



FAKULTÄT FÜR
INFORMATIK

Introduction to Software Engineering for Engineers

Introduction to Android Platform

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Overview:

- What is Android ?
- Android Architecture
 - Overview
 - Mobile Platform Characteristics
 - Application Components
 - Activity Lifecycle
- Android Developer Tools
 - Setting up Android Studio
 - Creating your first project
 - Code and File Structure

What is Android:

- Google's mobile platform
 - Open Source
 - Most popular and installed mobile OS
- Development Platform
 - Multiplatform
 - Previously based on Java (Kotlin alternative)
 - Android Studio

Platform Characteristics:

- A mobile OS with limited resources
 - limited memory and processing power
 - Battery life is very important
- Specific and restricted architectural decisions
 - Aggressively flushed memory when not in use
 - Background computation is extremely limited
- Unusual Device Characteristics
 - Small screen, typically focused on a single app
 - Gestural input

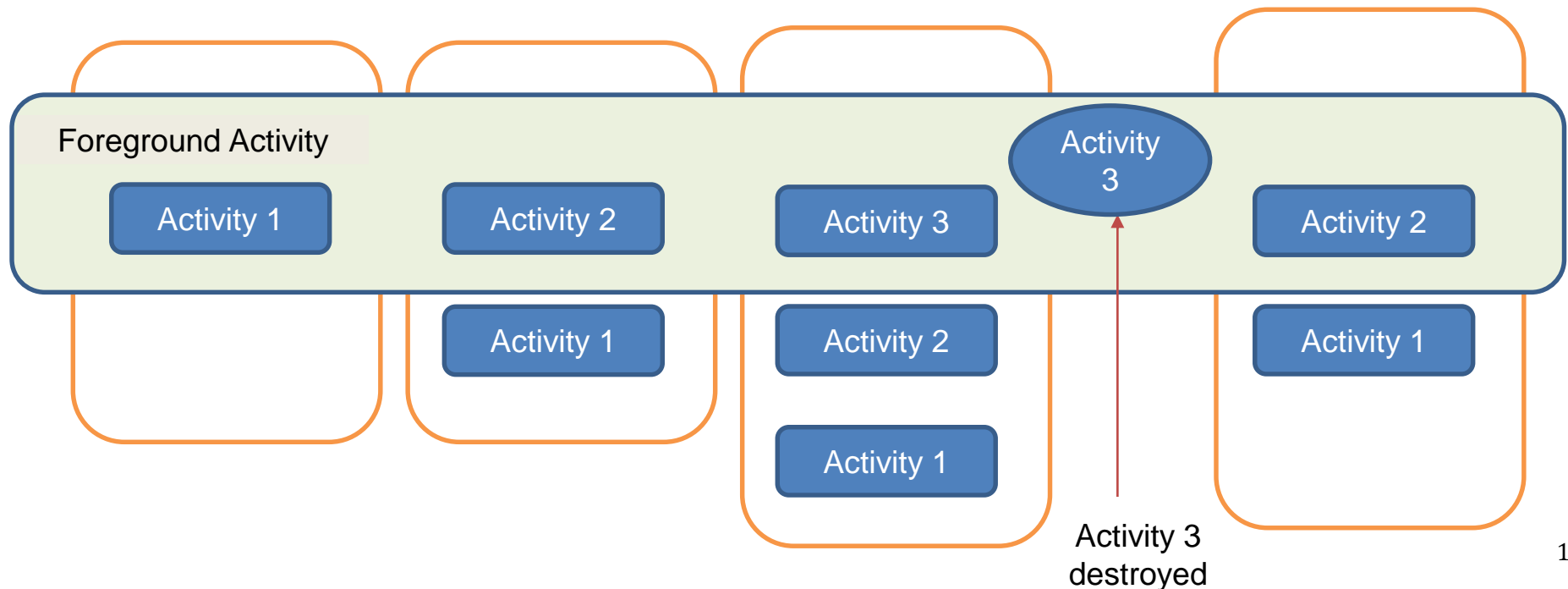
Application Components:

- Core building blocks for Android applications
- Applications can publish components for other applications to use
 - Use asynchronous message called **INTENT**.
 - Intents and components defined in a **MANIFEST** file.

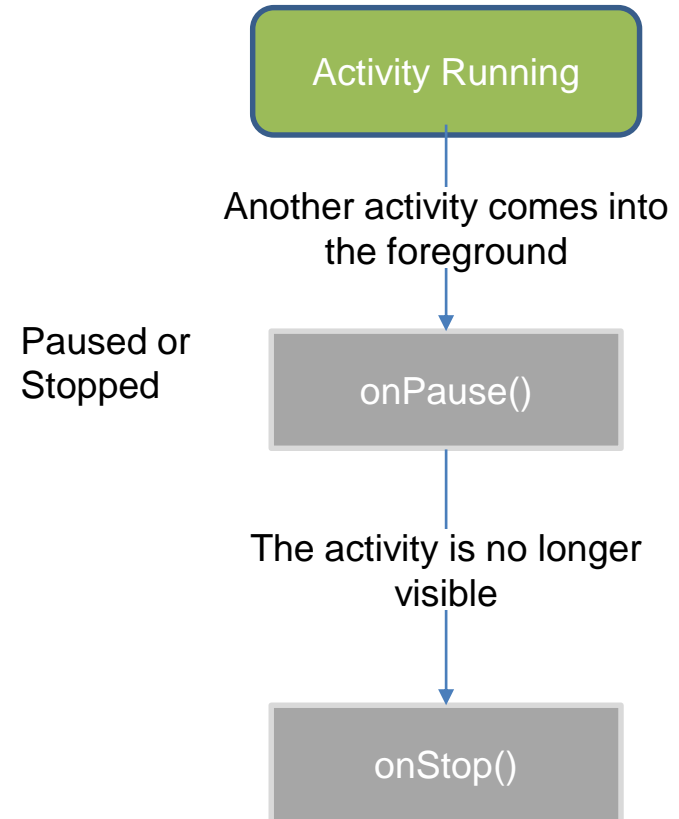
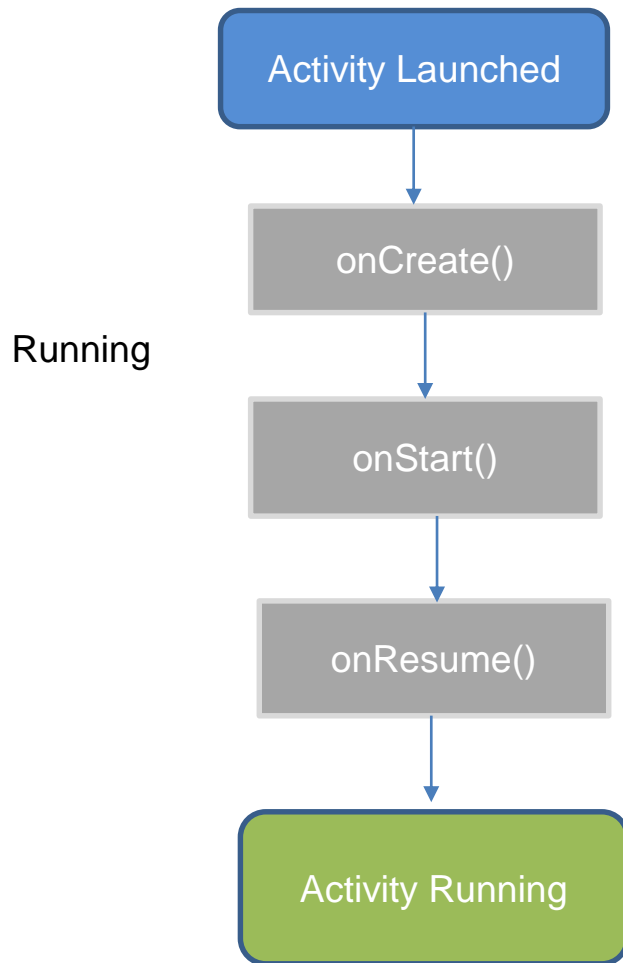
Component	Description
Activity	Single-screen of an application
Service	Long-running background application
Content Provider	Providers shared set of application data
Broadcast receiver	Responds to system broadcast events

