CS 528 Mobile and Ubiquitous Computing

Lecture 3a: Data-Driven Views and Android Components

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Announcements

- Projects 2-4, and final project will be done in groups
  - Form groups before next class (9/21),
  - Ideal group size is 3
  - All members email me!!
  - Student unable to form groups, I will put you in groups

Data-Driven Layouts

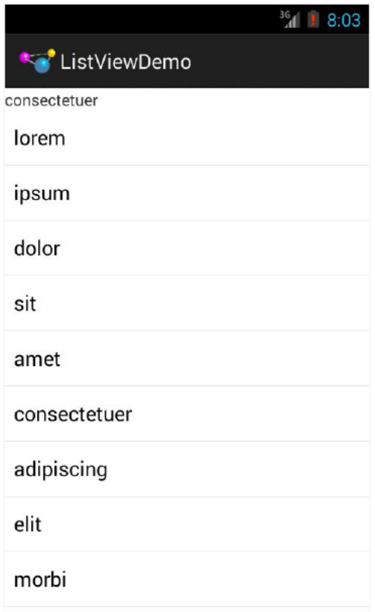
Data-Driven Layouts

- LinearLayout, RelativeLayout, TableLayout, GridLayout useful for positioning UI elements
  - UI data is hard coded

- Other layouts dynamically composed from data
  - ListView, GridView, GalleryView
  - Tabs with TabHost, TabControl

From Data source

lorem
ipsum
dolor
amet
consectetuer
adipiscing
elit
morbi

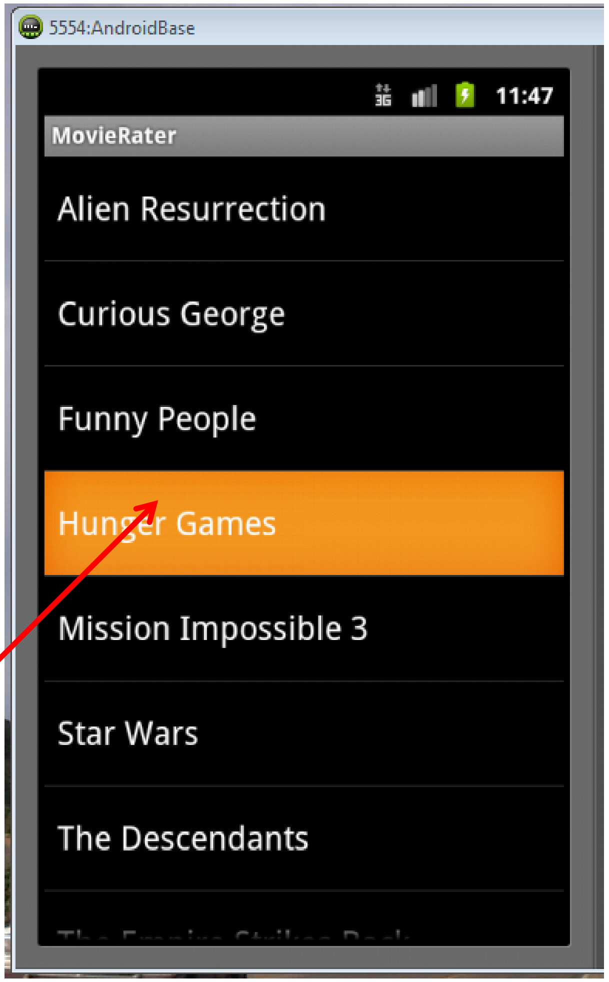

8:03
ListViewDemo
consectetuer
lorem
ipsum
dolor
sit
amet
consectetuer
adipiscing
elit
morbi

Data Driven Layouts

- May want to populate views from a data source (XML file or database)

- Layouts that display repetitive child Views from data source
    - ListView
    - GridView
    - GalleryView

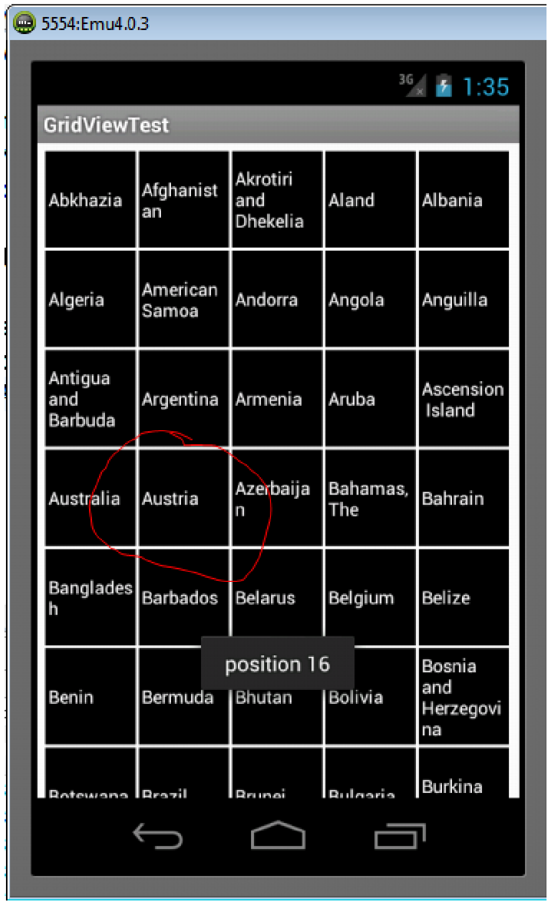
- ListView
    - vertical scroll, horizontal row entries, pick item



