Mobile Application Development

Produced by

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Application Structure

Agenda & Goals

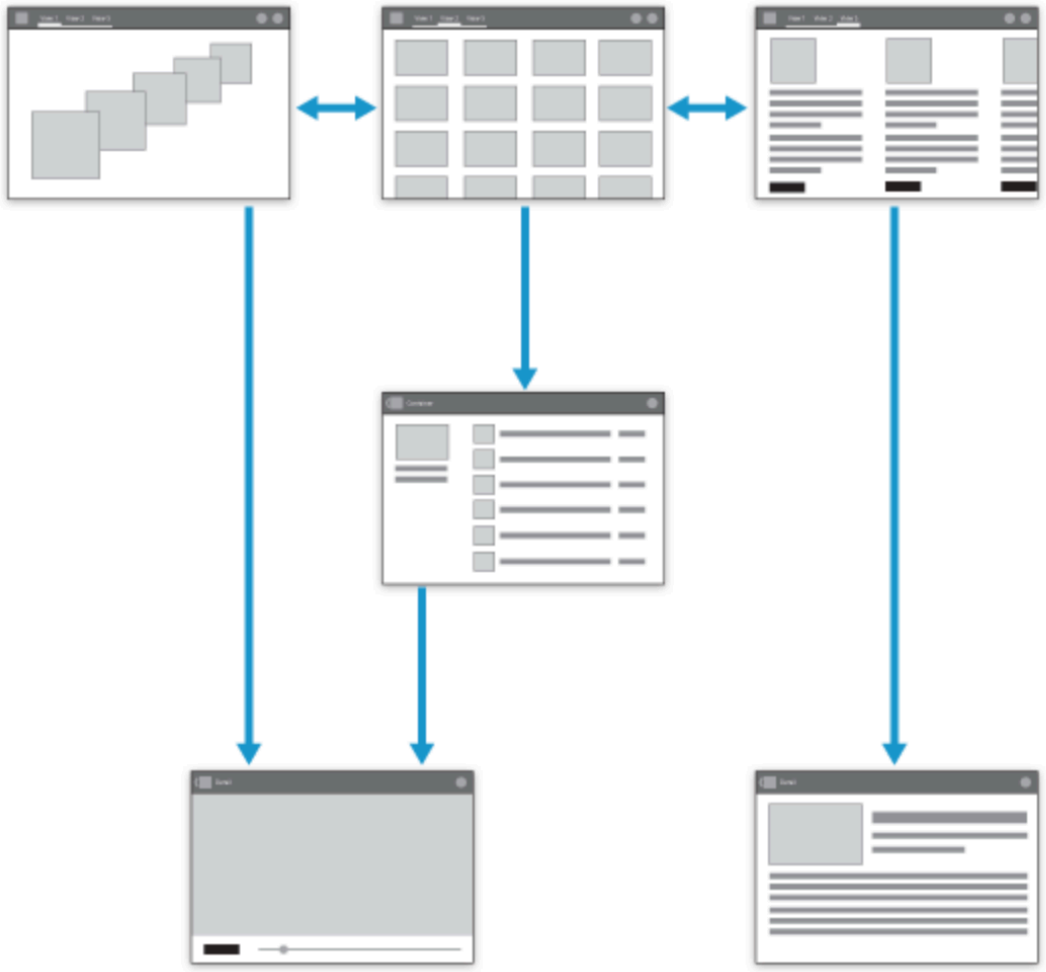
- Application Structure & Considerations
- More Menu Navigation
- Creating and using Custom Adapters

Introduction – App Structure

- Apps come in many varieties that address very different needs.
- For example:
  - Apps such as Calculator or Camera that are built around a single focused activity handled from a single screen
  - Apps such as Phone whose main purpose is to switch between different activities without deeper navigation
  - Apps such as Gmail or the Play Store that combine a broad set of data views with deep navigation
- Your app's structure depends largely on the content and tasks you want to surface for your users.

General (App) Structure

- A typical Android app consists of top level and detail/edit views.
- If the navigation hierarchy is deep and complex, category views connect top level and detail views.



Top level views

The top level of the app typically consists of the different views that your app supports. The views either show different representations of the same data or expose an altogether different functional facet of your app.

Category views

Category views allow you to drill deeper into your data.

Detail/edit view

The detail/edit view is where you consume or create data.

App Structure : Considerations

- Top Level Content
- Top Level Switching
- Categories
- Details

Top Level : Content

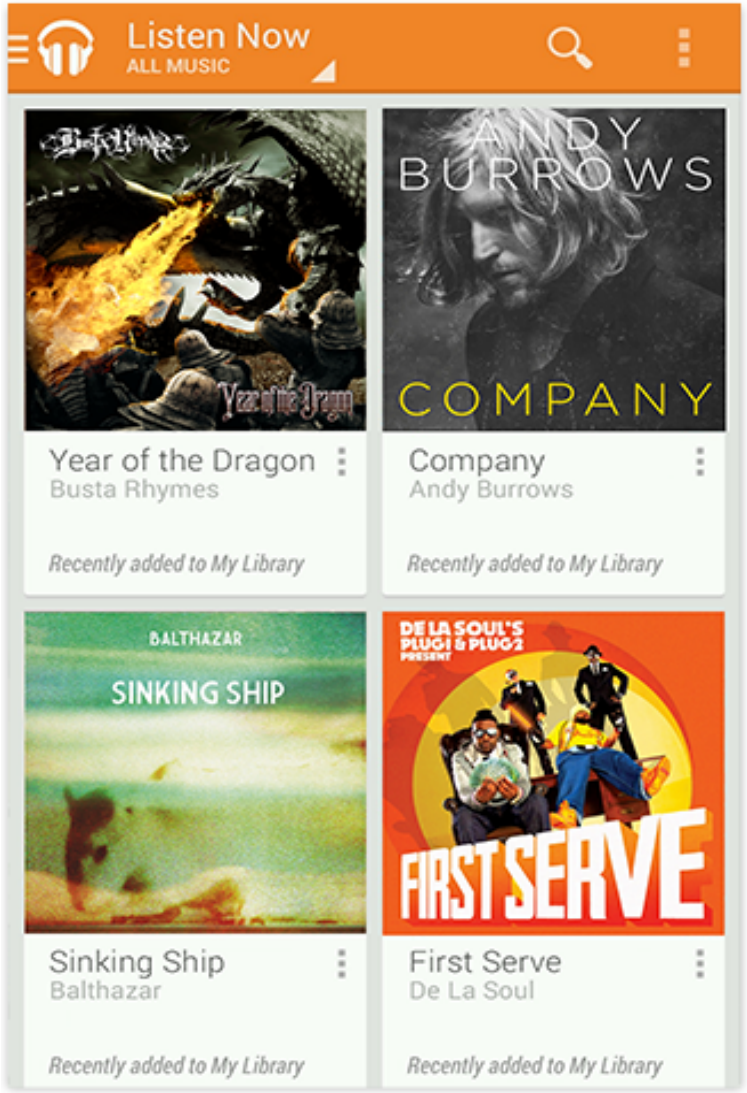
- "What are my typical users most likely going to want to do in my app?"

- **Put content forward**

  - Many apps focus on the content display.

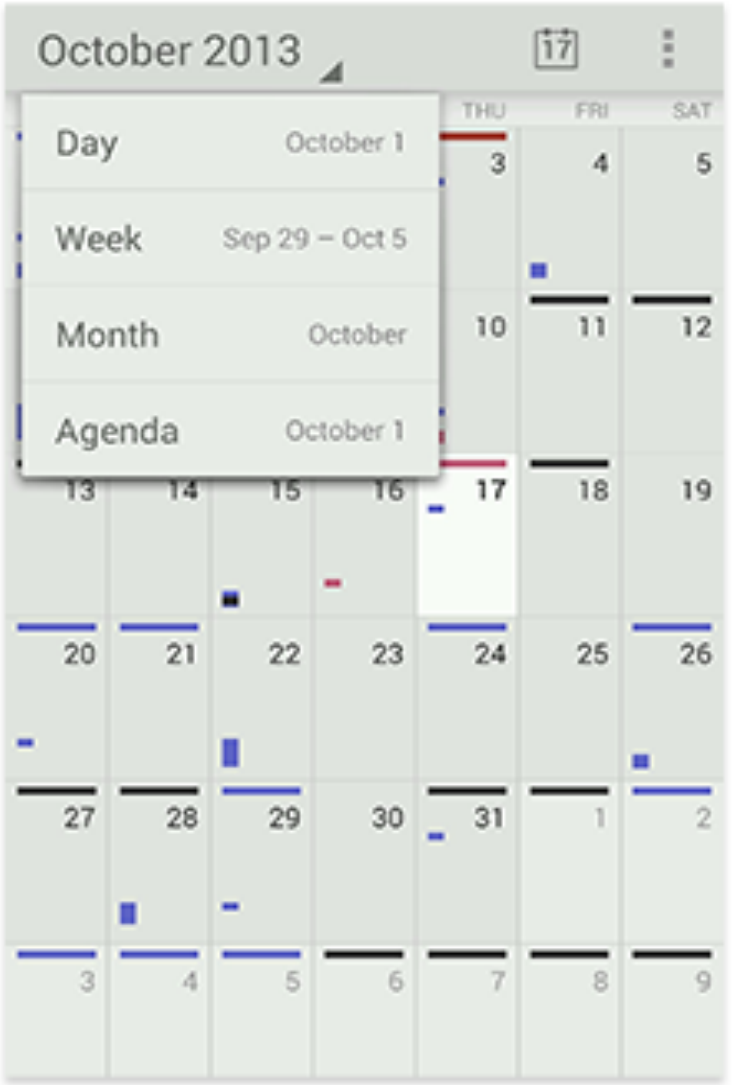
  - Avoid navigation-only screens and instead let people get to the meat of your app right away by making content the centerpiece of your start screen.

