# 目录



# 一、Fragment

## 1.1 Fragment的基本用法和生命周期

## 1.1.1 Fragment的优点

1. 将Activity模块化，将功能分散到小的Fragment中
2. 一个Activity可以有多个Fragment，一个Fragment也可以有多个Fragment
3. 可以重用、灵活
4. 相比View，带有声明周期的概念

## 1.1.2 静态添加Fragment

1. 定义**fragment布局文件**：**fragment_hello_layout.xml**

```
<?xml version="1.0" encoding="utf-8"?>
<FrameLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="@color/black">

    <!--显示一行文字: Hello-->
    <TextView
        android:id="@+id/tv_hello"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_gravity="center"
        android:text="Hello"
        android:textSize="32sp"
        android:textColor="@color/white"/>
</FrameLayout>
```

2. 定义**fragment类**：**HelloFragment.java**

```
public class HelloFragment extends Fragment {
    @Nullable
    @Override
    public View onCreateView(@NonNull LayoutInflater inflater, @Nullable
ViewGroup container, @Nullable Bundle savedInstanceState) {
        return inflater.inflate(R.layout.fragment_hello_layout, container,
false);
        // inflate方法的主要作用: 将xml转换成一个View对象, 用于动态的创建布局
        // 参数说明
        // 1.int resource:          布局的资源id
        // 2.ViewGroup root:        填充的根视图
        // 3.boolean attachToRoot:  是否将载入的视图绑定到根视图中
    }
}
```

3. 在 **activity布局文件**中嵌入 **fragment**：

   **activity_main.xml**

```
<?xml version="1.0" encoding="utf-8"?>
<FrameLayout 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">

    <androidx.fragment.app.FragmentContainerView
        android:id="@+id/fragment_hello"
        android:name="com.example.demo.HelloFragment"
        android:layout_width="300dp"
        android:layout_height="400dp"
        android:layout_gravity="center"/>
</FrameLayout>
```

**MainActivity.java**

```
public class MainActivity extends AppCompatActivity {
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
    }
}
```

### 1.1.3 动态添加/删除Fragment

1. 在**Activity布局文件**中定义**Fragment容器**：**activity_main.xml**

```
<?xml version="1.0" encoding="utf-8"?>
<FrameLayout 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">

    <androidx.fragment.app.FragmentContainerView
        android:id="@+id/fragment_hello"
        android:name="com.example.demo.HelloFragment"
        android:layout_width="300dp"
        android:layout_height="400dp"
        android:layout_gravity="center"/>

    <!--Fragment容器-->
    <FrameLayout
        android:id="@+id/fragment_container"
        android:layout_width="match_parent"
        android:layout_height="match_parent"/>

    <!--后续实现跳转逻辑的一个Button-->
    <Button
        android:id="@+id/btn_replace"
        android:layout_width="120dp"
        android:layout_height="60dp"
        android:layout_marginBottom="40dp"
        android:layout_gravity="bottom|center_horizontal"
        android:text="Replace"/>
</FrameLayout>
```

2. 定义一个新的**MainFragment**：

**fragment布局文件：fragment_main_layout.xml**

```
<?xml version="1.0" encoding="utf-8"?>
<FrameLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="#66CCFF">
    <!--设置背景色: android:background="#66CCFF"-->

    <!--显示一行文字: Replace success-->
    <TextView
        android:id="@+id/tv_replace"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_gravity="center"
        android:text="Replace success"
        android:textSize="32sp"/>

</FrameLayout>
```

**fragment类：MainFragment.java**

```
public class MainFragment extends Fragment {
    @Nullable
    @Override
    public View onCreateView(@NonNull LayoutInflater inflater, @Nullable
ViewGroup container, @Nullable Bundle savedInstanceState) {
        return inflater.inflate(R.layout.fragment_main_layout, container,
false);
    }
}
```

3. 使用**FragmentManager添加Fragment**：**MainActivity.java**

```
public class MainActivity extends AppCompatActivity {

    private static final String TAG = "MainActivity";
    private Button mReplaceButton;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);

        mReplaceButton = findViewById(R.id.btn_replace);
        mReplaceButton.setOnClickListener(v->{
            FragmentManager fragmentManager = getSupportFragmentManager();
            // 获取一个系统提供的FragmentManager

            fragmentManager.beginTransaction().commit()

            fragmentManager.beginTransaction()

.remove(fragmentManager.findFragmentById(R.id.fragment_hello))
                    .add(R.id.fragment_container, new MainFragment())
                    .commit();
```

```
            // FragmentManager使用事务机制管理所有的Fragment
            // .beginTransaction(): 开始事务, 返回类型为FragmentTransaction
            // .remove(Fragment): 移除一个Fragment, 返回类型为
FragmentTransaction
            // .add(id, Fragment): 添加一个Fragment, 返回类型为
FragmentTransaction
            // .commit(): 将当前执行的操作提交, 返回类型为int

            mReplaceButton.setVisibility(View.GONE);
            // setVisibility(): 设置组件的是否可见
            // 有三个参数可供选择
            // VISIBLE:0   意思是可见的
            // INVISIBILITY:4 意思是不可见的, 但还占着原来的空间
            // GONE:8   意思是不可见的, 不占用原来的布局空间
        });
    }
}
```

## 1.1.4 Fragment 生命周期

### Fragment 生命周期

- onAttach/onDetach
- onCreate/onDestroy
- onCreateView/onDestroyView
- onActivityCreated
- onStart/onStop
- onResume/onPause


1. **onAttach/onDetach**：Fragment与Activity绑定/解除绑定
2. **onCreate/onDestroy**：进行与View无关的初始化才做
3. **onCreateView/onDestroyView**：渲染出视图布局，进行与View有关的初始化才做
4. **onActivityCreated**：宿主Activity执行onCreate后调用该方法
5. **onStart/onStop**：可见/不可见
6. **onResume/onPause**：可交互/不可交互

