twitch.tv/dancojocar
youtube.com/dancojocar

Lecture #10
Advanced Mobile Development

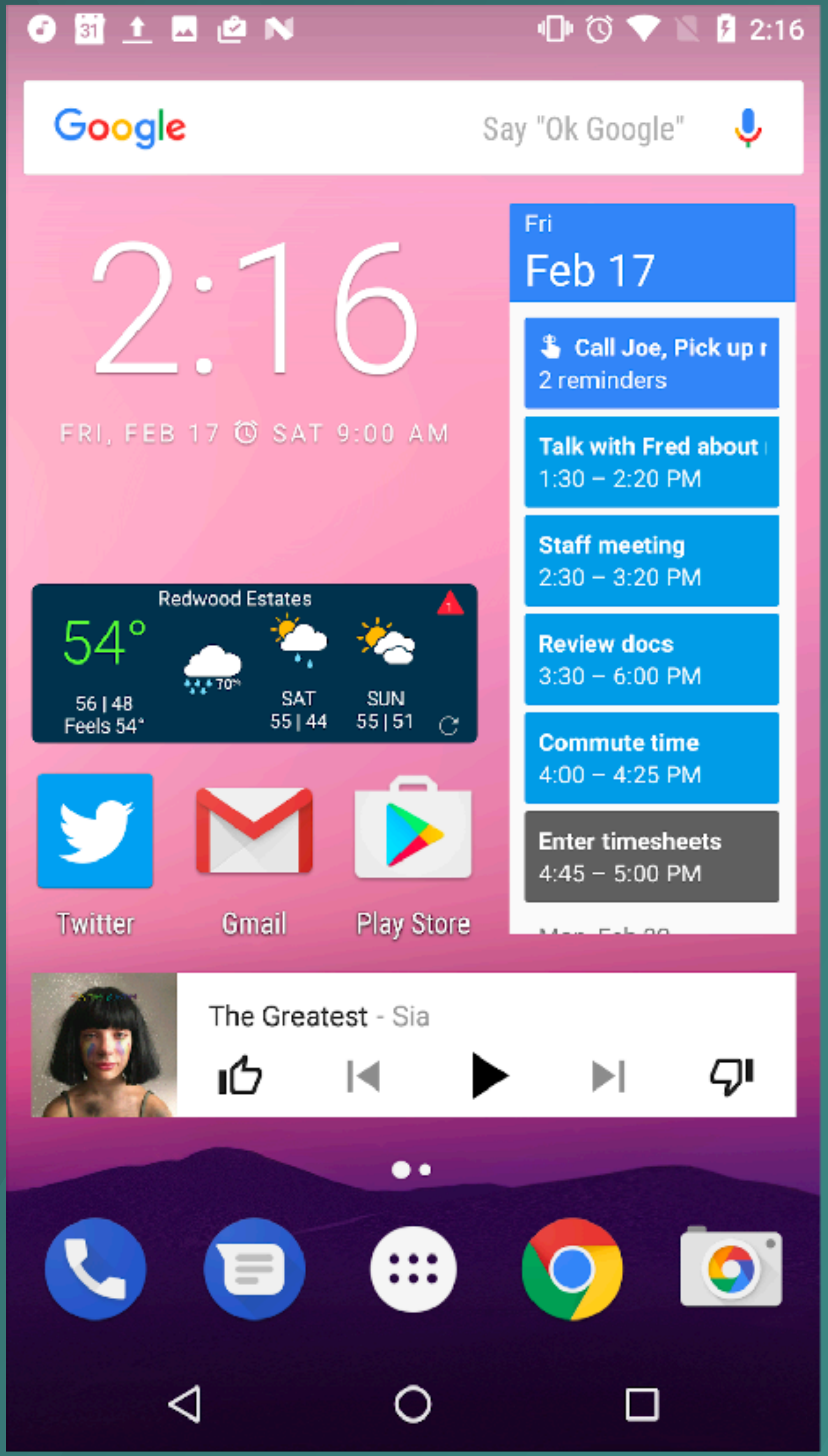
Mobile Applications
Fall 2024

La mulți ani!

Happy Birthday!

