twitch.tv/dancojocar
youtube.com/dancojocar

Lecture #3
Navigation and Rest Resources

Mobile Applications 2022-2023

REST using Retrofit

Retrofit

A type-safe **HTTP client** for Android and Java

Introduction

Retrofit turns your HTTP API into a Java interface.

```
public interface GitHubService {
  @GET("users/{user}/repos")
  Call<List<Repo>> listRepos(@Path("user") String user);
}
```

The `Retrofit` class generates an implementation of the `GitHubService` interface.

```
Retrofit retrofit = new Retrofit.Builder()
    .baseUrl("https://api.github.com/")
    .build();

GitHubService service = retrofit.create(GitHubService.class);
```

Each `Call` from the created `GitHubService` can make a synchronous or asynchronous HTTP request to the remote webserver.

```
Call<List<Repo>> repos = service.listRepos("octocat");
```

Use annotations to describe the HTTP request:

- URL parameter replacement and query parameter support
- Object conversion to request body (e.g., JSON, protocol buffers)
- Multipart request body and file upload

https://square.github.io/retrofit/

REST using Retrofit

```
compile "com.squareup.retrofit2:retrofit:2.9.0"
compile "com.squareup.retrofit2:adapter-rxjava2:2.9.0"
compile "com.squareup.retrofit2:converter-gson:2.9.0"

compile “io.reactivex.rxjava2:rxandroid:2.0.1"
```

https://square.github.io/retrofit/

REST using Retrofit

```
compile "com.squareup.retrofit2:retrofit:2.9.0"
compile "com.squareup.retrofit2:adapter-rxjava2:2.9.0"
compile "com.squareup.retrofit2:converter-gson:2.9.0"

compile “io.reactivex.rxjava2:rxandroid:2.0.1"
```

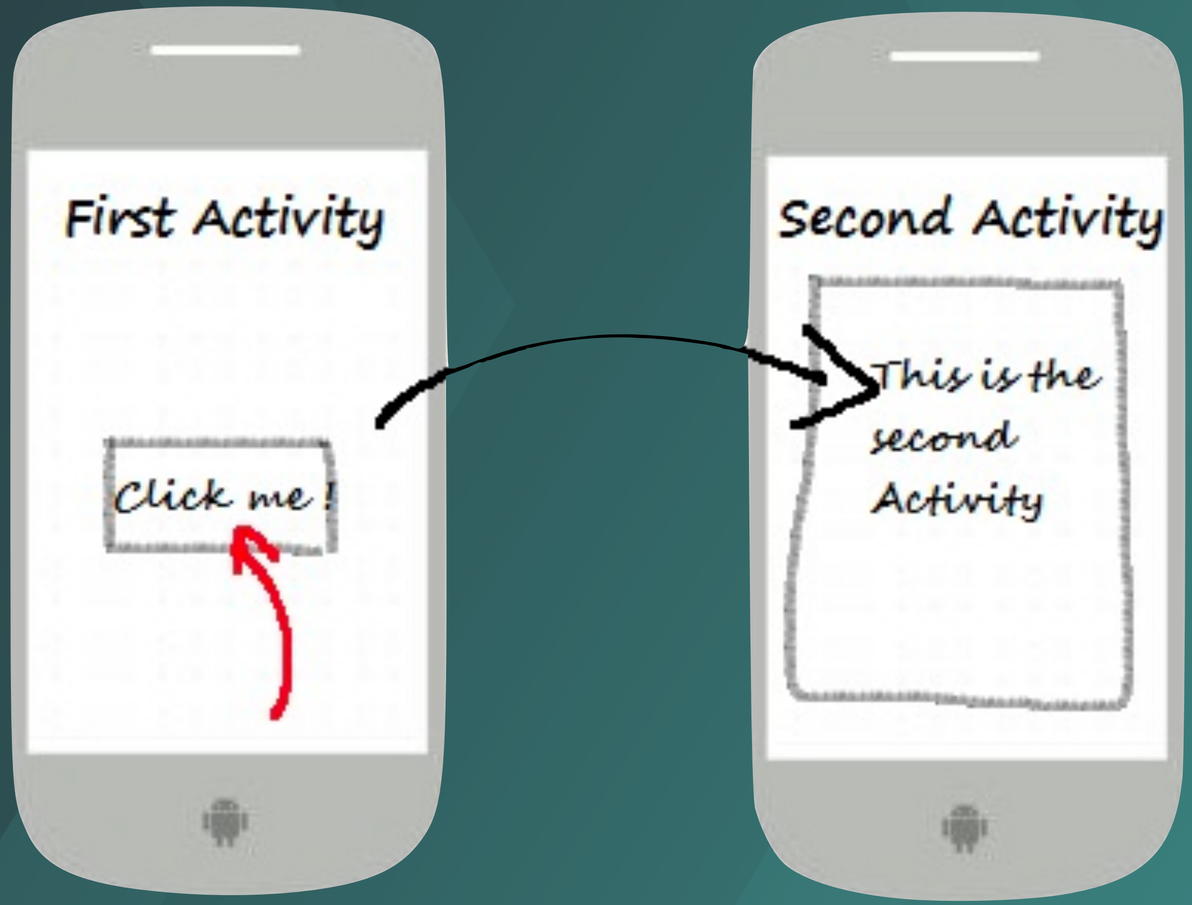
https://square.github.io/retrofit/

REST using Retrofit


```
interface MovieService {

  @GET("movies")
  val movies: Observable<List<Movie>>

  @GET("genres")
  val genres: Observable<List<String>>

  @GET("moviesByGenre/{genre}")
  fun moviesByGenre(@Path("genre") genre: String)
      : Observable<List<Movie>>

  @GET("details/{id}")
  fun details(@Path("id") id: Int): Observable<Movie>

  @POST("updateDescription")
  fun updateDescription(@Body movie: Movie): Observable<Movie>

  @POST("updateRating")
  fun updateRating(@Body movie: Movie): Observable<Movie>

  @POST("update")
  fun update(@Body movie: Movie): Observable<Movie>

  @DELETE("delete/{id}")
  fun delete(@Path("id") id: Int): Observable<ResponseBody>

  @POST("add")
  fun add(@Body movie: Movie): Observable<Movie>

  companion object {
    const val SERVICE_ENDPOINT = “http://SERVER_IP:2022”
  }
}
```