Alien Resurrection
Curious George
Funny People
Hunger Games
Mission Impossible 3
Star Wars
The Descendants

Data Driven Containers

- GridView
  - List with specified number of rows and columns
- GalleryView
  - List with horizontal scrolling, typically images



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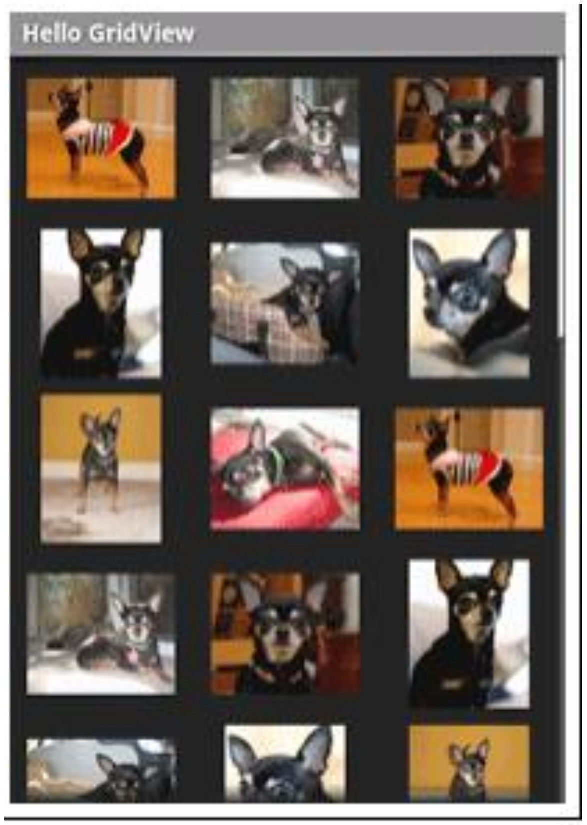
1:35

GridViewTest

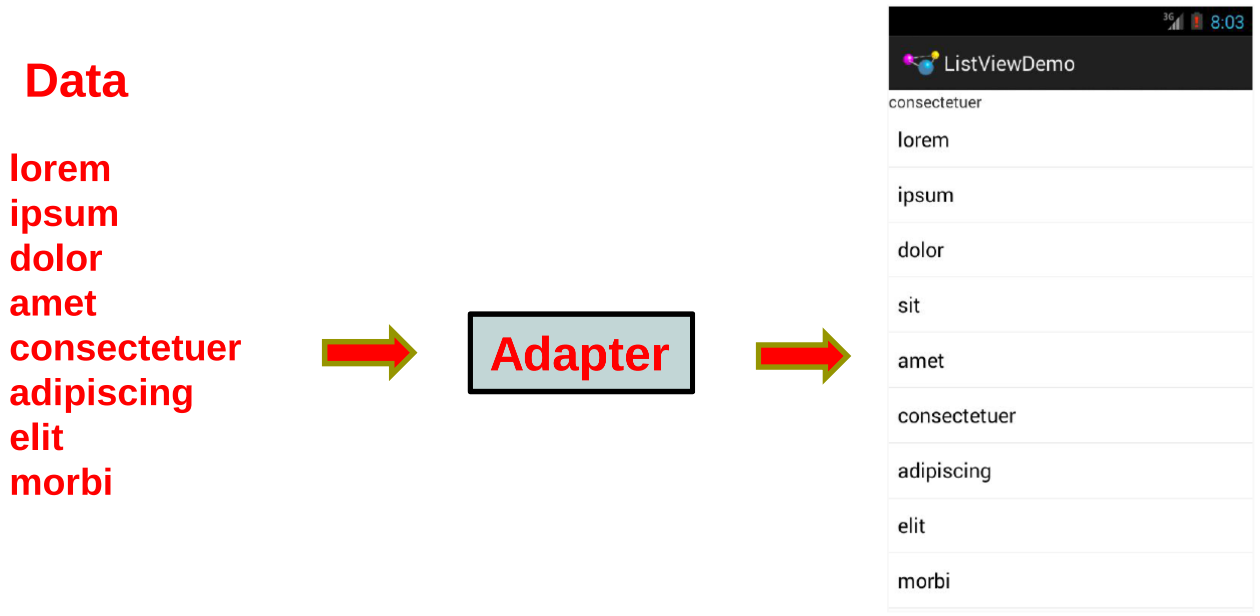
Abkhazia	Afghanistan	Akrotiri and Dhekelia	Aland	Albania
Algeria	American Samoa	Andorra	Angola	Anguilla
Antigua and Barbuda	Argentina	Armenia	Aruba	Ascension Island
Australia	Austria	Azerbaijan	Bahamas, The	Bahrain
Bangladesh	Barbados	Belarus	Belgium	Belize
Benin	Bermuda	Bhutan	Bolivia	Bosnia and Herzegovina
Botswana	Brazil	Brunei	Bulgaria	Burkina

position 16



AdapterView

- ListView, GridView, and GalleryView are sub classes of AdapterView (variants)
- **Adapter:** generates widgets from a data source, populates layout
  - E.g. Data is adapted into cells of GridView



