



UI Design and Development

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# Agenda



1. Designing for Android
2. Layouts and resources
3. Tablet considerations
4. System UI integration
5. Wireframing



# Designing for Android

# Design for...



- Touch
  - Interact primarily with your fingers
  - Expect direct manipulation
- Mobile
  - Often on the go
  - Often without network connectivity
- Heterogeneity
  - Different screen sizes and densities
  - Different hardware features
  - Different OS versions

# Key principles

1 + 2



"Pictures are faster than words."

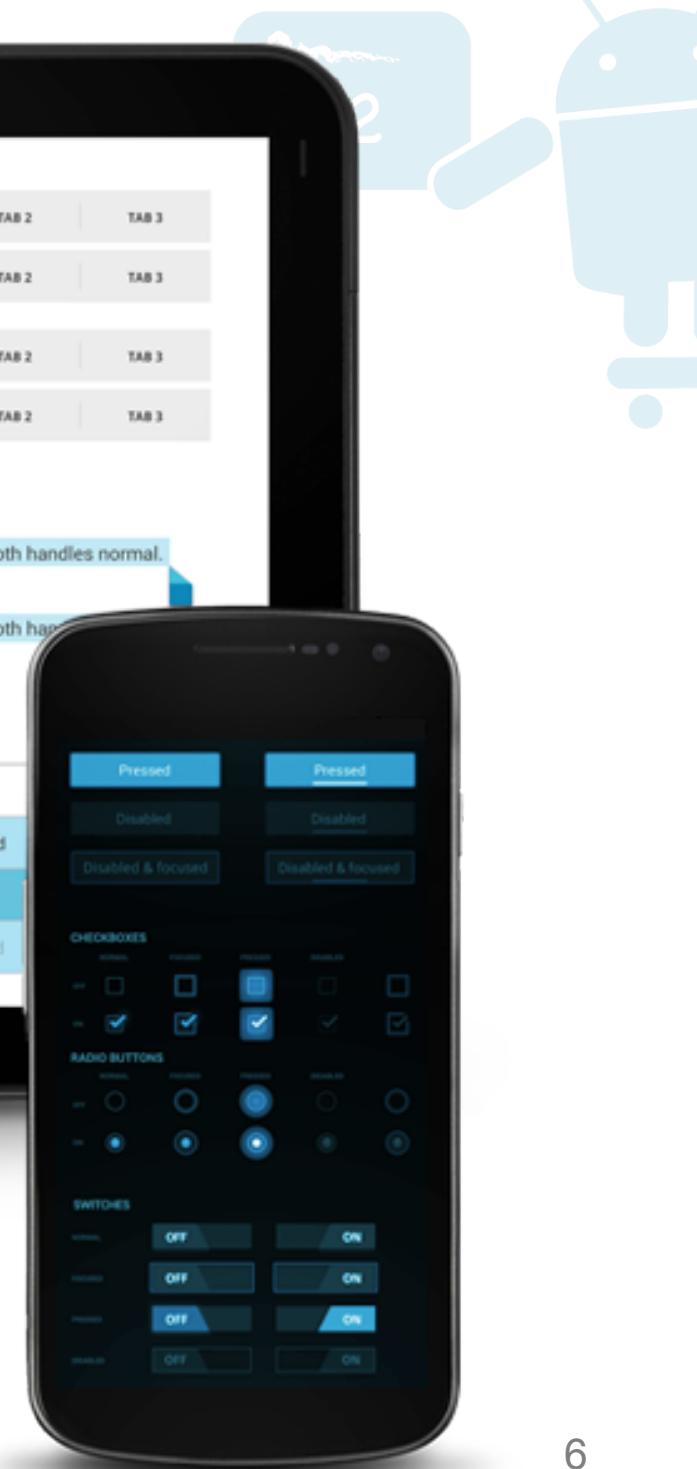
"Only show what I need when I need it."

"Make the important things fast."

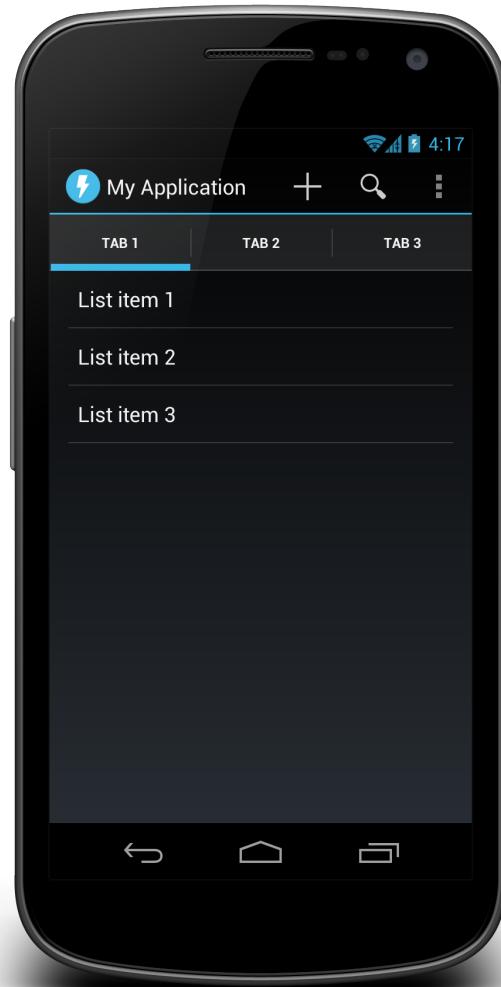
"Do the heavy lifting for me."