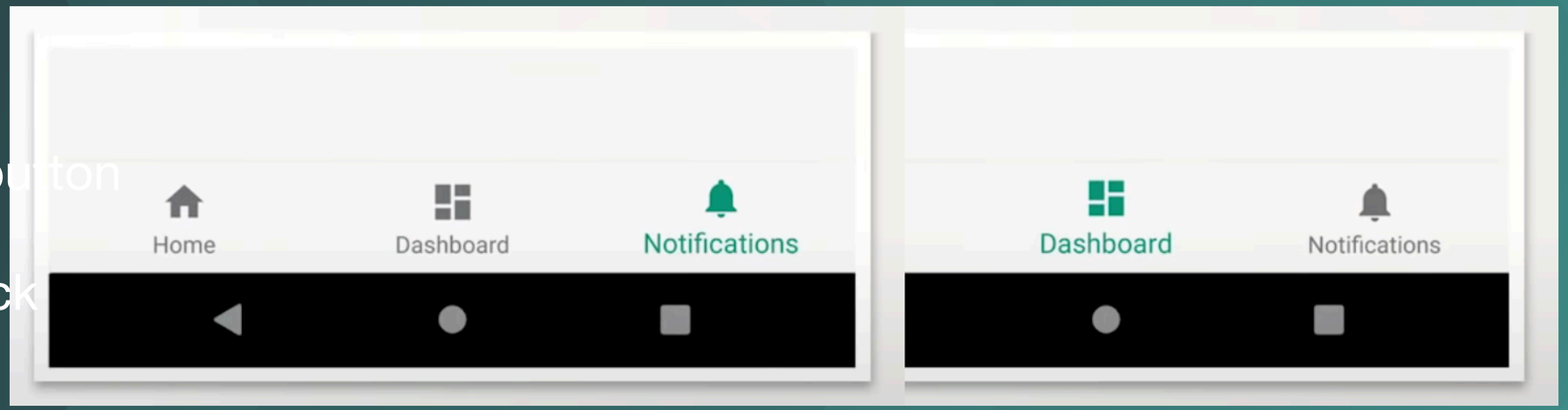
https://square.github.io/retrofit/

Navigation


First Activity
Click me!
Second Activity
This is the second Activity

Navigation

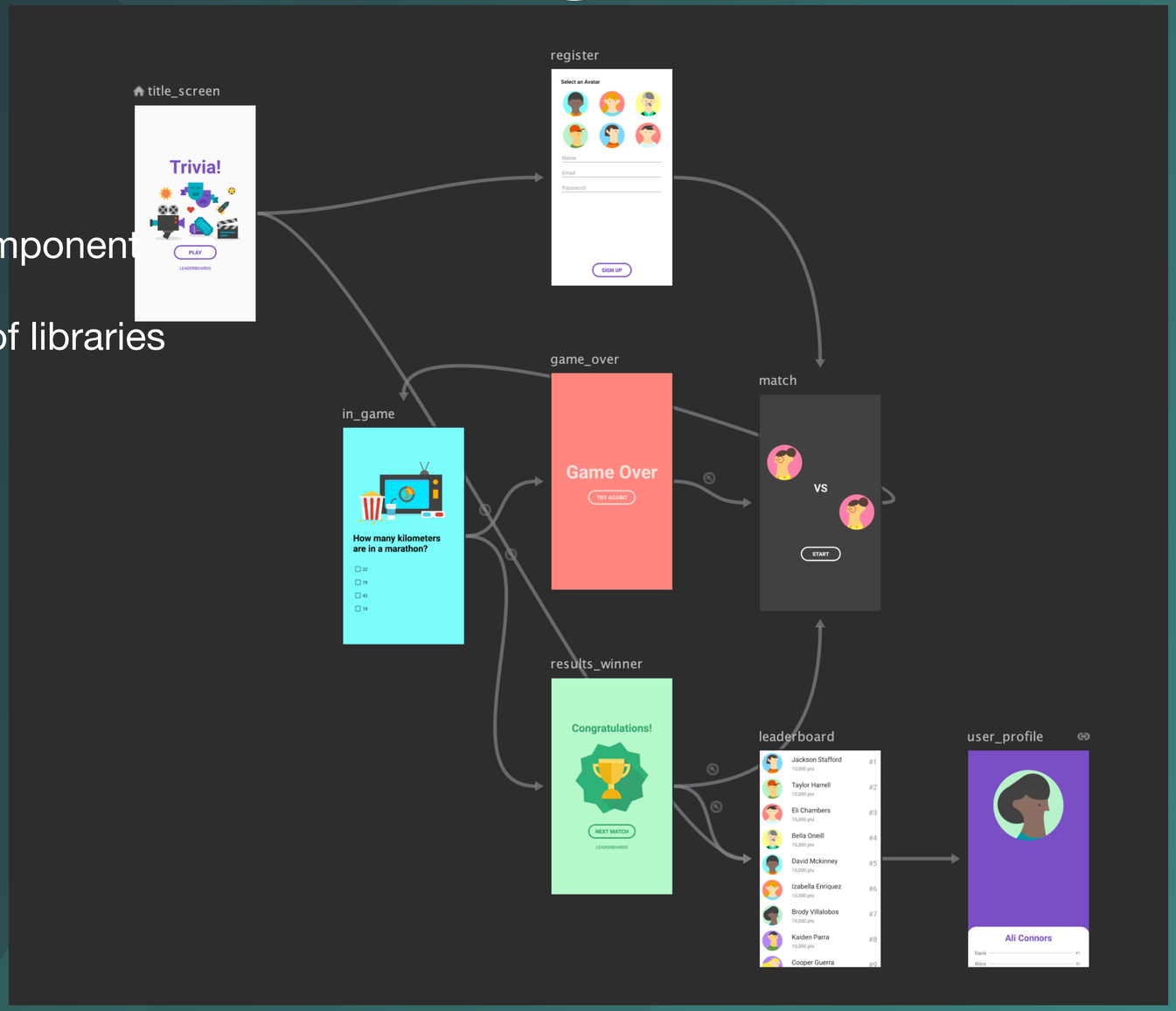
- Correctly
- Highlight the correct button
- Handles the back-stack



