Android Resources

Tran Giang Son, tran-giang.son@usth.edu.vn

ICT Department, USTH

Resources

- Things that are embedded (bundled) into the app
- Resources in res/ directory
- Several resource categories
- Accessible through code: `R.<category>.<resourceName>`
- Do NOT hard-code values inside codes

Contents

- Values
- Layouts
- Drawables
- Raw
- Styles, Design Guidelines

Layouts

Layouts

- **Remind**
- **Definition**
- **Layout in XML**
- Popular Layout classes

Remind

- Remind: HTML
- Old-school: `<div>` and `<table>`
- HTML5: `<header>`, `<nav>`, `<section>`, `<aside>`, `<footer>`
- CSS float and padding

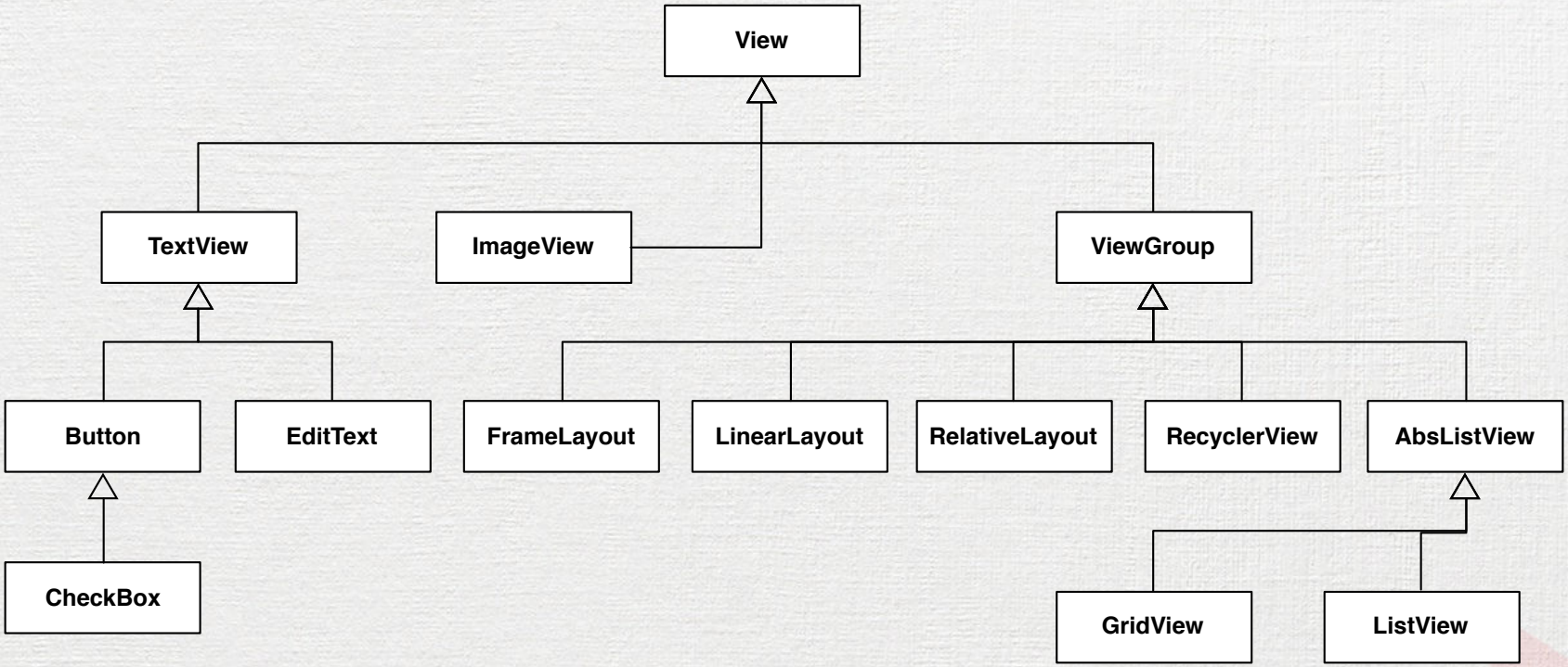
Remind

- Remind: what's the base View class for layouting in android?

Remind

- Remind: what's the base View class for layouting in android?
- ViewGroup
- FrameLayout, LinearLayout, RelativeLayout

Remind


View
TextView
ImageView
ViewGroup
Button
EditText
FrameLayout
LinearLayout
RelativeLayout
RecyclerView
AbsListView
CheckBox
GridView
ListView

Layout

- A way to organize Views inside an UI
- Can be created by code (see Practical Work #4)
- XML files in **res/layout**
- Hierarchical "structure" of one UI
- Can be nested
- WYSIWYG or manual editor

Layout XML

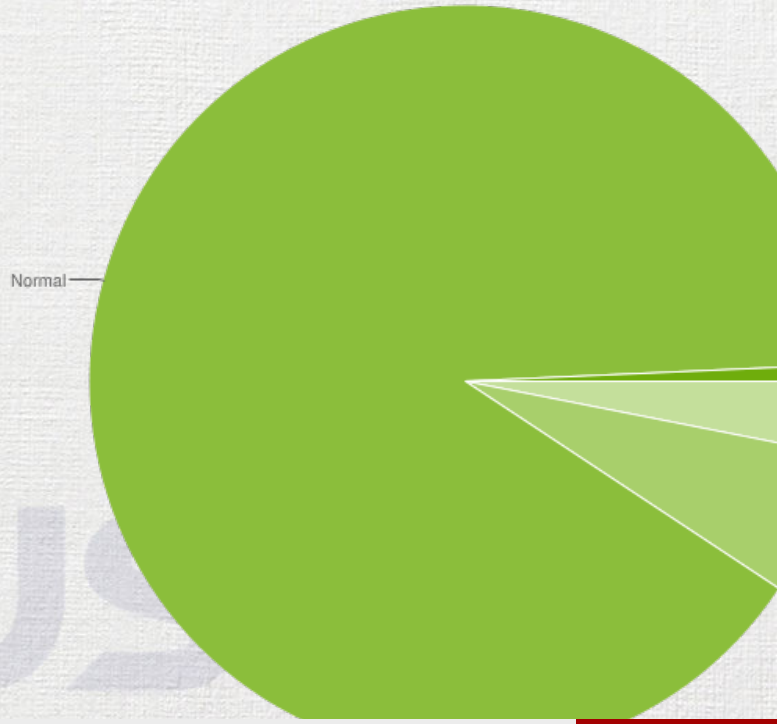
- Containers (ViewGroups) contain Views (TextView, ImageView, EditText, Button, ImageButton...)
- Required: layout_width, layout_height
- Optional: id (for later `findViewById()`)

Layout XML

```
<?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="16dip">

    <TextView
        android:id="@+id/question"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Is Android a Linux Distribution?"
        android:textAppearance=
            "?android:attr/textAppearanceMedium" />

    <LinearLayout
        android:orientation="horizontal"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_marginTop="16dp">

        <Button
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:text="True"
            android:id="@+id/btnTrue" />

        <Button
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:text="False"
            android:id="@+id/btnFalse" />

        <Button
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:text="Next"
            android:id="@+id/btnNext" />
    </LinearLayout>
</LinearLayout>
```

«Adaptive» Layout on Android

- Use different layout XMLs in different directories
- Tablet: layout-large, layout-xlarge
- Phone: layout-normal
- Small: layout-small
- Orientation: -land, -port
- Examples



Layout XML

- How to load XML layout?
  - Activity: in `onCreate()`, with `setContentView()`
  - Fragment: in `onCreateView()`

```
// Activity
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_layout);
}

// Fragment
public View onCreateView(LayoutInflater inflater, ViewGroup container,...) {
    // Inflate the layout for this fragment
    return inflater.inflate(R.layout.fragment_layout, container, false);
}
```

Layouts

- Remind
- Definition
- Layout in XML
- **Popular Layout classes**

Popular Layout Classes

- FrameLayout
- LinearLayout
- RelativeLayout
- ViewPager

FrameLayout

- Can contain multiple children (Views)
- Multiple layers, Z-based order: like a Photoshop design
- First child will be at the bottom
- Support child margins
- Support gravity

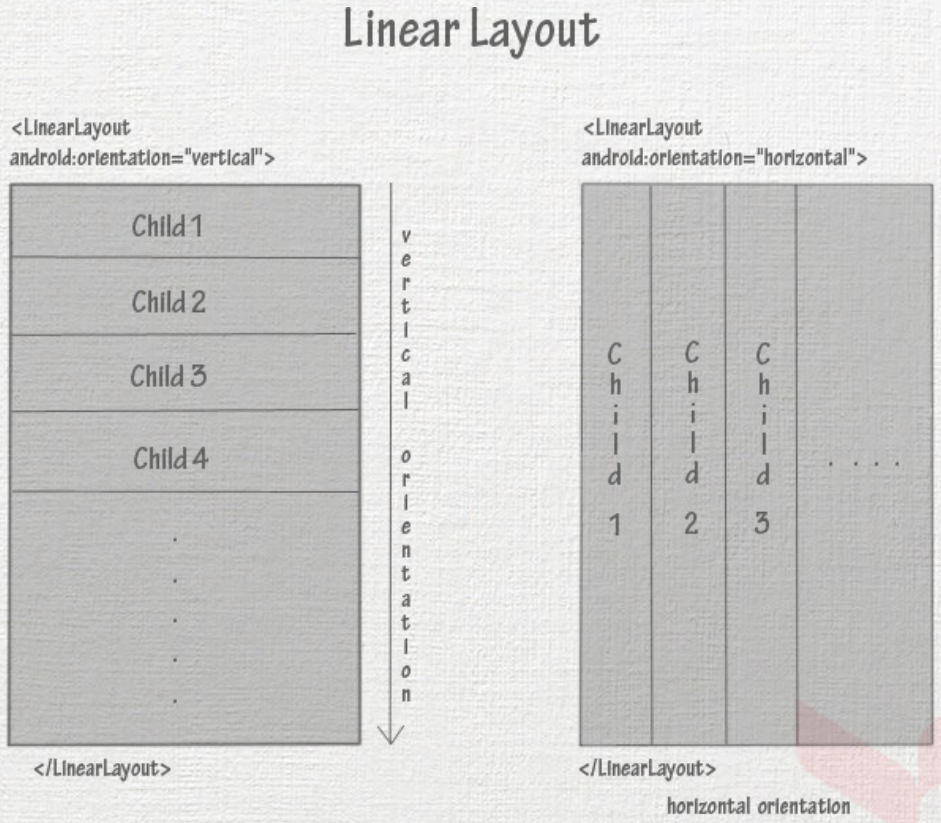
FrameLayout

```
<FrameLayout
    android:layout_width="match_parent"
    android:layout_height="wrap_content">

    <ImageView
        android:id="@+id/imageView"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:adjustViewBounds="true"
        android:background="#20FF0000"
        android:src="@drawable/usth" />

    <TextView
        android:id="@+id/textView"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:background="#FF00FF00"
        android:text="Is USTH awesome?" />
</FrameLayout>
```