Typical Activity Life-Cycle:

- Applications usually do contain multiple activities (screens) but one main activity which serves as entry point.
- Activities can create other activities
- Navigation triggered by user actions.



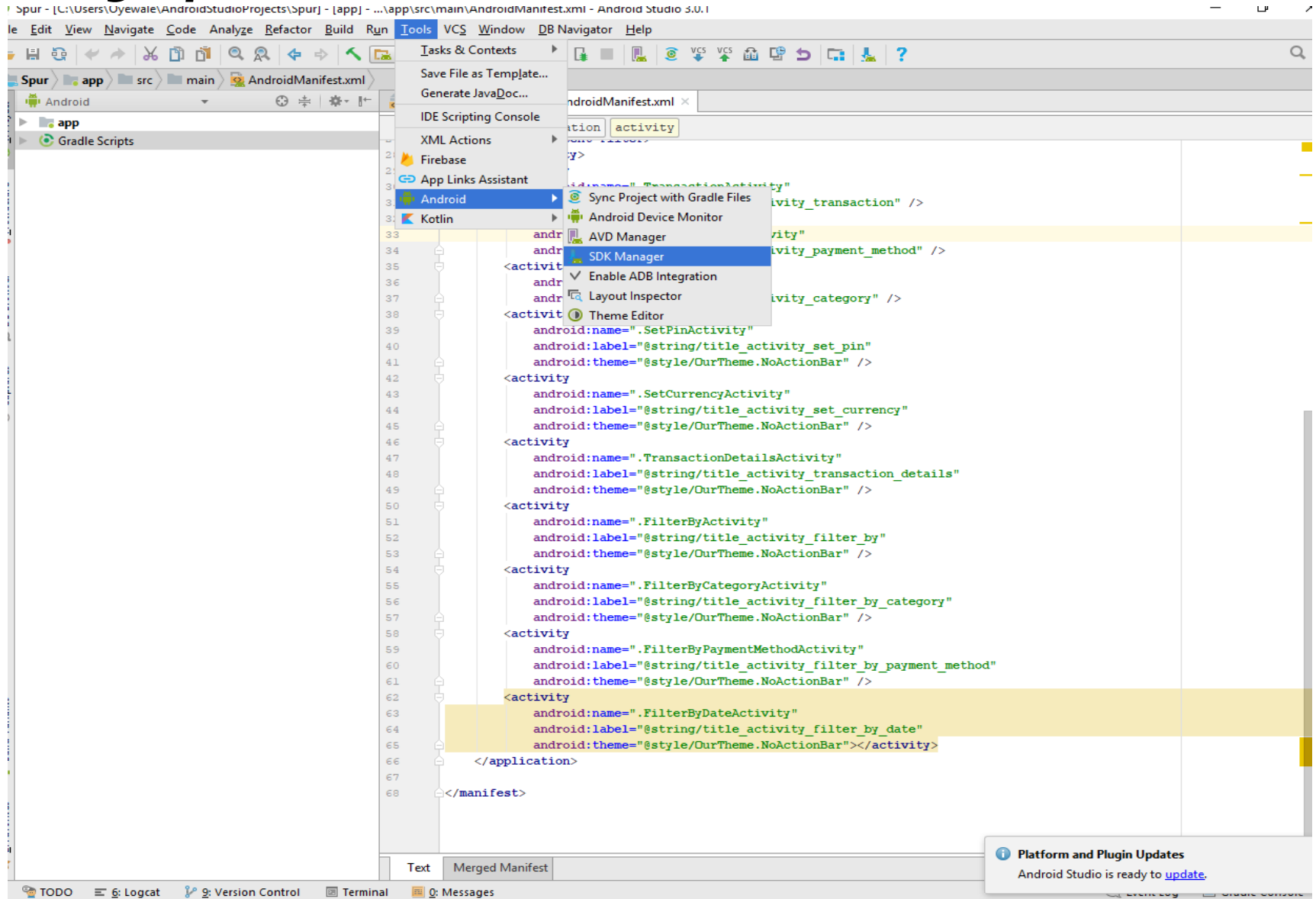
What does this mean ?