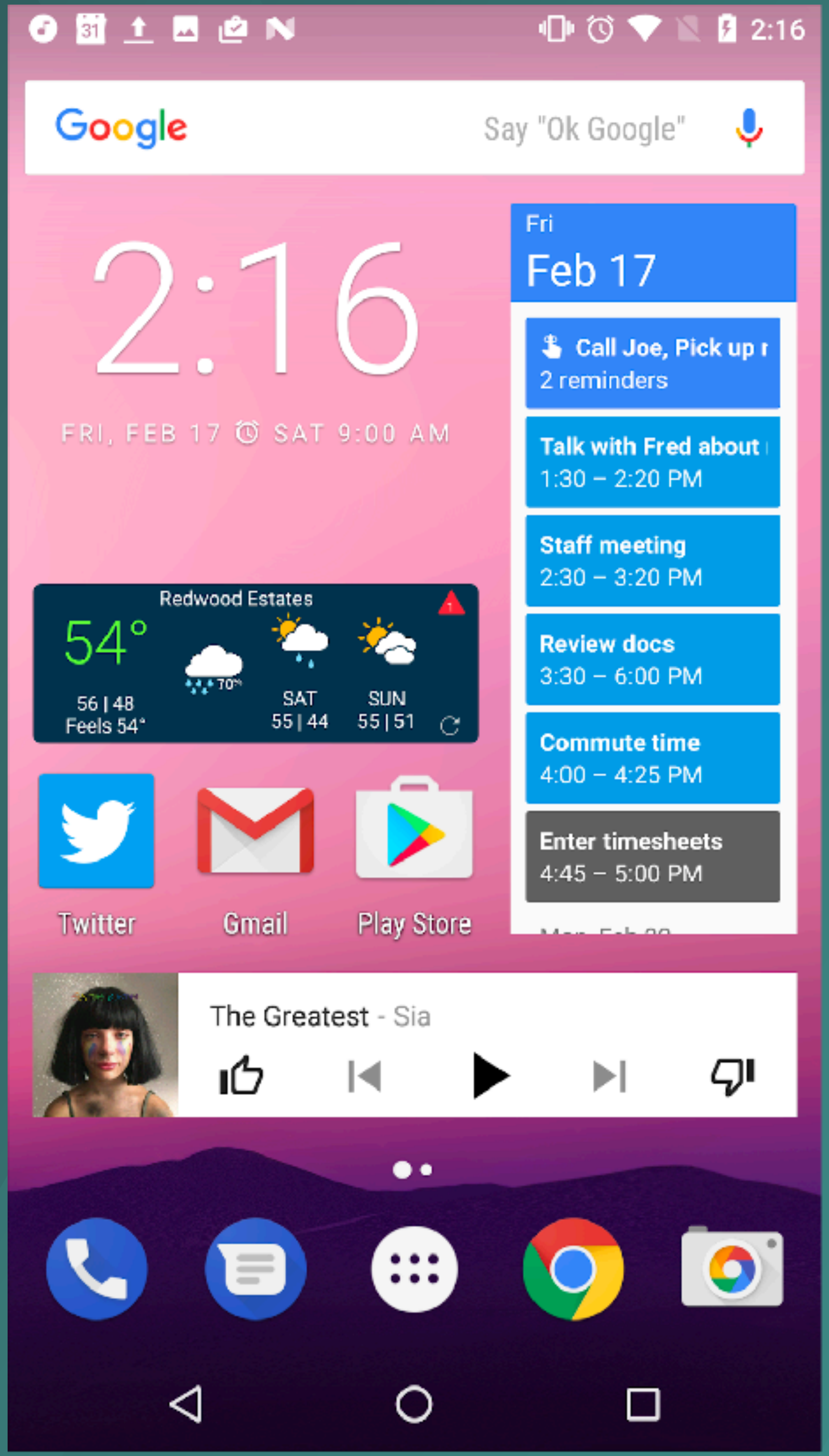
App Widgets

- A miniature app view.
- Runs on the home screen.
- Updated periodically.
- Display small amounts of information.
- Perform simple functions.