LinearLayout

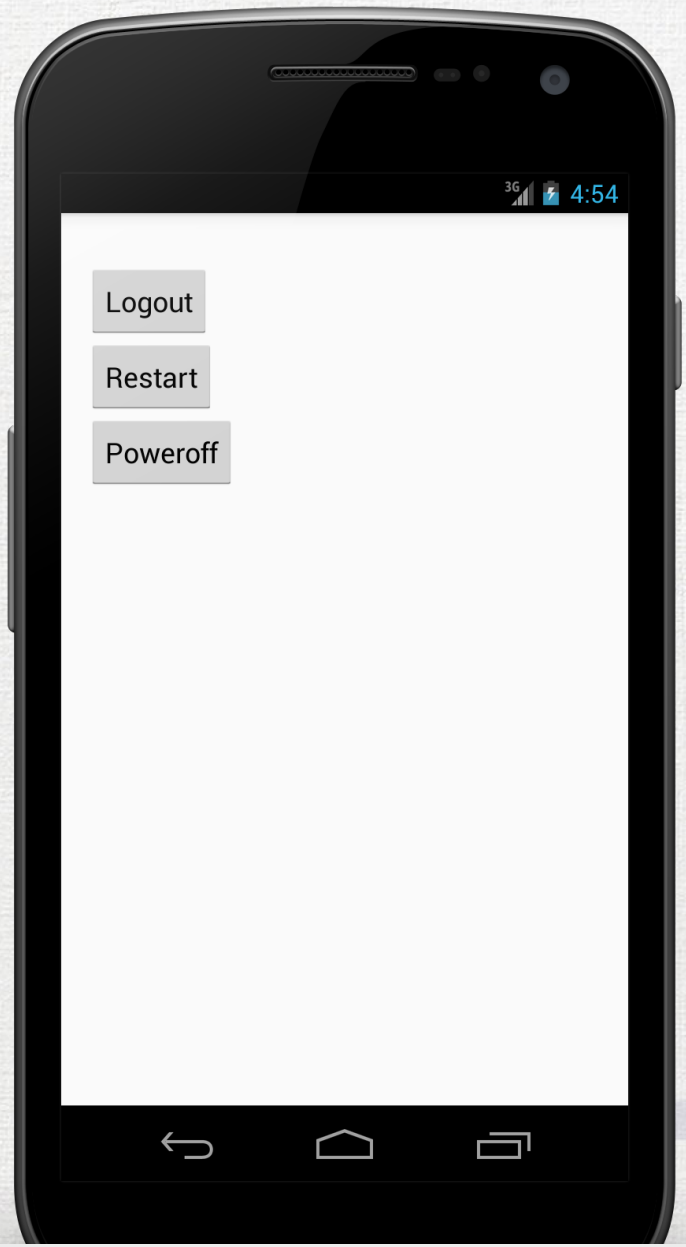
- One direction
- Horizontal or Vertical

```
<LinearLayout
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:orientation="vertical">

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

    <Button
        android:id="@+id/button2"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Restart" />

    <Button
        android:id="@+id/button3"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Poweroff" />
</LinearLayout>
```

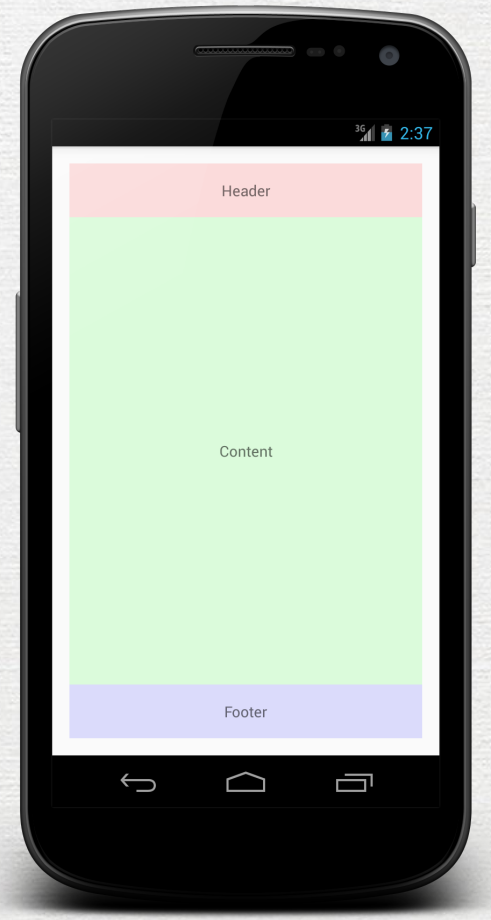


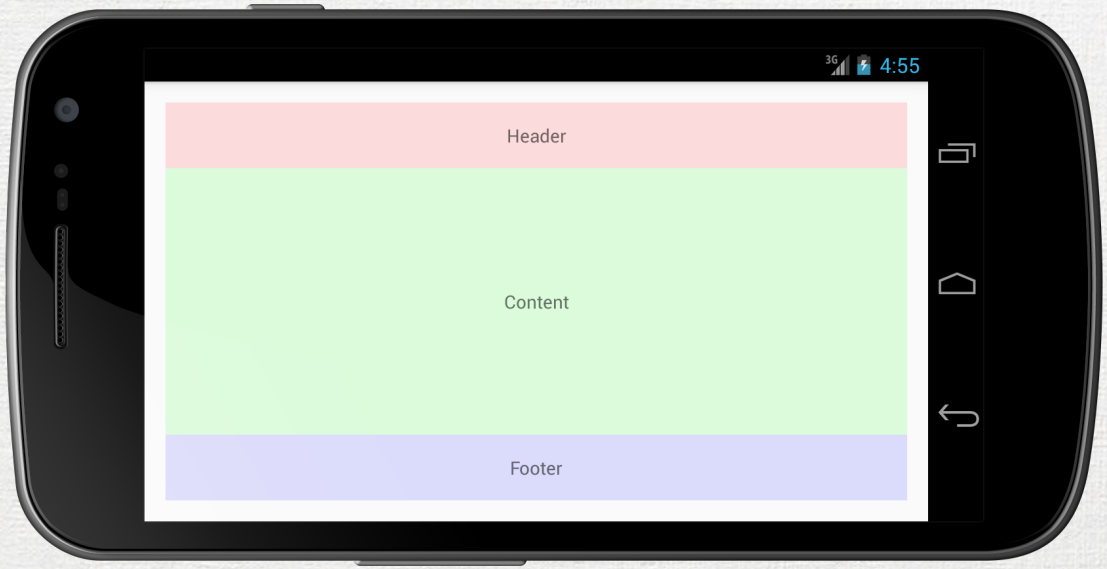
LinearLayout

```
<LinearLayout
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:orientation="vertical">

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

    <Button
        android:id="@+id/button2"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Restart" />

    <Button
        android:id="@+id/button3"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Poweroff" />
</LinearLayout>
```



LinearLayout





LinearLayout Stretching

- Use layout_weight
- Based on orientation
  - horizontal: stretch width
  - vertical: stretch height
- no layout_weight: no stretch
- width/height ω_i is calculated based on weight γ_i of child i as

$$\omega_i = \frac{\gamma_i}{\sum_{j=0}^{n-1} \gamma_j} \times (\omega_{parent} - \sum_{k=0}^{n-1} \omega_k | \gamma_k = 0)$$

LinearLayout: Exercise

```
<LinearLayout
    android:layout_width="720px"
    android:layout_height="wrap_content"
    android:orientation="horizontal">

    <Button
        android:id="@+id/button"
        android:layout_width="0px"
        android:layout_height="wrap_content"
        android:layout_weight="1"
        android:text="Logout" />

    <Button
        android:id="@+id/button2"
        android:layout_width="100px"
        android:layout_height="wrap_content"
        android:text="Restart" />

    <Button
        android:id="@+id/button3"
        android:layout_width="0px"
        android:layout_height="wrap_content"
        android:layout_weight="1"
        android:text="Poweroff" />
</LinearLayout>
```

What's the width value of each child in this layout?

$$\omega_i = \frac{\gamma_i}{\sum_{j=0}^{n-1} \gamma_j} \times (\omega_{parent} - \sum_{k=0}^{n-1} \omega_k | \gamma_k = 0)$$

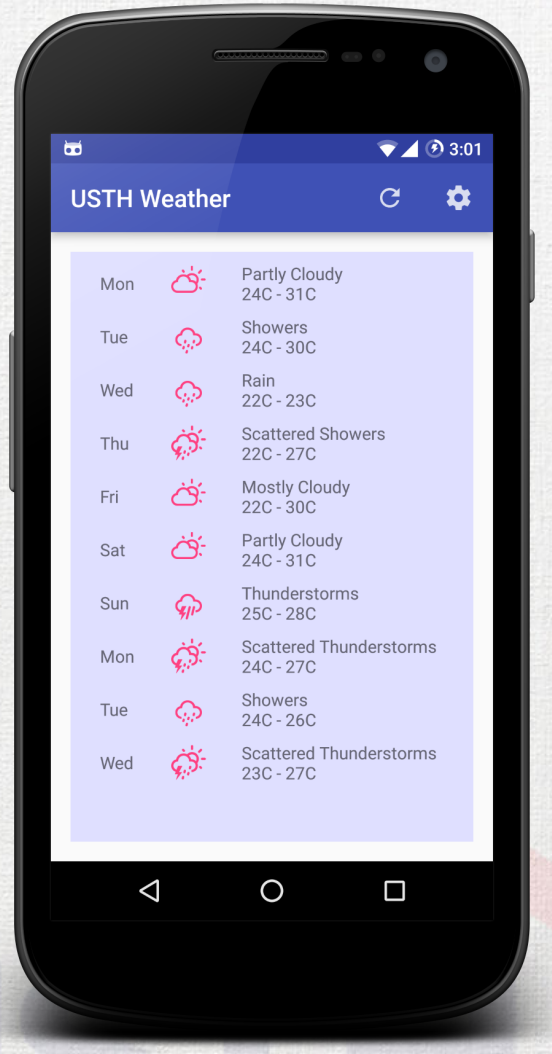
LinearLayout: Exercise

```
<LinearLayout
    android:id="@+id/container"
    android:layout_width="720px"
    android:layout_height="48px"
    android:orientation="horizontal"
    android:padding="4px">

    <View
        android:layout_width="0px"
        android:layout_height="1px"
        android:layout_weight="1" />

    <TextView
        android:id="@+id/item1"
        android:layout_width="100px"
        android:layout_height="match_parent"
        android:paddingLeft="8px"
        android:paddingRight="8px" />

    <View
        android:layout_width="1px"
        android:layout_height="match_parent"
        android:layout_marginLeft="8px"
        android:layout_marginRight="8px"
        android:background="@drawable/divider" />

    <TextView
        android:id="@+id/item2"
        android:layout_width="0px"
        android:layout_height="match_parent"
        android:layout_weight="2"
        android:paddingLeft="16px"
        android:paddingRight="16px" />

    <View
        android:layout_width="1px"
        android:layout_height="match_parent"
        android:layout_marginLeft="8px"
        android:layout_marginRight="8px"
        android:background="@drawable/divider" />

    <TextView
        android:id="@+id/item3"
        android:layout_width="120px"
        android:layout_height="match_parent"
        android:paddingLeft="8px"
        android:paddingRight="8px" />

    <View
        android:layout_width="0px"
        android:layout_height="1px"
        android:layout_weight="1" />
</LinearLayout>
```

$$\omega_i = \frac{\gamma_i}{\sum_{j=0}^{n-1} \gamma_j} \times (\omega_{parent} - \sum_{k=0}^{n-1} \omega_k | \gamma_k = 0)$$