## Fragment 生命周期

- 与Activity生命周期对比

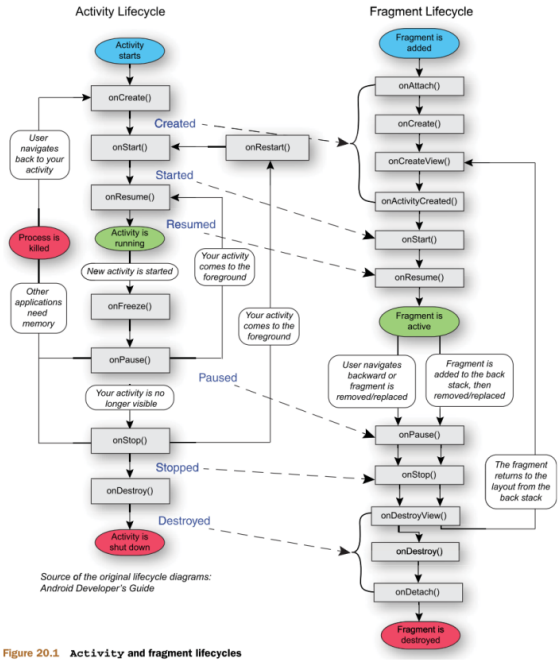
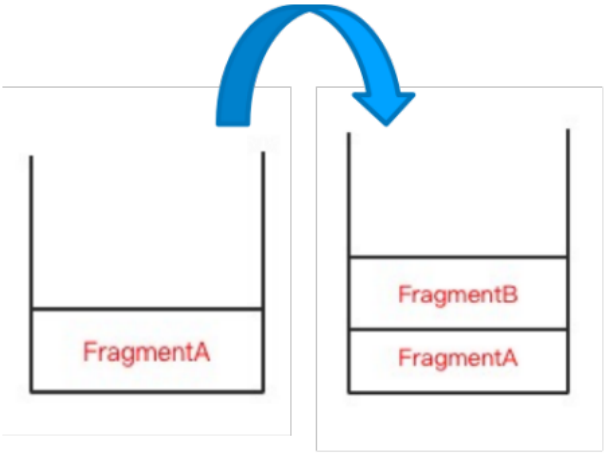



Figure 20.1 Activity and fragment lifecycles



## 1.1.4 Fragment添加到返回栈




1. **addToBackStack**：将新的Fragment添加至返回栈，**MainActivity.java**

```
public class MainActivity extends AppCompatActivity {

    private static final String TAG = "MainActivity";
    private Button mReplaceButton;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);

        mReplaceButton = findViewById(R.id.btn_replace);
        mReplaceButton.setOnClickListener(v->{
            FragmentManager fragmentManager = getSupportFragmentManager();

            fragmentManager.beginTransaction()
                           .add(R.id.fragment_container, new
MainFragment())
                           .addToBackStack(null)
                           .commit();
            // .addToBackStack(String name): 将Fragment加入到回退栈
```

```
            // 是否使用 取决于 是否要在回退的时候显示上一个Fragment

            mReplaceButton.setVisibility(View.GONE);
        });
    }
}
```

# 1.2 结合 ViewPager 创建多 Tab 界面

## 1.2.1 ViewPager的作用

1. 常用于实现**可滑动的多个视图**
2. 容器，类似于**RecyclerView**
3. 需要通过 **Adapter** 配置内容
4. 内容一般通过 **Fragment** 实现
5. 可配置 **TabLayout** 或三方库添加 **Title**

## 1.2.2 ViewPager + Fragment

1. 在**布局xml** 中添加**ViewPager**： **fragment_main_layout.xml**

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical">
    <!--线性布局的对齐方式: android:orientation-->

    <!--添加一个ViewPager2-->
    <androidx.viewpager2.widget.ViewPager2
        android:id="@+id/view_pager_main"
        android:layout_width="match_parent"
        android:layout_height="match_parent"/>

</LinearLayout>
```

2. 定义**Fragment**

   **fragment_view_animation.xml**

```
<?xml version="1.0" encoding="utf-8"?>
<FrameLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent">

    <!--显示文本: values/string.xml中名为first_text的变量的值-->
    <TextView
        android:id="@+id/tv_content"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_gravity="center"
        android:text="@string/first_text"
        android:textSize="28sp"/>
```

```
</FrameLayout>
```

**fragment_object_animation.xml**

```
<?xml version="1.0" encoding="utf-8"?>
<FrameLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="#34C724">

    <!--显示文本: values/string.xml中名为second_text的变量的值-->
    <TextView
        android:id="@+id/tv_content"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_gravity="center"
        android:text="@string/second_text"
        android:textSize="28sp"/>
</FrameLayout>
```

**fragment_lottie_animation.xml**

```
<?xml version="1.0" encoding="utf-8"?>
<FrameLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="#ff0000">

    <!--显示文本: values/string.xml中名为third_text的变量的值-->
    <TextView
        android:id="@+id/tv_content"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_gravity="center"
        android:text="@string/third_text"
        android:textSize="28sp"/>

</FrameLayout>
```

3. 定义配置页面**Fragment的Adapter**：**HelloFragmentViewPagerAdapter.java**

```
public class HelloFragmentViewPagerAdapter extends FragmentStateAdapter {
    private static final int FRAGMENTS_Count = 3;
    public static final int FRAGMENT_View_Animation = 0;
    public static final int FRAGMENT_Object_Animation = 1;
    public static final int FRAGMENT_Lottie_Animation = 2;

    public HelloFragmentViewPagerAdapter(@NonNull Fragment fragment) {
        super(fragment);
    }

    // 根据position的值, 判断创建哪一个Fragment
    @NonNull
    @Override
```

```
    public Fragment createFragment(int position) {
        switch (position){
            case FRAGMENT_View_Animation:
                return new ViewAnimationFragment();
            case FRAGMENT_Object_Animation:
                return new ObjectAnimationFragment();
            case FRAGMENT_Lottie_Animation:
                return new LottieAnimationFragment();
            default:
                return new Fragment();
        }
    }

    // 返回当前ViewPager有多少个Fragment
    @Override
    public int getItemCount() {
        return FRAGMENTS_Count;
    }
}
```

4. 为**ViewPager设置Adapter**：**MainFragment.java**