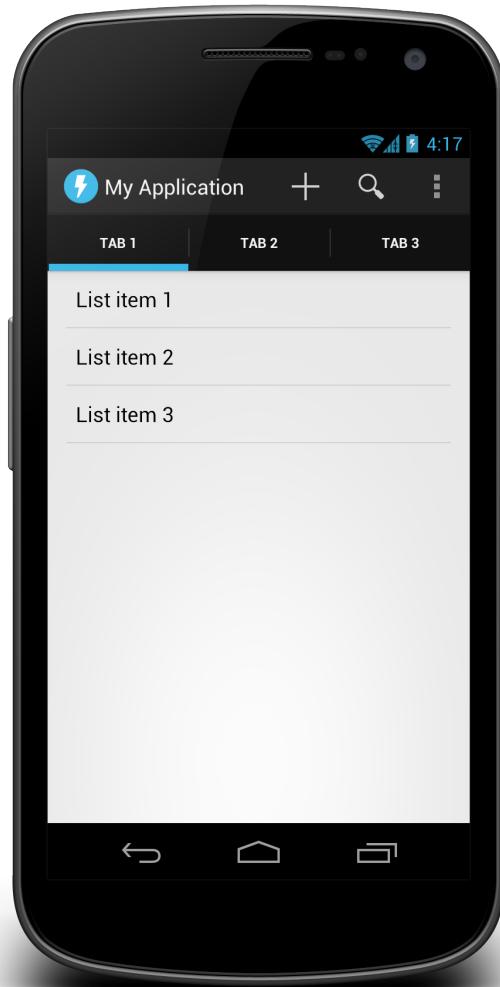
"Holo" visual language



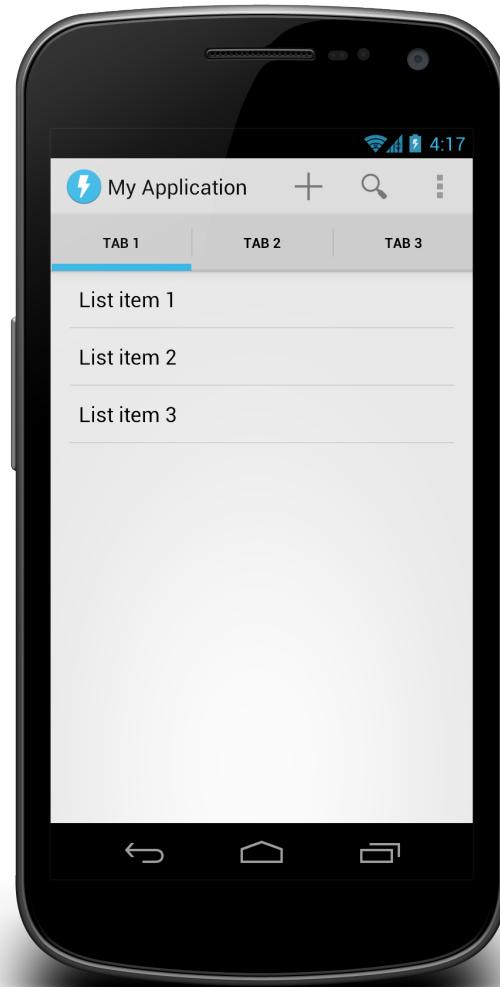
# Holo variations



Dark



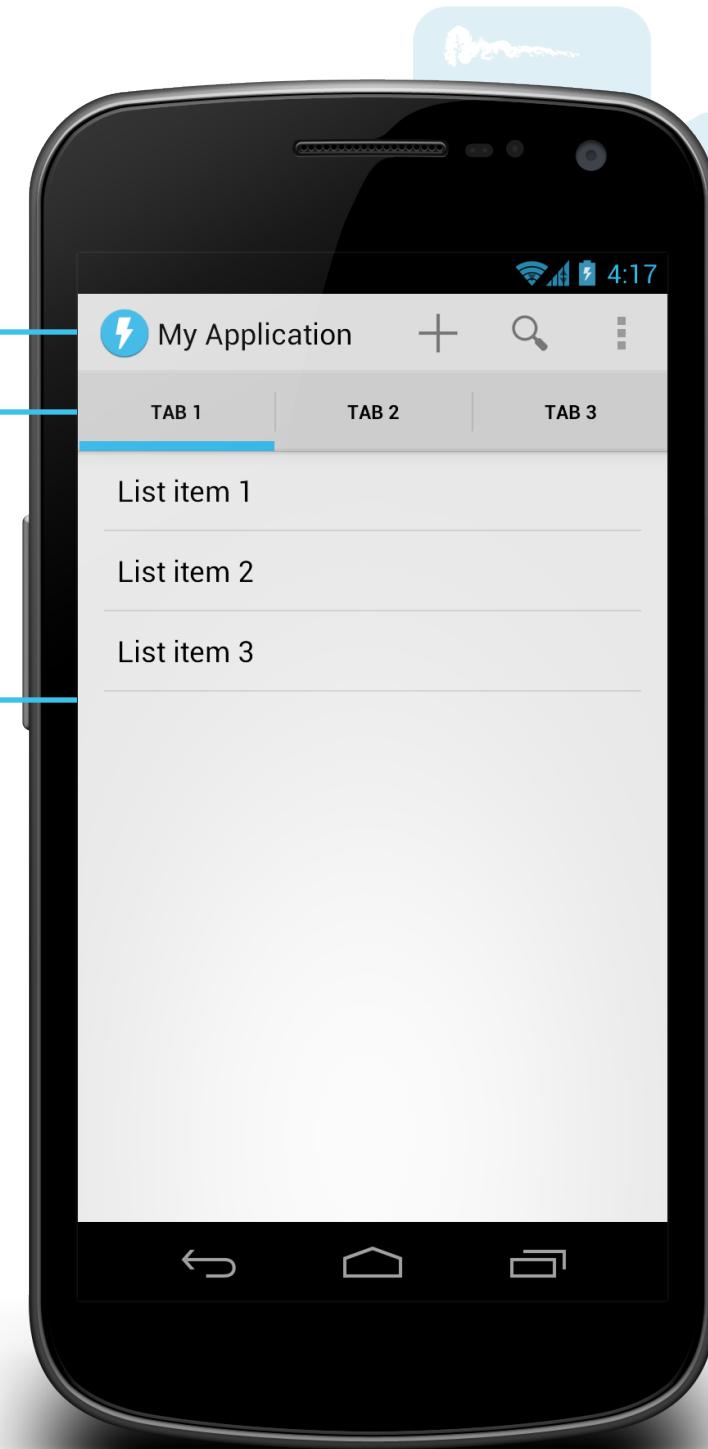
Dark Action Bar



Light

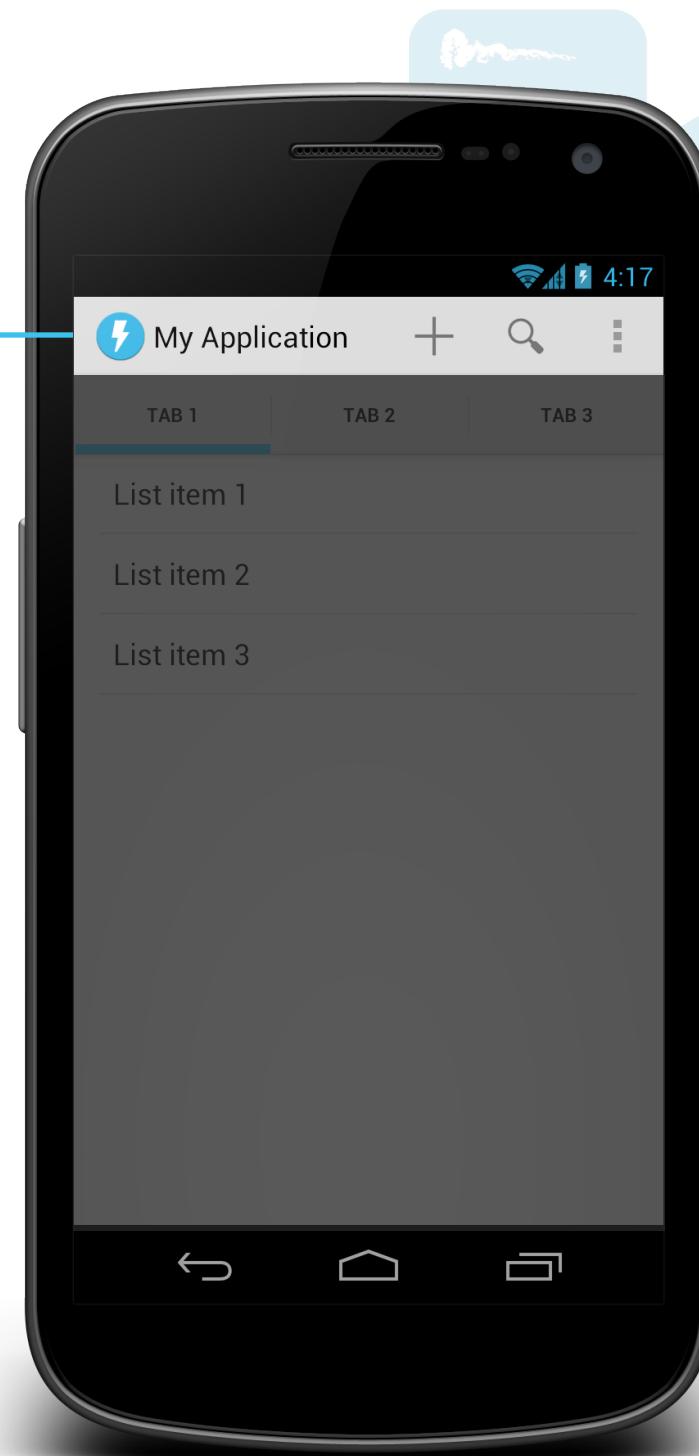
# Activity UI structure

Action bar  
Tabs  
Content  
(activity layout)

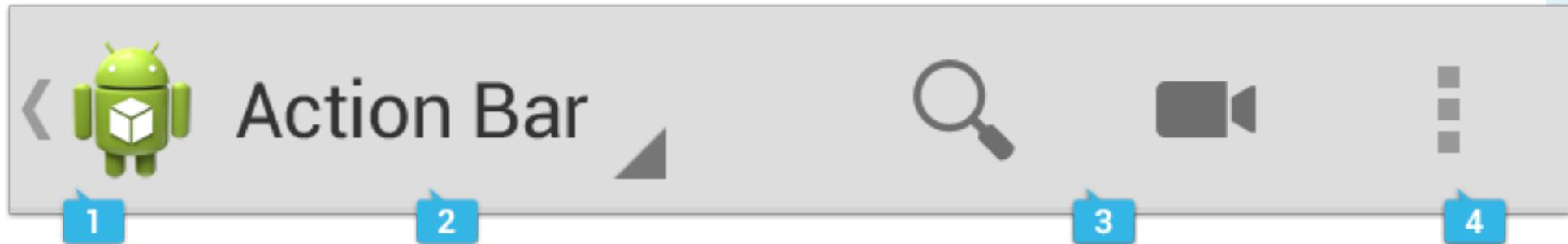


# Activity UI structure

Action bar

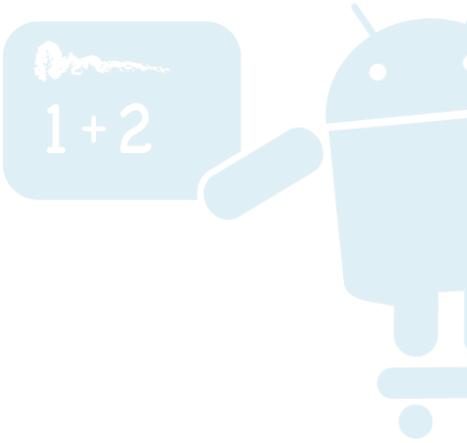


# Action bar



1. App icon and optional Up caret
2. View control (Title/tabs/dropdown)
3. Action buttons
4. Action overflow

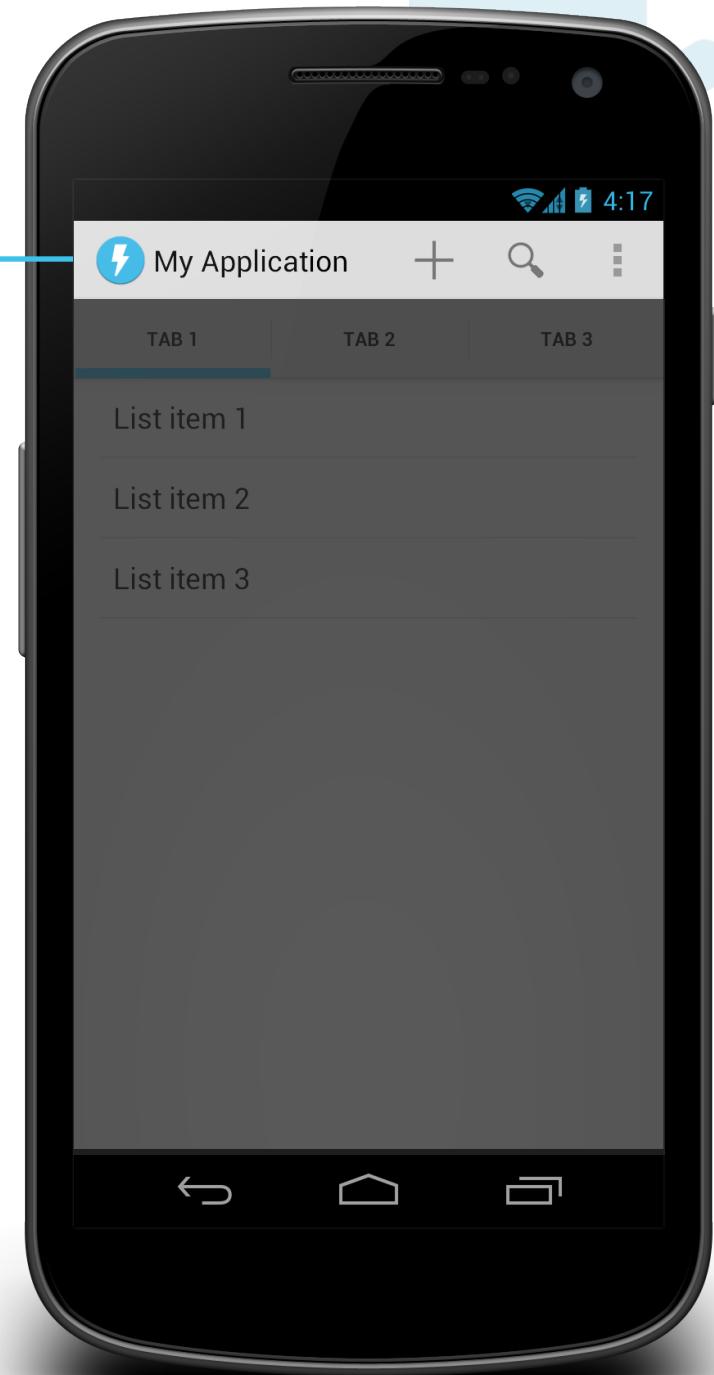
# Action bar



- Android 3.0 and above
- Automatically part of Holo themes
- Customize:
  - `getActionBar().setDisplayOptions()`
  - `getActionBar().setNavigationMode()`

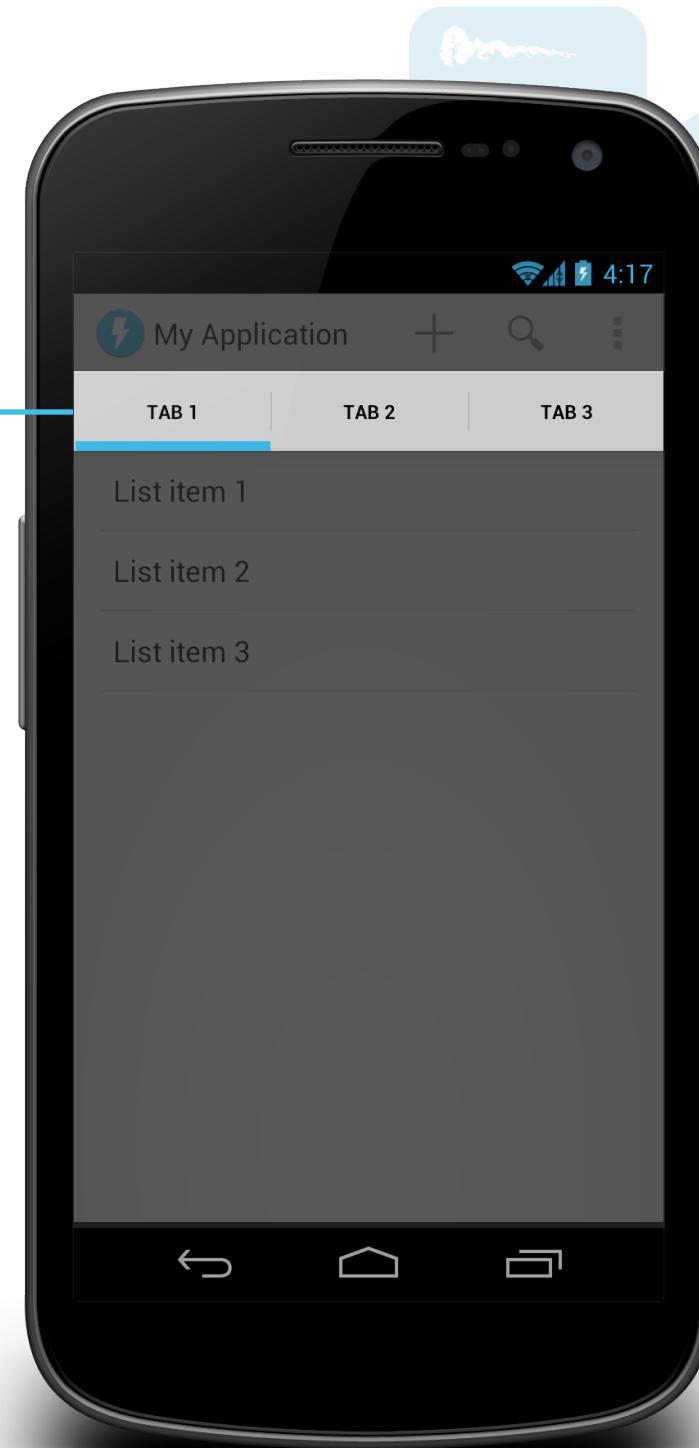
# Activity UI structure

Action bar



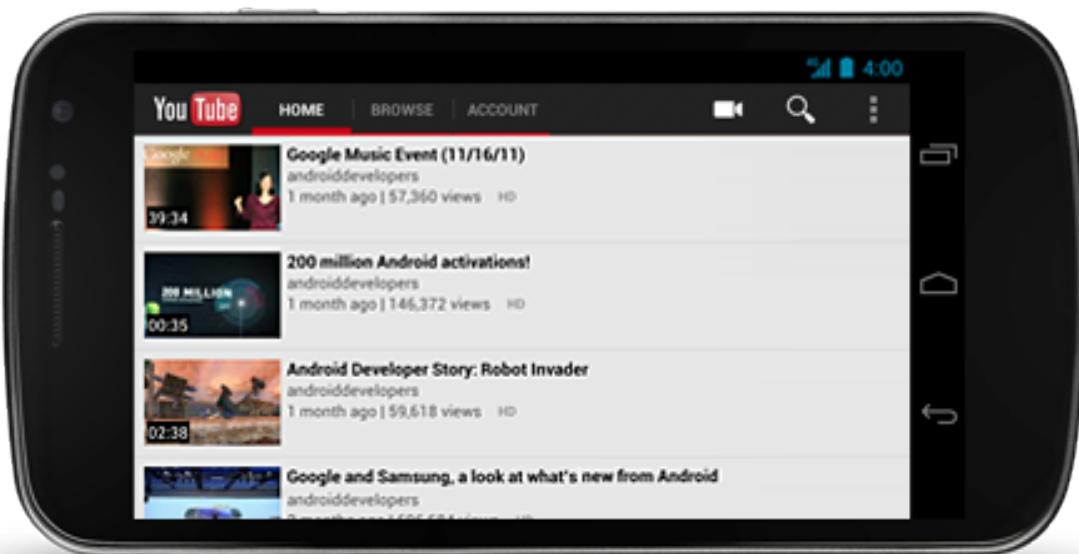
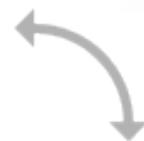
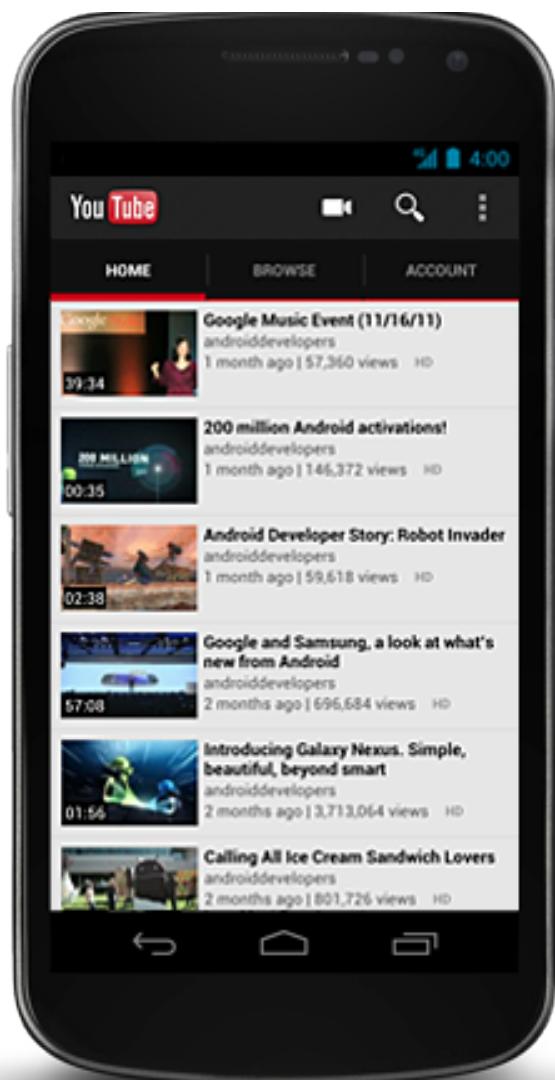
# Activity UI structure

