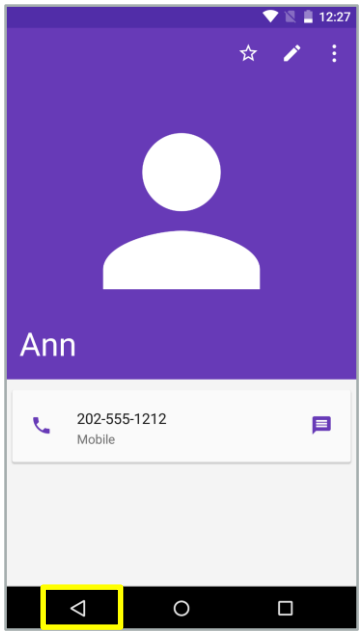
Navigation Patterns

Objectives

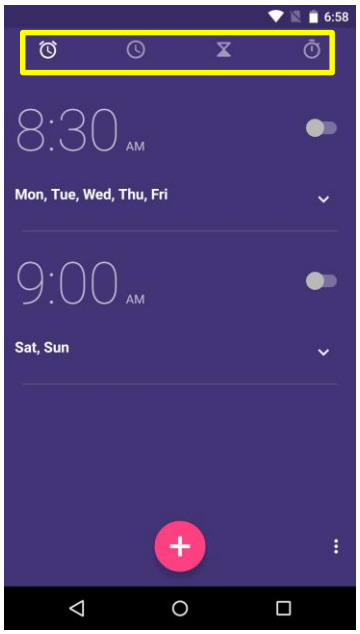
1. Implement Stack navigation
2. Introduce Fragments
3. Implement Tab navigation
4. Introduce `ActionBar`
5. Implement Drawer navigation

Navigation Patterns

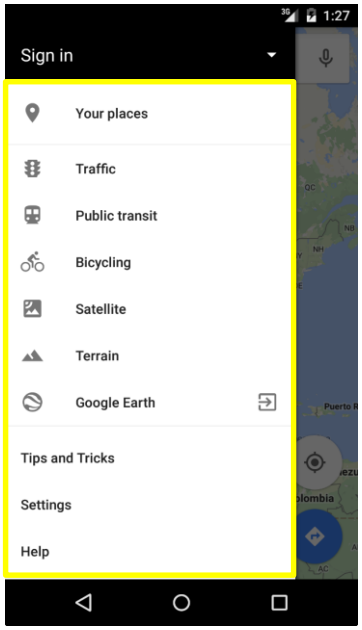
- Android apps use several common navigation patterns



Stack



Tab



Drawer

Implement Stack Navigation

Tasks

1. Implement Forward navigation
2. Use the back-button for Back navigation

Forward Navigation [definition]

- *Forward navigation* is the process of moving from one activity to another

Forward Navigation [implementation]

- Use an Intent to navigate forward

```
var intent = new Intent(this, typeof(SessionActivity));

intent.PutExtra("Title", title);

StartActivity(intent);
```

Launches the new Activity and adds the previous one to the back stack

What is the back-stack?

❖ The *back-stack* is a historical record of the user's live Activities

Back Navigation

- *Back navigation* moves through the screens in the back-stack
  - Screen progression tracked by default, so no additional work to implement

All Android devices provide either hardware or software back button

Individual Exercise

Stack Navigation

Summary

1. Implement Forward navigation
2. Use the back-button for Back navigation

Introduce Fragments

Tasks

1. Add a `Fragment` to a `FrameLayout` dynamically

Motivation

❖ Activities are too large to be the core building blocks of a dynamic UI

Want to keep this part the same…

…while swapping new content and behavior in here

What is `FrameLayout`? [concept]

- A `FrameLayout` is a container that is intended to hold a single child, it is common to set the child from code

Use a `FrameLayout` here and replace its child-view dynamically

What is **FrameLayout**? [code]

❖ **FrameLayout** methods let you update its child view

No children In AXML →

```
<FrameLayout android:id ="@+id/myFrame" ... />
```

```
void ShowInFrame(string message)
{
  var frame = FindViewById<FrameLayout>(Resource.Id.myFrame);

  if (frame.ChildCount > 0)
    frame.RemoveViewAt(0);

  var tv = new TextView(this) { Text = message };
  frame.AddView(tv);
}
```

Remove old child →

Add new child →

What is a Fragment?

- A *Fragment* is a unit of UI + behavior intended for use with dynamic UI

MyFragment.axml

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout ... >
  ...
</LinearLayout>
```

UI

MyFragment.cs

```
public class MyFragment : Fragment
{
  ...
}
```

Behavior

Fragments and Activities

- Fragments are hosted inside Activities, the **`Activity`** class has built-in support for this

```
public class Activity : ...
{ ...
  public virtual FragmentManager FragmentManager { get; }
}
```

Helps you dynamically add/remove fragments from your Activity's UI

Fragment transactions

- Android requires that dynamic changes to an Activity's fragments be done inside a transaction

```
public abstract class FragmentManager
{ ...
  public abstract FragmentTransaction BeginTransaction();
}
```

Update your UI's fragments →

```
public abstract class FragmentTransaction
{ ...
  public abstract FragmentTransaction Remove (Fragment fragment);
  public abstract FragmentTransaction Add    (int containerViewId, Fragment fragment);
  public abstract FragmentTransaction Replace(int containerViewId, Fragment fragment);

  public abstract int Commit();
}
```

The Id of the **`FrameLayout`** that will hold your fragment

How to replace a fragment

- `FragmentTransaction` handles the details of loading a new fragment into your UI

```
public class MainActivity : Activity
{ ...
  void ShowFragment()
  {
    var fragment = new MyFragment();

