ANDROID LAYOUTS AND WIDGETS

Introduction

- Parts of the Android screen
- Sizing widgets and fonts
- Layouts and their characteristics
- Buttons, checkboxes and other widgets
- Ways to program event handlers

Android UI Concepts

- All Android applications have similar user interface elements
  - Some of this has changed from the first phones but that was a long time ago
  - Some of the first devices had a hardware menu button

Android Screen Elements (1)

- The System bar appears along the top of the screen and contains system and notification icons
- Toolbars typically appear across the top of the application and can be rendered differently
  - The App bar (action bar) is a special form of toolbar having the one or many of a navigation icon, title, filter, and action icons and menu icons

Android Screen Elements (2)

- The navigation bar appears along the bottom of the device
- The remainder of the screen is covered by a layout
- There are other popup windows and messages that will be discussed later with multiple activities

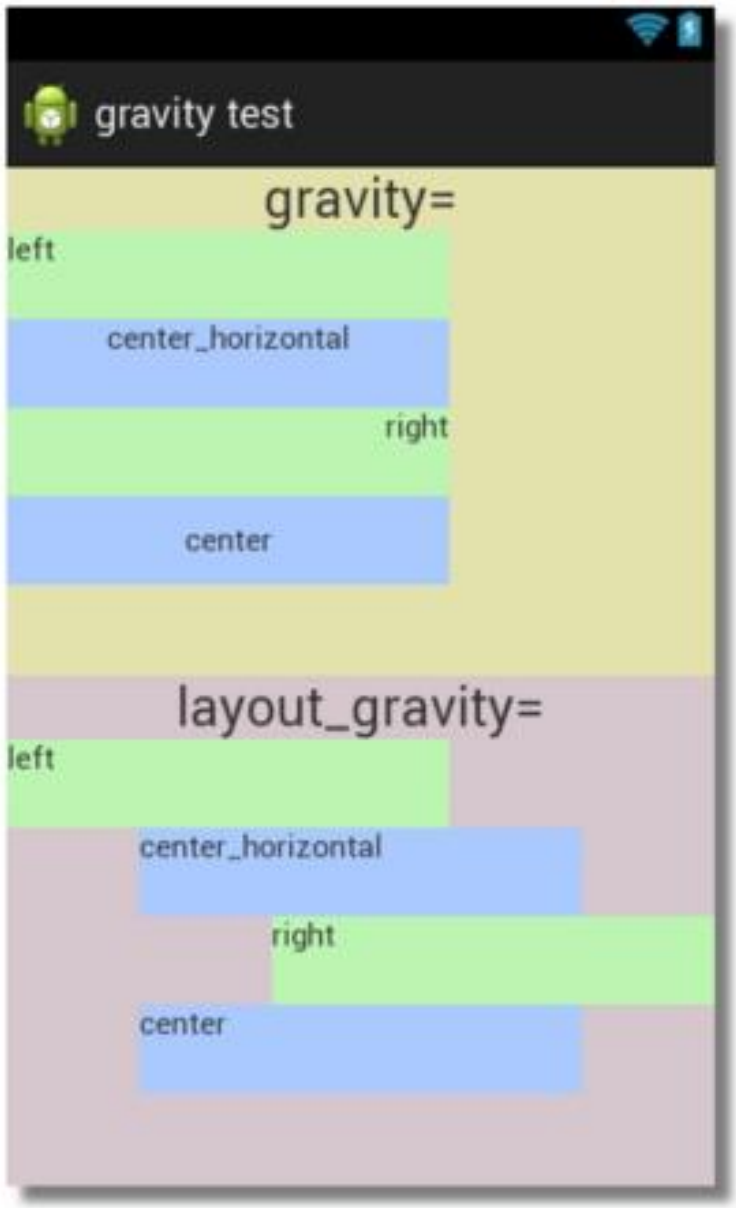
Android Font Sizes

- All views have a size Fonts have a size. We can use the following units of measure
- **px** – screen pixels
- **in** – inches based on the physical screen size
- **mm** – millimeters based on the physical screen size
- **pt** – 1/72 of an inch based on physical screen size
- **dp** or **dip** – device independent unit based relative to a 160 dpi screen
- **sp** – similar to dp but used for font sizes

Gravity

- Gravity is a way to define which side of the parent an object is anchored
- **`android:gravity`** refers to the gravity of the view's content (text for example)
- **`android:layout_gravity`** refers to the gravity of the view itself
  - Only works with a linear layout
  - Widgets are anchored along the parent layout
- **`center_vertical`**, **`center_horiztonal`**, **`center`**

