

android:layout_alignParentLeft
android:layout_alignParentRight

android:layout_centerInParent
android:layout_centerVertical
android:layout_centerHorizontal
```

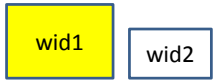


Relative Layout - Referring to Other Widgets

```
android:layout_alignTop="@+id/wid1"
```

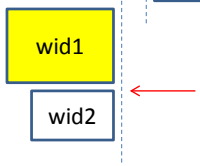



```
android:layout_alignBottom ="@+id/wid1"
```



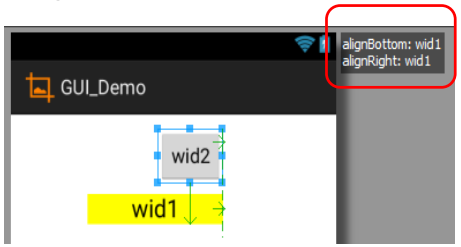

```
android:layout_alignLeft="@+id/wid1"
```


```
android:layout_alignRight="@+id/wid1"
```



Relative Layout - Referring to Other Widgets – WYSIWYG Editor

Example1: The image shows a screen designed with the WYSIWYG Editor. We are trying to collocate the button identified as **wid2**. Observe that its placement is **visually** described using (green) lines referencing the already drawn **wid1** view. Both views have same *bottom*, same *right*, but wig2 has an elevation of 36 dps respect wid1.




```
<Button
        android:id="@+id/wid2"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_alignBottom="@+id/wid1"
        android:layout_alignRight="@+id/wid1"
        android:layout_marginBottom="36dp"
        android:text="@string/wid2" />
```

Relative Layout - Referring to Other Widgets – WYSIWYG Editor

When using relative positioning you need to:

1. Use identifiers (`android:id` attributes) on *all elements* that you will be referring to.

2. XML elements are named using the prefix: `@+id/...` For instance an EditText box could be called: `android:id="@+id/txtUserName"`

3. You must refer only to widgets that have been already defined. For instance a new control to be positioned below the *txtUserName* EditText box could refer to it using:
   `android:layout_below="@+id/txtUserName"`

Relative Layout - Example2

```
<RelativeLayout
xmlns:android="http://schemas.android.com/apk/res/android"
    android:id="@+id/myRelativeLayout"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="#ff000099" >

    <TextView
        android:id="@+id/lblUserName"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_alignParentLeft="true"
        android:layout_alignParentTop="true"
        android:background="#ffff0066"
        android:text="User Name"
        android:textColor="#ff000000"
        android:textStyle="bold" >
    </TextView>

    <EditText
        android:id="@+id/txtUserName"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_alignParentLeft="true"
        android:layout_below="@+id/lblUserName"
        android:padding="20dp" >
    </EditText>

    <Button
        android:id="@+id/btnGo"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
android:layout_alignRight="@+id/txtUserName"
        android:layout_below="@+id/txtUserName"
        android:text="Go"
        android:textStyle="bold" >
    </Button>

    <Button
        android:id="@+id/btnCancel"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_below="@+id/txtUserName"
        android:layout_toLeftOf="@+id/btnGo"
        android:text="Cancel"
        android:textStyle="bold" >
    </Button>

</RelativeLayout>
```

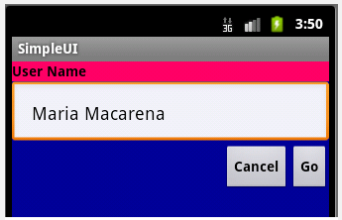


Table Layout

1. Android's **TableLayout** uses a grid template to position your widgets.
2. Like in a 2D matrix, cells in the grid are identified by *rows* and *columns*.
3. Columns are *flexible*, they could *shrink* or *stretch* to accommodate their contents.
4. The element **TableRow** is used to define a new row in which widgets can be allocated.
5. The number of columns in a TableRow is determined by the total of side-by-side widgets placed on the row.

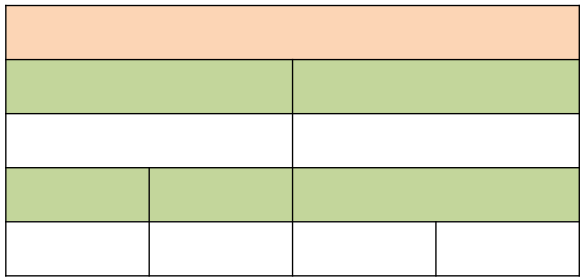


Table Layout – Setting Number of Columns

The final number of columns in a table is determined by Android.

Example:
If your *TableLayout* have three rows
- one row with two widgets,
- one with three widgets, and
- one final row with four widgets,

there will be at least **four** columns in the table, with column indices: **0, 1, 2, 3.**

0		1	
0		1	2
0	1	2	3

Table Layout – Example 3

The screen shows various items from a McDonald's restaurant menu [*].

The TableLayout has four TableRows, with three columns in the first row (labels) and four cells in each of the other three rows (item, Calories, Price, and Buy button).

[*] Reference: Pages visited on Sept 8, 2014
http://nutrition.mcdonalds.com/getnutrition/nutritionfacts.pdf

http://hackthemenu.com/mcdonalds/menu-prices/

Table Layout – Example 3 *continuation*

```
<TableLayout

xmlns:android="http://schemas.android.com/apk/res/android"
    android:id="@+id/myTableLayout"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    android:padding="6dp" >

    <TableRow>
        <TextView
            android:background="#FF33B5E5"
            android:text="Item " />
        <TextView
            android:layout_marginLeft="5dp"
            android:background="#FF33B5E5"
            android:text="Calories " />

        <TextView
            android:layout_marginLeft="5dp"
            android:background="#FF33B5E5"
            android:text="Price $ " />
    </TableRow>

    <View
        android:layout_height="1dp"
        android:background="#FF33B5E5" />
```

```
    <TableRow>

        <TextView
            android:text="Big Mac" />
        <TextView
            android:gravity="center"
            android:text="530" />
        <TextView
            android:gravity="center"
            android:text="3.99" />
        <Button
            android:id="@+id/btnBuyBigMac"
            android:gravity="center"
            android:text="Buy" />
    </TableRow>

    <View
        android:layout_height="1dp"
        android:background="#FF33B5E5" />

    <!-- other TableRows ommitted --!>


</TableLayout>
```


Table Layout – Stretching a Column

- A single widget in a TableLayout can occupy more than one column.
- The `android:layout_span` property indicates the number of columns the widget is allowed to expand.

```
<TableRow>
   <TextView
            android:text="URL:" />
   <EditText
            android:id="@+id/txtData"
            android:layout_span="3" />
</TableRow>
```


Table Layout – Stretching a Column

Widgets on a table's row are placed lexicographically from left to right, beginning with the first available column. Each column in the table stretches as needed to accommodate its occupants.

Example 4:

- The table shown below has four columns (*indices*: 0,1,2,3).
- The label ("**ISBN**") goes in the first column (*index 0*).
- The EditText to the right of the label uses the `layout_span` attribute to be placed into a spanned set of three columns (columns 1 through 3).

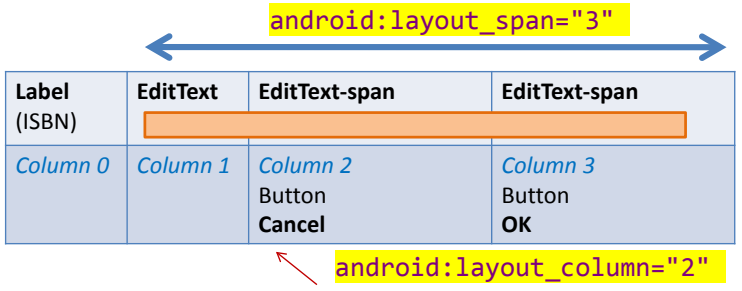
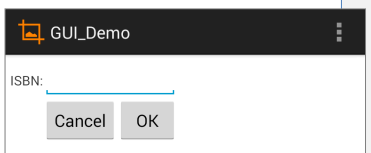


Table Layout – Example 4 *continuation*




```
<?xml version="1.0" encoding="utf-8"?>
<TableLayout
xmlns:android="http://schemas.android.com/apk/res/android"
    android:id="@+id/myTableLayout"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:padding="6dp"
    android:orientation="vertical" >
    <TableRow>
        <TextView android:text="ISBN:" />
        <EditText
            android:id="@+id/ediISBN"
            android:layout_span="3" />
    </TableRow>

    <TableRow>
        <Button
            android:id="@+id/cancel"
            android:layout_column="2"
            android:text="Cancel" />
        <Button
            android:id="@+id/ok"
            android:text="OK" />
    </TableRow>

</TableLayout>
```

Occupy 3 columns

Skip columns 0, 1

Note to the reader:
Experiment changing layout_span to 1, 2, 3

Table Layout – Stretching the Entire Table

- By default, a column is as wide as the "natural' size of the widest widget collocated in this column (e.g. a column holding a button showing the caption "Go" is narrower than other column holding a button with the caption "Cancel").
- A table does not necessarily take all the horizontal space available.
- If you want the table to (horizontally) match its container use the property:

```
android:stretchColumns="column(s)"
```

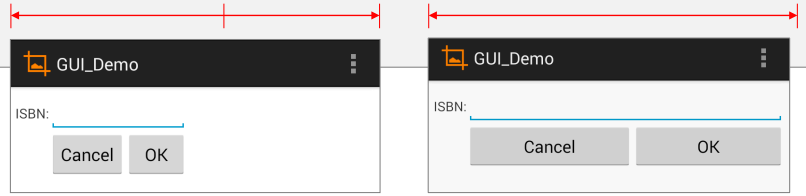
Where 'column(s)' is the column-index (or comma-separated column indices) to be stretched to take up any space still available on the row. For example, to stretch columns 0, and 2 of a table you set

```
android:stretchColumns="0,2"
```


Table Layout – Stretching the Entire Table

In Example 4 we created a table with four columns. We may elongate its columns 2, 3 to force the TableLayout to horizontally occupy the empty rest of the screen. Observe the use of the clause ':strechColumns'

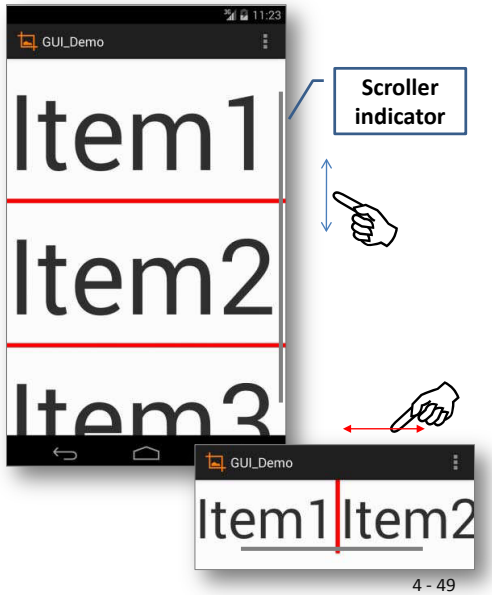
```
...
<TableLayout
 xmlns:android="http://schemas.android.com/apk/res/android"
  android:id="@+id/myTableLayout"
  android:layout_width="match_parent"
  android:layout_height="match_parent"
  android:orientation="vertical"
  android:stretchColumns="2,3"
>
...
```



Screens shown before and after using the `android:stretchColumns` clause.

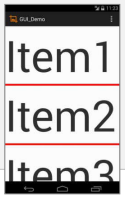
ScrollView Layout (Vertical & Horizontal)

- The **ScrollView** control is useful in situations in which we have *more data to show* than what a single screen could display.
- **ScrollViews** provide a vertical sliding (up/down) access to the data.
- The **HorizontalScrollView** provides a similar left/right sliding mechanism)
- Only a portion of the user's data can be seen at one time, however the rest is available for viewing.



Example 5. Vertical ScrollView Layout

```
<ScrollView
xmlns:android=
"http://schemas.android.com/apk/res/android"
    android:id="@+id/myVerticalScrollView1"
    android:layout_width="match_parent"
    android:layout_height="match_parent" >

    <LinearLayout
       android:id="@+id/myLinearLayoutVertical"
       android:layout_width="match_parent"
       android:layout_height="match_parent"
       android:orientation="vertical" >

       <TextView
           android:id="@+id/textView1"
           android:layout_width="match_parent"
           android:layout_height="wrap_content"
           android:text="Item1"
           android:textSize="150sp" />

        <View
            android:layout_width="match_parent"
            android:layout_height="6dp"
            android:background="#ffff0000" />

       <TextView
            android:id="@+id/textView2"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:text="Item2"
            android:textSize="150sp" />

        <View
            android:layout_width="match_parent"
            android:layout_height="6dp"
            android:background="#ffff0000" />

       <TextView
            android:id="@+id/textView3"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:text="Item3"
            android:textSize="150sp" />

    </LinearLayout>
</ScrollView>
```

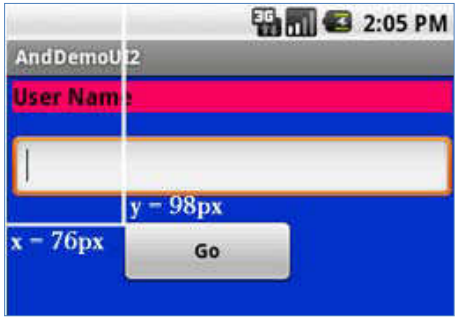


Example 6. HorizontalScrollView Layout

```
<HorizontalScrollView

xmlns:android="http://schemas.android.com/apk/r
es/android"
    android:id="@+id/myHorizontalScrollView1"
    android:layout_width="match_parent"
    android:layout_height="wrap_content" >

    <LinearLayout
       android:id="@+id/myLinearLayoutVertical"
       android:layout_width="match_parent"
       android:layout_height="match_parent"
       android:orientation="horizontal" >

       <TextView
           android:id="@+id/textView1"
           android:layout_width="match_parent"
           android:layout_height="wrap_content"
           android:text="Item1"
           android:textSize="75sp" />
        <View
           android:layout_width="6dp"
           android:layout_height="match_parent"
           android:background="#ffff0000" />

       <TextView
           android:id="@+id/textView2"
           android:layout_width="match_parent"
           android:layout_height="wrap_content"
           android:text="Item2"
           android:textSize="75sp" />

       <View
          android:layout_width="6dp"
          android:layout_height="match_parent"
          android:background="#ffff0000" />

       <TextView
          android:id="@+id/textView3"
          android:layout_width="match_parent"
          android:layout_height="wrap_content"
          android:text="Item3"
          android:textSize="75sp" />
    </LinearLayout>

</HorizontalScrollView>
```

Miscellaneous: Absolute Layout (Deprecated)

- This layout lets you specify exact locations (x/y coordinates) of its children.
- Absolute layouts are *less flexible* and harder to maintain than other types of layouts without absolute positioning.
- They DO NOT migrate well from one device to the other; not even from *portrait* to *landscape* modes in the same device!

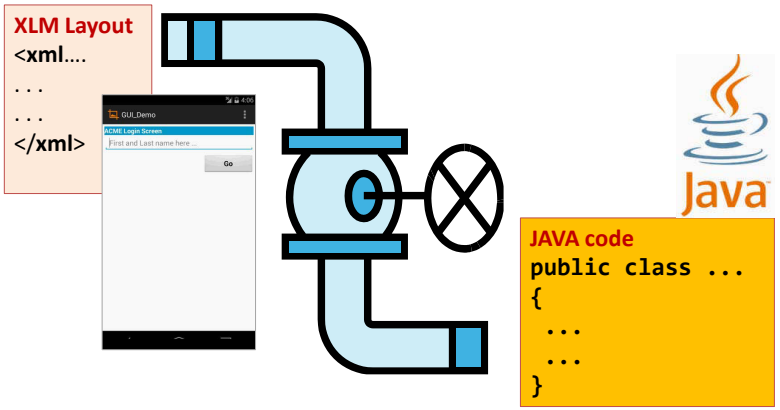


Example 7. Absolute Layout (Deprecated)

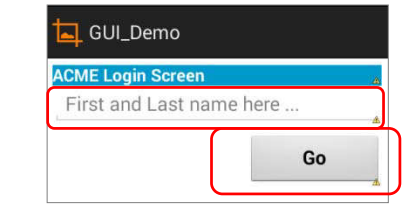
```
<?xml version="1.0" encoding="utf-8"?>
<AbsoluteLayout
android:id="@+id/myLinearLayout"
android:layout_width="match_parent"
android:layout_height="match_parent"
android:background="#ff0033cc"
android:padding="4dp"
xmlns:android="http://schemas.android.co
m/apk/res/android"
>

<TextView
android:id="@+id/tvUserName"
android:layout_width="match_paren"
android:layout_height="wrap_conten"
android:background="#ffff0066"
android:text="User Name"
android:textSize="16sp"
android:textStyle="bold"
android:textColor="#ff000000"
android:layout_x="0dp"
android:layout_y="10dp"
>
</TextView>
<EditText
android:id="@+id/etName"
android:layout_width="match_parent"
android:layout_height="wrap_content"
android:textSize="18sp"
android:layout_x="0dp"
android:layout_y="38dp"
>
</EditText>

<Button
android:layout_width="120dp"
android:text="Go"
android:layout_height="wrap_content"
android:textStyle="bold"
android:id="@+id/btnGo"
android:layout_x="100dp"
android:layout_y="170dp"  />
</AbsoluteLayout>
```

Connecting Layouts to Java Code

PLUMBING.
You must 'connect' functional XML elements –such as buttons, text boxes, check boxes- with their equivalent Java objects. This is typically done in the **onCreate(…)** method of your main activity. After all the connections are made and programmed, your app should be ready to interact with the user.



Connecting Layouts to Java Code




```
<!- XML LAYOUT -->
<LinearLayout
    android:id="@+id/myLinearLayout"
    ... >

    <TextView
        android:text="ACME Login Screen"
        ... />

    <EditText
        android:id="@+id/edtUserName"
        ... />

    <Button
        android:id="@+id/btnGo"
        ... />

</LinearLayout>
```

Java code

```
package csu.matos.gui_demo;
import android…;

public class MainActivity extends Activity {

   EditText edtUserName;

   Button   btnGo;

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

    setContentView(R.layout.activity_main);

    edtUserName = (EditText) findViewById(R.id.edtUserName);

    btnGo = (Button) findViewById(R.id.btnGo);
    ...