    var transaction = base.FragmentManager.BeginTransaction();
    transaction.Replace(Resource.Id.myFrame, fragment);
    transaction.Commit();
  }
}
```

Add to UI

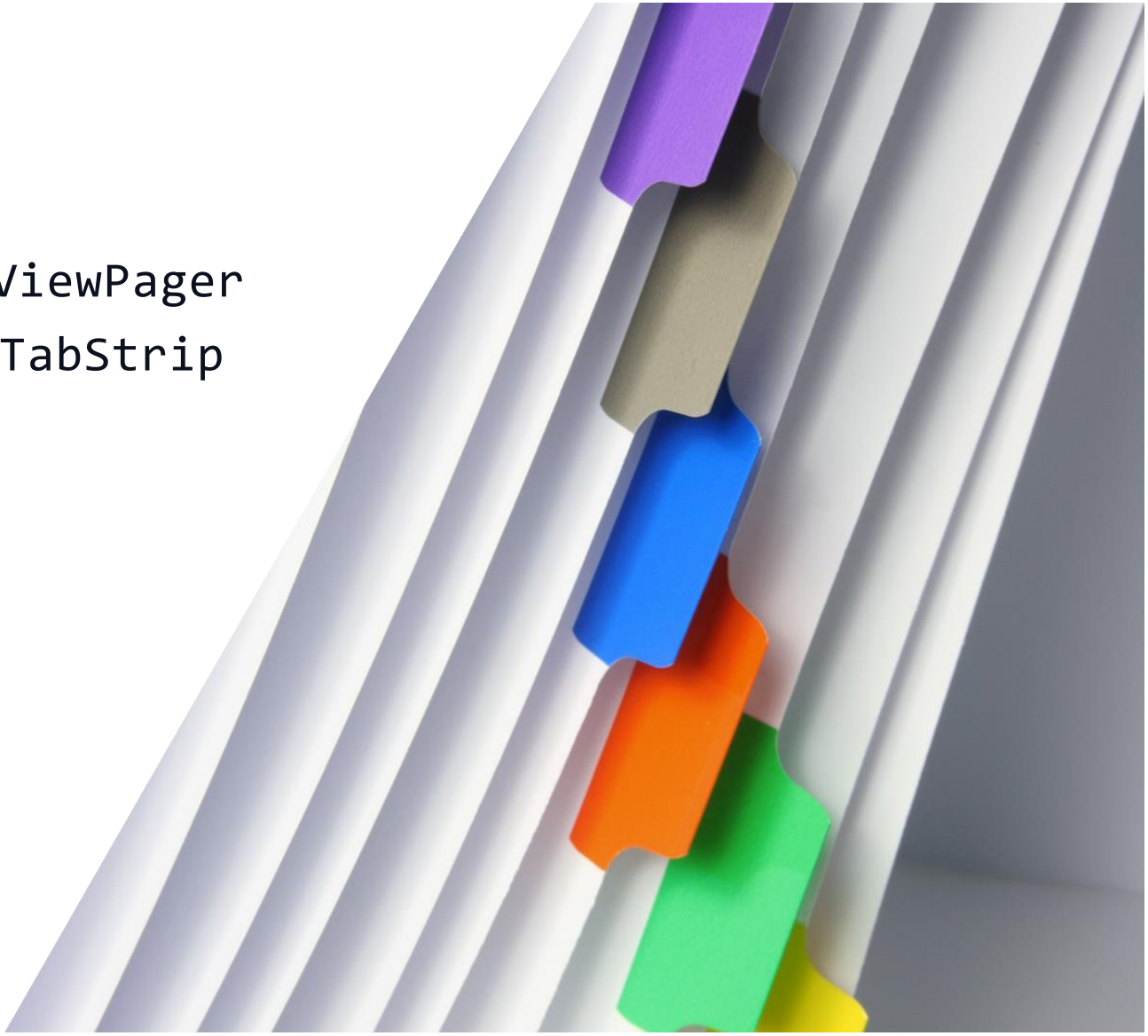
Summary

1. Add a `Fragment` to a `FrameLayout` dynamically

Implement Tab Navigation

Tasks

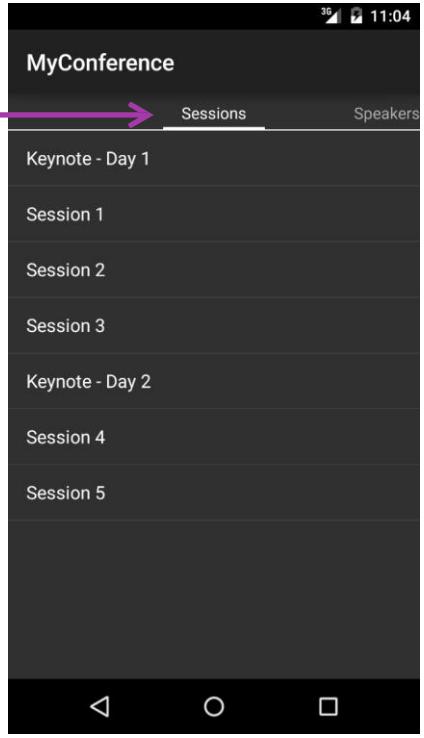
1. Display Fragments in a `ViewPager`
2. Show tabs using `PagerTabStrip`



Motivation

- Tabs let the user see their options and switch between functions quickly

Navigation tabs



Support Library

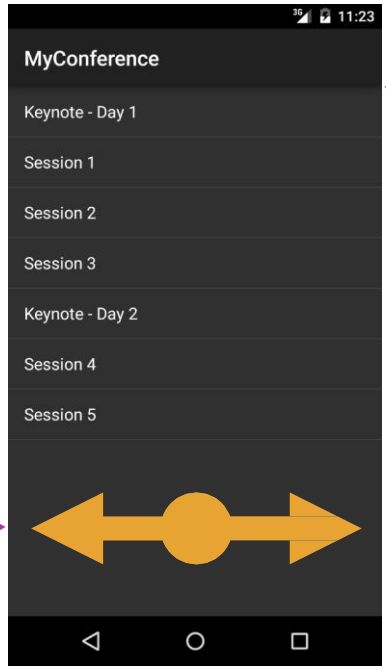
- The classes that implement Tab Navigation are in the v4 Support Library

Android Support Library v4 (21.0.3.0) Details Remove

Provide backward-compatible versions of Android framework APIs.

What is `ViewPager`?

- `ViewPager` is a layout manager that lets the user step forward and back through a sequences of pages



Does not have built-in tabs

Swipe gesture used to change pages

The Android docs say `ViewPager` is new so you should expect changes to the API.

How to use `ViewPager`

- Add a `ViewPager` to your layout file

`ViewPager` is a often the root node in your XML

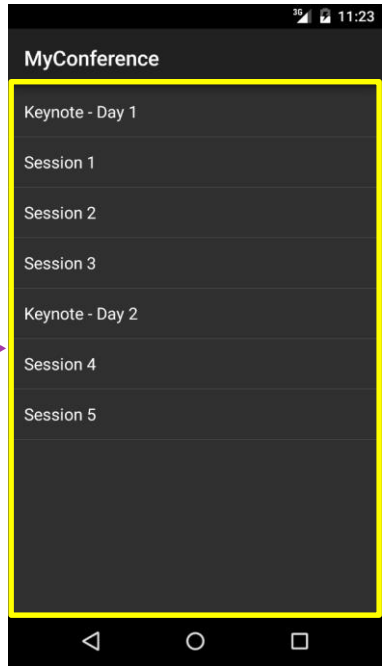
Pages are loaded via code-behind, not hardcoded in XML

```
<?xml version="1.0" encoding="utf-8"?>
<android.support.v4.view.ViewPager
  xmlns:android="http://schemas.android.com/apk/res/android"
  android:id="@+id/viewPager"
  android:layout_width="match_parent"
  android:layout_height="match_parent">

</android.support.v4.view.ViewPager>
```

What are pages?

- The pages displayed by **`ViewPager`** are typically either Fragments or Views (we will use Fragments as they are more powerful and more common)

Typically a Fragment



Fragment transactions

- **`ViewPager`** performs the fragment transactions for you, but you need to supply it with a **`FragmentManager`**

```
var fragment = new MyFragment();

var transaction = base.FragmentManager.BeginTransaction();
transaction.Replace(Resource.Id.myFrame, fragment);
transaction.Commit();
```

`ViewPager` manages the Fragments for you, you do not need to write this code

Fragment base type

- Fragments displayed by **`ViewPager`** must use the support-library **`Fragment`** class as their base