- Most common Adapters
  - **CursorAdapter:** read from database
  - **ArrayAdapter:** read from resource (e.g. XML file)

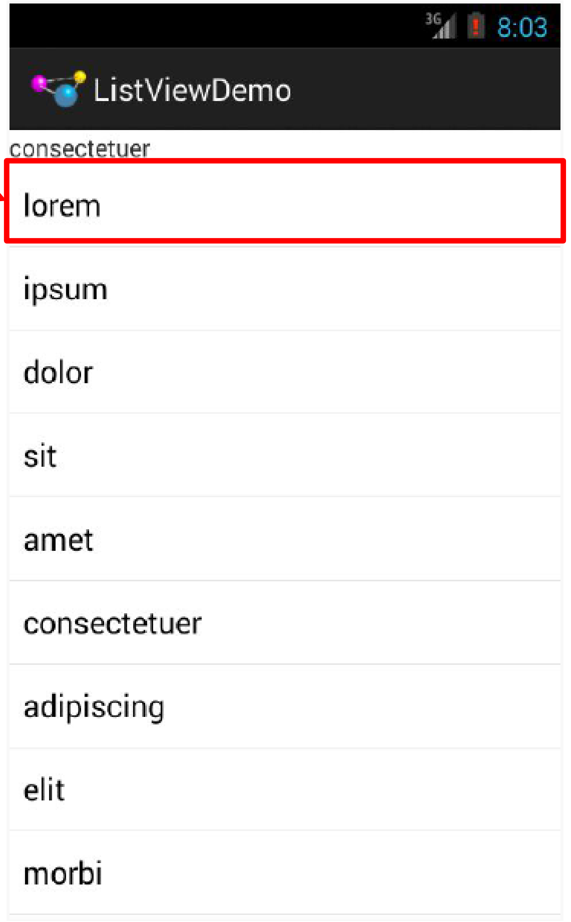
Adapters

- When using Adapter, a layout (XML format) is defined for each child element (View)

- The adapter
  - Reads in data (list of items)
  - Creates Views (widgets) using layout for each element in data source
  - Fills the containing layout (List, Grid, Gallery) with the created Views

- Child Views can be as simple as a TextView or more complex layouts / controls
  - simple views can be declared in a layout file

    (e.g. android.R.layout)

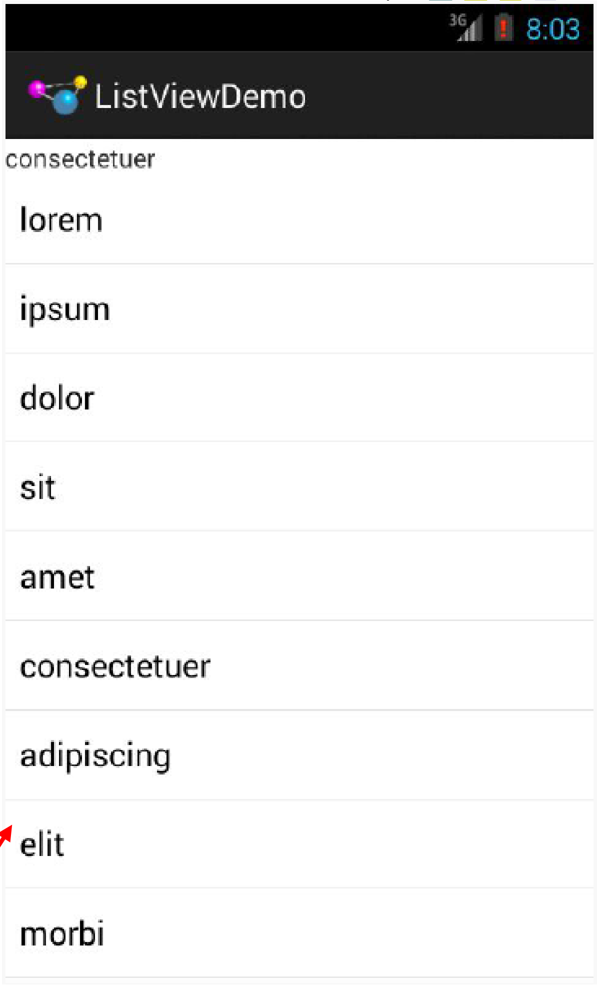


Example: Creating ListView using AdapterArray

- **Task:** Create listView (on right) from strings below

```
private static final String[] items={"lorem", "ipsum", "dolor",
        "sit", "amet",
        "consectetuer", "adipiscing", "elit", "morbi", "vel",
        "ligula", "vitae", "arcu", "aliquet", "mollis",
        "etiam", "vel", "erat", "placerat", "ante",
        "porttitor", "sodales", "pellentesque", "augue", "purus"};
```