Navigation

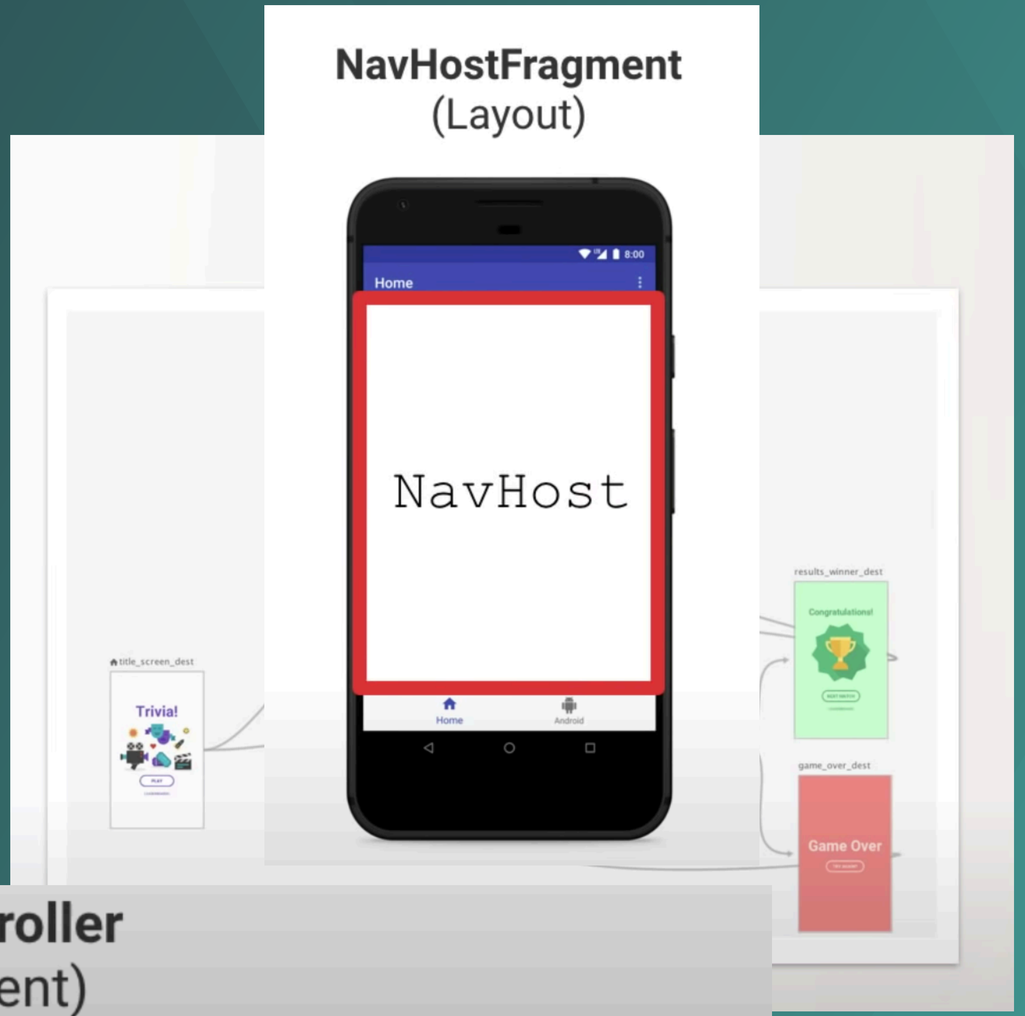
Navigation Component

- A collection of libraries
- A plugin
- Tooling



Navigation

- Navigation Graph
- NavHostFragment
- NavController



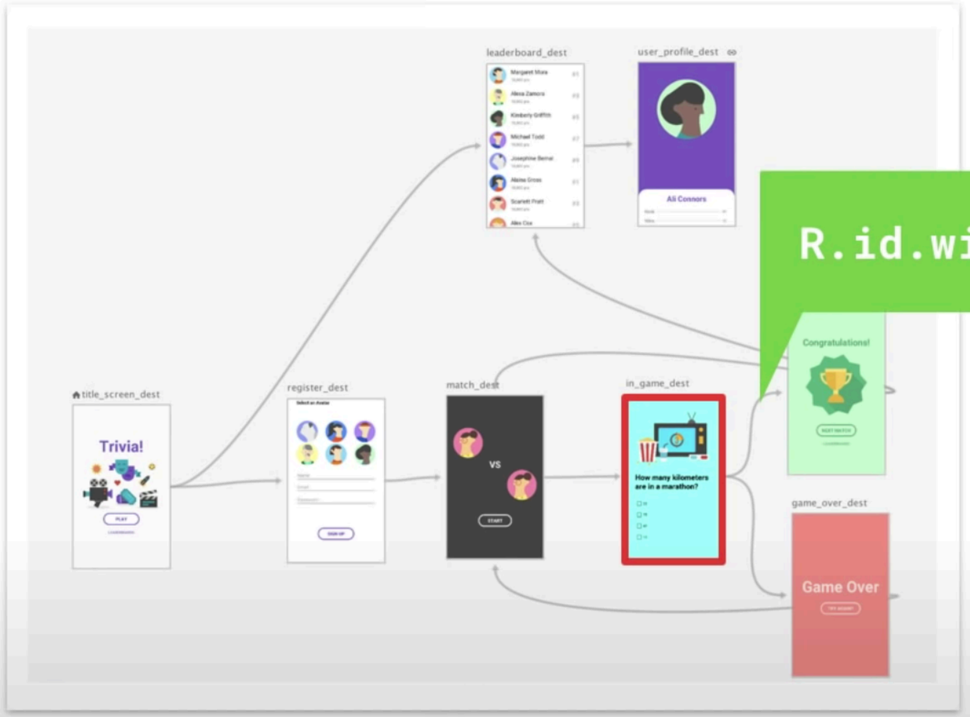
NavController
(Fragment)

```
findNavController().navigate(<Destination or Action id>)
```

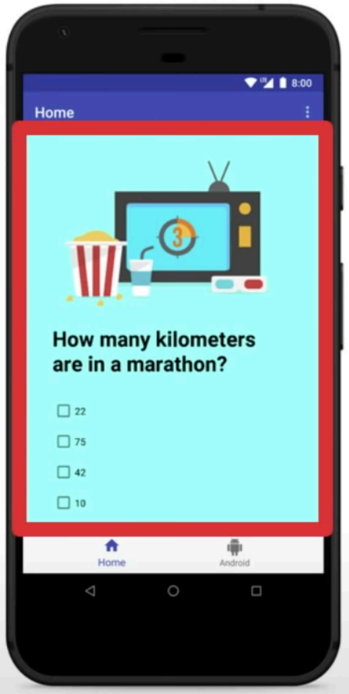
Navigation

DEMO

Navigation Graph
(New Resource)



NavHostFragment
(Layout)



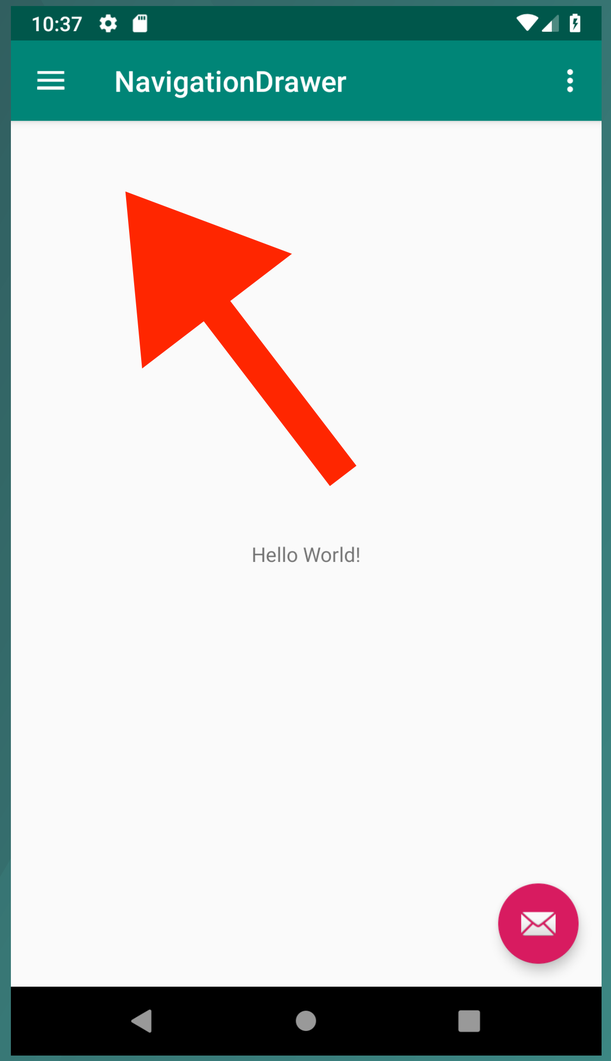
NavController
(Fragment)

```
findNavController().navigate(R.id.win_action)
```

https://developer.android.com/guide/navigation

Navigation Drawer

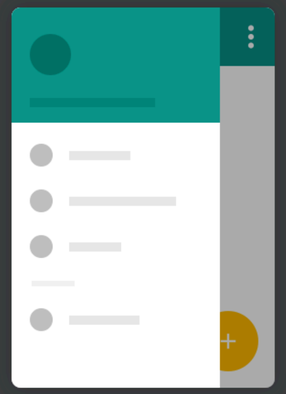
- App main navigation menu.
- Hidden when not in use.
- Appears:
  - with a left swipe from the screen edge
  - when the user touches the drawer icon in the app bar



https://developer.android.com/training/implementing-navigation/nav-drawer

Create New Project

Configure Your Project



Navigation Drawer Activity

Creates a new Activity with a Navigation Drawer

Name

My Application

Package name

ro.cojocar.myapplication

Save location

/Users/dan/work/school/ma/lectures/3/MyApplication

Language

Kotlin

Minimum SDK

API 29: Android 10.0 (Q)

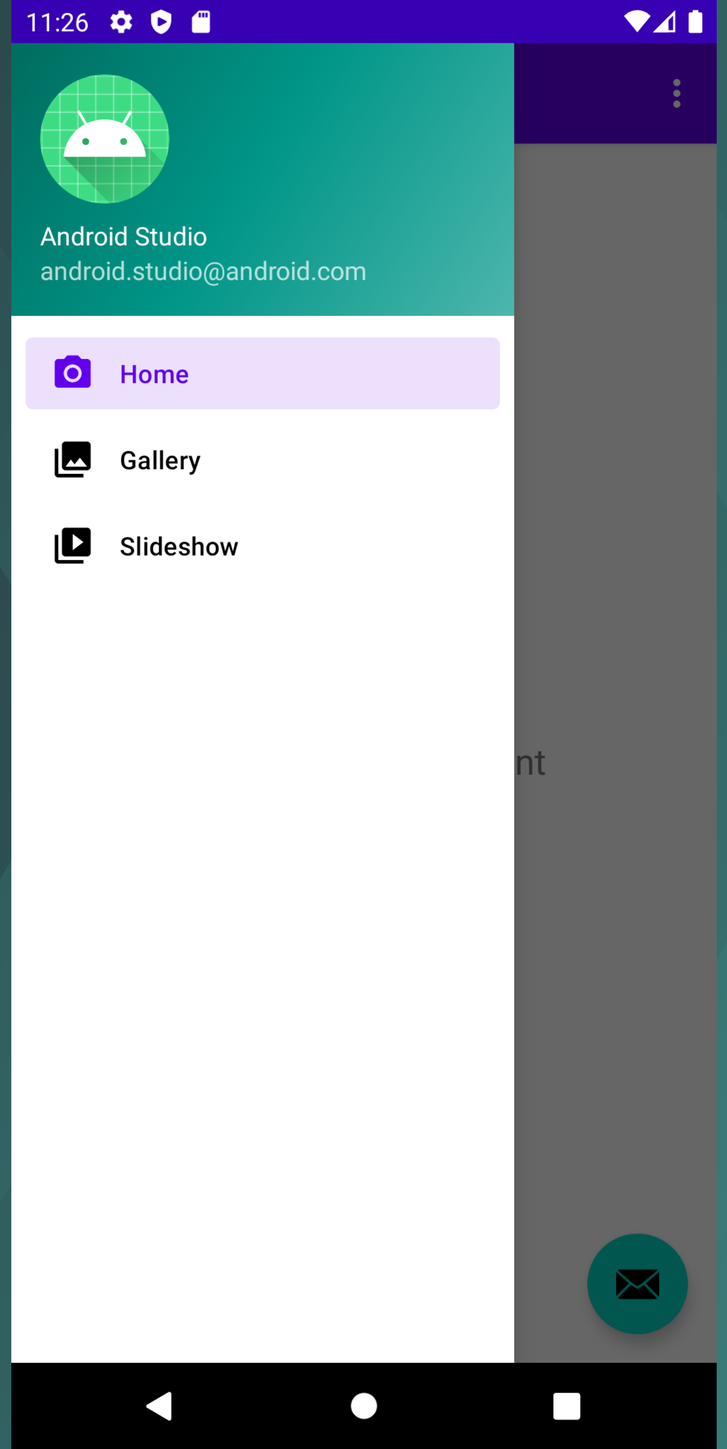
Your app will run on approximately 8.2% of devices.
Help me choose