```
public class MyFragment : Android.Support.V4.App.Fragment
{
  ...
}
```

Required because **`ViewPager`** uses the support version of **`FragmentManager`** for its fragment transactions

Activity base type

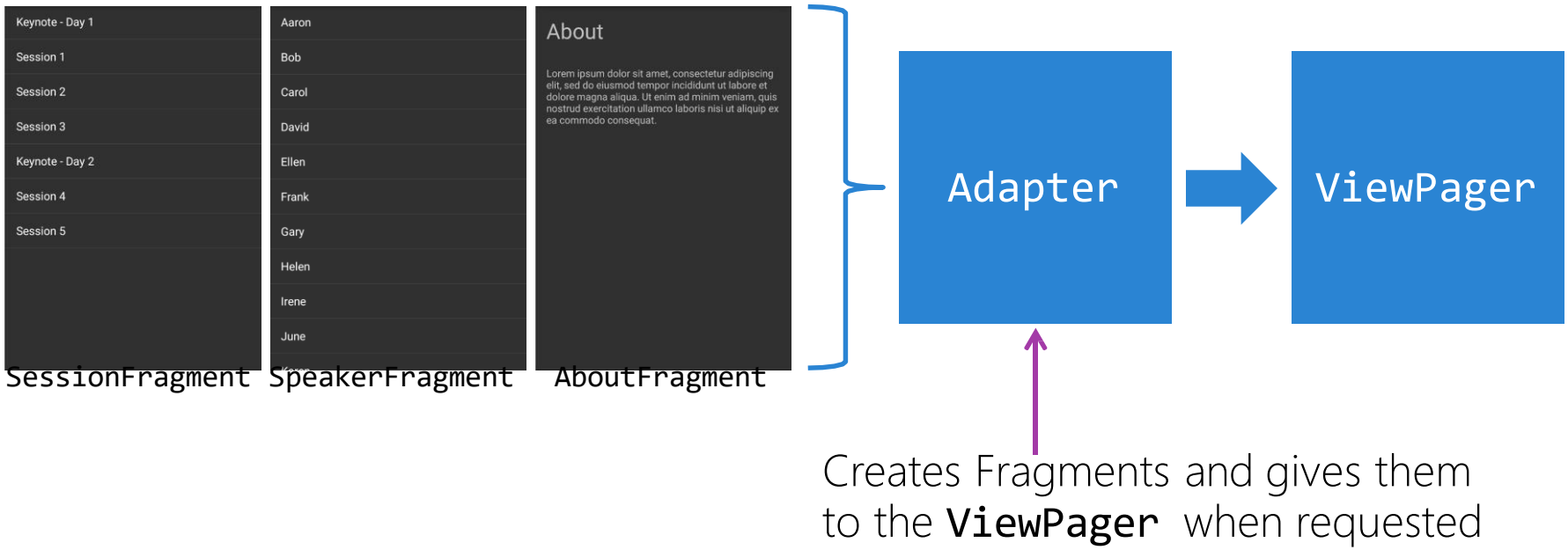
- Activities that host a **`ViewPager`** use the support-library **`FragmentActivity`** class as their base

```
public class MainActivity : Android.Support.V4.App.FragmentActivity
{
  ...
}
```

You inherit a **`SupportFragmentManager`** property that gives you the support version of the **`FragmentManager`** which **`ViewPager`** needs

What is an adapter?

- Your adapter provides your pages to the **`ViewPager`**



Adapter base class

- You code an adapter that inherits from **`FragmentPagerAdapter`**

`Android.Support.V4.App.PagerAdapter`

`Android.Support.V4.App.FragmentPagerAdapter`

`MyAdapter`

Derive from **`FragmentStatePagerAdapter`** when you have many pages.
It conserves memory by destroying Fragments that are not visible to the user.

Adapter `FragmentManager`

- You must pass a support `FragmentManager` to your adapter's base

```
public abstract class FragmentPagerAdapter : Android.Support.V4.View.PagerAdapter
{ ...
  public FragmentPagerAdapter(Android.Support.V4.App.FragmentManager fm)
  {
    ...
  }
}
```

Your adapter's constructor needs to chain to its base constructor and pass the manager

Adapter implementation

- Your adapter provides the Fragments to the **`ViewPager`**

```
public class MyAdapter : Android.Support.V4.App.FragmentPagerAdapter
{
  Android.Support.V4.App.Fragment[] fragments;

  public MyAdapter(Android.Support.V4.App.FragmentManager fm, Android.Support.V4.App.Fragment[] fragments)
    : base(fm)
  {
    this.fragments = fragments;
  }

  public override int Count
  {
    get { return fragments.Length; }
  }

  public override Android.Support.V4.App.Fragment GetItem(int position)
  {
    return fragments[position];
  }
}
```

Number of Fragments

Fragment at the given position

Using an adapter

- Your instantiate an adapter and load it into your **`ViewPager`**

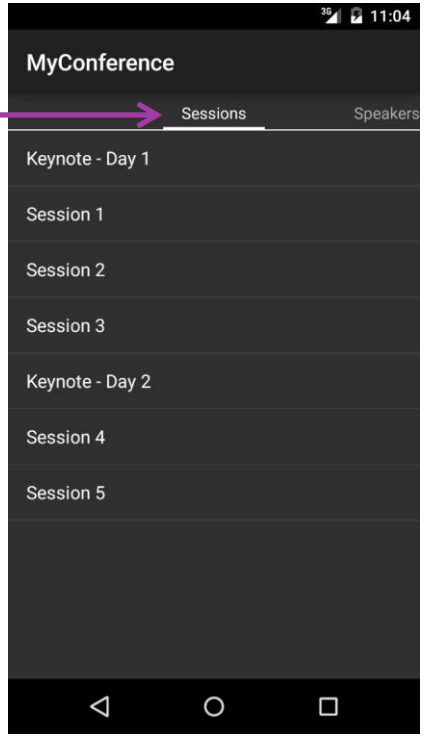
```
protected override void OnCreate(Bundle bundle)
{
  var fragments = new Android.Support.V4.App.Fragment[]
    {
      new SessionFragment(),
      new SpeakerFragment(),
      new AboutFragment  ()
    };

  var viewPager = FindViewById<Android.Support.V4.View.ViewPager>(Resource.Id.viewPager);

  viewPager.Adapter = new MyAdapter(base.SupportFragmentManager, fragments);
}
```

2. Assign 1. Create

What is `PagerTabStrip`?

- `PagerTabStrip` displays tabs inside a `ViewPager`

Current tab is highlighted and centered to give context



User can tap to navigate or swipe to scroll the tabs

How to use `PagerTabStrip`

- `PagerTabStrip` is intended for use with `ViewPager`, you just declare one as a child of your `ViewPager`

`ViewPager` will automatically find this since it is a child

```
<android.support.v4.view.ViewPager ... >

  <android.support.v4.view.PagerTabStri
    p
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:layout_gravity="top" />
</android.support.v4.view.ViewPager>
```

You choose tab position

Adapter tab titles

- You override a method in your adapter to provide the tab titles

```
public class MyAdapter : Android.Support.V4.App.FragmentPagerAdapter
{ ...
  ICharSequence[] titles;

  public MyAdapter(... ICharSequence[] titles)
    : base(...)
  {
    this.titles = titles;
  }