  - Choose layouts that are visually engaging and appropriate for the data type and screen size



Top Level: Navigation

- All screens in your app should display action bars to provide consistent navigation and surface important actions.
- At the top level, special considerations apply to the action bar:
  - Use the action bar to display your app's icon or title.
  - If your top level consists of multiple views, make sure that it's easy for the user to navigate between them by adding view controls to your action bar.
  - If your app allows people to create content, consider making the content accessible right from the top level.
  - if your content is searchable, include the Search action in the action bar so people can cut through the navigation hierarchy



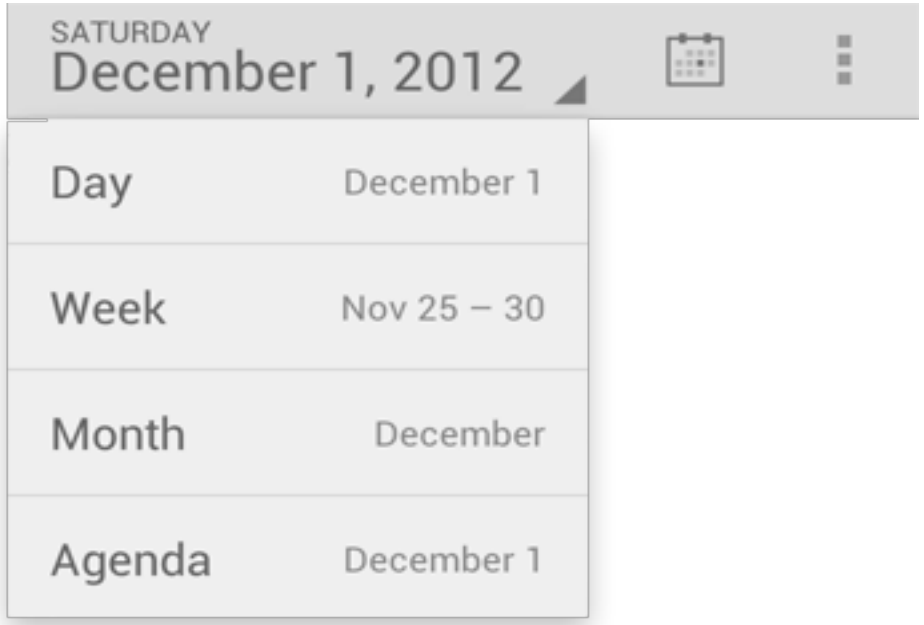
Top Level Switching: Fixed Tabs

- Fixed tabs display top-level views concurrently and make it easy to explore and switch between them.
- They are always visible on the screen, and can't be moved out of the way like scrollable tabs.
- Fixed tabs should always allow the user to navigate between the views by swiping left or right on the content area.

- Use if:
  - You expect your app's users to switch views frequently.
  - You have a limited number of up to three top-level views.
  - You want the user to be highly aware of the alternate views.

Top Level Switching: Spinners

- A spinner is a drop-down menu that allows users to switch between views of your app.

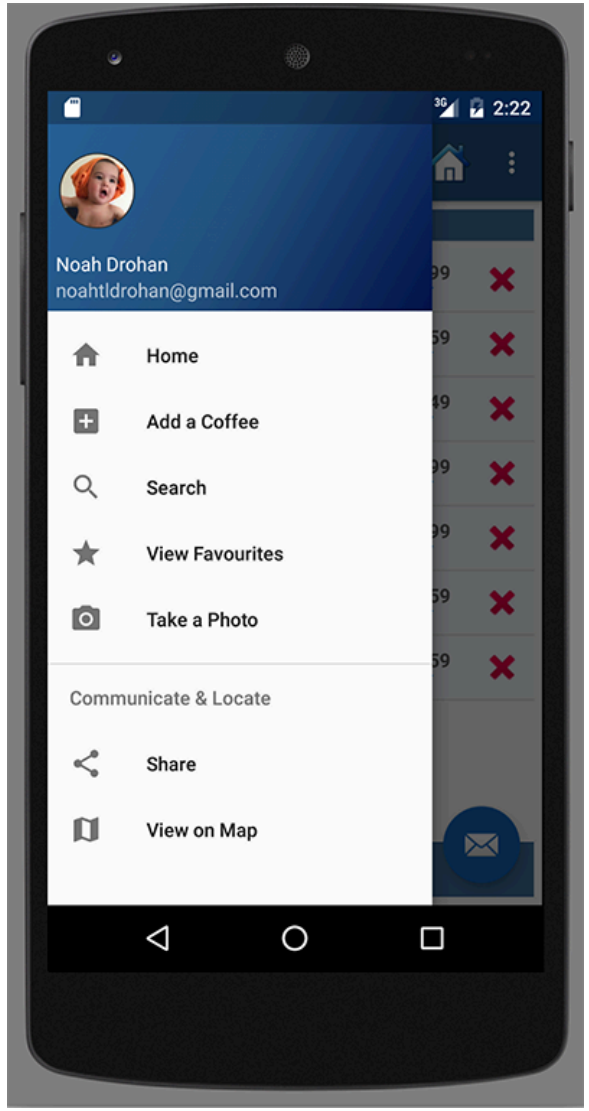


- Use if:
  - You don't want to give up the vertical screen real estate for a dedicated tab bar.
  - The user is switching between views of the same data set (for example: calendar events viewed by day, week, or month) or data sets of the same type (such as content for two different accounts).

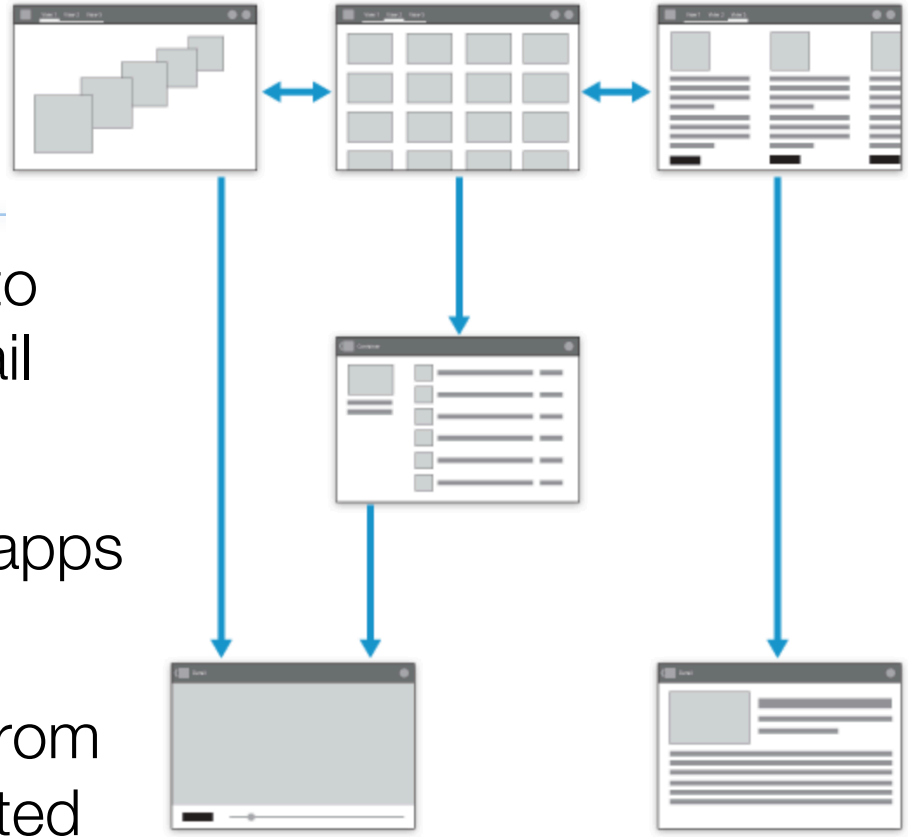
Top Level Switching: Navigation Drawer

- A navigation drawer is a slide-out menu that allows users to switch between views of your app. It can hold a large number of items and is accessible from anywhere in your app. Navigation drawers show your app's top-level views, but can also provide navigation to lower-level screens. This makes them particularly suitable for complex apps.