Use legacy android.support libraries

Cancel | Previous | Next | Finish

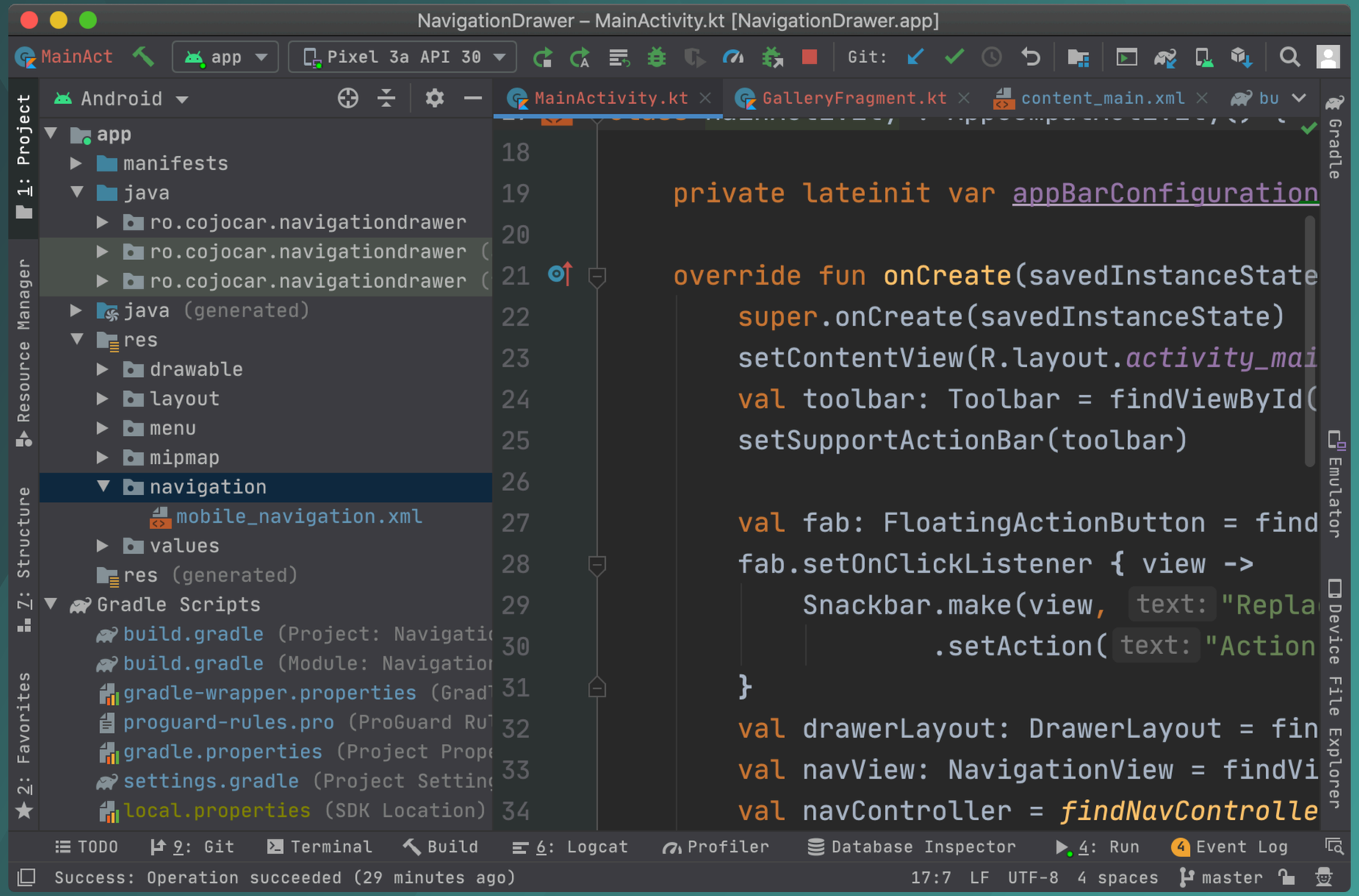
Gallery...

Android TV Activity (Requires
Android Things Empty Activity
Android Things Peripheral Acti
Basic Activity
Blank Wear Activity (Requires
Bottom Navigation Activity
Empty Activity
Fragment + ViewModel
Fullscreen Activity
Login Activity
Master/Detail Flow
Navigation Drawer Activity
Scrolling Activity
Settings Activity
Tabbed Activity



Generated Artifacts

- Sources
- Layouts
- Menus
- Navigation



Dependencies

```
buildscript {
   ext.nav_version = “2.5.3”
}
…
dependencies {
  implementation "androidx.navigation:navigation-fragment-ktx:$nav_version"
  implementation "androidx.navigation:navigation-ui-ktx:$nav_version"
}
```

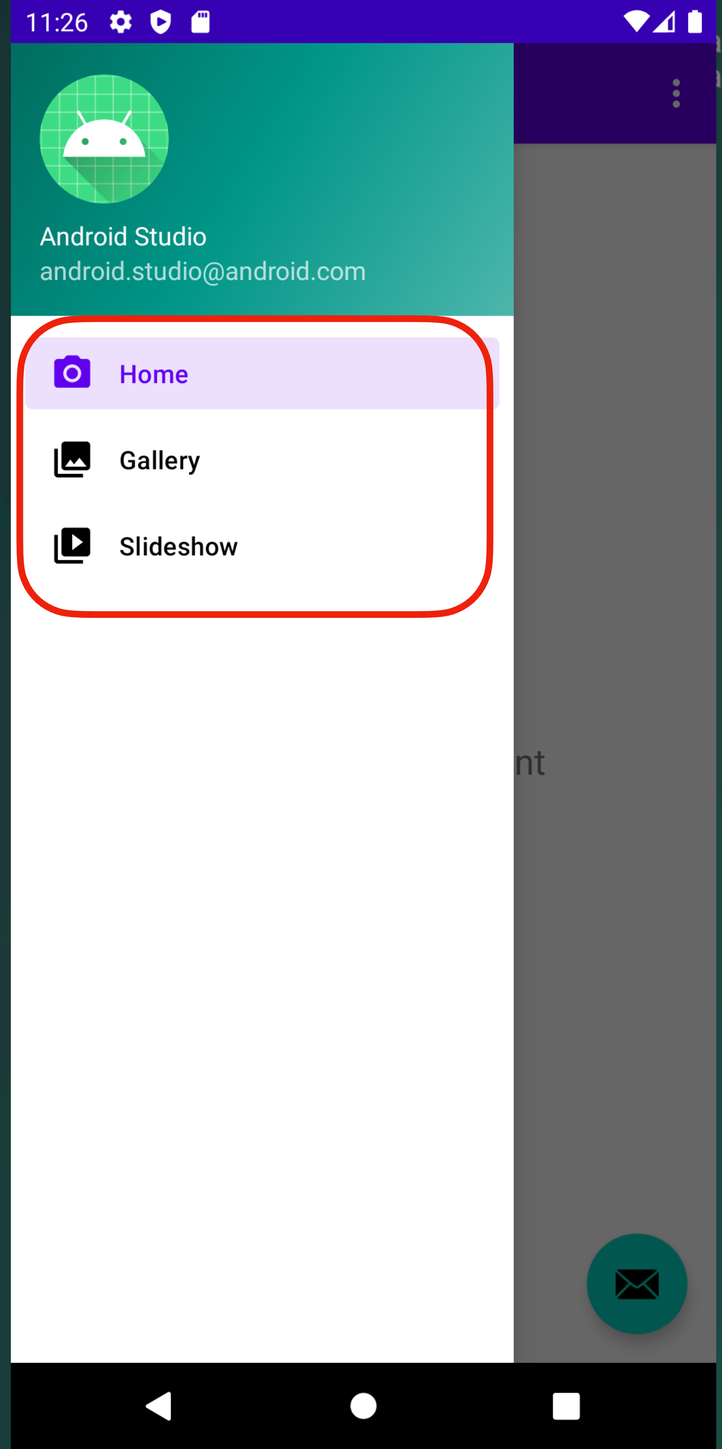
Add a drawer to a layout

```
<?xml version="1.0" encoding="utf-8"?>
<androidx.drawerlayout.widget.DrawerLayout
 xmlns:android="http://schemas.android.com/apk/res/android"
 xmlns:app="http://schemas.android.com/apk/res-auto"
 xmlns:tools="http://schemas.android.com/tools"
 android:id="@+id/drawer_layout"
 android:layout_width="match_parent"
 android:layout_height="match_parent"
 android:fitsSystemWindows="true"
 tools:openDrawer="start">
 <include
   layout="@layout/app_bar_main"
   android:layout_width="match_parent"
   android:layout_height="match_parent" />
 <com.google.android.material.navigation.NavigationView
   android:id="@+id/nav_view"
   android:layout_width="wrap_content"
   android:layout_height="match_parent"
   android:layout_gravity="start"
   android:fitsSystemWindows="true"
   app:headerLayout="@layout/nav_header_main"
   app:menu="@menu/activity_main_drawer" />
</androidx.drawerlayout.widget.DrawerLayout>
```