```
public class MainFragment extends Fragment {
    ViewPager2 mViewPager;

    @Nullable
    @Override
    public View onCreateView(@NonNull LayoutInflater inflater, @Nullable
ViewGroup container, @Nullable Bundle savedInstanceState) {
        View view = inflater.inflate(R.layout.fragment_main_layout,
container, false);

        mViewPager = view.findViewById(R.id.view_pager_main);
        mViewPager.setAdapter(new HelloFragmentViewPagerAdapter(this));
        return view;
    }
}
```

## 4.2.3 ViewPager + TabLayout

1. 在**布局 xml** 中继续添加 **TabLayout**：**fragment_main_layout.xml**

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical">
    <!--线性布局的对齐方式: android:orientation-->

    <com.google.android.material.tabs.TabLayout
        android:id="@+id/tab_layout"
        android:layout_width="match_parent"
        android:layout_height="40dp"
        app:tabIndicatorColor="@color/black"
```

```
        app:tabIndicatorHeight="2dp"
        app:tabIndicatorFullWidth="false"
        app:tabIndicatorGravity="bottom"
        app:tabGravity="center"
        app:layout_constraintTop_toTopOf="parent"/>

    <View
        android:id="@+id/divider"
        android:layout_width="match_parent"
        android:layout_height="2dp"
        android:background="#1A000000"/>


    <!--添加一个ViewPager2-->
    <androidx.viewpager2.widget.ViewPager2
        android:id="@+id/view_pager_main"
        android:layout_width="match_parent"
        android:layout_height="match_parent"/>

</LinearLayout>
```

2. 在代码中**对 ViewPager 和 TabLayout 建立关联**：**MainFragment.java**

```
public class MainFragment extends Fragment {
    private static final String TITLE_View_Animation = "视图动画";
    private static final String TITLE_Object_Animation = "属性动画";
    private static final String TITLE_Lottie_Animation = "Lottie动画";

    private final String[] tabTitles = new String[3];
    private ViewPager2 mViewPager;
    private TabLayout mTabLayout;

    @Nullable
    @Override
    public View onCreateView(@NonNull LayoutInflater inflater, @Nullable
ViewGroup container, @Nullable Bundle savedInstanceState) {
        View view = inflater.inflate(R.layout.fragment_main_layout,
container, false);

        // 设置ViewPager的Adapter
        mViewPager = view.findViewById(R.id.view_pager_main);
        mViewPager.setAdapter(new HelloFragmentViewPagerAdapter(this));

        // 设置标题
        tabTitles[HelloFragmentViewPagerAdapter.FRAGMENT_View_Animation] =
TITLE_View_Animation;
        tabTitles[HelloFragmentViewPagerAdapter.FRAGMENT_Object_Animation] =
TITLE_Object_Animation;
        tabTitles[HelloFragmentViewPagerAdapter.FRAGMENT_Lottie_Animation] =
TITLE_Lottie_Animation;

        // 设置TabLayout的监听器
        mTabLayout = view.findViewById(R.id.tab_layout);
        TabLayoutMediator tabLayoutMediator = new TabLayoutMediator(
                mTabLayout,
                mViewPager,
                true,
```

```
                false,
                (tab, position) -> tab.setText(tabTitles[position]));
        tabLayoutMediator.attach();
        return view;
    }
}
```

# 1.3 Fragment/Activity 之间的通信

1. 构造 Fragment 时传递参数（setArguments/getArguments）
2. 通过接口和回调

## 1.3.1 Fragment与Activity之间的通信

### 1.3.1.1 传参

1. 在**activity_main.xml**中添加一个文本框，用于测试

```
<?xml version="1.0" encoding="utf-8"?>
<FrameLayout 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">

    <androidx.fragment.app.FragmentContainerView
        android:id="@+id/fragment_hello"
        android:name="com.example.demo.HelloFragment"
        android:layout_width="300dp"
        android:layout_height="400dp"
        android:layout_gravity="center"/>

    <!--Fragment容器-->
    <FrameLayout
        android:id="@+id/fragment_container"
        android:layout_width="match_parent"
        android:layout_height="match_parent"/>

    <!--后续实现跳转逻辑的一个Button-->
    <Button
        android:id="@+id/btn_replace"
        android:layout_width="120dp"
        android:layout_height="60dp"
        android:layout_marginBottom="40dp"
        android:layout_gravity="bottom|center_horizontal"
        android:text="Replace"/>

    <!--用于测试传参的文本框-->
    <TextView
        android:id="@+id/tv_tabs_count"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginTop="60dp"
        android:layout_gravity="center_horizontal"
        android:visibility="gone"
        android:textSize="32sp" />
```

```
</FrameLayout>
```

2. 通过传参为Fragment指定一个背景色：**ViewAnimationFragment.java**

    1. **Fragment**中提供实例化自身对象的静态方法
    2. **onCreate**中处理传递的参数

```
public class ViewAnimationFragment extends Fragment {
    private static final String PARAM_Color = "param_color";
    private int mColor = Color.WHITE;

    public ViewAnimationFragment(){
    }

    public static ViewAnimationFragment newInstance(int color){
        ViewAnimationFragment fragment = new ViewAnimationFragment();
        Bundle args = new Bundle();
        args.putInt(PARAM_Color, color);
        fragment.setArguments(args);
        return fragment;
    }

    @Override
    public void onCreate(@Nullable Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        if (getArguments() != null) {
            mColor = getArguments().getInt(PARAM_Color);
        }
    }

    @Nullable
    @Override
    public View onCreateView(@NonNull LayoutInflater inflater, @Nullable
ViewGroup container, @Nullable Bundle savedInstanceState) {
        View view = inflater.inflate(R.layout.fragment_view_animation,
container, false);
        view.setBackgroundColor(mColor);
        return view;
    }
}
```