- Use if:
  - You don't want to give up the vertical screen real estate for a dedicated tab bar.
  - You have a large number of top-level views.
  - You want to provide direct access to screens on lower levels.
  - You want to provide quick navigation to views which don't have direct relationships between each other.
  - You have particularly deep navigation branches.



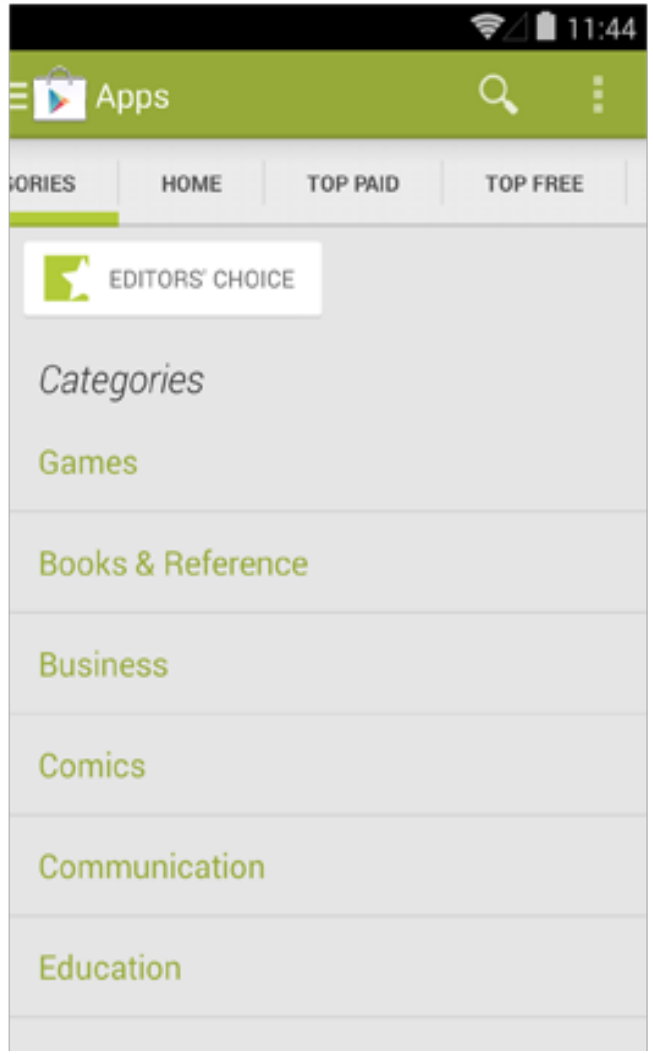
Categories



- Generally, the purpose of a deep, data-driven app is to navigate through organizational categories to the detail level, where data can be viewed and managed.
- Minimize perceived navigation effort by keeping your apps shallow.
- Even though the number of vertical navigation steps from the top level down to the detail views is typically dictated by the structure of your app's content, there are several ways you can cut down on the perception of onerous navigation.
  - Use tabs to combine category selection and data display
  - Allow cutting through hierarchies
  - Acting upon multiple data items

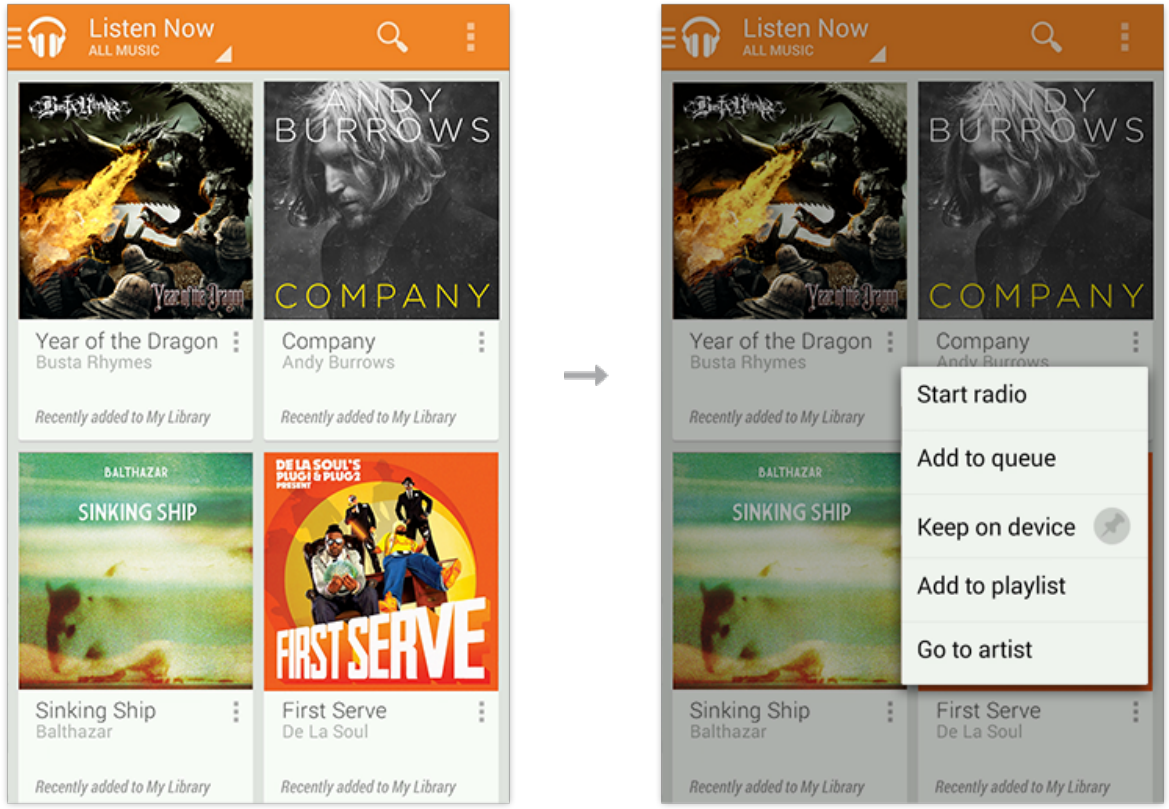
Categories: Use tabs to combine category selection and data

- This can be successful if the categories are familiar or the number of categories is small.
- It has the advantage that a level of hierarchy is removed and data remains at the center of the user's attention.
- Navigating laterally between data-rich categories is more akin to a casual browsing experience than to an explicit navigation step.



Categories: Allow cutting through hierarchies

- Take advantage of shortcuts that allow people to reach their goals quicker.
- To allow top-level invocation of actions for a data item from within list or grid views, display prominent actions directly on list view items using drop-downs or split list items.



- This lets people invoke actions on data without having to navigate all the way down the hierarchy.

Categories: Acting upon multiple data items

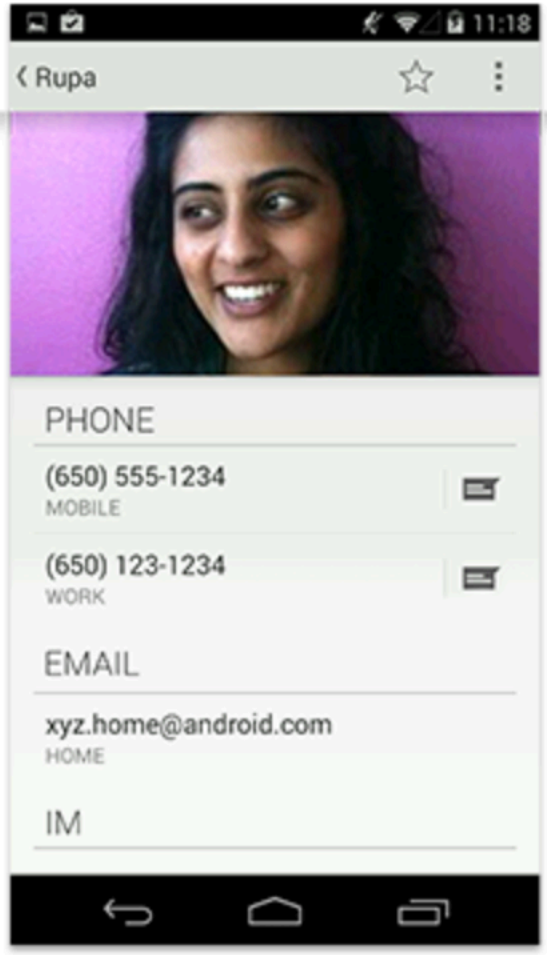
- Even though category views mostly serve to guide people to content detail, keep in mind that there are often good reasons to act on collections of data as well.