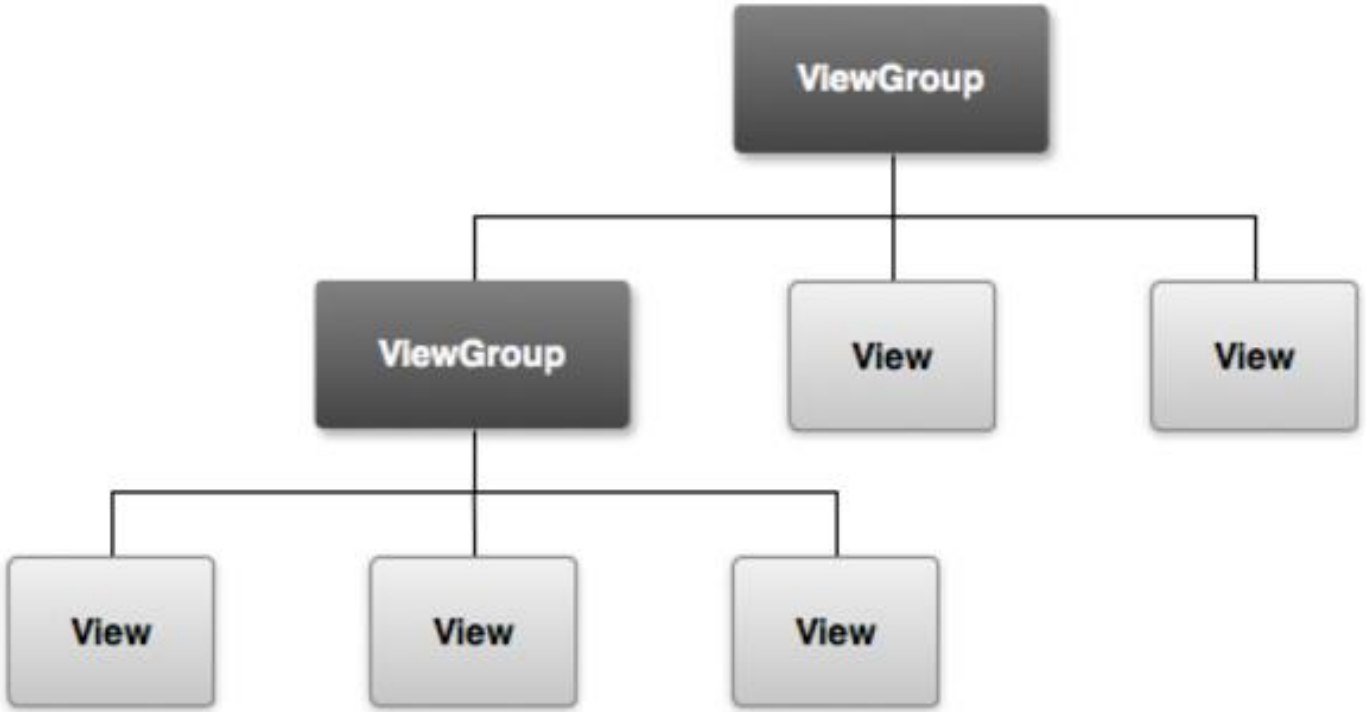
Gravity


gravity test
gravity=
left
center_horizontal
right
center
layout_gravity=
left
center_horizontal
right
center

Android Layouts (Introduction)

- Visual elements are built from
  - **`ViewGroup`**: These are the different layouts which connect other ViewGroups and other widgets (**`LinearLayout`**, **`RelativeLayout`**)
  - **`Views`** are the widgets with which the user interacts (**`Button`**, etc).
- **`ViewGroup`** and **`View`** objects are organized into a hierarchy

Android Layouts (Illustration)



Application Components (Layout)

- There are different types of layouts for a screen (View)
  - Using a `LinearLayout`, child widgets are aligned horizontally or vertically
  - Using a `RelativeLayout` child widgets are aligned relative to each other or the parent window
- There are other layouts not discussed in this section

Application Components (Layout) (1)

- A layout describes the visual structure for a UI element, such as the UI for an activity
- It's an XML document, so you need some familiarity with XML
- Android provides an XML vocabulary that corresponds to the `View` classes and subclasses, such as those for widgets and layouts

Application Components (`LinearLayout`)

- **`LinearLayout`** aligns child objects vertically or horizontally
  - Use the **`android:orientation`** attribute to specify the layout direction (**`vertical`** / **`horizontal`**)
  - Scrollbars appear if the window length exceeds the screen length

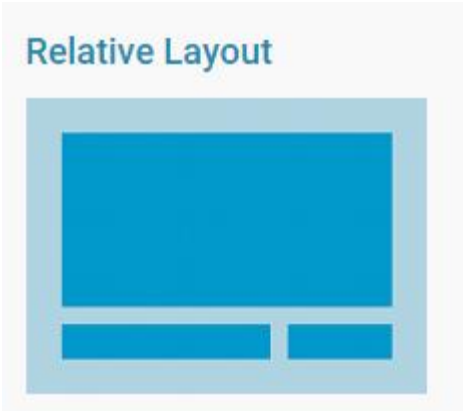
```
<LinearLayout xmlns:android="http://schemas.android.com/apk/re
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:paddingLeft="16dp"
    android:paddingRight="16dp"
    android:orientation="vertical" >
```

