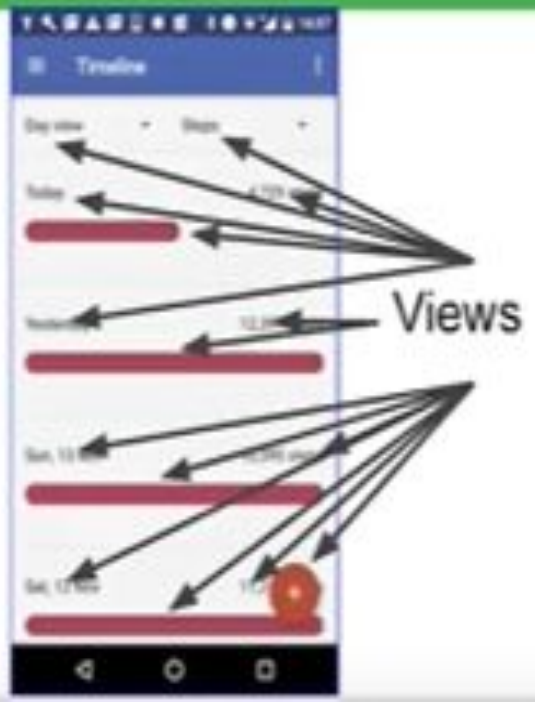
Layouts, Views and Resources

Contents

- Views, view groups, and view hierarchy
- Layouts in XML and Java code
- Event Handling
- Resources
- Screen Measurements

Everything you see is a view

If you look at your mobile device, every user interface element that you see is a **View**.



What is a view

Views are Android's basic user interface building blocks.

- display text (TextView class), edit text (EditText class)
- buttons (Button class), menus, other controls
- scrollable (ScrollView, RecyclerView)
- show images (ImageView)
- subclass of View class