- For example, if you allow people to delete an item in a detail view, you should also allow them to delete multiple items in the category view.

- Analyze which detail view actions are applicable to collections of items. Then use multi-select to allow application of those actions to multiple items in a category view.

Details : Layout

- The detail view allows you to view and act on your data.
- The layout of the detail view depends on the data type being displayed, and therefore differs widely among apps.
- Consider the activities people will perform in the detail view and arrange the layout accordingly.

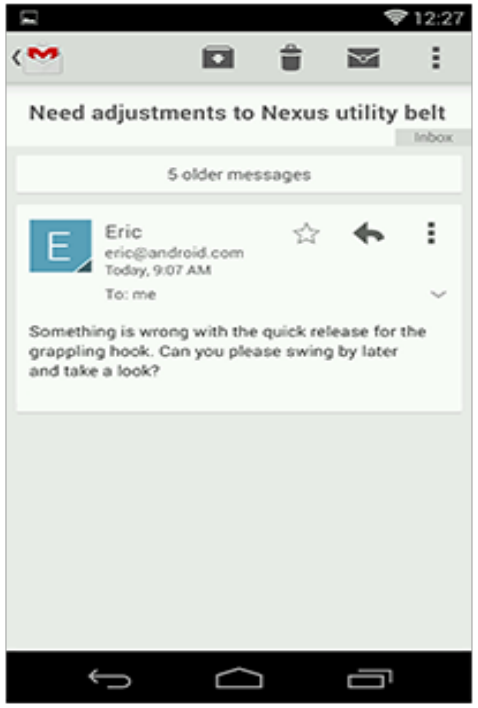


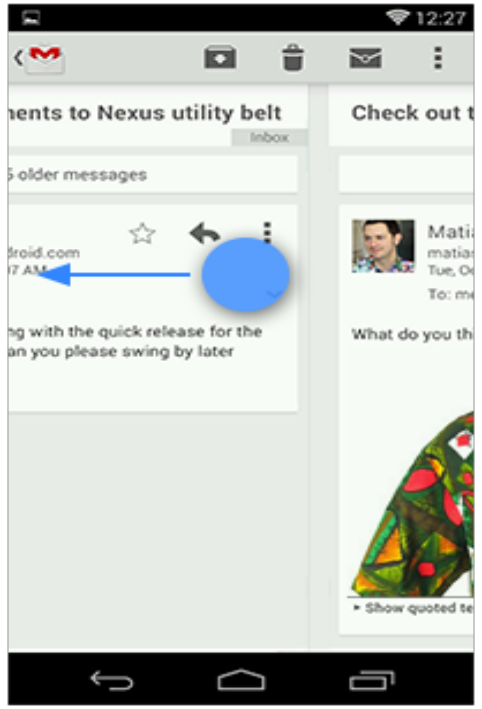
Details: Navigation

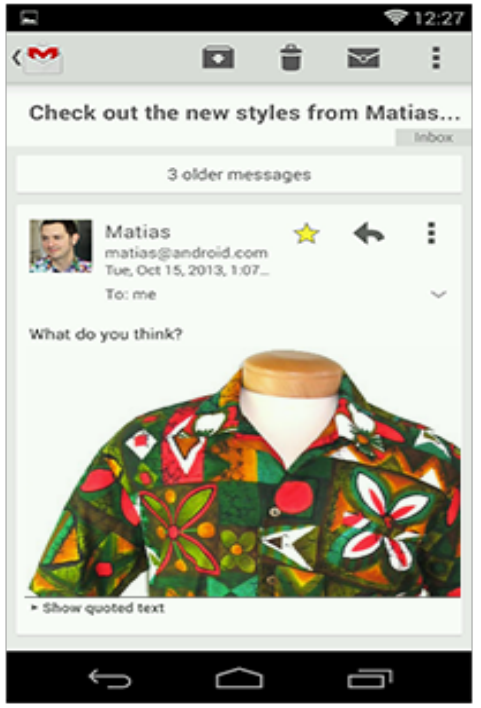
- Make navigation between detail views efficient
- If your users are likely to want to look at multiple items in sequence, allow them to navigate between items from within the detail view.

- Use swipe views or other techniques, such as thumbnail view controls, to achieve this.

- *Gmail uses swipe views to navigate from detail view to detail view.*





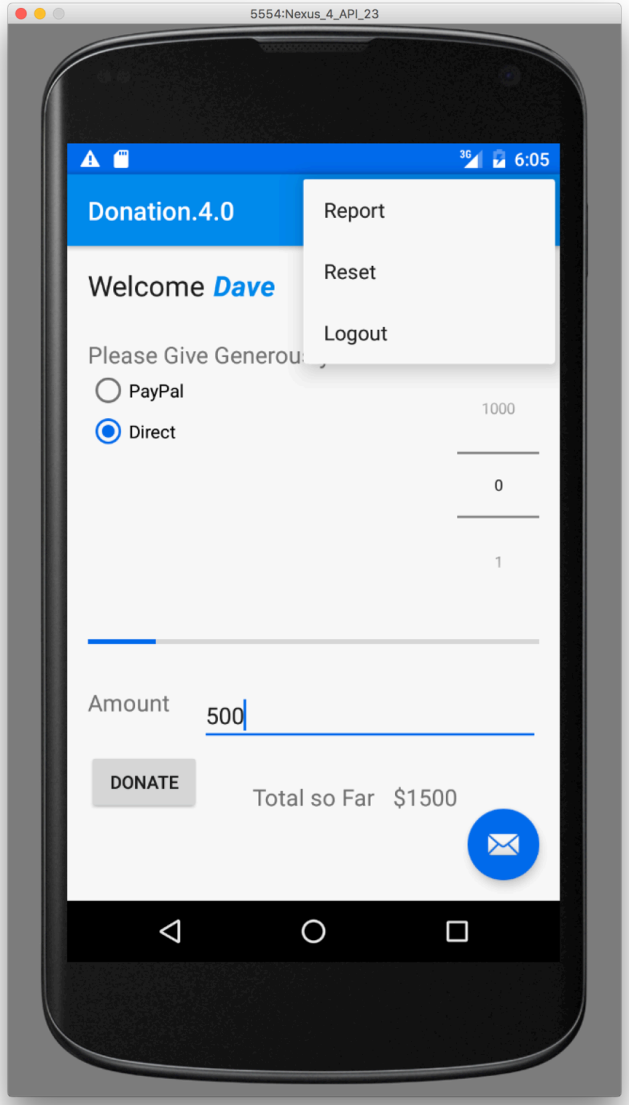


App Structure Checklist *

- Find ways to display useful content on your start screen.
- Use action bars to provide consistent navigation.
- Keep your hierarchies shallow by using horizontal navigation and shortcuts.
- Use multi-select to allow the user to act on collections of data.
- Allow for quick navigation between detail items with swipe views.