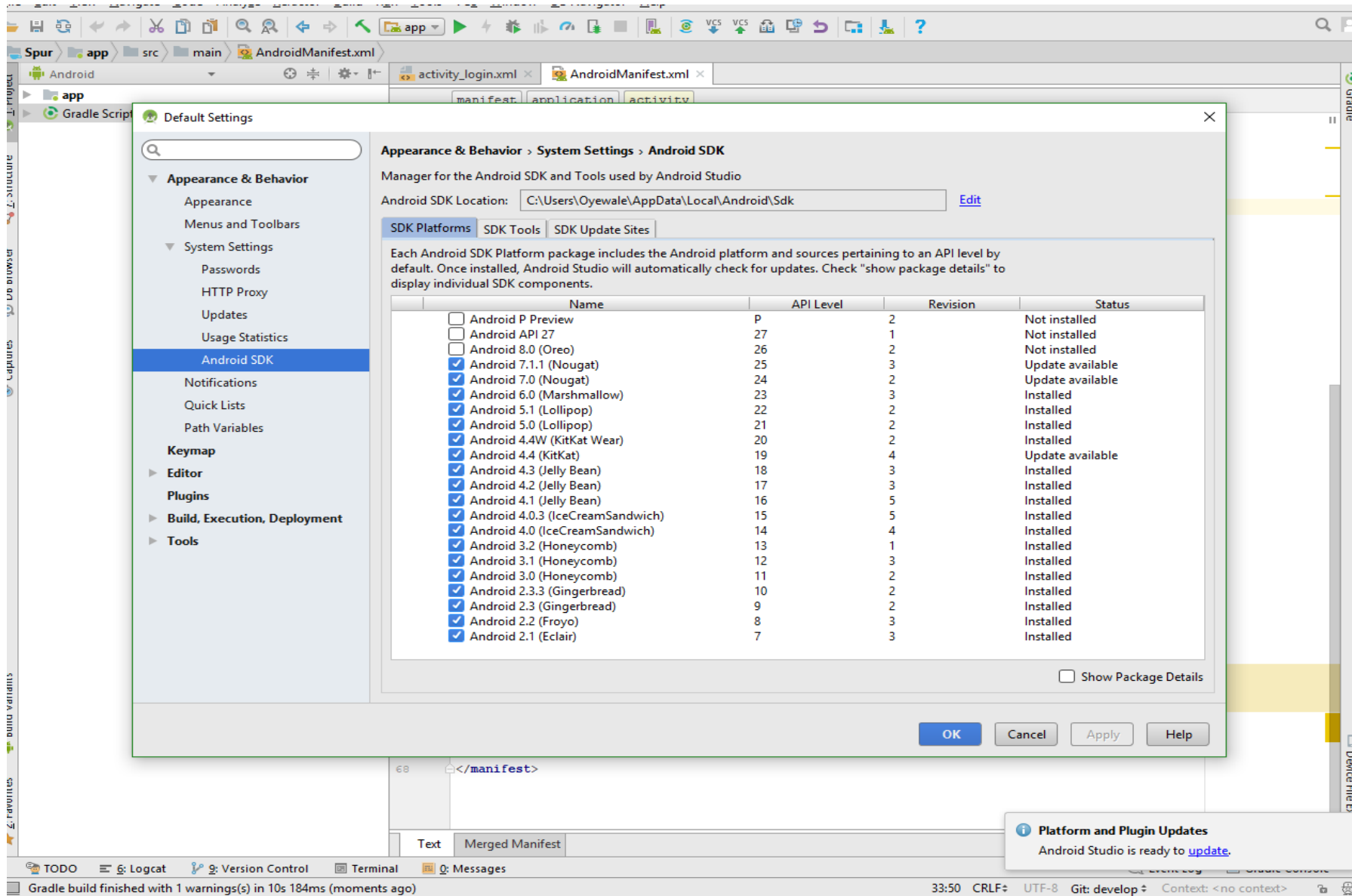
Setting up Android Studio:

- Download and Install Android Studio via <https://developer.android.com/studio/index.html>
- The <https://developer.android.com> platform also contains all the platform documentation you might need.
- After installation, go to Tools -> Android -> SDK Manager to install versions and requirement of choice.

Setting up Android Studio:



Setting up Android Studio:



The screenshot shows the Android Studio interface with the 'Default Settings' dialog box open. The 'Appearance & Behavior' tab is selected, and the 'System Settings' section is expanded. The 'Android SDK' option is highlighted in the left sidebar. The 'Android SDK Location' is set to 'C:\Users\Oyewale\AppData\Local\Android\Sdk'. The 'SDK Platforms' tab is active, displaying a list of Android SDK platforms.

Name	API Level	Revision	Status
<input type="checkbox"/> Android P Preview	P	2	Not installed
<input type="checkbox"/> Android API 27	27	1	Not installed
<input type="checkbox"/> Android 8.0 (Oreo)	26	2	Not installed
<input checked="" type="checkbox"/> Android 7.1.1 (Nougat)	25	3	Update available
<input checked="" type="checkbox"/> Android 7.0 (Nougat)	24	2	Update available
<input checked="" type="checkbox"/> Android 6.0 (Marshmallow)	23	3	Installed
<input checked="" type="checkbox"/> Android 5.1 (Lollipop)	22	2	Installed
<input checked="" type="checkbox"/> Android 5.0 (Lollipop)	21	2	Installed
<input checked="" type="checkbox"/> Android 4.4W (KitKat Wear)	20	2	Installed
<input checked="" type="checkbox"/> Android 4.4 (KitKat)	19	4	Update available
<input checked="" type="checkbox"/> Android 4.3 (Jelly Bean)	18	3	Installed
<input checked="" type="checkbox"/> Android 4.2 (Jelly Bean)	17	3	Installed
<input checked="" type="checkbox"/> Android 4.1 (Jelly Bean)	16	5	Installed
<input checked="" type="checkbox"/> Android 4.0.3 (IceCreamSandwich)	15	5	Installed
<input checked="" type="checkbox"/> Android 4.0 (IceCreamSandwich)	14	4	Installed
<input checked="" type="checkbox"/> Android 3.2 (Honeycomb)	13	1	Installed
<input checked="" type="checkbox"/> Android 3.1 (Honeycomb)	12	3	Installed
<input checked="" type="checkbox"/> Android 3.0 (Honeycomb)	11	2	Installed
<input checked="" type="checkbox"/> Android 2.3.3 (Gingerbread)	10	2	Installed
<input checked="" type="checkbox"/> Android 2.3 (Gingerbread)	9	2	Installed
<input checked="" type="checkbox"/> Android 2.2 (Froyo)	8	3	Installed
<input checked="" type="checkbox"/> Android 2.1 (Eclair)	7	3	Installed

At the bottom right of the dialog, there is a checkbox labeled 'Show Package Details' which is currently unchecked. The 'OK' button is highlighted in blue.

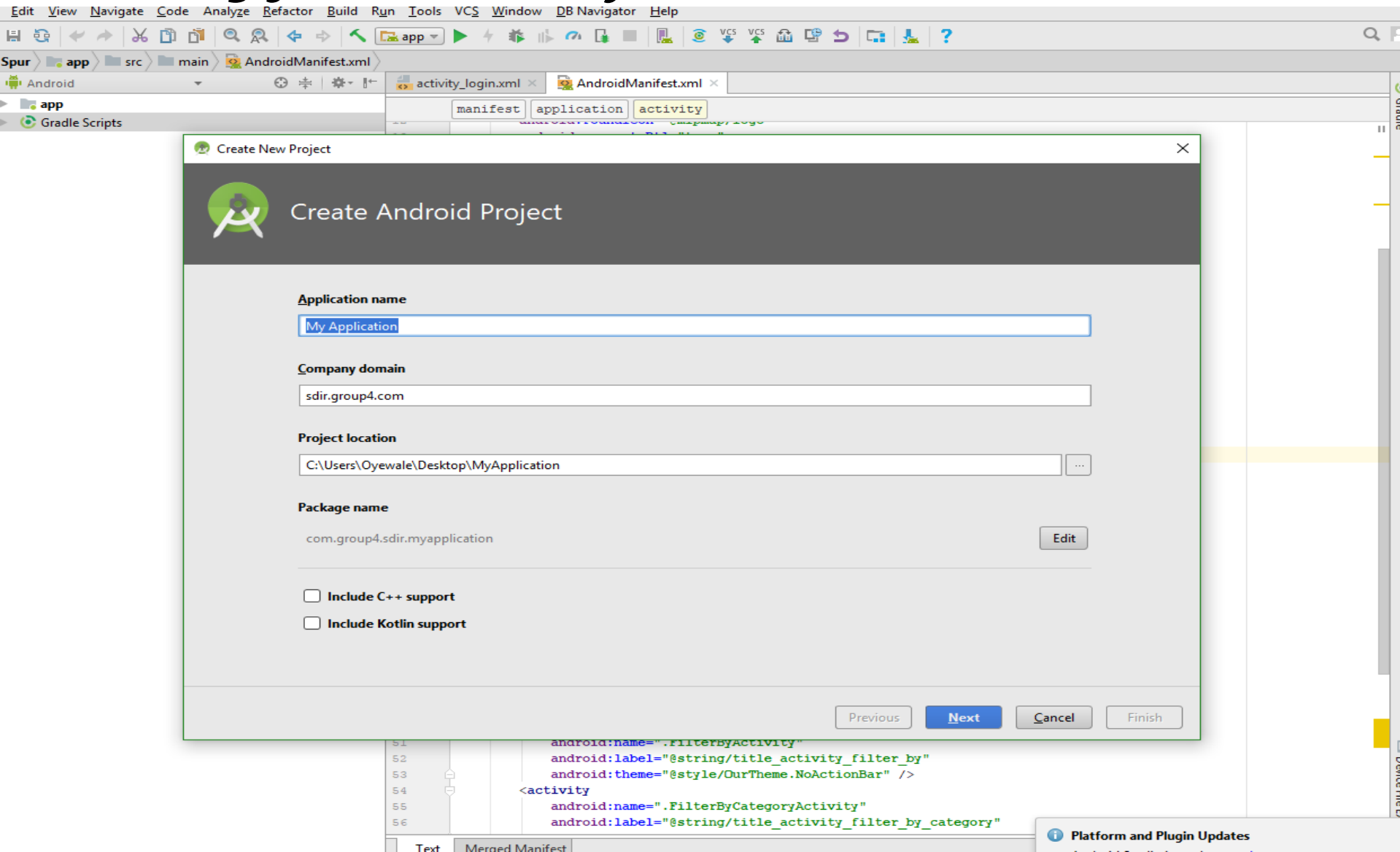
In the bottom right corner of the screen, there is a small notification box that says: 'Platform and Plugin Updates. Android Studio is ready to update.'