Tabs



# Tabs

1 + 2



# Tabs

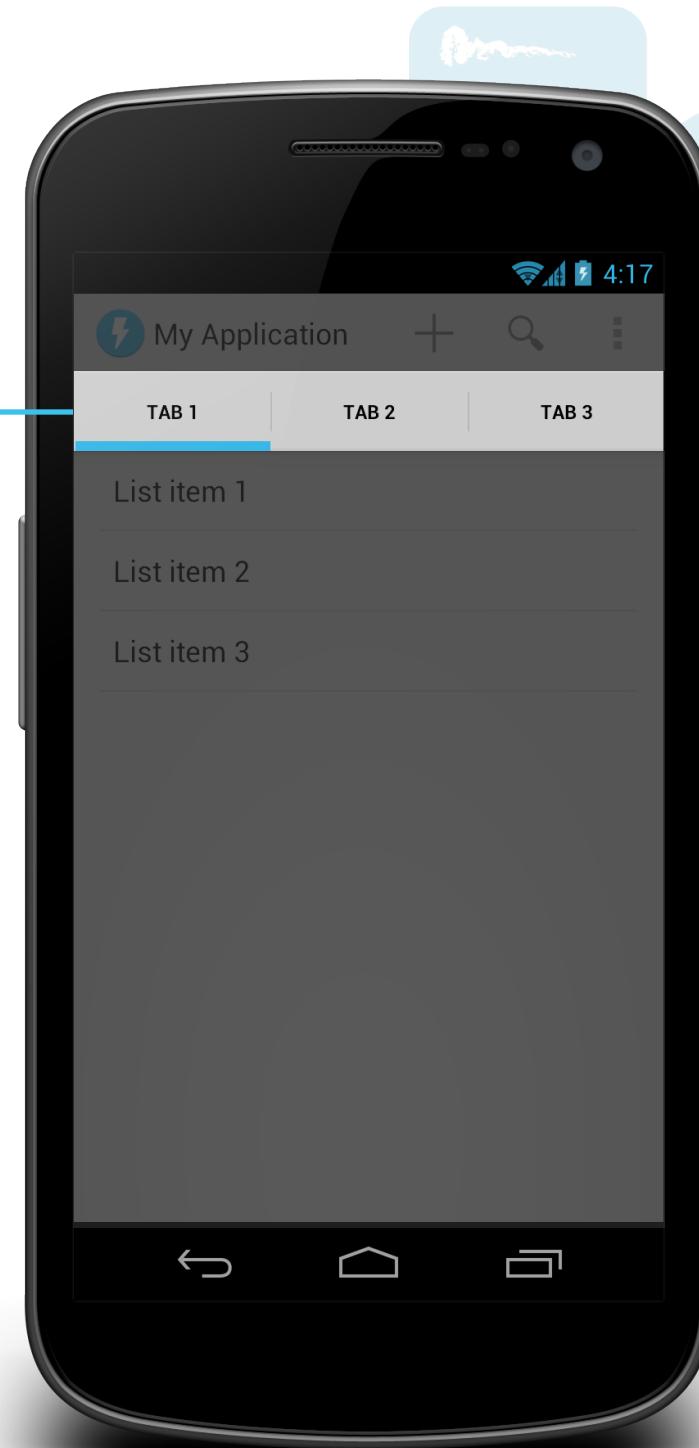


- Part of the `ActionBar` APIs
- Usually gesture-enabled using `ViewPager`

```
getActionBar().setNavigationMode(NAVIGATION_MODE_TABS);  
  
ActionBar.Tab tab = actionBar.newTab();  
tab.setText("Tab 1");  
tab.setTabListener(this);  
getActionBar().addTab(tab);
```

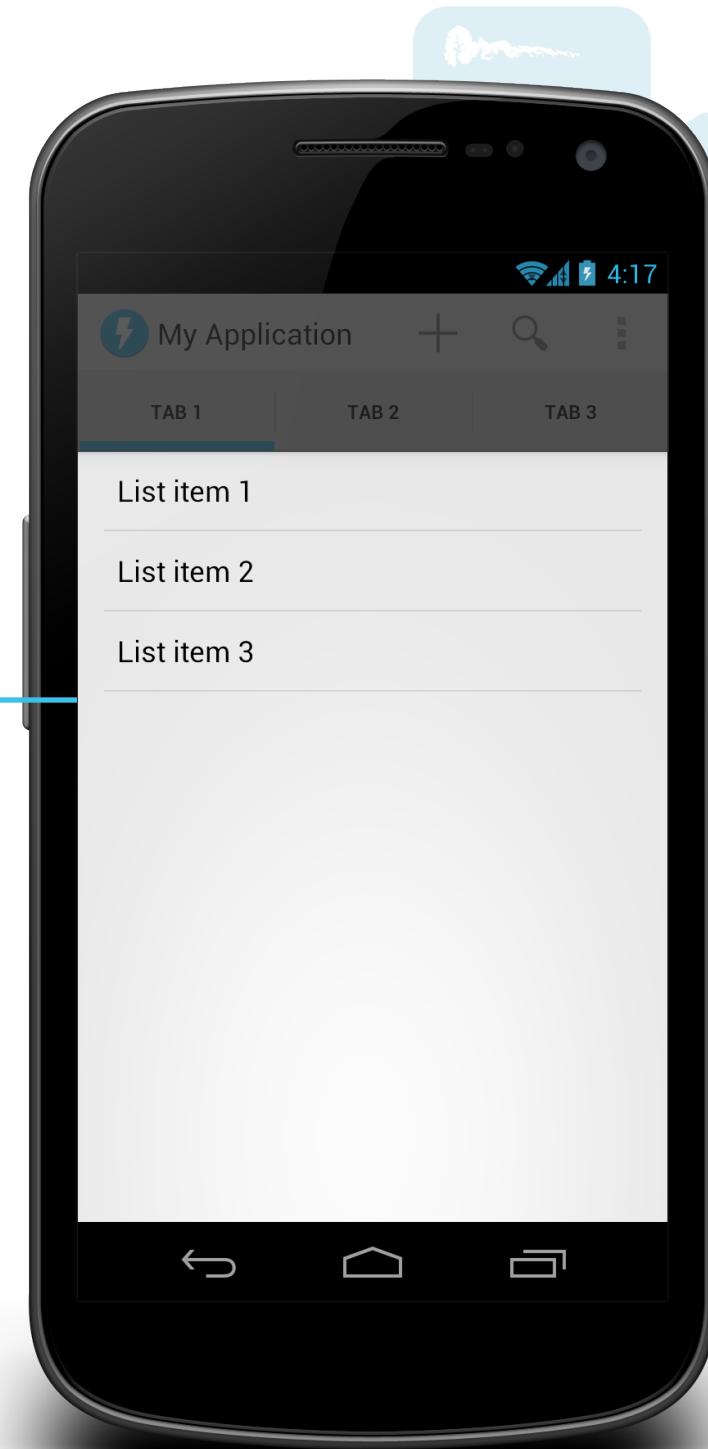
# Activity UI structure

Tabs



# Activity UI structure

Content  
(activity layout)





# Layouts and resources

# Layout system



- The UI for an activity is a tree consisting of view groups and views (leaf nodes), like HTML.

```
<view group>
    <view group>
        <view>
    <view group>
        <view>
        <view>
```

- Most commonly defined in XML under `res/layout/`.

# Views and View Groups



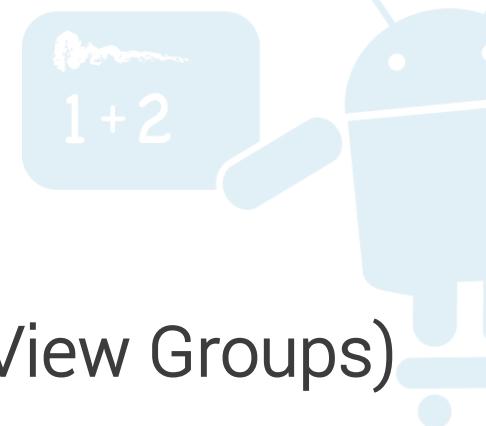
## Views

- Reusable individual UI components
- Optionally interactive (clickable/focusable/etc.)
- Bare minimum functionality is to draw themselves

## View Groups

- Ordered list of Views and View Groups
- In charge of positioning and sizing their child views and layouts
- Simple layouts and more complex groups (e.g. `ListView`)

# Views and View Groups



## Views

- TextView
- EditText
- Spinner
- ImageView
- Button
- WebView
- SurfaceView
- Your own custom views

## Layouts (simple View Groups)

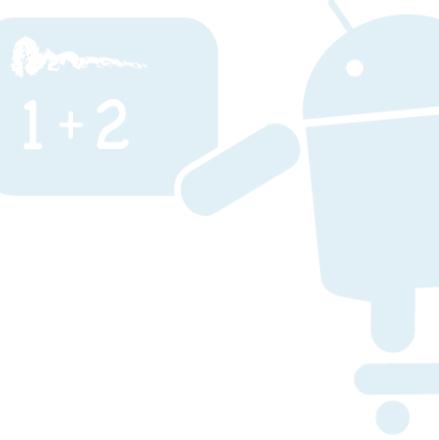
- FrameLayout
- LinearLayout
- RelativeLayout
- GridLayout
- Your own custom layouts