Practical Work 5

- Modify your ForecastFragment layout
- Use LinearLayout to have the blue forecast area

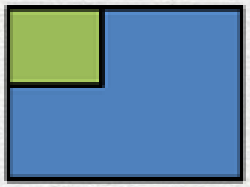


RelativeLayout

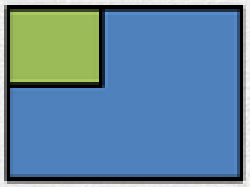
- Multiple layers, Z-order based: similar to Photoshop layers
- Relativity of children's position and size
  - to parent
  - to each other

RelativeLayout

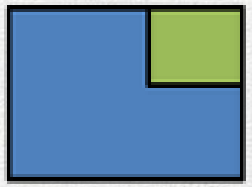
- Children are «relative» to parent



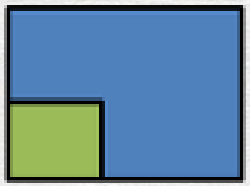
android:layout_alignParentLeft



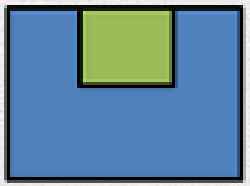
android:layout_alignParentTop



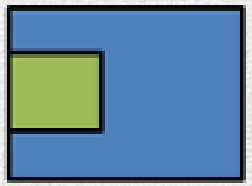
android:layout_alignParentRight



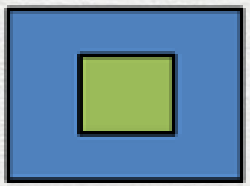
android:layout_alignParentBottom



android:layout_centerHorizontal



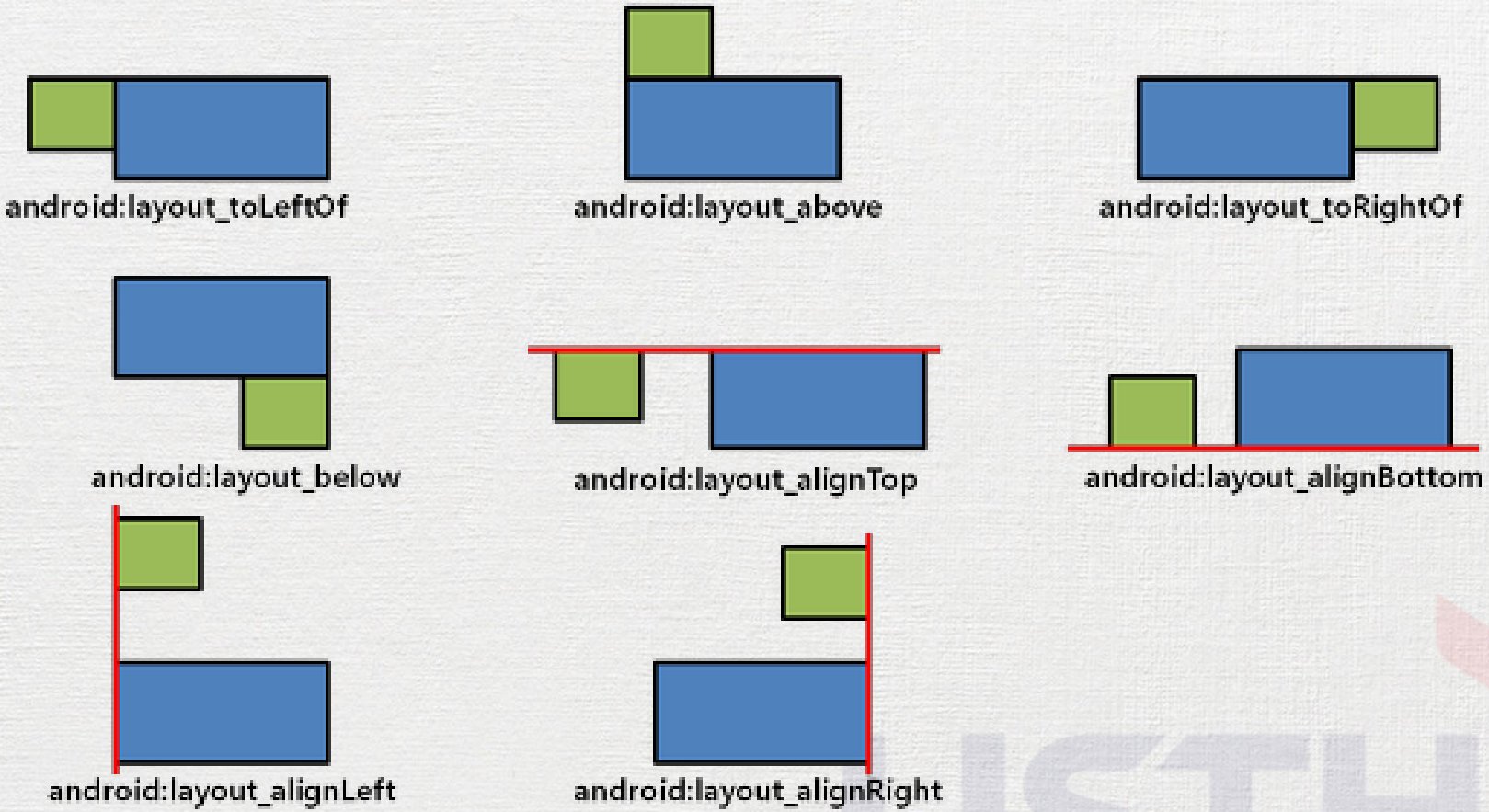
android:layout_centerVertical



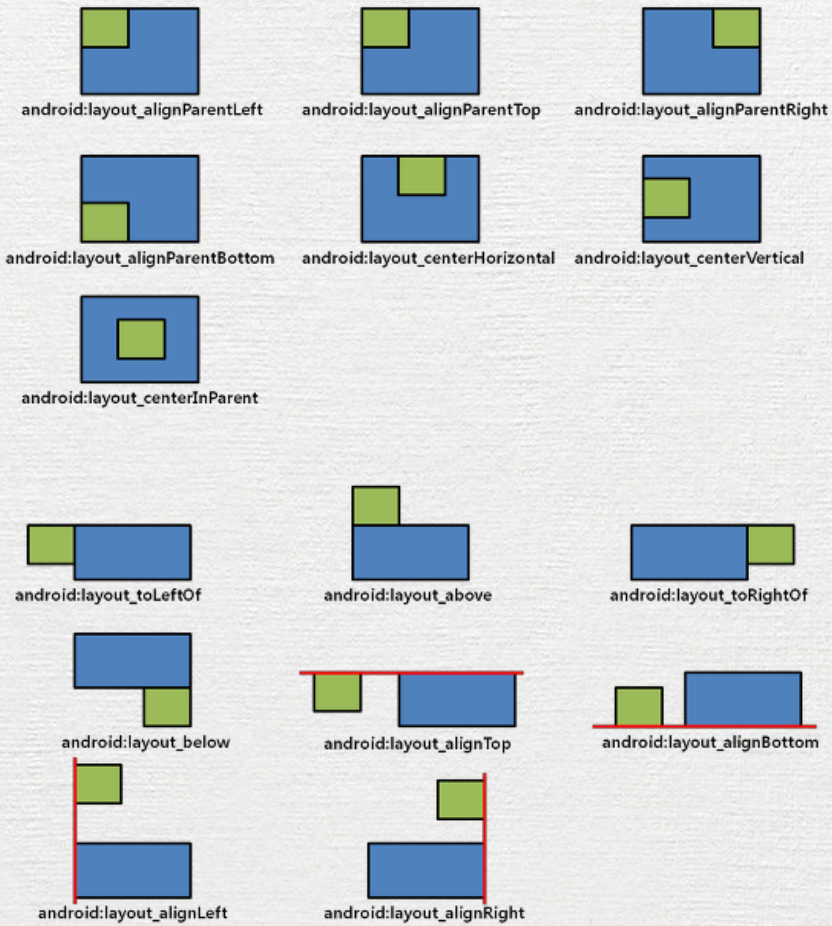
android:layout_centerInParent

RelativeLayout

- Children are «relative» to each other



RelativeLayout

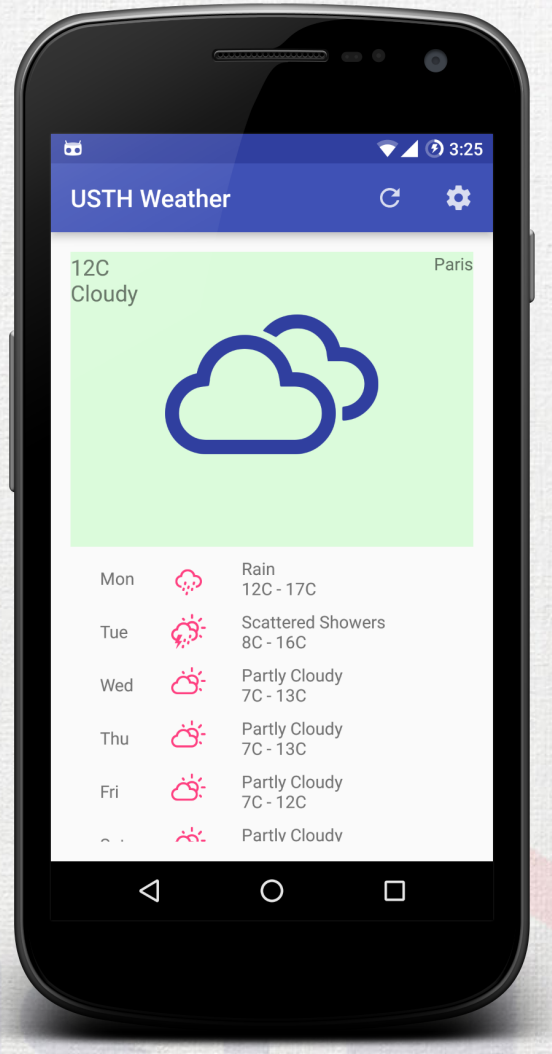


RelativeLayout

- Questions:
  - How to simulate vertical LinearLayout using RelativeLayout?
  - Is it possible to simulate LinearLayout's stretching feature (layout_weight) using RelativeLayout?