### 1.3.1.2 Listener

1. **宿主Activity**通过**Listener**回调获取当前已创建的**tab数量**：**MainFragment.java**(省略部分见之前的MainFragment.java)

```
public class MainFragment extends Fragment {
    // ...

    // Fragment 中定义一个接口以及接口类型的成员变量
    private MainFragmentListener mListener = null;
    public interface MainFragmentListener{
        void onMultiTabsViewCreated(int tabsCount);
    }

    // onAttach 中获取接口实例
    @Override
```

```
    public void onAttach(@NonNull Context context) {
        super.onAttach(context);
        mListener = (MainFragmentListener) context;
    }

    @Nullable
    @Override
    public View onCreateView(@NonNull LayoutInflater inflater, @Nullable
ViewGroup container, @Nullable Bundle savedInstanceState) {
        // 创建view, 见之前的MainFragment...

        // 按需调用改接口方法进行通信
        if(mListener != null){
            mListener.onMultiTabsViewCreated(adapter.getItemCount());
        }
        return view;
    }
}
```

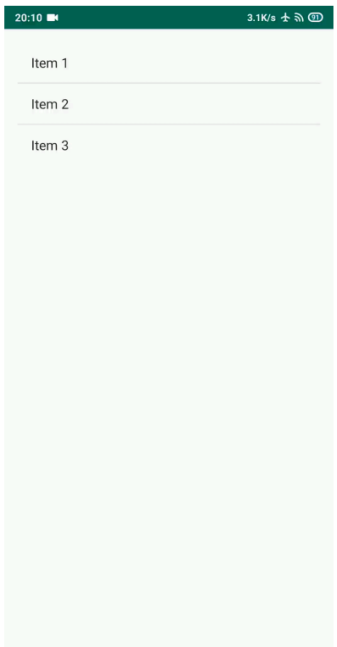
2. **宿主Activity**中实现接口方法，执行相关处理：**MainActivity.java**

```
public class MainActivity extends AppCompatActivity
    implements MainFragment.MainFragmentListener {

    @Override
    public void onMultiTabsViewCreated(int tabsCount) {
        TextView tv = findViewById(R.id.tv_tabs_count);
        tv.setText(tabsCount + " tabs created");
        tv.setVisibility(View.VISIBLE);
    }
}
```

## 1.3.2 Master Detail(自学)

### 示例 – Master Detail




- Portrait
  - Master Activity: Item List
  - Detail Activity: Item Detail
- Landscape
  - One Activity: List & Detail

## 示例 – Master Detail

- ItemsListActivity 横竖屏布局文件不同

```
public class ItemsListActivity extends FragmentActivity implements ItemsListFragment.OnItemSelectedListener {
    private boolean isTwoPane = false;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_items);
        determinePaneLayout();
    }

    private void determinePaneLayout() {
        FrameLayout fragmentItemDetail = findViewById(R.id.flDetailContainer);
        if (fragmentItemDetail != null) {
            isTwoPane = true;
            ItemsListFragment fragmentItemsList =
                    (ItemsListFragment) getSupportFragmentManager().findFragmentById(R.id.fragmentItemsList);
            fragmentItemsList.setActivateOnItemClick(true);
        }
    }
```

```
Choose Declaration
  "@+id/flDetailContainer" src/main/res/layout/activity_item_detail.xml   Chapter3Demo.app
  "@+id/flDetailContainer" src/main/res/layout-land/activity_items.xml    Chapter3Demo.app
```



## 示例 – Master Detail

- 横屏

```
<LinearLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    android:id="@+id/LinearLayout1"
    android:showDividers="middle"
    android:baselineAligned="false"
    android:orientation="horizontal"
    android:layout_width="match_parent"
    android:layout_height="match_parent" >

    <fragment
        android:id="@+id/fragmentItemsList"
        android:name="xxx.ItemsListFragment"
        android:layout_height="wrap_content"
        android:layout_width="0dp"
        android:layout_weight="1"
        tools:layout="@layout/fragment_items_list" />

    <View android:background="#000000"
        android:layout_width="1dp"
        android:layout_height="wrap_content"/>

    <FrameLayout
        android:id="@+id/flDetailContainer"
        android:layout_width="0dp"
        android:layout_height="match_parent"
        android:layout_weight="3" />

</LinearLayout>
```

- 竖屏

```
<RelativeLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:paddingBottom="16dp"
    android:paddingLeft="16dp"
    android:paddingRight="16dp"
    android:paddingTop="16dp">

    <fragment
        android:id="@+id/fragmentItemsList"
        android:name="xxx.ItemsListFragment"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_alignParentBottom="true"
        android:layout_alignParentStart="true"
        android:layout_alignParentEnd="true"
        android:layout_alignParentTop="true"
        tools:layout="@layout/fragment_items_list" />

</RelativeLayout>
```



## 1.4 总结

1. Fragment: 灵活，可重用，迷你 Activity
2. 生命周期、静态/动态添加用法
3. ViewPager & Fragment
4. 和 Activity 通信：Argument、Listener

# 二、Animation

## 2.1 视图动画

- 视图动画/补间动画

| 动画名称 | 对应Java类 | 动画描述 |
| --- | --- | --- |
| 透明度动画 | AlphaAnimation | 透明度渐变 |
| 旋转动画 | RotateAnimation | 旋转视图 |
| 平移动画 | TranslateAnimation | 移动视图 |
| 缩放动画 | ScaleAnimation | 缩放视图尺寸 |

## 2.1.1 示例

1. Java方式设置

```
private static final long ROTATE_Duration = 2000;
private static final float ROTATE_Start_Degree = 0f;
private static final float ROTATE_End_Degree = 360f;
private static final float ROTATE_Pivot = 0.5f;

private void initAnimation(){
    mRotateAnimation = new RotateAnimation(
        ROTATE_Start_Degree, ROTATE_End_Degree,
        Animation.RELATIVE_TO_SELF, ROTATE_Pivot, //x轴旋转中心
        Animation.RELATIVE_TO_SELF, ROTATE_Pivot  //y轴旋转中心
    );

    // 设置动画的持续时间，重复次数，重复模式
    mRotateAnimation.setDuration(ROTATE_Duration);
    mRotateAnimation.setRepeatCount(Animation.INFINITE);
    mRotateAnimation.setRepeatMode(Animation.REVERSE);

    // 设置监听器
    mRotateAnimation.setAnimationListener(new Animation.AnimationListener()
{
        @Override
        public void onAnimationStart(Animation animation) {
            Log.d(TAG, "onAnimationStart");
        }

        @Override
        public void onAnimationEnd(Animation animation) {
            Log.d(TAG, "onAnimationEnd");
        }

        @Override
        public void onAnimationRepeat(Animation animation) {
            Log.d(TAG, "onAnimationRepeat");
        }
    });
```

```
}
```

