CS 4518 Mobile and Ubiquitous Computing
Lecture 2: Introduction to Android Programming

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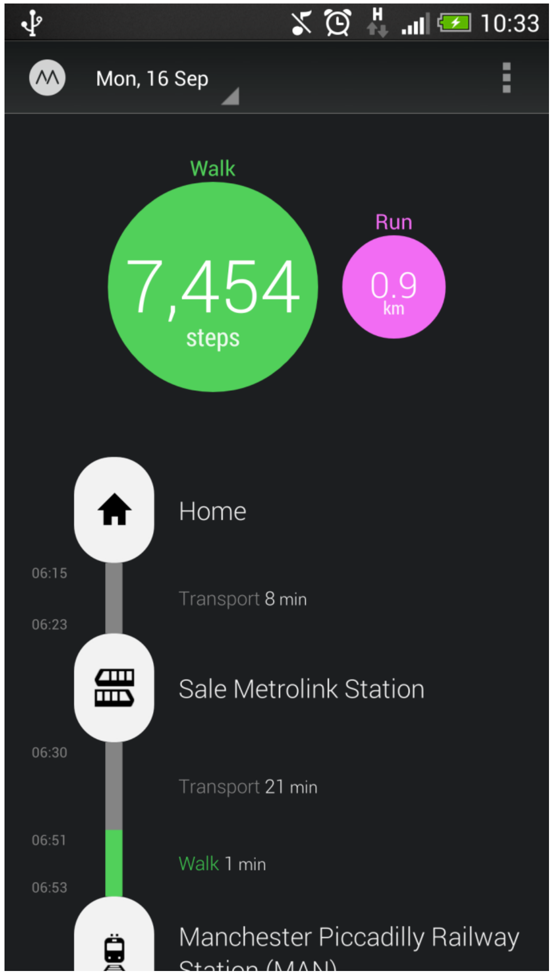
Android Apps: Big Picture

UI Design using XML

- UI design code (XML) separate from the program (Java)
- Why? Can modify UI without changing Java program
- **Example:** Shapes, colors can be changed in XML file without changing Java program
- UI designed using either:
  - Drag-and drop graphical (WYSIWYG) tool or
  - Programming Extensible Markup Language (XML)
- **XML:** Markup language, both human-readable and machine-readable''



Android App Compilation

- Android Studio compiles code, data and resource files into **Android PacKage (filename.apk)**.
  - .apk is similar to .exe on Windows

- Apps download from Google Play, or copied to device as **filename.apk**

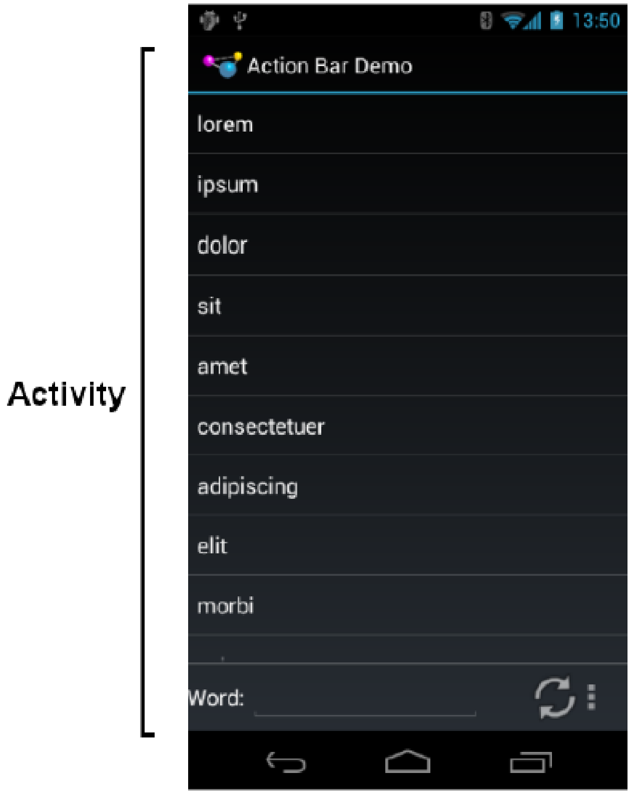
- Installation = installing **apk file**

Activities

- Activity? 1 Android screen or dialog box
- Apps
  - Have at least 1 activity that deals with UI
  - Entry point, similar to **main( )** in C
  - Typically have multiple activities

- Example: A camera app
  - **Activity 1:** to focus, take photo, launch activity 2
  - **Activity 2:** to view photo, save it

- Activities
  - independent of each other
  - E.g. Activity 1 can write data, read by activity 2
  - App Activities derived from Android's **Activity** class



Our First Android App

3 Files in “Hello World” Android Project

- **Activity_my.xml:** XML file specifying screen layout

- **MainActivity.Java:** Java code to define behavior, actions taken when button clicked (intelligence)

- **AndroidManifest.xml:**
  - Lists all screens, components of app
  - Analogous to a table of contents for a book
  - E.g. Hello world program has 1 screen, so AndroidManifest.xml has 1 item listed
  - App starts running here (like main( ) in C)

- **Note:** Android Studio creates these 3 files for you

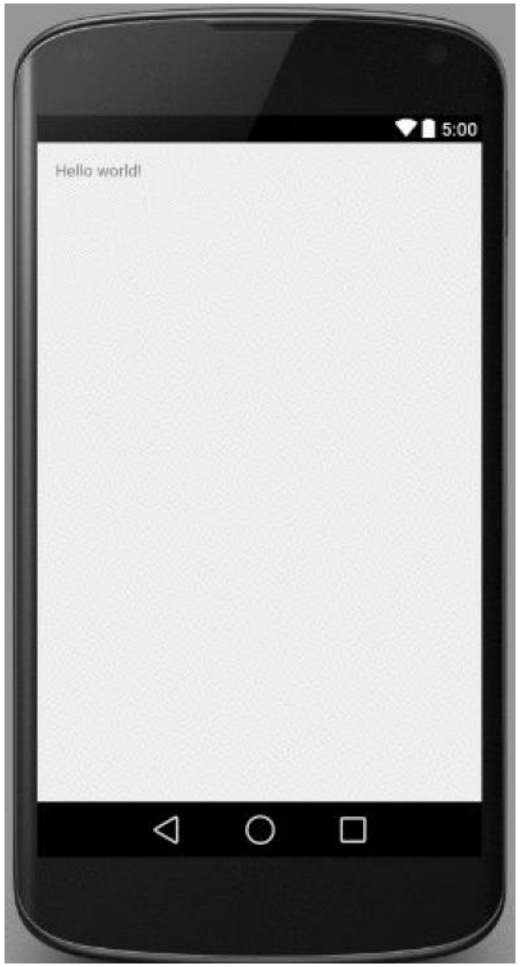
Execution Order

Next: Samples of AndroidManifest.xml
Hello World program

Start in AndroidManifest.xml
Read list of activities (screens)
Start execution from Activity
tagged Launcher

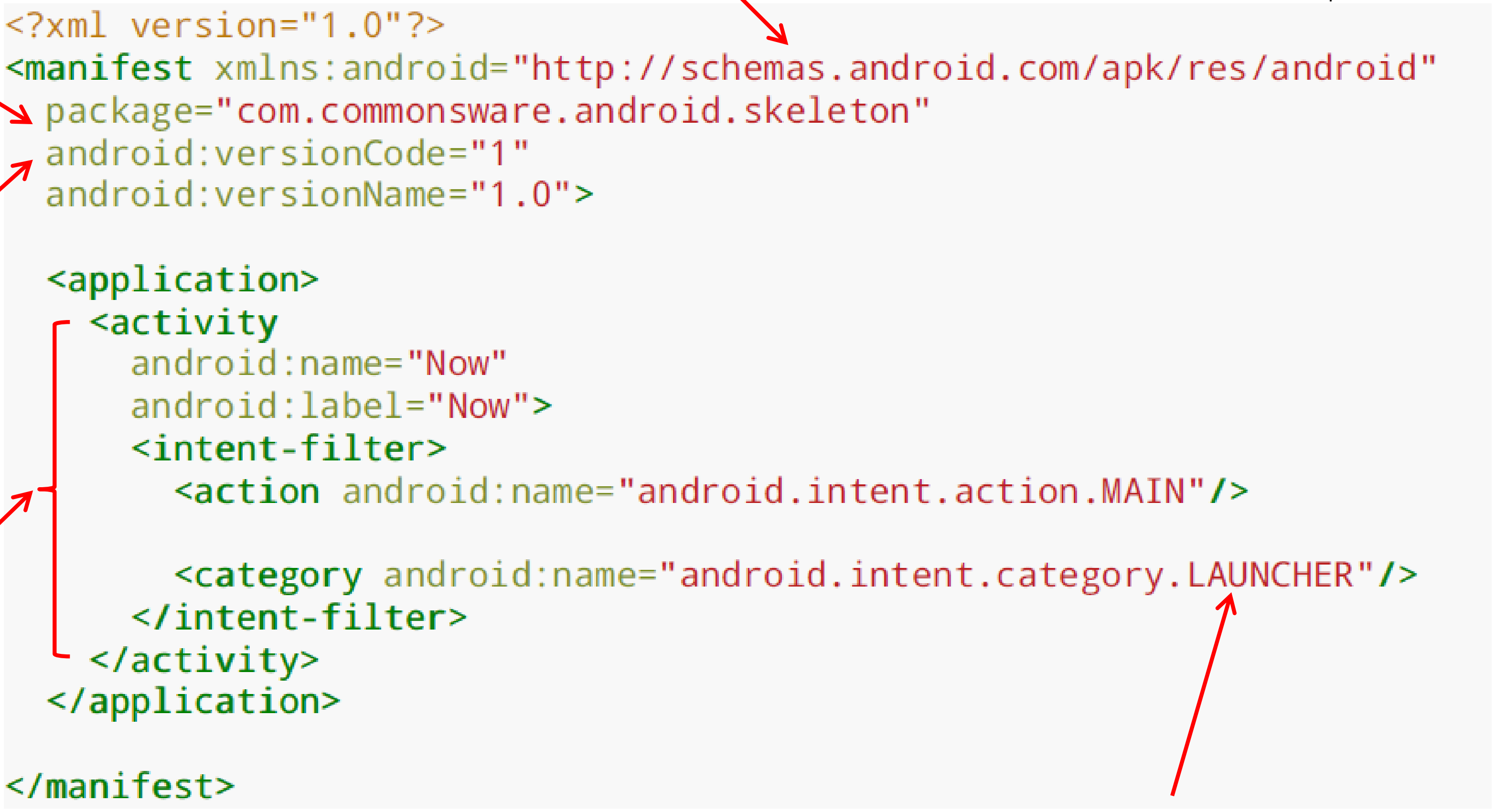
Create/execute activities
(declared in java files)
E.g. MainActivity.Java

Format each activity using layout
In XML file (e.g. Activity_my.xml)



Inside “Hello World” AndroidManifest.xml

This file is written using xml namespace and tags and rules for android



```
<?xml version="1.0"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
  package="com.commonsware.android.skeleton"
  android:versionCode="1"
  android:versionName="1.0">

  <application>
    <activity
      android:name="Now"
      android:label="Now">
      <intent-filter>
        <action android:name="android.intent.action.MAIN"/>

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

</manifest>
```

Your package name

Android version

List of activities (screens) in your app

One activity (screen) designated LAUNCHER. The app starts running here

Execution Order

Start in AndroidManifest.xml
Read list of activities (screens)
Start execution from Activity
tagged Launcher

Next

Create/execute activities
(declared in java files)
E.g. MainActivity.Java

Format each activity using layout
In XML file (e.g. Activity_my.xml)

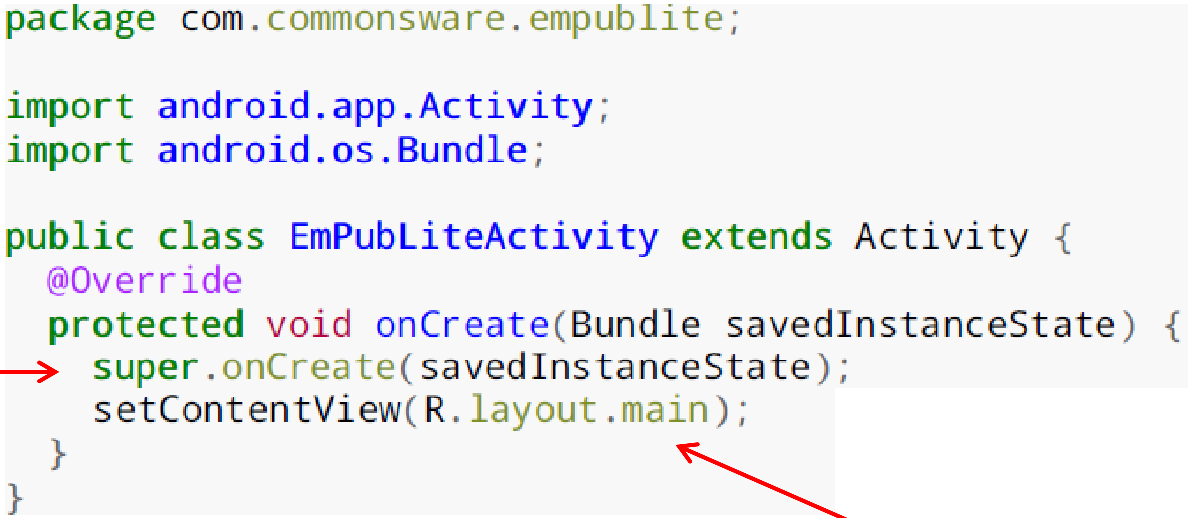
Example Activity Java file (E.g. MainActivity.java)

Package declaration

Import needed classes

My class inherits from Android activity class

Initialize by calling onCreate( ) method of base Activity class



```java
package com.commonsware.empublite;

import android.app.Activity;
import android.os.Bundle;

public class EmPubLiteActivity extends Activity {
  @Override
  protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);
  }
}
```

Note: Android calls your Activity's onCreate method once it is created

Use screen layout (design) declared in file main.xml

Execution Order

Start in AndroidManifest.xml
Read list of activities (screens)
Start execution from Activity
tagged Launcher

↓

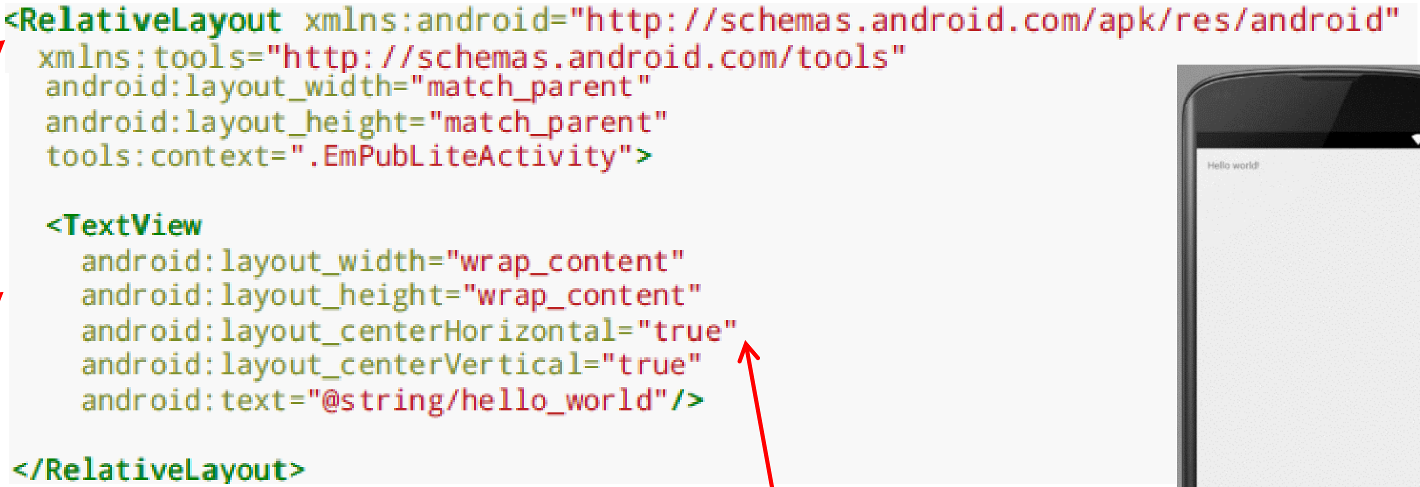
Create/execute activities
(declared in java files)
E.g. MainActivity.Java

↓

Next → Format each activity using layout
In XML file (e.g. Activity_my.xml)

Simple XML file Designing UI

- After choosing the layout, then widgets added to design UI
- XML Layout files consist of:
  - UI components (boxes) called **Views**
  - Different types of views. E.g
    - **TextView:** contains text,
    - **ImageView:** picture,
    - **WebView:** web page
  - **Views** arranged into layouts or **ViewGroups**