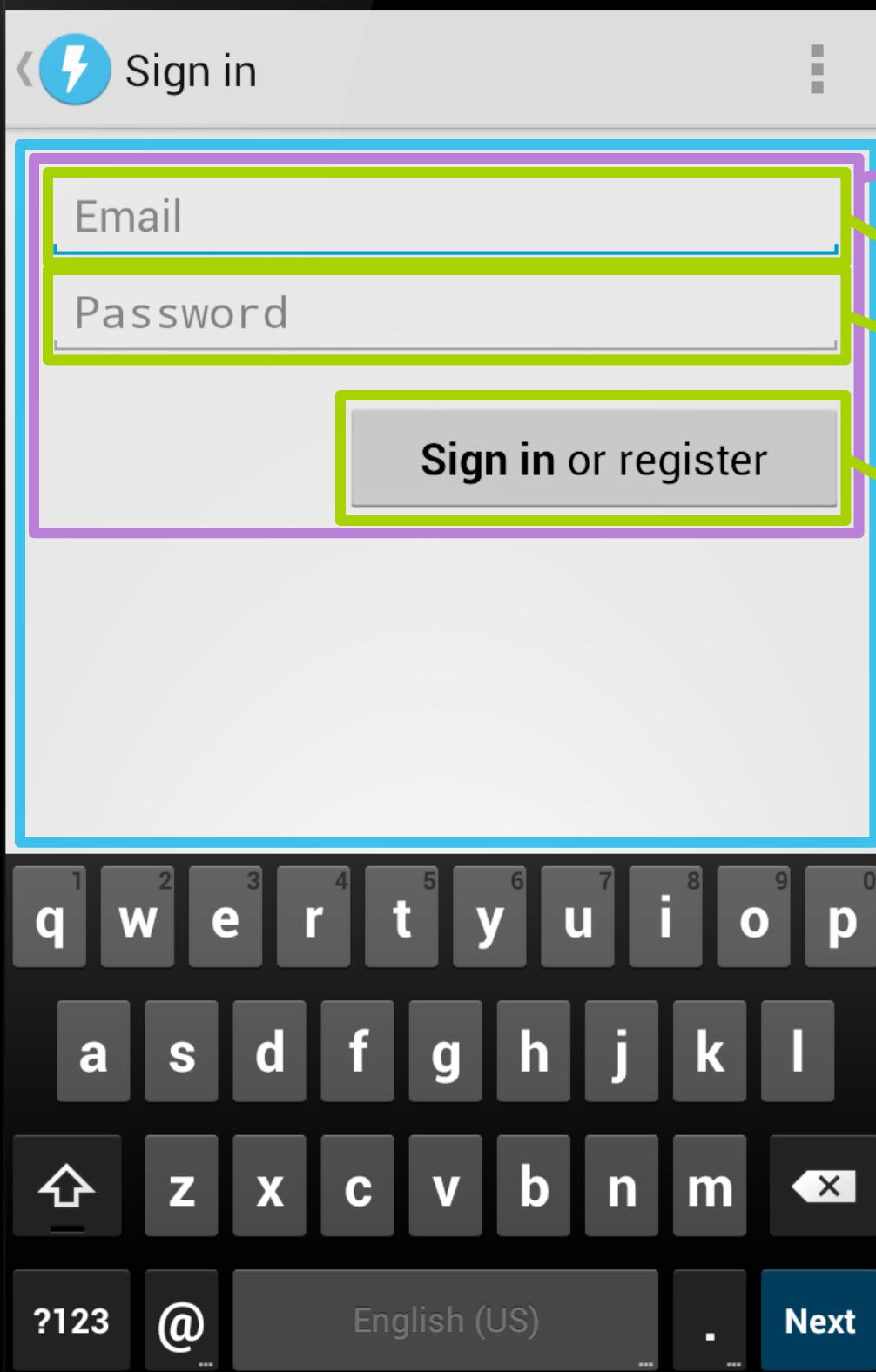
## Complex View Groups

- ScrollView
- ListView

# Anatomy of a simple layout

4:58





<LinearLayout  
    orientation="vertical">

<EditText>

<Button>

<ScrollView>

```

<ScrollView
    android:layout_width="match_parent"
    android:layout_height="match_parent">

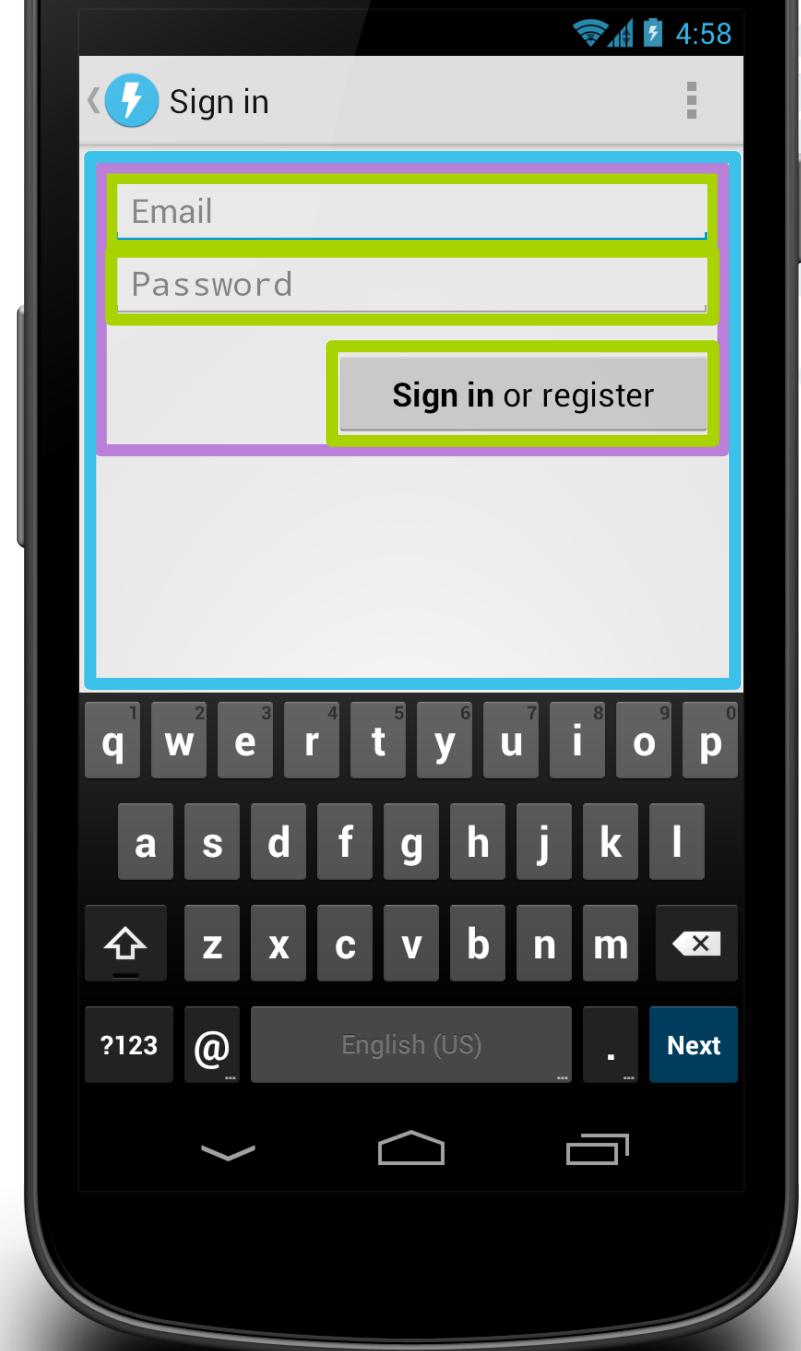
    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:orientation="vertical"
        android:padding="16dp">

        <EditText
            android:id="@+id/email"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:hint="@string/prompt_email"
            android:inputType="textEmailAddress"
            android:singleLine="true" />

        <EditText
            android:id="@+id/password"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:hint="@string/prompt_password"
            android:inputType="textPassword"
            android:singleLine="true" />

        <Button
            android:id="@+id/sign_in_button"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_gravity="right"
            android:layout_marginTop="16dp"
            android:paddingLeft="32dp"
            android:paddingRight="32dp"
            android:text="@string/action_sign_in_register" />
    </LinearLayout>
</ScrollView>

```

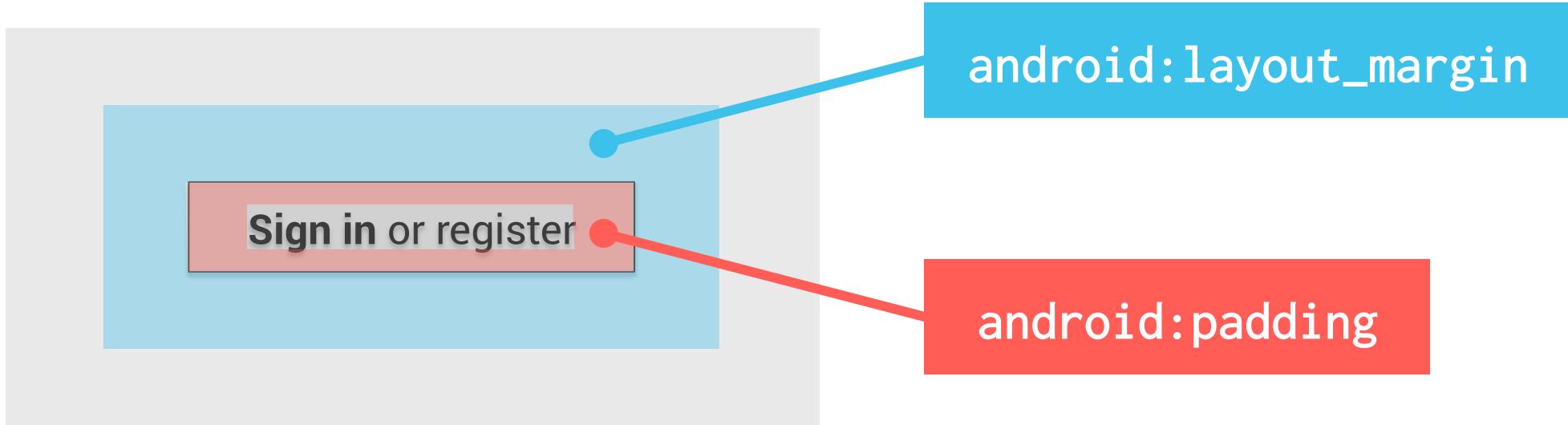


# Important layout attributes



- **android:layout\_weight**
  - Children of LinearLayout
- **android:layout\_gravity**
  - Children of FrameLayout, LinearLayout
- **android:gravity**
  - TextView, LinearLayout

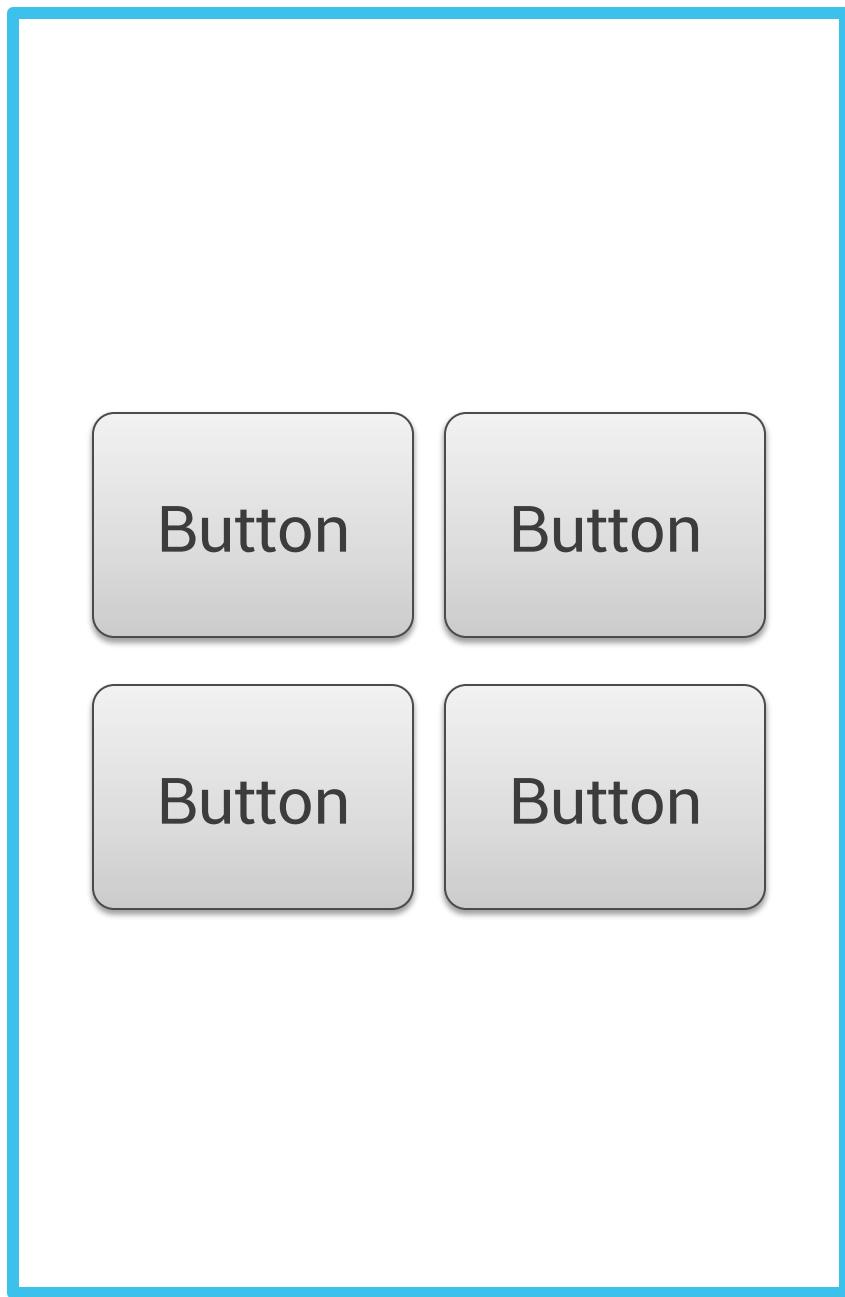
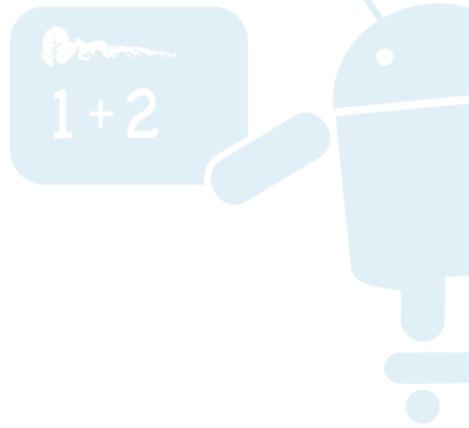
# Margins and padding