  public override ICharSequence GetPageTitleFormatted(int position)
  {
    return titles[position];
  }
}
```

Tab text at the given position

Deprecated tab API

- Previous versions of Android provided a tabs API in the `ActionBar`

This method was deprecated in API level 21.

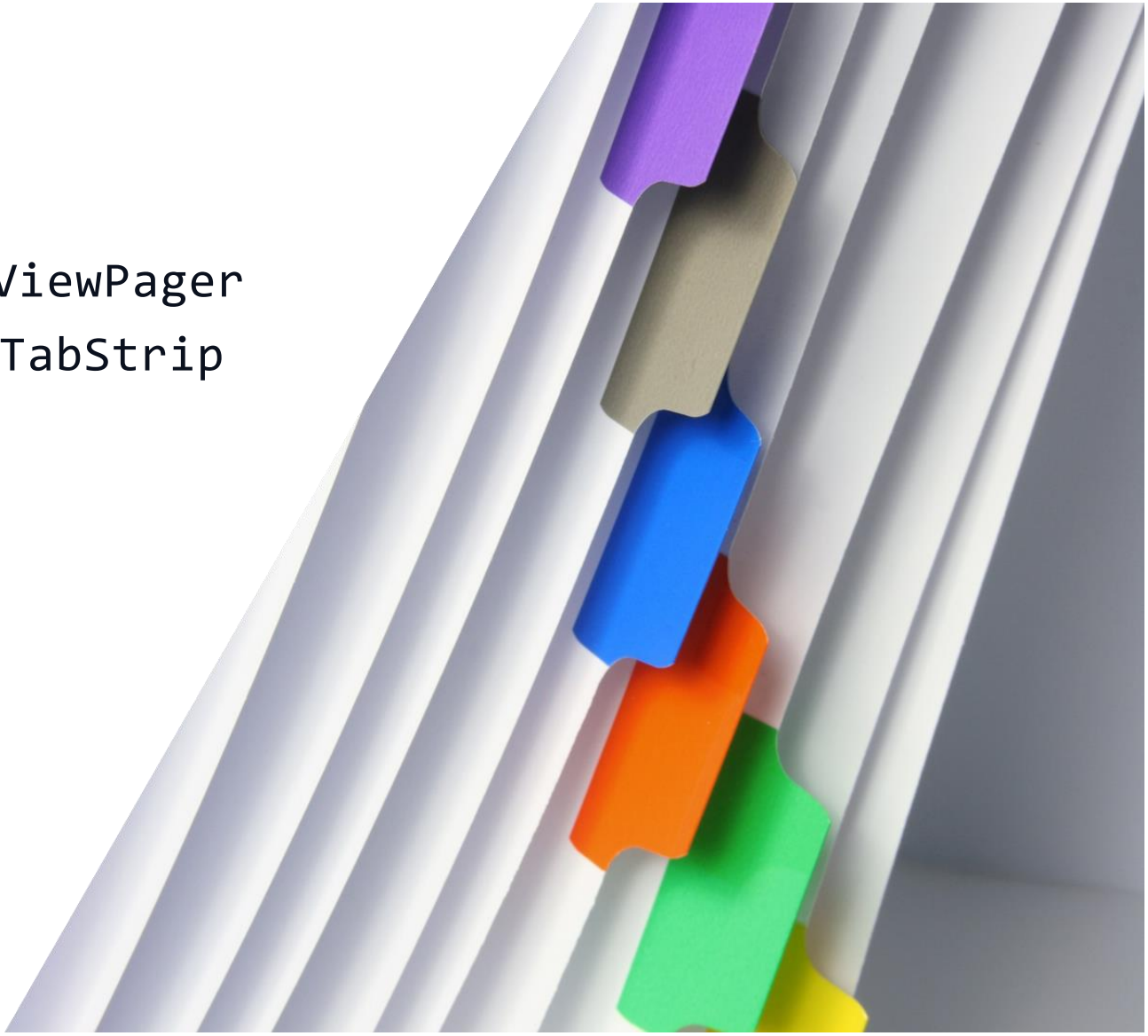
Using `ActionBar` for tabs is no longer the recommended practice

Individual Exercise

Tab Navigation

Summary

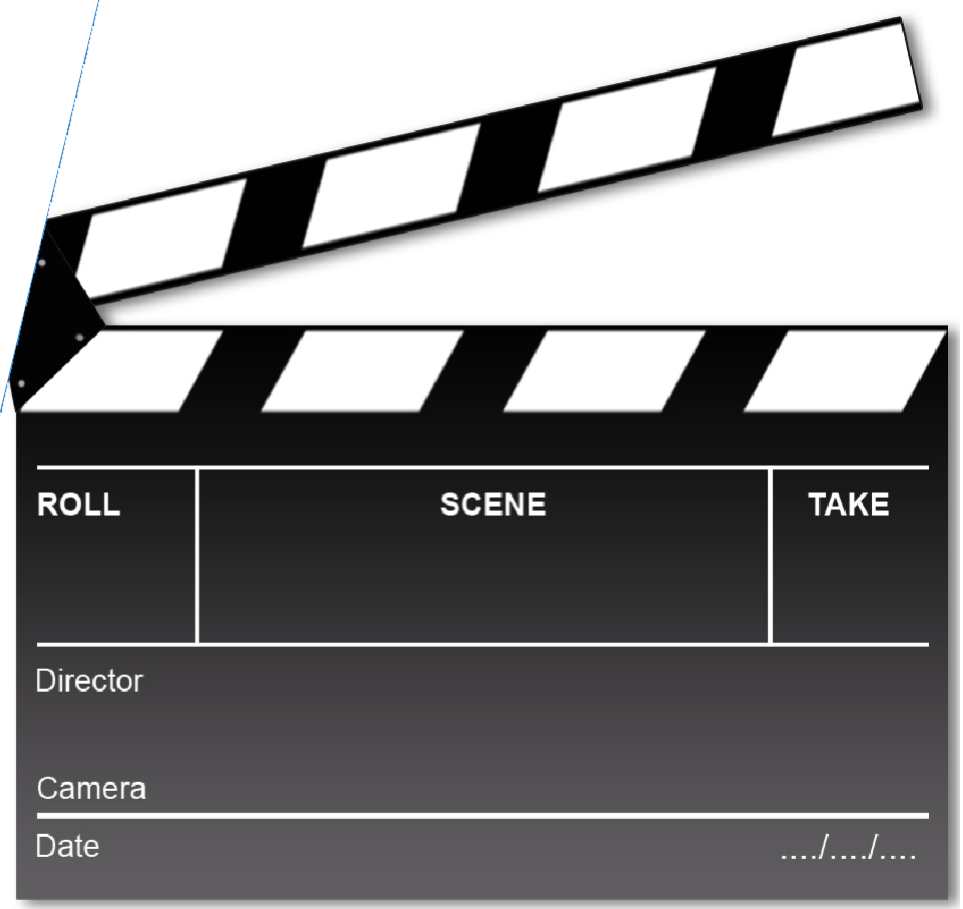
1. Display Fragments in a `ViewPager`
2. Show tabs using `PagerTabStrip`



Introduce ActionBar

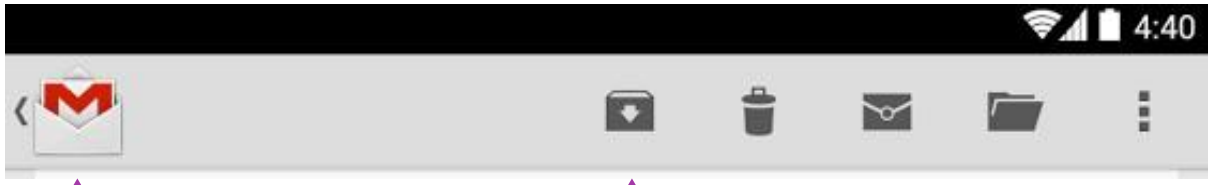
Tasks

1. Use an `ActionBar` in an Activity
2. Respond to item-click
3. Add a support library to your project



What is `ActionBar`?

- `ActionBar` is a control that hosts your app's navigation and command buttons



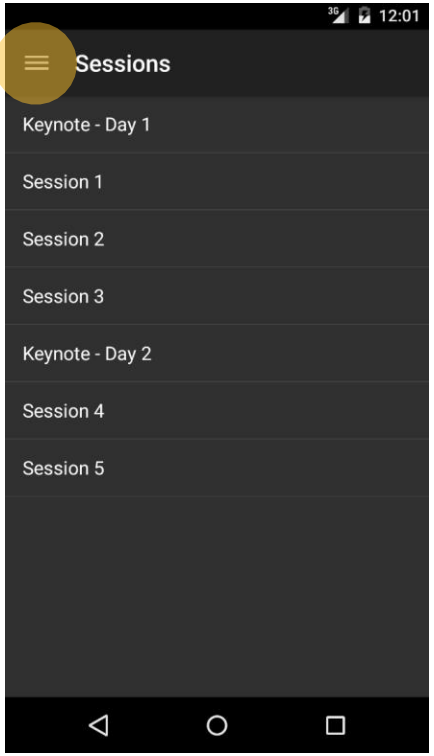
Navigation

Commands

In this course, we will use `ActionBar` for navigation, not for commands.

Navigation controls in `ActionBar`

- Drawer navigation uses the Action Bar for the Drawer icon



`ActionBar` property

- The `Activity` class has an `ActionBar` property (added in API level 11)