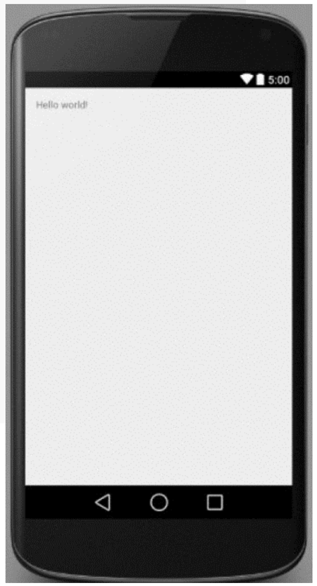


```
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
  xmlns:tools="http://schemas.android.com/tools"
   android:layout_width="match_parent"
   android:layout_height="match_parent"
   tools:context=".EmPubLiteActivity">

   <TextView
     android:layout_width="wrap_content"
     android:layout_height="wrap_content"
     android:layout_centerHorizontal="true"
     android:layout_centerVertical="true"
     android:text="@string/hello_world"/>

</RelativeLayout>
```

Declare Layout

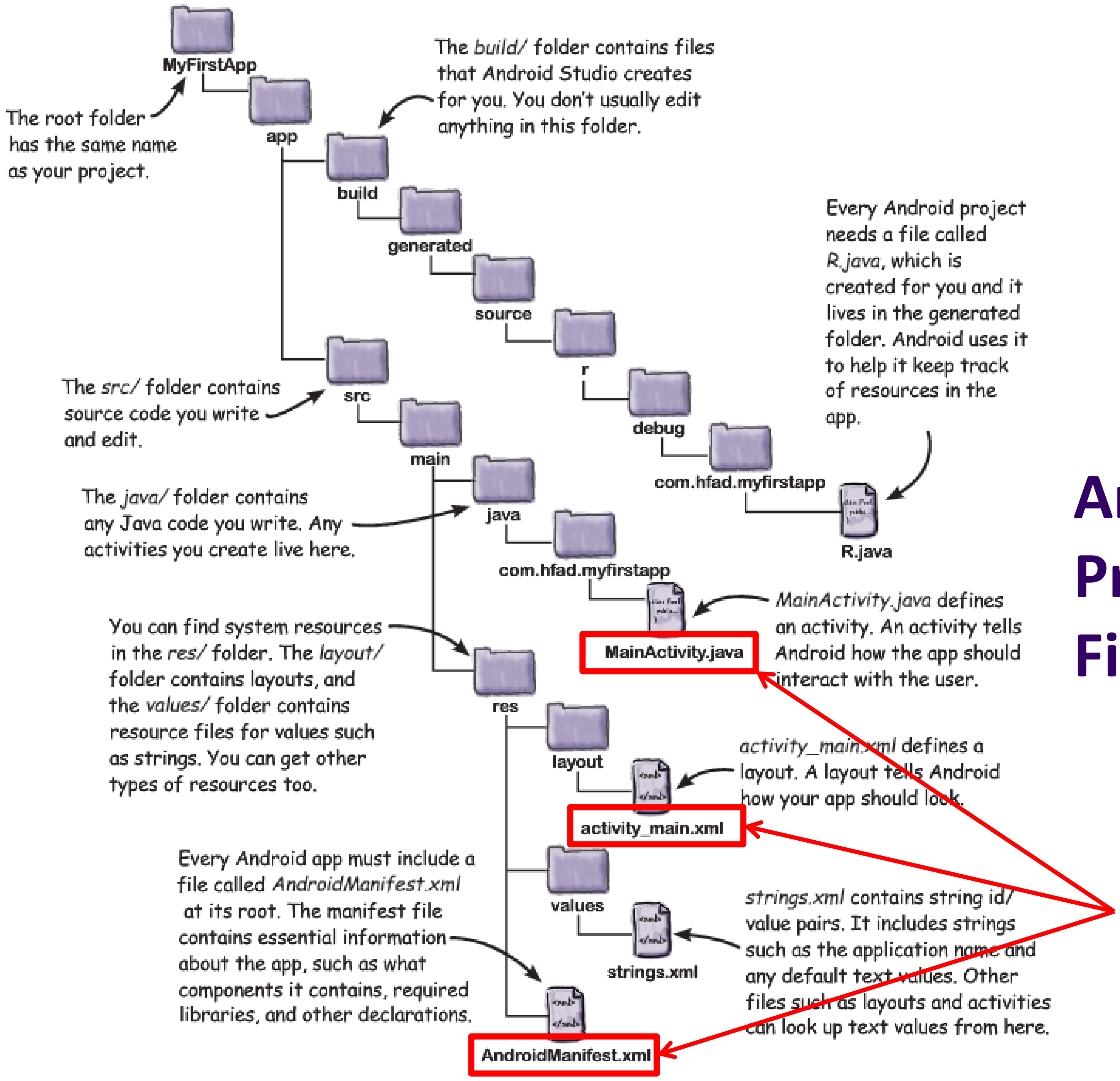
Add widgets

Widget properties
(e.g. center contents
horizontally and vertically)



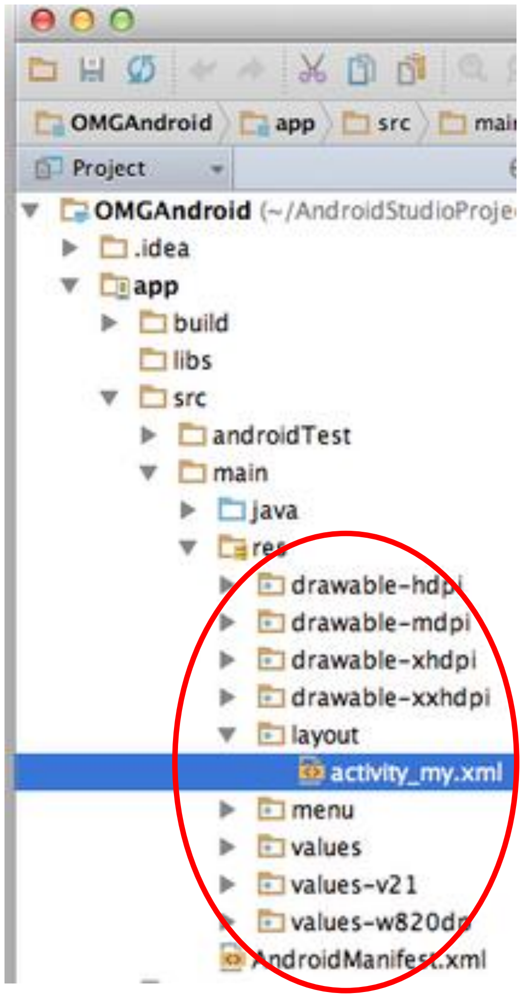
Android Files

Android Project File Structure


MyFirstApp
The root folder has the same name as your project.
app
build
The build/ folder contains files that Android Studio creates for you. You don't usually edit anything in this folder.
generated
source
r
debug
com.hfad.myfirstapp
R.java
Every Android project needs a file called R.java, which is created for you and it lives in the generated folder. Android uses it to help it keep track of resources in the app.
src
The src/ folder contains source code you write and edit.
main
java
The java/ folder contains any Java code you write. Any activities you create live here.
com.hfad.myfirstapp
MainActivity.java
MainActivity.java defines an activity. An activity tells Android how the app should interact with the user.
res
You can find system resources in the res/ folder. The layout/ folder contains layouts, and the values/ folder contains resource files for values such as strings. You can get other types of resources too.
layout
activity_main.xml
activity_main.xml defines a layout. A layout tells Android how your app should look.
values
strings.xml
strings.xml contains string id/value pairs. It includes strings such as the application name and any default text values. Other files such as layouts and activities can look up text values from here.
AndroidManifest.xml
Every Android app must include a file called AndroidManifest.xml at its root. The manifest file contains essential information about the app, such as what components it contains, required libraries, and other declarations.
3 Main Files to Write Android app

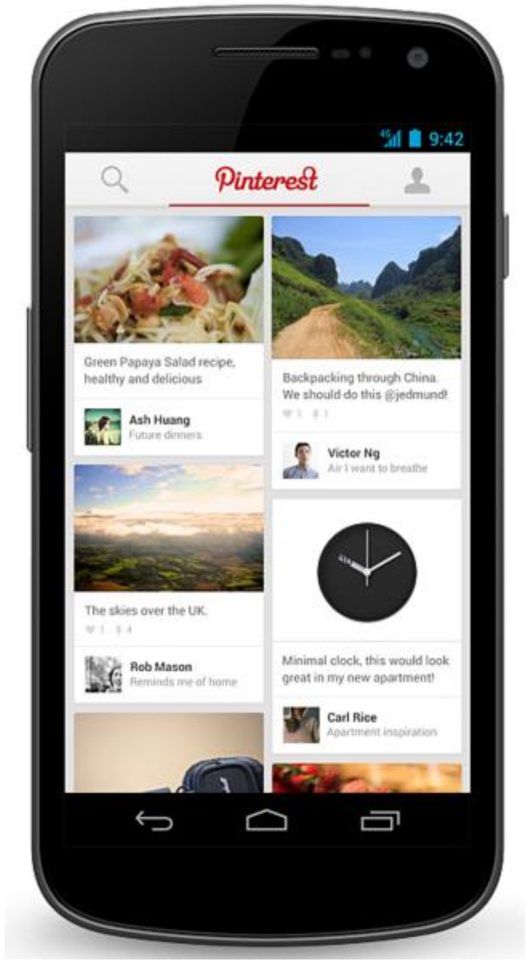
Files in an Android Project

- **res/** (resources) folder contains static resources you can embed in Android screen (e.g. pictures, string declarations, etc)
- **res/menu/:** XML files for menu specs
- **res/drawable-xyz/:** images (PNG, JPEG, etc) at various resolutions
- **res/raw:** general-purpose files (e.g. audio clips, mpeg, video files, CSV files
- **res/values/:** strings, dimensions, etc



Concrete Example: Files in an Android Project

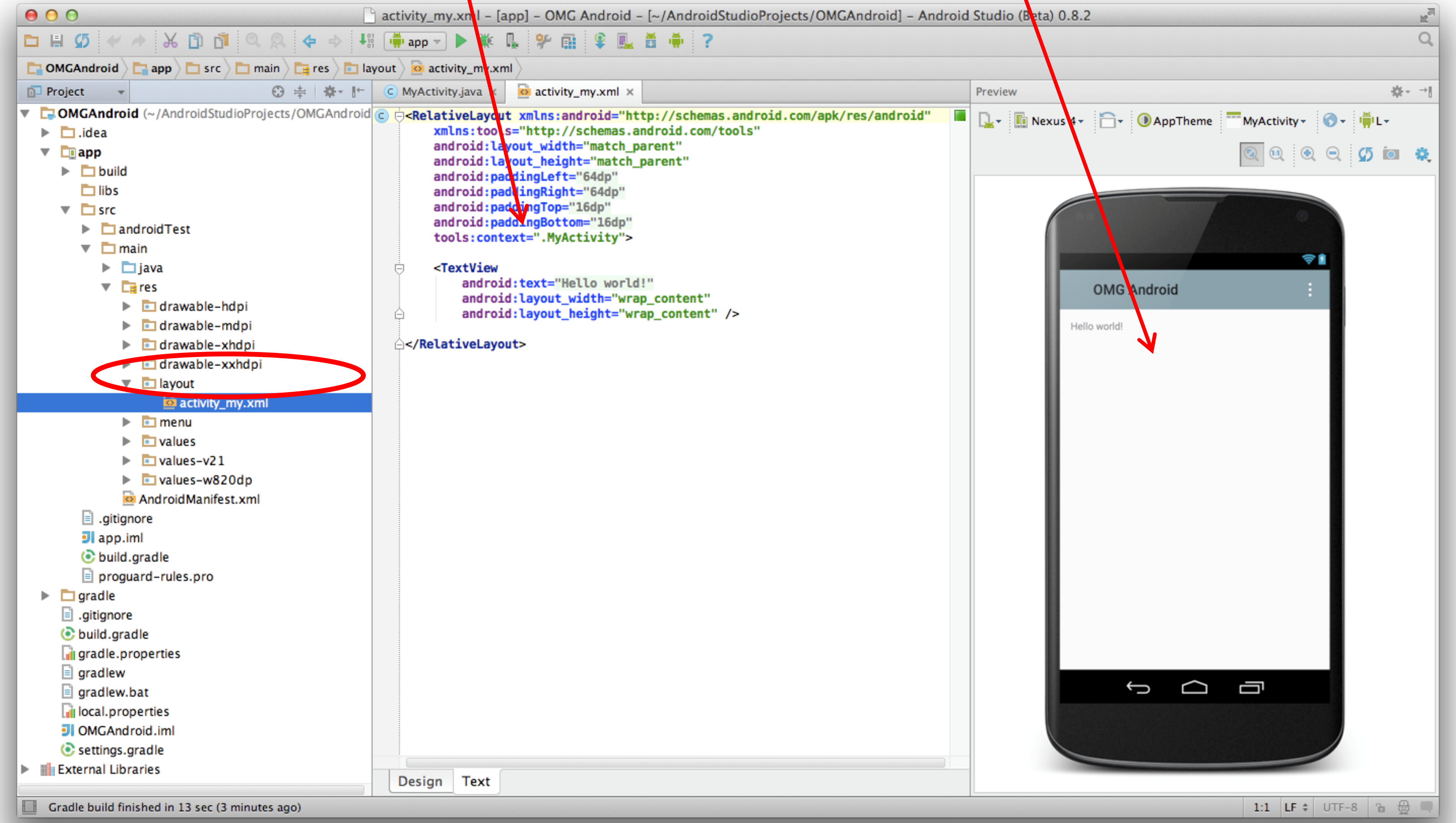
- **res/layout:** layout, dimensions (width, height) of screen cells are specified in XML file here
- **res/drawable-xyz/:** The images stored in jpg or other format here
- **java/:** App's response when user clicks on a selection is specified in java file here
- **AndroidManifext.XML:** Contains app name (Pinterest), list of app screens, etc


9:42
Pinterest
Green Papaya Salad recipe, healthy and delicious
Ash Huang
Future dinners
Backpacking through China. We should do this @jedmund!
Victor Ng
Air I want to breathe
The skies over the UK.
Rob Mason
Reminds me of home
Minimal clock, this would look great in my new apartment!
Carl Rice
Apartment inspiration

Editting in Android Studio

Editting Android

- Can edit apps in:
  - **Text View:** edit XML directly
  - **Design View:** or drag and drop widgets unto emulated phone



activity_my.xml – [app] – OMG Android – [~/AndroidStudioProjects/OMGAndroid] – Android Studio (Beta) 0.8.2

```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="64dp"
    android:paddingRight="64dp"
    android:paddingTop="16dp"
    android:paddingBottom="16dp"
    tools:context=".MyActivity">

    <TextView
        android:text="Hello world!"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content" />

</RelativeLayout>
```

Gradle build finished in 13 sec (3 minutes ago)