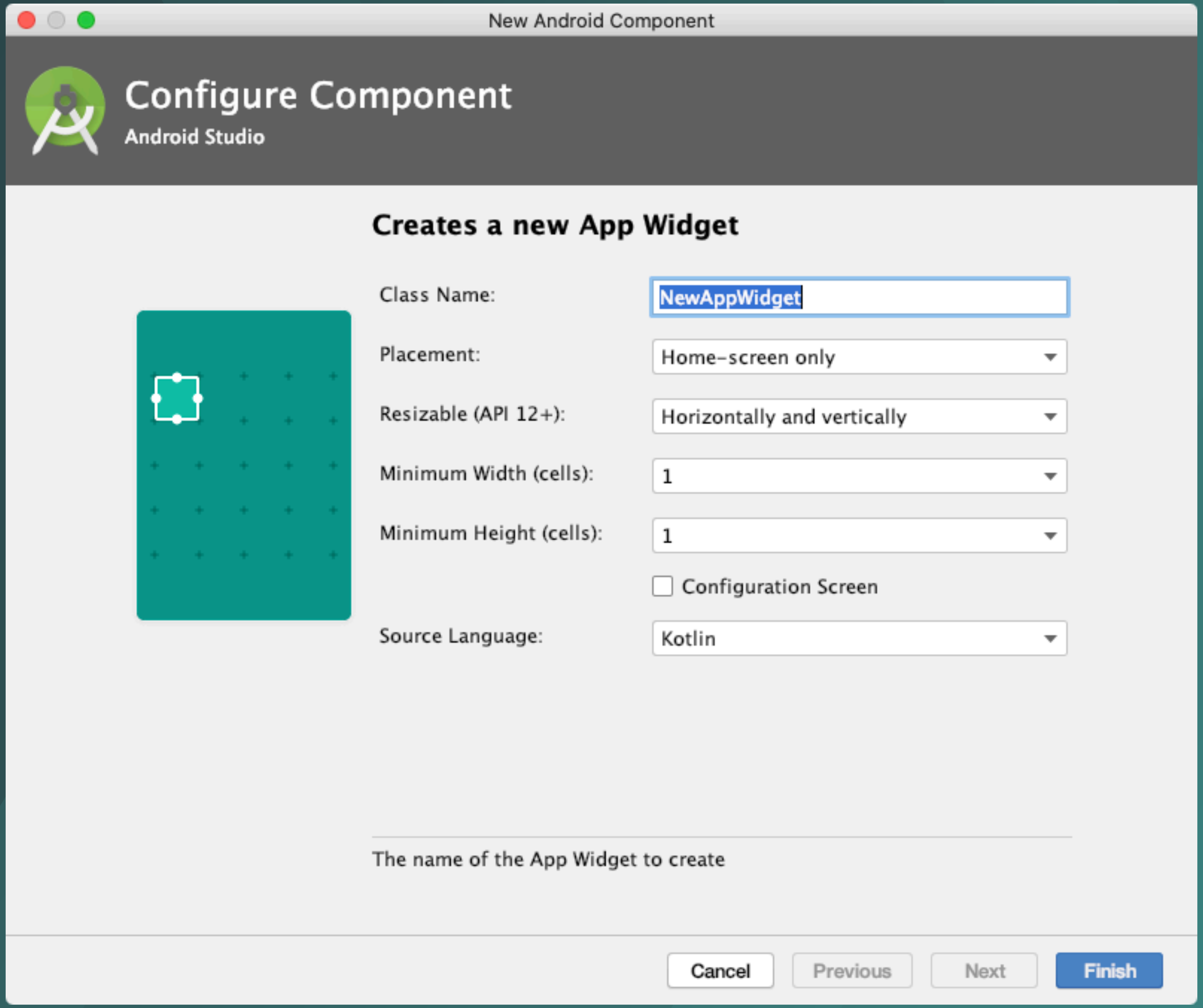
App Widgets

- Add-ons for an existing app.
- An app can have multiple widgets.
- Not available without an app.
- The default action is to start the app.



Set up the app widget project

- File > New > Widget > AppWidget.