Enumerated list



consectetuer

lorem

ipsum

dolor

sit

amet

consectetuer

adipiscing

elit

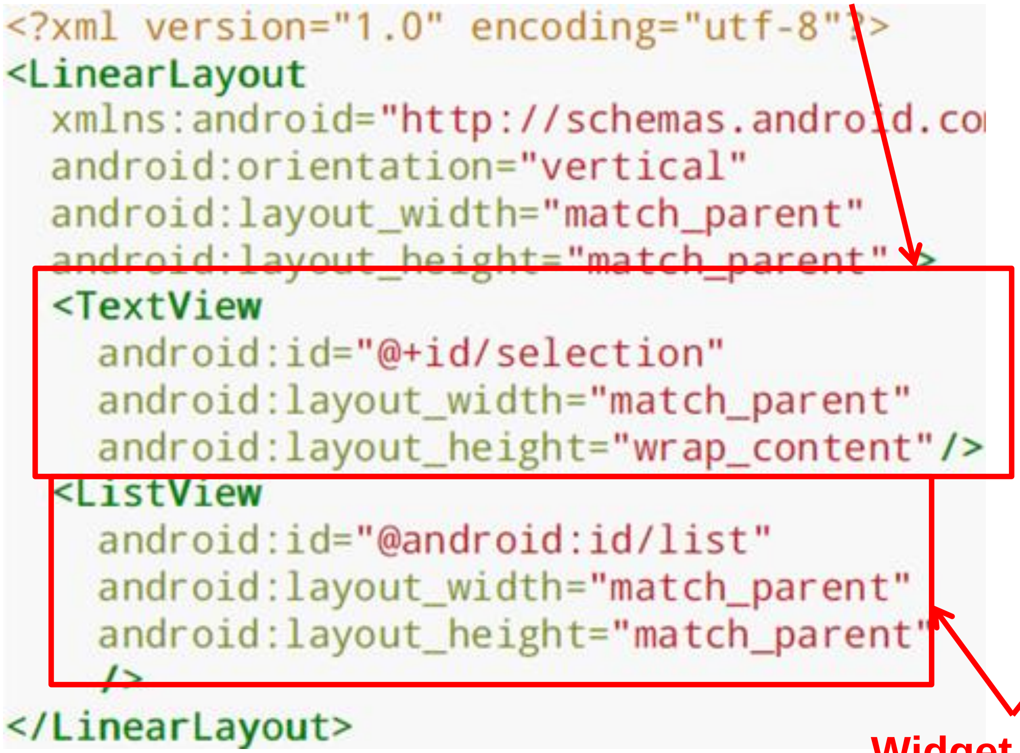
morbi

ListView of items

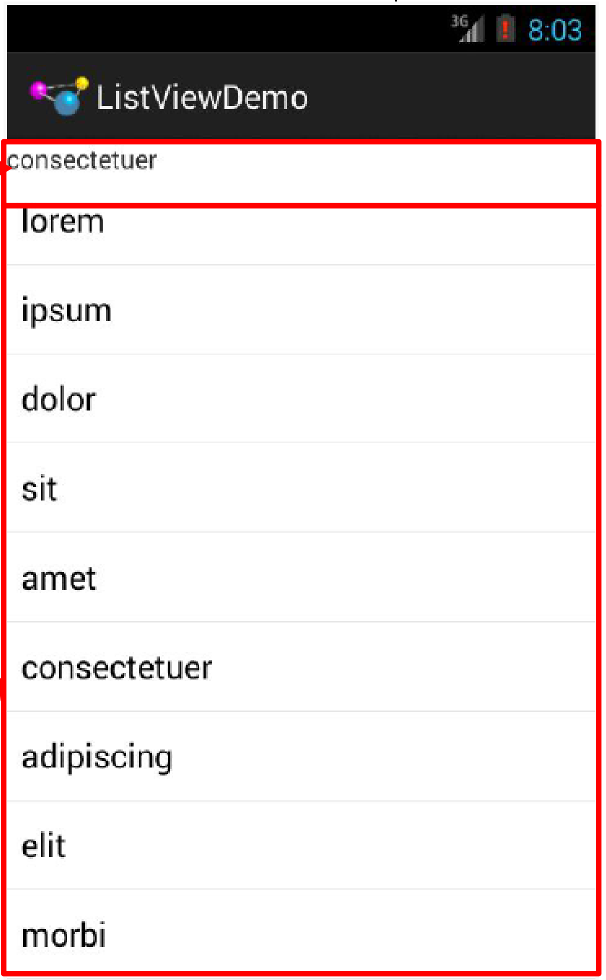
Example: Creating ListView using AdapterArray

- First create Layout file (e.g. LinearLayout)