```
public class Activity : ...
{
  ...
  public virtual ActionBar ActionBar { get; }
  ...
}
```

Every `Activity` has an `ActionBar`

ActionBar callback

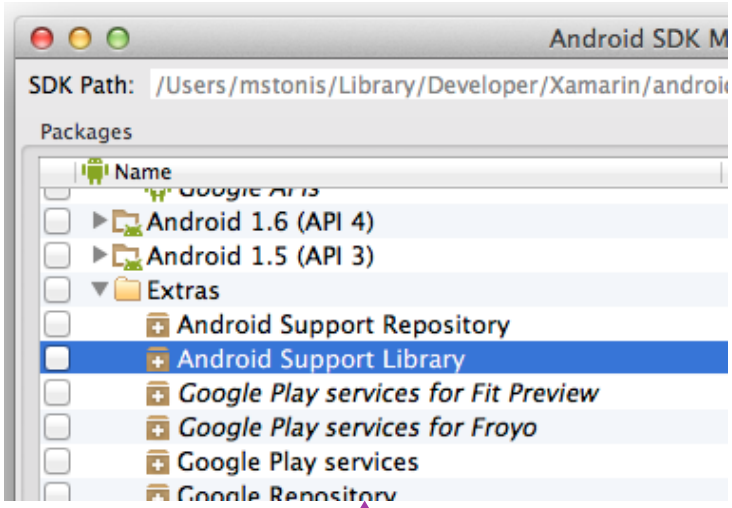
- **ActionBar** item-click events are reported via an **Activity** method