Configure Component

Android Studio

Creates a new App Widget

Class Name: NewAppWidget

Placement: Home-screen only

Resizable (API 12+): Horizontally and vertically

Minimum Width (cells): 1

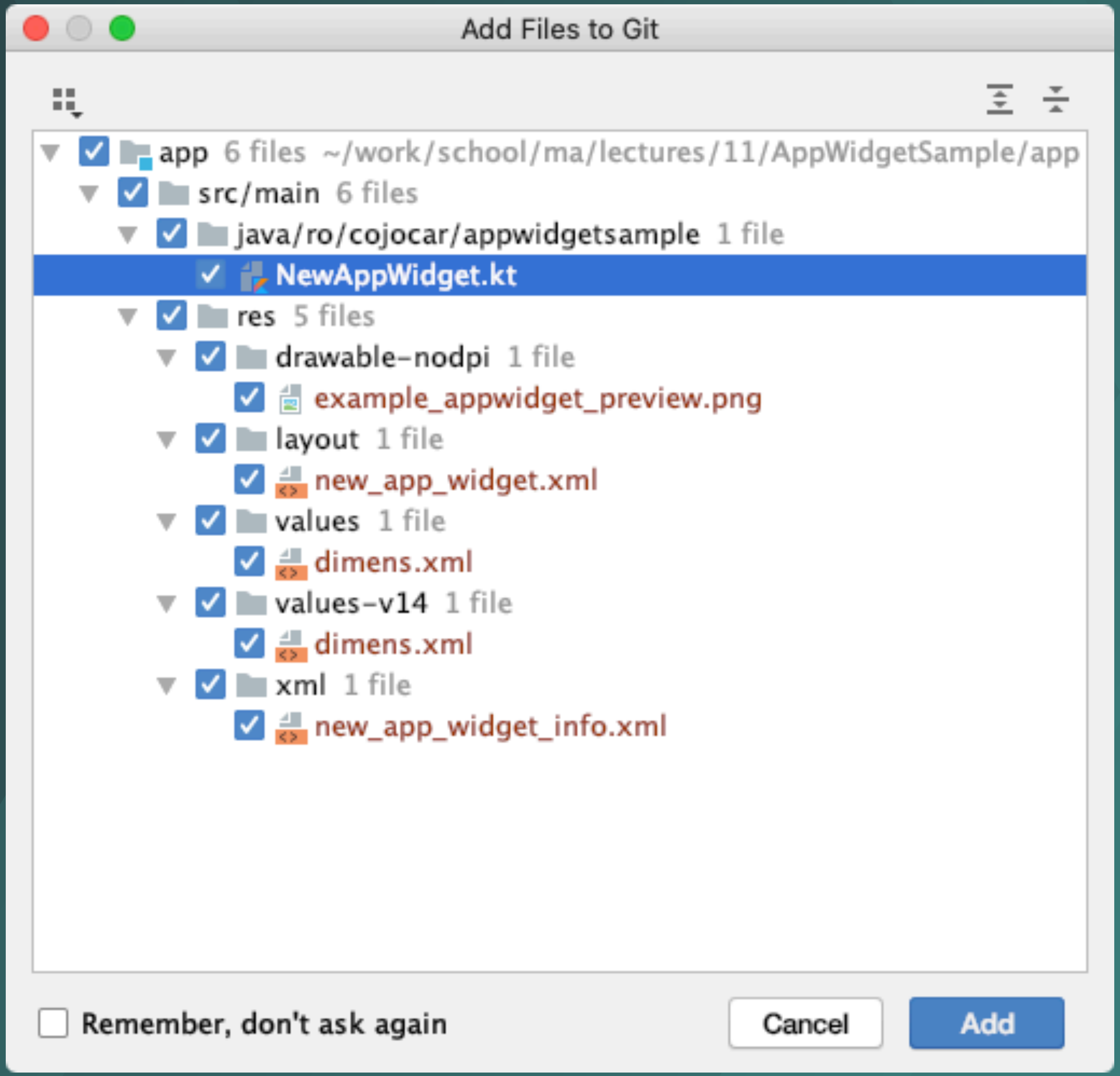
Minimum Height (cells): 1

□ Configuration Screen

Source Language: Kotlin

The name of the App Widget to create

Generated Files

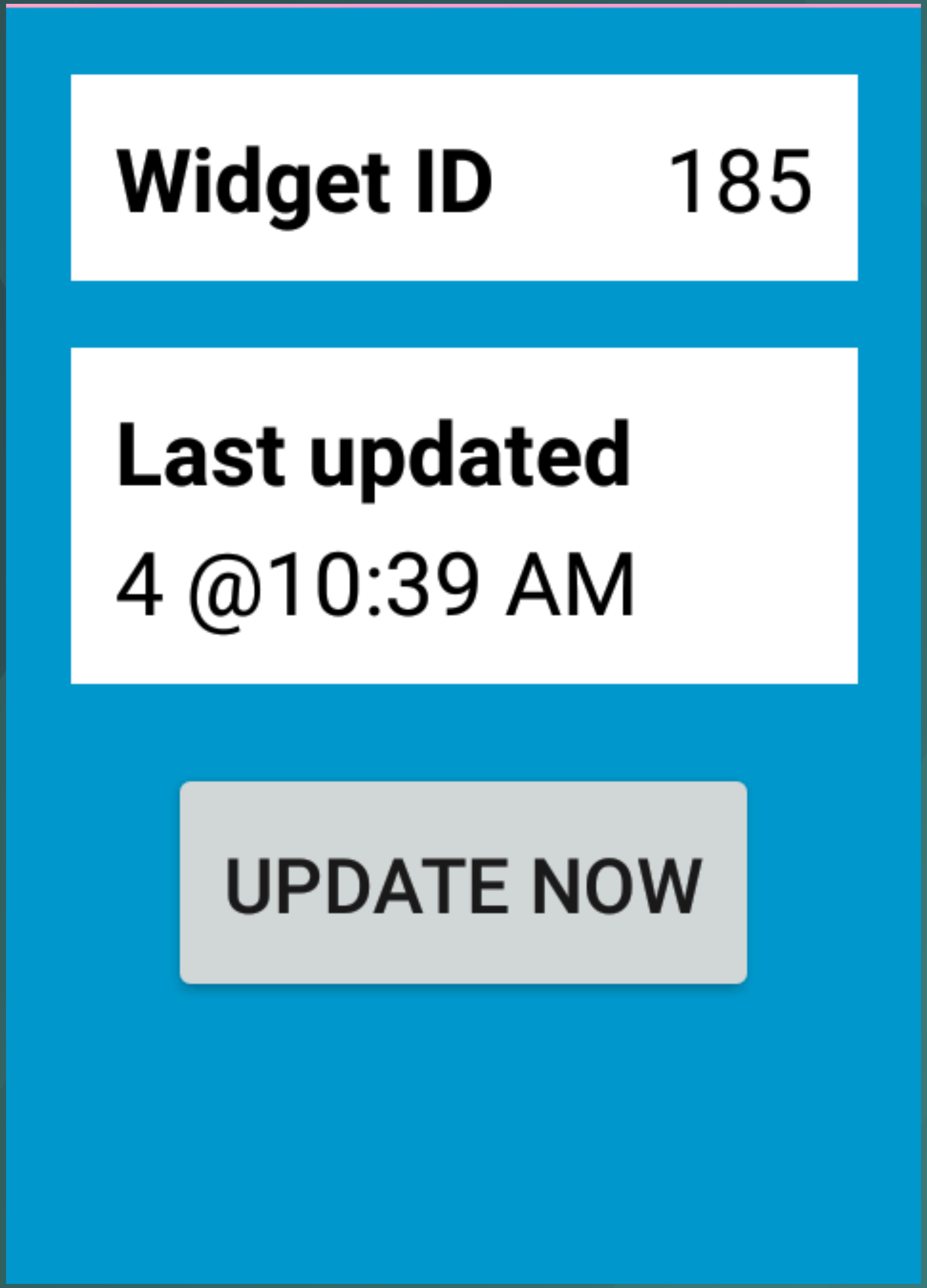


```
▼ ☑ app  6 files  ~/work/school/ma/lectures/11/AppWidgetSample/app
    ▼ ☑ src/main  6 files
        ▼ ☑ java/ro/cojocar/appwidgetsample  1 file
              ☑ NewAppWidget.kt
        ▼ ☑ res  5 files
            ▼ ☑ drawable-nodpi  1 file
                  ☑ example_appwidget_preview.png
            ▼ ☑ layout  1 file
                  ☑ new_app_widget.xml
            ▼ ☑ values  1 file
                  ☑ dimens.xml
            ▼ ☑ values-v14  1 file
                  ☑ dimens.xml
            ▼ ☑ xml  1 file
                  ☑ new_app_widget_info.xml
```