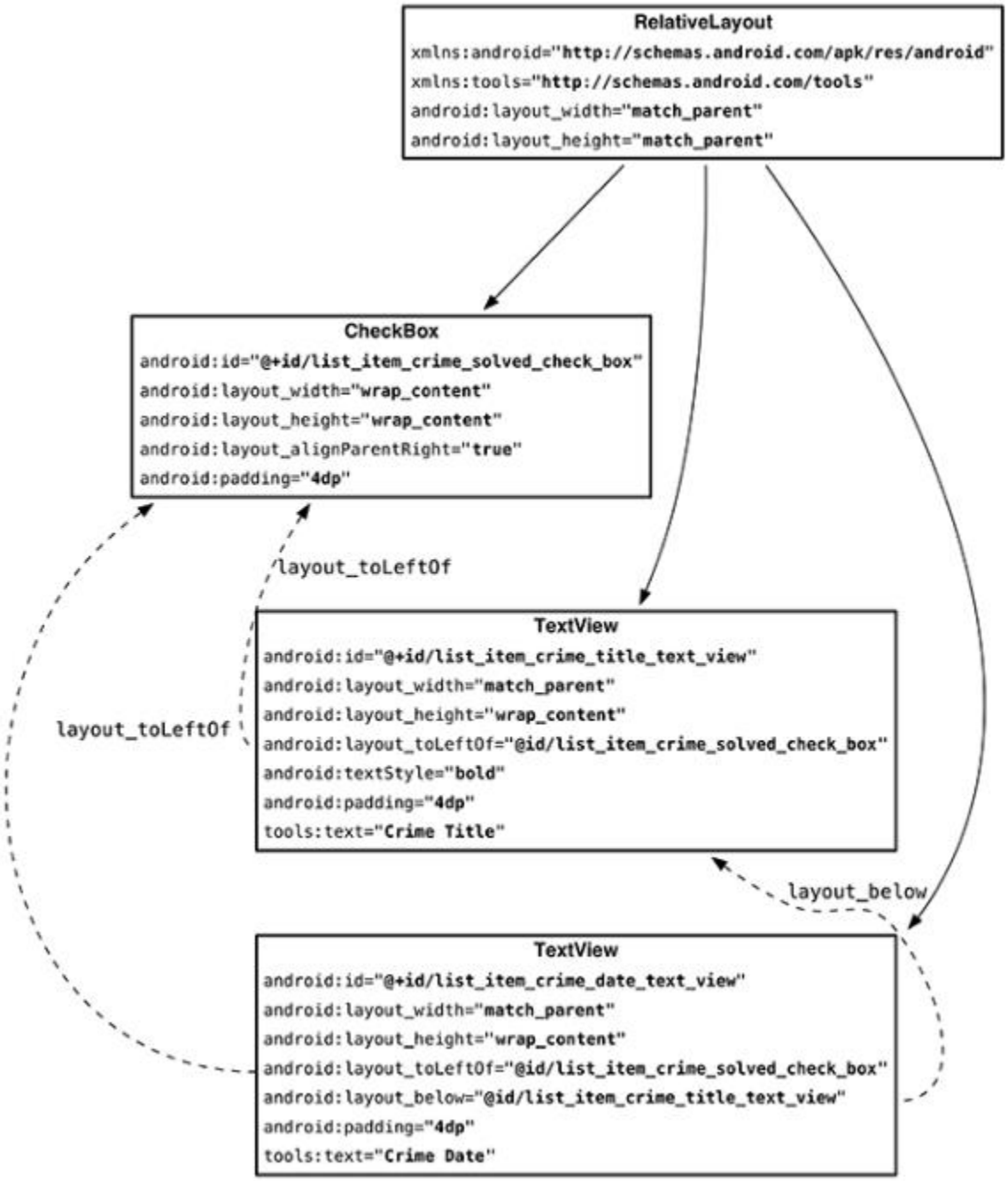
Application Components (`LinearLayout`)

- Create multiple nested `LinearLayout` widgets to nest vertical and horizontal layouts

Application Components (`RelativeLayout`)

- **`RelativeLayout`** aligns objects relative to each other (siblings)
- Such as:
  - Child A to the left of child B
  - Or align to the parent