Android UI Design in XML

Recall: Files Hello World Android Project

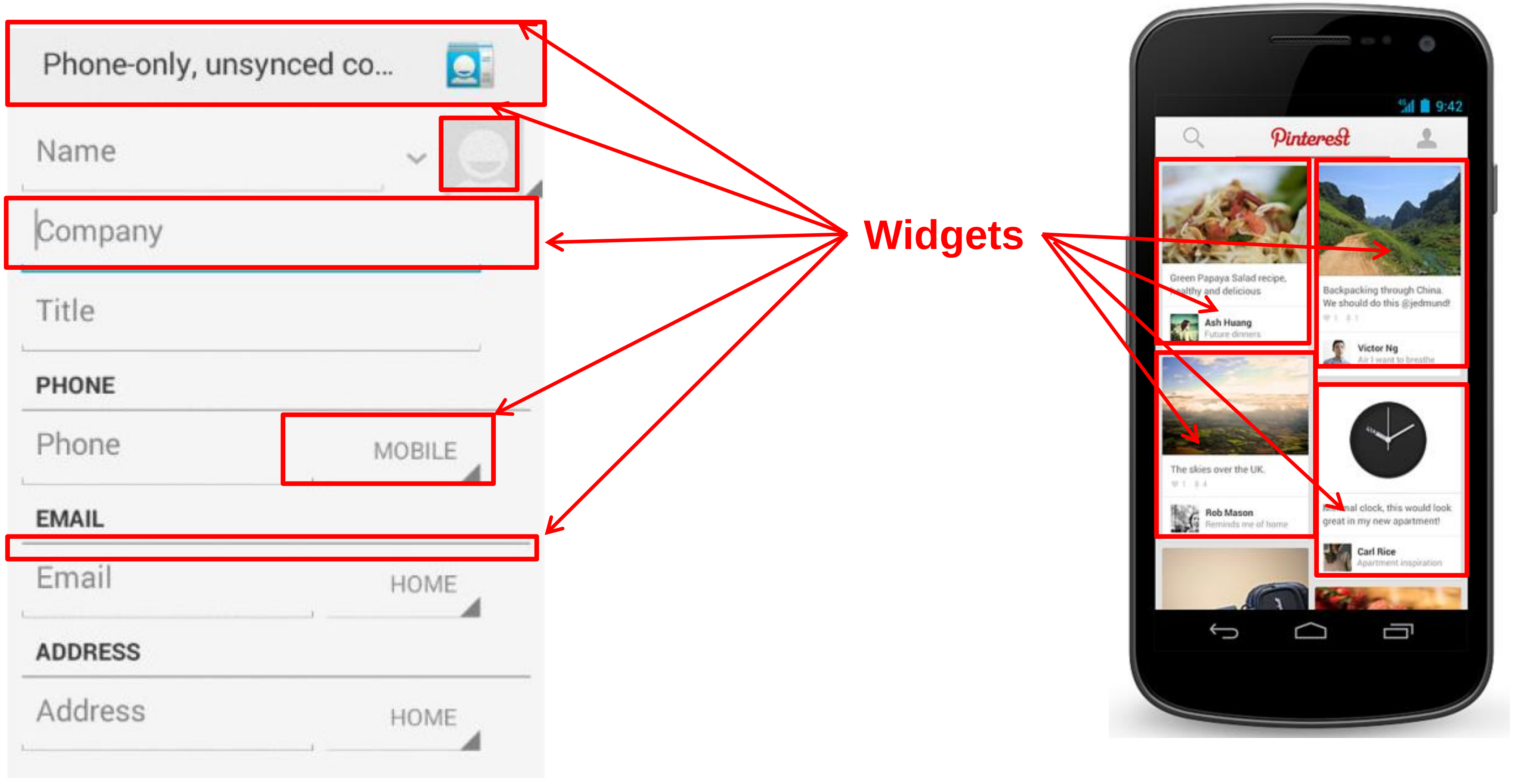
XML file used to design Android UI

- 3 Files:
  - **Activity_main.xml:** XML file specifying screen layout
  - **MainActivity.Java:** Java code to define behavior, actions taken when button clicked (intelligence)
  - **AndroidManifest.xml:**
    - Lists all app components and screens
    - Like a table of contents for a book
    - E.g. Hello world program has 1 screen, so AndroidManifest.xml has 1 item listed
    - App starts running here (a bit like main( ) in C), launching activity with a tag “LAUNCHER”

9:42
Pinterest
Green Papaya Salad recipe, healthy and delicious
Ash Huang
Future dinners
Backpacking through China. We should do this @jedmund!
Victor Ng
All I want to breathe
The skies over the UK
Rob Mason
Reminds me of home
Minimal clock, this would look great in my new apartment!
Carl Rice
Apartment inspiration

Widgets

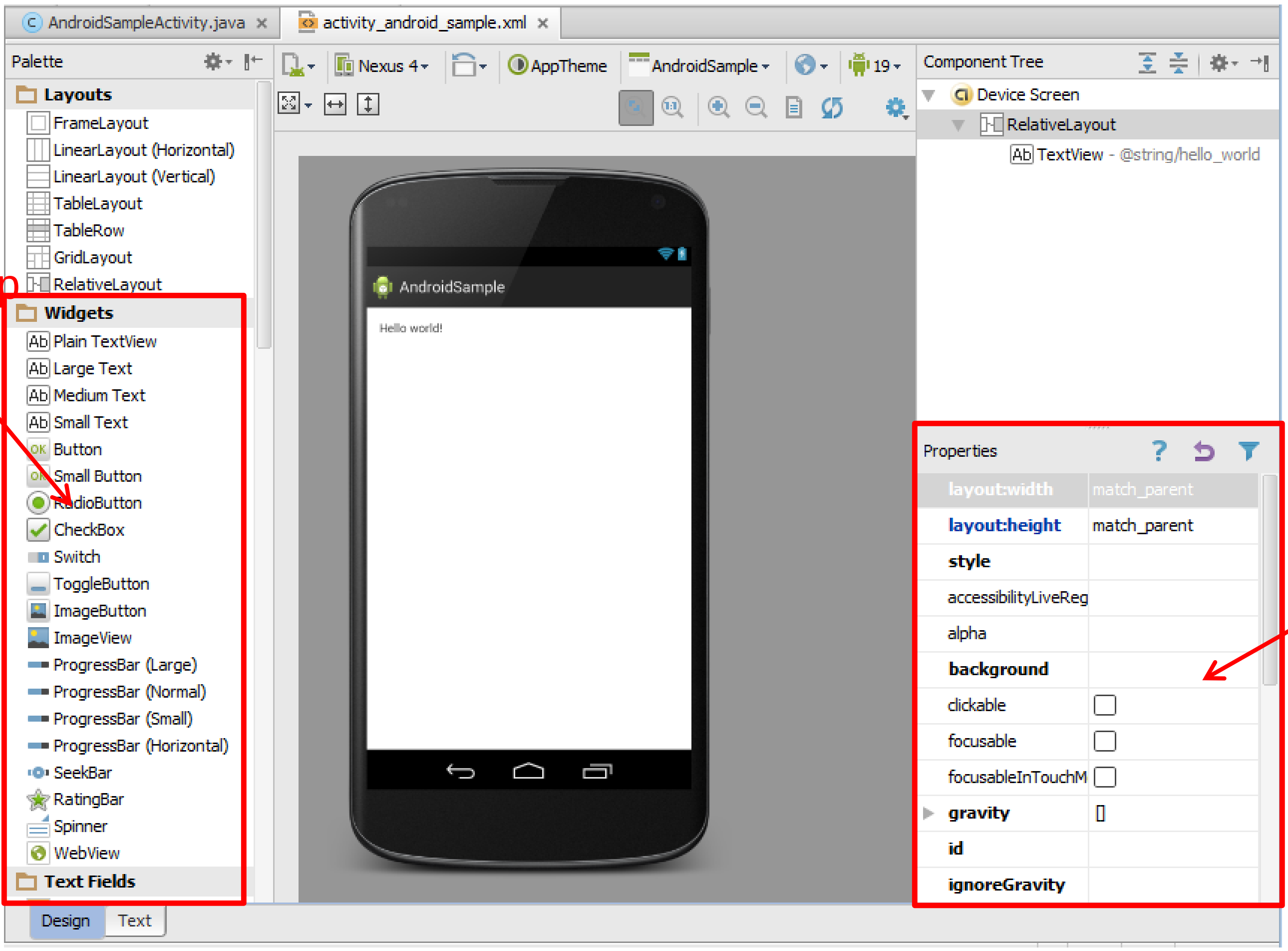
- ***Android UI design involves arranging widgets on a screen***
- **Widgets?** Rectangles containing texts, image, etc
- **Screen design:** Pick widgets, specify attributes (dimensions, margins, etc)



Design Option 1: Drag and Drop Widgets

- Drag and drop widgets in Android Studio Design View
- Edit widget properties (e.g. height, width, color, etc)

Drag and drop button or any other widget or view

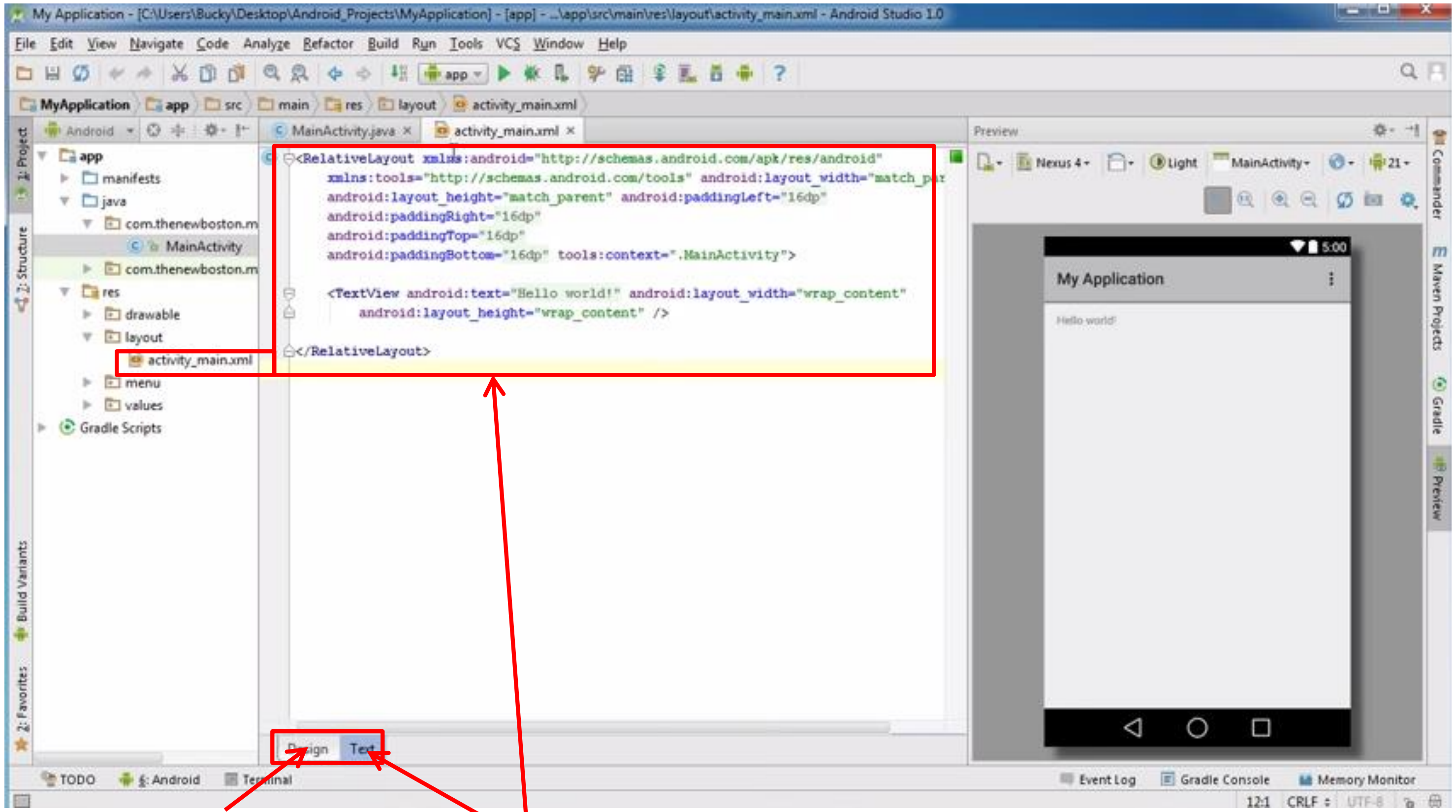


Properties	
layout:width	match_parent
layout:height	match_parent
style	
accessibilityLiveReg	
alpha	
background	
clickable	☐
focusable	☐
focusableInTouchM	☐
gravity	[]
id	
ignoreGravity	

Edit widget properties

Design Option 2: Edit XML Directly

- **Text view:** Directly edit XML file defining screen (activity_main.xml)
- **Note:** dragging and dropping widgets in design view auto-generates corresponding XML in Text view



```
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools" android:layout_width="match_par
    android:layout_height="match_parent" android:paddingLeft="16dp"
    android:paddingRight="16dp"
    android:paddingTop="16dp"
    android:paddingBottom="16dp" tools:context=".MainActivity">

    <TextView android:text="Hello world!" android:layout_width="wrap_content"
        android:layout_height="wrap_content" />

</RelativeLayout>
```

My Application - [C:\Users\Bucky\Desktop\Android_Projects\MyApplication] - [app] - ...\app\src\main\res\layout\activity_main.xml - Android Studio 1.0
File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help
MyApplication app src main res layout activity_main.xml
MainActivity.java activity_main.xml
app manifests java com.thenewboston.m MainActivity com.thenewboston.m res drawable layout activity_main.xml menu values Gradle Scripts
Preview
Nexus 4 Light MainActivity 21
My Application
Hello world!
Design Text
TODO 6: Android Terminal Event Log Gradle Console Memory Monitor

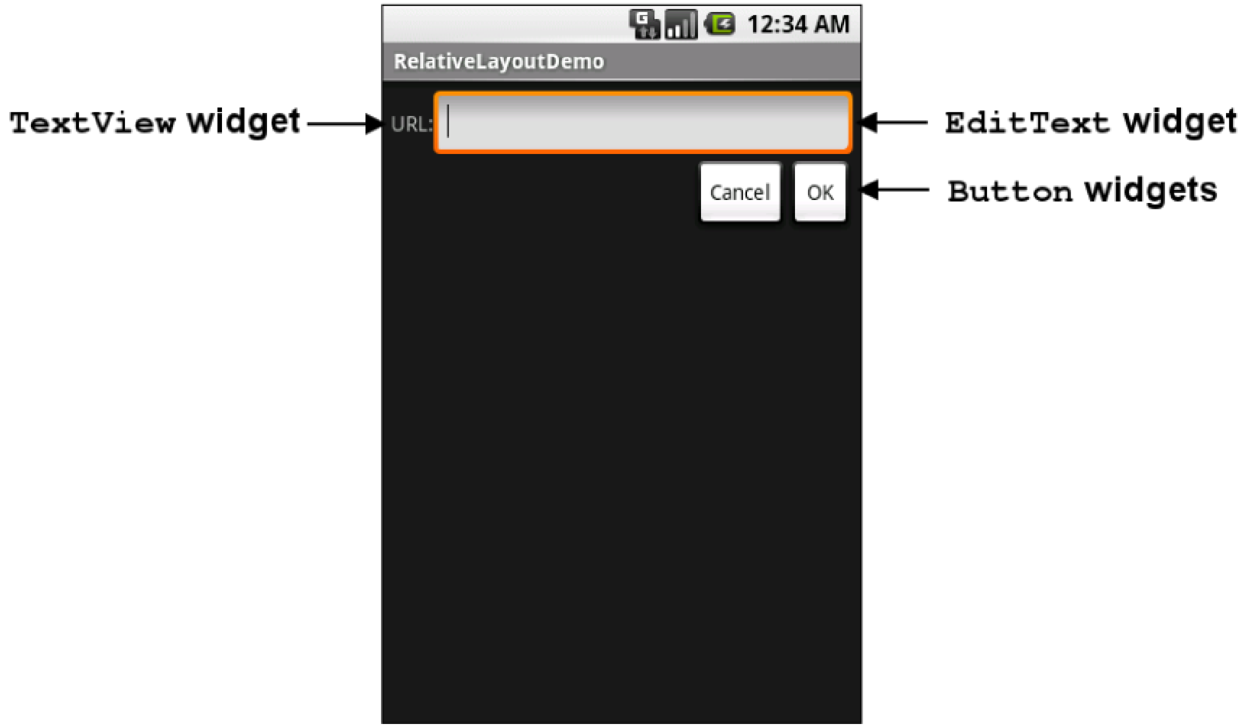
Drag and drop widget

Edit XML

Android Widgets

Example: Some Common Widgets

- **TextView:** Text in a rectangle
- **EditText:** Text box for user to type in text
- **Button:** Button for user to click on



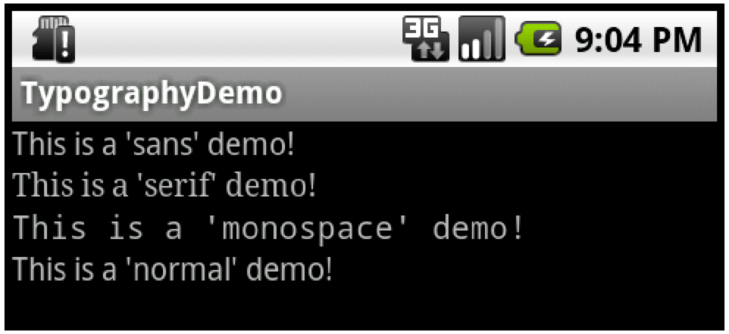
TextView Widget

- Text in a rectangle
- Just displays text, no interaction

XML code

```
<TextView
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:text="This is a 'sans' demo!"
    android:typeface="sans"
/>
```

TextView Widgets

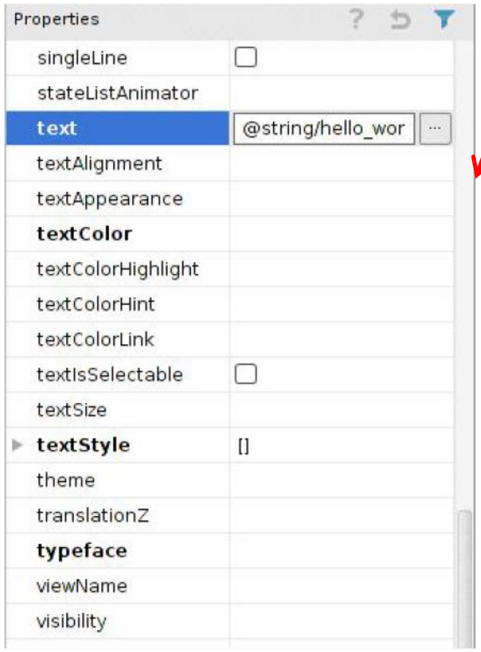


```
This is a 'sans' demo!
This is a 'serif' demo!
This is a 'monospace' demo!
This is a 'normal' demo!
```

