CMSC436: Programming Handheld Systems

The Fragment Class

Tablet UIs

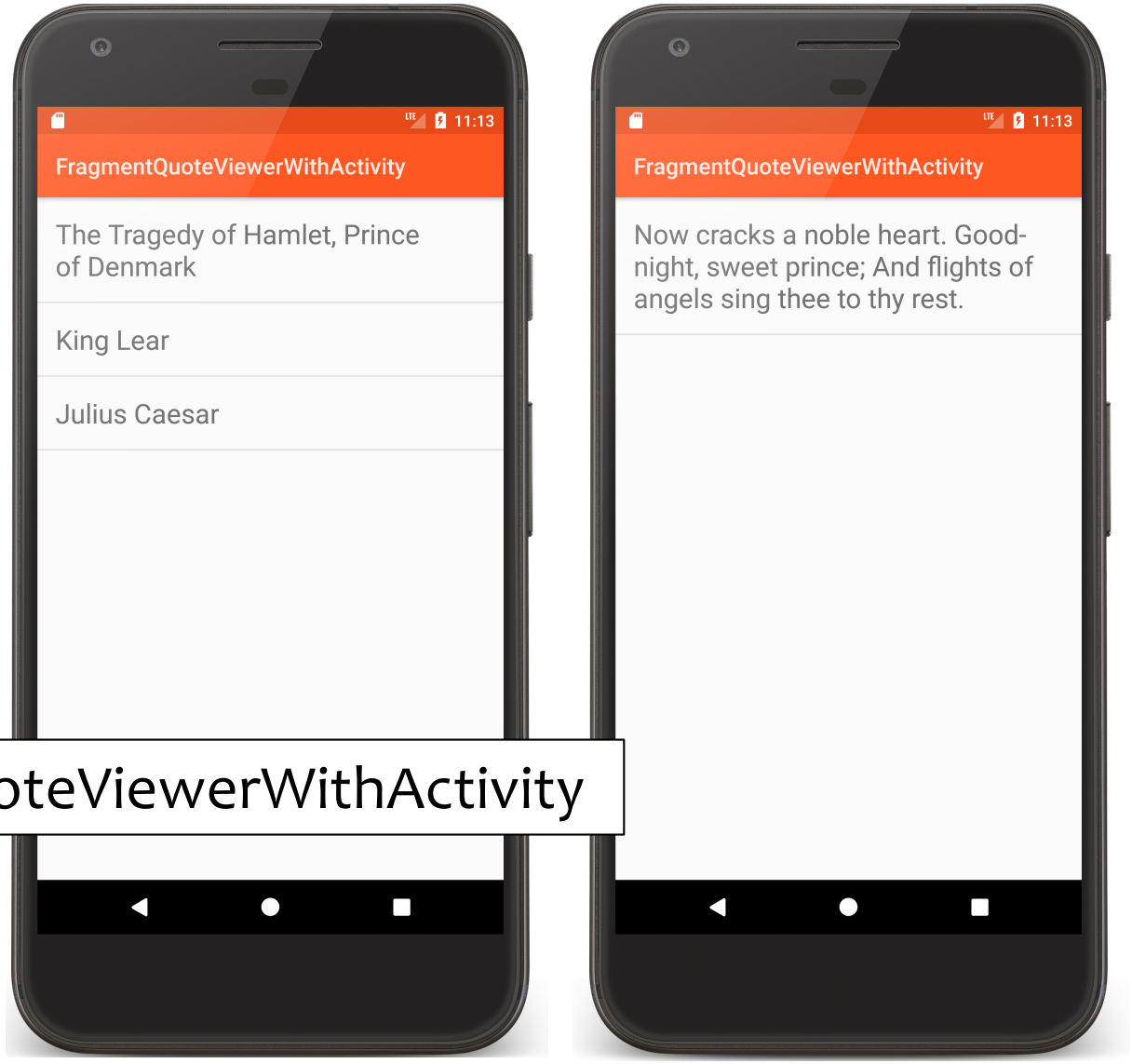
Tablets have larger displays than phones do

They can support multiple UI panes / user behaviors at the same time

- The “1 activity – 1 thing the user can do” heuristic may not make sense for larger devices

FragmentQuoteViewerWithActivity

- Application uses two Activities
  - One shows titles of Shakespeare plays & allows user to select one title
  - The other shows a quote from the selected play