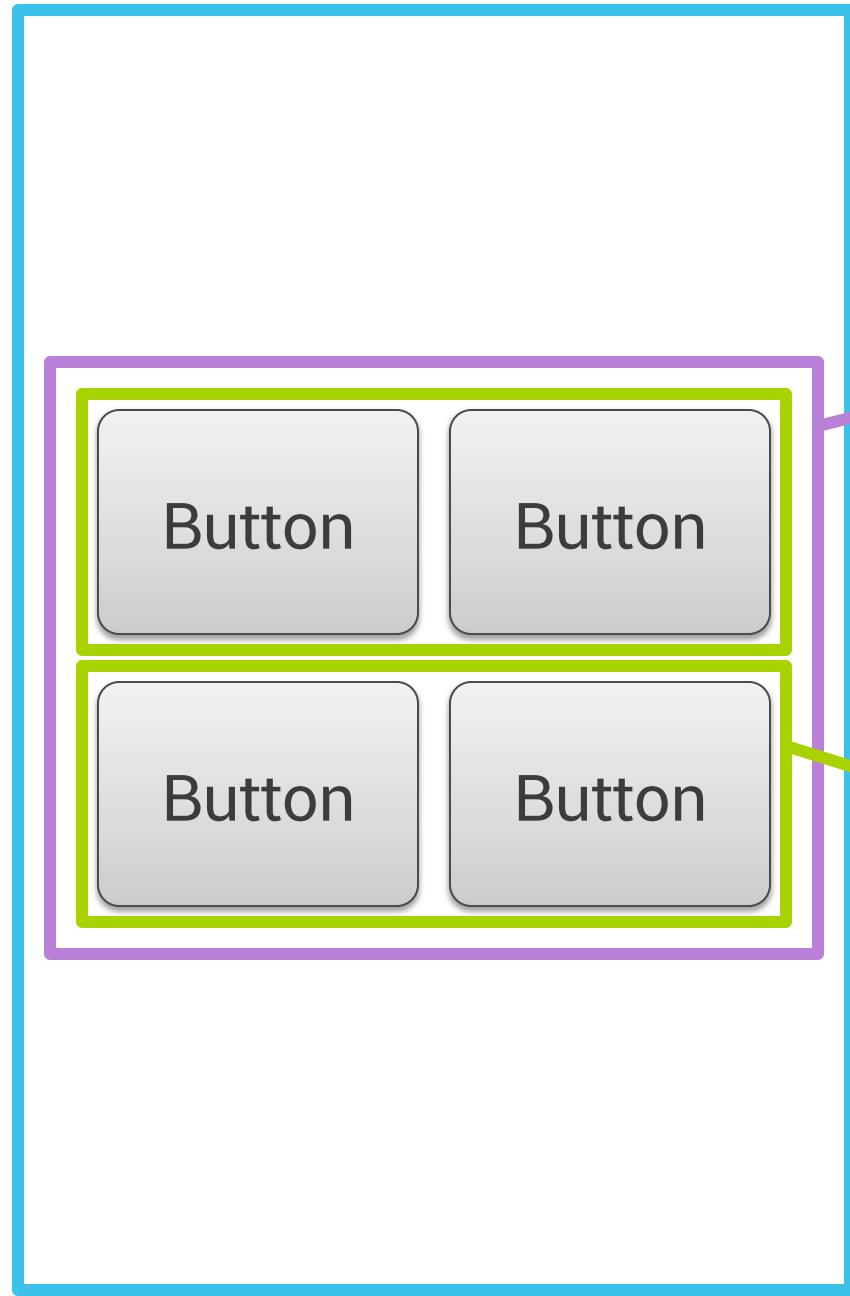




EXERCISE

**Code this layout**





<FrameLayout>

<LinearLayout  
    orientation="vertical">

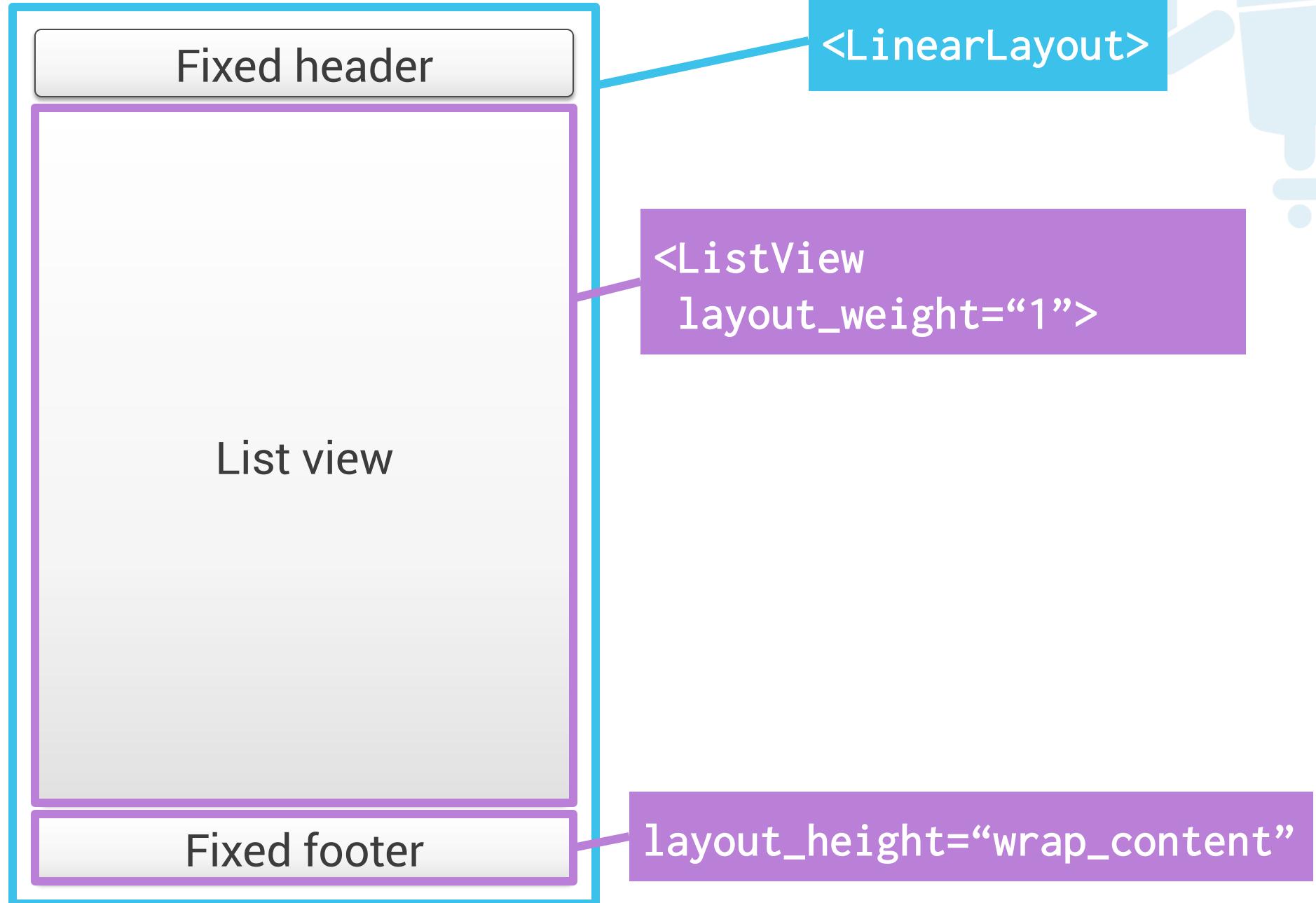
<LinearLayout  
    orientation="horizontal"  
    layout\_weight="1">



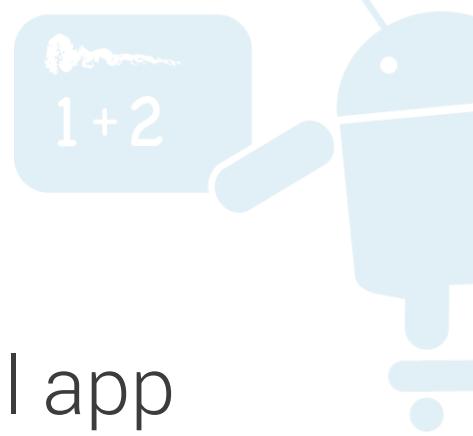
Fixed header

List view

Fixed footer



# App resources



```
res/  
  drawable  
  drawable-xhdpi  
  drawable-hdpi  
  drawable-mdpi  
  layout  
  layout-land  
  layout-large  
  layout-large-land
```

- One universal app binary contains all resources
- System chooses at runtime which resources to use

 res/

 drawable
 drawable-xhdpi
 drawable-hdpi
 drawable-mdpi
 layout
 layout-land
 layout-large
 layout-large-land
 values
 values-v11
 values-v14
 values-en
 values-fr
 values-ja

Drawable XML

PNGs, 9-patch PNGs,  
optimized for multiple densities

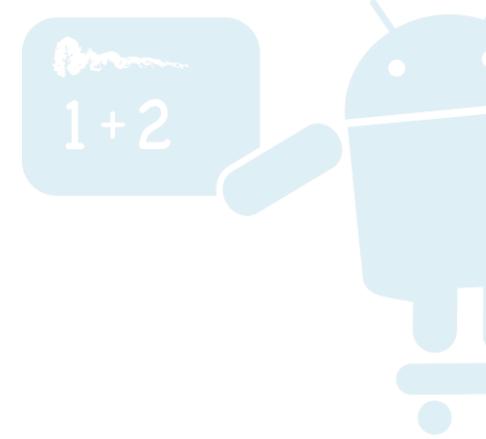
Layout XML  
optimized for  
physical screen size  
and orientation

Strings, styles, themes, etc.

Styles, themes varying by API level

Strings XML localized for your  
target regions

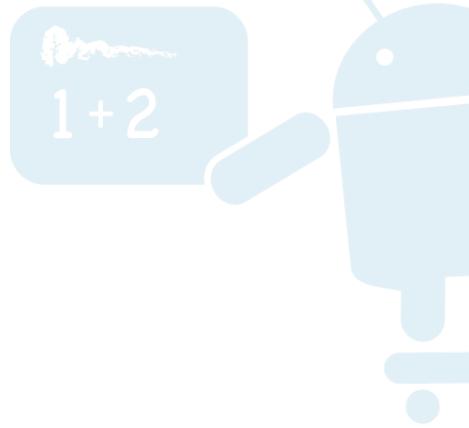
# Screen density and DIP units



DIP units keep things the same physical size across any screen.

1 dip = 1 pixel @ MDPI (160 dpi)

1 dip = 2 pixels @ XHDPI (320 dpi)



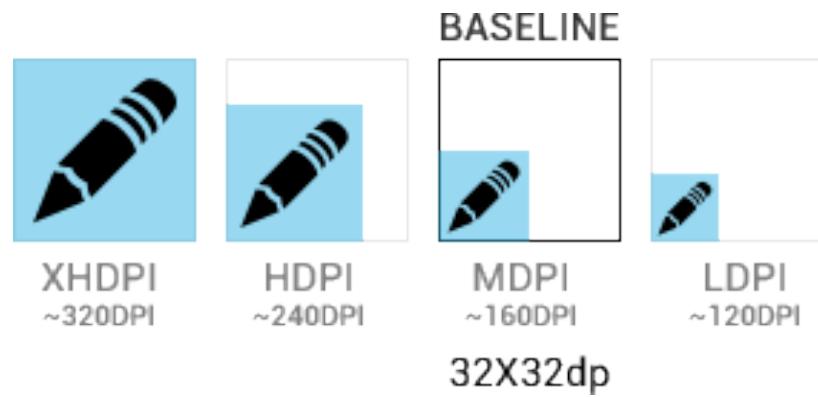
Q: What is the Nexus 7's screen resolution in DIPs if it's 1280x800 px and 213dpi?