- **Common attributes:**
  - typeface (android:typeface e.g monospace), bold, italic, (android:textStyle), text size, text color (android:textColor e.g. #FF0000 for red), width, height, padding, background color
  - Can also include links to email address, url, phone number,
    - web, email, phone, map, etc

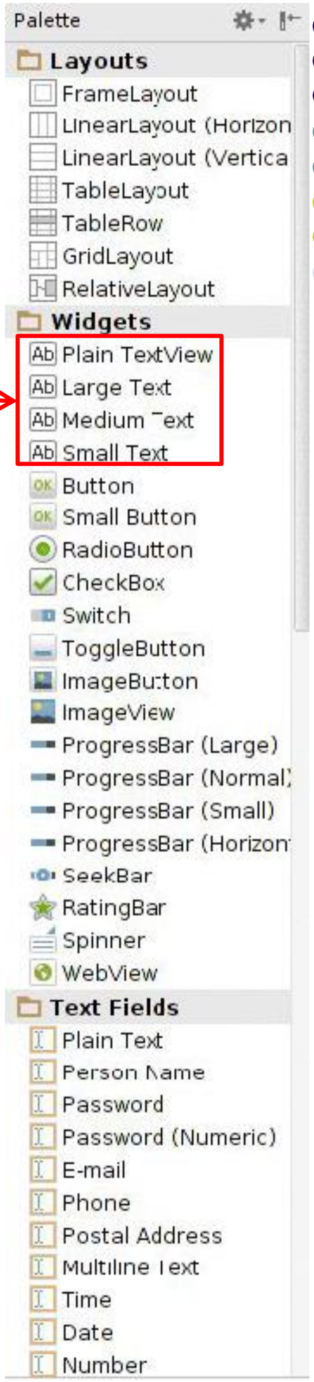
TextView

- TextView widget is available in widgets palette in Android Studio Layout editor
  - **Plain TextView**, **Large text, Medium text** and **Small text**
- After dragging Textview widget in, edit properties



Properties

singleLine	☐
stateListAnimator	
text	@string/hello_wor
textAlignment	
textAppearance	
textColor	
textColorHighlight	
textColorHint	
textColorLink	
textIsSelectable	☐
textSize	
textStyle	[]
theme	
translationZ	
typeface	
viewName	
visibility	



Palette

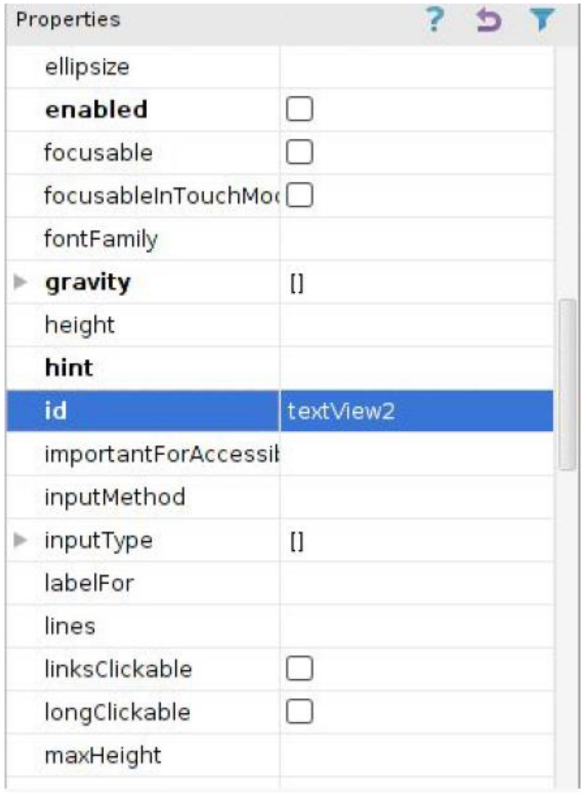
Layouts
- FrameLayout
- LinearLayout (Horizon
- LinearLayout (Vertica
- TableLayout
- TableRow
- GridLayout
- RelativeLayout

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
- Plain Text
- Person Name
- Password
- Password (Numeric)
- E-mail
- Phone
- Postal Address
- Multiline Text
- Time
- Date
- Number

Widget ID

- Every widget has ID, stored in **android:id** attribute
- Using Widget ID declared in XML, widget can be referenced, modified in java code (More later)

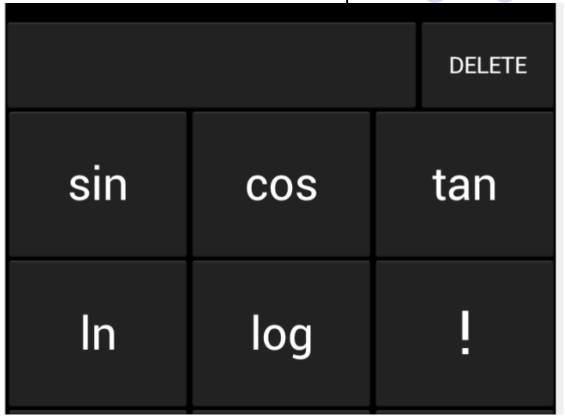


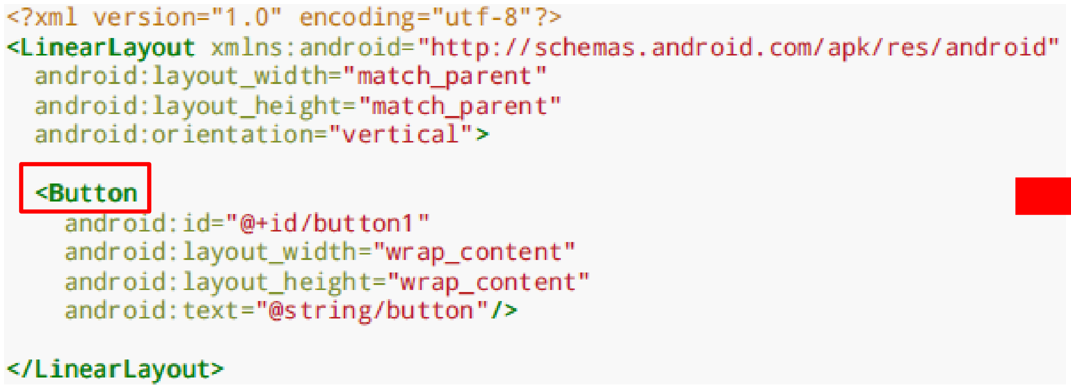
Properties

ellipsize	
enabled	☐
focusable	☐
focusableInTouchMo	☐
fontFamily	
gravity	[]
height	
hint	
id	textView2
importantForAccessil	
inputMethod	
inputType	[]
labelFor	
lines	
linksClickable	☐
longClickable	☐
maxHeight	

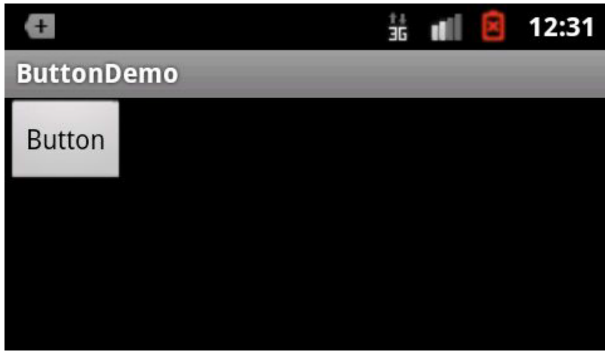
Button Widget

- Clickable Text or icon on a Widget (Button)
- E.g. “Click Here”
- Appearance can be customized
- Declared as subclass of TextView so similar attributes (e.g. width, height, etc)





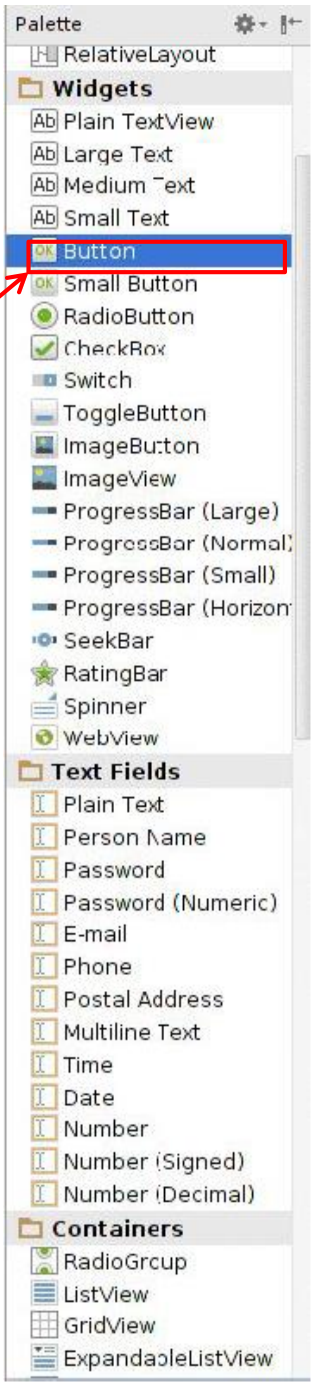
```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:layout_width="match_parent"
  android:layout_height="match_parent"
  android:orientation="vertical">

 <Button
    android:id="@+id/button1"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:text="@string/button"/>

</LinearLayout>
```



Button in Android Studio

- **Button** widget available in palette of Android Studio graphical layout editor

- Drag and drop button, edit its attributes



Responding to Button Clicks

- May want Button press to trigger some action
- How?

1. In XML file (e.g. Activity_my.xml), set android:onClick attribute to specify method to be invoked

2. In Java file (e.g. MainActivity.java) declare method/handler to take desired action

Activity_my.xml

```
<Button
  android:onClick="someMethod"
  ...
/>
```

MainActivity.java

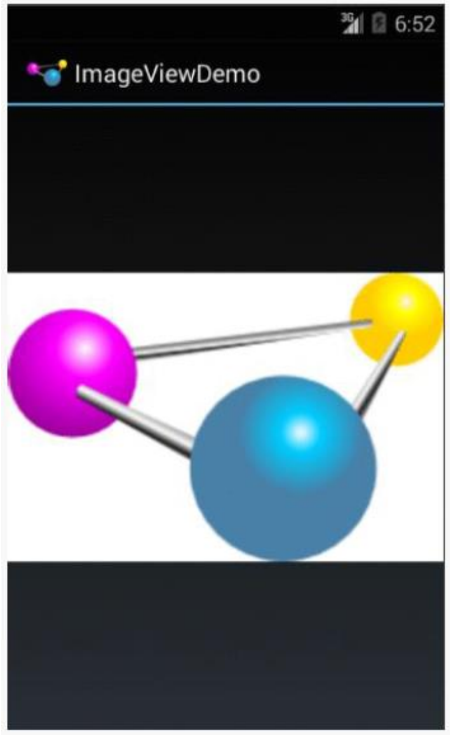
```
public void someMethod(View theButton) {
  // do something useful here
}
```

Embedding Images: ImageView and ImageButton

- **ImageView:** display image (not clickable)
- **ImageButton:** Clickable image

- Use **android:src** attribute to specify image source in **drawable** folder (e.g. **@drawable/icon**)

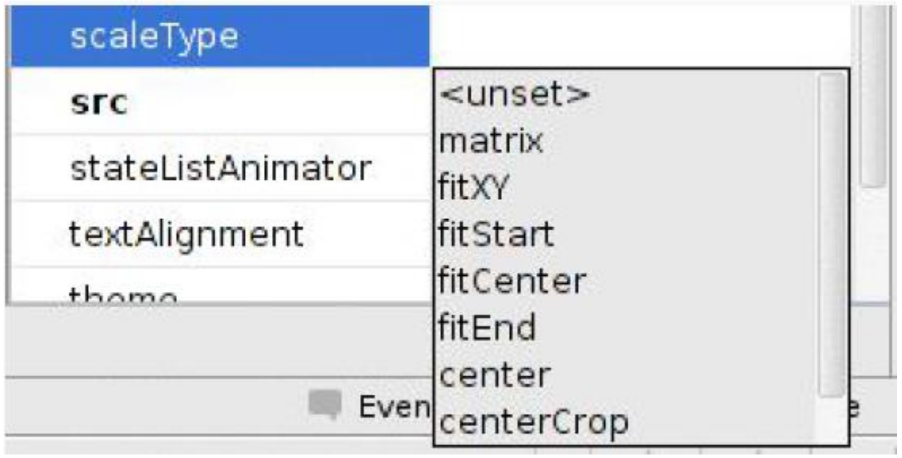
```
<?xml version="1.0" encoding="utf-8"?>
<ImageView xmlns:android="http://schemas.android.com/apk/res/android"
  android:id="@+id/icon"
  android:layout_width="match_parent"
  android:layout_height="match_parent"
  android:adjustViewBounds="true"
  android:src="@drawable/molecule"/>
```

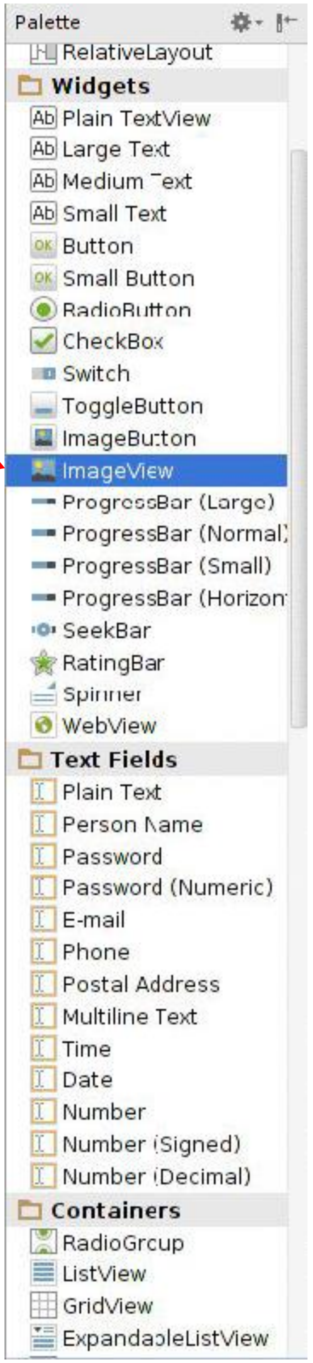


File molecule.png in drawable/ folder

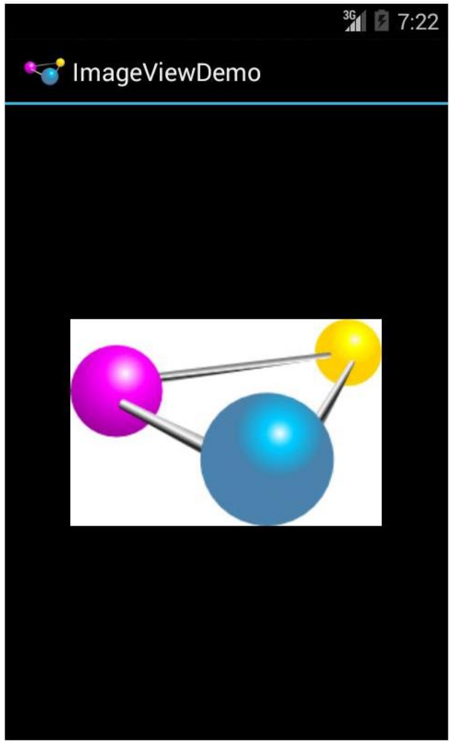
ImageView in Widgets Palette

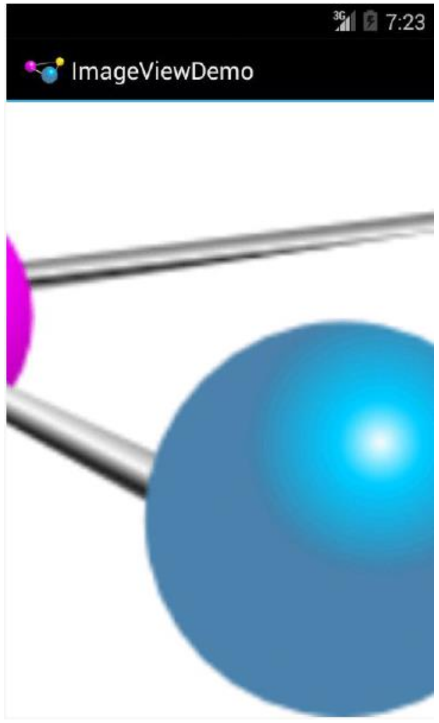
- Can drag and drop ImageView from Widgets Palette
- Use pop-up menus (right-click) to specify:
  - **src:** choose image to be displayed
  - **scaleType:** choose how image should be scaled