TextView Widget for selected list item



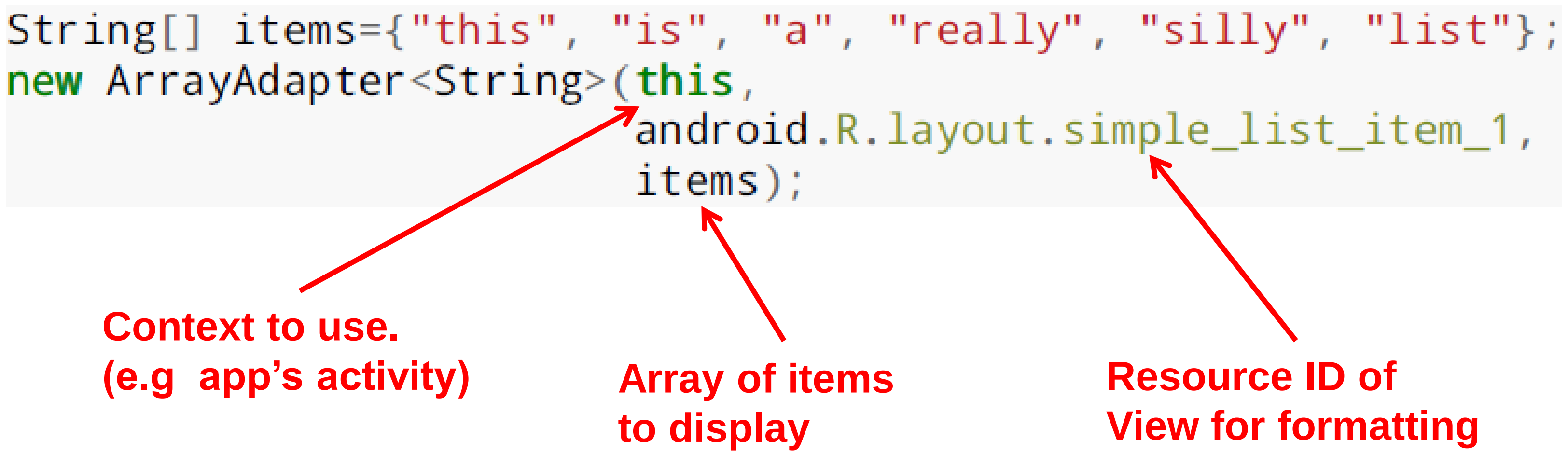
```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout
  xmlns:android="http://schemas.android.co
  android:orientation="vertical"
  android:layout_width="match_parent"
  android:layout_height="match_parent" >
  <TextView
    android:id="@+id/selection"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"/>
  <ListView
    android:id="@android:id/list"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    />
</LinearLayout>
```



Widget for list of options

Using ArrayAdapter

- Command used to wrap adapter around array of menu items or **java.util.List** instance



```
String[] items={"this", "is", "a", "really", "silly", "list"};
new ArrayAdapter<String>(this,
                         android.R.layout.simple_list_item_1,
                         items);
```

- E.g. **android.R.layout.simple_list_item_1** turns strings into textView objects (widgets)

Example: Creating ListView using AdapterArray

```java
package com.commonsware.android.list;

import android.app.ListActivity;
import android.os.Bundle;
import android.view.View;
import android.widget.ArrayAdapter;
import android.widget.ListView;
import android.widget.TextView;
public class ListViewDemo extends ListActivity {
  private TextView selection;
  private static final String[] items={"lorem", "ipsum", "dolor",
          "sit", "amet",
          "consectetuer", "adipiscing", "elit", "morbi", "vel",
          "ligula", "vitae", "arcu", "aliquet", "mollis",
          "etiam", "vel", "erat", "placerat", "ante",
          "porttitor", "sodales", "pellentesque", "augue", "purus"};

  @Override
  public void onCreate(Bundle icicle) {
    super.onCreate(icicle);
    setContentView(R.layout.main);
    setListAdapter(new ArrayAdapter<String>(this,
                        android.R.layout.simple_list_item_1,
                        items));
    selection=(TextView)findViewById(R.id.selection);
  }

  @Override
  public void onListItemClick(ListView parent, View v, int position,
                              long id) {
    selection.setText(items[position]);
  }
}
```

Set list adapter (Bridge Data source and views)