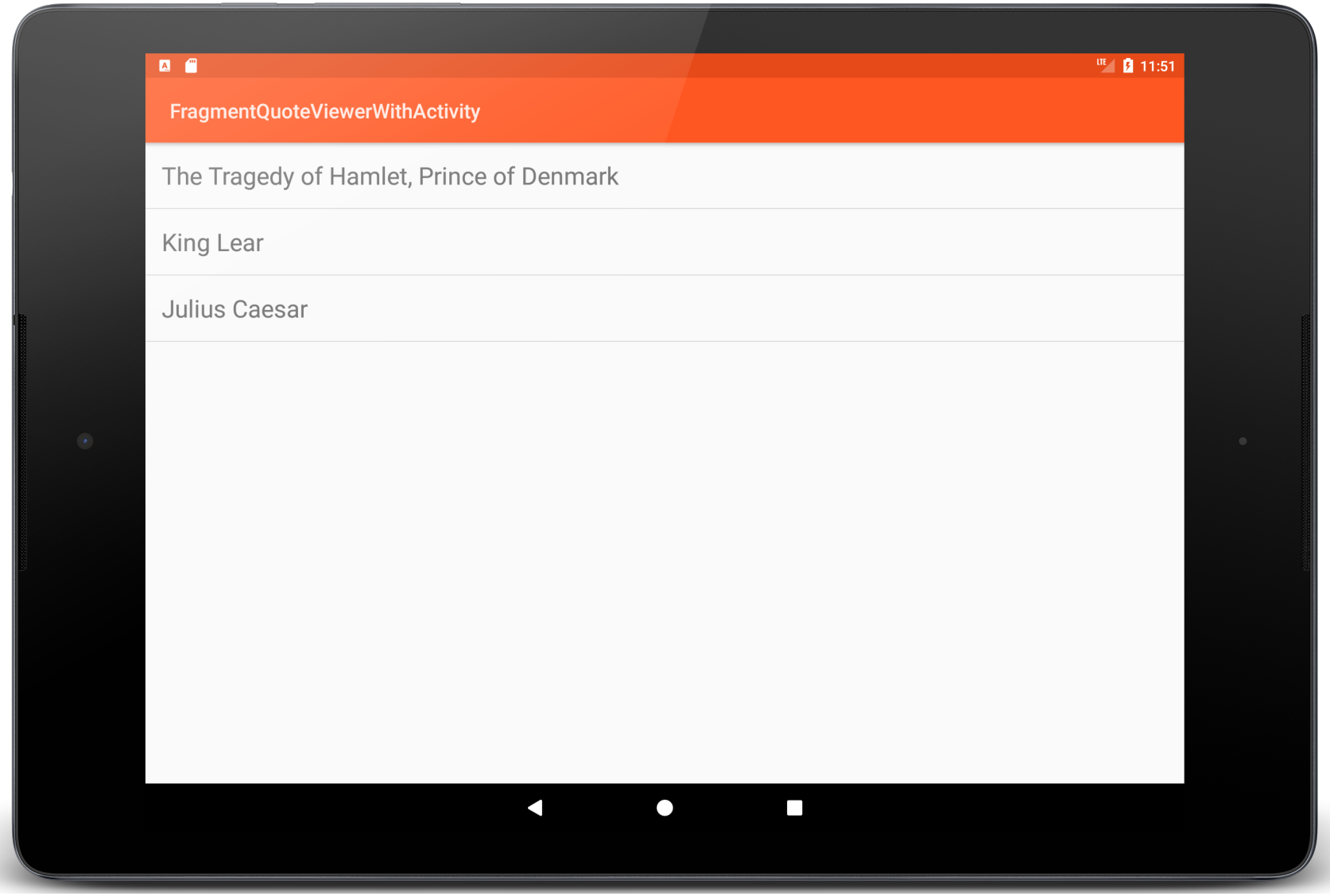


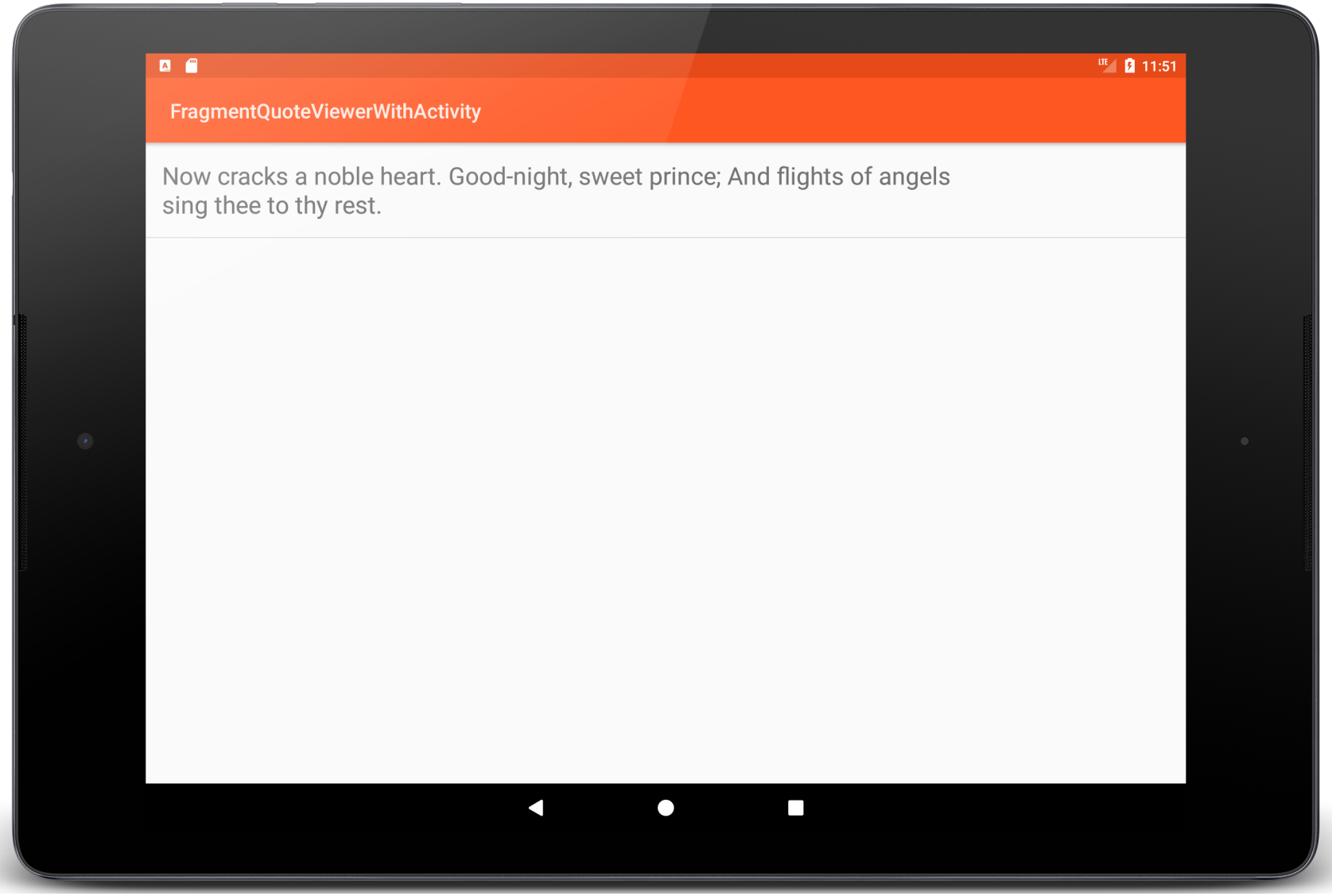
FragmentQuoteViewerWithActivity

FragmentQuoteViewerWithActivity UI

This layout is reasonable on a phone

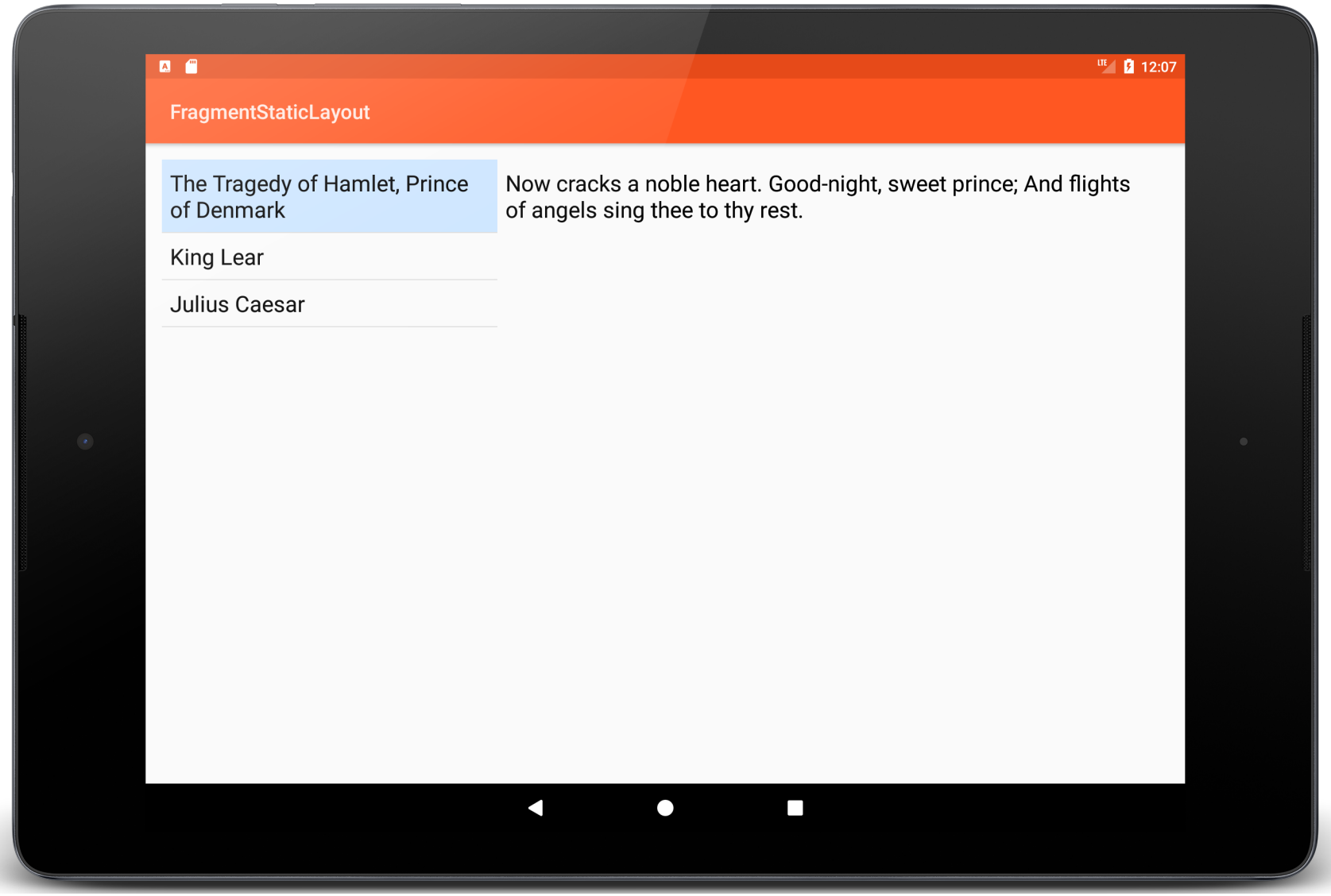
But inefficient on a larger device


11:51
FragmentQuoteViewerWithActivity
The Tragedy of Hamlet, Prince of Denmark
King Lear
Julius Caesar


11:51
FragmentQuoteViewerWithActivity
Now cracks a noble heart. Good-night, sweet prince; And flights of angels sing thee to thy rest.

Better Layout

Use two cooperating layout units on one screen


12:07
FragmentStaticLayout
The Tragedy of Hamlet, Prince of Denmark
King Lear
Julius Caesar
Now cracks a noble heart. Good-night, sweet prince; And flights of angels sing thee to thy rest.

The Fragment Class

Typically represents a behavior / portion of UI