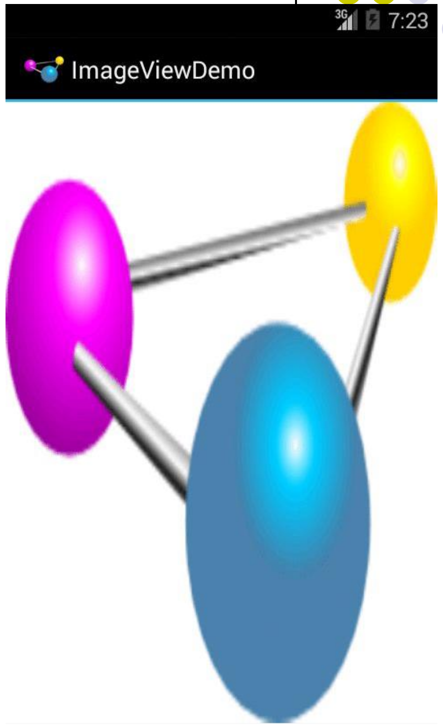




Options for Scaling Images (scaleType)







"center" centers image but does not scale it

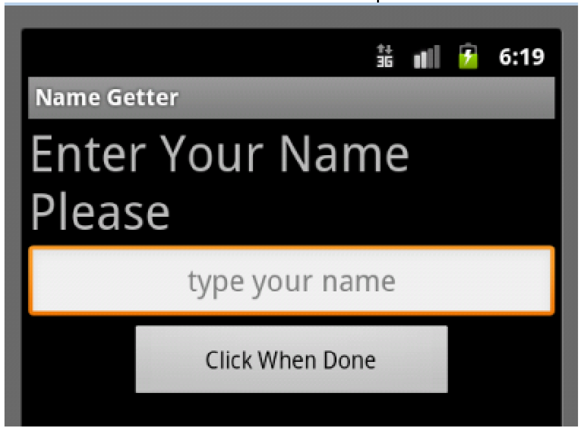
"centerCrop" centers image, scales it (maintaining aspect ratio) so that shorter dimension fills available space, and crops longer dimension

"fitXY" scales/distorts image to fit ImageView, ignoring aspect ratio

EditText Widget

- Widget with box for user input
- Example:

```
<EditText
    android:id="@+id/edittext"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:layout_gravity="center"
    android:gravity="center"
    android:inputType="textPersonName"
    android:hint="type your name" />
```

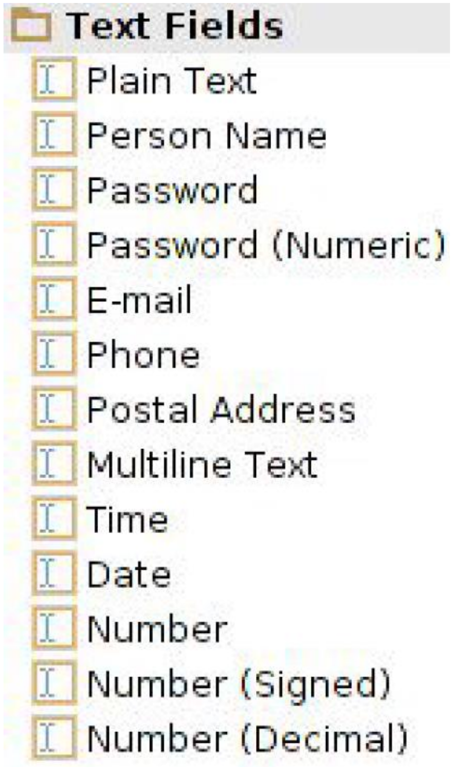


- Text fields can have different input types
  - e.g. number, date, password, or email address

- **android:inputType** attribute sets input type, affects
  - What type of keyboard pops up for user
  - E.g. if inputType is a number, numeric keyboard pops up

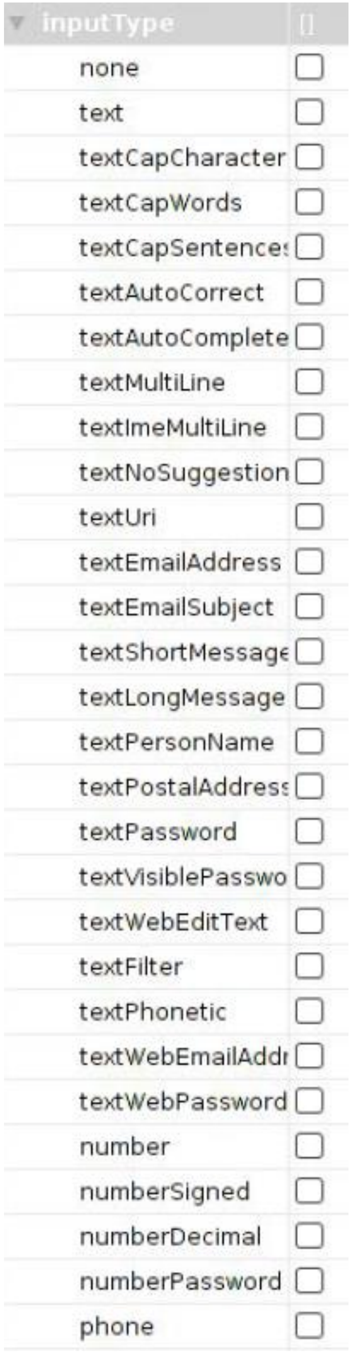
EditText Widget in Android Studio Palette

- A section of Android Studio palette has EditText widgets (or text fields)



Text Fields
Plain Text
Person Name
Password
Password (Numeric)
E-mail
Phone
Postal Address
Multiline Text
Time
Date
Number
Number (Signed)
Number (Decimal)

Text Fields
Section of Widget palette

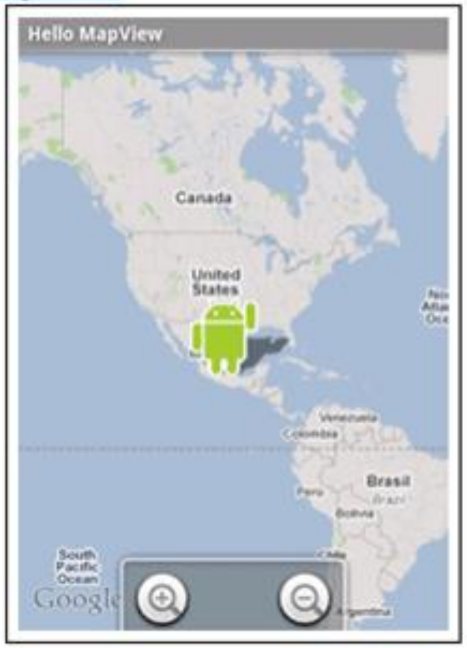


inputType []
none
text
textCapCharacter
textCapWords
textCapSentence
textAutoCorrect
textAutoComplete
textMultiLine
textImeMultiLine
textNoSuggestion
textUri
textEmailAddress
textEmailSubject
textShortMessage
textLongMessage
textPersonName
textPostalAddress
textPassword
textVisiblePasswo
textWebEditText
textFilter
textPhonetic
textWebEmailAddr
textWebPassword
number
numberSigned
numberDecimal
numberPassword
phone

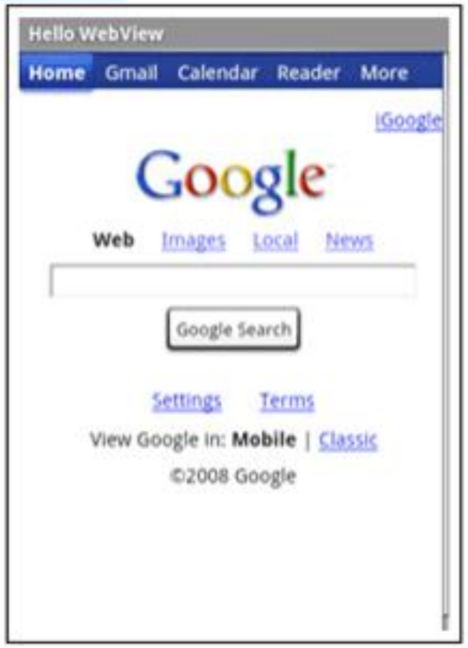
EditText inputType menu

Some Other Available Widgets

MapView



WebView

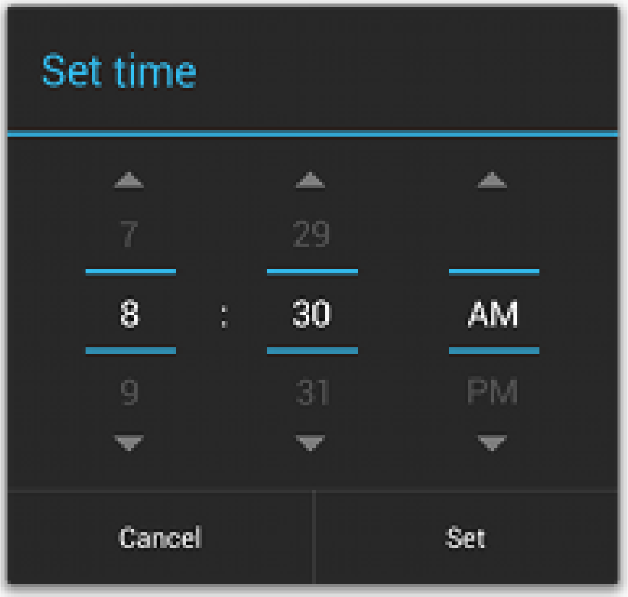


Rectangle that contains a map

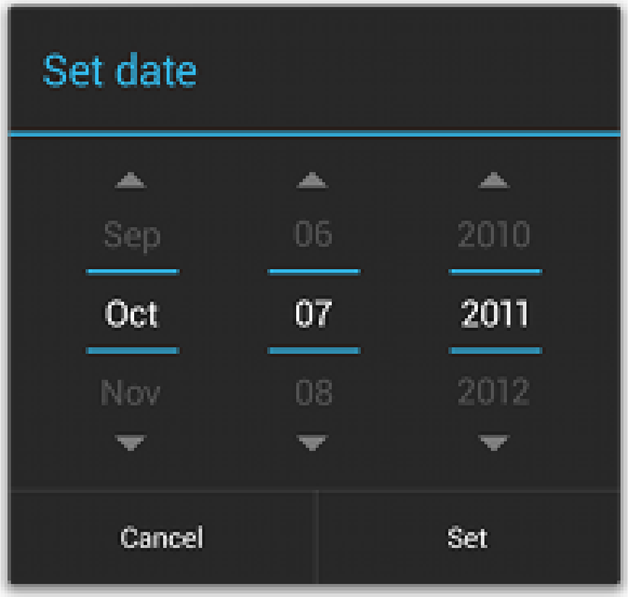
Rectangle that contains a web page

Pickers

- **TimePicker:** Select a time
- **DatePicker:** Select a date
- Typically displayed in pop-up dialogs (**TimePickerDialog** or **DatePickerDialog**)



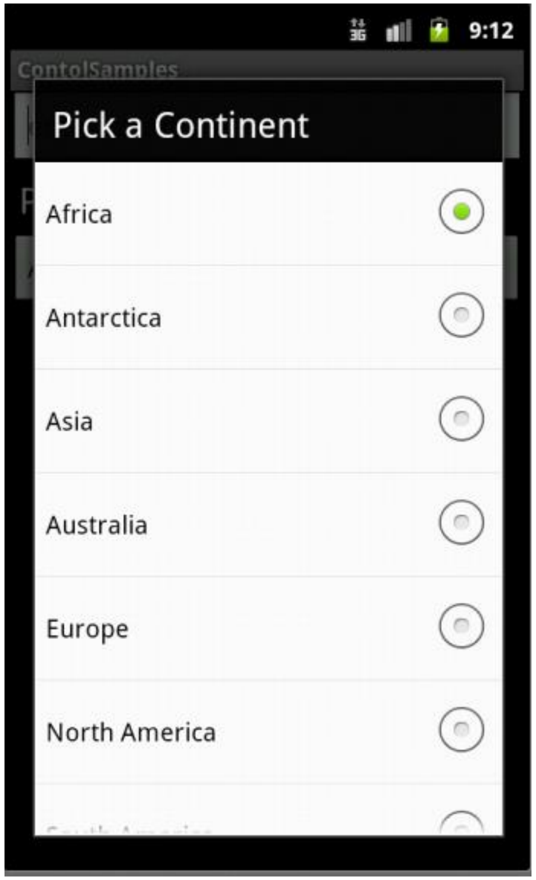
TimePicker



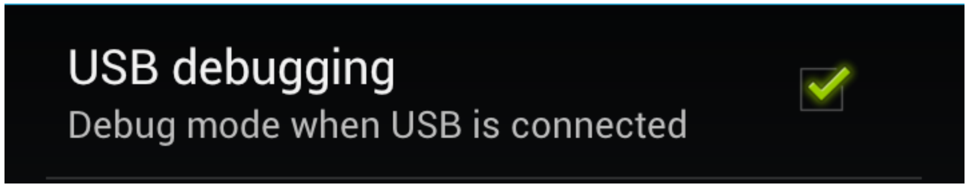
DatePicker

Spinner Controls

- user **must** select one of a set of choices



Checkbox



USB debugging

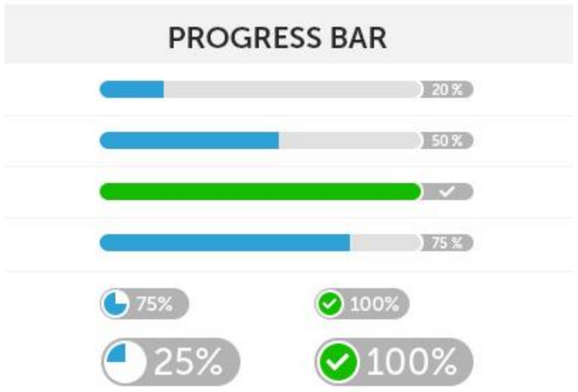
Debug mode when USB is connected

- Checkbox has 2 states: checked and unchecked
- XML code to create Checkbox

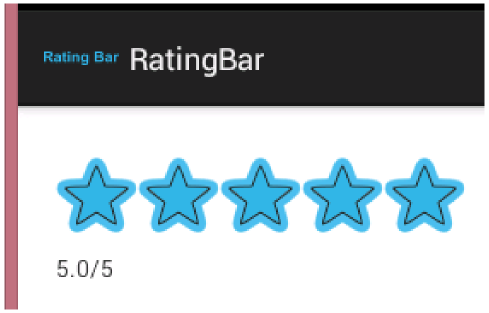
```
<?xml version="1.0" encoding="utf-8"?>
<CheckBox xmlns:android="http://schemas.android.com/apk/res/android"
  android:id="@+id/check"
  android:layout_width="wrap_content"
  android:layout_height="wrap_content"
  android:text="@string/unchecked"/>
```

Other Indicators

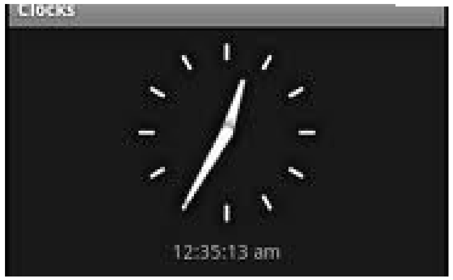
- ProgressBar



- RatingBar



- Chronometer
- DigitalClock
- AnalogClock

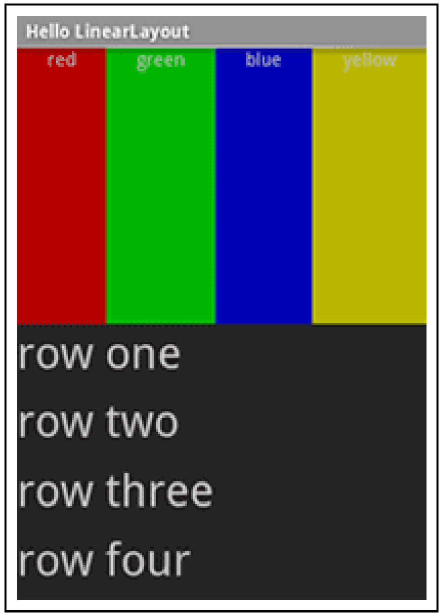


Android Layouts in XML

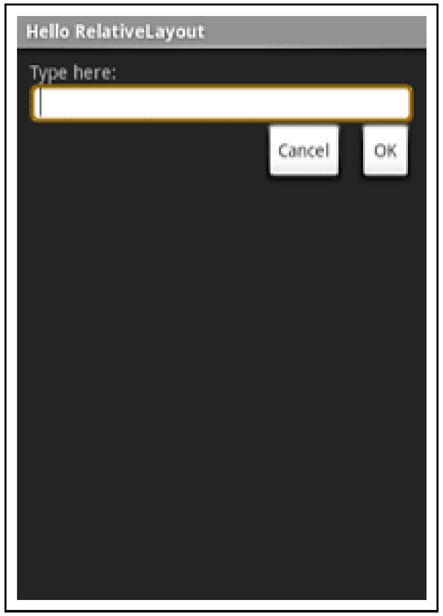
Android UI using XML Layouts

- Layout? Pattern in which multiple widgets are arranged
- Layouts contain widgets
- In Android internal classes, widget is child of layout
- Layouts (XML files) stored in **res/layout**