  }

 ...
}
```


What is the meaning of an Android Context?

An Aside

On Android, a **Context** defines a logical **workspace** on which an app can load and access resources.

- When a widget is created, it is attached to a particular Context. By means of its affiliation to that environment, it then could access other members of the hierarchy on which it has been collocated.
- For a simple '*one activity app*' -say MainActivity- the method **getApplicationContext()** and the reference **MainActivity.this** return the same result.
- An application could have **several activities**. Therefore, for a *multi-activity* app we have one app context, and a context for each of its activities, each good for accessing what is available in *that context.*

Connecting Layouts to Java Code

Assume the UI in *res/layout/activity_main.xml* has been created. This layout could be called by an application using the statement

```
setContentView(R.layout.activity_main);
```

Individual XML defined widgets, such as *btnGo* is later associated to the Java application using the statement `findViewByID(...)` as in

```
Button btnGo= (Button) findViewById(R.id.btnGo);
```

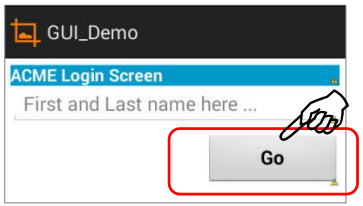
Where **R** is a class automatically generated to keep track of resources available to the application. In particular **R.id...** is the collection of widgets defined in the XML layout (Use Eclipse's Package Explorer, look at your **/gen/package/R.java** contents).

A Suggestion: The widget's identifiers used in the XML layout and Java code could be the same. It is convenient to add a prefix to each identifier indicating its nature. Some options are *txt, btn, edt, rad, chk*, etc. Try to be consistent.

Connecting Layouts to Java Code

Attaching Listeners to Widgets

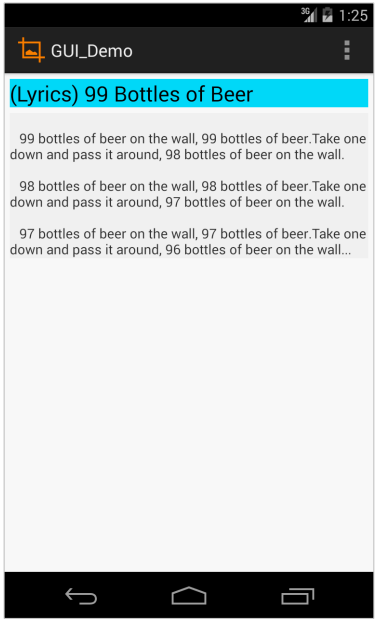
Consider the screen on the right. To make its '**Go'** button widget be responsive to the user's pushing of that button, we may add a listener for the **click event.**




```
Button btnGo = (Button) findViewById(R.id.btnGo);

btnGo.setOnClickListener(new OnClickListener() {
    @Override
    public void onClick(View v) {
        // get userName and validate against some database
        // put some more logic here...
    }
});
```

Note: Other common 'listeners' watch for events such as: textChanged, tap, long-press, select, focus, etc.

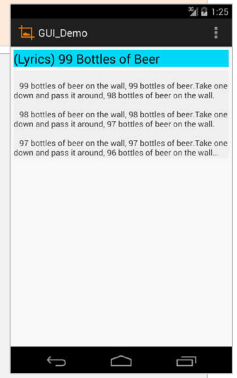
Basic Widgets: TextViews



- In Android a **label or text-box** is called a **TextView**.
- A TextView is typically used for showing a caption or a text message.
- TextViews are *not* editable, therefore they take no input.
- The text to be shown may include the **\n** formatting character (newLine)
- You may also use HTML formatting by setting the text to:
  `Html.fromHtml("<b>bold</b> string")`

For a 'colorful' rendition of the '99 Bottles of Beer' song see:
https://www.youtube.com/watch?v=3KnpZYkTWno

Basic Widgets: Example 8 - TextViews

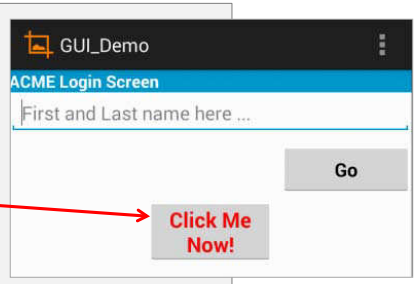



```
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    android:padding="6dp" >

    <TextView
        android:id="@+id/textView1"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:background="@color/holo_blue_bright"
        android:text="(Lyrics) 99 Bottles of Beer"
        android:textAppearance="?android:attr/textAppearanceLarge" />

    <TextView
        android:id="@+id/textView2"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_marginTop="6dp"
        android:background="@color/gray_light"
        android:text="\n\t99 bottles of beer on the wall, 99 bottles of beer.Take one down and
pass it around, 98 bottles of beer on the wall.\n\n\t98 bottles of beer on the wall, 98 bottles
of beer.Take one down and pass it around, 97 bottles of beer on the wall. \n\n\t97 bottles of
beer on the wall, 97 bottles of beer.Take one down and pass it around, 96 bottles of beer on
the wall... "
        android:textSize="14sp" />

</LinearLayout>
```


Basic Widgets: Buttons

- A **Button** widget allows the simulation of a GUI clicking action.
- **Button** is a subclass of **TextView**. Therefore formatting a button's face is similar to the setting of a **TextView**.
- You may alter the default behavior of a button by providing a custom *drawable.xml* specification to be applied as background. In those specs you indicate the shape, color, border, corners, gradient, and behavior based on states (pressed, focused). More on this issue in the appendix.

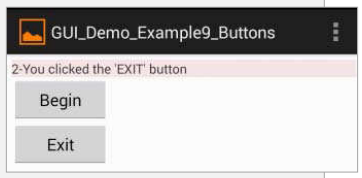
```
<Button
        android:id="@+id/btnClickMeNow"
        android:layout_width="120dp"
        android:layout_height="wrap_content"
        android:layout_gravity="center"
        android:layout_marginTop="5dp"
        android:gravity="center"
        android:padding="5dp"
        android:text="Click Me Now!"
        android:textColor="#ffff0000"
        android:textSize="20sp"
        android:textStyle="bold" />
```



Example9: Connecting Multiple Buttons

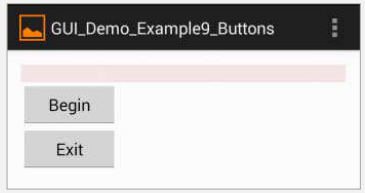
```
public class MainActivity extends Activity implements OnClickListener {
    TextView txtMsg;
    Button btnBegin;
    Button btnExit;
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main );

        txtMsg = (TextView) findViewById(R.id.txtMsg);
        btnBegin = (Button) findViewById(R.id.btnBegin);
        btnExit = (Button) findViewById(R.id.btnExit);

        btnBegin.setOnClickListener(this);
        btnExit.setOnClickListener(this);
    }//onCreate


    @Override
    public void onClick(View v) {
        if (v.getId() == btnBegin.getId()) {
            txtMsg.setText("1-You clicked the 'BEGIN' button");
        }
        if (v.getId() == btnExit.getId()) {
            txtMsg.setText("2-You clicked the 'EXIT' button");
        }

    }//onClick
}
```

This example shows an alternative way of wiring-up multiple buttons. Observe how the main activity implements the **OnClickListener** interface.
The mandatory **onClick** method checks which of the many buttons sent the signal and proceeds from there.



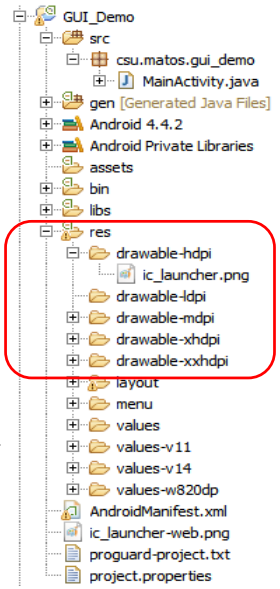
Example9: Connecting Multiple Buttons [Layout]

```
<LinearLayout 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:orientation="vertical"
    android:padding="6dp" >

    <TextView
        android:id="@+id/txtMsg"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:background="#88eed0d0" />

    <Button
        android:id="@+id/btnBegin"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:ems="5"
        android:text="Begin" />

    <Button
        android:id="@+id/btnExit"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:ems="5"
        android:text="Exit" />