A: ~960x600 dip

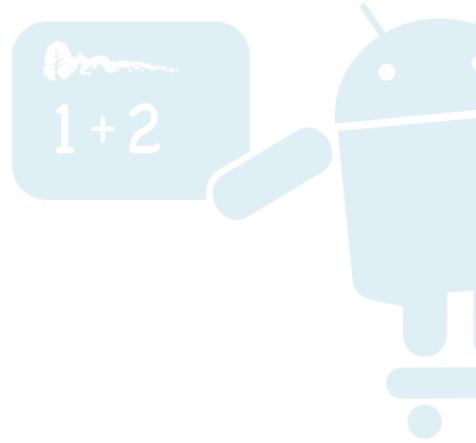
# Screen density and DIP units



Icons and other PNG files should generally be provided for multiple densities

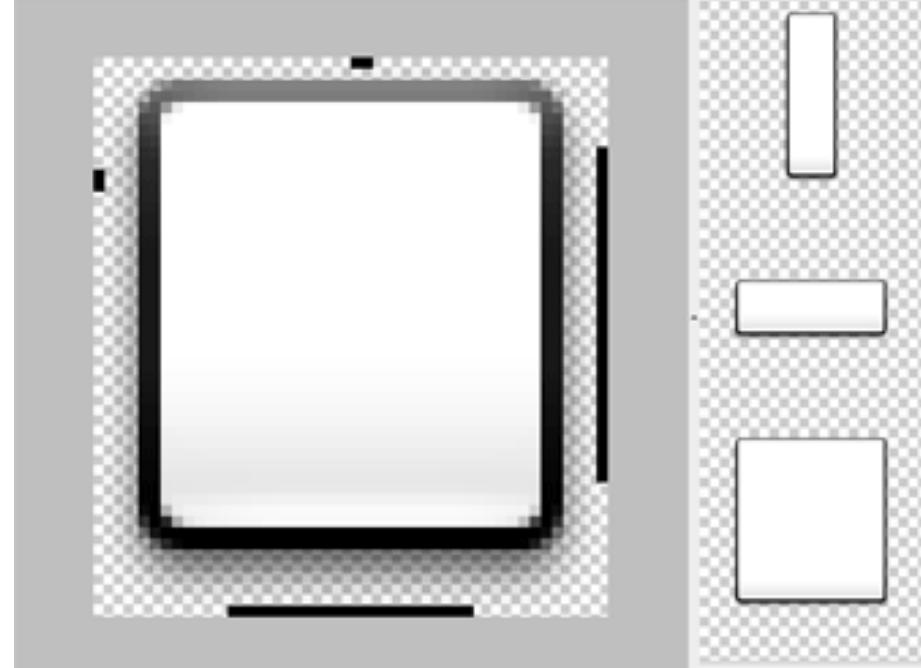


# Drawables



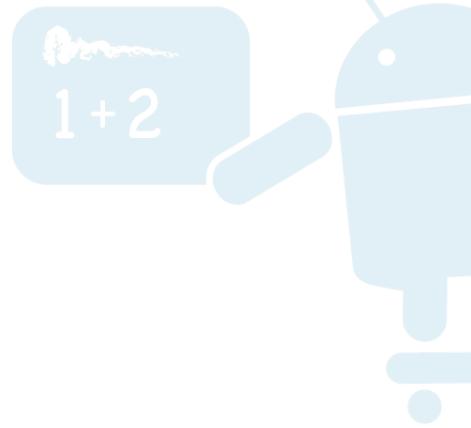
- Bitmaps (.png)
- 9-patches (.9.png)
- State Lists (.xml)
- Basic Vector Shapes (.xml)
- Color Drawables (.xml)

# 9-patches – foo.9.png



- Border pixels indicate stretchable regions
- Make density-specific versions (**-xhdpi**)

# State Lists (selector)



drawable/

foo.xml

```
<selector>
    <item android:drawable="@drawable/foo_disabled"
          android:state_enabled="false" ... />
    <item android:drawable="@drawable/foo_pressed"
          android:state_pressed="true" ... />
    <item android:drawable="@drawable/foo_focused"
          android:state_focused="true" ... />
    <item android:drawable="@drawable/foo_default" />
</selector>
```

# State Lists (selector)



drawable-mdpi/



foo\_default.png



foo\_disabled.png



foo\_focused.png



foo\_pressed.png

drawable-hdpi/



foo\_default.png



foo\_disabled.png



foo\_focused.png

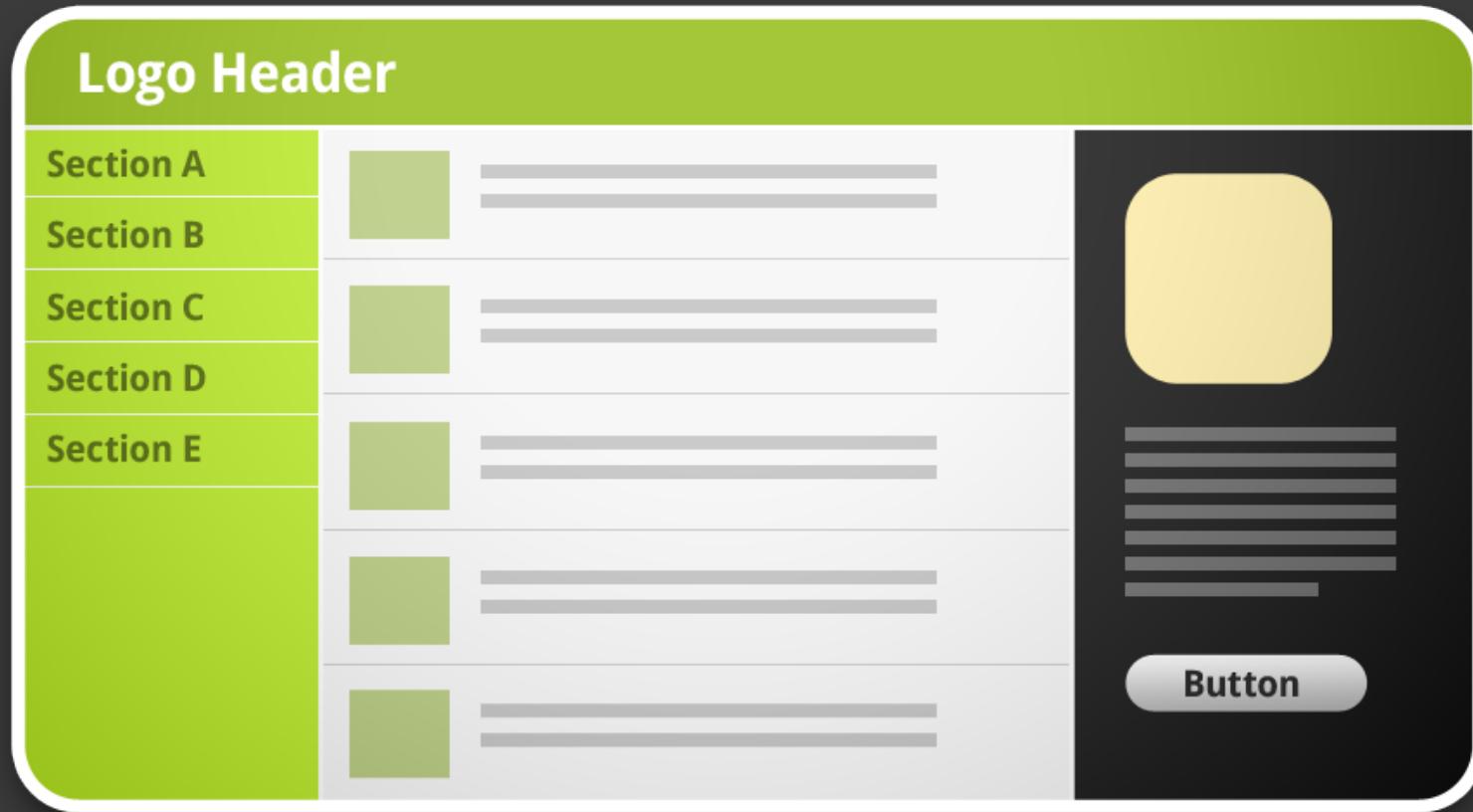


foo\_pressed.png



# Tablet considerations

# Information hierarchy and flow



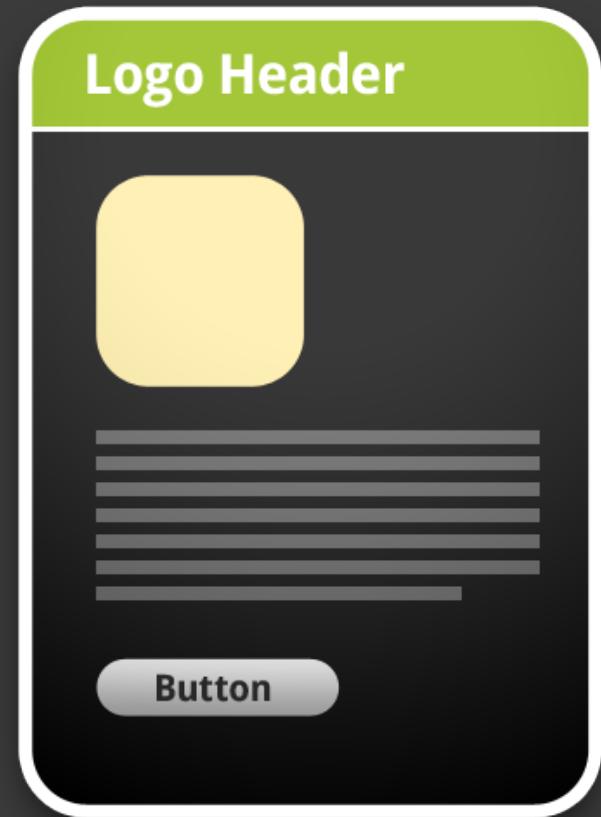
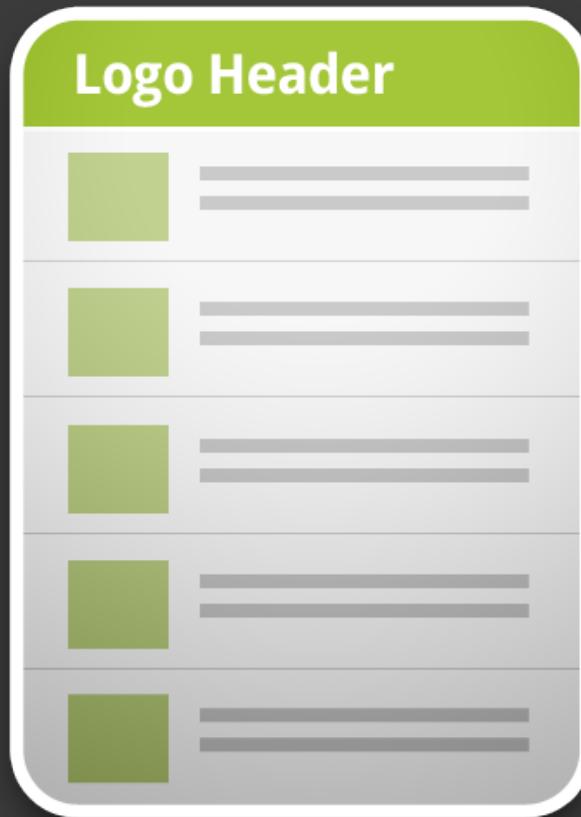
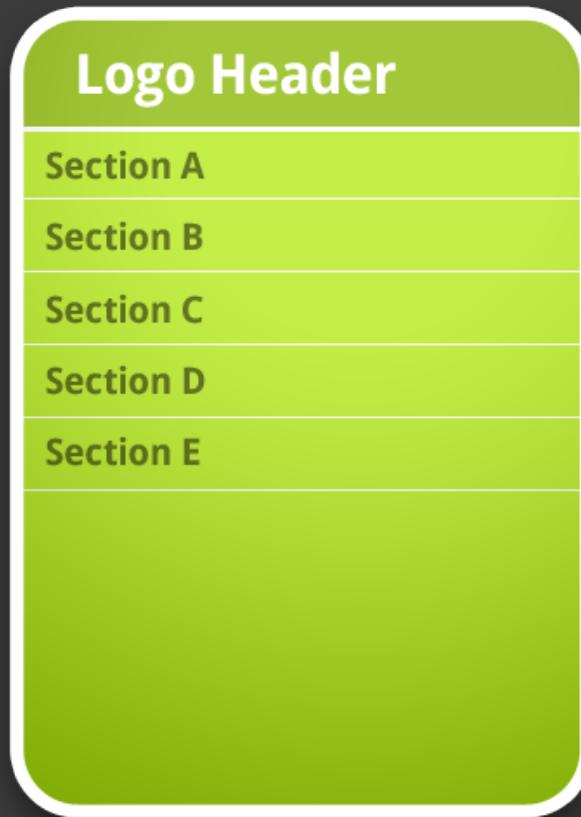
Traditional desktop app or website

# Information hierarchy and flow



Tablet or mini desktop app

# Information hierarchy and flow



**Mobile phone app**

# Fragments



- Separate activities into UI or code modules, each have their own class
- Help with supporting phones + tablets
  - Each content pane is a fragment
  - Fragments split across activities
- **<fragment>** in layout XML
  - Automatically instantiates the given fragment
  - Acts as a placeholder for the fragment's view to be inserted in that part of the layout tree

# Tablet resources

```
res/  
  layout-large/  
  values-large/  
    dimens.xml  
    styles.xml
```

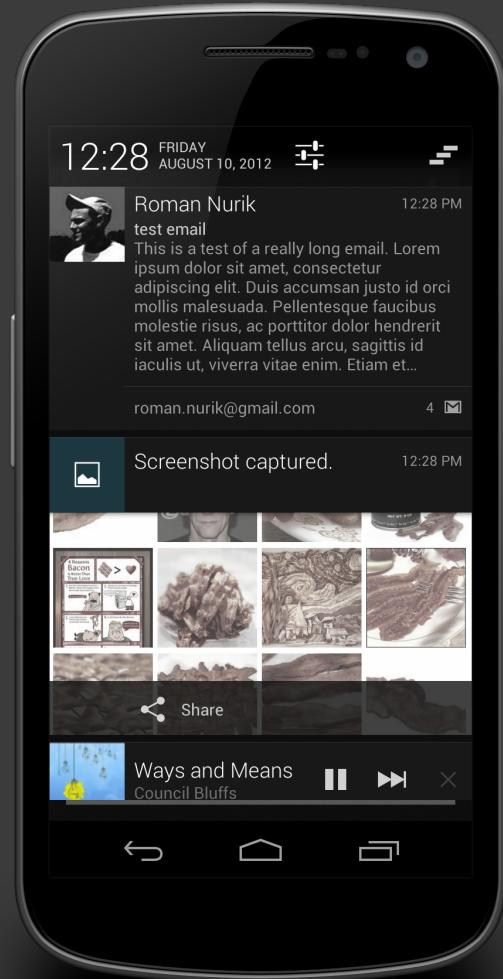
- Customize layouts for large screens
  - Includes <fragment> tags
- Incrementally increase font sizes, spacing, tweak styles