```
public class MainActivity : Activity
{ ...
  public override bool OnOptionsItemSelected(IMenuItem
  item)
  {
    switch (item.ItemId)
    {
      ...
    }
  }
}
```

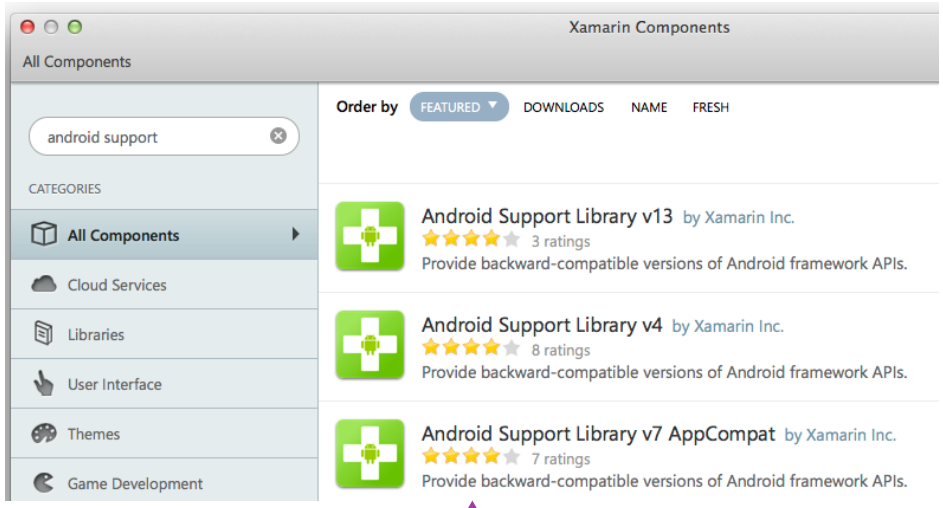
An identifier that indicates which element was clicked

Support Library

- The Action Bar is available in the Support Library and can be used back to version 2.1



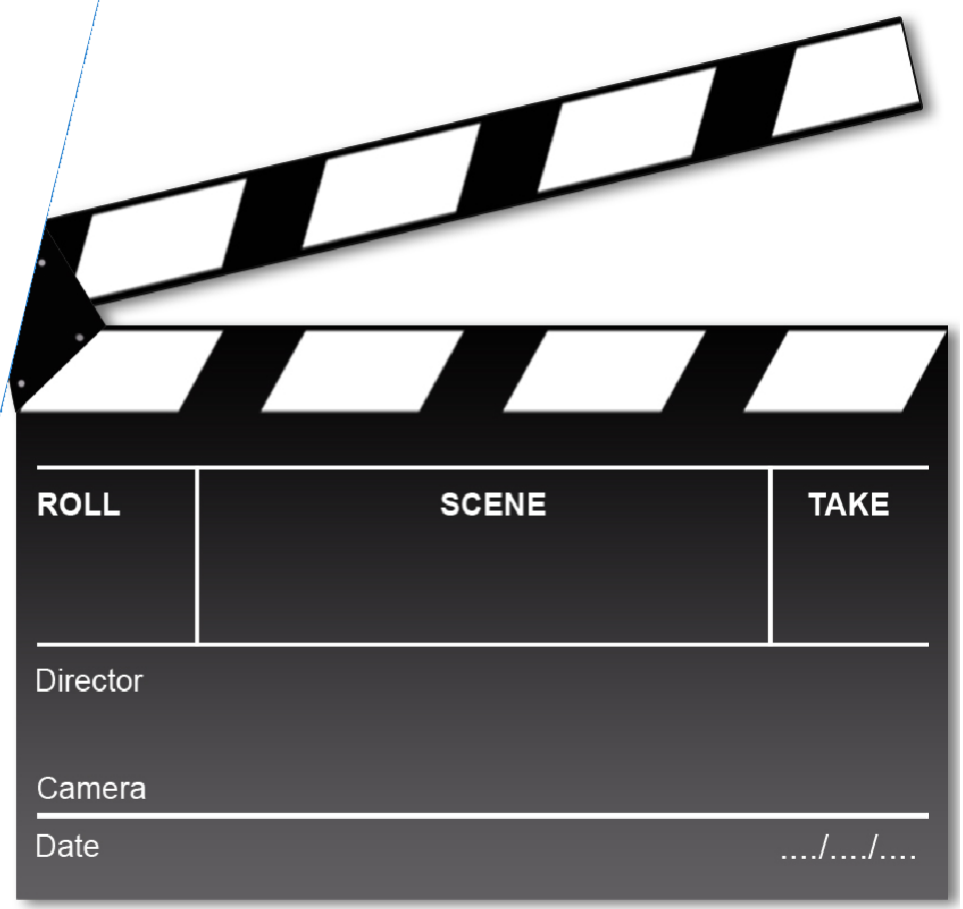
1. Install on your dev machine



2. Add to your project

Summary

1. Use an **`ActionBar`** in an Activity
2. Respond to item-click
3. Add a support library to your project



Implement Drawer Navigation

Tasks

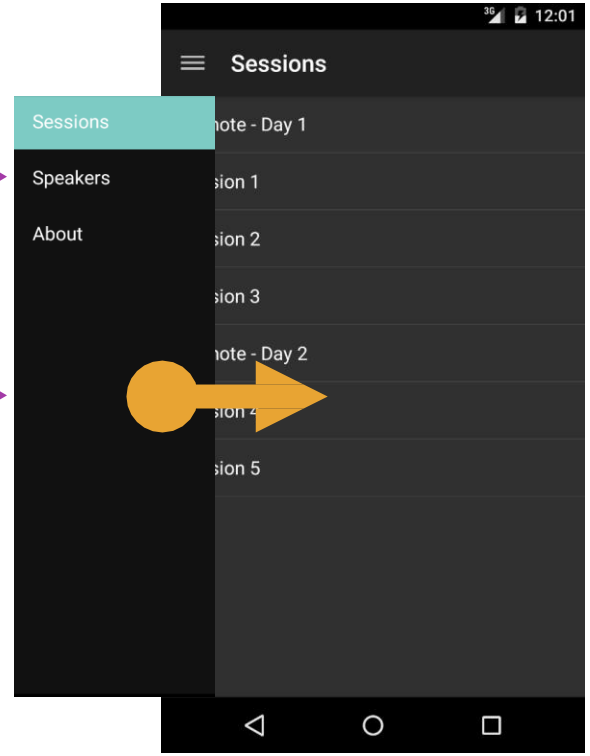
1. Code a `ListView` for your menu
2. Load a Fragment when your menu is clicked
3. Use a `DrawerLayout` to host your flyout menu
4. Use an `ActionBarDrawerToggle` to open/close the drawer

Motivation

- Drawer navigation works well when your app needs a large menu

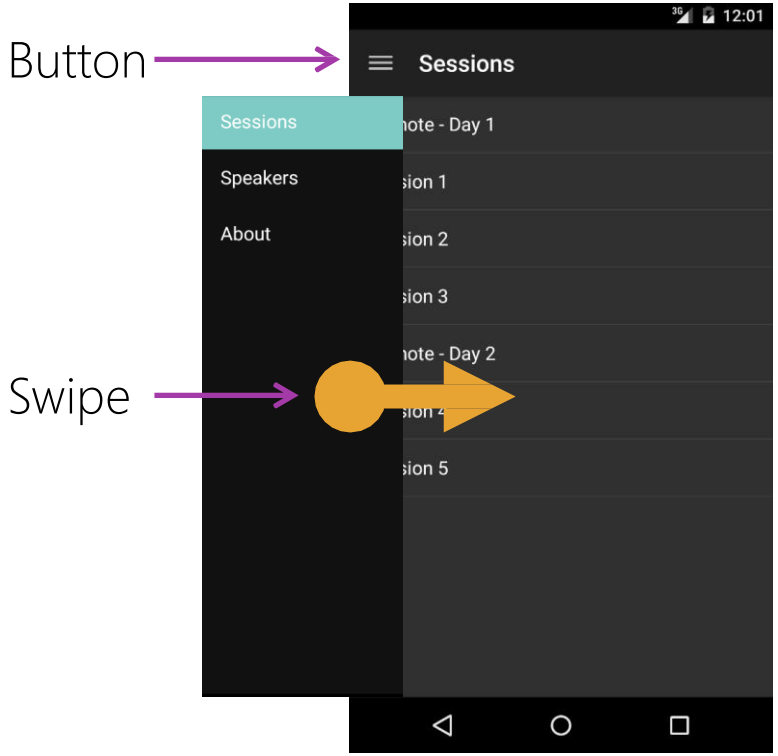
Menu has room for many entries

Menu overlays content when open, but then disappears when closed



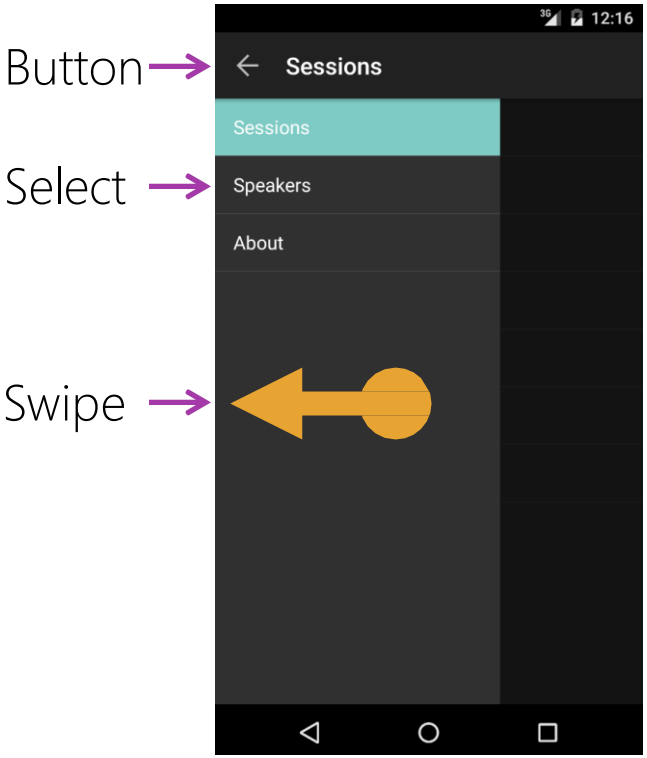
How to open the drawer?

❖ There are two ways for the user to open the drawer



How to close the drawer?

❖ There are several ways for the user to close the drawer



Architecture

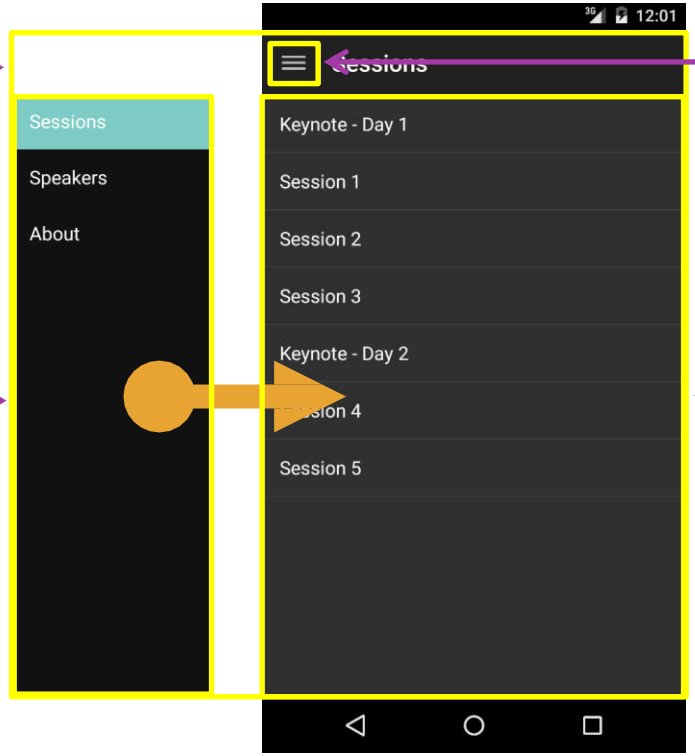
❖ There are 4 pieces to the Drawer Navigation pattern

`DrawerLayout`
to hold all the parts

`ActionBarDrawerToggle`
button to open/close the menu drawer

`ListView`
for the menu

`FrameLayout` to hold your content



Support Library

- The classes that implement Drawer Navigation are in the v4 and v7 Support Libraries (including v7 gets you v4 automatically)

`DrawerLayout` →

Android Support Library v4 (21.0.3.0) Details Remove

Provide backward-compatible versions of Android framework APIs.

`ActionBarDrawerToggle` →

Android Support Library v7 AppCompat (21.0.3.0) Details Remove

Provide backward-compatible versions of Android framework APIs.

Define your menu UI

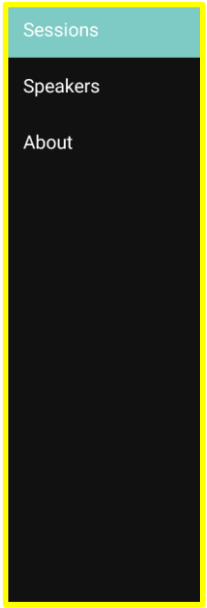
- Typical to use a **`ListView`** for the drawer menu

Navigation drawer goes on the left

You choose the width, should be 320dp or less

Main.axml