Practical Work 6

- Create a new WeatherFragment
- Modify your WeatherActivity layout
  - Add the WeatherFragment above ForecastFragment
  - Use LinearLayout
  - Use `<fragment>` tag
- Produce the green area (WeatherFragment) with RelativeLayout

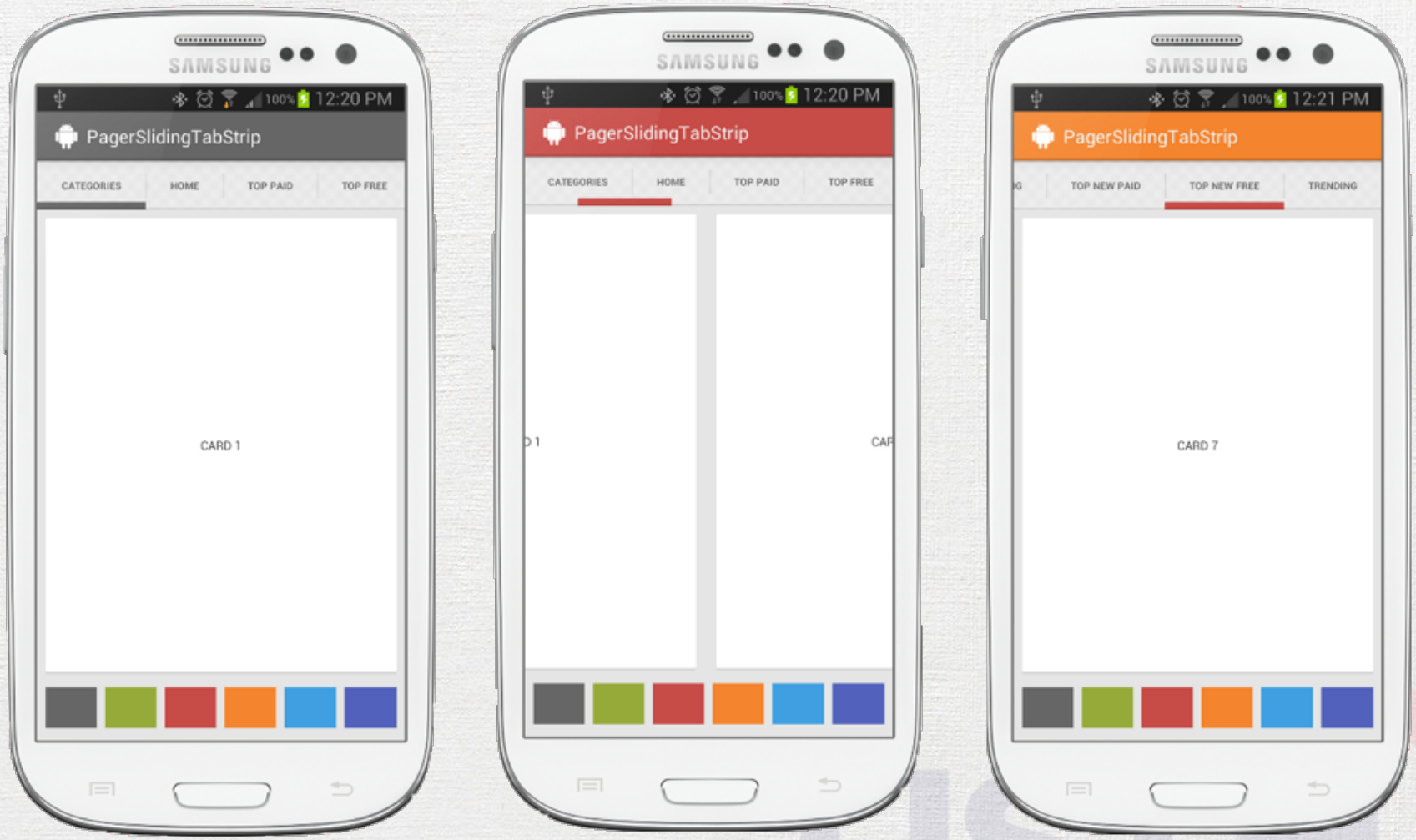


Layout

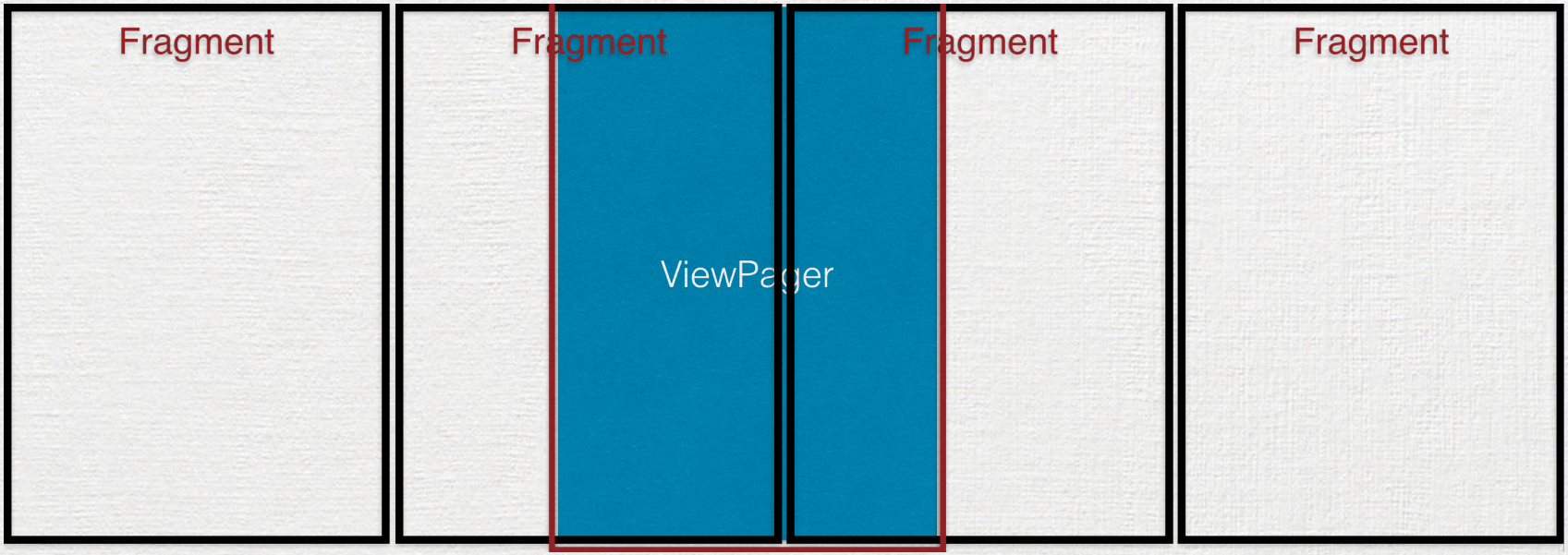
- Many other ViewGroups
  - ScrollView
  - GridView
  - CardView
  - ListView
  - **ViewPager**
  - DrawerLayout
  - CoordinatorLayout
  - RecyclerView

ViewPager

ViewPager


SAMSUNG
12:20 PM
PagerSlidingTabStrip
CATEGORIES
HOME
TOP PAID
TOP FREE
CARD 1
SAMSUNG
12:20 PM
PagerSlidingTabStrip
CATEGORIES
HOME
TOP PAID
TOP FREE
SAMSUNG
12:21 PM
PagerSlidingTabStrip
TOP NEW PAID
TOP NEW FREE
TRENDING
CARD 7

ViewPager

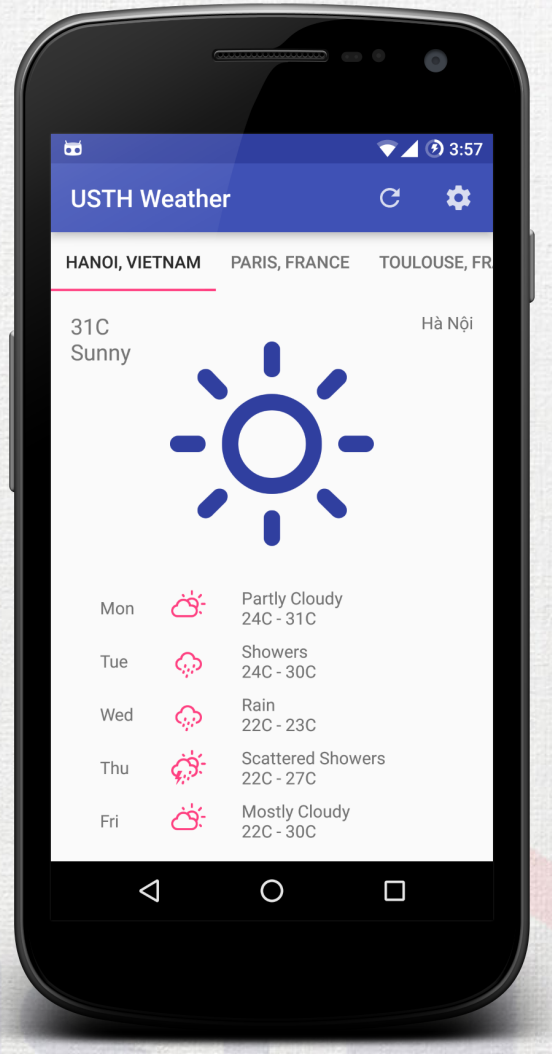


ViewPager

- Tab-like container
  - Widely used, user-friendly
  - Horizontal swipe gesture
  - «Page-by-page» scrolling

ViewPager

- No header. Use a separate View for that
  - Previously, use PagerSlidingTabStrip on GitHub
  - Now: Android design library's TabLayout



ViewPager

- Each tab content is a fragment
  - UI inflated / created by fragment
  - Controlled by fragment
  - Can be nested
  - «Off-screen» limit: fragments outside this limit are destroyed and recreated when necessary.
    - Why?