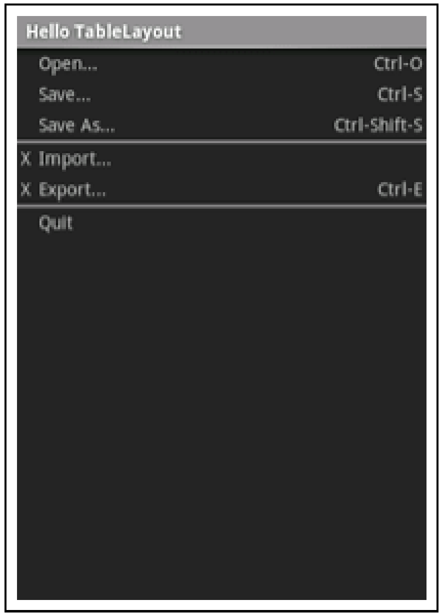
LinearLayout



RelativeLayout



TableLayout

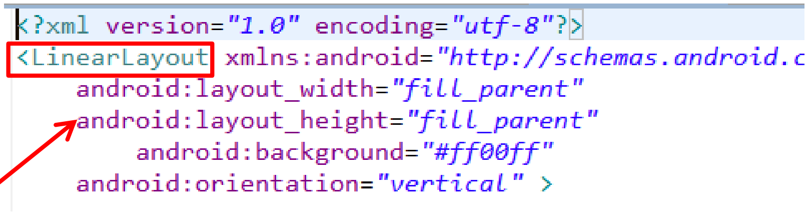


Some Layouts

- FrameLayout,
- LinearLayout,
- TableLayout,
- GridLayout,
- RelativeLayout,
- ListView,
- GridView,
- ScrollView,
- DrawerLayout,
- ViewPager

LinearLayout

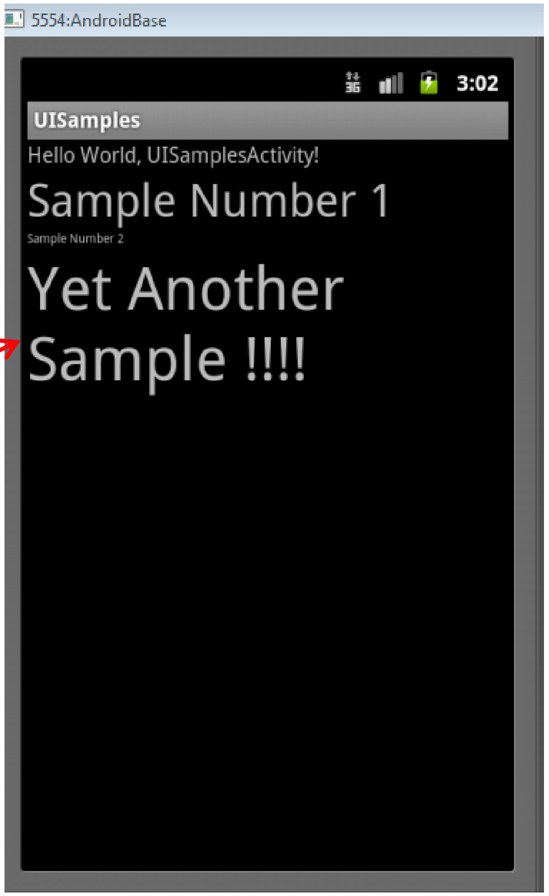
- aligns child elements (e.g. buttons, text boxes, pictures, etc.) in one direction
- Example:



```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.c
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
        android:background="#ff00ff"
    android:orientation="vertical" >
```

Layout properties

- orientation attribute defines direction (vertical or horizontal):
    - E.g. android:orientation=*"vertical"*



5554:AndroidBase

3:02

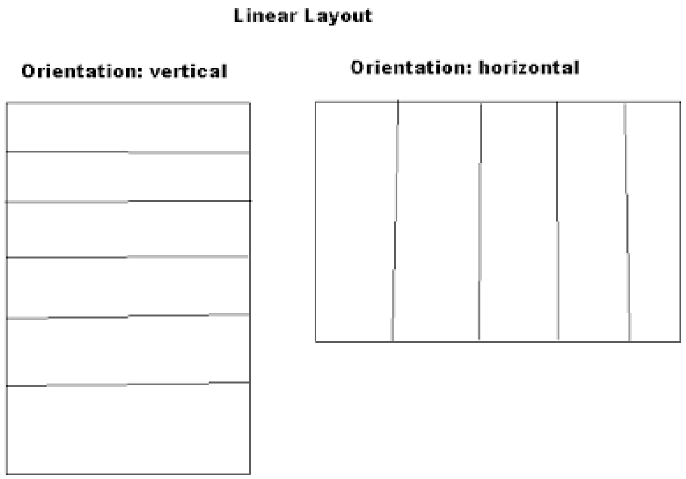
UISamples

Hello World, UISamplesActivity!

Sample Number 1

Sample Number 2

Yet Another Sample !!!!

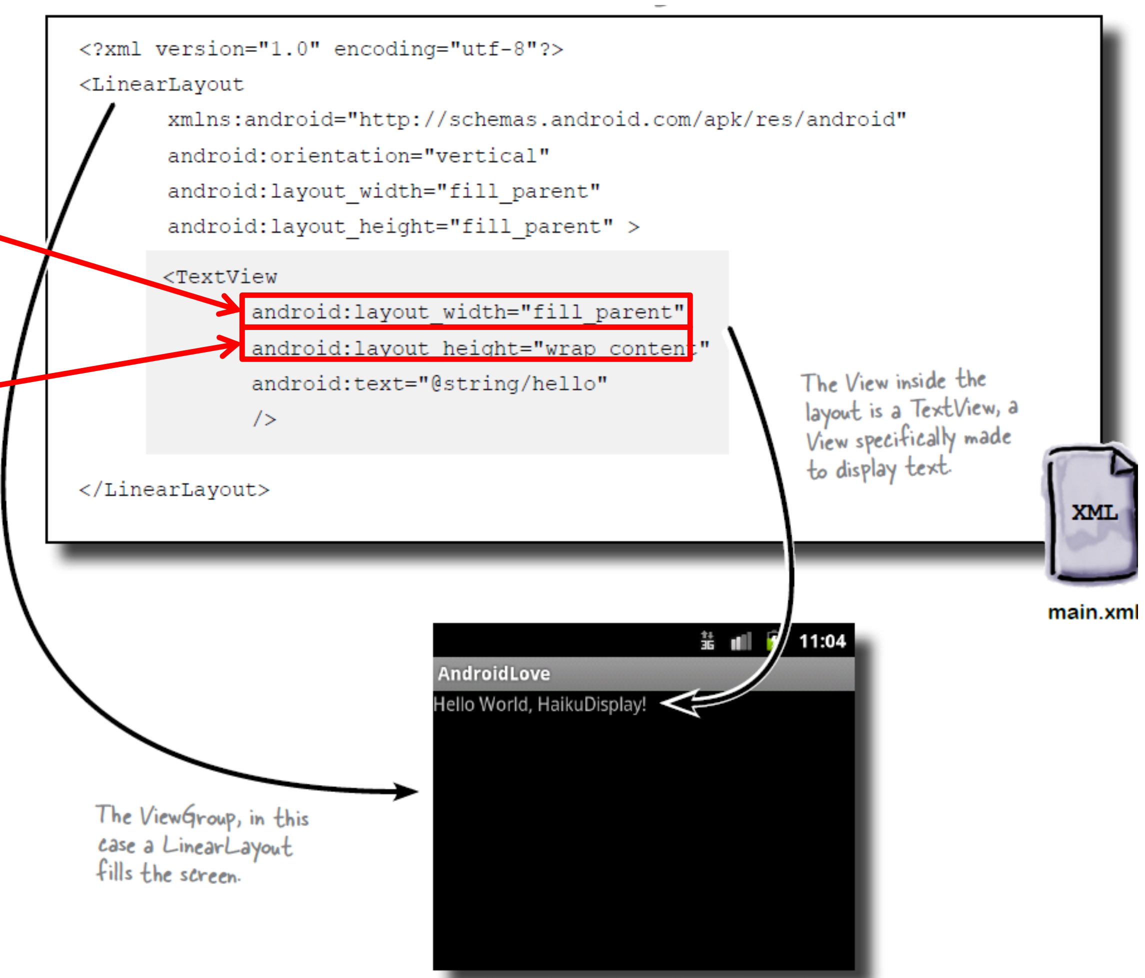


Layout Width and Height Attributes

- **wrap_content:** widget as wide/high as its content (e.g. text)
- **match_parent:** widget as wide/high as its parent layout box
- **fill_parent:** older form of **match_parent**

Text widget width should be as wide as Its parent (the layout)

Text widget height should Be as wide as the content (text)



```
<?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" >
   <TextView
         android:layout_width="fill_parent"
         android:layout_height="wrap_content"
         android:text="@string/hello"
         />
</LinearLayout>
```

The View inside the layout is a TextView, a View specifically made to display text.
XML
main.xml
11:04
AndroidLove
Hello World, HaikuDisplay!
The ViewGroup, in this case a LinearLayout fills the screen.

Hierarchy

Screen (Hardware)

↑

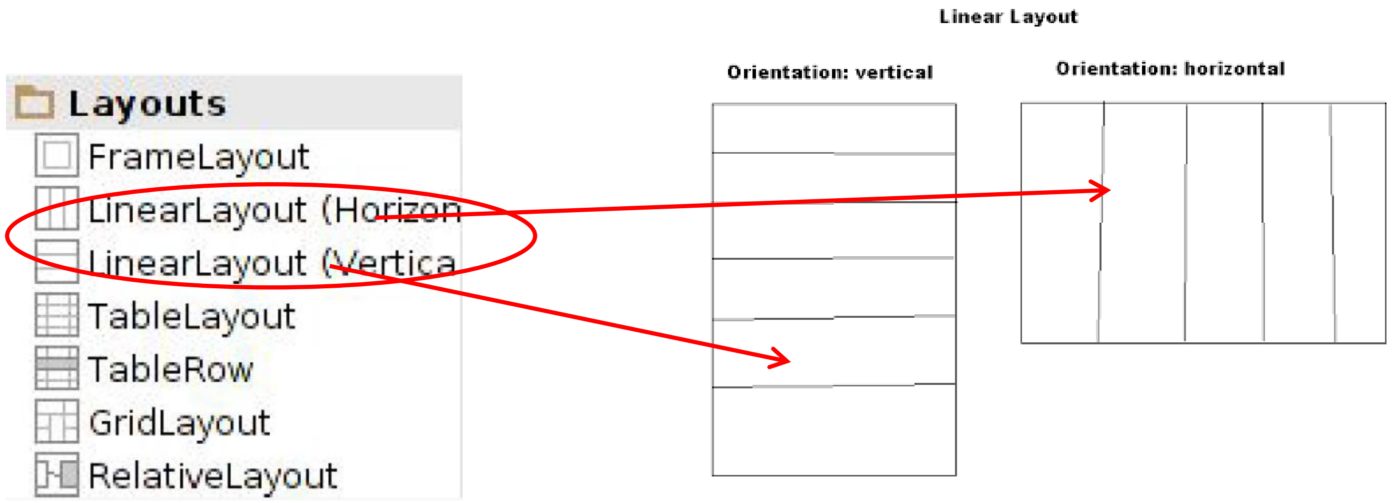
Linear Layout

↑

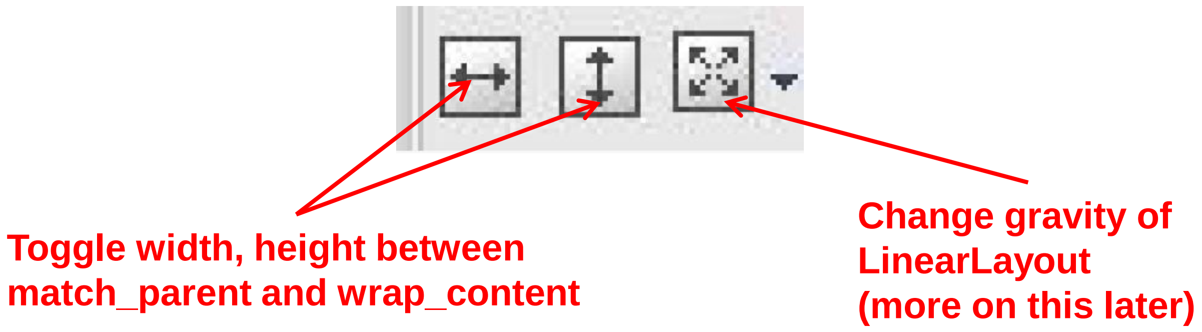
TextView

LinearLayout in Android Studio

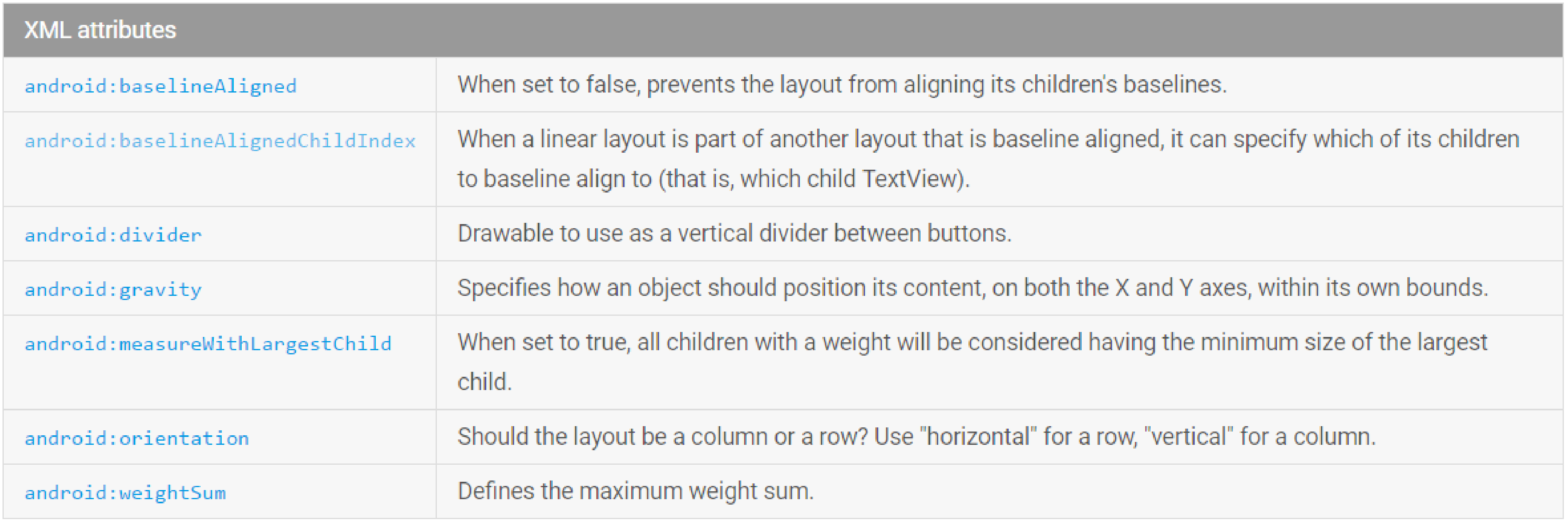
- LinearLayout in Android Studio Graphical Layout Editor



- After selecting LinearLayout, toolbars buttons to set parameters


Toggle width, height between match_parent and wrap_content
Change gravity of LinearLayout (more on this later)

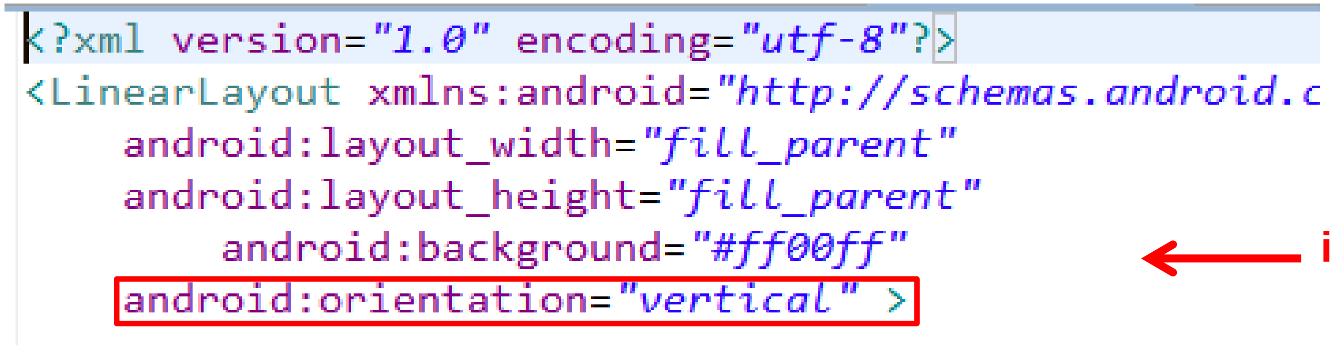
LinearLayout Attributes



XML attributes	
`android:baselineAligned`	When set to false, prevents the layout from aligning its children's baselines.
`android:baselineAlignedChildIndex`	When a linear layout is part of another layout that is baseline aligned, it can specify which of its children to baseline align to (that is, which child TextView).
`android:divider`	Drawable to use as a vertical divider between buttons.
`android:gravity`	Specifies how an object should position its content, on both the X and Y axes, within its own bounds.
`android:measureWithLargestChild`	When set to true, all children with a weight will be considered having the minimum size of the largest child.
`android:orientation`	Should the layout be a column or a row? Use "horizontal" for a row, "vertical" for a column.
`android:weightSum`	Defines the maximum weight sum.