2. 配合XML方式设置

**fragment_view_animation.xml**

```
<?xml version="1.0" encoding="utf-8"?>
<FrameLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent">

    <!--显示一张图片-->
    <ImageView
        android:id="@+id/iv_robot"
        android:layout_width="200dp"
        android:layout_height="200dp"
        android:layout_gravity="center"
        android:src="@mipmap/ic_launcher_round" />

</FrameLayout>
```

**ViewAnimationFragment.java**

```
public class ViewAnimationFragment extends Fragment {
    private static final String TAG = "ViewAnimationFragment";

    private static final String PARAM_Color = "param_color";
    private static final long ROTATE_Duration = 2000;
    private static final float ROTATE_Start_Degree = 0f;
    private static final float ROTATE_End_Degree = 360f;
    private static final float ROTATE_Pivot = 0.5f;

    private int mColor = Color.WHITE;
    private ImageView mRobot;

    // 动画部分: 旋转动画
    private RotateAnimation mRotateAnimation;

    public ViewAnimationFragment(){
    }

    public static ViewAnimationFragment newInstance(int color){
        ViewAnimationFragment fragment = new ViewAnimationFragment();
        Bundle args = new Bundle();
        args.putInt(PARAM_Color, color);
        fragment.setArguments(args);
        return fragment;
    }

    @Override
    public void onCreate(@Nullable Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        Bundle args = getArguments();
        if(args != null){
```

```
            int givenColor = args.getInt(PARAM_Color);
            mColor = (givenColor != 0) ? givenColor : mColor;
        }
    }

    @Nullable
    @Override
    public View onCreateView(@NonNull LayoutInflater inflater, @Nullable
ViewGroup container, @Nullable Bundle savedInstanceState) {
        View view = inflater.inflate(R.layout.fragment_view_animation,
container, false);
        view.setBackgroundColor(mColor);
        mRobot = view.findViewById(R.id.iv_robot);
        return view;
    }

    @Override
    public void onResume() {
        super.onResume();
        // 启动动画
        initAnimation();
        if(mRobot != null){
            mRobot.startAnimation(mRotateAnimation);
        }
    }

    @Override
    public void onPause() {
        super.onPause();
        // 动画不为空，且动画已经启动，则停止动画
        if(mRotateAnimation != null && mRotateAnimation.hasStarted()){
            mRotateAnimation.cancel();
        }
    }

    private void initAnimation(){
        mRotateAnimation = new RotateAnimation(
                ROTATE_Start_Degree, ROTATE_End_Degree,
                Animation.RELATIVE_TO_SELF, ROTATE_Pivot, //x轴旋转中心
                Animation.RELATIVE_TO_SELF, ROTATE_Pivot  //y轴旋转中心
        );

        // 设置动画的持续时间，重复次数，重复模式
        mRotateAnimation.setDuration(ROTATE_Duration);
        mRotateAnimation.setRepeatCount(Animation.INFINITE);
        mRotateAnimation.setRepeatMode(Animation.REVERSE);

        // 设置监听器
        mRotateAnimation.setAnimationListener(new
Animation.AnimationListener() {
            @Override
            public void onAnimationStart(Animation animation) {
                Log.d(TAG, "onAnimationStart");
            }

            @Override
            public void onAnimationEnd(Animation animation) {
                Log.d(TAG, "onAnimationEnd");
```

```
            }

            @Override
            public void onAnimationRepeat(Animation animation) {
                Log.d(TAG, "onAnimationRepeat");
            }
        });
    }
}
```

### 2.1.2 视图动画的属性

- Animation 公有属性

| | |
|---|---|
| android:duration | 动画持续时间 |
| android:fillAfter | 为true动画结束时，View将保持动画结束时的状态 |
| android:fillBefore | 为true动画结束时，View将还原到开始开始时的状态 |
| android:repeatCount | 动画重复执行的次数 |
| android:repeatMode | 动画重复模式 ，重复播放时restart重头开始，reverse重复播放时倒叙回放，该属性需要和android:repeatCount一起使用 |
| android:interpolator | 插值器，相当于变速器，改变动画的不同阶段的执行速度 |

## 2.2 属性动画

### 2.2.1 属性动画 vs 视图动画

1. 属性动画：**android.animation**
    1. 基于属性的动画
    2. 一切可以连续变化的属性都是动画的元素
    3. 实现一种复杂动画，就是将动画拆解成不同属性组合的过程
2. 视图动画：**android.view.animation**
    1. 只能对 View 做动画
    2. 只能对 View 的某些绘制属性做动画
    3. 只是视觉效果

### 2.2.2 属性动画的角色构成

1. **Property**：alpha, scaleX, scaleY, rotation, translationX, translationY
2. **参数**：StartValue, EndValue, Duration
3. **RepeatCount**：number, infinite
4. **RepeatMode**：restart, reverse
5. **TypeEvaluator**：IntEvaluator, ArgbEvaluator
6. **Interpolator**：linear/accelerate/decelerate

## 2.2.3 Animator：单个属性动画

### 2.2.3.1 fragment_object_animation.xml

```
<?xml version="1.0" encoding="utf-8"?>
<FrameLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="#34C724">

    <!--显示一张图片-->
    <ImageView
        android:id="@+id/iv_robot"
        android:layout_width="200dp"
        android:layout_height="200dp"
        android:layout_gravity="center"
        android:src="@mipmap/ic_launcher_round"/>
</FrameLayout>
```