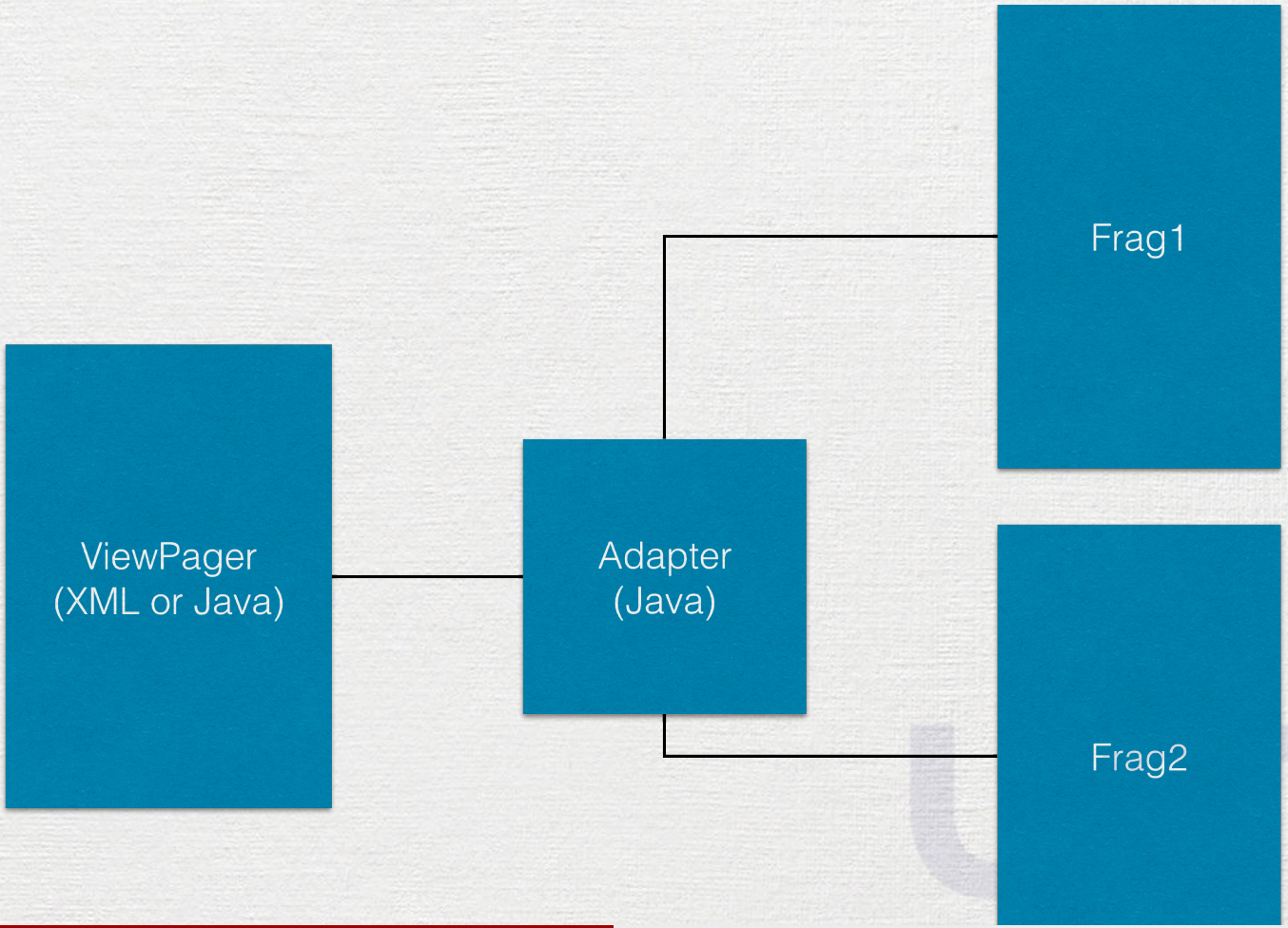
ViewPager

- ViewPager in XML layout

```
<android.support.v4.view.ViewPager
    android:id="@+id/pager"
    android:layout_width="match_parent"
    android:layout_height="match_parent" />
```

ViewPager

- «Adapter» in Java class (in parent Activity or Fragment)
- Specify what fragment is in what page



Adapter

```
public class HomeFragmentPagerAdapter extends FragmentPagerAdapter {
    private final int PAGE_COUNT = 3;
    private String titles[] = new String[] { "Hanoi", "Paris", "Toulouse" };

    public HomeFragmentPagerAdapter(FragmentManager fm) {
        super(fm);
    }

    @Override
    public int getCount() {
        return PAGE_COUNT;      // number of pages for a ViewPager
    }

    @Override
    public Fragment getItem(int page) {
        // returns an instance of Fragment corresponding to the specified page
        switch (page) {
            case 0: return Fragment1.newInstance();
            case 1: return Fragment2.newInstance();
            case 2: return Fragment3.newInstance();
        }
        return new EmptyFragment(); // failsafe
    }

    @Override
    public CharSequence getPageTitle(int page) {
        // returns a tab title corresponding to the specified page
        return titles[page];
    }
}
```

How to use ViewPager and Adapter

- Setup ViewPager in Activity's onCreate() or Fragment's onCreateView()

```
PagerAdapter adapter = new HomeFragmentPagerAdapter(
        getSupportFragmentManager());

ViewPager pager = (ViewPager) findViewById(R.id.pager);
pager.setOffscreenPageLimit(3);
pager.setAdapter(adapter);
```

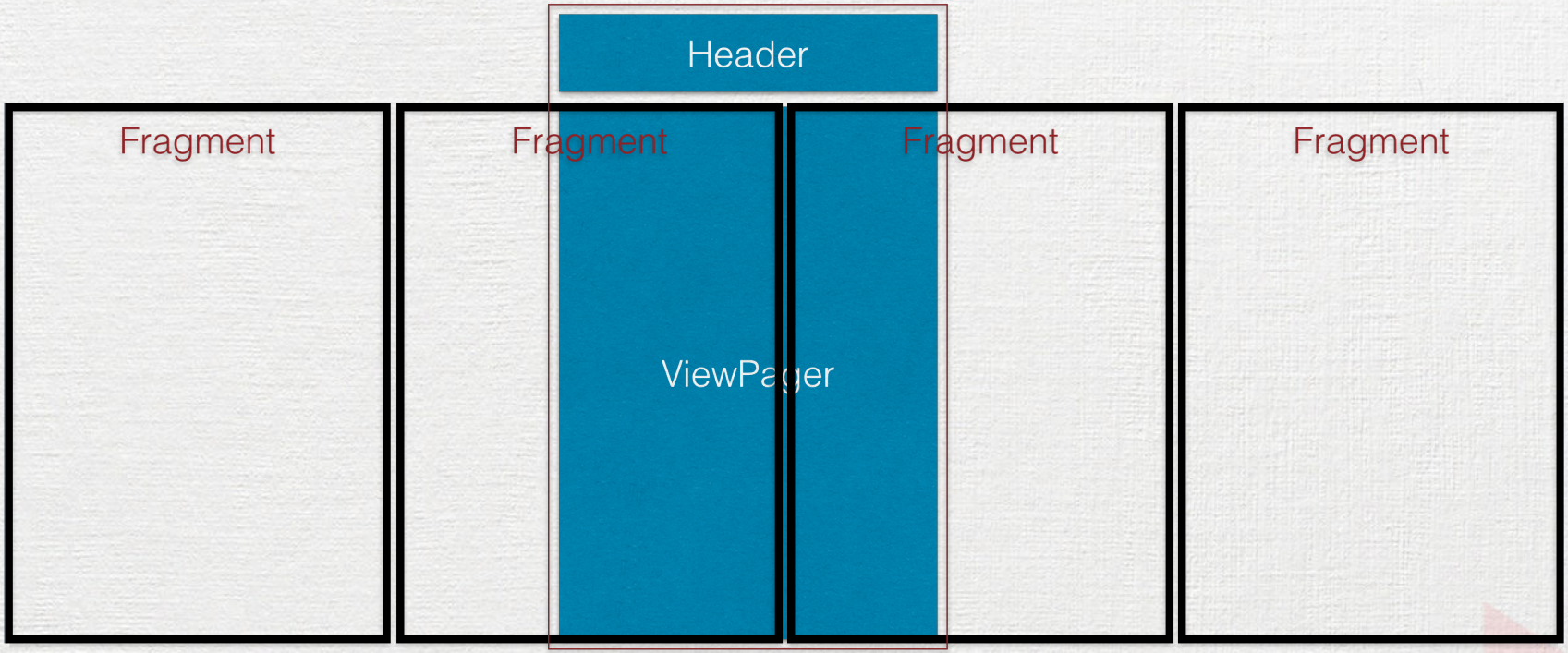
Practical Work 7

- Create a new `WeatherAndForecastFragment`
- Put your two fragments (`WeatherFragment` and `ForecastFragment`) into it
- Remove `WeatherFragment` and `ForecastFragment` from `WeatherActivity`
- Add a ViewPager into `WeatherActivity`
- Put 3 `WeatherAndForecastFragments` into the ViewPager
- Swipe!

Header for ViewPager

- A specialized ViewGroup
- TabLayout
- PagerSlidingTabStrip

Header for ViewPager



Header for ViewPager

- build.gradle (of your app, not your project)

```
implementation "com.android.support:design:23.1.0"
```

- layout XML: **above** your ViewPager (LinearLayout or RelativeLayout may work)

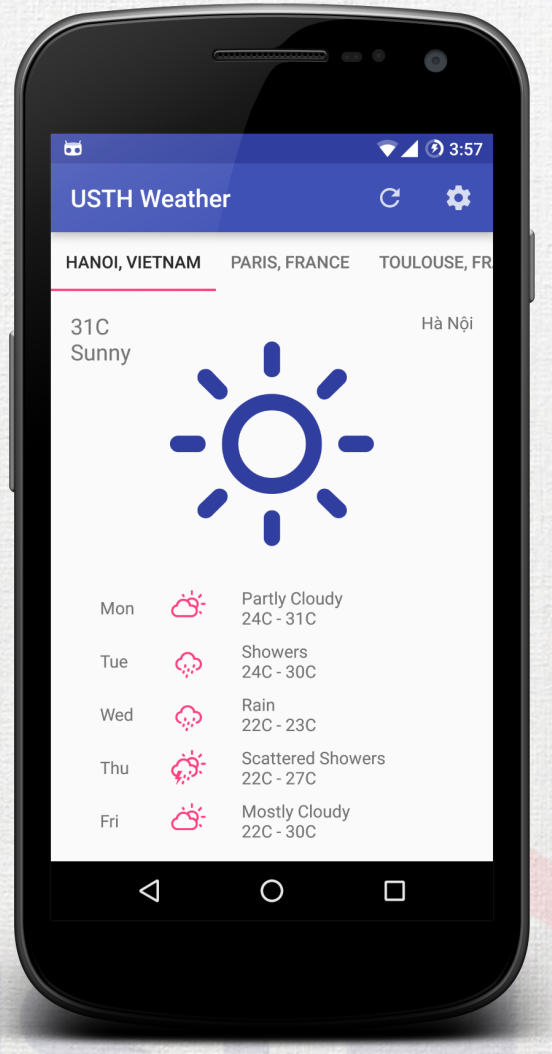
```
<android.support.design.widget.TabLayout
    android:id="@+id/tab"
    android:layout_width="match_parent"
    android:layout_height="wrap_content" />
```

- In Activity or Fragment: setup a link between them

```
TabLayout tabLayout = (TabLayout) findViewById(R.id.tab);
tabLayout.setupWithViewPager(pager);
```

Practical Work 8

- Add a header to your ViewPager
  - TabLayout



Values

Values

- Values are . . . values
  - Strings: res/strings.xml
  - Integers: res/integers.xml
  - Booleans: res/bool.xml
  - Colors: res/colors.xml
  - Sizes: res/dimens.xml
  - Arrays: res/arrays.xml
  - Themes / Styles: res/styles.xml

Why Values?

- Central point of all “constants”
- Themeable
- i18n

Why Values?

- Central point of all “constants”
- Themeable
- i18n

(internationalization!)

Why Values?

- Central point of all “constants”
- Themeable
- i18n

(internationalization!)

- Size-, orientation- dependent (-large, -xlarge, -land. . .)