</LinearLayout>
```



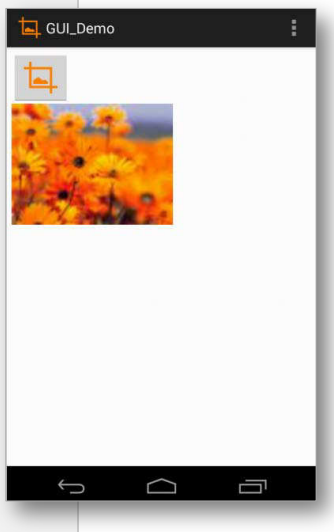
Basic Widgets: ImageView & ImageButton

- **ImageView** and **ImageButton** allow the embedding of images in your applications (gif, jpg, png, etc).
- Analogue to *TextView* and *Button* controls (respectively).
- Each widget takes an
  `android:src` or
  `android:background`
  attribute (in an XML layout) to specify what picture to use.
- Pictures are stored in the **res/drawable** folder (optionally a *medium, high, x-high, xx-high, and xxx-high* respectively definition version of the same image could be stored for later usage with different types of screens). Details available at:
  http://developer.android.com/design/style/iconography.html



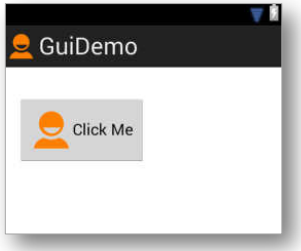
Basic Widgets: ImageView & ImageButton

```
<LinearLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:padding="6dp"
    android:orientation="vertical" >

    <ImageButton
        android:id="@+id/imgButton1"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:src="@drawable/ic_launcher" >
    </ImageButton>

    <ImageView
        android:id="@+id/imgView1"
        android:layout_width="200dp"
        android:layout_height="150dp"
        android:scaleType="fitXY"
        android:src="@drawable/flowers1" >
    </ImageView>

</LinearLayout>
```



Basic Widgets: Buttons - Combining Images & Text

A common **Button** widget could display text and a simple image as shown below

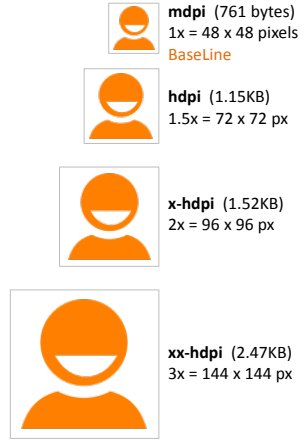



```
<LinearLayout
    . . .

 <Button
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:drawableLeft="@drawable/ic_launcher"
        android:gravity="left|center_vertical"
        android:padding="15dp"
        android:text="Click me" />

</LinearLayout>
```


Basic Widgets: How icons are used in Android?

Icons are small images used to graphically represent your application and/or parts of it. They may appear in different parts of your app including:

- Home screen
- Launcher window.
- Options menu
- Action Bar
- Status bar
- Multi-tab interface.
- Pop-up dialog boxes
- List view



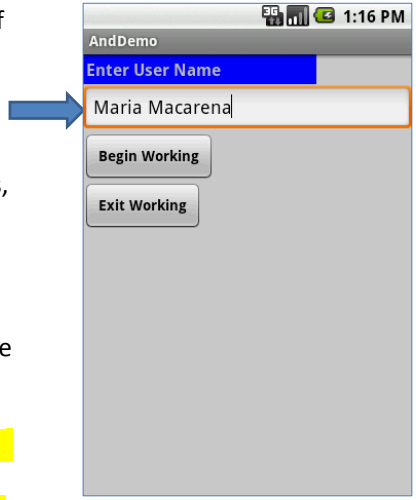
Detailed information on Android's iconography is available at: http://developer.android.com/design/style/iconography.html

HINT: Several websites allow you to convert for free your pictures to image-files under a variety of formats and sizes such as png, .jpg, .gif, etc. For instance try:
http://www.prodraw.net/favicon/index.php
http://converticon.com/

Basic Widgets: EditText Boxes

- The **EditText** widget is an extension of TextView that allows user's input.
- In addition to plain text, this widget can display **editable** text formatted with HTML-styles such as bold, italics, underline, etc). This is done with `Html.fromHtml(html_text)`
- Moving data in and out of an EditText box is usually done in Java through the following methods:

```
txtBox.setText("someValue")

txtBox.getText().toString()
```



Basic Widgets: EditText Boxes

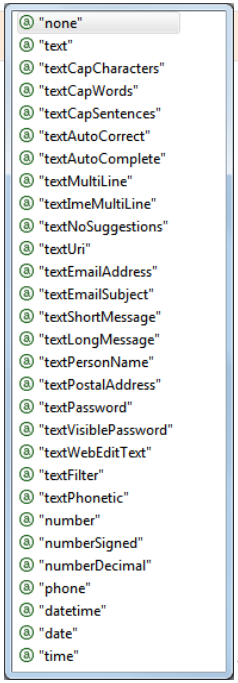
Input Type Formats

An EditText box could be set to accept input strings satisfying a particular pattern such as: numbers (with and without decimals or sign), phones, dates, times, uris, etc.

Setting the EditText box to accept a particular choice of data-type, is done through the XML clause

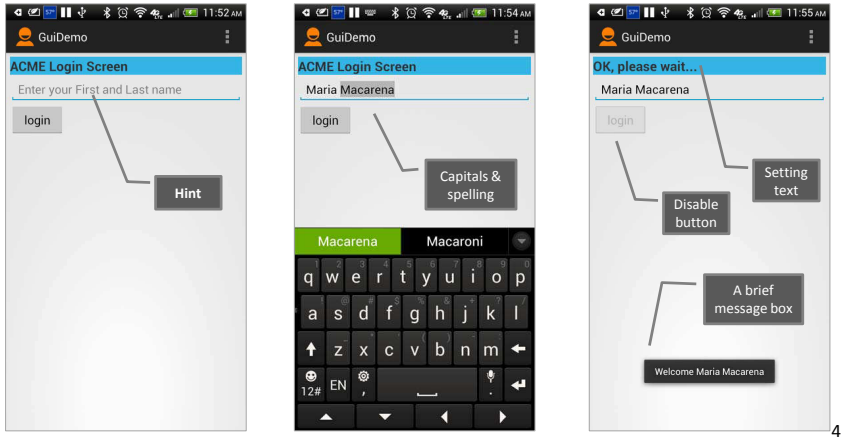
```
android:inputType="choices"
```

where **choices** include any of the single values shown in the figure. You may combine types, for instance: `textCapWords|textAutoCorrect`
Accepts text that capitalizes every word, incorrect words are automatically changed (for instance 'teh' is converted into 'the', and so on.



Example10: Login-Screen

In this example we will create a simple login screen holding a label (**TexView**), a textBox (**EditText**), and a **Button**. When the EditTex box gains focus, the system provides a **virtual keyboard** customized to the input-type given to the entry box (capitals & spelling). Clicking the button displays a Toast-message that echoes the supplied user-name.



Images from an HTC-One device

Example10: Login-Screen

LAYOUT 1 of 2

```
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    android:padding="6dp" >

    <TextView
        android:id="@+id/txtLogin"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:background="@android:color/holo_blue_light"
        android:text="@string/ACME_Login_Screen"
        android:textSize="20sp"
        android:textStyle="bold" />

    <EditText
        android:id="@+id/edtUserName"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_marginTop="2dp"
        android:hint="@string/Enter_your_First_and_Last_name"
        android:inputType="textCapWords|textAutoCorrect"
        android:textSize="18sp" >
        <requestFocus />
    </EditText>
```


Example10: Login-Screen

LAYOUT 2 of 2

```
    <Button
        android:id="@+id/btnLogin"
        android:layout_width="82dp"
        android:layout_height="wrap_content"
        android:layout_marginTop="2dp"
        android:text="@string/Login" />
</LinearLayout>
```

res/values/strings.xml

```
<?xml version="1.0" encoding="utf-8"?>
<!-- this is the res/values/strings.xml file -->
<resources>

    <string name="app_name">GuiDemo</string>
    <string name="action_settings">Settings</string>
    <string name="Login">Login</string>
    <string name="ACME_Login_Screen">ACME Login Screen</string>
    <string name="Enter_your_First_and_Last_name">Enter your First and Last name</string>

</resources>
```

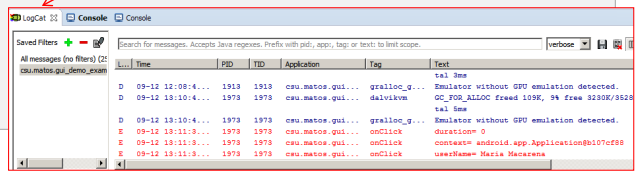

Example10: Login-Screen - MainActivity 1 of 3

```
public class MainActivity extends ActionBarActivity {

 // class variables representing UI controls to be controlled from the Java program
 TextView txtLogin;
 EditText edtUserName;
 Button btnLogin;

 // variables used with the Toast message class
 private Context context;
 private int duration = Toast.LENGTH_SHORT;

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

  // show the login screen
  setContentView(R.layout.activity_main);
  context = getApplicationContext();

  // binding the UI's controls defined in "main.xml" to Java code
  txtLogin = (TextView) findViewById(R.id.txtLogin);
  edtUserName = (EditText) findViewById(R.id.edtUserName);
  btnLogin = (Button) findViewById(R.id.btnLogin);
```

Example10: Login-Screen - MainActivity 2 of 3

```
// LISTENER: allowing the button widget to react to user interaction
btnLogin.setOnClickListener(new OnClickListener() {
 @Override
 public void onClick(View v) {

  String userName = edtUserName.getText().toString();