Multiple Fragments can be embedded in an Activity to create a multi-pane UI

A single Fragment can be reused across multiple Activities

Fragment Lifecycle

Fragment lifecycle is coordinated with the lifecycle of its containing/hosting Activity

Fragments have their own lifecycles and receive their own callbacks

Fragment Lifecycle States

Resumed

- Fragment is visible in the hosting Activity

Paused

- Another Activity is in the foreground and has focus, this Fragment’s hosting Activity is still visible

Stopped

- The Fragment is not visible

Lifecycle Callback Methods

onAttach()

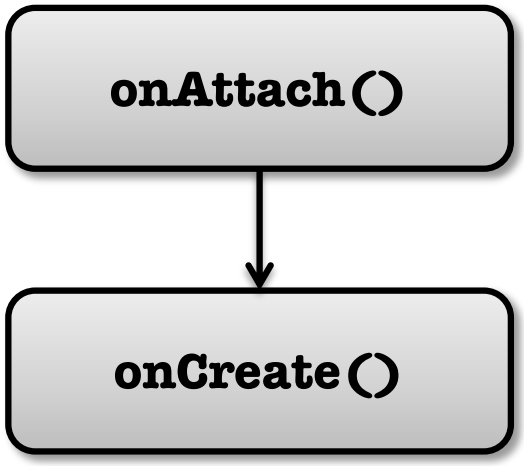
Activity is created

Fragment is first attached to its Activity

onCreate()

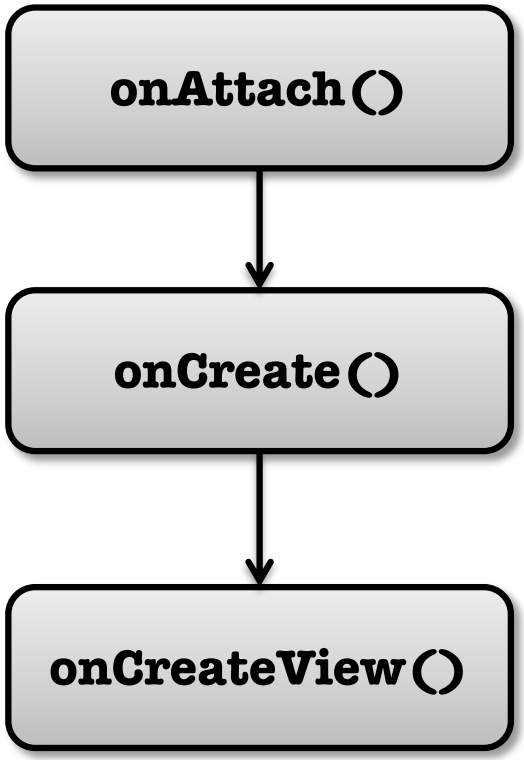
Initialize the Fragment

Note: The hosting Activity may not be fully created at this point



onCreateView()