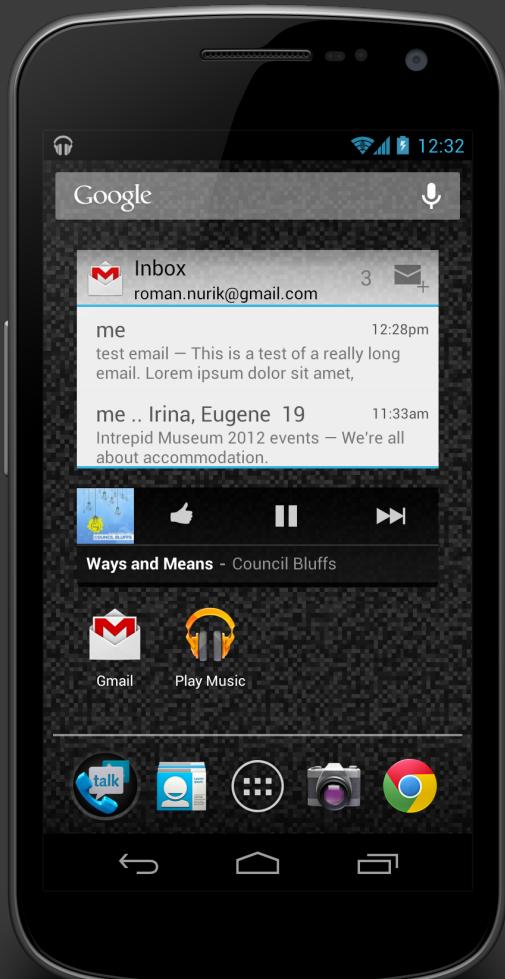


# System UI integration

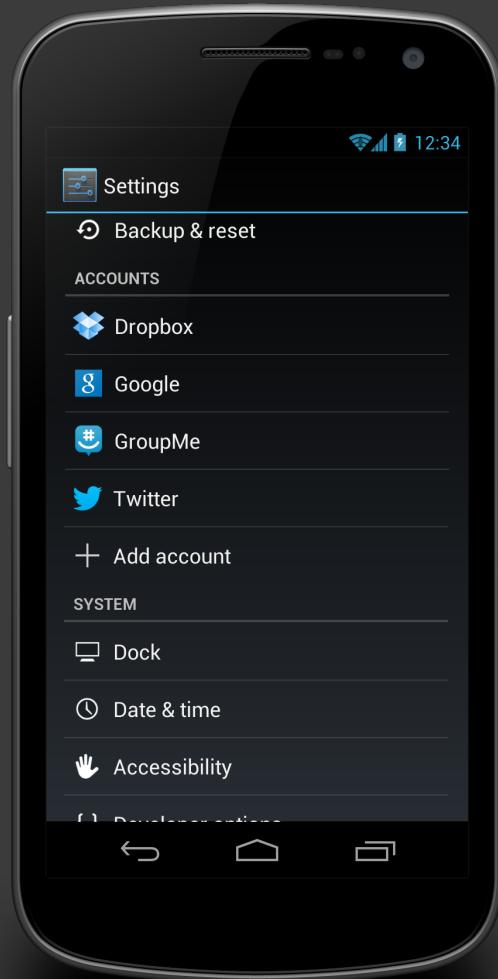
# System UI integration



Notifications

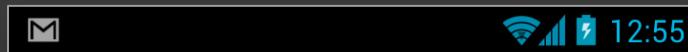
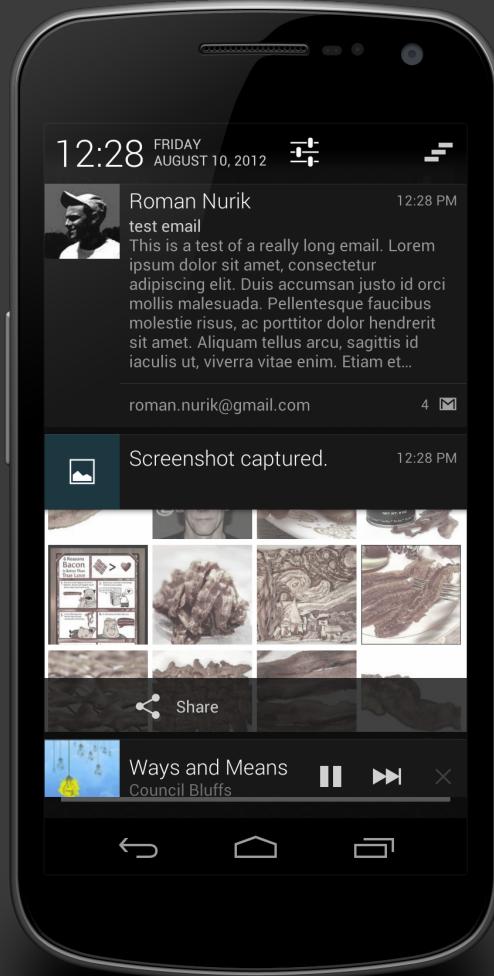


App Widgets

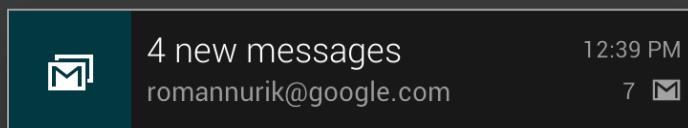


Accounts + Sync

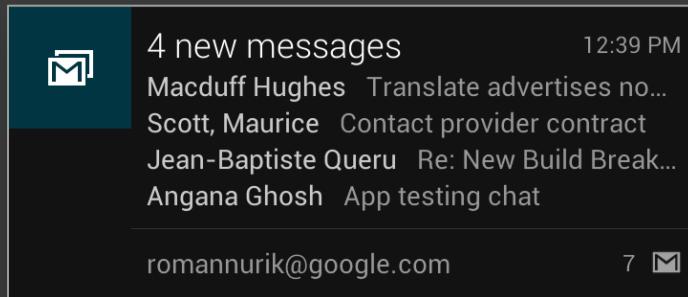
# Notifications



Iconified



Collapsed



Expanded  
Android 4.1+



# Notifications

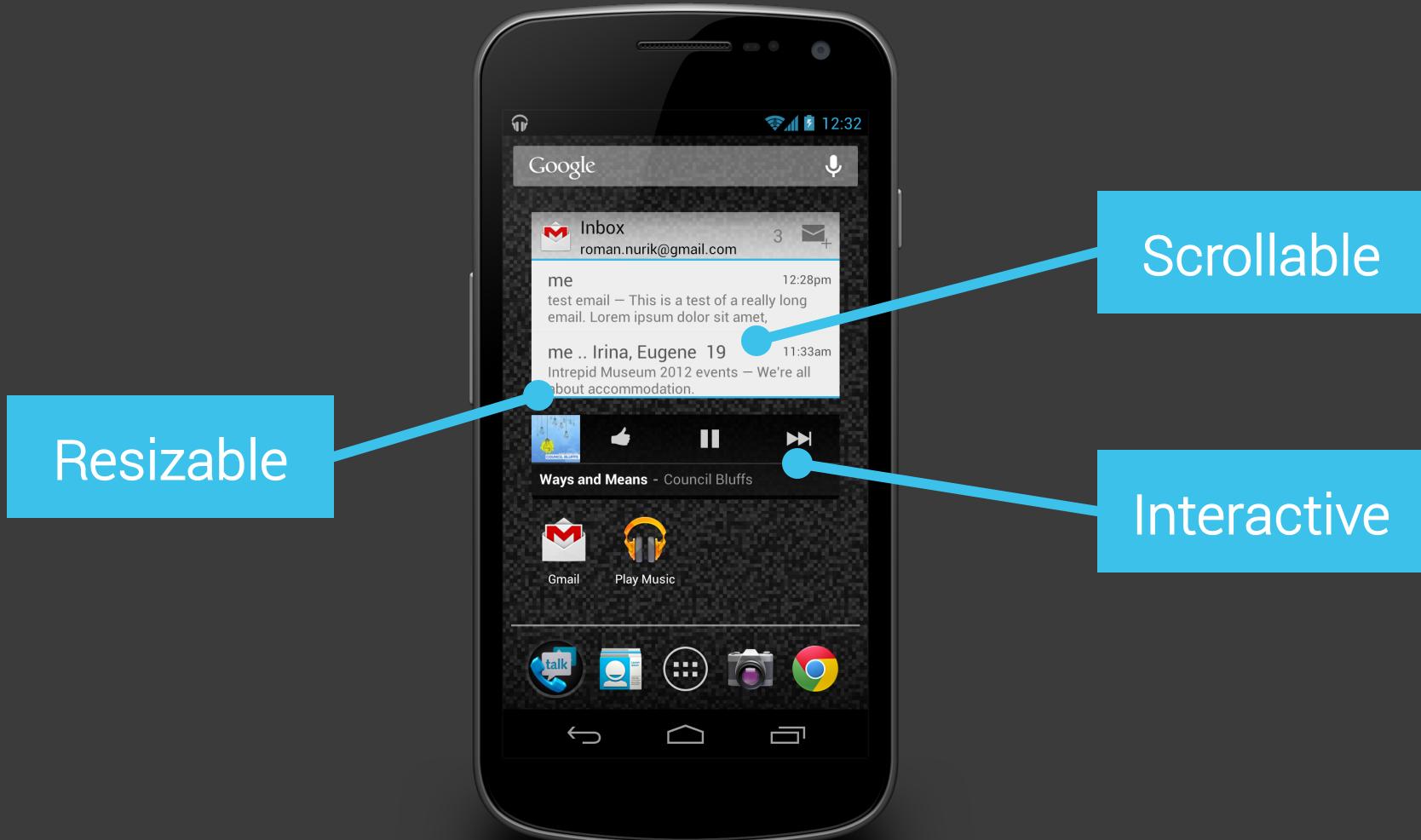


Interactive

# Notifications

- Created with `NotificationManager` and `Notification.Builder()`
- Custom layouts with `RemoteViews`
  - Your layouts, used in a different process
- Interaction is handled entirely using intents

# App widgets



# App widgets

- Defined in your manifest as a receiver
  - Handles the APPWIDGET\_UPDATE intent action
  - Metadata provided in `res/xml/widgetinfo.xml` and referenced in manifest
- Layout using `RemoteViews`
  - Your layouts, used in a different process
- Interaction is handled entirely using intents



# Wireframing

# Why create wireframes?



- Record your ideas and asses their real-world feasibility
- Test your ideas and **rapidly iterate**
  - See which work and which don't, evolve them
- Map out user flow and activity diagrams
  - Re-arrange/add/remove interactions quickly
  - Scope UI complexity
  - Plan out intra-app “Intent-based API”



Wireframing before  
coding saves you time.