```
...
<ListView
  android:id              ="@+id/drawerListView"
  android:layout_gravit   ="start"
  android:choiceMode      ="singleChoice"
  android:layout_width    ="240dp"
  android:layout_height   ="match_parent"
  android:background      ="?android:attr/windowBackground" />
...
```



`DrawerLayout` uses the gravity setting to determine which child is the menu. You must set it to **`start/left`** for a left-side drawer or **`DrawerLayout`** will throw an exception.

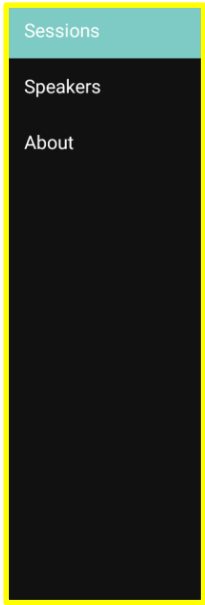
Load your menu from code

- Typical to load your **`ListView`** menu from code-behind using an adapter

MainActivity.cs

```
string[] titles = new string[] { "Sessions", "Speakers", "About" };

drawerListView =

FindViewById<ListView>(Resource.Id.drawerListView);

drawerListView.Adapter = new ArrayAdapter<string>
  (
    this,
    Resource.Id.menuRowTextView,     // id of TextView in layout file
    Resource.Layout.ListViewMenuRow, // layout file for row
    titles
  );
```

Menu entries



Define your content UI

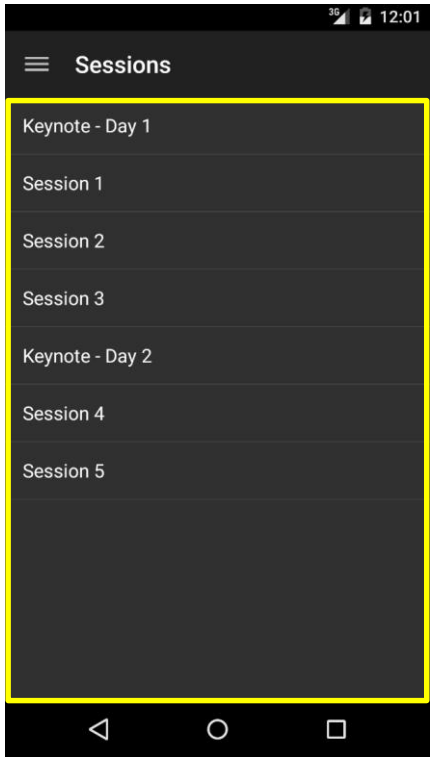
❖ Use a **`FrameLayout`** to host your content

Will hold Fragments loaded from code

Main.axml

```
...
<FrameLayout
  android:id              ="@+id/frameLayout"
  android:layout_width    ="match_parent"
  android:layout_height   ="match_parent"
  />
...
```

Occupies the entire UI area



Load your content from code

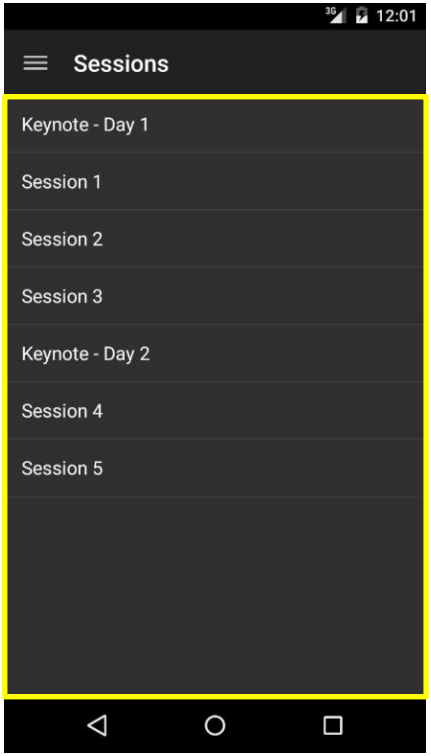
- Update the **`FrameLayout`** when the user selects from the menu

```
drawerListView.ItemClick += OnMenuItemClick;
```

`MainActivity.cs`

```
void OnMenuItemClick(object sender, AdapterView.ItemClickEventArgs e)
{
  base.FragmentManager
    .BeginTransaction()
    .Replace(Resource.Id.frameLayout, fragments[e.Position])
    .Commit();

  this.Title = titles[e.Position];
}
```

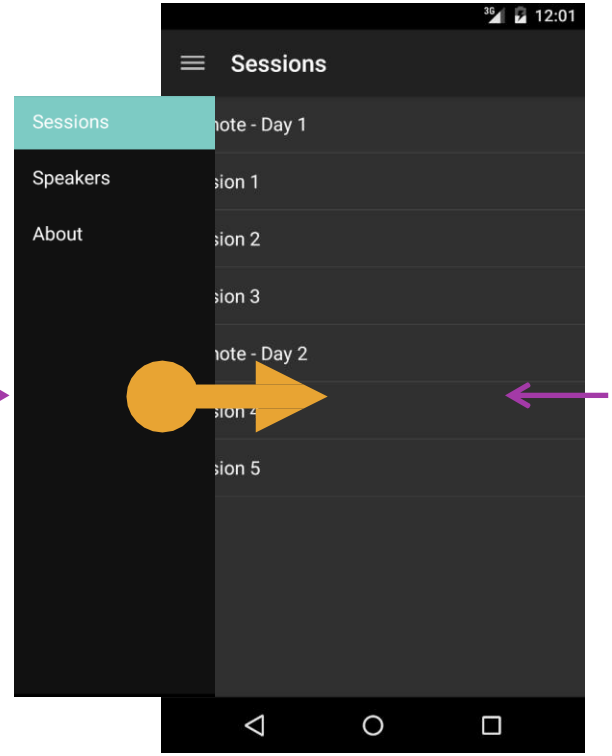
Load a Fragment based on the **`ListView`** item the user clicked



What is `DrawerLayout`?

- `DrawerLayout` is a layout manager that provides a flyout menu

It implements the "sliding drawer" containing your list



It is a layout manager so it has children that it displays for you

Define your root layout UI

- Use a **`DrawerLayout`** as your root layout manager

Main.axml

```
<?xml version="1.0" encoding="utf-8"?>
<android.support.v4.widget.DrawerLayout ...>