Case Study

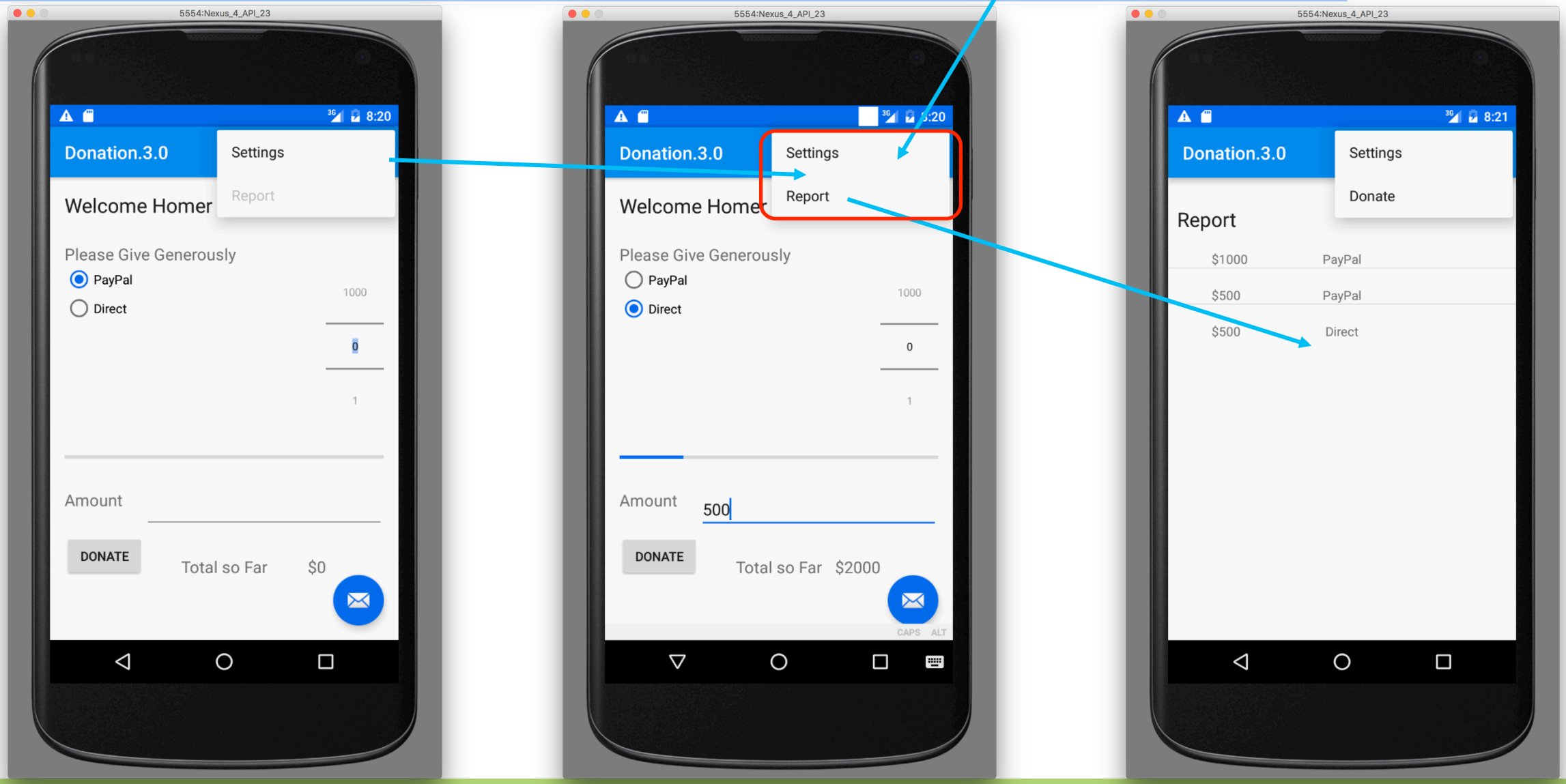
- *Donation* – an Android App to keep track of donations made to '*Homers Presidential Campaign* '.
- App Features
  - Accept donation via number picker or typed amount
  - Keep a running total of donations
  - Display report on donation amounts and types
  - Display running total on progress bar



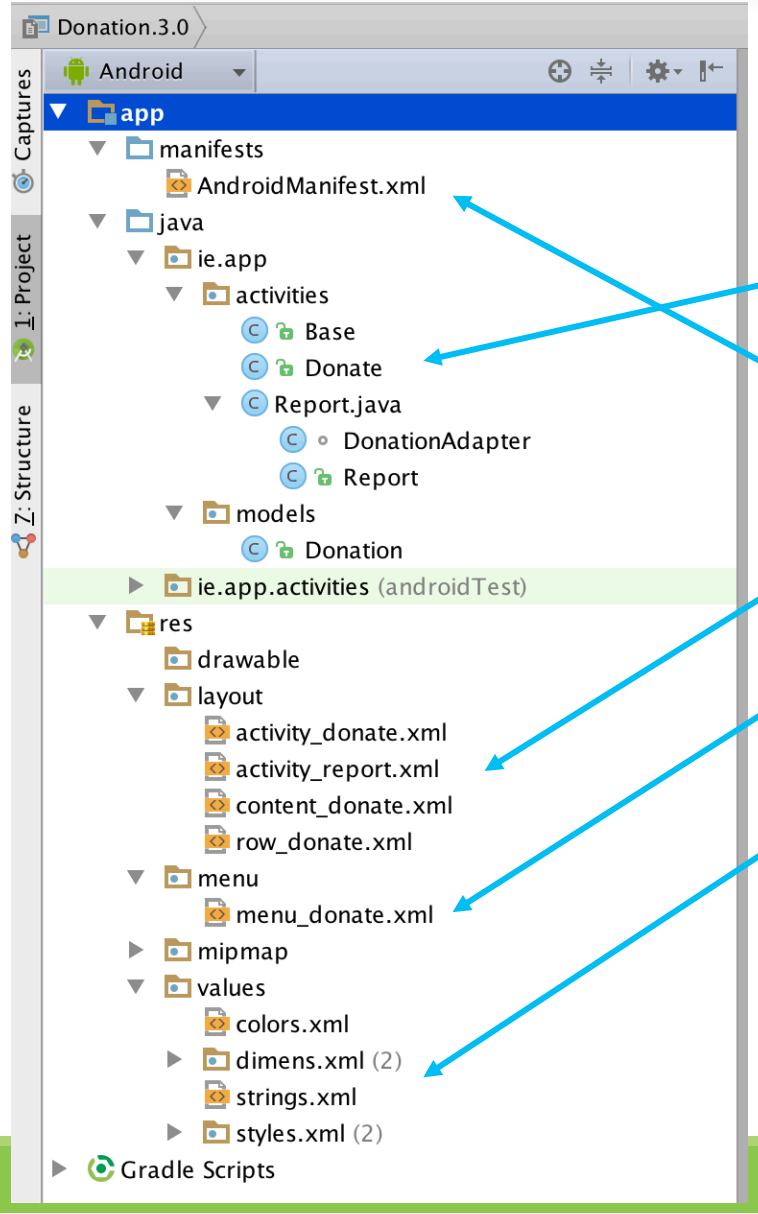
Donation.3.0

Introducing the Model
&
Base Class

Donation 3.0 *


Custom Menu
5554:Nexus_4_API_23
8:20
Donation.3.0
Settings
Report
Welcome Homer
Please Give Generously
PayPal
Direct
1000
0
1
Amount
DONATE
Total so Far $0
5554:Nexus_4_API_23
8:20
Donation.3.0
Settings
Report
Welcome Homer
Please Give Generously
PayPal
Direct
1000
0
1
Amount
500
DONATE
Total so Far $2000
5554:Nexus_4_API_23
8:21
Donation.3.0
Settings
Donate
Report
$1000 PayPal
$500 PayPal
$500 Direct

Donation 3.0 – Project Structure *



- 3 java source files
- 4 xml layouts
- 1 xml menu
- 6 xml files for resources
- 1 xml 'configuration' file

Donation 3.0 - Model

Donation.java

```
1  package ie.app.models;
2
3  public class Donation
4  {
5      public int    amount;
6      public String method;
7
8      public Donation (int amount, String method)
9      {
10         this.amount = amount;
11         this.method = method;
12     }
13 }
14
```

We'll refactor this class in Donation 4.0 to include an 'id'

Donation 3.0 – Base Class *

```
public class Base extends AppCompatActivity
{
    public final int       target       = 10000;
    public int             totalDonated = 0;
    public static List<Donation> donations    = new ArrayList<Donation>();

    public boolean newDonation(Donation donation)
    {
        boolean targetAchieved = totalDonated > target;
        if (!targetAchieved)
        {
            donations.add(donation);
            totalDonated += donation.amount;
        }
        else
            Toast.makeText(this, "Target Exceeded!", Toast.LENGTH_SHORT).show();

        return targetAchieved;
    }

    @Override
    public boolean onCreateOptionsMenu(Menu menu)
    {...}

    @Override
    public boolean onPrepareOptionsMenu (Menu menu){...}

    public void settings(MenuItem item)
    {...}

    public void report(MenuItem item) { startActivity (new Intent(this, Report.class)); }

    public void donate(MenuItem item) { startActivity (new Intent(this, Donate.class)); }
}
```

Our List of Donations

We'll take a closer look at these methods in "Menus Part 2"

Adding a 'donation'

Why a ‘Base’ Class?? *

- *Green* Programming – Reduce, Reuse, Recycle
  - Reduce the amount of code we need to implement the functionality required (Code Redundancy)
  - Reuse common code throughout the app/project where possible/appropriate
  - Recycle existing code for use in other apps/projects