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"
CheckBox
android:id="@+id/list_item_crime_solved_check_box"
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:layout_alignParentRight="true"
android:padding="4dp"
layout_toLeftOf
layout_toLeftOf
TextView
android:id="@+id/list_item_crime_title_text_view"
android:layout_width="match_parent"
android:layout_height="wrap_content"
android:layout_toLeftOf="@id/list_item_crime_solved_check_box"
android:textStyle="bold"
android:padding="4dp"
tools:text="Crime Title"
layout_below
TextView
android:id="@+id/list_item_crime_date_text_view"
android:layout_width="match_parent"
android:layout_height="wrap_content"
android:layout_toLeftOf="@id/list_item_crime_solved_check_box"
android:layout_below="@id/list_item_crime_title_text_view"
android:padding="4dp"
tools:text="Crime Date"

Android `RelativeLayout` (Positioning Child Widgets)

- Position children relative to each other or the parent
  - By default, all views are drawn at the top left of the layout
- These properties belong to `RelativeLayout.LayoutParams`
- There are many properties but we really only need a few for most layouts

Android `RelativeLayout` (Positioning Child Widgets)

- **`android:layout_alignParentTop`**
  - If **`true`** makes the top edge of this widget match the top edge of the parent
- **`android:layout_alignTop`**
  - Positions the top edge of this view to match the one with the specified resource ID

Android `RelativeLayout` (Positioning Child Widgets)

- **`android:layout_below`**
  - Positions the top edge of this view below the one with the specified resource id
- **`android:layout_toRightOf`**
  - Positions the left edge of this view to the right of the one with the specified resource id

Introduction to Input Controls

- **`TextView`**
- **`EditText`**
- **`Button`**
- **`CheckBox`**
- *etc*..
- All are configured as XML in a layout file

`TextView` Control

- It displays (clickable) text to the user
  - **`text`** is primary attribute, containing the visible text
  - Other attributes (**`text, textStyle, textSize, …`**) control appearance

```
<TextView
    android:id="@+id/tvLength"
    android:labelFor="@+id/txtLength"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:text="@string/length_prompt" />
```

`EditText` Control

- An editable text control similar to a text box
  - **`android:inputType`** defines the allowable input values (e.g., **`textEmailAddress`**)
  - **`android:text`** contains the initial text
  - Runtime **`getText`** and **`setText`** method retrieve or set the text, respectively

```
<EditText
    android:id="@id/txtLength"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:inputType="numberSigned"
/>
```

`EditText` Control

- Using `getText` and `setText`

```
final EditText txtDemo;
txtDemo = (EditText) findViewById(R.id.txtDemo)
txtDemo.setText("Hello");
String s = txtDemo.getText.toString();
```

Button Control

- A button has a width and height
- The button's text appears in strings.xml
- As you will see, there are several ways to wire events

```
<Button
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:text="@string/button_text"
    ... />
```

`CheckBox` Control

- As in most environments, it's a two-state control that is checked or unchecked
  - The `isChecked` accessor indicates whether the box is checked or not
  - The `setChecked` mutator accepts a Boolean argument to set the state of the widget (checked / unchecked)

Handling Events

- There are different ways to handle events in Android
- We will discuss a few of them
  - Link XML document to handler

Application Components (Handling a Click – Method 1)

- When the user clicks a button, the object receives an **`onClick`** event which you can handle

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

```
/** Called when the user touches the button */
public void sendMessage(View view) {
    // Do something in response to button click
}
```

Application Components (Handling a Click – Method 2)

- The event handler can also be declared programmatically using an anonymous class
  - The book uses this technique

```
Button button = (Button) findViewById(R.id.button_send);
button.setOnClickListener(new View.OnClickListener() {
    public void onClick(View v) {
        // Do something in response to button click
    }
});
```

Application Components (Handling a Click – Method 3)

- Using this technique, you create a class that implements the `OnClickListener` interface
  - When you implement this interface, you must implement the `onClick` method
- Call the `setOnClickListener` for the view passing an instance of the above class

Application Components (Handling a Click – Method 3)

```
final Button button3 = (Button) findViewById(R.id.btnTechnique3);
button3.setOnClickListener(new HandleClickTechnique3());
```

```
private class HandleClickTechnique3 implements OnClickListener
{
    public void onClick(View v)
    {
        TextView tvResult;
        tvResult = (TextView) findViewById(R.id.tvResult);
        tvResult.setText("btnTechnique3 Clicked");
    }
}
```

Application Components (Activities) (`onCreate`)

- `@Override` indicates that we are overriding a base class method
  - It's an informative annotation
  - Annotations are used to control compiler behavior

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

Application Components (Activities) (`onCreate`)

- **`super.onCreate`** calls the base class method
  - **`super`** is already familiar from Java
  - It typically appears as the first statement in the method

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

Application Components (Activities) (`onCreate`)

- **`setContentView`** takes one argument – the resource id corresponding to the activity
- It associates a particular view with the activity
  - The resource is always named R
  - Layout is the layout that you want to use
  - Followed by the resource id of the layout

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