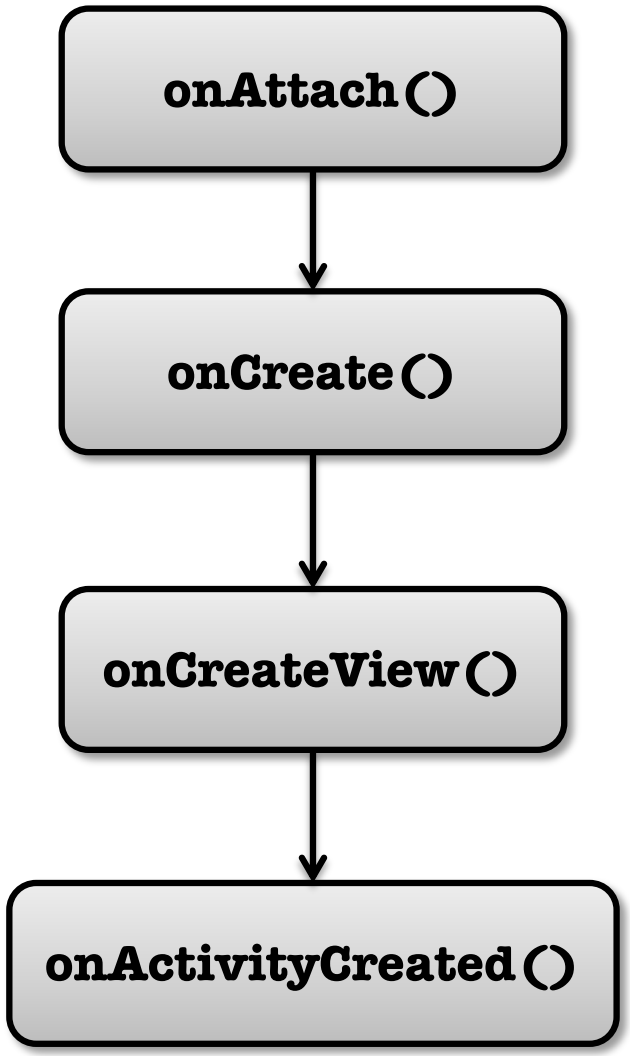
Fragment sets up & returns its user interface View



onActivityCreated()

Containing Activity has completed onCreate() and the Fragment has been installed

Can now safely access hosting Activity



onStart()

Activity is started

Hosting Activity about
to become visible

onResume()

Activity is resumed

Hosting Activity is about to become visible and ready for user interaction

onPause()

Activity is paused

Hosting Activity is visible, but does not have focus

onStop()

Activity is stopped

Hosting Activity is no longer visible

onDestroyView()

Activity is destroyed

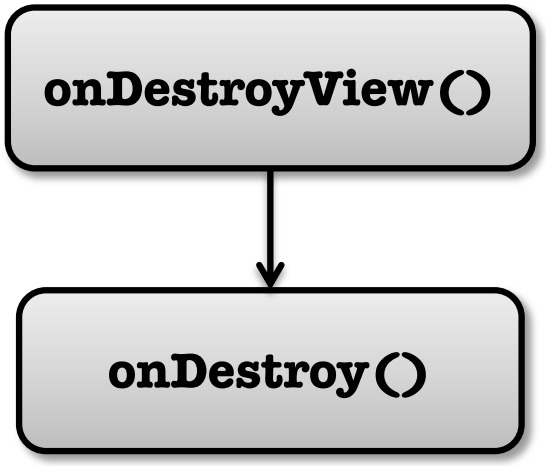
View previously created in onCreateView() has been detached from the Activity

Clean up view resources

onDestroy()

Fragment is no longer in use

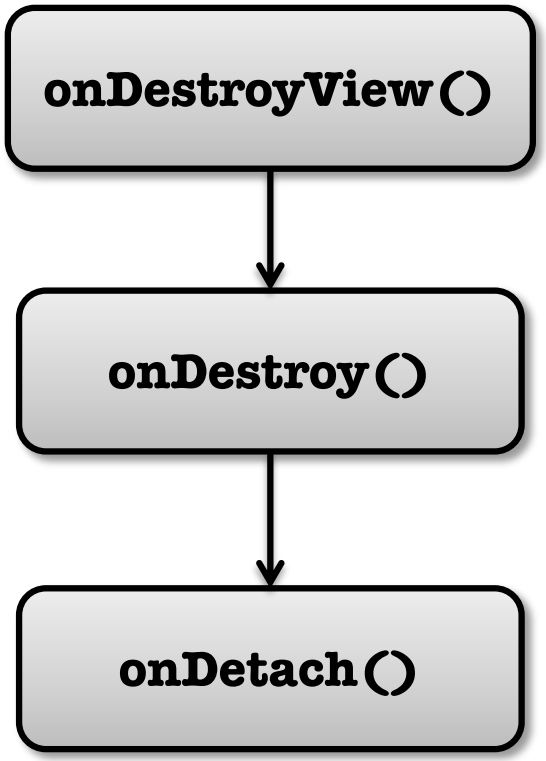
Clean up Fragment resources



onDetach()

Fragment no longer attached to its activity

Null out references to hosting Activity



Adding Fragments to Activities

Two general ways to add Fragments to an Activity's layout

- Declare it statically in the Activity's layout file
- Add it programmatically using the FragmentManager

Fragment Layout

Layout can be inflated/implemented in onCreateView()

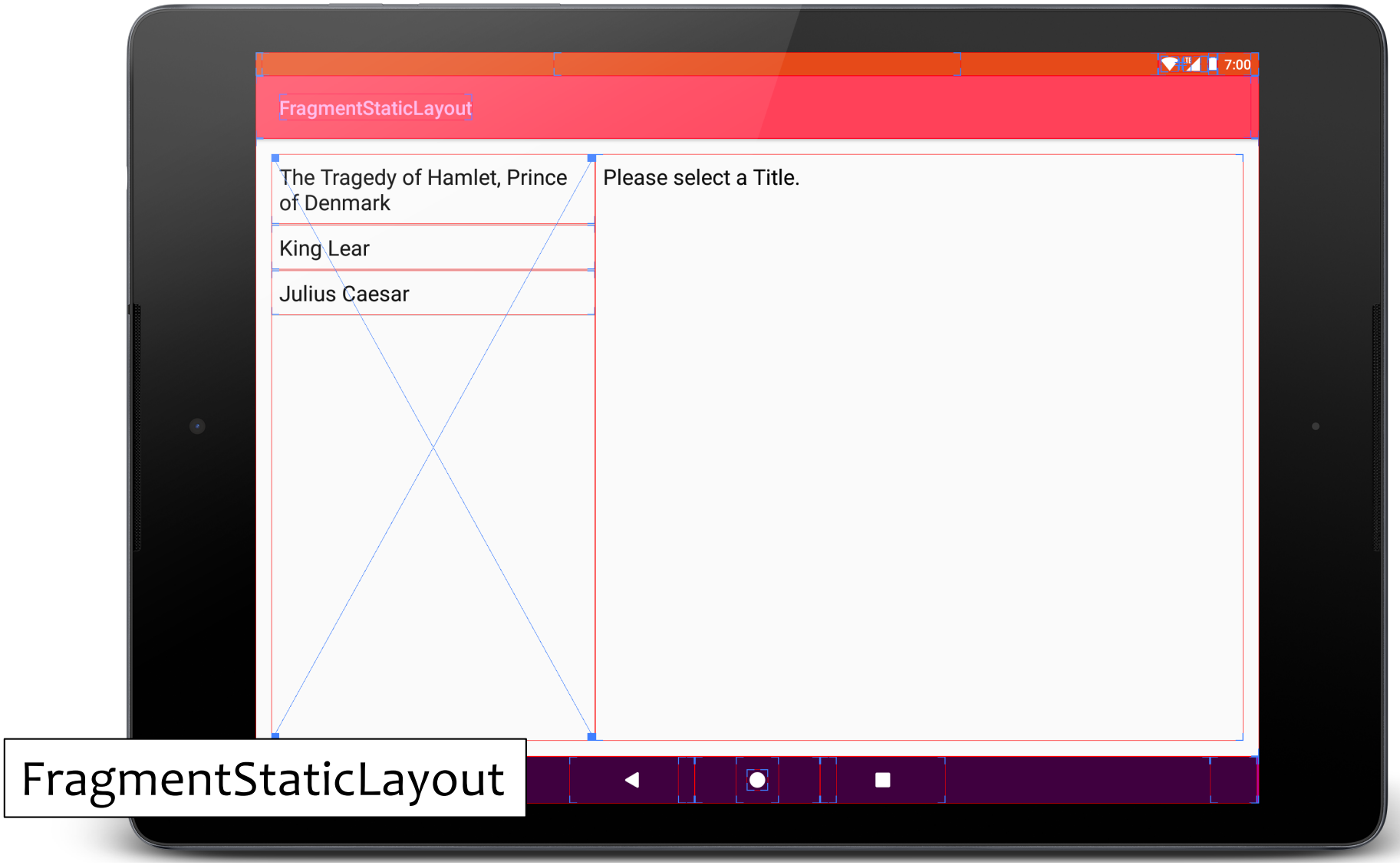
onCreateView() must return the View at the root of the Fragment’s layout