Declare the menu items

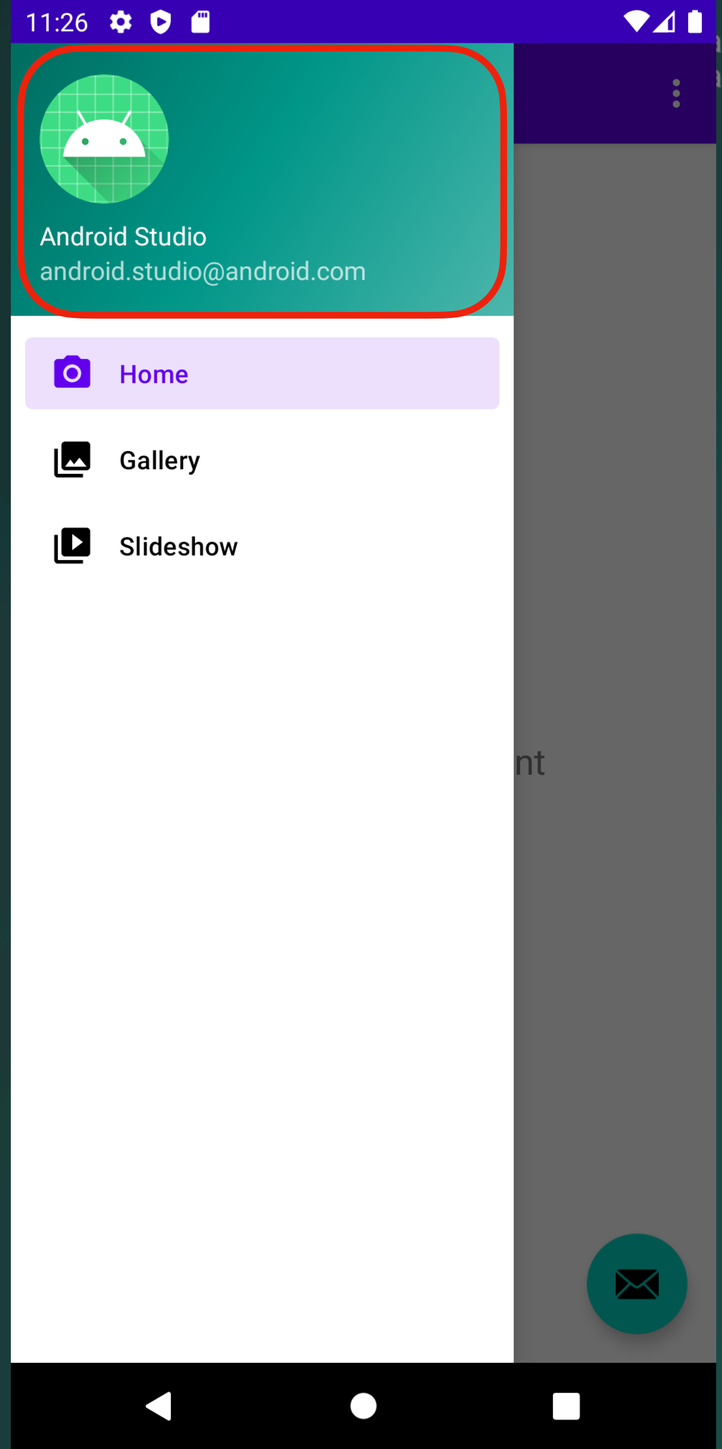
```
<?xml version="1.0" encoding="utf-8"?>
<menu xmlns:android="http://schemas.android.com/apk/res/android">
  <group android:checkableBehavior="single">
    <item
      android:id="@+id/nav_home"
      android:icon="@drawable/ic_menu_camera"
      android:title="@string/home" />
    <item
      android:id="@+id/nav_gallery"
      android:icon="@drawable/ic_menu_gallery"
      android:title="@string/gallery" />
    <item
      android:id="@+id/nav_slideshow"
      android:icon="@drawable/ic_menu_slideshow"
      android:title="@string/slideshow" />
    ...
  </group>
</menu>
```

```
<android.support.design.widget.NavigationView
    android:id="@+id/nav_view"
    android:layout_width="wrap_content"
    android:layout_height="match_parent"
    android:layout_gravity="start"
    android:fitsSystemWindows="true"
    app:menu="@menu/activity_main_drawer" />
```



Add a header to the nav drawer

```
<?xml version="1.0" encoding="utf-8"?>
<android.support.design.widget.NavigationView
    android:id="@+id/nav_view"
    android:layout_width="wrap_content"
    android:layout_height="match_parent"
    android:layout_gravity="start"
    android:fitsSystemWindows="true"
    app:menu="@menu/activity_main_drawer" />
    app:headerLayout="@layout/nav_header_main" />
        <LinearLayout
            xmlns:android="http://schemas.android.com/apk/res/android"
            android:layout_width="match_parent"
            android:layout_height="192dp"
            android:background="?attr/colorPrimaryDark"
            android:padding="16dp"
            android:theme="@style/ThemeOverlay.AppCompat.Dark"
            android:orientation="vertical"
            android:gravity="bottom">

            <TextView
                android:layout_width="match_parent"
                android:layout_height="wrap_content"
                android:text="My header title"
                android:textAppearance=
                  "@style/TextAppearance.AppCompat.Body1"/>
        </LinearLayout>
```



Handle navigation events

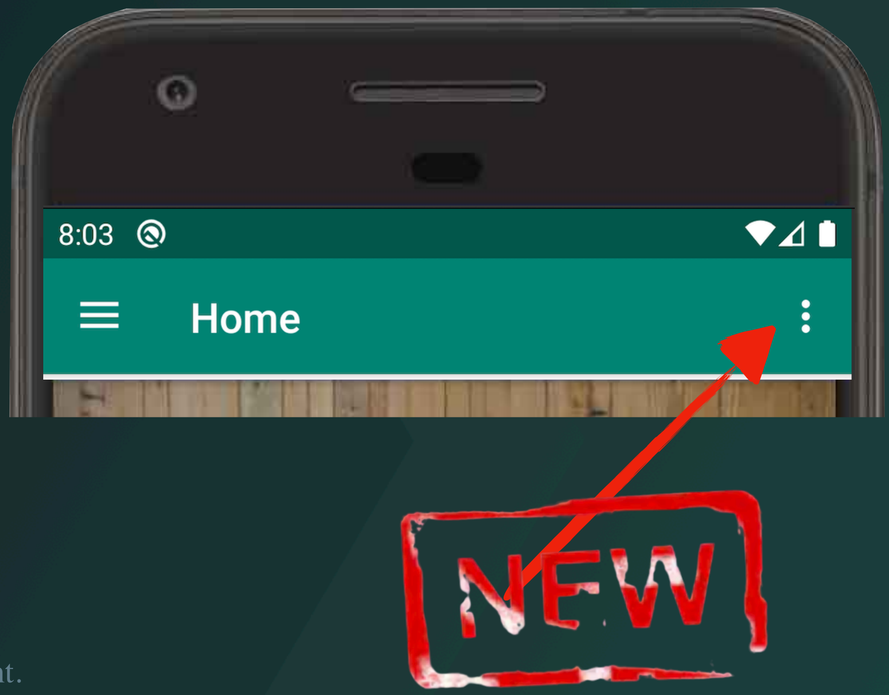
```
class MainActivity : AppCompatActivity() {

 private lateinit var appBarConfiguration: AppBarConfiguration

 override fun onCreate(savedInstanceState: Bundle?) {
  super.onCreate(savedInstanceState)
  setContentView(R.layout.activity_main)
  setSupportActionBar(toolbar)

  val navController = findNavController(R.id.nav_host_fragment)

  appBarConfiguration = AppBarConfiguration(
      setOf(
          R.id.nav_home,
          R.id.nav_gallery
      ), drawer_layout
  )
  setupActionBarWithNavController(navController, appBarConfiguration)
  nav_view.setupWithNavController(navController)
 }
}
```