Creating your first project:

- Launch the IDE and create a project using the New Project Wizard
- Setup the Android Virtual Device, which you will use to emulate a physical phone or setup your Android Phone (enable debugging) instead..

**IDE – Integrated Development Environment

Creating your First Project:



The screenshot shows an IDE interface with a 'Create New Project' dialog box open. The dialog is titled 'Create Android Project' and contains the following fields and options:

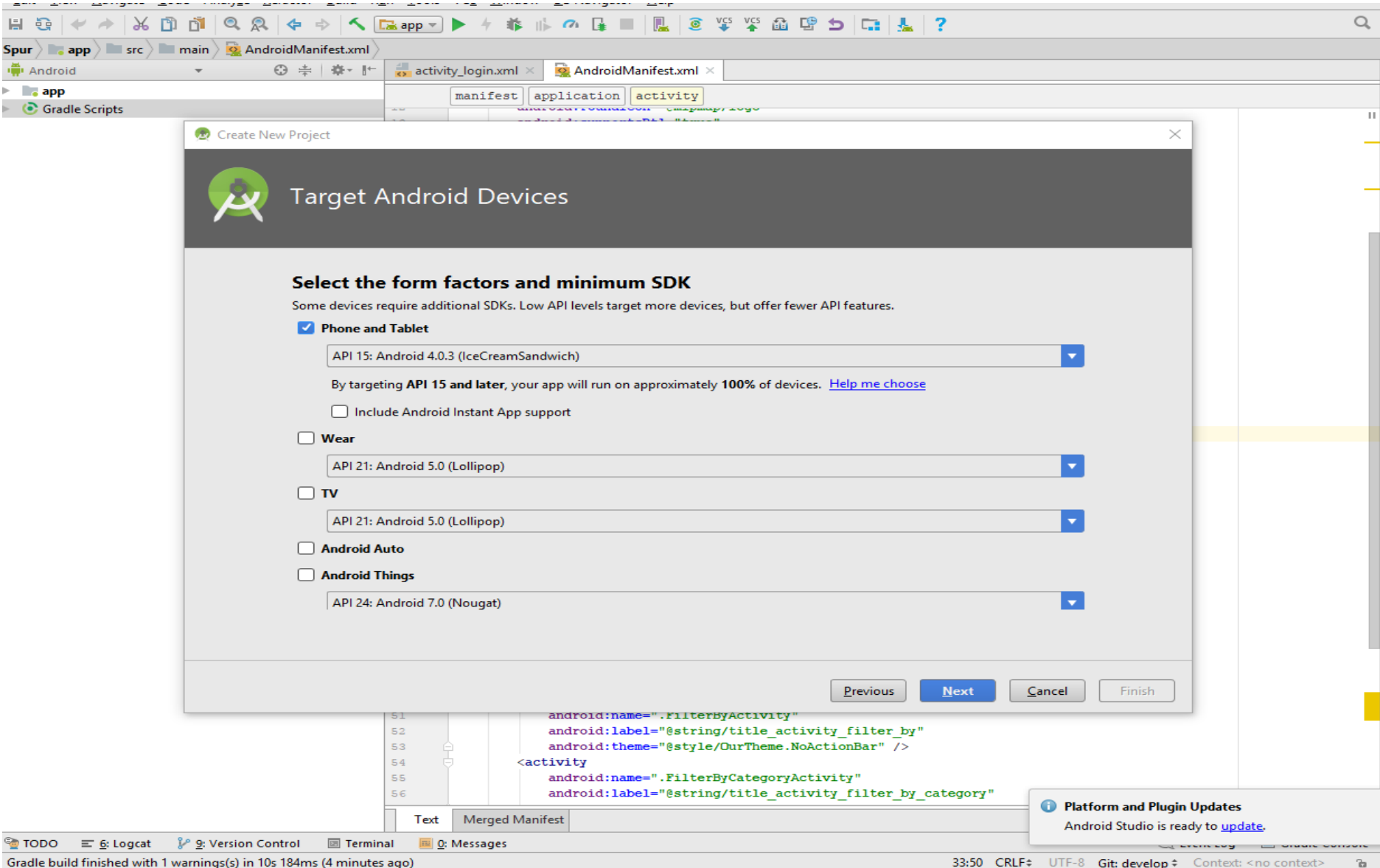
- Application name:** My Application
- Company domain:** sdir.group4.com
- Project location:** C:\Users\Oyewale\Desktop\MyApplication
- Package name:** com.group4.sdir.myapplication (with an 'Edit' button)
- ☐ Include C++ support
- ☐ Include Kotlin support

At the bottom of the dialog are four buttons: 'Previous', 'Next' (highlighted in blue), 'Cancel', and 'Finish'.