Get handle to TextView of Selected item

Change Text at top to that of selected view when user clicks on selection

Android App Components

Android App Components

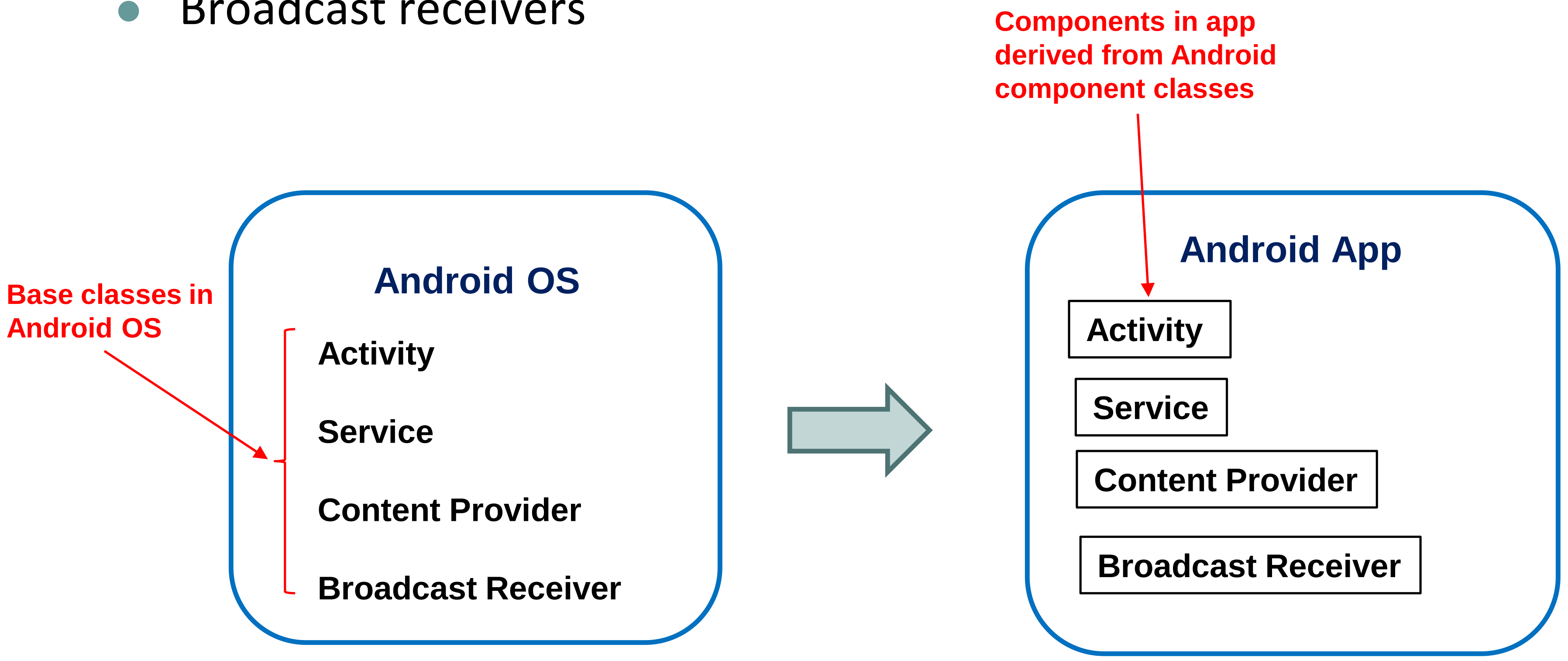
- Typical Java program starts from main( )

```
class SillyApp {
    public static void main(String[] args) {
        System.out.println("Hello World!");
    }
}
```

- Android app: No need to write a main
- Just define app components derived from base classes already defined in Android

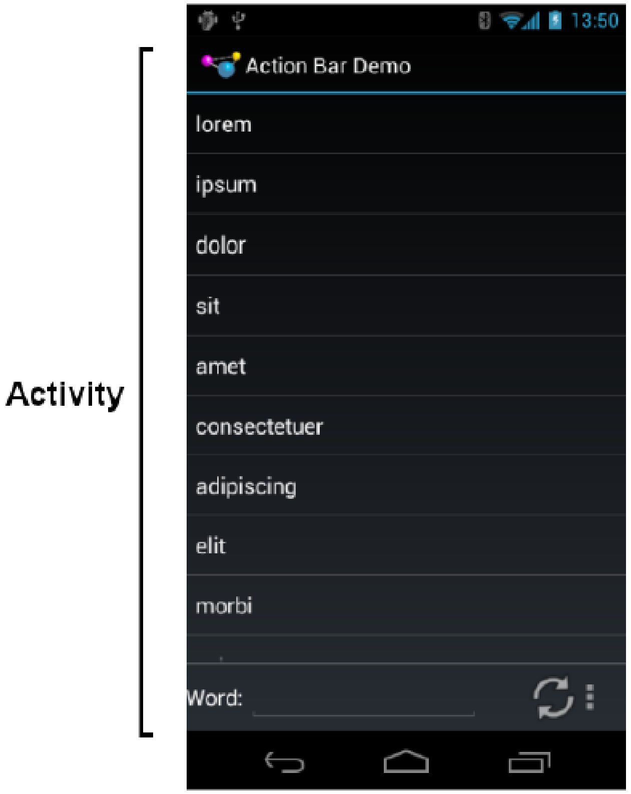
Android App Components

- 4 main types of Android app components:
  - Activities (already seen this)
  - Services
  - Content providers
  - Broadcast receivers