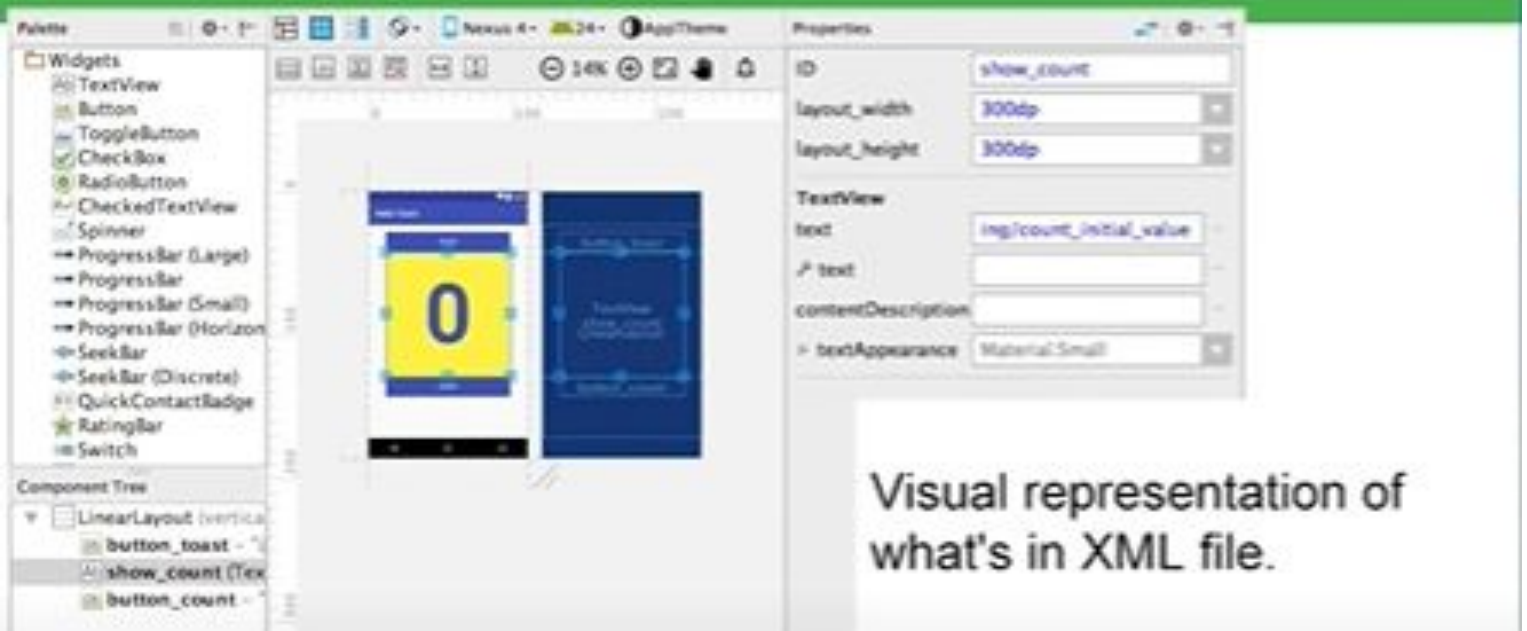
Views have properties

- Have properties (e.g., color, dimensions, positioning)
- May have focus (e.g., selected to receive user input)
- May be interactive (respond to user clicks)
- May be visible or not
- Have relationships to other views

Creating and laying out views

- Graphically within Android Studio
- XML Files
- Programmatically

Views defined in Layout Editor



Using the Layout Editor

1. Resizing handle
2. Constraint line and handle
3. Baseline handle
4. Constraint handle

Views defined in XML

```
<TextView
        android:id="@+id/show_count"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:background="@color/myBackgroundColor"
        android:text="@string/count_initial_value"
        android:textColor="@color/colorPrimary"
        android:textSize="@dimen/count_text_size"
        android:textStyle="bold"
/>
```

View properties in XML

```
android:<property_name>="<property_value>"
Example: android:layout_width="match_parent"

android:<property_name>="@<resource_type>/resource_id"
Example: android:text="@string/button_label_next"

android:<property_name>="@+id/view_id"
Example: android:id="@+id/show_count"
```

Create View in Java code

context

In an Activity:

```
TextView myText = new TextView(this);
myText.setText("Display this text!");
```

What is the context?

- Context is an interface to global information about an application environment
- Get the context:
```
Context context = getApplicationContext();
```
- An activity is its own context:
```
TextView myText = new TextView(this);
```

Custom views

- Over 100 (!) different types of views available from the Android system, all children of the View class
- If necessary, create custom views by subclassing existing views or the View class

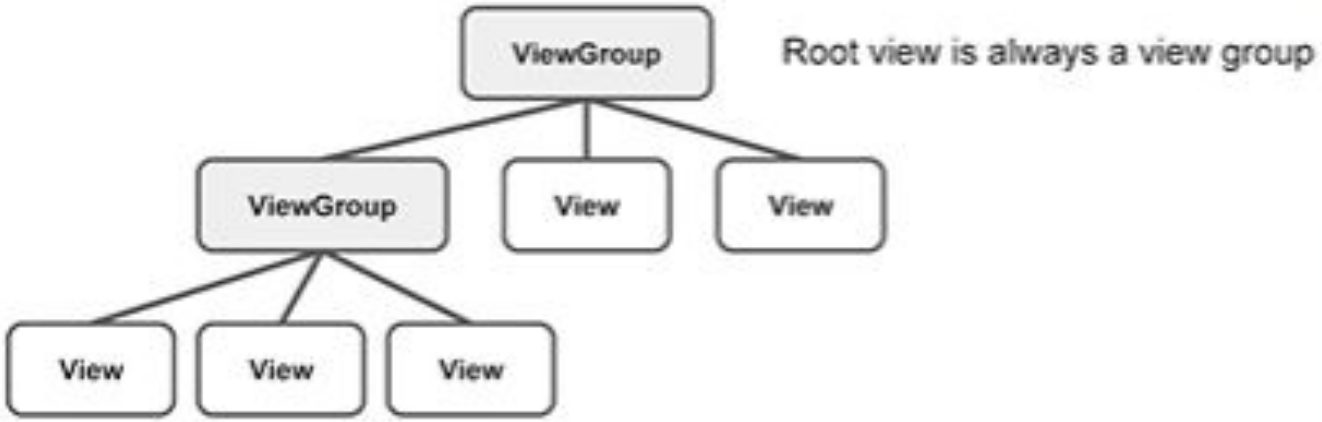
ViewGroup views

A ViewGroup (parent) is a type of view that can contain other views (children)