  Log.e("onClick ", "duration= " + duration);
  Log.e("onClick ", "context= " + context.toString());
  Log.e("onClick ", "userName= " + userName);

  if (userName.equals("Maria Macarena")) {
   txtLogin.setText("OK, please wait...");
   Toast.makeText(getApplicationContext(),
     "Welcome " + userName, duration).show();
   btnLogin.setEnabled(false);
  } else {
   Toast.makeText(context, userName + "  is not a valid USER",
     duration).show();
  }
 }
});// onClick

}// onCreate
```

Log.e used for debugging – *remove later*!!!



Example10: Login-Screen - MainActivity 3 of 3

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


Programming …

Your turn!

(working as a minimalist developer)

Implement any/all of the following projects using simple UI controls (EditText, TextView, buttons)

1. Currency Exchange calculator
2. Tip Calculator
3. Simple Flashlight

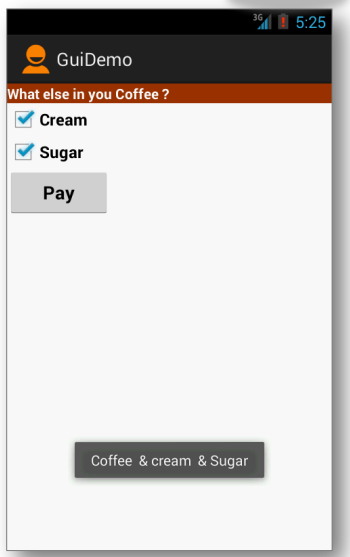
Basic Widgets: CheckBoxes

A checkbox is a special **two-states** button which can be either *checked* or *unchecked*.

A screen may include any number of **mutually inclusive** (independent) CheckBoxes. At any time, more than one CheckBox in the GUI could be checked.

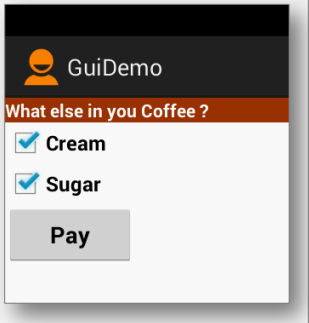
In our "CaféApp" example, the screen on the right displays two CheckBox controls, they are used for selecting 'Cream' and 'Sugar' options. In this image both boxes are 'checked'.

When the user pushes the 'Pay' button a Toast-message is issue echoing the current combination of choices held by the checkboxes.



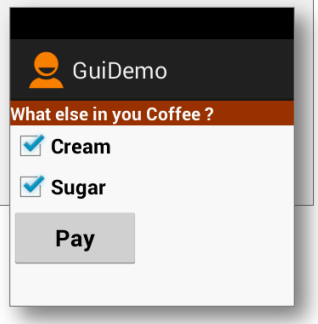
Example11: CheckBoxes – CaféApp [Layout 1 of 2]

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:padding="6dp"
    android:orientation="vertical" >

    <TextView
        android:id="@+id/labelCoffee"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:background="#ff993300"
        android:text="@string/coffee_addons"
        android:textColor="@android:color/white"
        android:textStyle="bold" />

    <CheckBox
        android:id="@+id/chkCream"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="@string/cream"
        android:textStyle="bold" />
```



Example11: CheckBoxes – CaféApp [Layout 2 of 2]

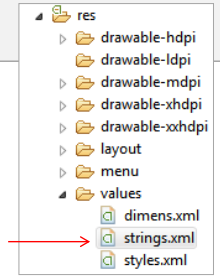
```
    <CheckBox
        android:id="@+id/chkSugar"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="@string/sugar"
        android:textStyle="bold" />

    <Button
        android:id="@+id/btnPay"
        android:layout_width="153dp"
        android:layout_height="wrap_content"
        android:text="@string/pay"
        android:textStyle="bold" />

</LinearLayout>
```



Example11: CheckBoxes – CaféApp [@string/…]

Resources: res/values/strings

```
<?xml version="1.0" encoding="utf-8"?>
<resources>

    <string name="app_name">GuiDemo</string>
    <string name="action_settings">Settings</string>

    <string name="click_me">Click Me</string>
    <string name="sugar">Sugar</string>
    <string name="cream">Cream</string>
    <string name="coffee_addons">What else in your coffee?</string>
    <string name="pay">Pay</string>
</resources>
```



Example11: CheckBoxes – CaféApp [Code 1 of 2]

```
public class MainActivity extends Activity {

    CheckBox chkCream;
    CheckBox chkSugar;
    Button btnPay;

    @Override
    public void onCreate(Bundle savedInstanceState) {

        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);

        //binding XML controls with Java code
        chkCream = (CheckBox)findViewById(R.id.chkCream);
        chkSugar = (CheckBox)findViewById(R.id.chkSugar);
        btnPay = (Button) findViewById(R.id.btnPay);
```

Example11: CheckBoxes – CaféApp [Code 2 of 2]

```
 //LISTENER: wiring button-events-&-code
        btnPay.setOnClickListener(new OnClickListener() {

@Override
public void onClick(View v) {
   String msg = "Coffee ";
   if (chkCream.isChecked()) {
      msg += " & cream ";
   }
   if (chkSugar.isChecked()){
      msg += " & Sugar";
   }
   Toast.makeText(getApplicationContext(),
                  msg, Toast.LENGTH_SHORT).show();
   //go now and compute cost...

   }//onClick
   });

  }//onCreate

}//class
```


Basic Widgets: CheckBoxes

- A **radio button** (like a CheckBox) is a two-states button that can be either *checked* or *unchecked*.
- Logically related radio buttons are normally put together in a **RadioGroup** container. The container forces the enclosed radio buttons to behave as **mutually exclusive selectors.** That is, the checking of one radio button *unchecks* all the others.
- Properties for *font face, style, color,* etc. are managed in a way similar to setting a TextView.
- You may call the method ***isChecked()*** to see if a specific RadioButton is selected, or change its state by calling **toggle()**.

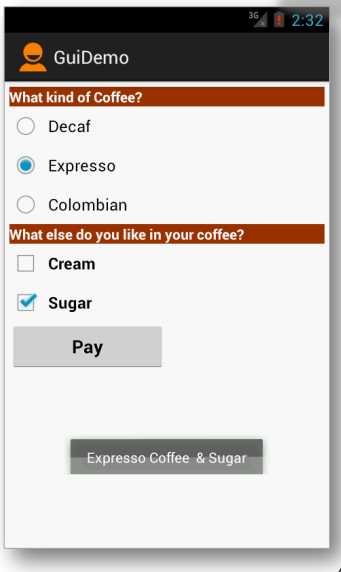
Example12: CheckBoxes – CaféApp [Layout]

Example

*We extend the previous CaféApp example by adding a **RadioGroup** control that allows the user to pick one type of coffee from three available options.*

RadioGroup

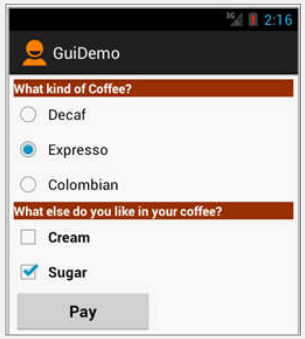
Summary of choices



Example12: CheckBoxes – CaféApp [Layout]

Based on Example11 - Only new XML and Java code is shown

```
<TextView
      android:id="@+id/textView1"
      android:layout_width="match_parent"
      android:layout_height="wrap_content"
      android:background="#ff993300"
      android:text="@string/kind_of_coffee"
      android:textColor="#ffffff"
      android:textStyle="bold" />
```




```
<RadioGroup
      android:id="@+id/radioGroupCoffeeType"
      android:layout_width="match_parent"
      android:layout_height="wrap_content" >

      <RadioButton
          android:id="@+id/radDecaf"
          android:layout_width="wrap_content"
          android:layout_height="wrap_content"
          android:text="@string/decaf" />

      <RadioButton
          android:id="@+id/radExpresso"
          android:layout_width="wrap_content"
          android:layout_height="wrap_content"
          android:text="@string/expresso" />

      <RadioButton
          android:id="@+id/radColombian"
          android:layout_width="wrap_content"
          android:layout_height="wrap_content"
          android:checked="true"
          android:text="@string/colombian" />
</RadioGroup>
```

Example12: CheckBoxes – CaféApp [MainActivity]

```
public class MainActivity extends Activity {

   CheckBox chkCream;
   CheckBox chkSugar;
   Button btnPay;

   RadioGroup radCoffeeType;
     RadioButton radDecaf;
     RadioButton radExpresso;
     RadioButton radColombian;

   @Override
   public void onCreate(Bundle savedInstanceState) {
      super.onCreate(savedInstanceState);
      setContentView(R.layout.main);

      chkCream = (CheckBox) findViewById(R.id.chkCream);
      chkSugar = (CheckBox) findViewById(R.id.chkSugar);
      btnPay = (Button) findViewById(R.id.btnPay);

      radCoffeeType = (RadioGroup) findViewById(R.id.radioGroupCoffeeType);

      radDecaf = (RadioButton) findViewById(R.id.radDecaf);
      radExpresso = (RadioButton) findViewById(R.id.radExpresso);
      radColombian = (RadioButton) findViewById(R.id.radColombian);
```