In the background, the IDE's 'AndroidManifest.xml' file is visible, showing the following XML code:

```
51 <activity android:name=".FilterByActivity"
52         android:label="@string/title_activity_filter_by"
53         android:theme="@style/OurTheme.NoActionBar" />
54 <activity
55     android:name=".FilterByCategoryActivity"
56     android:label="@string/title_activity_filter_by_category"
```

Creating your First Project:

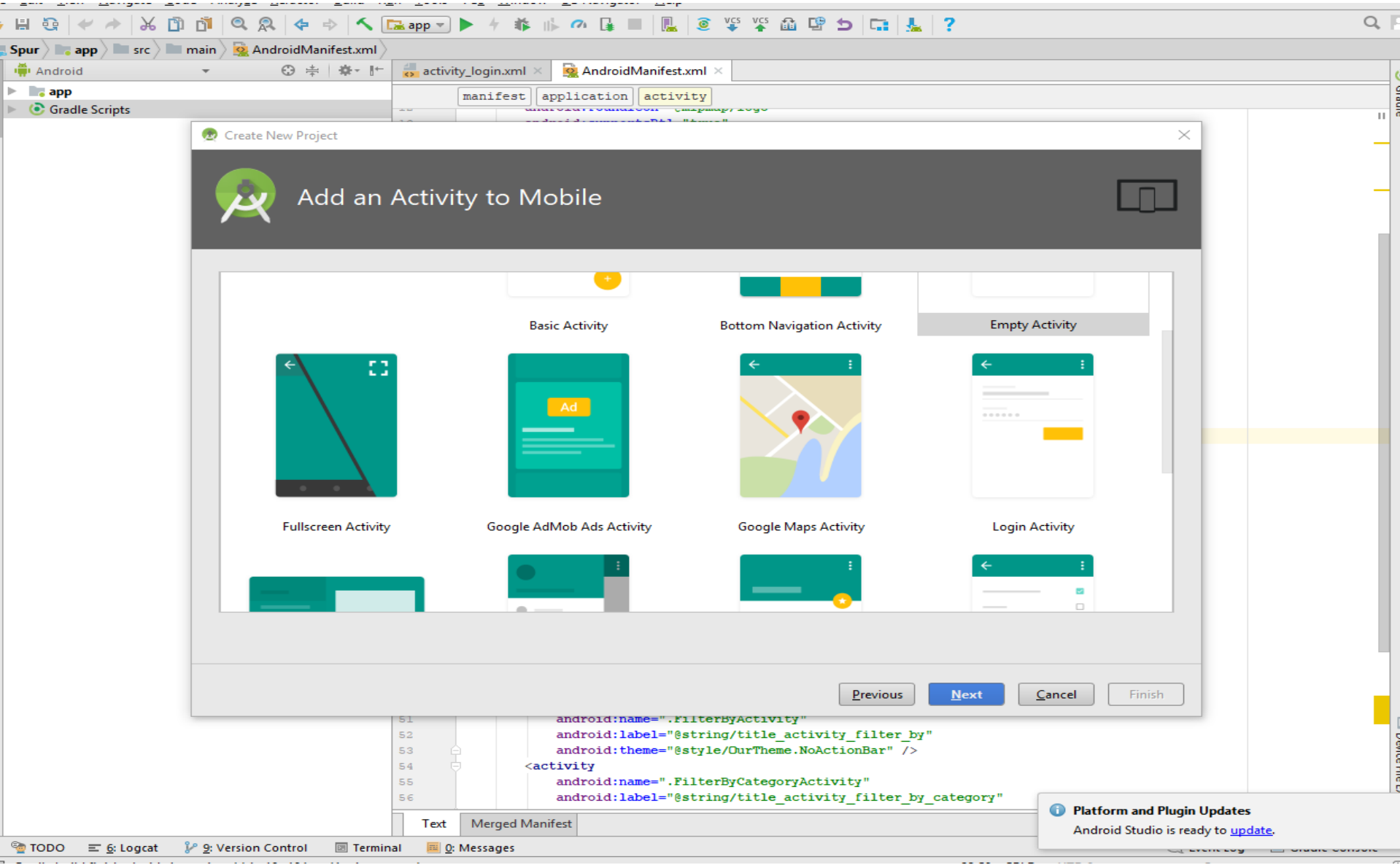


The screenshot shows the Android Studio interface with the 'Create New Project' dialog open. The dialog is titled 'Target Android Devices' and prompts the user to 'Select the form factors and minimum SDK'. The 'Phone and Tablet' option is selected, and the API level is set to 'API 15: Android 4.0.3 (IceCreamSandwich)'. The 'Include Android Instant App support' checkbox is unchecked. Other options like 'Wear', 'TV', 'Android Auto', and 'Android Things' are also listed with their respective API levels. The 'Next' button is highlighted in blue. In the background, the IDE shows the 'AndroidManifest.xml' file with the following XML code:

```
1 <manifest xmlns:android="http://schemas.android.com/apk/res/android"
2     package="com.example.myapplication"
3     android:versionCode="1"
4     android:versionName="1.0"
5     android:usesCleartextTraffic="true"
6     android:allowBackup="true"
7     android:label="@string/app_name"
8     android:icon="@mipmap/ic_launcher"
9     android:theme="@style/AppTheme"
10    >
11     <activity
12         android:name=".MainActivity"
13         android:label="@string/app_name"
14         android:theme="@style/AppTheme"
15         android:exported="true"
16     >
17         <intent-filter>
18             <action android:name="android.intent.action.MAIN" />
19             <category android:name="android.intent.category.LAUNCHER" />
20         </intent-filter>
21     </activity>
22 </manifest>
```

At the bottom of the screen, a status bar shows 'Gradle build finished with 1 warnings(s) in 10s 184ms (4 minutes ago)' and a 'Platform and Plugin Updates' notification stating 'Android Studio is ready to update.'

Creating your First Project:



The screenshot shows the Android Studio interface with the 'Add an Activity to Mobile' dialog open. The dialog displays several activity templates: Fullscreen Activity, Basic Activity, Google AdMob Ads Activity, Bottom Navigation Activity, Google Maps Activity, Empty Activity, and Login Activity. The 'Next' button is highlighted. The background shows the AndroidManifest.xml file with the activity declaration.

```
android:name=".FilterByActivity"  
android:label="@string/title_activity_filter_by"  
android:theme="@style/OurTheme.NoActionBar" />  
<activity  
  android:name=".FilterByCategoryActivity"  
  android:label="@string/title_activity_filter_by_category"
```

Platform and Plugin Updates
Android Studio is ready to [update](#).

A Sample Activity:

Spur - [C:\Users\Oyewale\AndroidStudioProjects\Spur] - [app] - ...app\src\main\java\com\spur\isee\spur\LoginActivity.java - Android Studio 3.0.1

File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window DB Navigator Help