String Values

- Default: res/values/strings.xml

```
<string name="refresh">Refresh</string>
```

- i18n: res/values-fr/strings.xml

```
<string name="refresh">Rafraîchir</string>
```

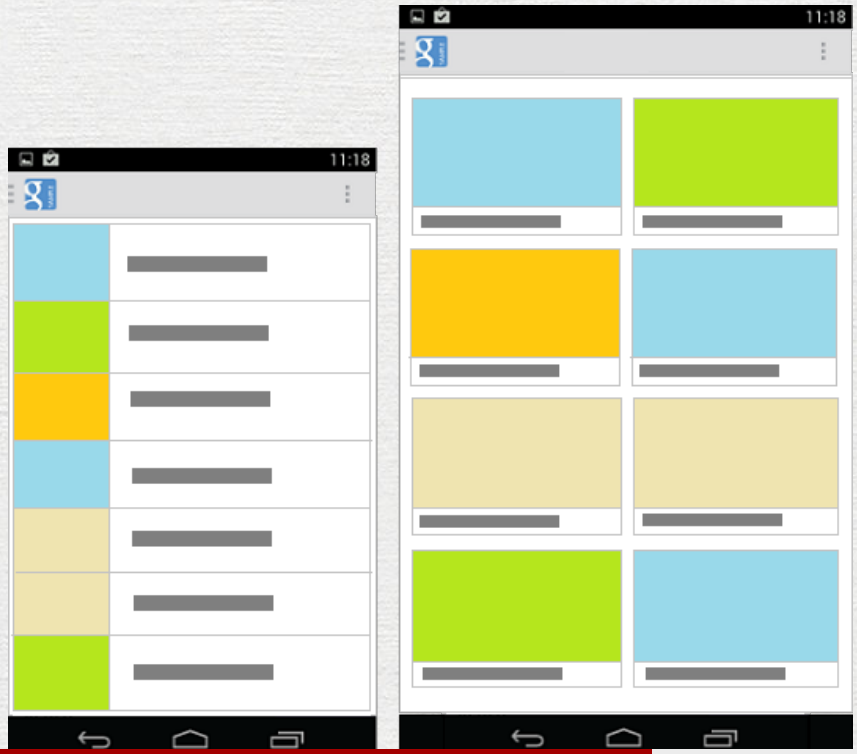
Integers

- Default: res/values/integers.xml

```
<integer name="column_count">1</integer>
```

- Landscape: res/values-land/integers.xml

```
<integer name="column_count">2</integer>
```



Booleans

- Default: res/values/bools.xml

```
<bool name="is_tablet">false</bool>
```

- Tablet: res/values-large/bools.xml

```
<bool name="is_tablet">true</bool>
```

Colors

- Default: res/values/colors.xml

```
<color name="colorPrimary">#3F51B5</color>
```

- Tablet: res/values-large/colors.xml

```
<color name="colorPrimary">#FF4081</color>
```

Dimensions

- Default: res/values/dimens.xml

```
<dimen name="title_width">60dp</dimen>
<dimen name="title_height">24dp</dimen>
<dimen name="title_font_size">48sp</dimen>
```

- Tablet: res/values-large/dimens.xml

```
<dimen name="title_width">120dp</dimen>
<dimen name="title_height">480dp</dimen>
<dimen name="title_font_size">48sp</dimen>
```

Using Values in Layout XML

- strings.xml

```
<string name="refresh">Refresh</string>
```

- colors.xml

```
<color name="colorPrimary">#3F51B5</color>
```

- dimens.xml

```
<dimen name="title_width">60dp</dimen>
<dimen name="title_height">24dp</dimen>
<dimen name="title_font_size">48sp</dimen>
```

- fragment_weather.xml

```
<TextView
        android:layout_width="@dimen/title_width"
        android:layout_height="@dimen/title_height"
        android:text="@string/refresh"
        android:textColor="@color/colorPrimary"
        android:textSize="@dimen/title_font_size" />
```

Using Values in Java

- String: can be used with TextView's `setText()`

```
String title = context.getString(R.string.refresh);
textView.setText(title);
```

- Integer

```
int columns = (int) getContext().getResources().getInteger(
                R.integer.column_count);
gridView.setNumColumns(columns);
```

- Color: 32-bit AARRGGBB format

```
int primaryColor = ContextCompat.getColor(context, R.color.colorPrimary);
textView.setTextColor(primaryColor);
```

- Dimension

```
int height = (int) context.getResources().getDimension(R.dimen.title_height);
// use LayoutParams to set height
```

Practical Work 9

- Convert all of your hard-coded values into resource values
  - Strings
  - Dimensions
  - Colors
- Make a Vietnamese translation of your string values
- Globally switch phone language to Vietnamese
- Check your UI with the new language

Drawables

Drawables

- 2 types
  - XML drawables: res/drawable
  - Bitmap drawables (PNG/JPEG): res/drawable-*dpi
- ImageView: src="@drawable/name"
- View: background="@drawable/name"

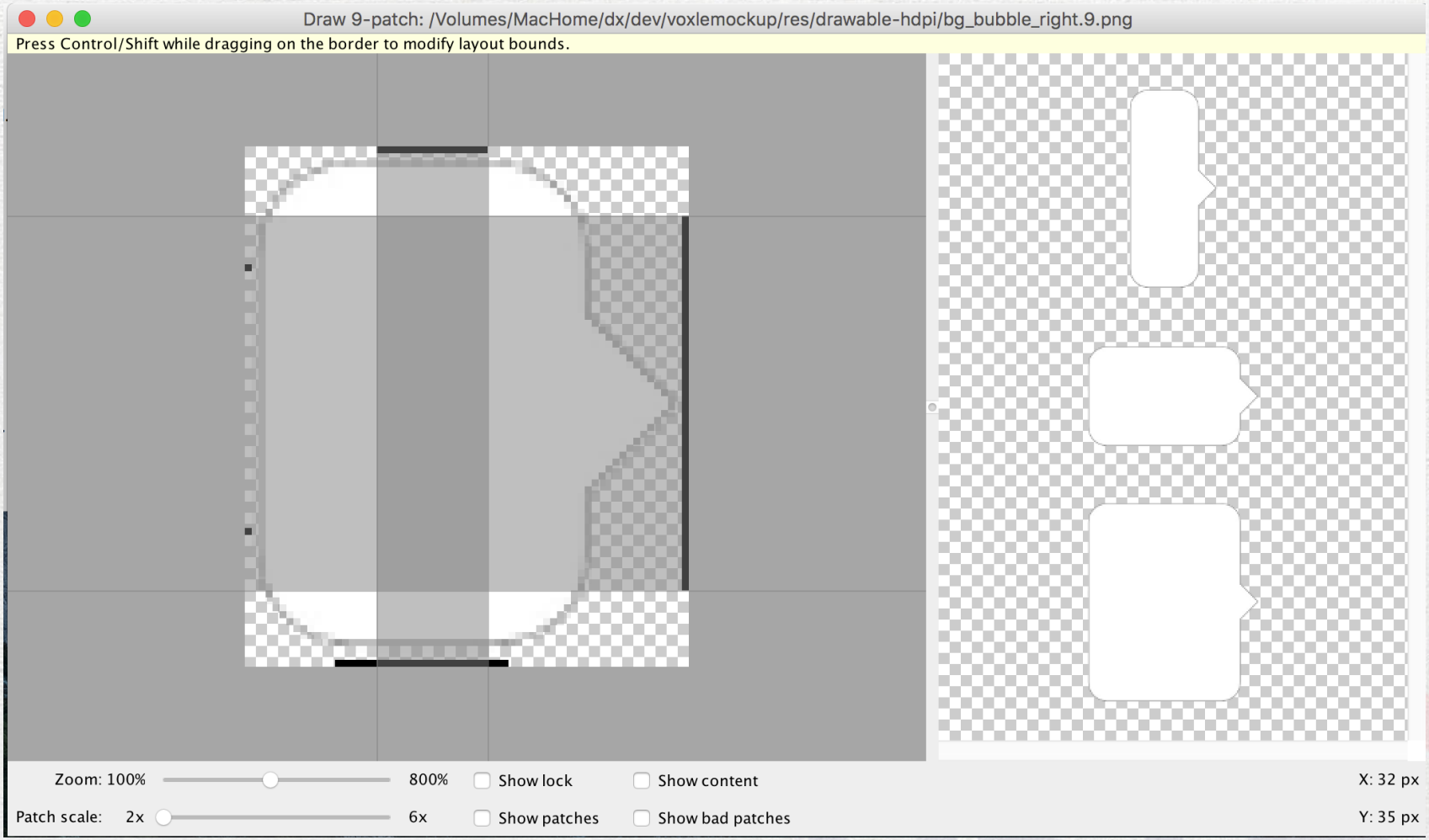
9patch Drawables

- *.9.png
  - Transparency
  - Stretch certain part of the image
  - Padding

9patch Drawables

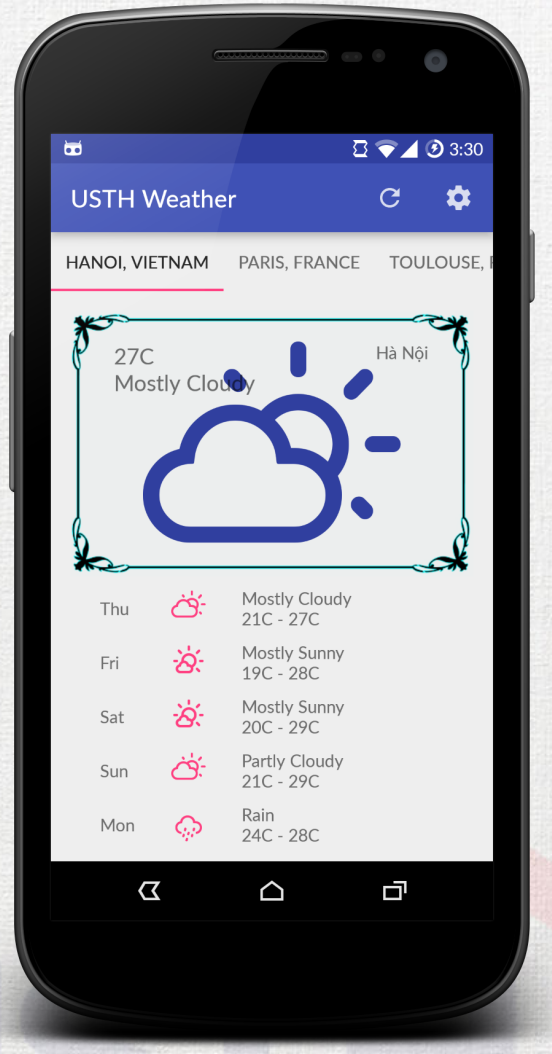
- Top & Left edges
  - Black pixels define stretching area
- Bottom & Right edges
  - Black pixels define paddings
- Can be editted with many image tools
- **Warning**: other edge pixels need to be completely transparent

9patch Drawables



Practical Work 10

- Download a frame background from MAD's moodle
- Modify it to be a 9patch image
- Apply to your WeatherFragment's layout



Raw data

Raw data

- Embedded in your apps
- Anything *not* common types
  - XMLs
    - String
    - Layout
    - Menu
    - XML drawable
  - Drawables, fonts
  - JSONs
  - Audio: MP3, ...
  - Others: even HTML/CSS/JS ☺