### 2.2.3.2 ObjectAnimationFragment.java

```
public class ObjectAnimationFragment extends Fragment {
    private static final String PARAM_Color = "param_color";
    private int mColor = Color.WHITE;

    private ImageView mRobot;

    // 属性动画类
    private ObjectAnimator mAnimator;
    // 当前播放的时哪一个动画
    private int mAnimationType = ALPHA_Animation_Type;
    // 每个动画的重复次数，持续时间
    private static final int ANIMATION_Repeat_Count = 1;
    private static final long ANIMATION_Duration = 2000;
    // 透明度动画
    private static final int ALPHA_Animation_Type = 0;
    private static final float ALPHA_Start = 1f;
    private static final float ALPHA_End = 0f;

    public ObjectAnimationFragment(){
    }


    // ObjectAnimationFragment加载视图时调用
    @Nullable
    @Override
    public View onCreateView(@NonNull LayoutInflater inflater, @Nullable
ViewGroup container, @Nullable Bundle savedInstanceState) {
        View view = inflater.inflate(R.layout.fragment_view_animation,
container, false);
        mRobot = view.findViewById(R.id.iv_robot);
        return view;
    }

    // ObjectAnimationFragment可交互时调用
```

```
    @Override
    public void onResume() {
        super.onResume();
        startAnimation();
    }
    // 创建动画类,并开始动画
    private void startAnimation(){
        // 如果图片不存在, 则直接返回
        if(mRobot == null) return;
        initAlphaAnimation();
        mAnimator.start();
    }
    // 初始化动画类
    private void initAlphaAnimation(){
        // 设置属性动画的相关参数
        mAnimator = ObjectAnimator.ofFloat(
                mRobot, "alpha",
                ALPHA_Start, ALPHA_End, ALPHA_Start);

        mAnimator.setDuration(ANIMATION_Duration);
        mAnimator.setRepeatCount(ANIMATION_Repeat_Count);
        mAnimator.setRepeatMode(ValueAnimator.RESTART);
    }

    // ViewAnimationFragment不可交互时调用
    @Override
    public void onPause() {
        super.onPause();
        cancelAnimation();
    }
    // 将所有动画类删除
    private void cancelAnimation(){
        // 动画不为空, 且动画已经启动, 则停止动画
        if(mAnimator != null && mAnimator.isRunning()){
            mAnimator.cancel();
        }
    }
}
```

## 2.2.4 AnimatorSet：多个属性动画之间的切换

```
public class ObjectAnimationFragment extends Fragment {
    private static final String PARAM_Color = "param_color";
    private int mColor = Color.WHITE;

    private ImageView mRobot;

    // 属性动画类
    private AnimatorSet mAnimatorSet;
    // 当前播放的时哪一个动画
    private int mAnimationType = ROTATE_Animation_Type;
    // 每个动画的重复次数, 持续时间
    private static final int ANIMATION_Repeat_Count = 1;
    private static final long ANIMATION_Duration = 2000;
    // 透明度动画
    private ObjectAnimator mAlphaAnimator;
    private static final int ALPHA_Animation_Type = 0;
```

```
    private static final float ALPHA_Start = 1f;
    private static final float ALPHA_End = 0f;
    // 旋转动画
    private ObjectAnimator mRotateAnimator;
    private static final int ROTATE_Animation_Type = 1;
    private static final float ROTATE_Start_Degree = 0f;
    private static final float ROTATE_End_Degree = 360f;
    // 移动动画
    private ObjectAnimator mTranslateXAnimator;
    private static final int TRANSLATE_Animation_Type = 2;
    private static final float TRANSLATE_XDelta_Start = 0f;
    private static final float TRANSLATE_XDelta_End = 100f;
    // 缩放视图动画
    private ObjectAnimator mScaleXAnimator;
    private static final int SCALE_Animation_Type = 3;
    private static final float SCALE_X_Start = 1f;
    private static final float SCALE_X_End = 1.5f;

    public ObjectAnimationFragment(){ }

    // ObjectAnimationFragment加载视图时调用
    @Nullable
    @Override
    public View onCreateView(@NonNull LayoutInflater inflater, @Nullable
ViewGroup container, @Nullable Bundle savedInstanceState) {
        View view = inflater.inflate(R.layout.fragment_view_animation,
container, false);
        mRobot = view.findViewById(R.id.iv_robot);
        return view;
    }

    // ObjectAnimationFragment可交互时调用
    @Override
    public void onResume() {
        super.onResume();
        startAnimation();
    }
    // 创建AnimatorSet,并开始动画
    private void startAnimation(){
        // 如果图片不存在, 则直接返回
        if(mRobot == null) return;
        // 创建动画类
        initAlphaAnimation();
        initRotateAnimation();
        initTranslateXAnimation();
        initScaleXAnimation();
        // 创建AnimatorSet
        mAnimatorSet = new AnimatorSet();
        mAnimatorSet.playSequentially(mAlphaAnimator, mRotateAnimator,
mTranslateXAnimator, mScaleXAnimator);
        mAnimatorSet.start();
        mAnimatorSet.addListener(new Animator.AnimatorListener() {
            @Override
            public void onAnimationStart(Animator animator) { }

            @Override
            public void onAnimationEnd(Animator animator) {
                // 动画序列结束后, 重新开始播放动画序列
```

```
                mAnimatorSet.start();
            }

            @Override
            public void onAnimationCancel(Animator animator) { }

            @Override
            public void onAnimationRepeat(Animator animator) { }
        });
    }
    // 初始化动画类
    private void initAlphaAnimation(){
        // 设置属性动画的相关参数
        mAlphaAnimator = ObjectAnimator.ofFloat(
                mRobot, "alpha",
                ALPHA_Start, ALPHA_End, ALPHA_Start);

        mAlphaAnimator.setDuration(ANIMATION_Duration);
        mAlphaAnimator.setRepeatCount(ANIMATION_Repeat_Count);
        mAlphaAnimator.setRepeatMode(ValueAnimator.RESTART);
        mAlphaAnimator.setInterpolator(new LinearInterpolator());
    }
    private void initRotateAnimation(){
        mRotateAnimator = ObjectAnimator.ofFloat(
                mRobot, "rotation",
                ROTATE_Start_Degree, ROTATE_End_Degree, ROTATE_Start_Degree);

        mRotateAnimator.setDuration(ANIMATION_Duration);
        mRotateAnimator.setRepeatCount(ANIMATION_Repeat_Count);
        mRotateAnimator.setRepeatMode(ValueAnimator.RESTART);
        mRotateAnimator.setInterpolator(new LinearInterpolator());
    }
    private void initTranslateXAnimation(){
        mTranslateXAnimator = ObjectAnimator.ofFloat(
                mRobot, "translationX",
                TRANSLATE_XDelta_Start, TRANSLATE_XDelta_End,
TRANSLATE_XDelta_Start);

        mTranslateXAnimator.setDuration(ANIMATION_Duration);
        mTranslateXAnimator.setRepeatCount(ANIMATION_Repeat_Count);
        mTranslateXAnimator.setRepeatMode(ValueAnimator.RESTART);
        mTranslateXAnimator.setInterpolator(new LinearInterpolator());
    }
    private void initScaleXAnimation(){
        mScaleXAnimator = ObjectAnimator.ofFloat(
                mRobot, "scaleX",
                SCALE_X_Start, SCALE_X_End, SCALE_X_Start);

        mScaleXAnimator.setDuration(ANIMATION_Duration);
        mScaleXAnimator.setRepeatCount(ANIMATION_Repeat_Count);
        mScaleXAnimator.setRepeatMode(ValueAnimator.RESTART);
        mScaleXAnimator.setInterpolator(new LinearInterpolator());
    }

    // ViewAnimationFragment不可交互时调用
    @Override
    public void onPause() {
        super.onPause();
```

```
            cancelAnimation();
        }
        // 将所有动画类删除
        private void cancelAnimation(){
            // 动画不为空，且动画已经启动，则停止动画
            mAnimatorSet.cancel();
            if(mAlphaAnimator != null && mAlphaAnimator.isRunning()){
                mAlphaAnimator.cancel();
            }
            if(mRotateAnimator != null && mRotateAnimator.isRunning()){
                mRotateAnimator.cancel();
            }
            if(mTranslateXAnimator != null && mTranslateXAnimator.isRunning()){
                mTranslateXAnimator.cancel();
            }
            if(mScaleXAnimator != null && mScaleXAnimator.isRunning()){
                mScaleXAnimator.cancel();
            }
        }
    }
```