# Wireframing tools



Time/Effort



Pen + Paper

OmniGraffle  
(Mac)

Keynote/  
Powerpoint

Balsamiq

Pencil  
(Firefox addon)

Wireframe  
Sketcher

Photoshop

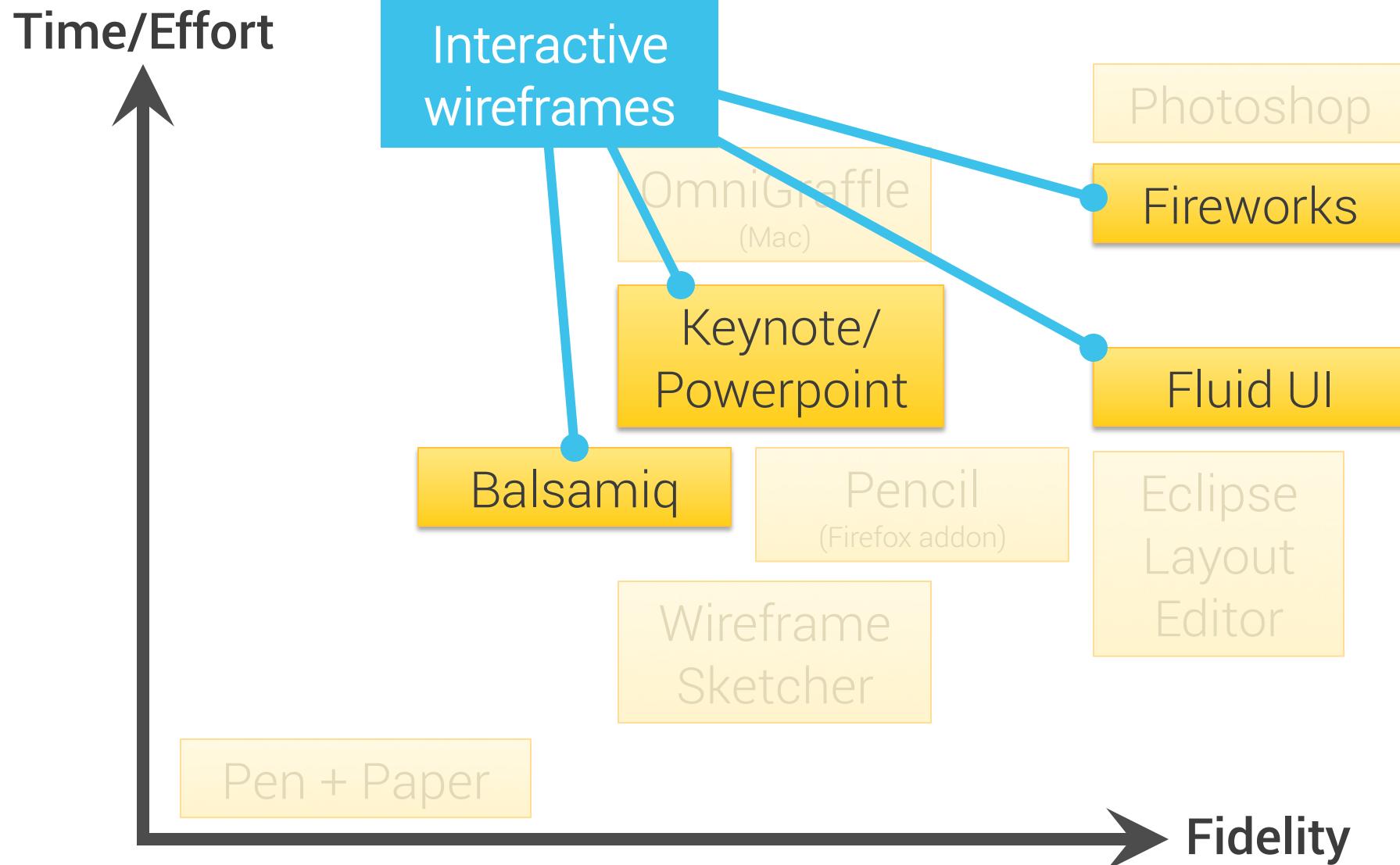
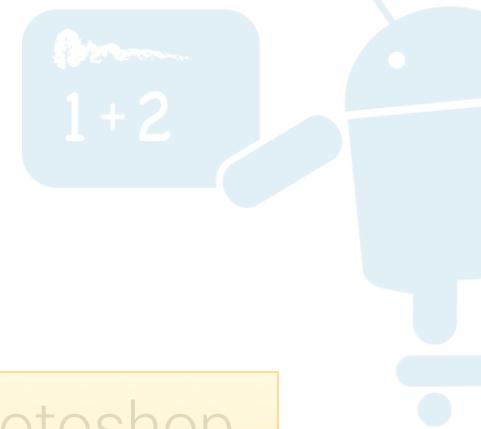
Fireworks

Fluid UI

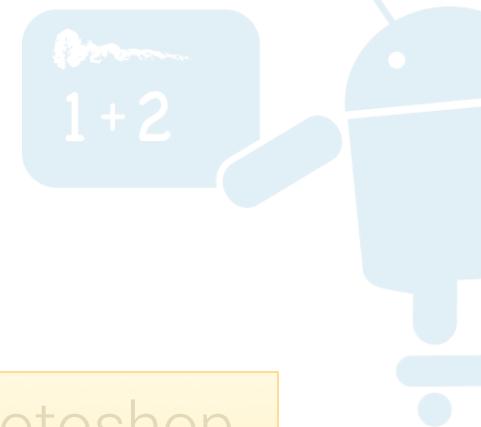
Eclipse  
Layout  
Editor

Fidelity

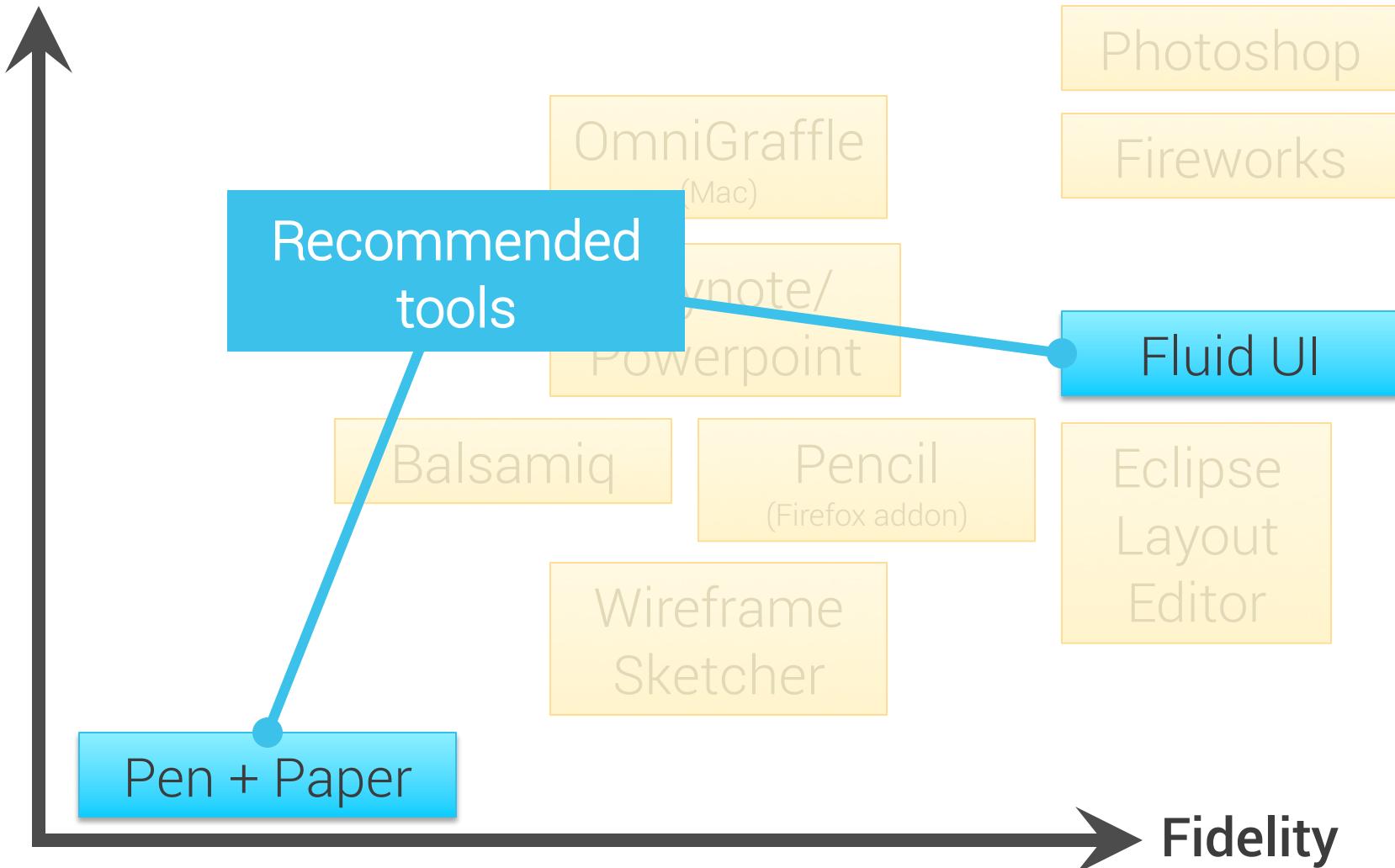
# Wireframing tools



# Wireframing tools



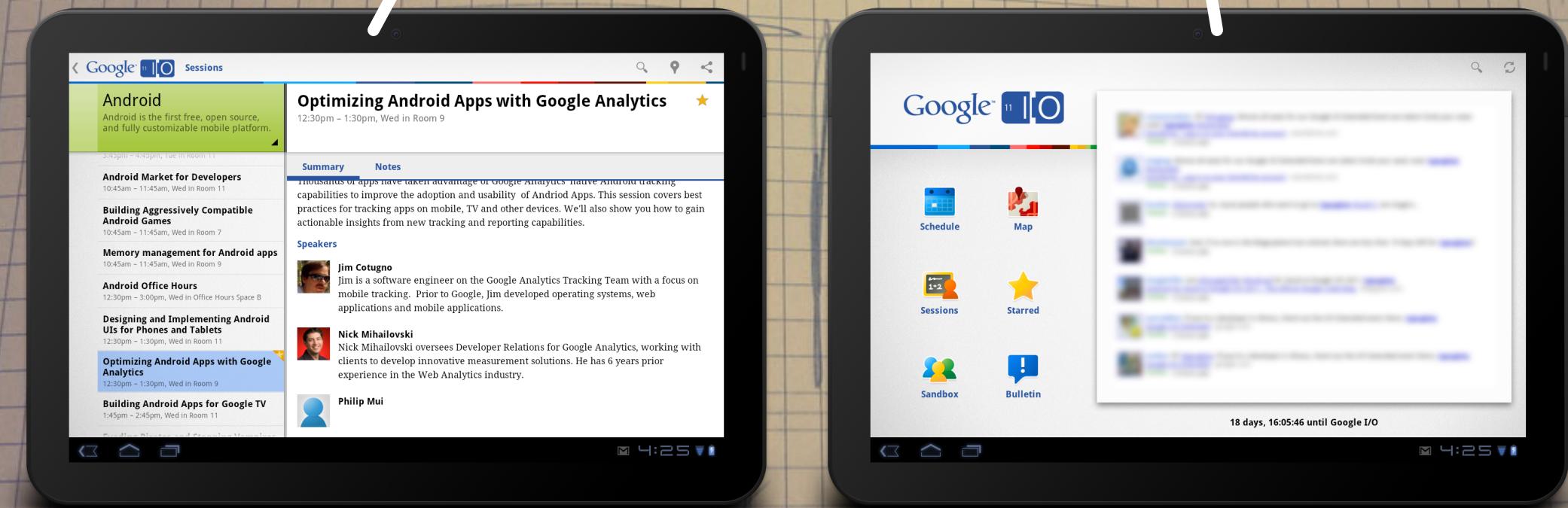
Time/Effort





**Always** start with  
pencil and paper.

(or a whiteboard)



< Google I/O Sessions

## Android

Android is the first free, open source, and fully customizable mobile platform.

5:05pm - 6:45pm, Tue in Room 11

### Android Market for Developers

10:45am - 11:45am, Wed in Room 11

### Building Aggressively Compatible Android Games

10:45am - 11:45am, Wed in Room 7

### Memory management for Android apps

10:45am - 11:45am, Wed in Room 9

### Android Office Hours

12:30pm - 3:00pm, Wed in Office Hours Space B

### Designing and Implementing Android UIs for Phones and Tablets

12:30pm - 1:30pm, Wed in Room 11

### Optimizing Android Apps with Google Analytics

12:30pm - 1:30pm, Wed in Room 9

### Building Android Apps for Google TV

1:45pm - 2:45pm, Wed in Room 11

## Optimizing Android Apps with Google Analytics

12:30pm - 1:30pm, Wed in Room 9

### Summary

### Notes

Thousands of apps have taken advantage of Google Analytics' native Android tracking capabilities to improve the adoption and usability of Android Apps. This session covers best practices for tracking apps on mobile, TV and other devices. We'll also show you how to gain actionable insights from new tracking and reporting capabilities.

### Speakers



**Jim Cotugno**

Jim is a software engineer on the Google Analytics Tracking Team with a focus on mobile tracking. Prior to Google, Jim developed operating systems, web applications and mobile applications.



**Nick Mihailovski**

Nick Mihailovski oversees Developer Relations for Google Analytics, working with clients to develop innovative measurement solutions. He has 6 years prior experience in the Web Analytics industry.



**Philip Mui**

Google I/O



Schedule



Map



Sessions



Starred



Sandbox



Bulletin

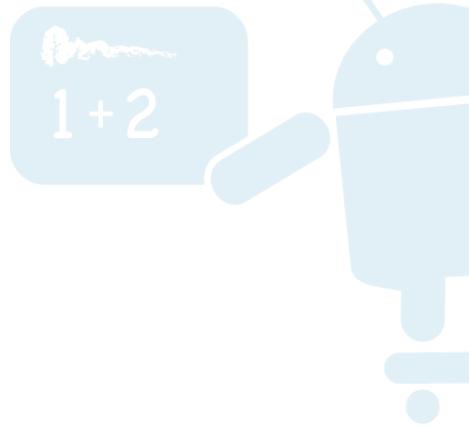
18 days, 16:05:46 until Google I/O

4:25

Sessions  
Multiplatform  
?

Sessions  
Multiplatform  
?

100%



EXERCISE

**Sketch a  
todo list app**