This View is added to the containing Activity

FragmentStaticLayout

Display titles and quotes in two Fragments, side-by-side

Fragments are statically added to UI based on a layout file



FragmentStaticLayout

```
class QuoteViewerActivity : FragmentActivity(),
                                    ListSelectionListener {

    …
    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        …
        setContentView(R.layout.quote_activity)
```

quote_activity.xml

```
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    …
     <fragment
         android:id="@+id/titles"
         class="course.examples.fragments.staticlayout.TitlesFragment"
         android:layout_width="0px"
         android:layout_height="match_parent"
         android:layout_weight="1" />

     <fragment
         android:id="@+id/details"
         class="course.examples.fragments.staticlayout.QuotesFragment"
         android:layout_width="0px"
         android:layout_height="match_parent"
         android:layout_weight="2" />

</LinearLayout>
```

Design Philosophy

- Fragments should be reusable across Activities
- Avoid coupling Fragments
  - i.e., Frag1 should not directly interact with Frag2
  - Coupling should be handled by callbacks to hosting Activity

ListSelectionListener.kt

```
// Callback interface that defines how a TitlesFragment notifies
// the QuoteViewerActivity when user clicks on a List Item in the
// TitlesFragment

internal interface ListSelectionListener {
    fun onListSelection(index: Int)
}
```

TitlesFragment.kt

```
…
 // Called when the user selects an item from the List
 override fun onListItemClick(l: ListView?, v: View?,
                                                pos: Int, id: Long) {
      …
// Inform the QuoteViewerActivity that item at position pos was selected
         mListener.onListSelection(pos)
     …
 }
 override fun onAttach(context: Context) {
      …
// ListSelectionListener for communicating with QuoteViewerActivity
         mListener = context as ListSelectionListener
      …
```

QuoteFragmentActivity.kt

```
class QuoteViewerActivity : FragmentActivity(),
                                    ListSelectionListener {

…

// Called by TitlesFragment when the user selects an item
override fun onListSelection(index: Int) {
    // Tell the QuoteFragment to show the quote string at
    // position index
    mQuotesFragment.showQuoteAtIndex(index)
}
```

Adding Fragments Programmatically

While an Activity is running you can add and remove Fragments from its layout

Four-step process

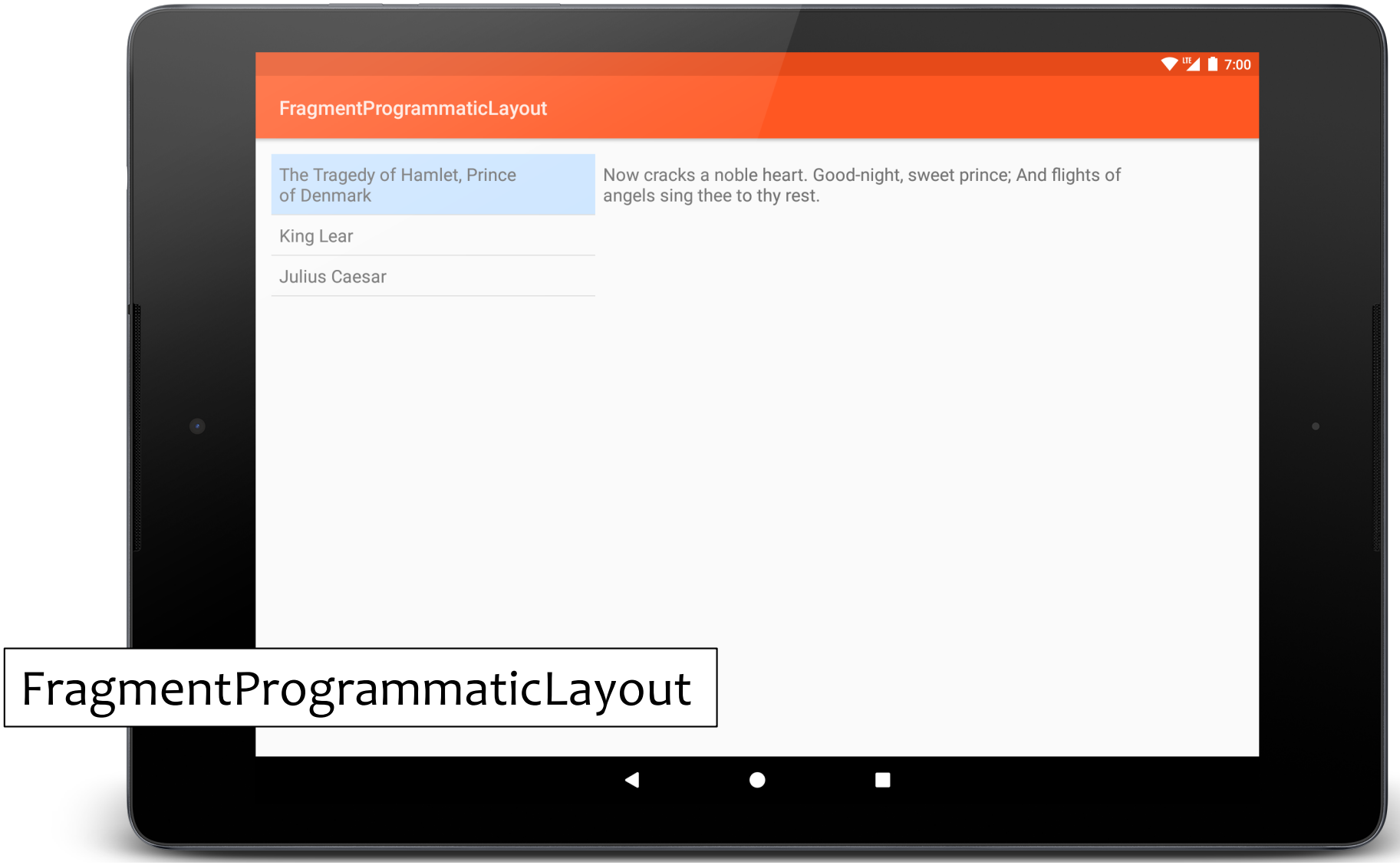
1. Get reference to the FragmentManager
2. Begin a FragmentTransaction
3. Add the Fragment
4. Commit the FragmentTransaction