Example12: CheckBoxes – CaféApp [MainActivity]

```
      // LISTENER: wiring button-events-&-code
      btnPay.setOnClickListener(new OnClickListener() {
         @Override
         public void onClick(View v) {
            String msg = "Coffee ";
            if (chkCream.isChecked())
               msg += " & cream ";
            if (chkSugar.isChecked())
               msg += " & Sugar";

            // get selected radio button ID number
            int radioId = radCoffeeType.getCheckedRadioButtonId();

            // compare selected's Id with individual RadioButtons ID
            if (radColombian.getId() == radioId)
               msg = "Colombian " + msg;
            // similarly you may use .isChecked() on each RadioButton
            if (radExpresso.isChecked())
               msg = "Expresso " + msg;
            // similarly you may use .isChecked() on each RadioButton
            if (radDecaf.isChecked())
               msg = "Decaf " + msg;

            Toast.makeText(getApplicationContext(), msg, 1).show();
            // go now and compute cost...
         }// onClick
      });
   }// onCreate

}// class
```


Example12: CheckBoxes – CaféApp [MainActivity]

Programming Note

```
radGroupradioId = (RadioGroup)findViewById(R.id.radioGroup1);

int radioId  = radGroupradioId.getCheckedRadioButtonId();

switch (radioId) {
  case R.id.radColombian: msg += " Colombian "; break;
  case R.id.radExpresso: msg += " Expresso "; break;
  case R.id.radDecaf: msg += " Decaf "; break;
}
```

Alternative you may also manage a **RadioGroup** as follows (this is simpler because you don't need to define the individual RadioButtons

Miscellaneous: Useful UI Attributes & Java Methods

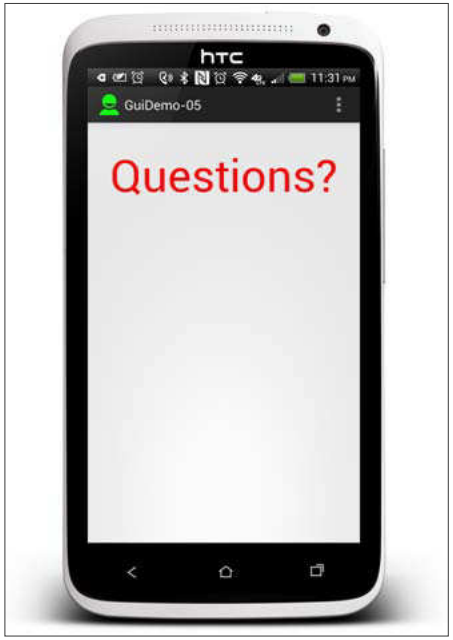
XML Controls the focus sequence:

```
android:visibility     true/false set visibility
android:background     color, image, drawable
<requestFocus />       react to user's interaction
```

Java methods

```
myButton.requestFocus()
myTextBox.isFocused()
myWidget.setEnabled()
myWidget.isEnabled()
```

User Interfaces



This image was made using the *Device Frame Generator*, which is part of the **Android Asset Studio tool**

http://romannurik.github.io/AndroidAssetStudio/

Appendix A. Using the @string resource

A *good programming practice* in Android is **NOT** to directly enter literal strings as immediate values for attribute inside xml files.

For example, if you are defining a **TextView** to show a company headquarter's location, a clause such as `android:text="Cleveland"` should not be used (observe it produces a **Warning** *`[I18N] Hardcoded string "Cleveland", should use @string resource`*)

Instead you should apply a two steps procedure in which

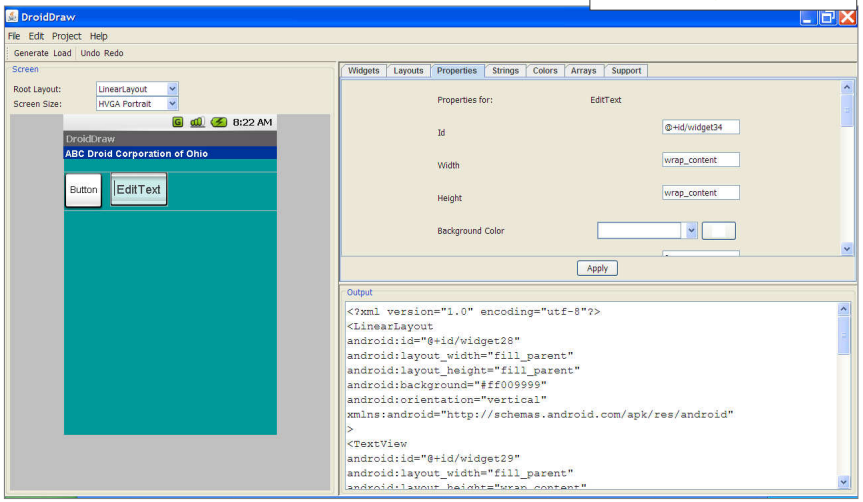
1. You write the literal string –say *headquarter* – in **res/values/string.xml.** Enter
   `<string name="headquarter">Cleveland</string>`

2. Whenever the string is needed provide a reference to the string using the notation *@string/headquarter*. For instance in our example you should enter
   `android:text="@string/headquarter"`

WHY?
If the string is used in many places and its actual value changes we just update the resource file entry once. It also provides some support for internationalization -easy to change a resource string from one language to another.

Appendix B. DroidDraw

A simple (but aging) GUI generator
LINK: www.droidDraw.org



Appendix C. Android Asset Studio

LINK: http://romannurik.github.io/AndroidAssetStudio/ [Visited on 9/14/2014]

This tool offers a number of options to craft high-quality icons and other displayed elements typically found in Android apps.

Icon Generators	Other Generators	Community Tools
Launcher icons Action bar and tab icons Notification icons Navigation drawer indicator Generic icons	Device frame generator Simple nine-patch gen.	Android Action Bar Style Generator Android Holo Colors Generator

Appendix D. Measuring Graphic Elements

Q. What is **dpi** (also know as **dp** and **ppi**) ?
Stands for *dots per inch*. It suggests a measure of screen quality.
You can compute it using the following formula:

$$dpi = \sqrt{widthPixels^2 + heightPixels^2} \;/\; diagonalInches$$

G1 (base device 320x480)	155.92 dpi	(3.7 in diagonally)
Nexus (480x800)	252.15 dpi	
HTC One (1080x1920)	468 dpi	(4.7 in)
Samsung S4 (1080x1920)	441 dpi	(5.5 in)

Q. What is the difference between **dp, dip** and **sp** units in Android?

dp *Density-independent Pixels* – is an abstract unit based on the physical density of the screen. These units are relative to a 160 dpi screen, so one dp is one pixel on a 160 dpi screen. Use it for measuring anything but fonts.

sp
Scale-independent Pixels – similar to the relative density dp unit, but used for **font** size preference.

Appendix D. Measuring Graphic Elements

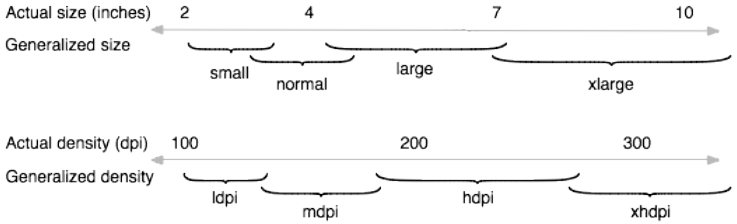
How Android deals with screen resolutions?
Illustration of how the Android platform maps actual screen densities and sizes to generalized density and size configurations.

A set of four generalized **screen sizes**

xlarge	screens are at least 960dp x 720dp
large	screens are at least 640dp x 480dp
normal	screens are at least 470dp x 320dp
small	screens are at least 426dp x 320dp

A set of six generalized **densities**:

ldpi	~120dpi (low)
mdpi	~160dpi (medium)
hdpi	~240dpi (high)
xhdpi	~320dpi (extra-high)
xxhdpi	~480dpi (extra-extra-high)
Xxxhdpi	~640dpi (extra-extra-extra-high)



Taken from: http://developer.android.com/guide/practices/screens_support.html

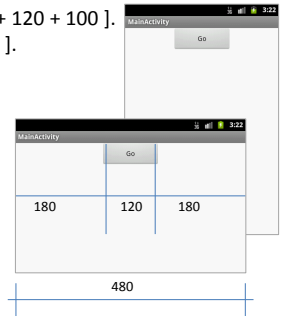
Appendix D. Measuring Graphic Elements

Q. Give me an example on how to use dp units.
Assume you design your interface for a G1 phone having 320x480 pixels (Abstracted density is **160** – See your AVD entry, the actual pixeling is defined as: [2***160]** x [3***160]**)

Assume you want a 120dp button to be placed in the middle of the screen.
On portrait mode you could allocate the 320 horizontal pixels as [100 + 120 + 100].
On Landscape mode you could allocate 480 pixels as [180 + 120 + 180].