Spur app src main java com spur isee spur LoginActivity

AndroidManifest.xml LoginActivity.java

```

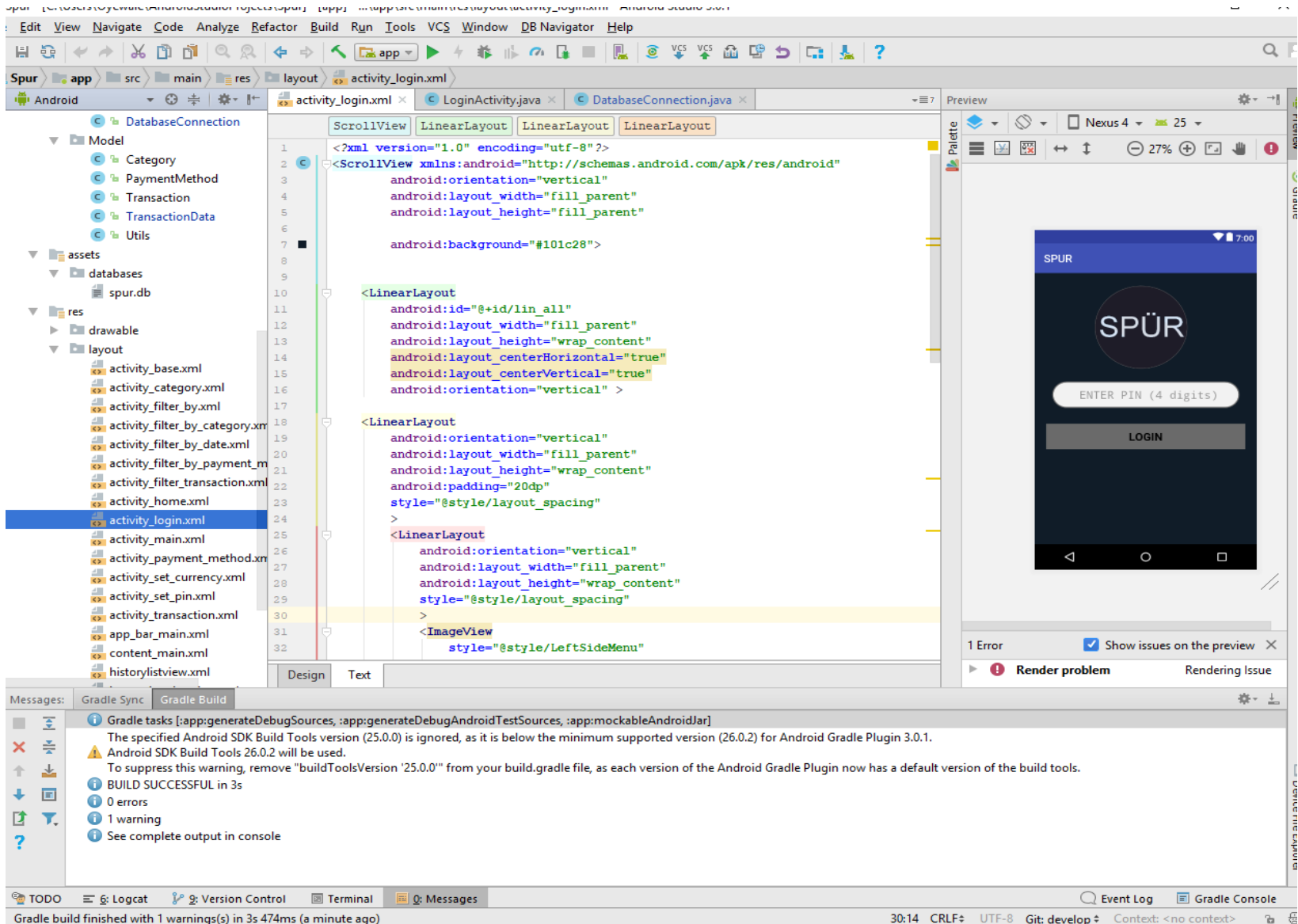
1  package com.spur.isee.spur;
2
3  import ...
4
15
16  public class LoginActivity extends Activity {
17      Button lgButton;
18      final Context context = this;
19      public static final String MyPREFERENCES = "MyPrefs";
20      SharedPreferences sharedPreferences;
21      @Override
22      protected void onCreate(Bundle savedInstanceState) {
23          super.onCreate(savedInstanceState);
24
25          sharedPreferences = getSharedPreferences(MyPREFERENCES, Context.MODE_PRIVATE);
26          final String pin = sharedPreferences.getString( key: "pin", defValue: "");
27          final Boolean enable = sharedPreferences.getBoolean( key: "enablepin", defValue: false);
28
29          if(enable) {
30              setContentView(R.layout.activity_login);
31              lgButton = (Button) findViewById(R.id.btnLogin);
32              lgButton.setOnClickListener((view) -> {
33                  String suppliedPin = ((EditText) findViewById(R.id.suppliedpin)).getText().toString().trim();
34                  if(pin.equals(suppliedPin)) {
35                      Intent homeIntent = new Intent(context, HomeActivity.class);
36                      startActivity(homeIntent);
37                  }else{
38                      AlertDialog.Builder alertDialogBuilder = new AlertDialog.Builder(context);
39                      alertDialogBuilder.setTitle("WRONG PIN !");
40                      // set dialog message
41                      alertDialogBuilder
42                          .setMessage("The PIN you supplied is wrong. Retry !")
43                          .setCancelable(false)
44                          .setPositiveButton( text: "OK", (dialog, id) -> {
45                              dialog.cancel();
46                          });
47                      AlertDialog alertDialog = alertDialogBuilder.create();
48                      alertDialog.show();
49                  }
50              });
51          }else{
52              Intent homeIntent = new Intent(context, HomeActivity.class);
53              startActivity(homeIntent);
54          }
55      }
56  }
57
58  }
59
60
61
62
63

```

Gradle build finished with 1 warnings(s) in 10s 184ms (11 minutes ago)

19:58 CRLF UTF-8 Git: develop Context: <no context>

A Sample Layout File:



The screenshot displays the Android Studio IDE with the following components:

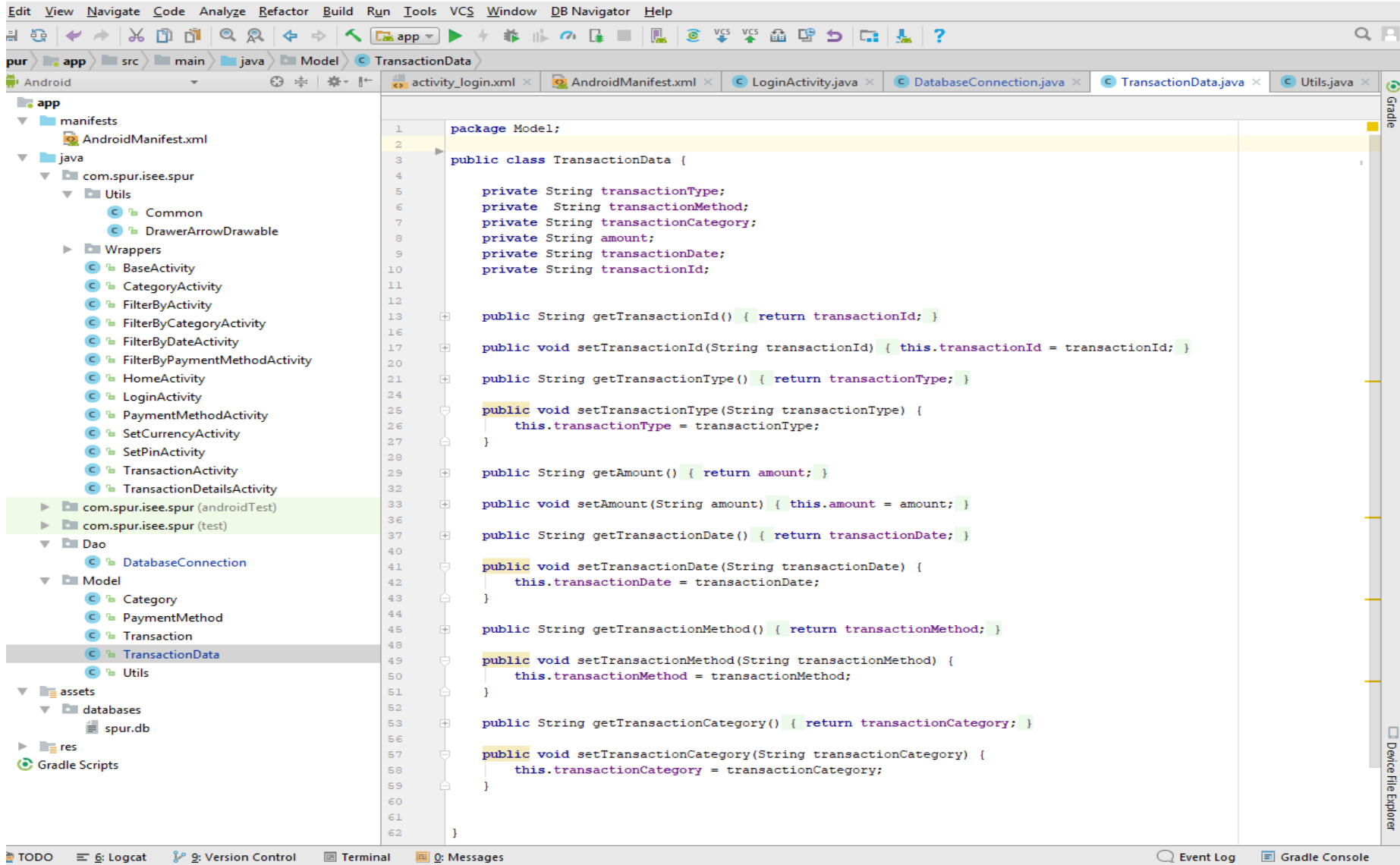
- Project Explorer (Left):** Shows the project structure with folders like `Model`, `assets`, `databases`, `res`, and `layout`. The `activity_login.xml` file is selected in the `layout` folder.
- Code Editor (Center):** Displays the XML code for `activity_login.xml`. The code defines a `ScrollView` containing three `LinearLayout` elements and an `ImageView`.


```

1 <?xml version="1.0" encoding="utf-8"?>
2 <ScrollView xmlns:android="http://schemas.android.com/apk/res/android"
3     android:orientation="vertical"
4     android:layout_width="fill_parent"
5     android:layout_height="fill_parent"
6
7     android:background="#101c28">
8
9
10
11     <LinearLayout
12         android:id="@+id/lin_all"
13         android:layout_width="fill_parent"
14         android:layout_height="wrap_content"
15         android:layout_centerHorizontal="true"
16         android:layout_centerVertical="true"
17         android:orientation="vertical" >
18
19         <LinearLayout
20             android:orientation="vertical"
21             android:layout_width="fill_parent"
22             android:layout_height="wrap_content"
23             android:padding="20dp"
24             style="@style/layout_spacing"
25         >
26
27             <LinearLayout
28                 android:orientation="vertical"
29                 android:layout_width="fill_parent"
30                 android:layout_height="wrap_content"
31                 style="@style/layout_spacing"
32             >
33
34                 <ImageView
35                     style="@style/LeftSideMenu"
      
```
- Preview (Right):** Shows a visual representation of the layout on a Nexus 4 device. The preview displays a dark blue background with the text "SPÜR" in a large white font, followed by a white input field labeled "ENTER PIN (4 digits)" and a "LOGIN" button.
- Messages (Bottom):** Shows the output of the Gradle build process. It indicates that the specified Android SDK Build Tools version (25.0.0) is ignored, as it is below the minimum supported version (26.0.2) for Android Gradle Plugin 3.0.1. The build was successful with 1 warning.

A Sample Model Class:

ur - [C:\Users\Oyewale\AndroidStudioProjects\Spur] - [app] - ...app\src\main\java\Model\TransactionData.java - Android Studio 3.0.1



The screenshot shows the Android Studio interface with the `TransactionData.java` file open in the `Model` package. The left sidebar displays the project structure, including the `app` directory, `manifests`, `java` directory, and various activity classes. The main editor shows the code for `TransactionData`, which is a public class with private attributes for transaction details and public methods for getting and setting these details.

```

1  package Model;
2
3  public class TransactionData {
4
5      private String transactionType;
6      private String transactionMethod;
7      private String transactionCategory;
8      private String amount;
9      private String transactionDate;
10     private String transactionId;
11
12
13     public String getTransactionId() { return transactionId; }
14
15
16     public void setTransactionId(String transactionId) { this.transactionId = transactionId; }
17
18
19     public String getTransactionType() { return transactionType; }
20
21
22     public void setTransactionType(String transactionType) {
23         this.transactionType = transactionType;
24     }
25
26
27     public String getAmount() { return amount; }
28
29
30     public void setAmount(String amount) { this.amount = amount; }
31
32
33     public String getTransactionDate() { return transactionDate; }
34
35
36     public void setTransactionDate(String transactionDate) {
37         this.transactionDate = transactionDate;
38     }
39
40
41     public String getTransactionMethod() { return transactionMethod; }
42
43
44     public void setTransactionMethod(String transactionMethod) {
45         this.transactionMethod = transactionMethod;
46     }
47
48
49     public String getTransactionCategory() { return transactionCategory; }
50
51
52     public void setTransactionCategory(String transactionCategory) {
53         this.transactionCategory = transactionCategory;
54     }
55
56
57 }

```

The bottom status bar shows the following information: `gradle build finished with 1 warnings(s) in 10s 184ms (14 minutes ago)`, `2:1 CRLF= UTF-8 Git: develop Context: <no context>`, and `Event Log` and `Gradle Console` tabs.

A Sample Database Class:

Spur - [C:\Users\Oyewale\AndroidStudioProjects\Spur] - [app] - ...\app\src\main\java\Dao\DatabaseConnection.java - Android Studio 3.0.1

File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window DB Navigator Help

Spur app src main java Dao DatabaseConnection

Android

manifests
AndroidManifest.xml

java
com.spur.isee.spur
Utils
Common
DrawerArrowDrawable

Wrappers
BaseActivity
CategoryActivity
FilterByActivity
FilterByCategoryActivity
FilterByDateActivity
FilterByPaymentMethodActivity
HomeActivity
LoginActivity
PaymentMethodActivity
SetCurrencyActivity
SetPinActivity
TransactionActivity
TransactionDetailsActivity

com.spur.isee.spur (androidTest)
com.spur.isee.spur (test)