- All good for improving Design

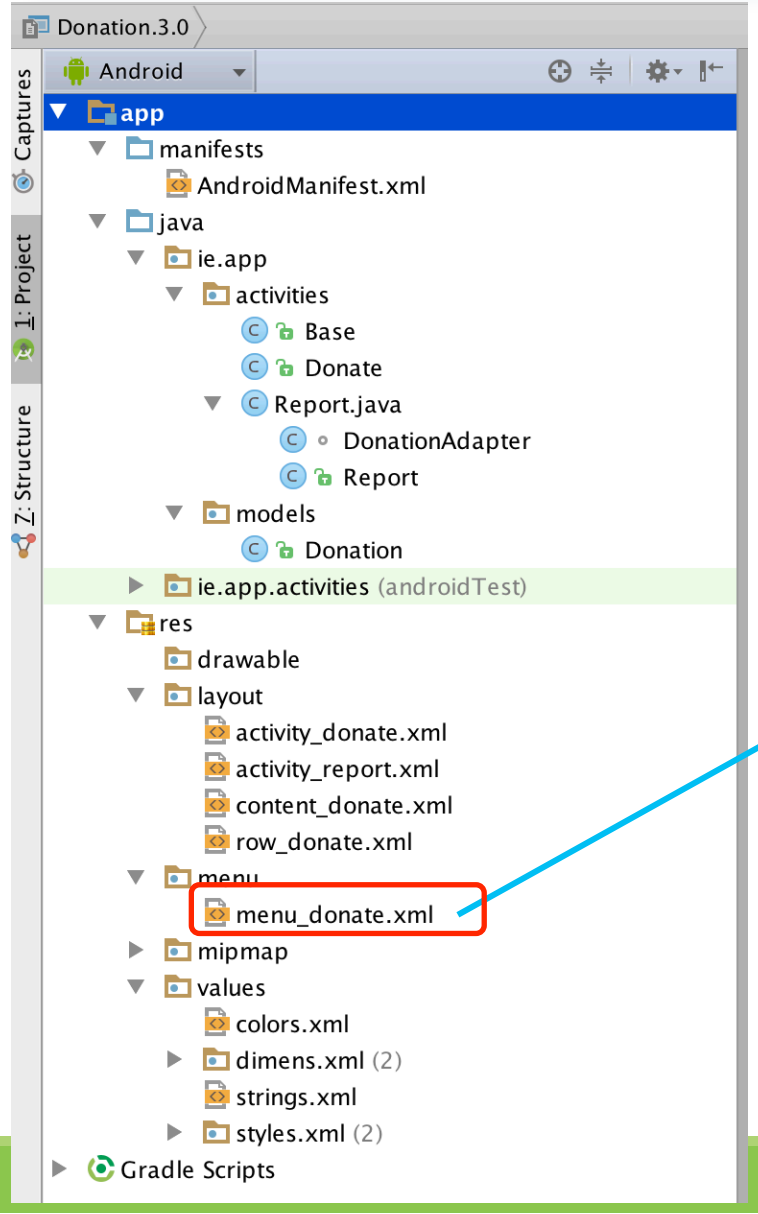
Donation.3.0

Using Menus
Part 2

Enabling/Disabling Menu Items on the fly

- There may be times where you don't want all your menu options available to the user under certain situations
  - e.g – if you've no donations, why let them see the report?
- You can modify the options menu at runtime by overriding the `onPrepareOptionsMenu()` method
  - called each and every time the user presses the *MENU* button.

Menus in *Donation 3.0 **



Menu Specification

```
<menu xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools" tools:context=".Donate">

    <item android:id="@+id/action_settings"
        android:title="Settings"
        android:orderInCategory="100"
        app:showAsAction="never"
        android:onClick="settings"/>

    <item
        android:id="@+id/menuReport"
        android:orderInCategory="100"
        android:title="Report"
        app:showAsAction="never"
        android:onClick="report"/>

    <item
        android:id="@+id/menuDonate"
        android:orderInCategory="100"
        android:title="Donate"
        app:showAsAction="never"
        android:onClick="donate"/>
</menu>
```

Note the use of an ‘onClick’ attribute

Donation 3.0 Menu Event Handler *

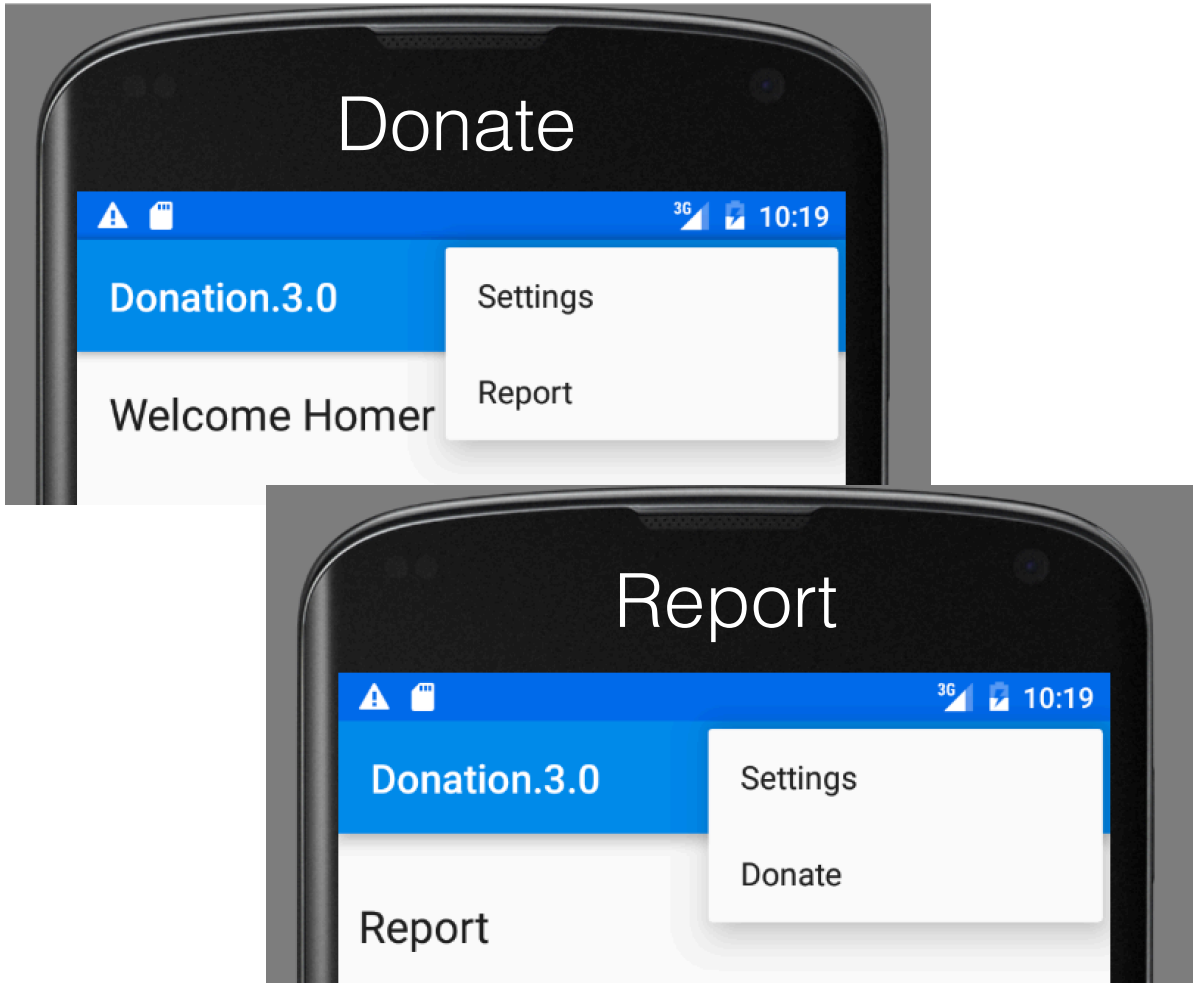
```
public class Base extends AppCompatActivity
{
    public final int       target       = 10000;
    public int             totalDonated = 0;
    public static List<Donation> donations    = new ArrayList<Donation>();

    public boolean newDonation(Donation donation)
    {...}

    @Override
    public boolean onCreateOptionsMenu(Menu menu)
    {...}

    @Override
    public boolean onPrepareOptionsMenu (Menu menu){...}

    public void settings(MenuItem item)
    {
        Toast.makeText(this, "Settings Selected", Toast.LENGTH_SHORT).show
    }

    public void report(MenuItem item)
    {
        startActivity (new Intent(this, Report.class));
    }

    public void donate(MenuItem item)
    {
        startActivity (new Intent(this, Donate.class));
    }
```