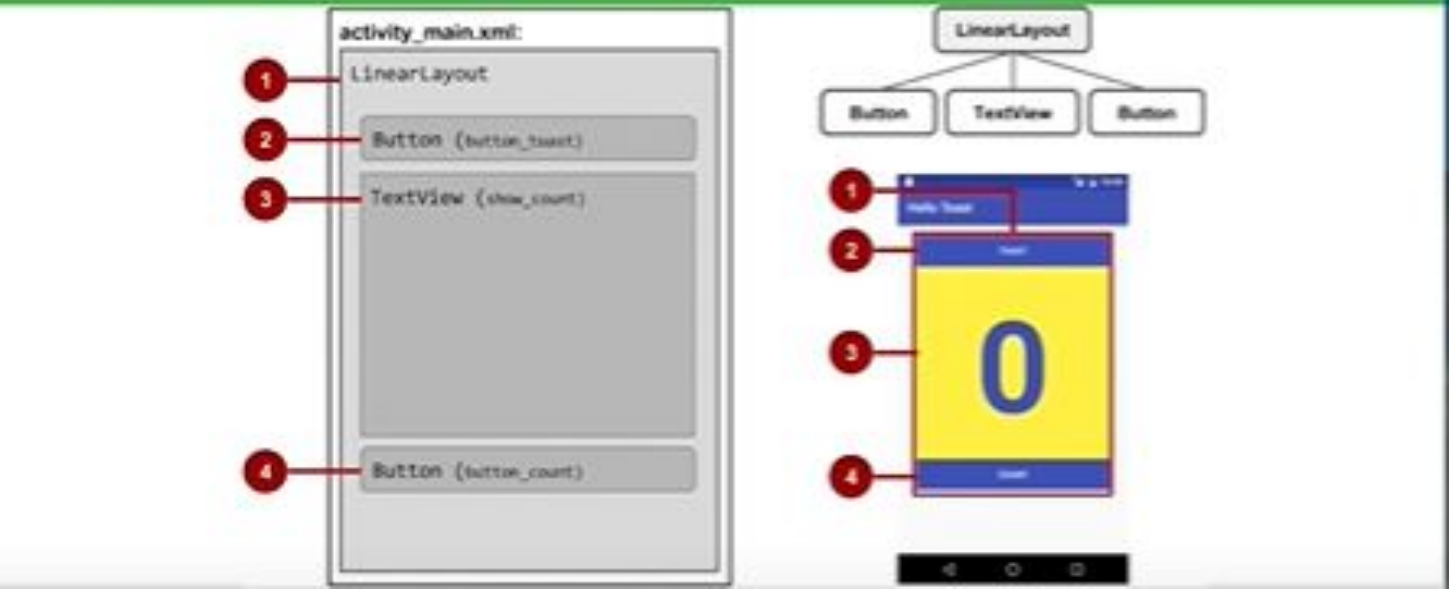
ViewGroup is the base class for layouts and view containers

- ScrollView—scrollable view that contains one child view
- LinearLayout—arrange views in horizontal/vertical row
- RecyclerView—scrollable "list" of views or view groups