Dao
DatabaseConnection

Model
Category
PaymentMethod
Transaction
TransactionData
Utils

assets
databases
spur.db

res

Gradle Scripts

DatabaseConnection

```

15
16 public class DatabaseConnection extends SQLiteOpenHelper {
17
18     private static final String DATABASE_NAME = "spur.db";
19     private static final int DATABASE_VERSION = 1;
20
21     SQLiteDatabase writeToDb = getWritableDatabase();
22     SQLiteDatabase readFromDb = getReadableDatabase();
23     SQLiteQueryBuilder queryBuilder = new SQLiteQueryBuilder();
24
25     public DatabaseConnection(Context context) {
26         super(context, DATABASE_NAME, factory: null, DATABASE_VERSION);
27     }
28
29     public Cursor getCategories() {
30
31         String sqlTables = "Categories";
32         queryBuilder.setTables(sqlTables);
33
34         String [] sqlSelect = {"0_id", "CategoryName"};
35         Cursor c = queryBuilder.query(readFromDb, sqlSelect, selection: null, selectionArgs: null,
36                                     groupBy: null, having: null, sortOrder: null);
37         c.moveToFirst();
38         return c;
39     }
40
41     public Cursor getPaymentMethods() {
42
43         String sqlTables = "PaymentMethod";
44         queryBuilder.setTables(sqlTables);
45
46         String [] sqlSelect = {"0_id", "methodName"};
47         Cursor c = queryBuilder.query(readFromDb, sqlSelect, selection: null, selectionArgs: null,
48                                     groupBy: null, having: null, sortOrder: null);
49         c.moveToFirst();
50         return c;
51     }
52
53     public boolean findCategory(String categoryName) {
54         String response = null;
55         String selectQuery = "SELECT CategoryName FROM Categories WHERE CategoryName = ?";
56         Cursor c = readFromDb.rawQuery(selectQuery, new String[] { categoryName });
57
58     }
59
60

```

Gradle

Device File Explorer

TODO Logcat Version Control Terminal Messages

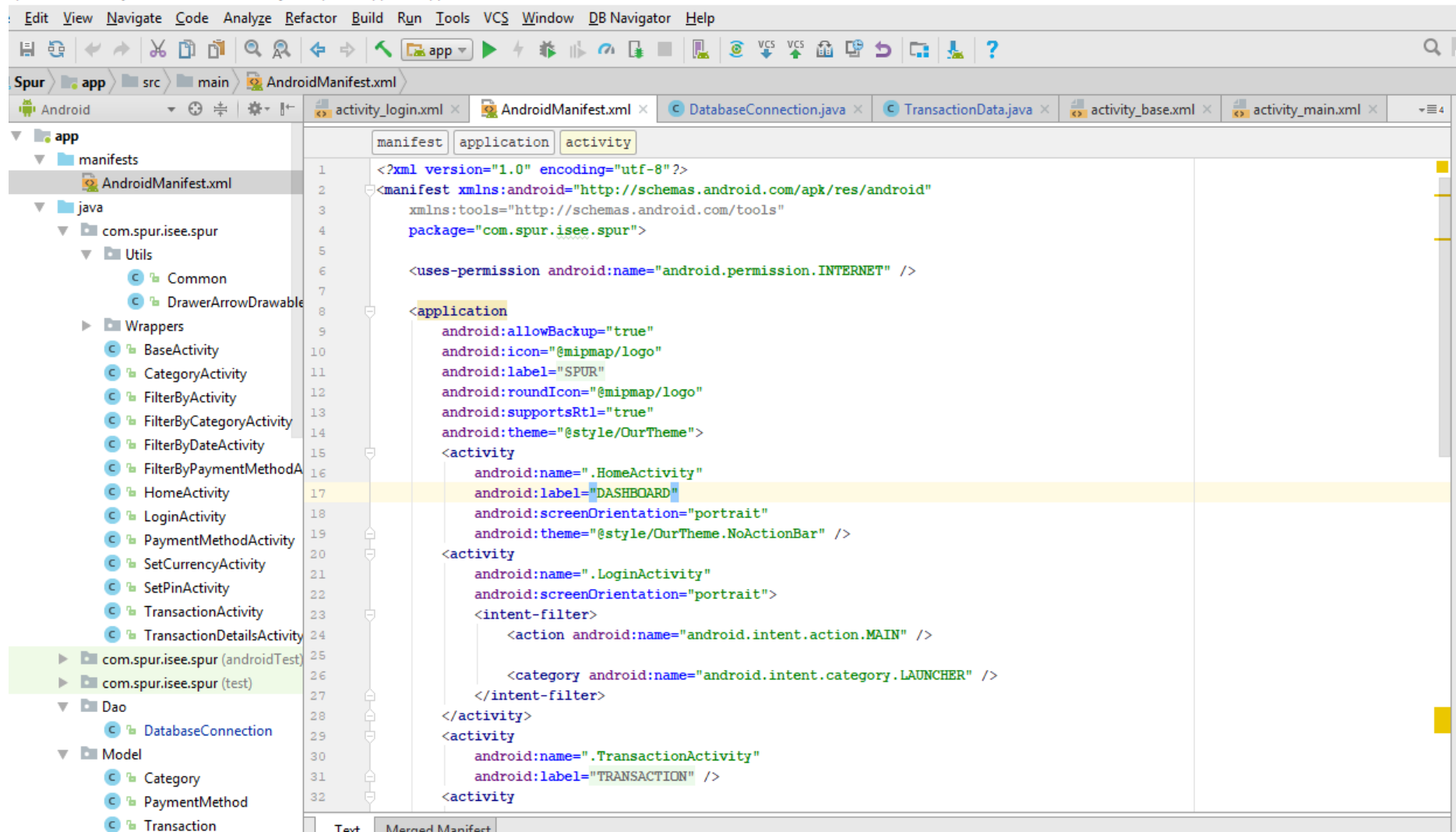
Event Log Gradle Console

Gradle build finished with 1 warnings(s) in 10s 184ms (12 minutes ago)

16:14 CRLF UTF-8 Git: develop Context: <no context>

A sample Android Manifest:

Spur - [C:\Users\Uyewale\AndroidStudioProjects\Spur] - [app] - ...app\src\main\AndroidManifest.xml - Android Studio 3.0.1



```

1  <?xml version="1.0" encoding="utf-8"?>
2  <manifest xmlns:android="http://schemas.android.com/apk/res/android"
3           xmlns:tools="http://schemas.android.com/tools"
4           package="com.spur.isee.spur">
5
6     <uses-permission android:name="android.permission.INTERNET" />
7
8     <application
9         android:allowBackup="true"
10        android:icon="@mipmap/logo"
11        android:label="SPUR"
12        android:roundIcon="@mipmap/logo"
13        android:supportRtl="true"
14        android:theme="@style/OurTheme">
15
16        <activity
17            android:name=".HomeActivity"
18            android:label="DASHBOARD"
19            android:screenOrientation="portrait"
20            android:theme="@style/OurTheme.NoActionBar" />
21
22        <activity
23            android:name=".LoginActivity"
24            android:screenOrientation="portrait">
25
26            <intent-filter>
27                <action android:name="android.intent.action.MAIN" />
28
29                <category android:name="android.intent.category.LAUNCHER" />
30            </intent-filter>
31
32        </activity>
33
34        <activity
35            android:name=".TransactionActivity"
36            android:label="TRANSACTION" />
37
38        <activity

```