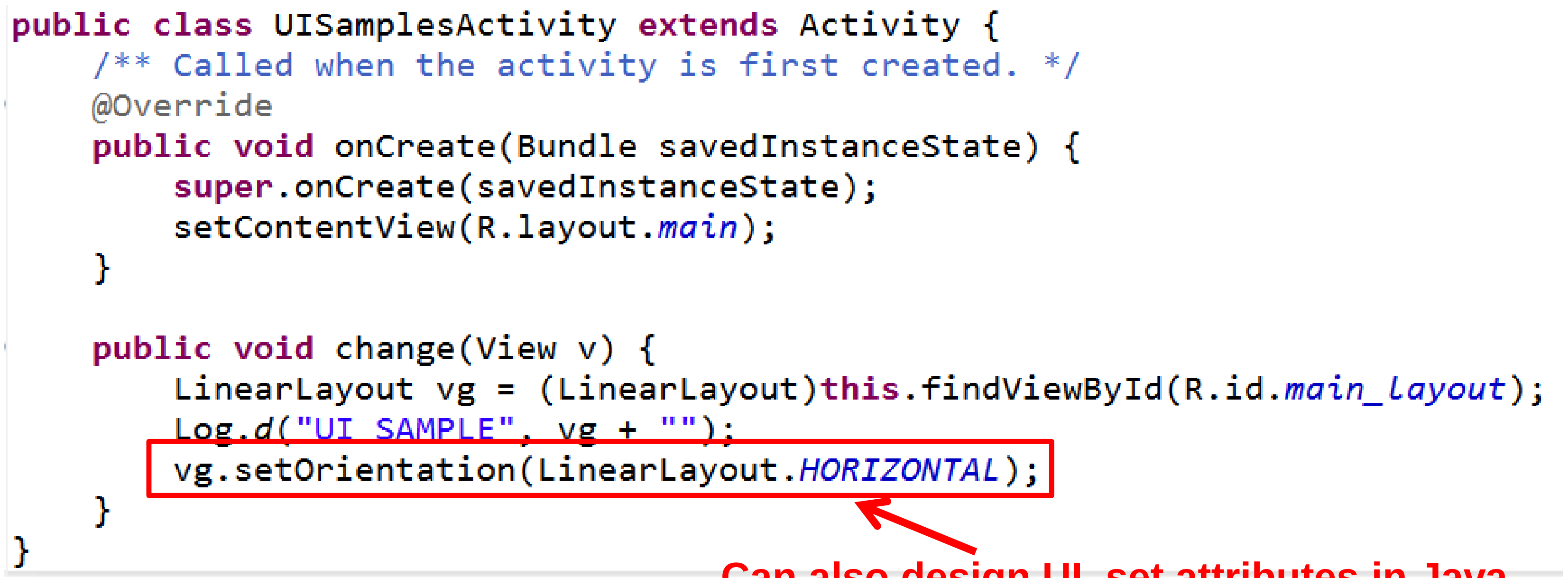
Ref: https://developer.android.com/reference/android/widget/LinearLayout.html

Setting Attributes



```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.c
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
        android:background="#ff00ff"
    android:orientation="vertical" >
```

in layout xml file



```
public class UISamplesActivity extends Activity {
    /** Called when the activity is first created. */
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.main);
    }

    public void change(View v) {
        LinearLayout vg = (LinearLayout)this.findViewById(R.id.main_layout);
        Log.d("UI SAMPLE", vg + "");
        vg.setOrientation(LinearLayout.HORIZONTAL);
    }
}
```

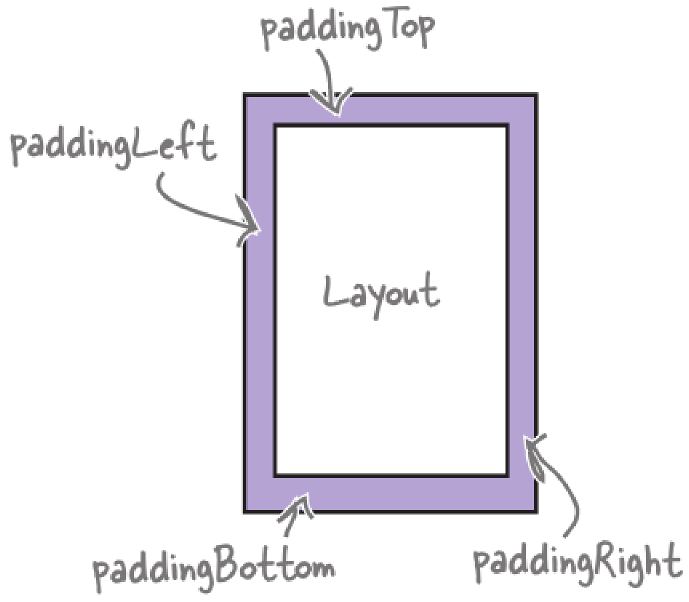
Can also design UI, set attributes in Java program (e.g. ActivityMain.java) (More later)

Adding Padding

- Paddings sets space between layout sides and its parent (e.g. the screen)

```
<RelativeLayout ...
    android:paddingBottom="16dp"
    android:paddingLeft="16dp"
    android:paddingRight="16dp"
    android:paddingTop="16dp">
    ...
</RelativeLayout>
```

Add padding of 16dp.

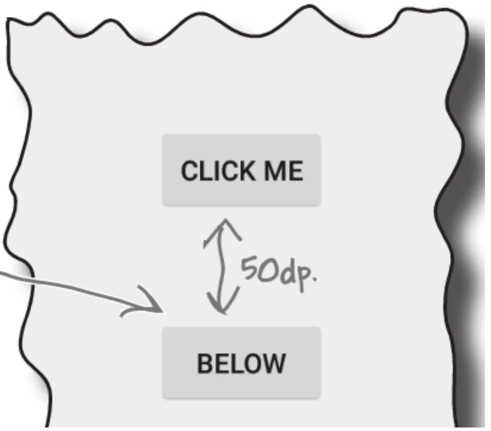


Setting Margins

- Can increase gap (margin) between adjacent widgets
- E.g. To add margin between two buttons, in declaration of bottom button

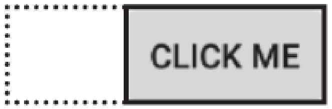
```
    <Button
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_alignLeft="@+id/button_click_me"
        android:layout_below="@+id/button_click_me"
        android:layout_marginTop="50dp"
        android:text="@string/button_below" />
</RelativeLayout>
```

Adding a margin to the top of the bottom button adds extra space between the two views.

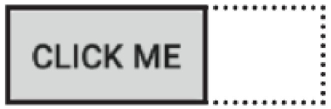


- Other options

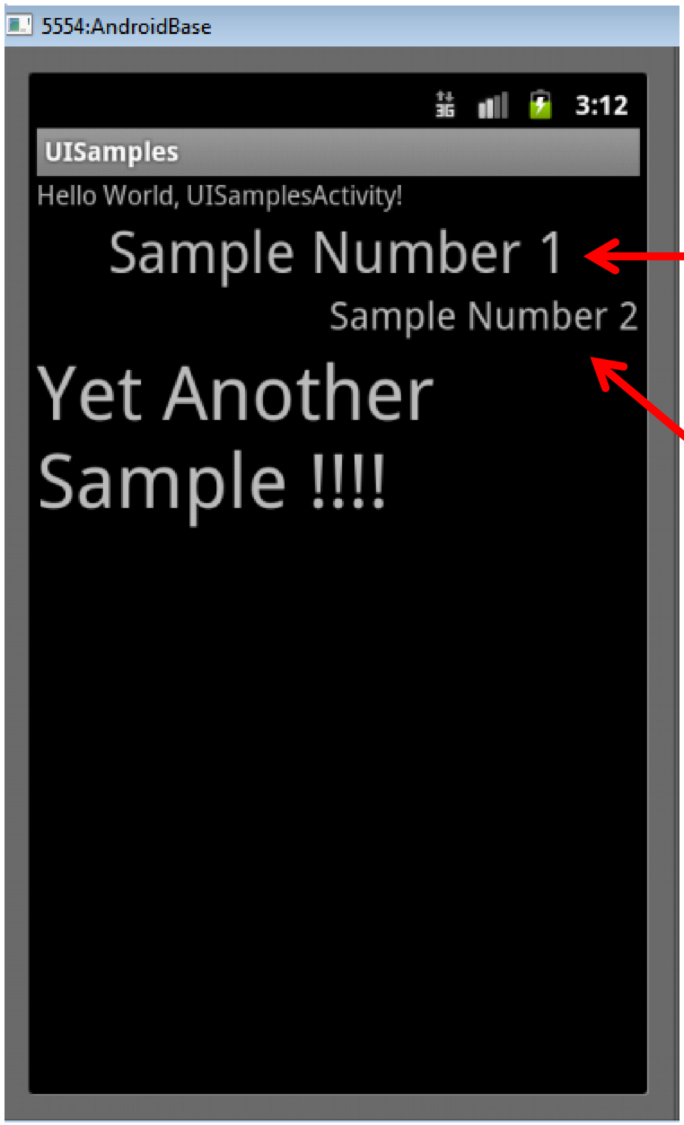
android:layout_marginLeft



android:layout_marginRight



Gravity Attribute


5554:AndroidBase

3:12

UISamples

Hello World, UISamplesActivity!

Sample Number 1

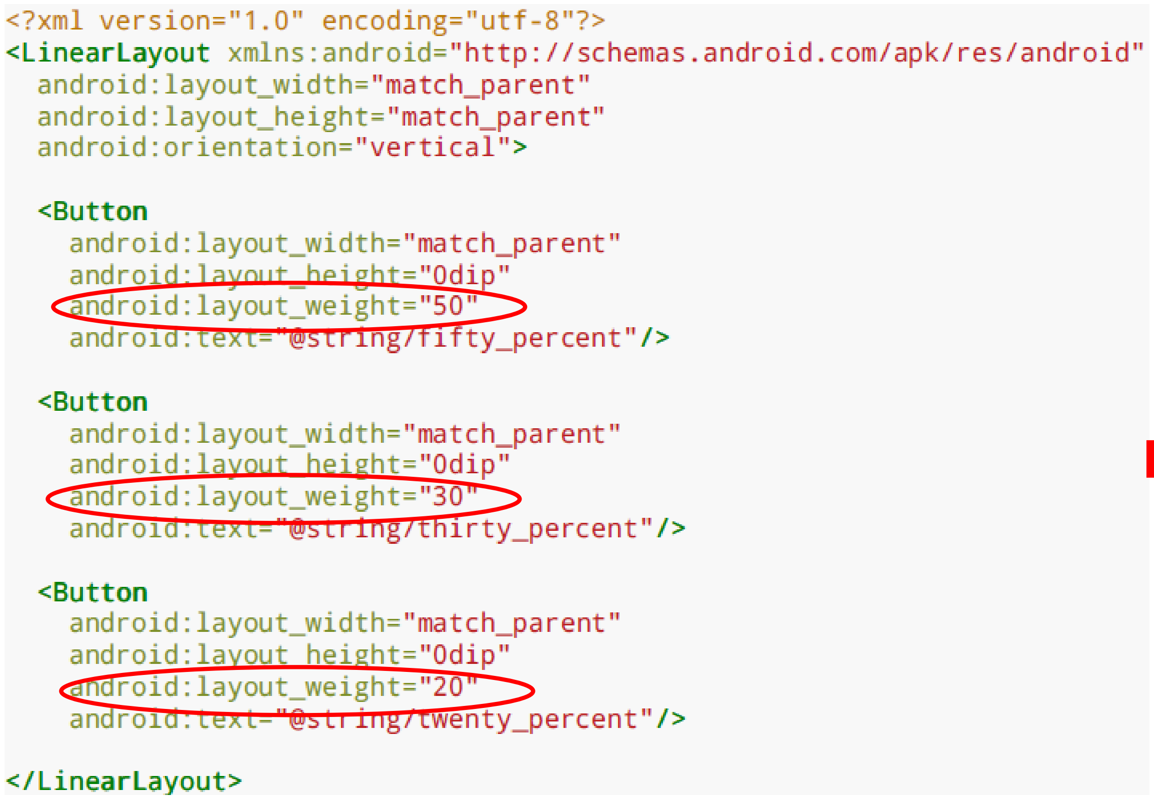
Sample Number 2

Yet Another Sample !!!!

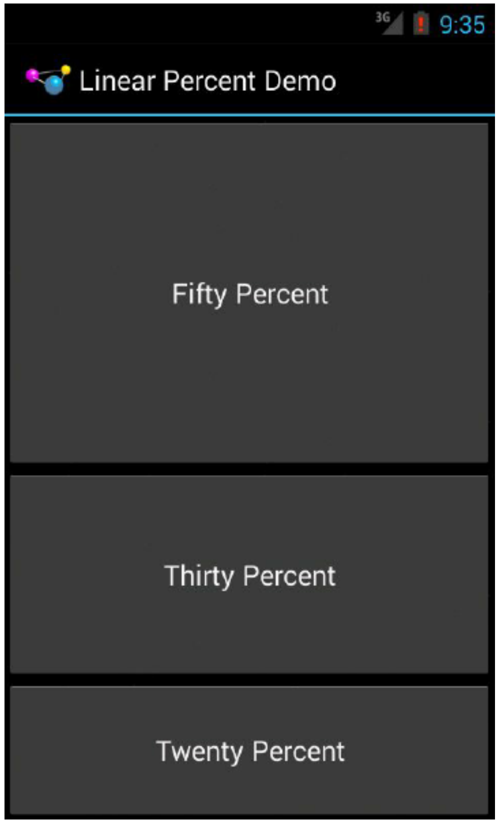
- By default, linearlayout left- and top-aligned
- Gravity attribute changes alignment :
  - e.g. android:gravity = “right”

Linear Layout Weight Attribute

- Specifies "importance“, larger weights takes up more space
- Can set width, height = 0 then
  - weight = percent of height/width you want element to cover



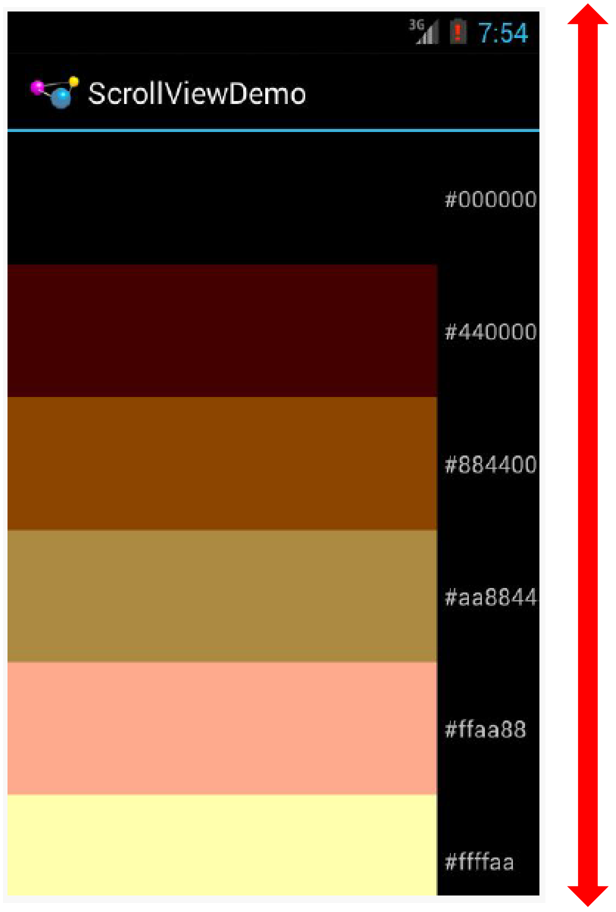
```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:layout_width="match_parent"
  android:layout_height="match_parent"
  android:orientation="vertical">

  <Button
    android:layout_width="match_parent"
    android:layout_height="0dip"
    android:layout_weight="50"
    android:text="@string/fifty_percent"/>

  <Button
    android:layout_width="match_parent"
    android:layout_height="0dip"
    android:layout_weight="30"
    android:text="@string/thirty_percent"/>

  <Button
    android:layout_width="match_parent"
    android:layout_height="0dip"
    android:layout_weight="20"
    android:text="@string/twenty_percent"/>

</LinearLayout>
```