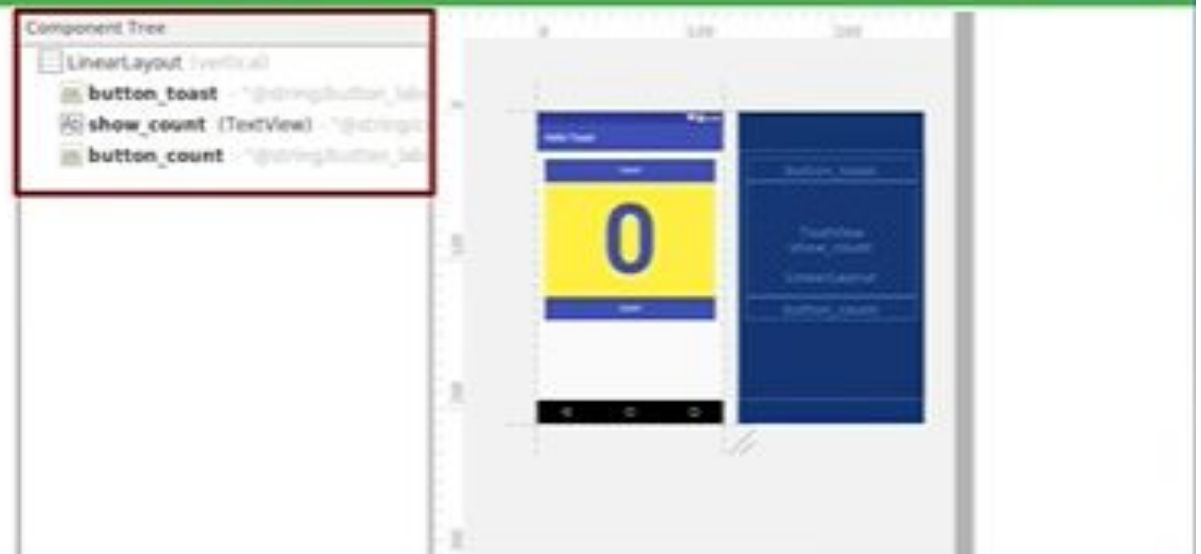
Hierarchy of view groups and views



View hierarchy and screen layout



View hierarchy in the component tree



Best practices for view hierarchies

- Arrangement of view hierarchy affects app performance
- Use smallest number of simplest views possible
- Keep the hierarchy flat—limit nesting of views and view groups

Layout Views

Layouts

- are specific types of view groups
- are subclasses of ViewGroup
- contain child views
- can be in a row, column, grid, table, absolute

Common Layout Classes

LinearLayout RelativeLayout GridLayout TableLayout

Common Layout Classes

- **ConstraintLayout -** connect views with constraints
- **LinearLayout** - horizontal or vertical row
- **RelativeLayout** - child views relative to each other
- **TableLayout** - rows and columns
- **FrameLayout** - shows one child of a stack of children
- **GridView** - 2D scrollable grid

Class Hierarchy vs. Layout Hierarchy

- View class-hierarchy is standard object-oriented class inheritance
  - For example, Button is-a TextView is-a View is-a Object
  - Superclass-subclass relationship
- Layout hierarchy is how Views are visually arranged
  - For example, LinearLayout can contain Buttons arranged in a row
  - Parent-child relationship

Layout created in XML

```
<LinearLayout
  android:orientation="vertical"
  android:layout_width="match_parent"
  android:layout_height="match_parent">
    <EditText
        ... />
    <Button
        ... />
</LinearLayout
```

Layout created in Java Activity code

```
LinearLayout linearL = new LinearLayout(this);
linearL.setOrientation(LinearLayout.VERTICAL);

TextView myText = new TextView(this);
myText.setText("Display this text!");

linearL.addView(myText);
setContentView(linearL);
```

Setting width and height in Java code

Set the width and height of a view:

```
LinearLayout.LayoutParams layoutParams =
  new Linear.LayoutParams(
     LayoutParams.MATCH_PARENT,
     LayoutParams.WRAP_CONTENT);

myView.setLayoutParams(layoutParams);
```

Events

Something that happens

- In UI: Click, tap, drag
- Device: DetectedActivity such as walking, driving, tilting
- Events are "noticed" by the Android system

Event Handlers

Methods that do something in response to a click

- A method, called an **event handler**, is triggered by a specific event and does something in response to the event

Handling clicks in XML & Java

Attach handler to view in layout:

```
android:onClick="showToast"
```

Implement handler in activity:

```
public void showToast(View view) {
  String msg = "Hello Toast!";
  Toast toast = Toast.makeText(
        this, msg, duration);
  toast.show();
  }
}
```

Setting click handlers in Java

```
final Button button = (Button) findViewById(R.id.button_id);
button.setOnClickListener(new View.OnClickListener() {
    public void onClick(View v) {
        String msg = "Hello Toast!";
        Toast toast = Toast.makeText(this, msg, duration);
        toast.show();
        }
     });
```

Resources

- Separate static data from code in your layouts.
- Strings, dimensions, images, menu text, colors, styles
- Useful for localization

Where are the resources in your project?

Refer to resources in code

- Layout:

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

- View:

```
R.id.recyclerview
rv = (RecyclerView) findViewById(R.id.recyclerview);
```

- String:

In Java: `R.string.title`

In XML: `android:text="@string/title"`

Measurements

- Device Independent Pixels (dp) - for Views
- Scale Independent Pixels (sp) - for text

Don't use device-dependent units:

- ~~Actual Pixels (px)~~
- ~~Actual Measurement (in, mm)~~
- ~~Points - typography 1/72 inch (pt)~~