FragmentProgrammaticLayout

Displays titles and quotes side-by-side in two Fragments

Layout file reserves space for Fragments (using FrameLayout elements)

Fragments are programmatically added to UI at runtime



FragmentProgrammaticLayout

QuoteViewerActivity.kt

```
override fun onCreate(savedInstanceState: Bundle?) {
    …
    // Get a reference to the FragmentManager
    val fragmentManager = supportFragmentManager
    if (null == fragmentManager.findFragmentById(R.id.title_frame)) {
        // Begin a new FragmentTransaction
        val fragmentTransaction = fragmentManager.beginTransaction()
        // Add the TitleFragment
        fragmentTransaction.add(R.id.title_frame, TitlesFragment())
        // Add the QuoteFragment
        mQuoteFragment = QuotesFragment()
        fragmentTransaction.add(R.id.quote_frame, mQuoteFragment)
        // Commit the FragmentTransaction
        fragmentTransaction.commit()
    } else {
        mQuoteFragment = fragmentManager.findFragmentById(R.id.quote_frame)
                                                        as QuotesFragment
    }
```

quote_activity.xml

```
<LinearLayout xmlns:android=
                    "http://schemas.android.com/apk/res/android"
    android:id="@+id/activityFrame"
    …

    <FrameLayout
        android:id="@+id/title_frame"
        android:layout_width="0dp"
        android:layout_height="match_parent"
        android:layout_weight="1" />

    <FrameLayout
        android:id="@+id/quote_frame"
        android:layout_width="0dp"
        android:layout_height="match_parent"
        android:layout_weight="2" />

</LinearLayout>
```

Dynamic Layout

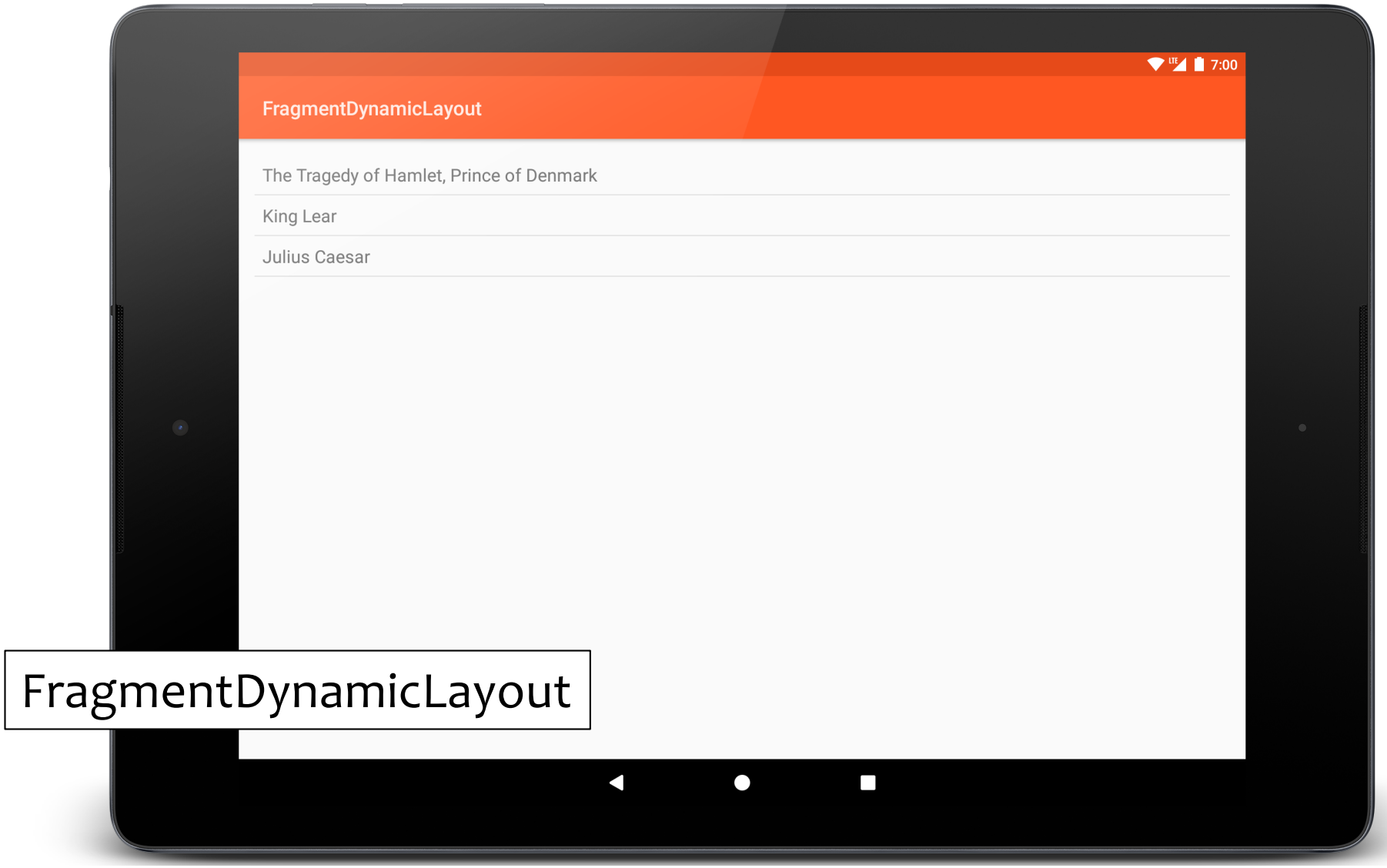
Fragment transactions allow you to dynamically change your app’s user interface