Menu Specification

```
<menu xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools" tools:context=".Donate">

    <item android:id="@+id/action_settings"
        android:title="Settings"
        android:orderInCategory="100"
        app:showAsAction="never"
        android:onClick="settings"/>

    <item
        android:id="@+id/menuReport"
        android:orderInCategory="100"
        android:title="Report"
        app:showAsAction="never"
        android:onClick="report"/>

    <item
        android:id="@+id/menuDonate"
        android:orderInCategory="100"
        android:title="Donate"
        app:showAsAction="never"
        android:onClick="donate"/>
</menu>
```

Donation 3.0 – onPrepareOptionsMenu()

```
@Override
public boolean onPrepareOptionsMenu (Menu menu){
    super.onPrepareOptionsMenu(menu);
    MenuItem report = menu.findItem(R.id.menuReport);
    MenuItem donate = menu.findItem(R.id.menuDonate);

    if(donations.isEmpty())
        report.setEnabled(false);
    else
        report.setEnabled(true);

    if(this instanceof Donate){
        donate.setVisible(false);
        if(!donations.isEmpty())
            report.setVisible(true);
    }
    else {
        report.setVisible(false);
        donate.setVisible(true);
    }

    return true;
}
```



Donation.3.0

Using ArrayAdapters & ListViews

Introducing Adapters

- **`Adapters`** are bridging classes that bind data to **`Views`** (eg ListViews) used in the UI.
  - Responsible for creating the child Views used to represent each item within the parent View, and providing access to the underlying data
- Views that support adapter binding must extend the **`AdapterView`** abstract class.
  - You can create your own `AdapterView`-derived controls and create new custom `Adapter` classes to bind to them.
- Android supplies a set of `Adapters` that pump data into native UI controls and layouts (next slide)

Building Layouts with an Adapter

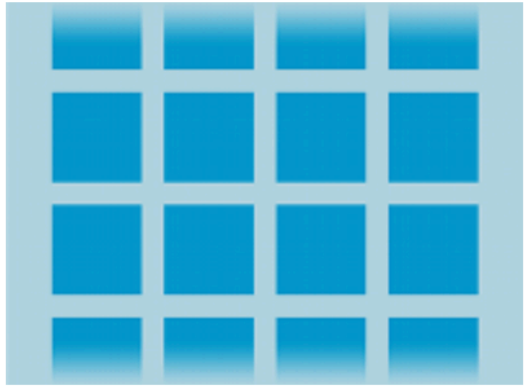
When the content for your layout is dynamic or not pre-determined, you can use a layout that subclasses `AdapterView` to populate the layout with views at runtime. A subclass of the `AdapterView` class uses an `Adapter` to bind data to its layout. The `Adapter` behaves as a middleman between the data source and the `AdapterView` layout—the `Adapter` retrieves the data (from a source such as an array or a database query) and converts each entry into a view that can be added into the `AdapterView` layout.

Common layouts backed by an adapter include:

List View

Displays a scrolling single column list.

Grid View



Displays a scrolling grid of columns and rows.

Building Layouts with an Adapter

- Because **`Adapters`** are responsible for supplying the data **AND** for creating the Views that represent each item, they can radically modify the appearance and functionality of the controls they're bound to.
- Most Commonly used Adapters
  - **`ArrayAdapter`**
    - uses generics to bind an **`AdapterView`** to an array of objects of the specified class.
    - By default, uses the **`toString()`** of each object to create & populate `TextViews`.
    - Other constructors available for more complex layouts (as we will see later on)
    - Can extend the class to use alternatives to simple `TextViews` (as we will see later on)
- See also **`SimpleCursorAdapter`** – attaches Views specified within a layout to the columns of Cursors returned from Content Provider queries.

Filling an Adapter View with Data

- You can populate an AdapterView such as ListView or GridView by binding the AdapterView instance to an Adapter, which retrieves data from an external source and creates a View that represents each data entry.

```
ArrayAdapter<String> adapter = new ArrayAdapter<String>(this,
                                                        android.R.layout.simple_list_item_1,
                                                        numbers);
```

- The arguments for this constructor are:
  - Your app Context
  - The layout that contains a TextView for each string in the array
  - The string array (*numbers*)
- Then simply call setAdapter() on your ListView:

```
listView = (ListView) findViewById(R.id.reportList);
listView.setAdapter(adapter);
```

Donation.2.0

Handling Click Events

- You can respond to click events on each item in an AdapterView by implementing the AdapterView.OnItemClickListener interface

```
// Create a message handling object as an anonymous class.
private OnItemClickListener mMessageClickedHandler = new OnItemClickListener() {
    public void onItemClick(AdapterView parent, View v, int position, long id) {
        // Do something in response to the click
    }
};

listView.setOnItemClickListener(mMessageClickedHandler);
```

- We won't be covering this in our Case Study, but would be desirable to see in your project

Donation.3.0

Custom Adapters

Customizing the ArrayAdapter *

- By default, the **`ArrayAdapter`** uses the **`toString()`** of the object array it's binding, to populate the **`TextView`** available within the specified layout.
- Generally, you customize the layout to display more complex views by..
  - Extending the **`ArrayAdapter`** class with a type-specific variation, eg

```
class DonationAdapter extends ArrayAdapter<Donation>
```

  - Override the **`getView()`** method to assign object properties to layout `View` objects. (see our case study example next)

The `getView()` Method

- Used to construct, inflate, and populate the View that will be displayed within the parent **`AdapterView`** class (eg a ListView) which is being bound to the underlying array using this adapter.
- Receives parameters that describes
  - The position of the item to be displayed
  - The **`View`** being updated (or `null`)
  - The **`ViewGroup`** into which this new **`View`** will be placed
- Returns the new populated **`View`** instance as a result

- A call to **`getItem()`** will return the value (object) stored at the specified index in the underlying array.

Donation 3.0 – Report Activity *

```
public class Report extends Base
{
    ListView listView;

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

        listView = (ListView) findViewById(R.id.reportList);
        DonationAdapter adapter = new DonationAdapter(this,  donations);
        listView.setAdapter(adapter);
    }
}
```

Donation 3.0 - DonationAdapter class

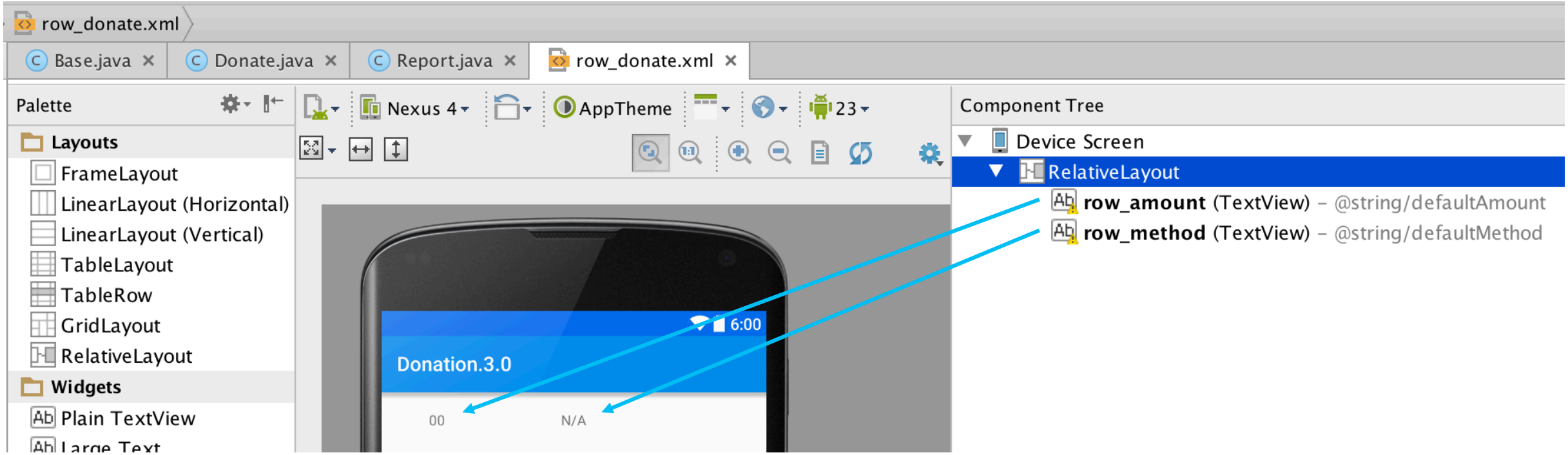
```
class DonationAdapter extends ArrayAdapter<Donation>
{
    private Context context;
    public List<Donation> donations;

    public DonationAdapter(Context context, List<Donation> donations)
    {
        super(context, R.layout.row_donate, donations);
        this.context   = context;
        this.donations = donations;
    }

    @Override
    public View getView(int position, View convertView, ViewGroup parent)
    {
        LayoutInflater inflater = (LayoutInflater) context.getSystemService(Context.LAYOUT_INFLATER_SERVICE);

        View     view       = inflater.inflate(R.layout.row_donate, parent, false);
        Donation donation   = donations.get(position);
        TextView amountView = (TextView) view.findViewById(R.id.row_amount);
        TextView methodView = (TextView) view.findViewById(R.id.row_method);

        amountView.setText("$" + donation.amount);
        methodView.setText(donation.method);

        return view;
    }

    @Override
    public int getCount() { return donations.size(); }
}
```