## 属性动画 – 示例2 – AnimatorSet

```
<set xmlns:android="http://schemas.android.com/apk/res/android">
    <objectAnimator
        android:duration="1000"
        android:valueFrom="1.1"
        android:valueTo="0.9"
        android:propertyName="scaleX"
        android:interpolator="@android:anim/linear_interpolator"
        android:repeatMode="reverse"
        android:repeatCount="infinite" />

    <objectAnimator
        android:duration="1000"
        android:valueFrom="1.1"
        android:valueTo="0.9"
        android:propertyName="scaleY"
        android:interpolator="@android:anim/linear_interpolator"
        android:repeatMode="reverse"
        android:repeatCount="infinite" />
</set>
```

```
Animator animator = AnimatorInflater.loadAnimator( context: this, R.animator.breath);
animator.setTarget(findViewById(R.id.image_view));
animator.start();
```

## 2.2.5 特点，xml语法

# 属性动画 – 特点，xml语法

```
<set
  android:ordering=["together" | "sequentially"]>

    <objectAnimator
        android:propertyName="string"
        android:duration="int"
        android:valueFrom="float | int | color"
        android:valueTo="float | int | color"
        android:startOffset="int"
        android:repeatCount="int"
        android:repeatMode=["repeat" | "reverse"]
        android:valueType=["intType" | "floatType"]/>

    <animator
        android:duration="int"
        android:valueFrom="float | int | color"
        android:valueTo="float | int | color"
        android:startOffset="int"
        android:repeatCount="int"
        android:repeatMode=["repeat" | "reverse"]
        android:valueType=["intType" | "floatType"]/>
    <set>
        ...
    </set>
</set>
```

## 2.2.6 属性动画核心 - ValueAnimator

1. 控制某个数值，在某个时间内，在某个区间内进行规律变化

# 属性动画核心 – ValueAnimator

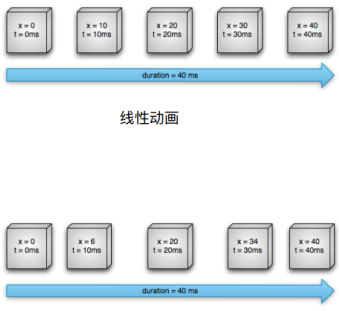
```
public final class ObjectAnimator extends ValueAnimator
```

```
final View v = findViewById(R.id.image_view);
ValueAnimator valueAnimator = ValueAnimator.ofFloat(0, 360);
valueAnimator.setRepeatCount(ValueAnimator.INFINITE);
valueAnimator.setInterpolator(new LinearInterpolator());
valueAnimator.setRepeatMode(ValueAnimator.RESTART);
valueAnimator.setDuration(8000);
valueAnimator.addUpdateListener(new ValueAnimator.AnimatorUpdateListener() {
    @Override
    public void onAnimationUpdate(ValueAnimator animation) {
        v.setRotation((float) animation.getAnimatedValue());
    }
});
valueAnimator.start();
```

## 2.2.7 属性动画原理

1. 插值器：决定变化的规律
2. 估值器：决定变化的具体数值

### 属性动画 – 原理

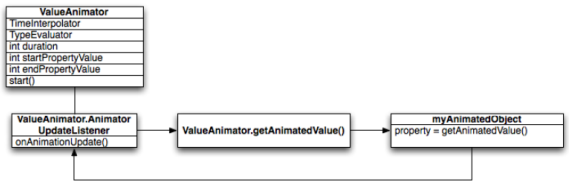



线性动画




非线性动画

- TimeInterpolator: 插值器，根据时间完成度计算动画完成度
- TypeEvaluator: 估值器，根据动画完成度计算具体属性值




动画如何计算动画

3. 常用系统内置插值器

- 常用系统内置插值器

| 描述 | 对应Java类 | 对应资源ID |
| --- | --- | --- |
| 匀速 | LinearInterpolator | @android:anim/linear_interpolator |
| 逐渐加速 | AccelerateInterpolator | @android:anim/accelerate_interpolator |
| 先加速后减速 | AccelerateDecelerateInterpolator | @android:anim/accelerate_decelerate_interpolator |
| 减速 | DecelerateInterpolator | @android:anim/decelerate_interpolator |