Can make the interface more fluid & take better advantage of available screen space

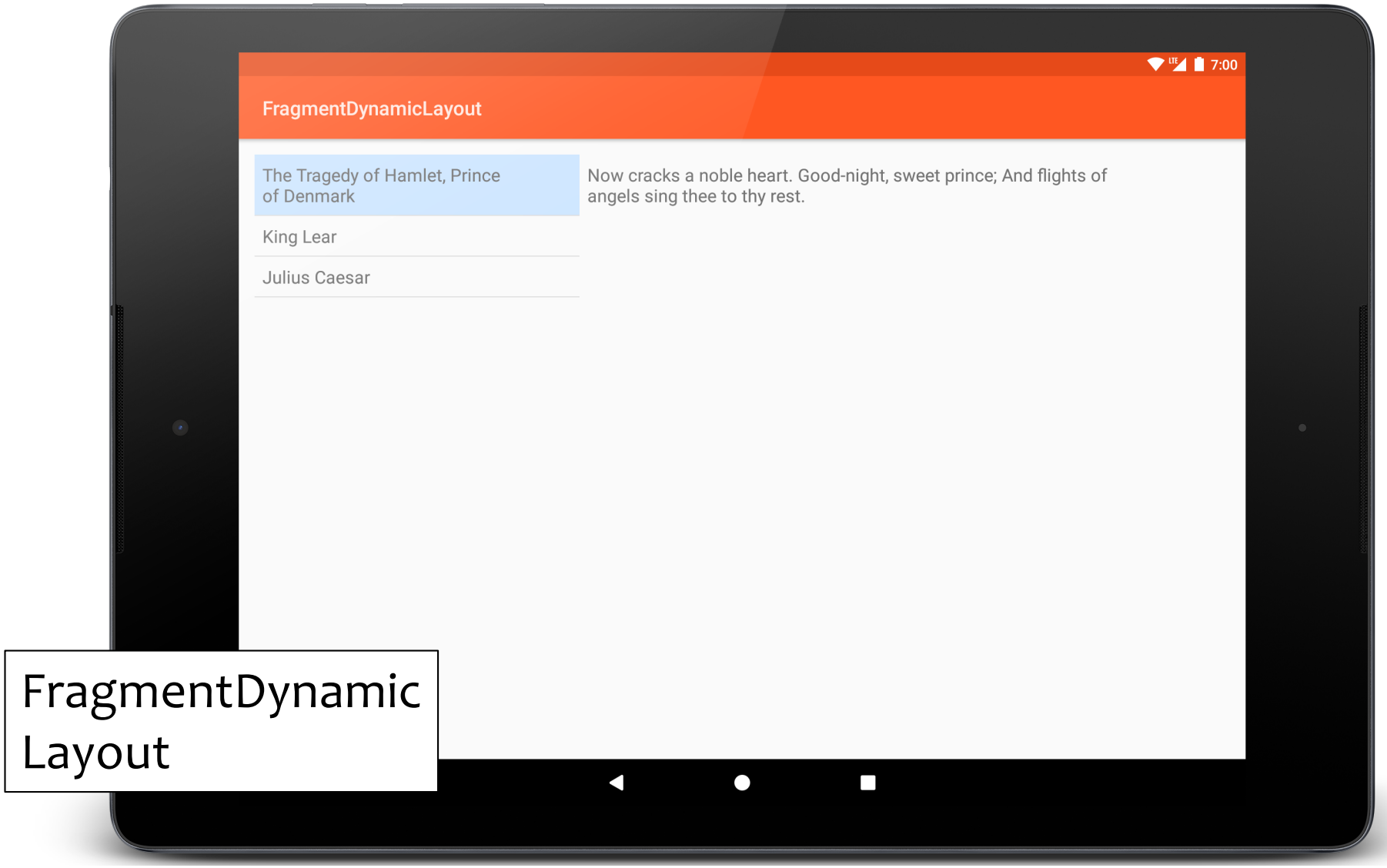
FragmentDynamicLayout

Starts with a single Fragment

Changes to two-Fragment layout when user selects a title



FragmentDynamicLayout



FragmentDynamic Layout

QuoteViewerActivity.kt

```
// Get a reference to the FragmentManager
mFragmentManager = supportFragmentManager

mQuoteFragment = mFragmentManager.
        findFragmentById(R.id.quote_fragment_container) as QuotesFragment?
mTitleFragment = mFragmentManager.
        findFragmentById(R.id.title_fragment_container) as TitlesFragment?
```

QuoteViewerActivity.kt

```
if (null == mFragmentManager.
                findFragmentById(R.id.title_fragment_container)) {
    mTitleFragment = TitlesFragment()
    mTitleFragment?.let { mTitleFragment ->
        // Start a new FragmentTransaction
        val fragmentTransaction = mFragmentManager.beginTransaction()

        // Add the TitleFragment to the layout
        fragmentTransaction.add(R.id.title_fragment_container,
                                                    mTitleFragment)

        // Commit the FragmentTransaction
        fragmentTransaction.commit()
    }
```

QuoteViewerActivity.kt

```
// Called when the user selects an item in the TitlesFragment
override fun onListSelection(index: Int) {
    // If the QuoteFragment has not been created, create and add it now
    if (null == mFragmentManager.
                        findFragmentById(R.id.quote_fragment_container)) {

        mQuoteFragment = QuotesFragment()

        mQuoteFragment?.let {mQuoteFragment ->
            // Start a new FragmentTransaction
            val fragmentTransaction = mFragmentManager
                .beginTransaction()
            // Add the QuoteFragment to the layout
            fragmentTransaction.add(R.id.quote_fragment_container,
                                                    mQuoteFragment)
```

QuoteViewerActivity.kt

```
                // Add this FragmentTransaction to the backstack
                fragmentTransaction.addToBackStack(null)

                // Commit the FragmentTransaction
                fragmentTransaction.commit()

                // Force Android to execute the committed FragmentTransaction
                mFragmentManager.executePendingTransactions()
            }
        }

        // Tell the QuoteFragment to show the quote string at position index
        mQuoteFragment?.showQuoteAtIndex(index)

}
```

Configuration Changes

If you call setRetainInstance(true) on a Fragment, Android won’t destroy that Fragment on configuration changes