Add a toolbar

OLD

```
<?xml version="1.0" encoding="utf-8"?>
<androidx.coordinatorlayout.widget.CoordinatorLayout
 xmlns:android="http://schemas.android.com/apk/res/android"
 xmlns:app="http://schemas.android.com/apk/res-auto"
 xmlns:tools="http://schemas.android.com/tools"
 android:layout_width="match_parent"
 android:layout_height="match_parent"
 tools:context=".MainActivity">

 <com.google.android.material.appbar.AppBarLayout
  android:layout_width="match_parent"
  android:layout_height="wrap_text"
  android:theme="@style/AppTheme.AppBarOverlay">

  <androidx.appcompat.widget.Toolbar
   android:id="@+id/toolbar"
   android:layout_width="match_parent"
   android:layout_height="?attr/actionBarSize"
   android:background="?attr/colorPrimary"
   app:popupTheme="@style/AppTheme.PopupOverlay" />

 </com.google.android.material.appbar.AppBarLayout>
```

```
class MainActivity : AppCompatActivity() {

    override fun onCreate(
        savedInstanceState: Bundle?) {
        ...
        setSupportActionBar(toolbar)
        ...
    }
}
```



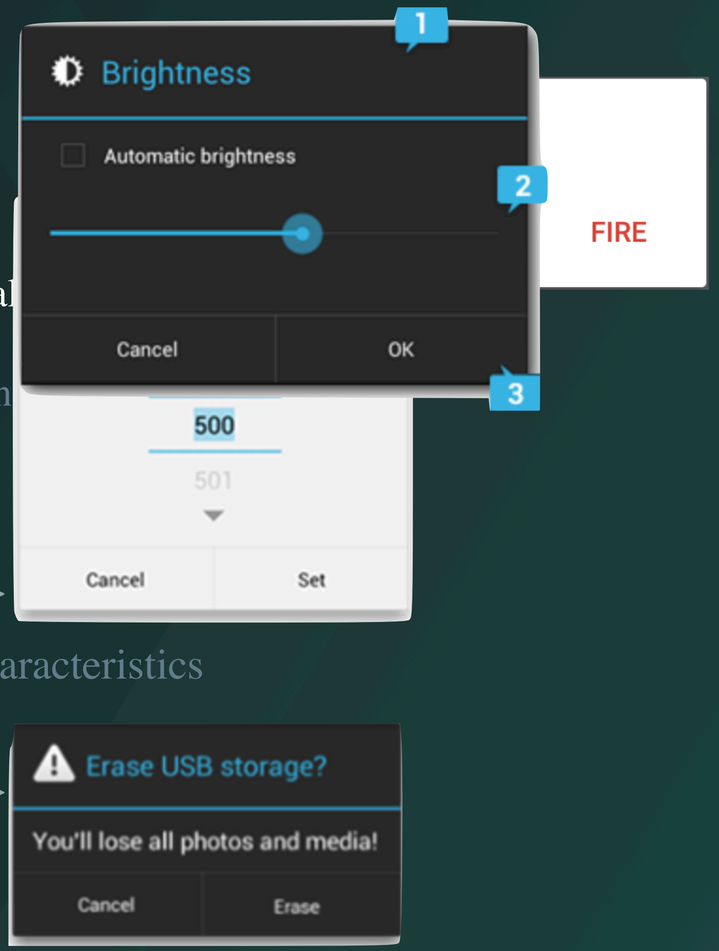
Other State Changes


```
drawer_layout.addDrawerListener(
  object : DrawerLayout.DrawerListener {
    override fun onDrawerSlide(drawerView: View, slideOffset: Float) {
      // Respond when the drawer's position changes
    }

    override fun onDrawerOpened(drawerView: View) {
      // Respond when the drawer is opened
    }

    override fun onDrawerClosed(drawerView: View) {
      // Respond when the drawer is closed
    }

    override fun onDrawerStateChanged(newState: Int) {
      // Respond when the drawer motion state changes
    }
  }
)
```

Dialogs

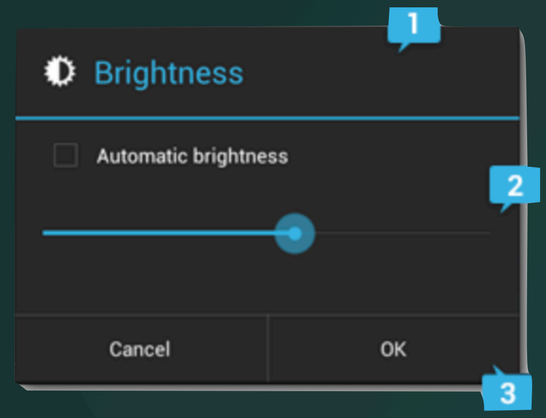
```
class FireMissilesDialogFragment : DialogFragment() {

    override fun onCreateDialog(savedInstanceState: Bundle): Dial
        return activity?.let {
            // Use the Builder class for convenient dialog construction
            val builder = AlertDialog.Builder(it)
            builder.setMessage(R.string.dialog_fire_missiles)
                    .setPositiveButton(R.string.fire,
                            DialogInterface.OnClickListener { dialog, id ->
                                // FIRE ZE MISSILES!
                            })
                    .setNegativeButton(R.string.cancel,
                            DialogInterface.OnClickListener { dialog, id ->
                                // User cancelled the dialog
                            })
            // Create the AlertDialog object and return it
            builder.create()
        } ?: throw IllegalStateException("Activity cannot be null")
    }
}
```

- Small window
- Prompts the user to take a decision.
- Modal, by default.



https://developer.android.com/guide/topics/ui/dialogs

Adding actions

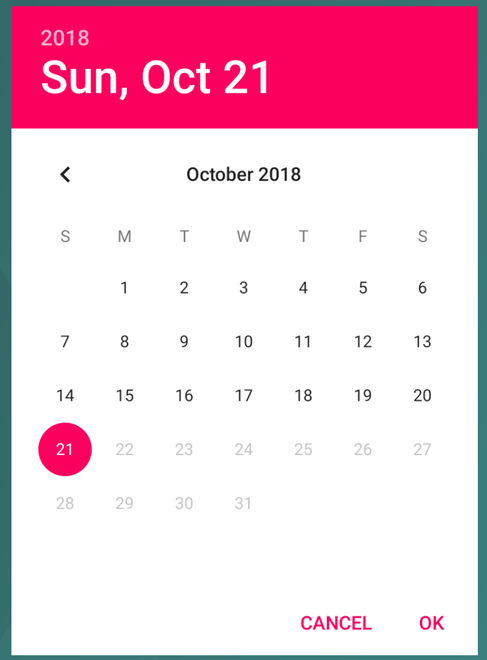



```
val alertDialog: AlertDialog? = activity?.let {
    val builder = AlertDialog.Builder(it)
    builder.apply {
        setPositiveButton(R.string.ok,
                DialogInterface.OnClickListener { dialog, id ->
                    // User clicked OK button
                })
        setNegativeButton(R.string.cancel,
                DialogInterface.OnClickListener { dialog, id ->
                    // User cancelled the dialog
                })
    }
    // Set other dialog properties
    ...

    // Create the AlertDialog
    builder.create()
}
```

https://developer.android.com/guide/topics/ui/dialogs

Using Anko

```
alert {
    isCancelable = false
    lateinit var datePicker: DatePicker
    customView {
        verticalLayout {
            datePicker = datePicker {
                maxDate = System.currentTimeMillis()
            }
        }
    }
    yesButton {
        val parsedDate =
          "${datePicker.dayOfMonth}/${datePicker.month + 1}/${datePicker.year}"
        toast("Selected date: $parsedDate")
    }
    noButton { }
}.show()
```