  <FrameLayout ... />
  <ListView ... />
</android.support.v4.widget.DrawerLayout>
```

Content → `<FrameLayout ... />`

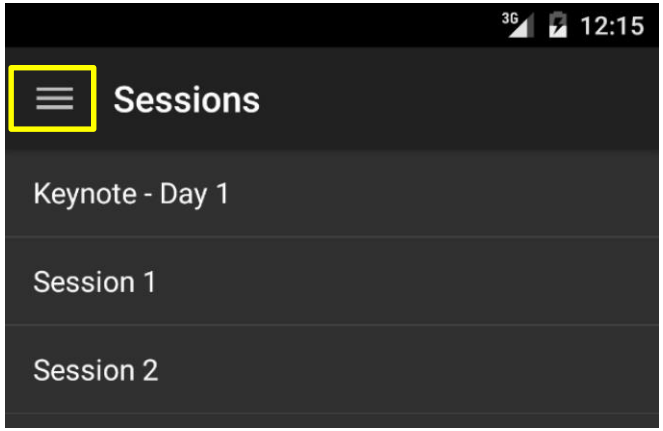
Menu → `<ListView ... />`

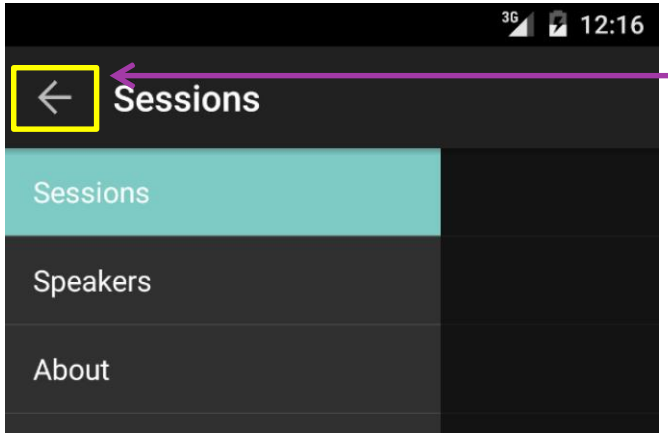
Android says to define the **`FrameLayout`** first and the **`ListView`** second so the menu is rendered above the content in Z-order.

What is `ActionBarDrawerToggle`?

- `ActionBarDrawerToggle` is a toggle button that is hosted inside your `ActionBar` and used to open/close a menu drawer

Looks like this when the menu is closed





Animates to this when the menu is open

`ActionBarDrawerToggle` creation

- You instantiate an **`ActionBarDrawerToggle`** in code, not XML

Allocate

```
public class MainActivity : Activity
{ ...
  ActionBarDrawerToggle drawerToggle;

  protected override void OnCreate(Bundle bundle)
  {
    ...
    drawerToggle = new ActionBarDrawerToggle(...);
    ...
  }
}
```

ActionBarDrawerToggle accessibility

- **ActionBarDrawerToggle** requires two string resources for use by accessibility services

Resources/values/Strings.xml

```
<?xml version="1.0" encoding="utf-8"?>
<resources>
  <string name="DrawerOpenDescription">Open navigation drawer</string>
  <string name="DrawerCloseDescription">Close navigation drawer</string>
</resources>
```

Pass your accessibility strings to the constructor

```
drawerToggle = new ActionBarDrawerToggle
  (
    ...,
    Resource.String.DrawerOpenDescription,
    Resource.String.DrawerCloseDescription
  );
```

`ActionBar` integration [UI]

- `ActionBarDrawerToggle` adds itself to your `ActionBar` automatically, you just need to enable your `ActionBar`'s Home button

`MainActivity.cs`

```
protected override void OnCreate(Bundle bundle)
{
  ...
  drawerToggle = new ActionBarDrawerToggle(this, ...);

  ActionBar.SetDisplayHomeAsUpEnabled(true);
  ...
}
```

It will replace the normal Home icon with its own

You must pass in your `Activity`, which allows it to access your `ActionBar`

`ActionBar` integration [clicks]

- You send ActionBar-click events to the **`ActionBarDrawerToggle`** or it won't know when the user clicks it

`MainActivity.cs`

It verifies the Home button was clicked and then toggles the drawer

Handle clicks on other **`ActionBar`** buttons

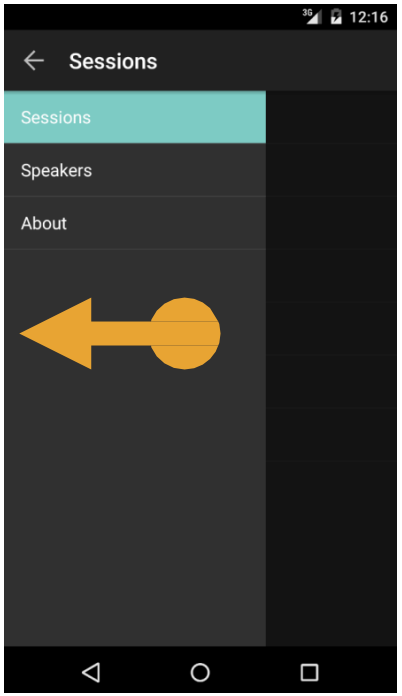
```
public override bool OnOptionsItemSelected(IMenuItem item)
{
  if (drawerToggle.OnOptionsItemSelected(item))
    return true;

  switch (item.ItemId)
  {
    ...
  }
}
```

Drawer management [overview]

- **`ActionBarDrawerToggle`** and **`DrawerLayout`** collaborate to manage the drawer

Button tells the drawer to open/close

Drawer listens for swipe gestures



Drawer management [automatic]

- **`ActionBarDrawerToggle`** and **`DrawerLayout`** have references to each other so they can work together

`MainActivity.cs`

```
protected override void OnCreate(Bundle bundle)
{ ...
  drawerLayout = FindViewById<DrawerLayout>(Resource.Id.drawerLayout);

  drawerToggle = new ActionBarDrawerToggle(this, drawerLayout,
  ...);
  drawerLayout.SetDrawerListener(drawerToggle);
  ...
}
```

Drawer reports changes to the button so the button can toggle its icon

Button can call open/close methods on the drawer when the user clicks on it

Drawer management [manual]

- You have to close the drawer when the user selects your menu item

MainActivity.cs

```
void OnMenuItemClick(object sender, AdapterView.ItemClickEventArgs e)
{
  base.FragmentManager
    .BeginTransaction()
    .Replace(Resource.Id.frameLayout, fragments[e.Position])
    .Commit();

  this.Title = titles[e.Position];

  drawerLayout.CloseDrawer(drawerListView);
}
```

Your code closes the drawer

Identifies which drawer to close (needed because **DrawerLayout** can have left and right drawers)

Drawer↔button sync at startup

- After your Activity's initialization is finished, you need to tell the toggle button to synchronize its icon with the open/closed state of the drawer

MainActivity.cs

Android recommends calling it here, after all Activity setup/ restore is complete

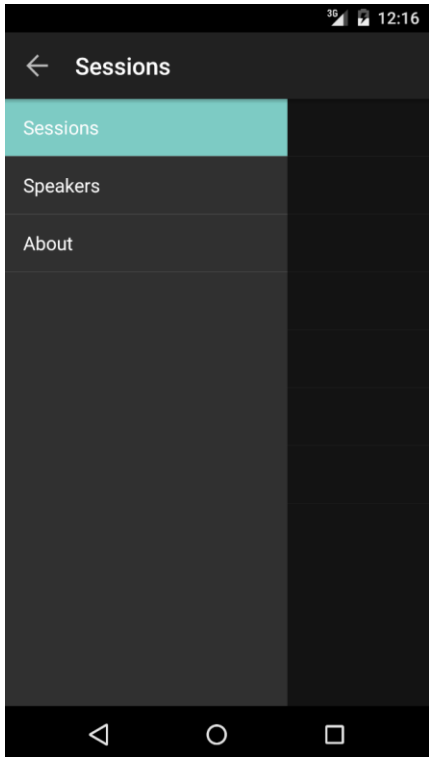
```
public class MainActivity : Activity
{ ...
  protected override void OnPostCreate(Bundle savedInstanceState)
  {
    drawerToggle.SyncState();

    base.OnPostCreate(savedInstanceState);
  }
}
```

Group Exercise

Drawer Navigation

Drawer guidelines

- Android has design guidelines to help you code Navigation Drawer
  - Start with the drawer open on first run
  - Make your drawer listings descriptive with icons, images, and counters



Our examples could not show all the best practices, please read the guidelines:
`https://developer.android.com/design/patterns/navigation-drawer.html`

Summary

1. Code a `ListView` for your menu
2. Load a Fragment when your menu is clicked
3. Use a `DrawerLayout` to host your flyout menu
4. Use an `ActionBarDrawerToggle` to open/close the drawer

Thank You!