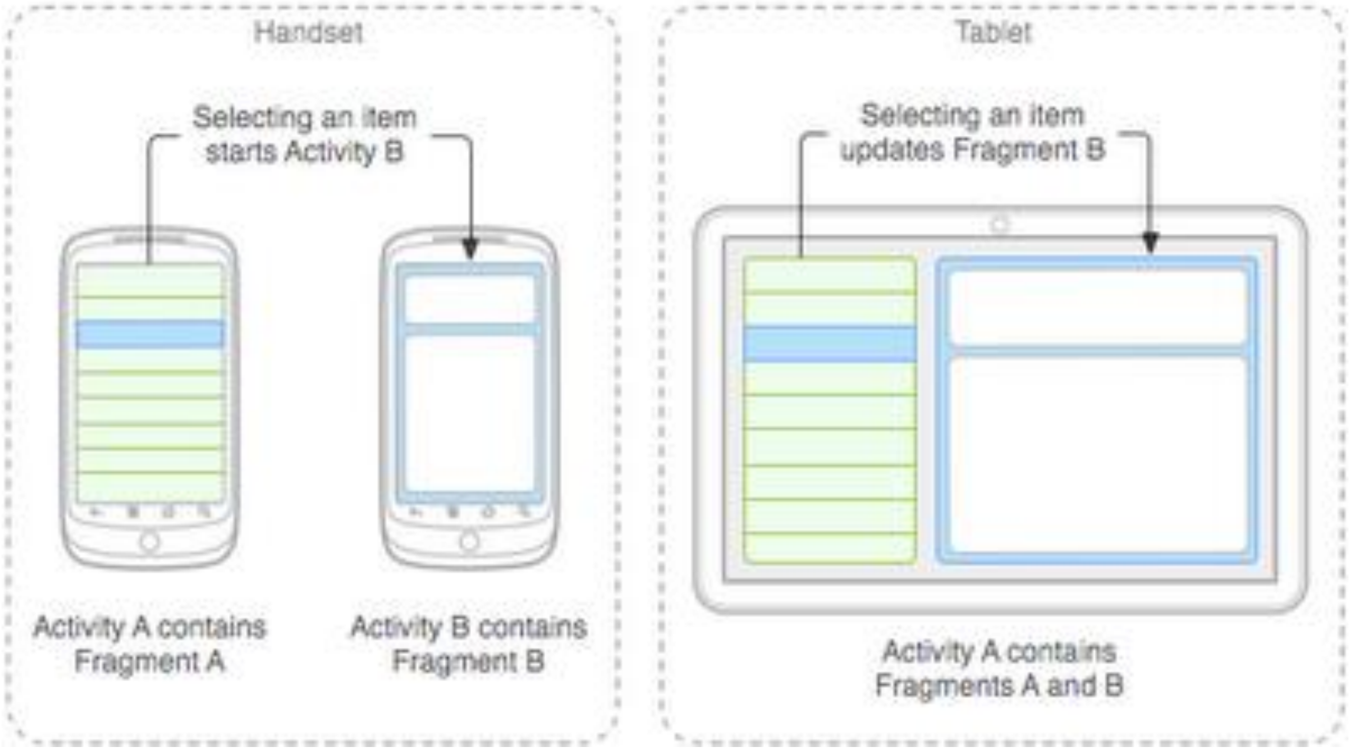
Recall: Activities

- Activity: main building block of Android UI
- Analogous to a window or dialog box in a desktop application
- Apps
  - have at least 1 activity that deals with UI
  - Entry point of app similar to **main( )** in C
  - typically have multiple activities
- Example: A camera app
  - **Activity 1:** to focus, take photo, start activity 2
  - **Activity 2:** to present photo for viewing, save it



Fragments

- Fragments
  - UI building blocks (pieces), can be attached to Activities in different ways.
  - Enables app to look different on different devices (e.g. phone vs tablet)
- An activity can contain multiple fragments that are organized differently for phone vs tablet
- More later


Handset
Selecting an item starts Activity B
Activity A contains Fragment A
Activity B contains Fragment B
Tablet
Selecting an item updates Fragment B
Activity A contains Fragments A and B

Services

- Activities are short-lived, can be shut down anytime (e.g when user presses back button)
- Services keep running in background
- Similar to Linux/Unix CRON job
- Example uses of services:
  - Periodically check device’s GPS location
  - Check for updates to RSS feed
- Minimal interaction with (independent of) any activity
- Typically an activity will control a service -- start it, pause it, get data from it
- App Services are sub-class of **Services** class

Android Platform Services

- Android Services can either be on:
  - Android Platform (local, on smartphone)
  - Google (remote, in Google server)

- Android platform services examples (on smartphone):
  - **LocationManager:** location-based services.
  - **ClipboardManager:** access to device’s clipboard, for cutting and pasting content.
  - **DownloadManager:** manages HTTP downloads in background
  - **FragmentManager:** manages the fragments of an activity.
  - **AudioManager:** provides access to audio and ringer controls.

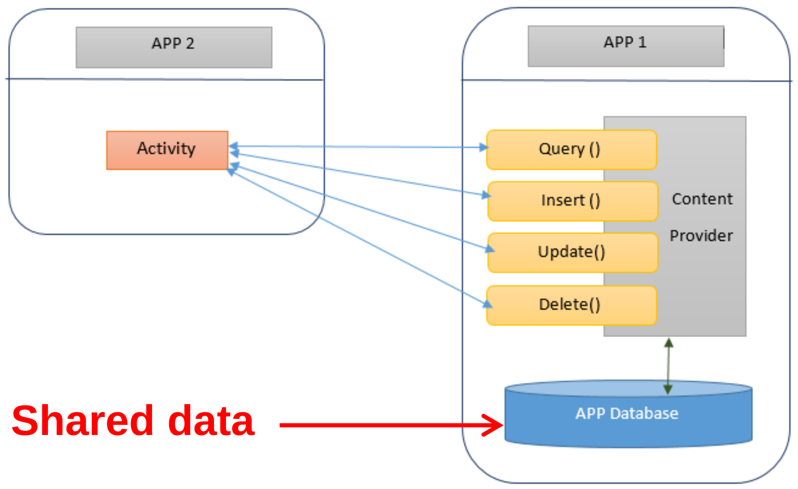
Google Services (In Google Cloud)