Custom ArrayAdapter of type 'Donation'

Custom Row Layout

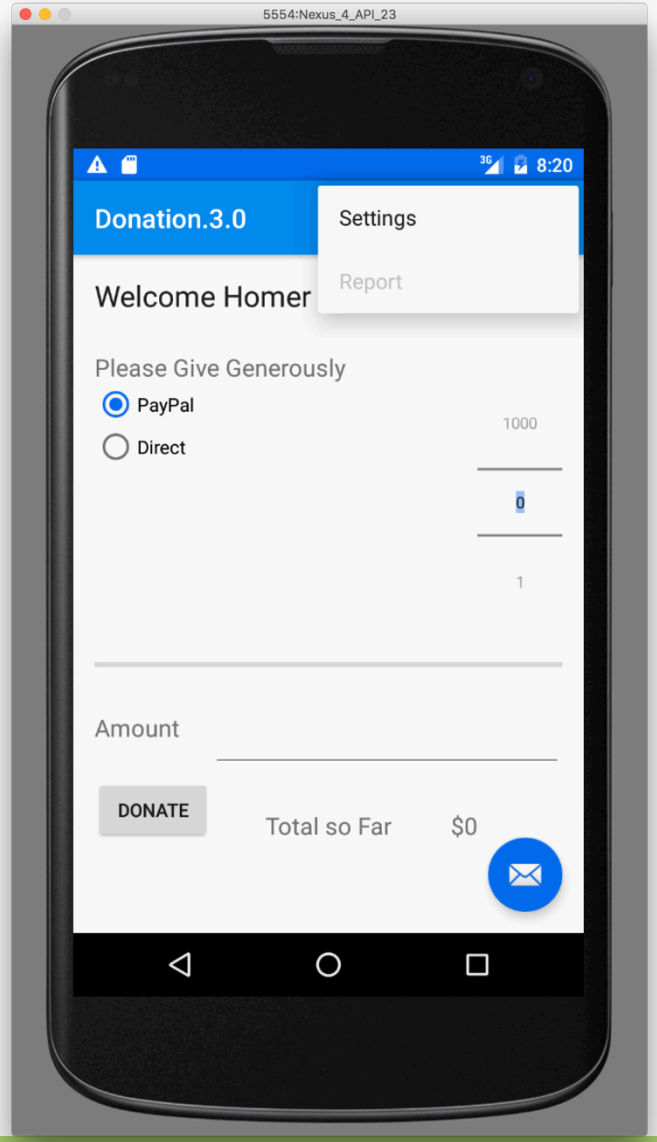
Every time this method is called we create a new 'Row' (a Donation from our List) to add to the ListView

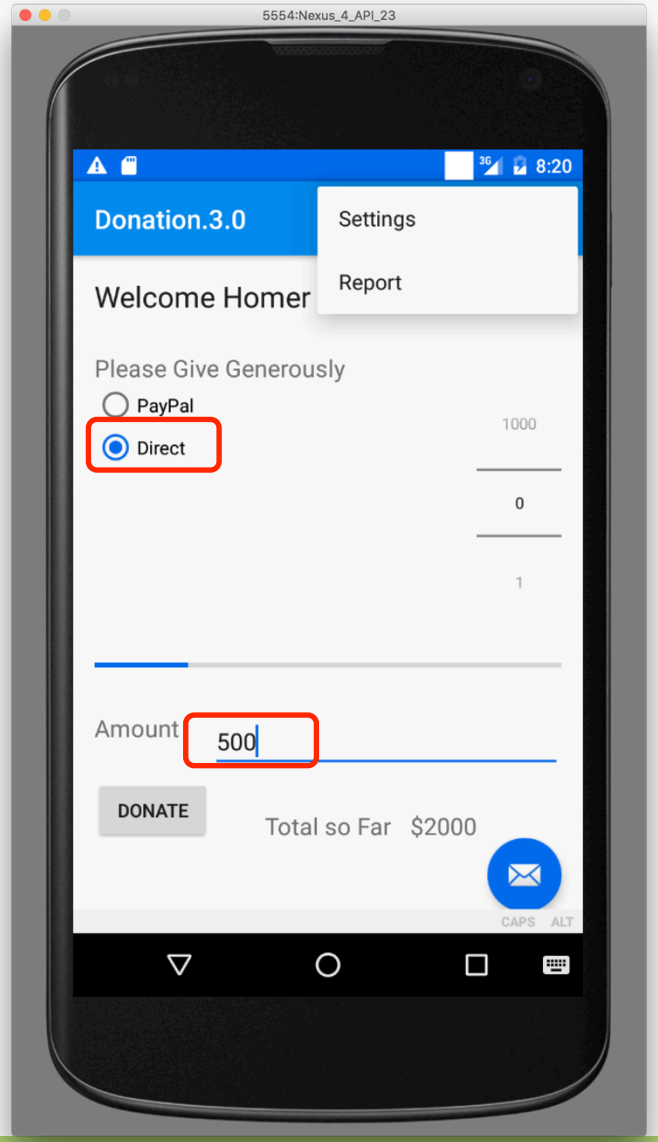
Donation 3.0 - row_donate.xml

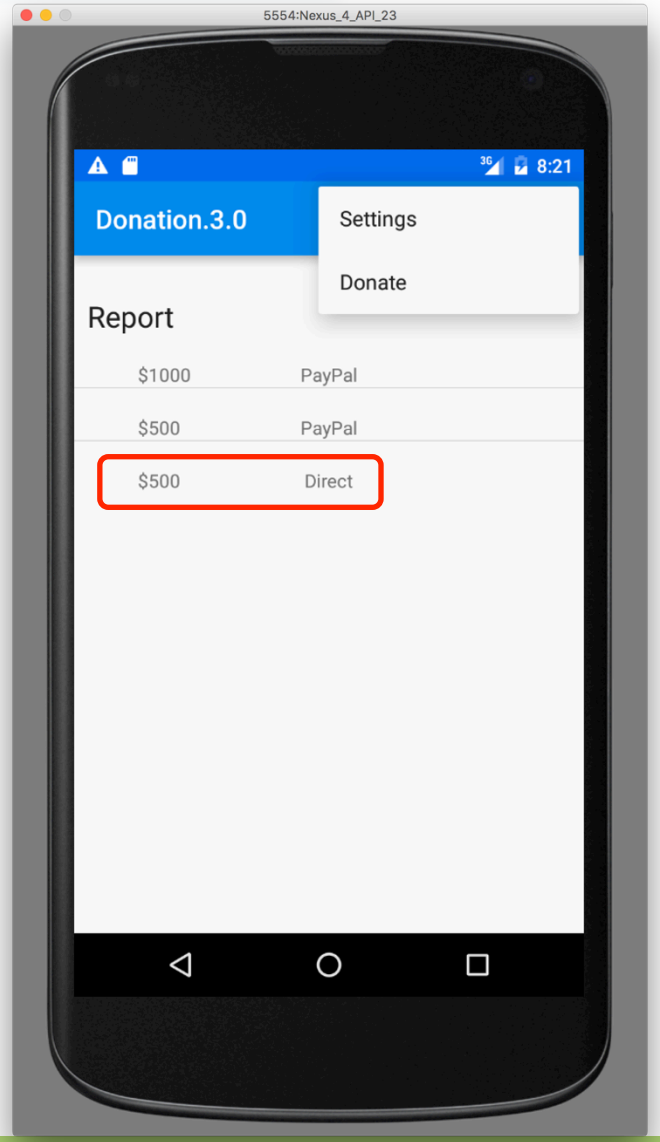


Each time `getView()` is called, it creates a new '`Row`' and binds the individual Views (widgets) above, to each element of the object array in the `ArrayAdapter`.

Resulting ListView (inside our Report) *







Summary

- We looked at Application Structure – specfically the UI Structure
- We revisited the Structure of our App and introduced a ‘Donation Model’ and Base class
- More Menu Navigation
- Creating and using Custom Adapters

Questions?