The XML would be

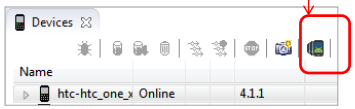
```
<Button
    android:id="@+id/button1"
    android:layout_height="wrap_content"
    android:layout_width="120dp"
    android:layout_gravity="center"
    android:text="@+id/go_caption" />
```

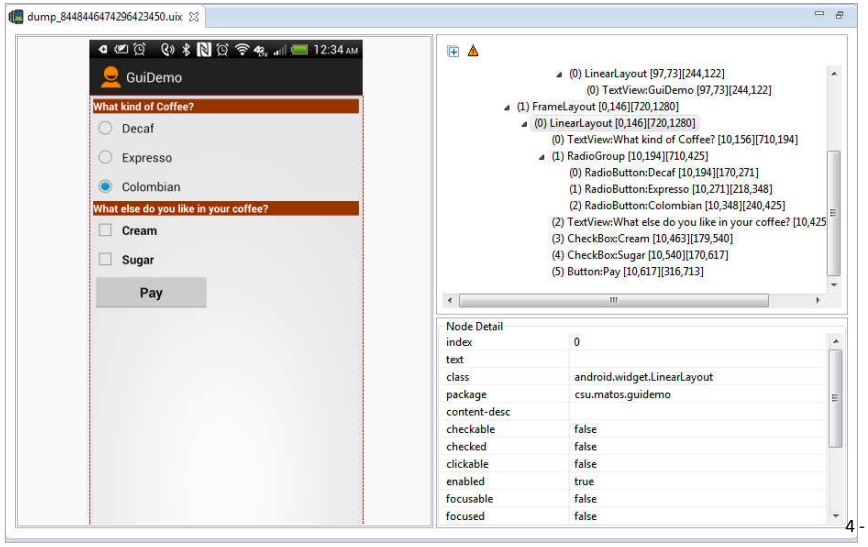


If the application is deployed on devices having a higher resolution the button is still mapped to the middle of the screen.

Appendix E. Hierarchy Viewer Tool

The HierarchyViewer Tool allows exploration of a displayed UI. Use **DDMS** > Click on Devices > Click on HierarchyViewer icon (next to camera)





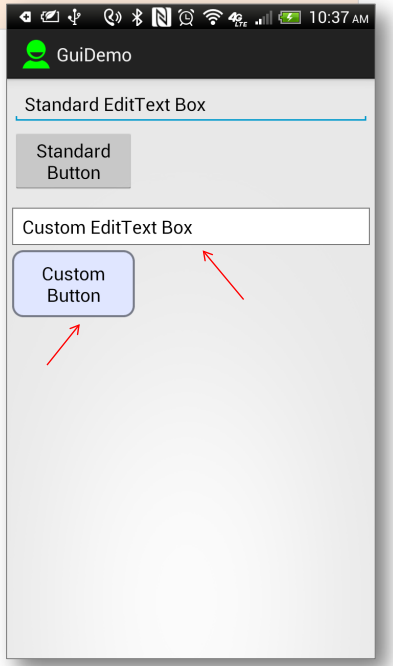
Appendix F. Customizing Widgets

1. The appearance of a widget can be adjusted by the user. For example a button widget could be modified by changing its shape, border, color, margins, etc.

2. Basic shapes include: rectangle, oval, line, and ring.

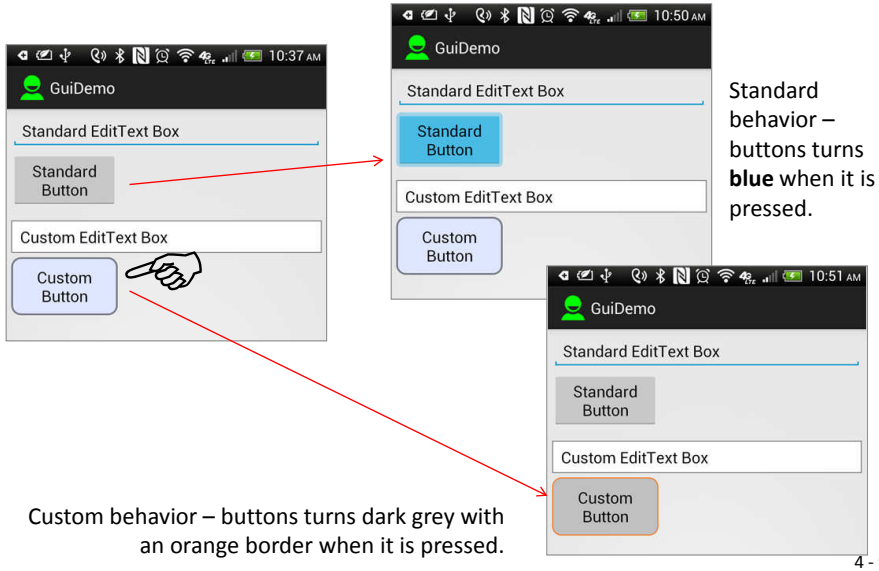
3. In addition to visual changes, the widget's reaction to user interaction could be adjusted for events such as: Focused, Clicked, etc.

4. The figure shows and EditText and Button widgets as *normally* displayed by a device running SDK4.3 (Ice Cream). The bottom two widgets (a TextView and a Button) are custom made versions of those two controls respectively.



Appendix F. Customizing Widgets

The image shows visual feedback provided to the user during the clicking of a standard and a *custom* Button widget. Assume the device runs under SDK4.3.

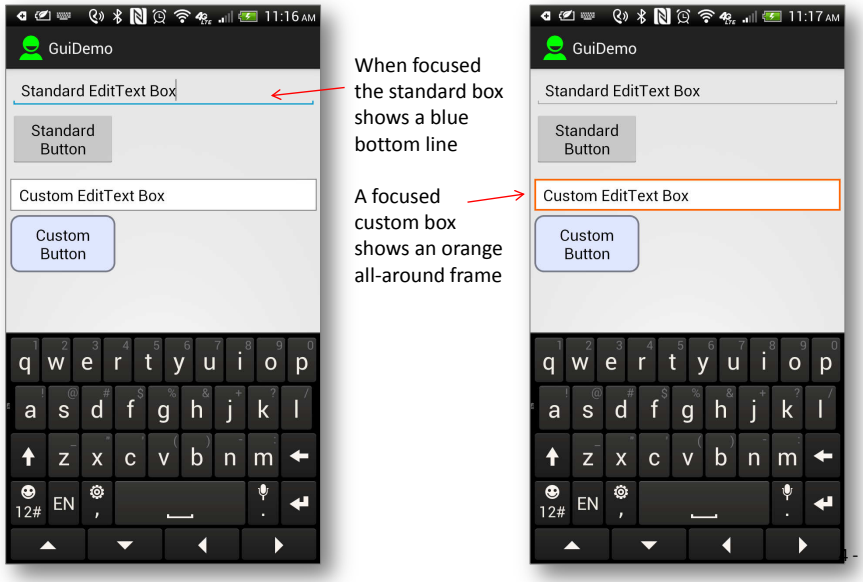


Standard behavior – buttons turns **blue** when it is pressed.

Custom behavior – buttons turns dark grey with an orange border when it is pressed.

Appendix F. Customizing Widgets

Observe the transient response of the standard and custom made EditText boxes when the user touches the widgets provoking the 'Focused' event.

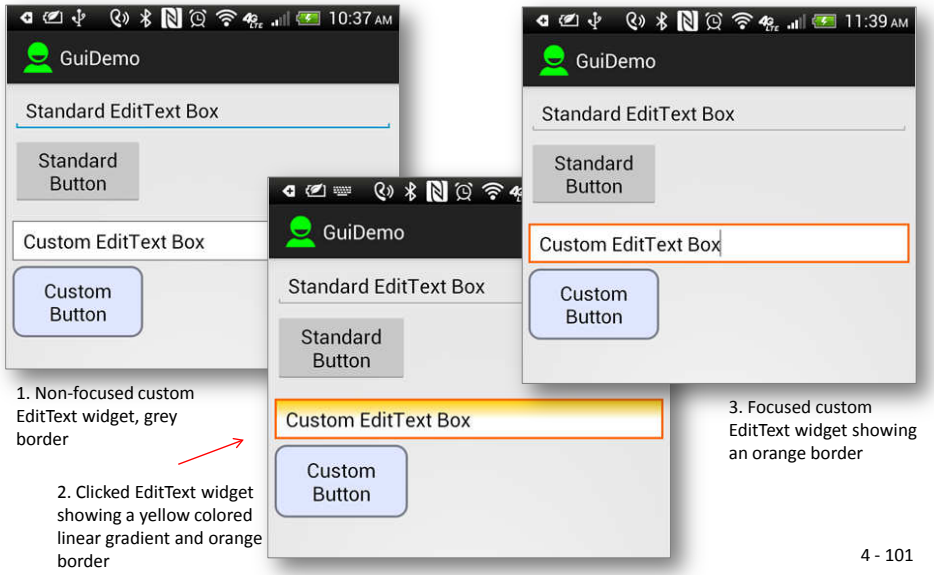


When focused the standard box shows a blue bottom line

A focused custom box shows an orange all-around frame

Appendix F. Customizing Widgets

When the user taps on the custom made EditText box a gradient is applied to the box to flash a visual feedback reassuring the user of her selection.