Places to store raw data

- 2 different places
  - res/raw/
  - assets/

res/raw/

- A « resource »
- Conforms previously explained resource name convention
- Accessible with `Context.getResources()`
- `R.raw.<name>`

res/raw/

- Use input stream to access binary data
- Examples

```
InputStream is = context.getResources()
                        .openRawResource(R.raw.resid);

// do whatever you like
// for example, copy to sdcard or send to network
```

assets/

- Not a resource
- **NO** `R.<assets>`
- Name it whatever you like

assets/

- Use input stream to access binary data
- Use file name with `Context.getAssets()`
- Examples

```
InputStream is = getAssets().open("<filename>");
```

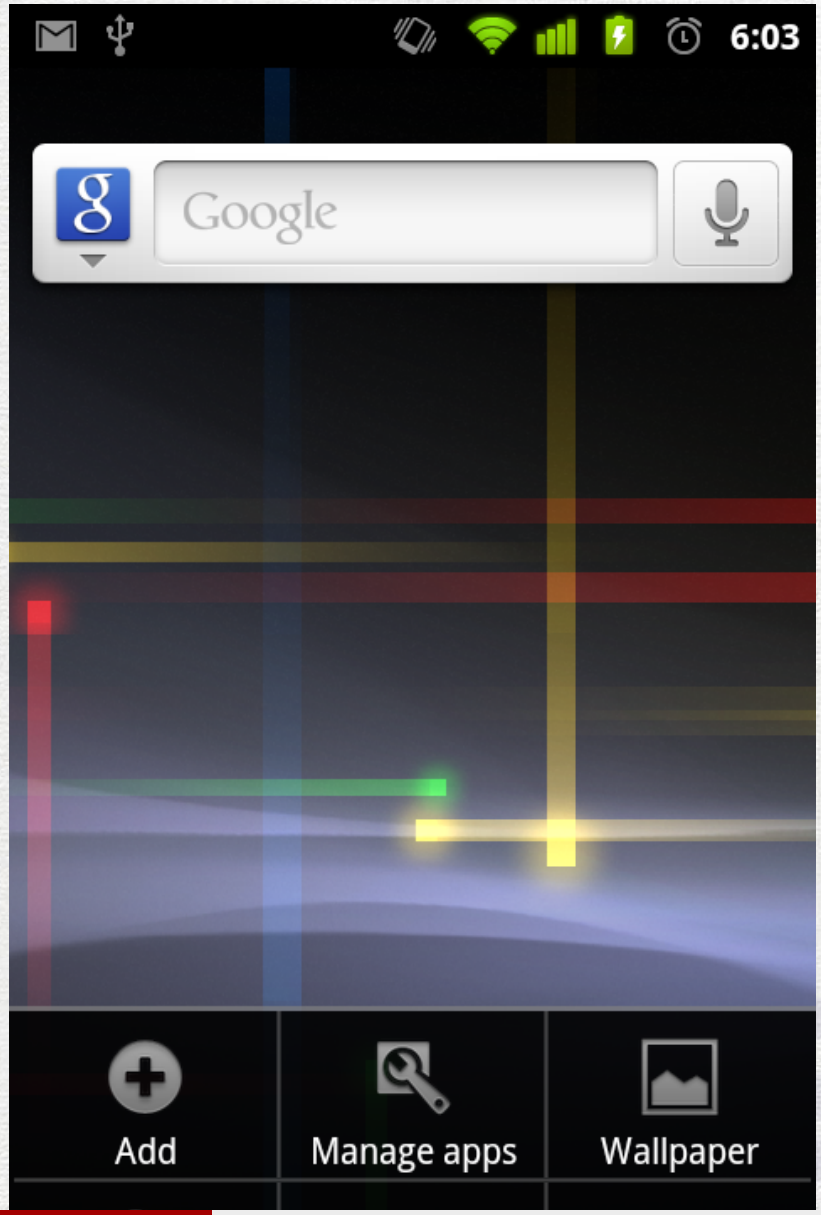
Practical Work 11

- Find and download a music file in MP3 format
- Include it in either `res/raw` or `assets`
- Activity startup:
  - Extract your MP3 file to sdcard
    - Permission to write to external storage `android.permission.WRITE_EXTERNAL_STORAGE`
    - Use your learnt `InputStream` / `OutputStream`
    - Important: reduce your `targetSdkVersion` down (≤ 22) if running on Marshmallow
  - Play it using `MediaPlayer` class

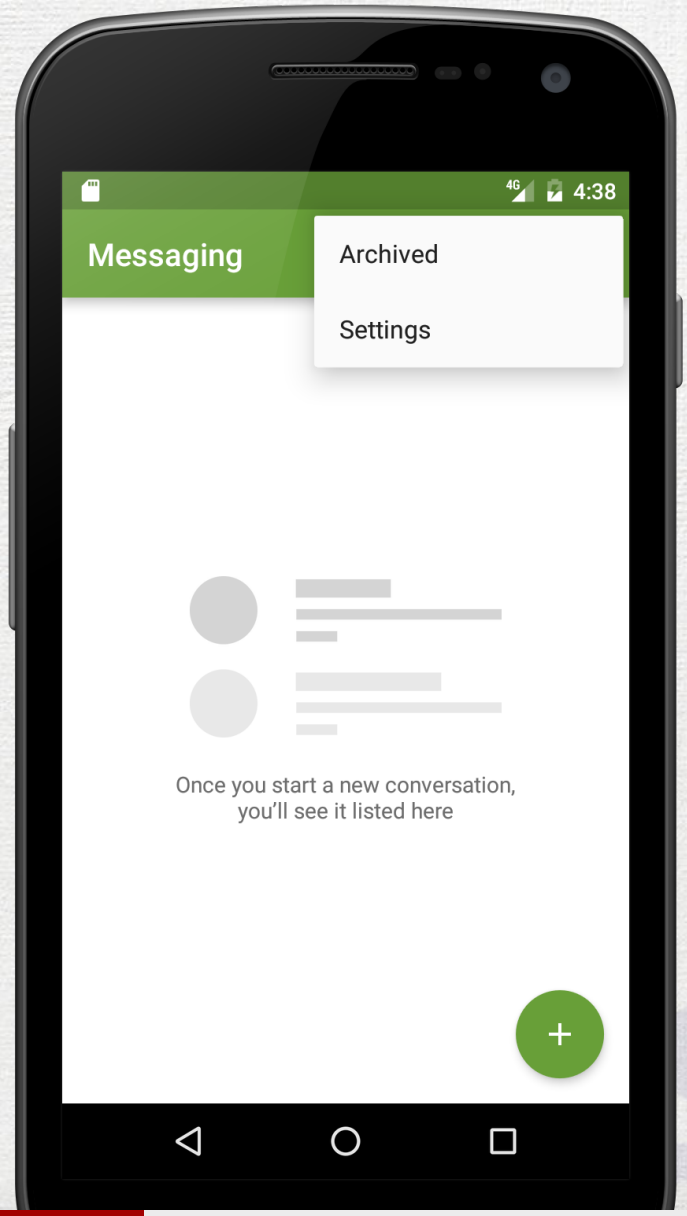
Menu

What?

What?



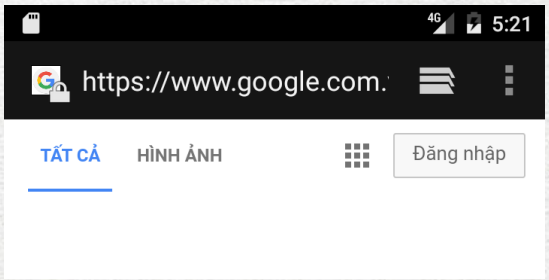
What?


4:38
Messaging
Archived
Settings
Once you start a new conversation,
you'll see it listed here

What?

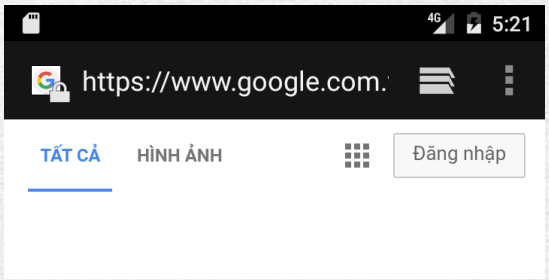
- Major user interface component
  - App wide actions (migrated to App Bar)
  - Context menu
  - Popup menu

What?

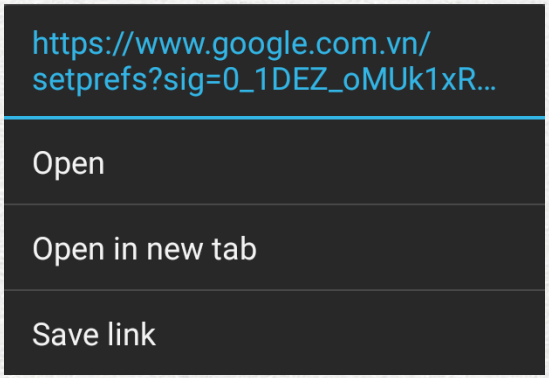


App Bar

What?

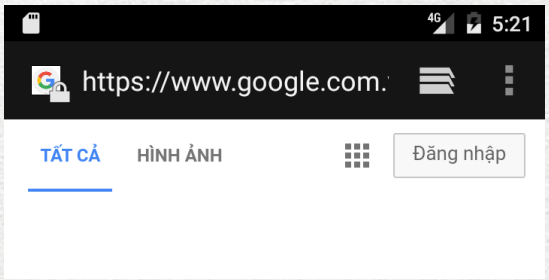


App Bar

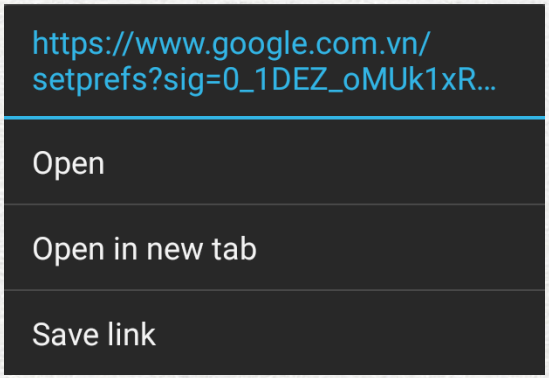


Context Menu

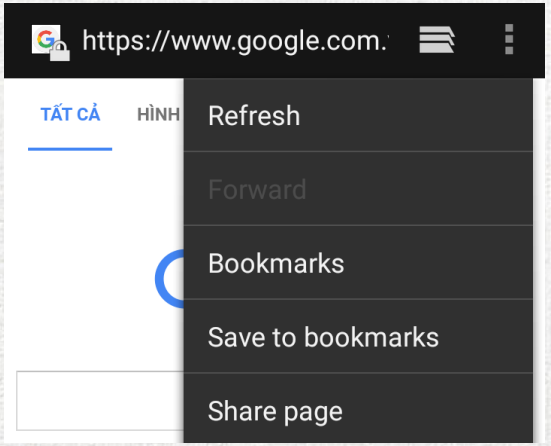
What?