Configuration Changes

Results in some changes to lifecycle callback sequence

onDestroy() will not be called

onCreate() will not be called

FragmentStaticConfigLayout

Essentially the same as FragmentStaticLayout

Focus here is on how Fragments are saved and restored on configuration changes

FragmentStaticConfigLayout

In landscape mode

Both Fragments use a large font

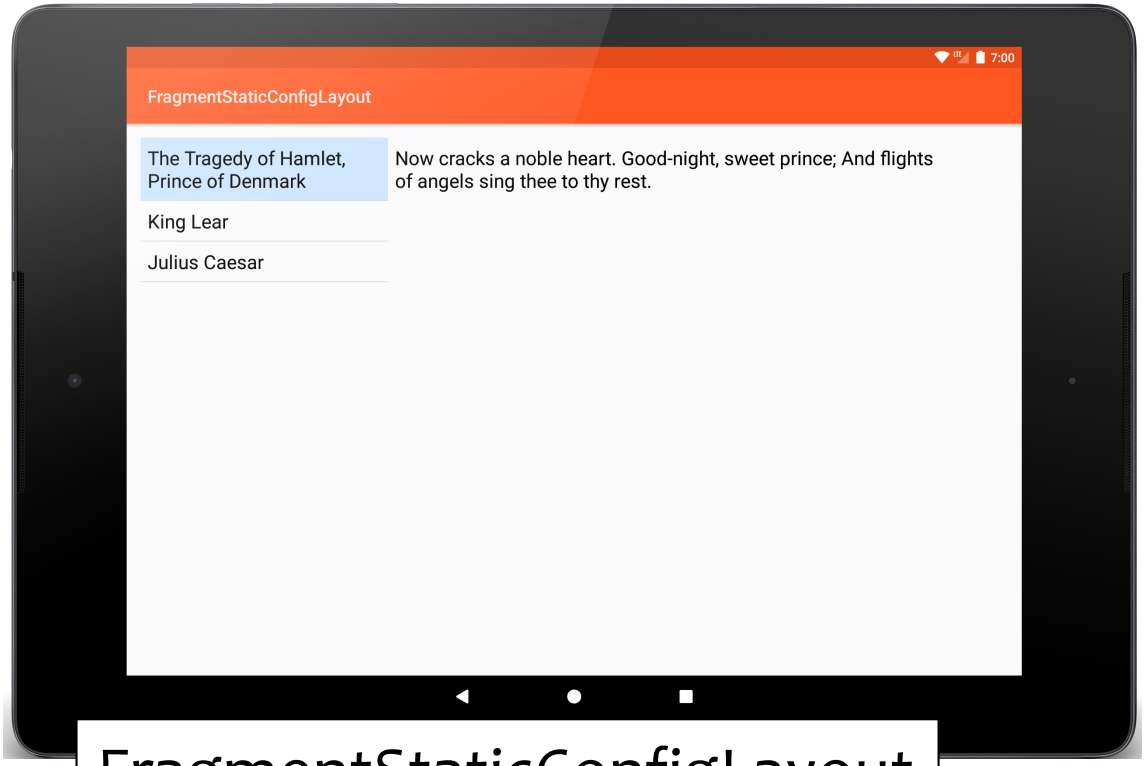
TitleFragment takes more horizontal space & allows long titles to span multiple lines

FragmentStaticConfigLayout

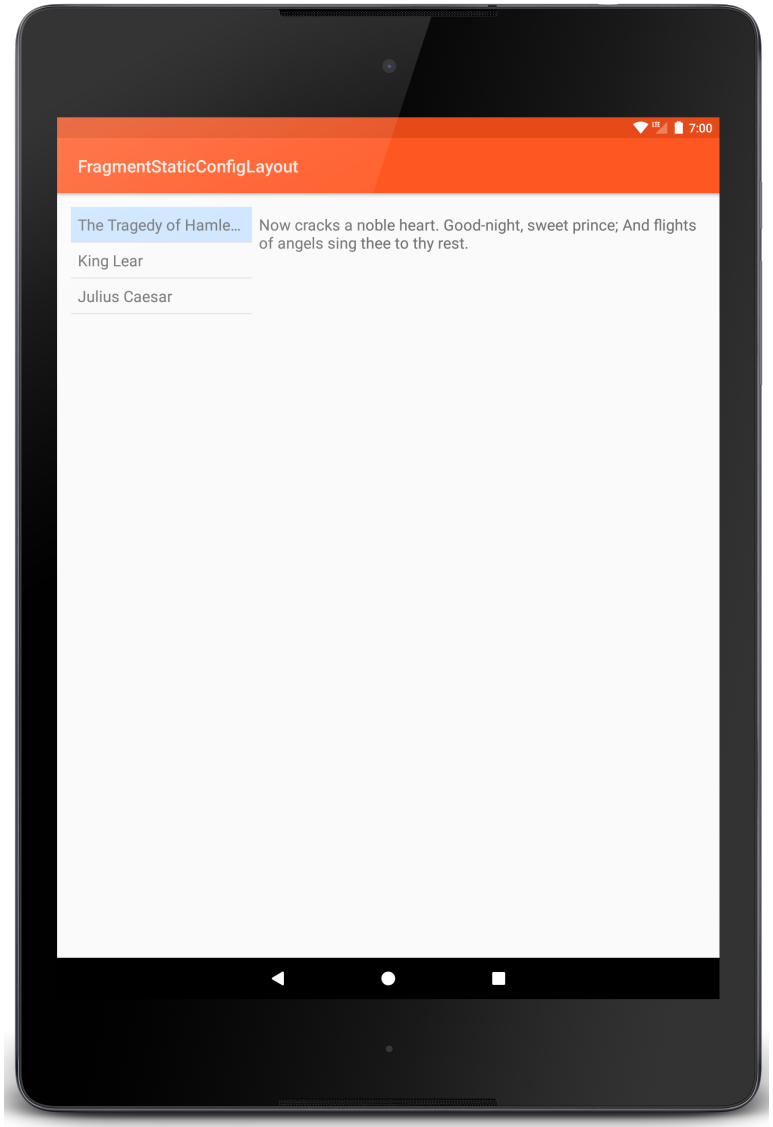
In portrait mode

Both Fragments use a smaller font

TitleFragment will use less space and will ellipsize long titles, limiting them to a single line



FragmentStaticConfigLayout



QuotesFragment.kt

```
class QuotesFragment : Fragment() {
    …
    override fun onCreate(savedInstanceState: Bundle?) {
    …
    // Retain this Fragment across Activity reconfigurations
        retainInstance = true
    }
```

QuotesFragment.kt

```
// Set up some information about the mQuoteView TextView
override fun onActivityCreated(savedInstanceState: Bundle?) {
    ...
    mQuoteView = activity!!.findViewById(R.id.quoteView)
    mQuoteArrayLen = QuoteViewerActivity.mQuoteArray.size

    showQuoteAtIndex(mCurrIdx)

}
```

Next

User Interface classes

Example Applications

FragmentQuoteViewerWithActivity

FragmentStaticLayout

FragmentProgrammaticLayout

FragmentDynamicLayout

FragmentStaticConfigLayout