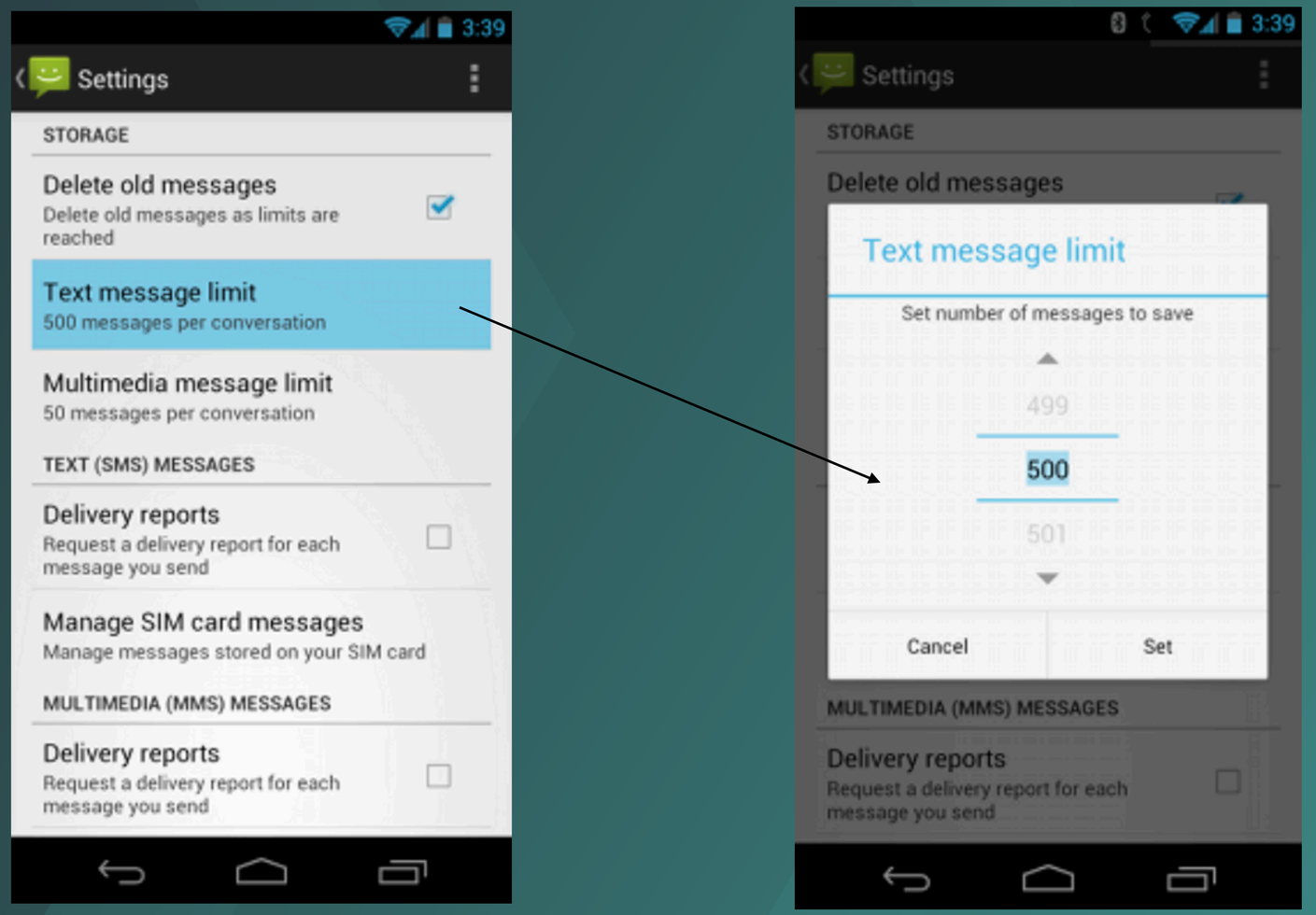


https://github.com/Kotlin/anko/wiki/Anko-Commons---Dialogs

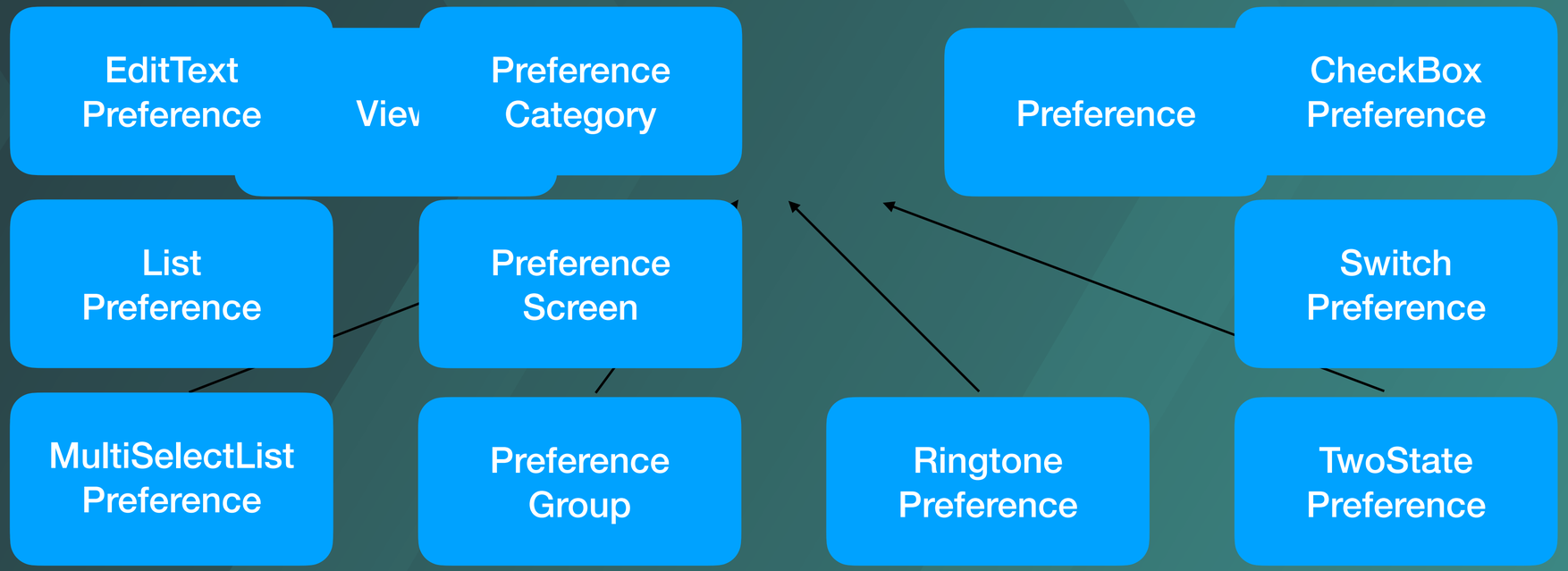
Jetpack Compose

```
AlertDialog(
  onDismissRequest = {
    // Dismiss the dialog when the user clicks outside the dialog or on the back
    // button. If you want to disable that functionality, simply use an empty
    // onCloseRequest.
    openDialog.value = false
  },
  title = { Text(text = "Dialog Title")},
  text = { Text("Here is a text ")},
  confirmButton = {
    Button(
      onClick = { openDialog.value = false }
    ) { Text("This is the Confirm Button")  }
  },
  dismissButton = {
    Button(
      onClick = { openDialog.value = false }
    ) { Text("This is the dismiss Button") }
  }
)
```