Scrolling

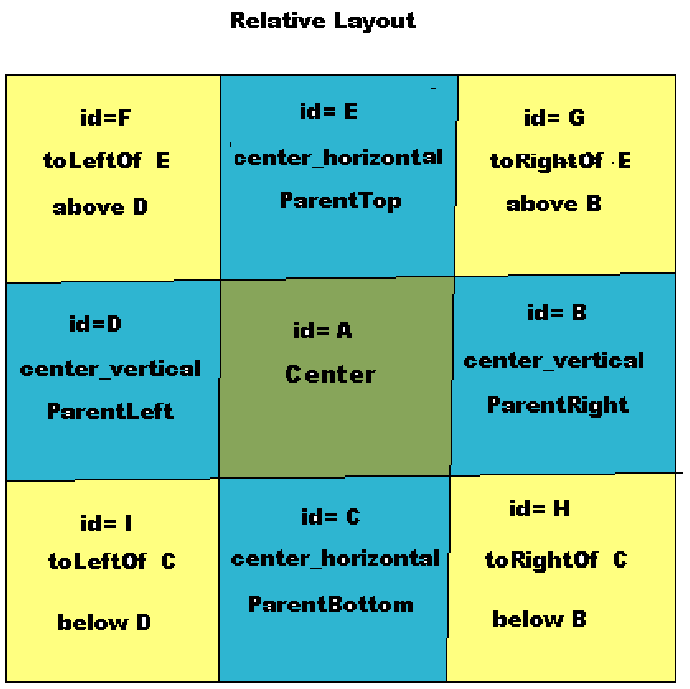
- Phone screens are small, scrolling content helps
- Examples: Scroll through
  - large image
  - Linear Layout with lots of elements
- Views for Scrolling:
  - **ScrollView** for vertical scrolling
  - **HorizontalScrollView**
- Rules:
  - Only one direct child View
  - Child could have many children of its own

```
<ScrollView
    ...>
    <LinearLayout>
       ....
       <!-- you can have as many Views in here as you want -->
    </LinearLayout>
</ScrollView>
```

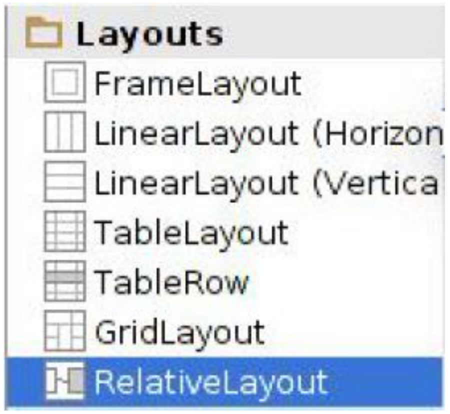


RelativeLayout

- First element listed is placed in "center"
- Positions of children specified relative to parent or to each other.



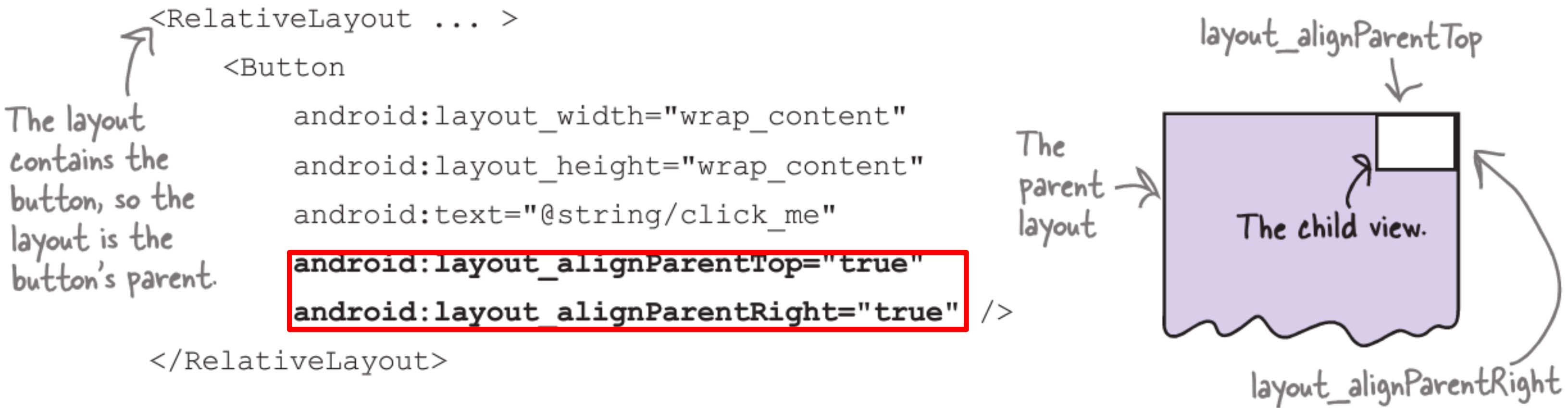
Relative Layout
id=F toLeftOf E above D
id= E center_horizontal ParentTop
id= G toRightOf E above B
id=D center_vertical ParentLeft
id= A Center
id= B center_vertical ParentRight
id= I toLeftOf C below D
id= C center_horizontal ParentBottom
id= H toRightOf C below B



RelativeLayout available
In Android Studio palette

Positioning Views Relative to Parent Layout

- Position a view (e.g. button, TextView) relative to its parent
- Example: Button aligned to top, right in a Relative Layout

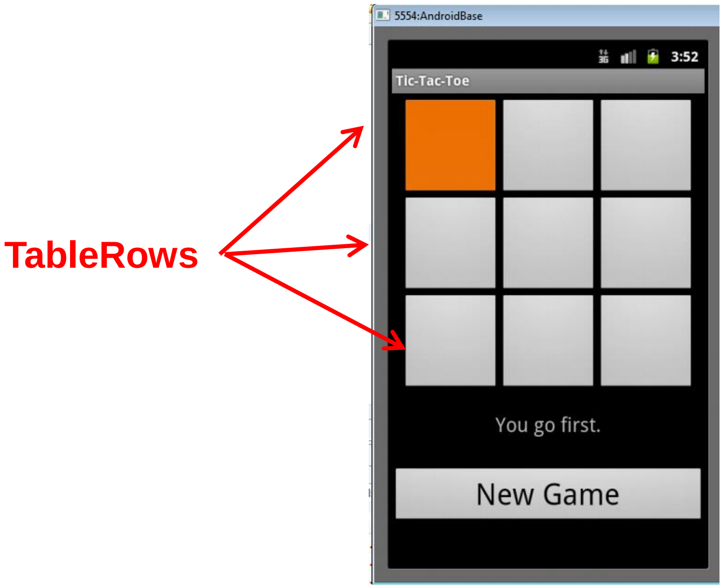


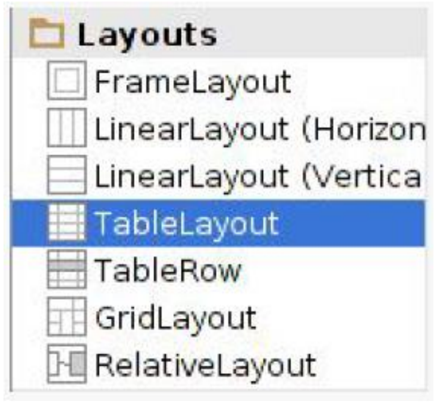
```
<RelativeLayout ... >
    <Button
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="@string/click_me"
        android:layout_alignParentTop="true"
        android:layout_alignParentRight="true" />
</RelativeLayout>
```

See Head First Android Development (2nd edition) page 169-220 for more examples

Table Layout

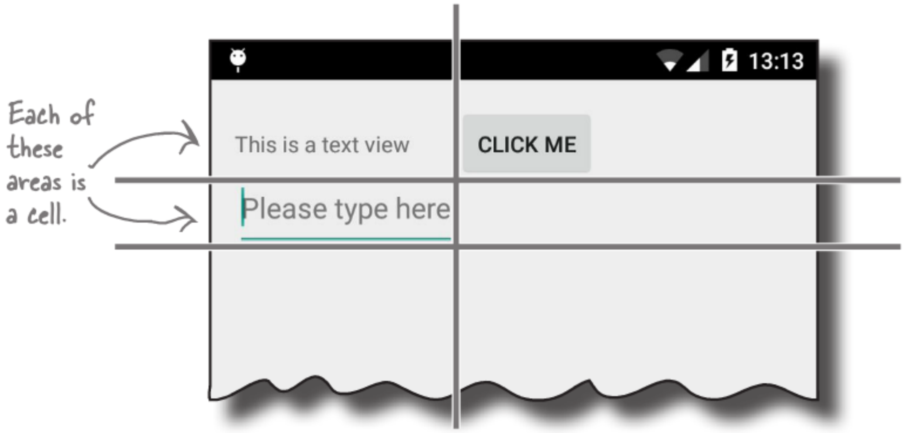
- Specify number of rows and columns of views.
- Available in Android Studio palette





GridLayout

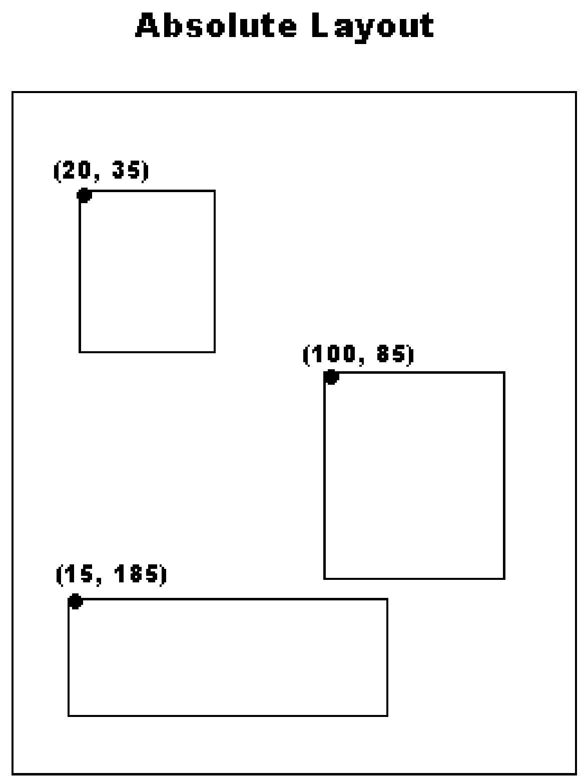
- In TableLayout, Rows can span multiple columns only
- In GridLayout, child views/controls can span multiple rows **AND** columns



- See section “GridLayout Displays Views in a Grid” in Head First Android Development 2nd edition (pg 824)

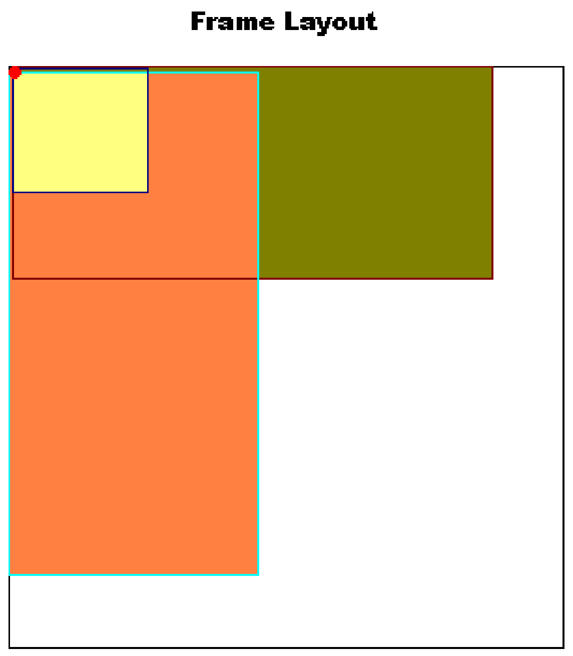
Absolute Layout

- Allows specification of exact x,y coordinates of layout's children.

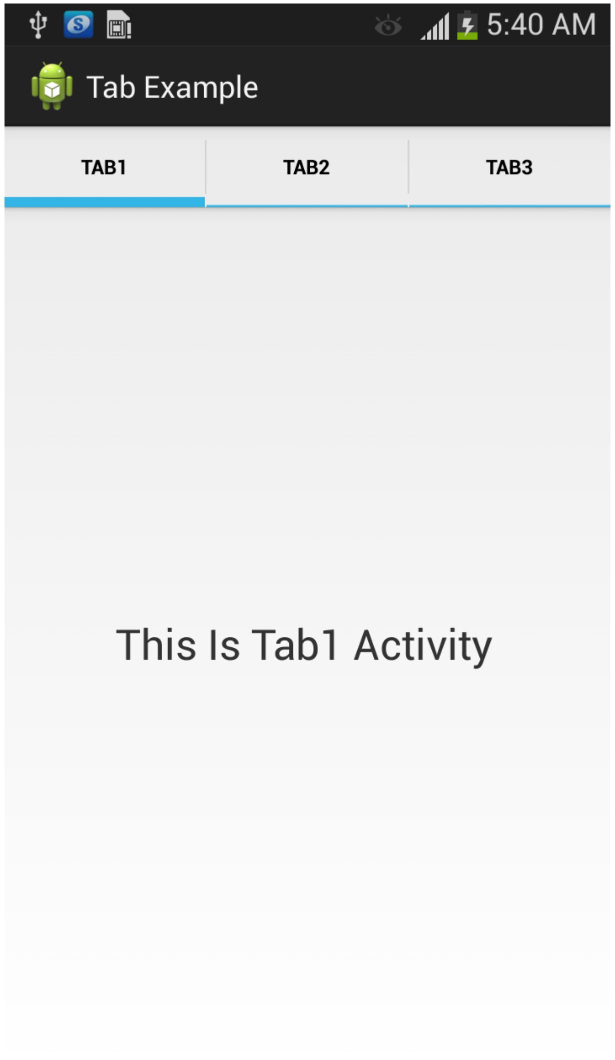


FrameLayout

- child elements pinned to top left corner of layout
- adding a new element / child draws over the last one



Other Layouts: Tabbed Layouts

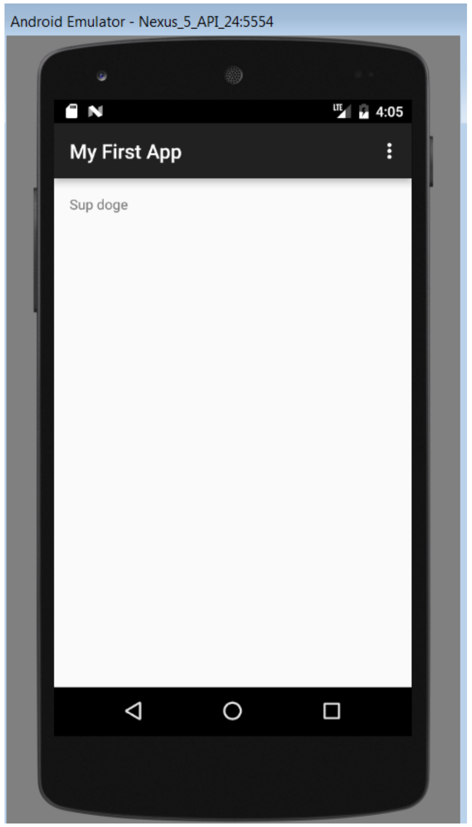


This Is Tab1 Activity

Android Example: My First App (Ref: Head First Android)

My First App

- Hello World program in Head First Android Development (Chapter 1)
- Creates app, types “Sup doge” in a TextView



HW0: Tutorials from YouTube Android Development Tutorials 1-8 by Bucky Roberts

- **Tutorials 1 & 2 (Optional):** Installing Java, Android Studio on your own machine
  - **Tutorial 1:** Install Java (Android studio needs this at least ver. 1.8)
  - **Tutorial 2:** Install Android Studio
- **Tutorial 3:** Setting up your project
  - How to set up a new Android Project, add new Activity (App screen)
- **Tutorial 4:** Running a Simple App
  - How to select, run app on a virtual device (AVD)
- **Tutorial 5:** Tour of Android Studio Interface
  - Intro to Android Studio menus, toolbars and Drag-and-drop widget palette

References

- Android App Development for Beginners videos by Bucky Roberts (thenewboston)
- Ask A Dev, Android Wear: What Developers Need to Know, https://www.youtube.com/watch?v=zTS2NZpLyQg
- Ask A Dev, Mobile Minute: What to (Android) Wear, https://www.youtube.com/watch?v=n5Yjzn3b_aQ
- Busy Coder's guide to Android version 4.4
- CS 65/165 slides, Dartmouth College, Spring 2014
- CS 371M slides, U of Texas Austin, Spring 2014