App Bar



Context Menu

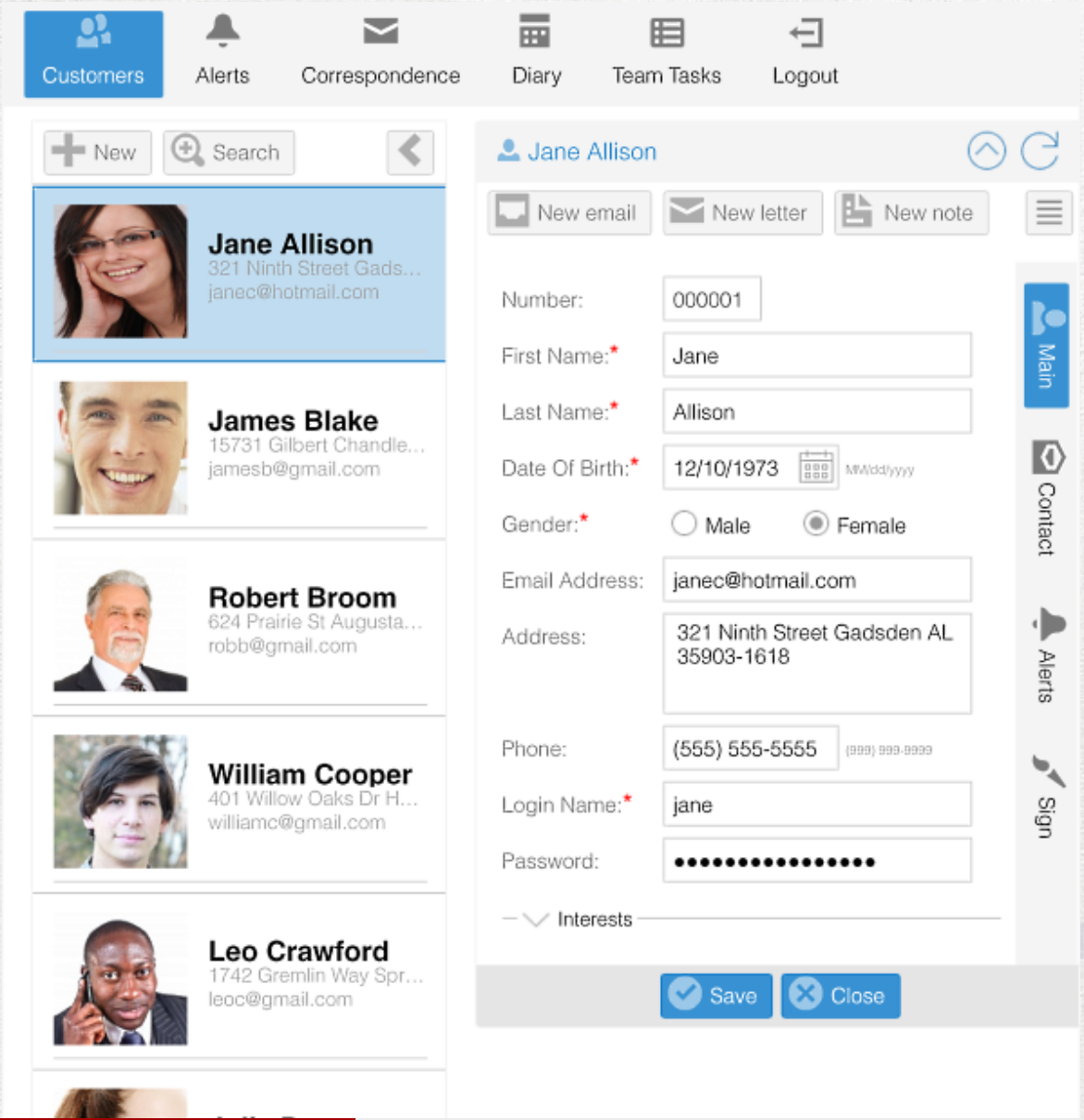


Popup Menu

Why?

- Common controls
- Less crammed components
- Consistent user experience
- Less is more ☺

Why?


Customers
Alerts
Correspondence
Diary
Team Tasks
Logout
New
Search
Jane Allison
321 Ninth Street Gads...
janec@hotmail.com
James Blake
15731 Gilbert Chandle...
jamesb@gmail.com
Robert Broom
624 Prairie St Augusta...
robb@gmail.com
William Cooper
401 Willow Oaks Dr H...
williamc@gmail.com
Leo Crawford
1742 Gremlin Way Spr...
leoc@gmail.com
Jane Allison
New email
New letter
New note
Number:
000001
First Name:*
Jane
Last Name:*
Allison
Date Of Birth:*
12/10/1973
MM/dd/yyyy
Gender:*
Male
Female
Email Address:
janec@hotmail.com
Address:
321 Ninth Street Gadsden AL
35903-1618
Phone:
(555) 555-5555
(999) 999-9999
Login Name:*
jane
Password:
Interests
Save
Close
Main
Contact
Alerts
Sign

App Bar

- Previously called `ActionBar`
- Android Support Library: `ToolBar`
  - Support material design for API 7+ (Eclair)
  - Best compatibility
- Contains most common functions with app-wide scope
  - Search
  - Settings
  - ...

App Bar

- App Bar layout:
  - [Optional] Navigation Drawer / back icon
  - [Optional] App logo
  - Activity Title
  - Actions

App Bar: How?

1. Define Menu resource for the AppBar
2. Inflate the menu xml in `onCreateOptionsMenu()`
3. Response to actions in `onOptionsItemSelected()`

How about the actions?

How about the actions?

Menu resources

App Bar: 1. Define menu resources

- Defined in `res/menu/<name>.xml`
- Each item represents a menu item
- `ToolBar`'s actions are defined as menu item

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- Defined in `res/menu/<name>.xml`
- Each item represents a menu item
- `ToolBar`'s actions are defined as menu item

```
<menu xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto">
    <item
        android:id="@+id/action_search"
        android:icon="@drawable/ic_action_search_search"
        android:title="@string/action_favorite"
        app:showAsAction="ifRoom"/>
</menu>
```

App Bar: 1. Define menu resources

- Menu item attributes
  - `id`: well... to identify each item
  - `icon`: points to an existing drawable, for AppBar icons only
  - `title`: text of the item in the menu
  - `app:showAsAction`: whether `ToolBar` should show the icon or not.
    - `ifRoom`: if there's enough space
    - `never`: always in an overflow popup menu
    - `always`

App Bar: 1. Define menu resources

```
<menu xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto">
    <item
        android:id="@+id/action_search"
        android:icon="@drawable/ic_action_search_search"
        android:title="@string/action_favorite"
        app:showAsAction="ifRoom"/>
</menu>
```

AppBar: remind

- Previous step defined menu for AppBar's action items

AppBar: remind

- Previous step defined menu for AppBar's action items
- Use it on the AppBar
  - Override Activity's `onCreateOptionsMenu()` for inflating the menu

AppBar: remind

- Previous step defined menu for AppBar's action items
- Use it on the AppBar
  - Override Activity's `onCreateOptionsMenu()` for inflating the menu
  - Override Activity's `onOptionsItemSelected()` for responding to actions

AppBar: 2. inflate the menu

- Override `onCreateOptionsMenu()`

```
public class MainActivity extends AppCompatActivity {

    ...

    @Override
    public boolean onCreateOptionsMenu(Menu menu) {
        getMenuInflater().inflate(R.menu.menu_weather, menu);
        return true;
    }
}
```

AppBar: 3. response to actions

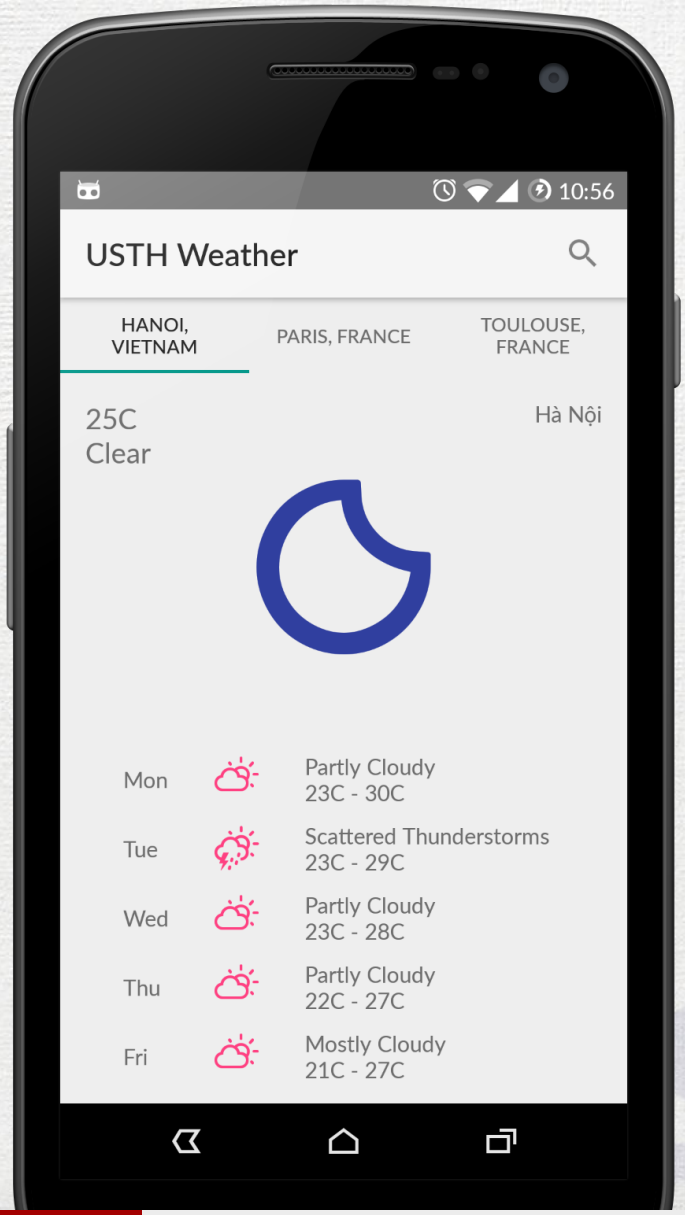
- Override `onOptionsItemSelected()`

```
public class MainActivity extends AppCompatActivity {

    ...

    @Override
    public boolean onOptionsItemSelected(MenuItem item) {
        switch (item.getItemId()) {
            case R.id.search:
                // do something when search is pressed here
                return true;
            default:
                super.onOptionsItemSelected(item);
        }
    }
}
```

App Bar: Result



App Bar: Recap

1. Add `ToolBar` (in Android Support Library) to the Activity's layout
2. Setup it in `onCreate()`
3. Define Menu resource for the AppBar
4. Inflate the menu xml in `onCreateOptionsMenu()`
5. Response to actions in `onOptionsItemSelected()`

Practical Work 12

- Use a ToolBar on your WeatherActivity
- Add two actions
  - Refresh (icon always visible): show a toast
  - Settings (always in the overflow menu): starts a new activity, named `PrefActivity`