Preferences

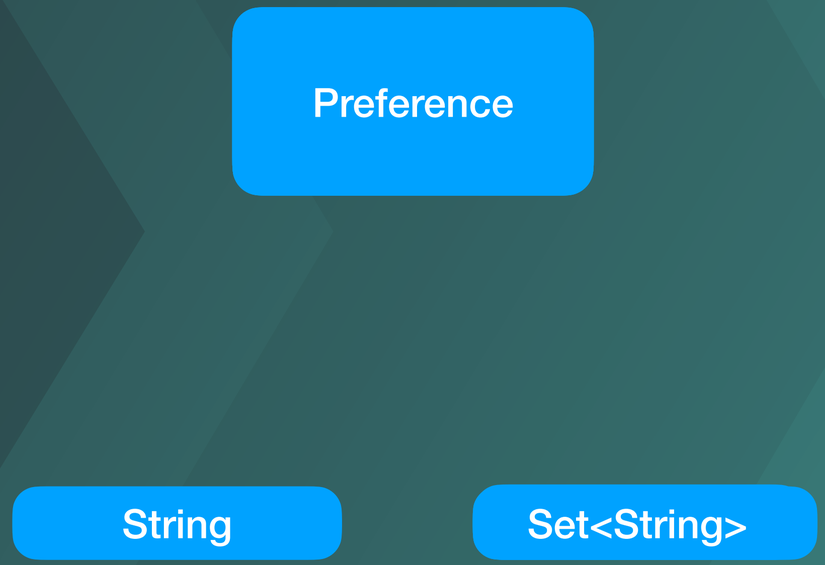


Preferences



https://developer.android.com/reference/android/preference/Preference

Preferences

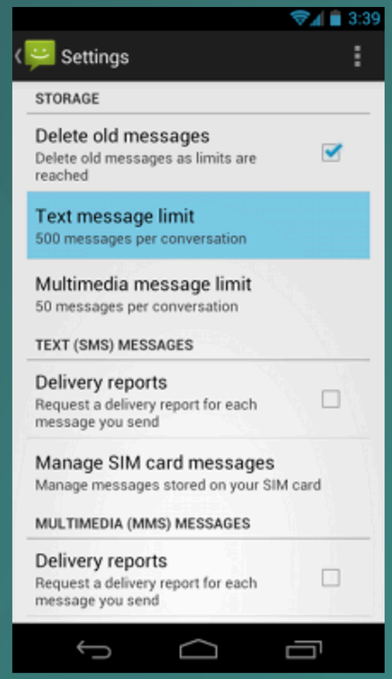


PreferenceScreen

DEMO

```
<?xml version="1.0" encoding="utf-8"?>
<PreferenceScreen
  xmlns:android="http://schemas.android.com/apk/res/android">
   <CheckBoxPreference
      android:key="pref_sync"
      android:title="@string/pref_sync"
      android:summary="@string/pref_sync_summ"
      android:defaultValue="true" />
      <ListPreference
      android:dependency="pref_sync"
      android:key="pref_syncConnectionType"
      android:title="@string/pref_syncConnectionType"
      android:dialogTitle="@string/pref_syncConnectionType"
      android:entries="@array/pref_syncConnectionTypes_entries"
      android:entryValues="@array/pref_syncConnectionTypes_values"
      android:defaultValue="@string/pref_syncConnectionTypes_default" />
  </PreferenceScreen>
```

```
class SettingsActivity : PreferenceActivity() {
    override fun onCreate(savedInstanceState: Bundle) {
        super.onCreate(savedInstanceState)
        addPreferencesFromResource(R.xml.preferences)
    }
}
```



Jetpack DataStore

Feature	SharedPreferences	Preferences DataStore	Proto DataStore
Async API	✅ (only for reading changed values, via listener)	✅ (via `Flow`)	✅ (via `Flow`)
Synchronous API	✅ (but not safe to call on UI thread)	❌	❌
Safe to call on UI thread	❌*	✅ (work is moved to `Dispatchers.IO` under the hood)	✅ (work is moved to `Dispatchers.IO` under the hood)
Can signal errors	❌	✅	✅
Safe from runtime exceptions	❌**	✅	✅
Has a transactional API with strong consistency guarantees	❌	✅	✅
Handles data migration	❌	✅ (from SharedPreferences)	✅ (from SharedPreferences)
Type safety	❌	❌	✅ with Protocol Buffers

Using DataStore

```
// Preferences DataStore
implementation "androidx.datastore:datastore-preferences:1.0.0"
```

Create the DataStore

```
// with Preferences DataStore
val dataStore: DataStore<Preferences> = context.createDataStore(
    name = "settings"
)
```

Read Data

```
val MY_COUNTER = preferencesKey<Int>("my_counter")
val myCounterFlow: Flow<Int> = dataStore.data
     .map { currentPreferences ->
      currentPreferences[MY_COUNTER] ?: 0
   }
```

Using DataStore

Write Data

```
suspend fun incrementCounter() {
    dataStore.edit { settings ->
        // We can safely increment our counter without losing data due to races!
        val currentCounterValue = settings[MY_COUNTER] ?: 0
        settings[MY_COUNTER] = currentCounterValue + 1
    }
}
```

Using DataStore

Write Data

```
suspend fun incrementCounter() {
    dataStore.edit { settings ->
        // We can safely increment our counter without losing data due to races!
        val currentCounterValue = settings[MY_COUNTER] ?: 0
        settings[MY_COUNTER] = currentCounterValue + 1
    }
}
```

Migrate from SharedPreferences

```
val dataStore: DataStore<Preferences> = context.createDataStore(
    name = "settings",
    migrations = listOf(SharedPreferencesMigration(context, "settings_preferences"))
)
```

https://developer.android.com/topic/libraries/architecture/datastore

Saving & Reading Local Files

- Internal storage
  - Internal cache files
- External storage
- Shared preferences
- Databases

https://developer.android.com/guide/topics/data

Internal Storage

- It's always available.
- Available only to your app.
- On uninstall everything is removed.

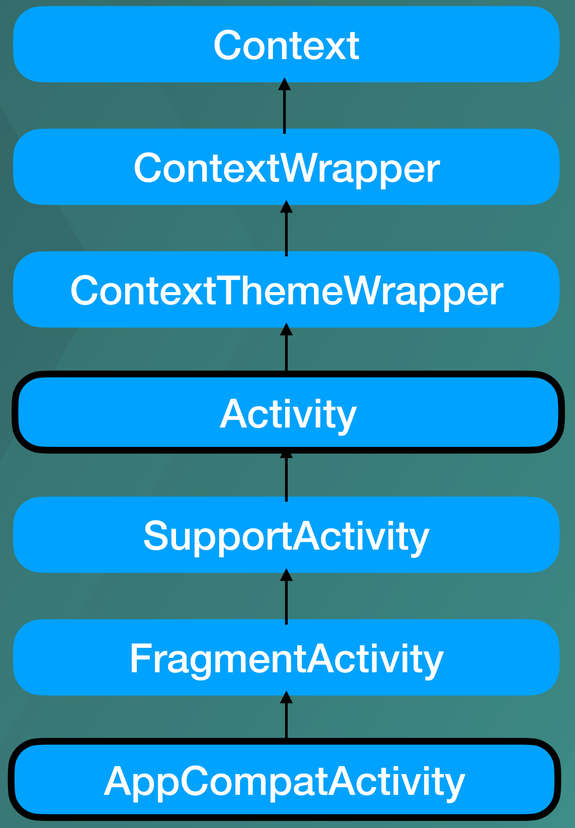
Neither the user nor other apps can access your files!

https://developer.android.com/guide/topics/data/data-storage#filesInternal

Internal Storage


```
val file = File(context.filesDir, filename)

val filename = "myfile"
val fileContents = "Hello world!"
context.openFileOutput(filename,
   Context.MODE_PRIVATE).use {
     it.write(fileContents.toByteArray())
}

private fun getTempFile(
    context: Context, url: String): File? =
 Uri.parse(url)?.lastPathSegment?.let { filename ->
    File.createTempFile(filename, null, context.cacheDir)
 }
```

```
public abstract class Context {
    ...
    public abstract File getFilesDir();
    ...
    public abstract File getCacheDir();
    ...
}
```



External Storage Permissions

```
<manifest ...>
    <uses-permission android:name=
      "android.permission.WRITE_EXTERNAL_STORAGE" />
    <uses-permission android:name=
      "android.permission.WRITE_EXTERNAL_STORAGE" />
    ...
</manifest>
```

< Android 4.4 (API level 19)


```
/* Checks if external storage is available for read and write */
fun isExternalStorageWritable(): Boolean {
    return Environment.getExternalStorageState() == Environment.MEDIA_MOUNTED
}
/* Checks if external storage is available to at least read */
fun isExternalStorageReadable(): Boolean {
    return Environment.getExternalStorageState() in
        setOf(Environment.MEDIA_MOUNTED, Environment.MEDIA_MOUNTED_READ_ONLY)
}
```

https://developer.android.com/training/data-storage/files#WriteInternalStorage

FileProvider

content://com.example.myapp.fileprovider/myimages/default_image.jpg

```
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.example.myapp">
    <application
        ...>
        <provider
            android:name="android.support.v4.content.FileProvider"
            android:authorities="com.example.myapp.fileprovider"
            android:grantUriPermissions="true"
            android:exported="false">
            <meta-data
                android:name="android.support.FILE_PROVIDER_PATHS"
                android:resource="@xml/filepaths" />
        </provider>
        ...
    </application>
</manifest>
```

```
<paths>
    <files-path path="images/" name="myimages" />
</paths>
```

https://developer.android.com/training/secure-file-sharing/setup-sharing

Lecture outcomes

- Navigate between screens/views.
- Use dialogs and pickers.
- Manage files & preferences.