### 2.2.8 属性动画 - 注意

1. 使用ObjectAnimator 时，目标属性必须同时具备getter()及setter() 方法
2. ObjectAnimator 操作对象宿主页面退出前台或销毁时，需保证动画任务得到妥善处理，防止内存泄漏

### 2.2.9 属性动画 - 自定义属性

#### 属性动画 – 自定义属性

- 操作的对象可以不是一个View的对象

```
class WrapperView {
    private View mTarget;

    public WrapperView(View mTarget) {
        this.mTarget = mTarget;
    }
    public int getHeight() {
        return mTarget.getLayoutParams().height;
    }
    public void setHeight(int height) {
        mTarget.getLayoutParams().height = height;
        mTarget.requestLayout();
    }
}
```

## 2.3 Activity 切换动画

# Activity 切换动画

```
/**
 * Call immediately after one of the flavors of {@link #startActivity(Intent)}
 * or {@link #finish} to specify an explicit transition animation to
 * perform next.
 *
 * <p>As of {@link android.os.Build.VERSION_CODES#JELLY_BEAN} an alternative
 * to using this with starting activities is to supply the desired animation
 * information through a {@link ActivityOptions} bundle to
 * {@link #startActivity(Intent, Bundle)} or a related function.  This allows
 * you to specify a custom animation even when starting an activity from
 * outside the context of the current top activity.
 *
 * @param enterAnim A resource ID of the animation resource to use for
 * the incoming activity.  Use 0 for no animation.
 * @param exitAnim A resource ID of the animation resource to use for
 * the outgoing activity.  Use 0 for no animation.
 */
public void overridePendingTransition(int enterAnim, int exitAnim)
```

### 2.3.1 示例 FadeInOut

### Activity 切换动画 – 示例 FadeInOut

```
// 进入动画
startActivity(new Intent(TransitionActivity.this, TransitionActivity.class));
overridePendingTransition(R.anim.fade_in, R.anim.fade_out);

// 退出动画
super.finish();
overridePendingTransition(R.anim.fade_in, R.anim.fade_out);
```

```
<!--anim/fade_in-->
<alpha xmlns:android="http://schemas.android.com/apk/res/android"
    android:duration="@android:integer/config_shortAnimTime"
    android:fromAlpha="0.0"
    android:interpolator="@android:anim/accelerate_interpolator"
    android:toAlpha="1.0" />

<!--anim/fade_out-->
<alpha xmlns:android="http://schemas.android.com/apk/res/android"
    android:duration="@android:integer/config_shortAnimTime"
    android:fromAlpha="1.0"
    android:interpolator="@android:anim/accelerate_interpolator"
    android:toAlpha="0.0" />
```

- 注意调用时机
- 进入和退出的 Activity 最好设置相同的动画时长，防止黑屏

# 2.4 逐帧动画/Drawable 动画

1. 逐帧动画可以被当作一种特殊的drawable对象
2. 逐帧动画会按次序播放一系列图片
3. 逐帧动画会一次性将所有图片加载到内存中，会有OOM风险

## 2.4.1 示例 AnimationDrawable

### 示例 – AnimationDrawable

```
// res/drawable/anim_list.xml
<animation-list xmlns:android="http://schemas.android.com/apk/res/android" >
    <item android:drawable="@drawable/one" android:duration="500"/>
    <item android:drawable="@drawable/two" android:duration="500"/>
    <item android:drawable="@drawable/three" android:duration="500"/>
    <item android:drawable="@drawable/four" android:duration="500"/>
</animation-list>
```

```
// activity
mImage = findViewById(R.id.image_frame);
mImage.setBackgroundResource(R.drawable.anim_list);
AnimationDrawable drawable = (AnimationDrawable) mImage.getBackground();
drawable.start();
```

# 2.5 Lottie

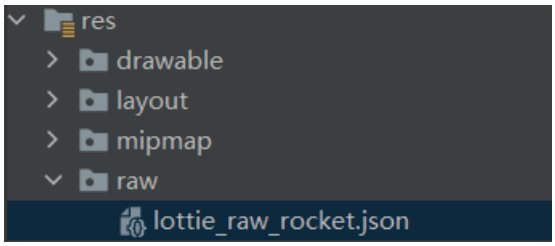
1. airbnb公司的开源库
2. 可以直接导入AE制作的动画素材
3. 本质是将所有动画元素抽象成绘制属性

## 2.5.1 示例

1. 在**app/build.gradle**中，添加依赖

```
dependencies {
    //...
    implementation 'com.airbnb.android:lottie:3.4.2'
}
```

2. 添加资源**raw/lottie_raw_rocket.json**




3. 修改**fragment_lottie_animation.xml**

```
<?xml version="1.0" encoding="utf-8"?>
<FrameLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="#ff0000">

    <com.airbnb.lottie.LottieAnimationView
        android:id="@+id/lottieView"
        android:layout_width="200dp"
        android:layout_height="200dp"
        android:layout_gravity="center"
        app:lottie_rawRes="@raw/lottie_raw_rocket"
        app:lottie_autoPlay="true"
        app:lottie_loop="true"/>

</FrameLayout>
```

4. 修改**LottieAnimationFragment.java**

```
public class LottieAnimationFragment extends Fragment {
    private static final String PARAM_Color = "param_color";

    public LottieAnimationFragment(){
    }


    @Nullable
    @Override
    public View onCreateView(@NonNull LayoutInflater inflater, @Nullable
ViewGroup container, @Nullable Bundle savedInstanceState) {
        return inflater.inflate(R.layout.fragment_lottie_animation,
container, false);
    }
}
```

# 三、总结

1. 动画意义
2. 属性动画
    1. ObjectAnimator & AnimatorSet
    2. 原理
    3. vs 视图动画
3. Lottie