1. Non-focused custom EditText widget, grey border

2. Clicked EditText widget showing a yellow colored linear gradient and orange border

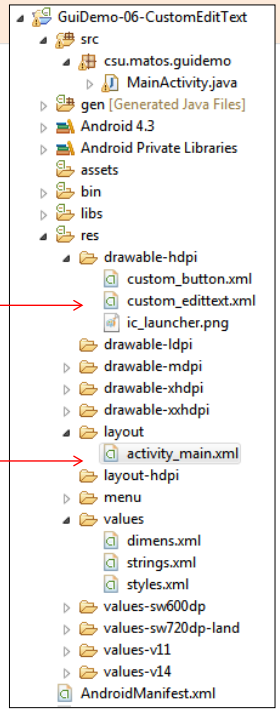
3. Focused custom EditText widget showing an orange border

Appendix F. Customizing Widgets

Organizing the application

Definition of the custom templates for Button and EditText widgets

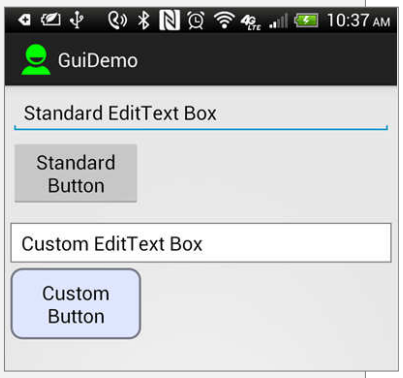
Layout referencing standard and custom made widgets



Appendix F. Customizing Widgets

Activity Layout 1 of 2

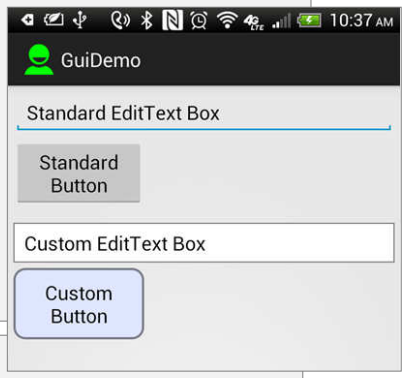
```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    android:padding="5dp" >

    <EditText
        android:id="@+id/editText1"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_marginBottom="5dp"
        android:ems="10"
        android:inputType="text"
        android:text="@string/standard_edittext" >

        <requestFocus />
    </EditText>

    <Button
        android:id="@+id/button1"
        android:layout_width="120dp"
        android:layout_height="wrap_content"
        android:layout_marginBottom="15dp"
        android:text="@string/standard_button" />
```



Appendix F. Customizing Widgets

Activity Layout (2 of 2) and **Resource: res/values/strings**

```
    <EditText
        android:id="@+id/editText2"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_marginBottom="5dp"
        android:background="@drawable/custom_edittext"
        android:ems="10"
        android:inputType="text"
        android:text="@string/custom_edittext" />

    <Button
        android:id="@+id/button2"
        android:layout_width="120dp"
        android:layout_height="wrap_content"
        android:background="@drawable/custom_button"
        android:text="@string/custom_button" />

</LinearLayout>
```



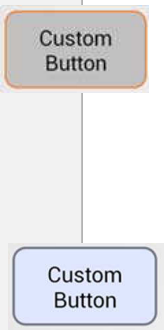

```
<?xml version="1.0" encoding="utf-8"?>
<resources>
    <string name="app_name">GuiDemo</string>
    <string name="action_settings">Settings</string>
    <string name="standard_button">Standard Button</string>
    <string name="standard_edittext">Standard EditText Box</string>
    <string name="custom_button">Custom Button</string>
    <string name="custom_edittext">Custom EditText Box</string>
</resources>
```


Appendix F. Customizing Widgets

Resource: res/drawable/custom_button.xml

The custom Button widget has two faces based on the event **state_pressed** (true, false). The Shape attribute specifies its solid color, padding, border (stroke) and corners (rounded corners have radius > 0)

```
<?xml version="1.0" encoding="utf-8"?>
<selector xmlns:android="http://schemas.android.com/apk/res/android" >
    <item android:state_pressed="true">
        <shape android:shape="rectangle">
            <corners  android:radius="10dp"/>
            <solid    android:color="#ffc0c0c0" />
            <padding  android:left="10dp"
                      android:top="10dp"
                      android:right="10dp"
                      android:bottom="10dp"/>
            <stroke   android:width="1dp" android:color="#ffFF6600"/>
        </shape>
    </item>
    <item android:state_pressed="false">
        <shape android:shape="rectangle">
            <corners  android:radius="10dp"/>
            <solid    android:color="#ffE0E6FF"/>
            <padding  android:left="10dp"
                      android:top="10dp"
                      android:right="10dp"
                      android:bottom="10dp"/>
            <stroke   android:width="2dp" android:color="#ff777B88"/>
        </shape>
    </item>
</selector>
```



Appendix F. Customizing Widgets

Resource: res/drawable/custom_edittext.xml

The rendition of the custom made EditText widget is based on three states: normal, state_focused, state_pressed.

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

<item android:state_pressed="true">
    <shape android:shape="rectangle">
          <gradient
                android:angle="90"
                android:centerColor="#FFffffff"
                android:endColor="#FFffcc00"
                android:startColor="#FFffffff"
                android:type="linear" />

        <stroke   android:width="2dp"
                  android:color="#FFff6600" />
        <corners  android:radius="0dp" />
        <padding  android:left="10dp"
                  android:top="6dp"
                  android:right="10dp"
                  android:bottom="6dp" />
    </shape>
</item>
```

Custom EditText Box

Appendix F. Customizing Widgets

Resource: res/drawable/custom_edittext.xml

The rendition of the custom made EditText widget is based on three states: normal, state focused, state_pressed.

```
<item android:state_focused="true">
    <shape>
        <solid    android:color="#FFffffff" />
        <stroke   android:width="2dp" android:color="#FFff6600" />
        <corners  android:radius="0dp" />
        <padding  android:left="10dp"
                  android:top="6dp"
                  android:right="10dp"
                  android:bottom="6dp" />
    </shape>
</item>

<item>
    <!-- state: "normal" not-pressed & not-focused  -->
    <shape>
        <stroke   android:width="1dp" android:color="#ff777777" />
        <solid    android:color="#ffffffff" />
        <corners  android:radius="0dp" />
        <padding  android:left="10dp"
                  android:top="6dp"
                  android:right="10dp"
                  android:bottom="6dp" />
    </shape>
</item>
</selector>
```

Custom EditText Box

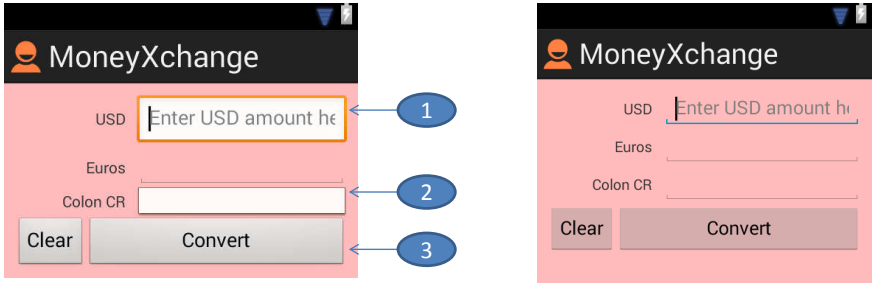
Custom EditText Box

Appendix G: Fixing Bleeding Background Color

You may change a layout's color by simply adding in the XML layout the clause `android:background="#44ff0000"` (color is set to semi-transparent red).

The problem is that the layout color appears to be placed on top of the other controls making them look 'smeared' as show in the figure below (right).

Although tedious, a solution is to reassert the smeared widgets' appearance by explicitly setting a value in their corresponding `android:background` XML attributes. The figure on the left includes explicit assignments to the widgets' background.



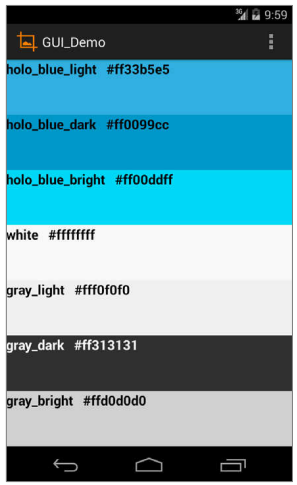

```
1. android:background="@android:drawable/edit_text"
2. android:background="@android:drawable/editbox_dropdown_light_frame"
3. android:background="@android:drawable/btn_default"
```


Appendix H: Useful Color Theme (Android Holo)

The screen shows color included in Android's **Holo-Theme.** The Holo-Theme color set provides a palette of *harmonious* colors recommended for all your applications.
Benefits: uniform design, homogeneous user-experience, beauty(?)…

You may want to add the following entries to your **res/values/colors.xml** file. Example of usage:
`android:background="@color/holo_blue_light"`

```
<?xml version="1.0" encoding="utf-8"?>
<resources>

    <color name="holo_blue_light">#ff33b5e5</color>
    <color name="holo_blue_dark">#ff0099cc</color>
    <color name="holo_blue_bright">#ff00ddff</color>
    <color name="gray_light">#fff0f0f0</color>
    <color name="gray_dark">#ff313131</color>
    <color name="gray_bright">#ffd0d0d0</color>

</resources>
```



For a **long** list of HEX colors to be copied in your **res/values/colors.xml** resource file see http://stackoverflow.com/questions/3769762/android-color-xml-resource-file