- Maps
- Location-based services
- Game Services
- Authorization APIs
- Google Plus
- Play Services
- In-app Billing
- Google Cloud Messaging
- Google Analytics
- Google AdMob ads

Typically need Internet connection

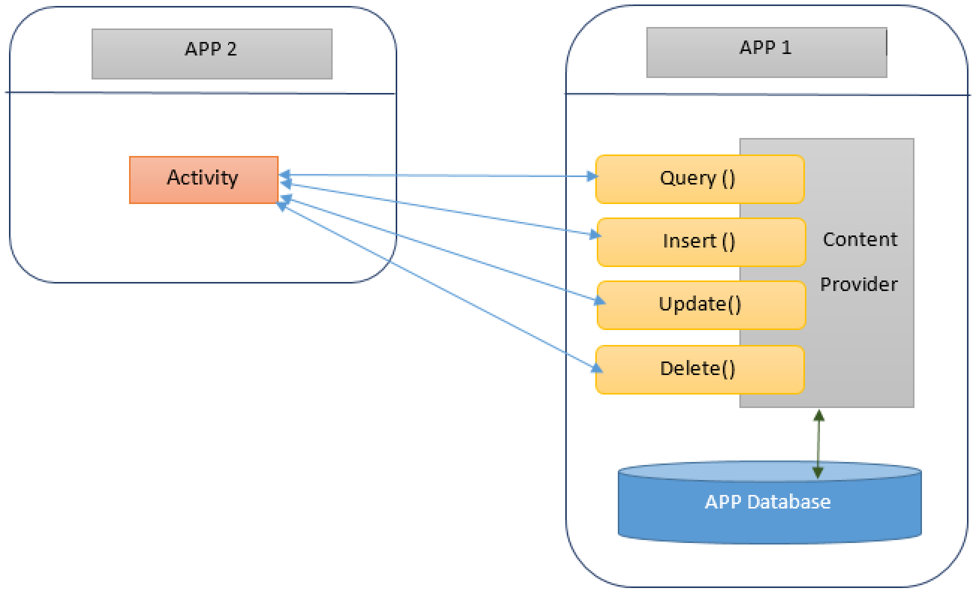
Content Providers

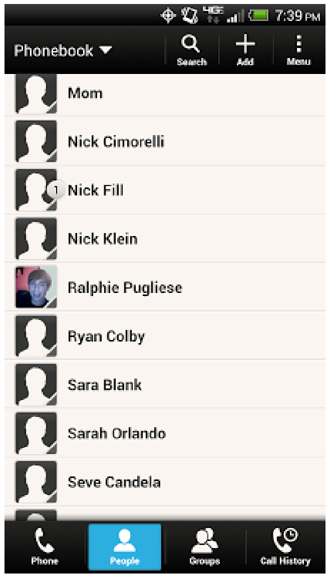
- Android apps can share data (e.g. User's contacts) as content provider
- Content Provider:
  - Abstracts shareable data, makes it accessible through methods
  - Applications can access that shared data by calling methods for the relevant **content provider**
  - E.g. Can query, insert, update, delete shared data (see below)



Content Providers

- **E.g.** Data stored in Android Contacts app can be accessed by other apps
- **Example:** We can write an app that:
  - Retrieve's contacts list from contacts content provider
  - Adds contacts to social networking (e.g. Facebook)
- Apps can also **ADD** to data through content provider. E.g. Add contact
- E.g. Our app can also share its data
- App Content Providers are sub-class of **ContentProvider** class

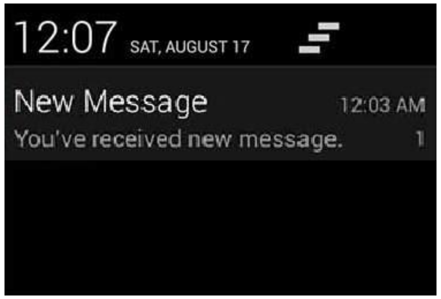




Mom
Nick Cimorelli
Nick Fill
Nick Klein
Ralphie Pugliese
Ryan Colby
Sara Blank
Sarah Orlando
Seve Candela

Broadcast Receivers

- The system, or applications, periodically *broadcasts* events
- Example broadcasts:
  - Battery getting low
  - Download completed
  - New email arrived
- Any app can create broadcast receiver to listen for broadcasts, respond
- Our app can also initiate broadcasts
- Broadcast receivers typically
  - Doesn't interact with the UI
  - Creates a status bar notification to alert the user when broadcast event occurs
- App Broadcast Receivers are sub-class of **BroadcastReceiver** class


12:07 SAT, AUGUST 17

New Message 12:03 AM

You've received new message. 1

Quiz

- Pedometer App
  - **Component A:** continously counts user's steps even when user closes app, does other things on phone (e.g. youtube, calls)
  - **Component B:** Displays user's step count
  - **Component C:** texts user's friends every day with their step totals

- What should component A be declared as (Activity, service, content provider, broadcast receiver)
- What of component B?
- Component C?

References

- Busy Coder's guide to Android version 4.4
- CS 65/165 slides, Dartmouth College, Spring 2014
- CS 371M slides, U of Texas Austin, Spring 2014