□ Remember, don't ask again

Customize the widget

DEMO



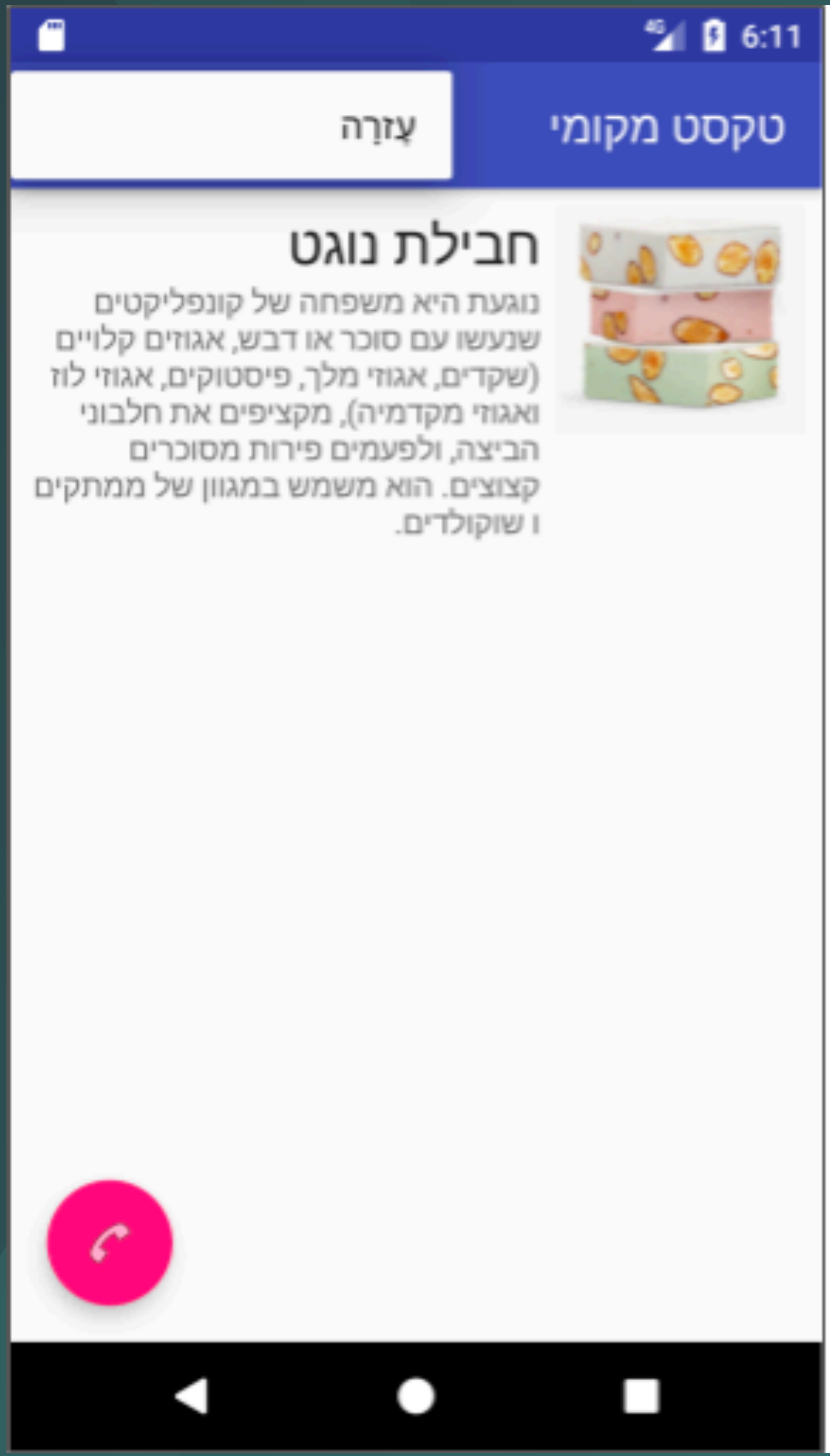
Widget ID 185

Last updated

4 @10:39 AM

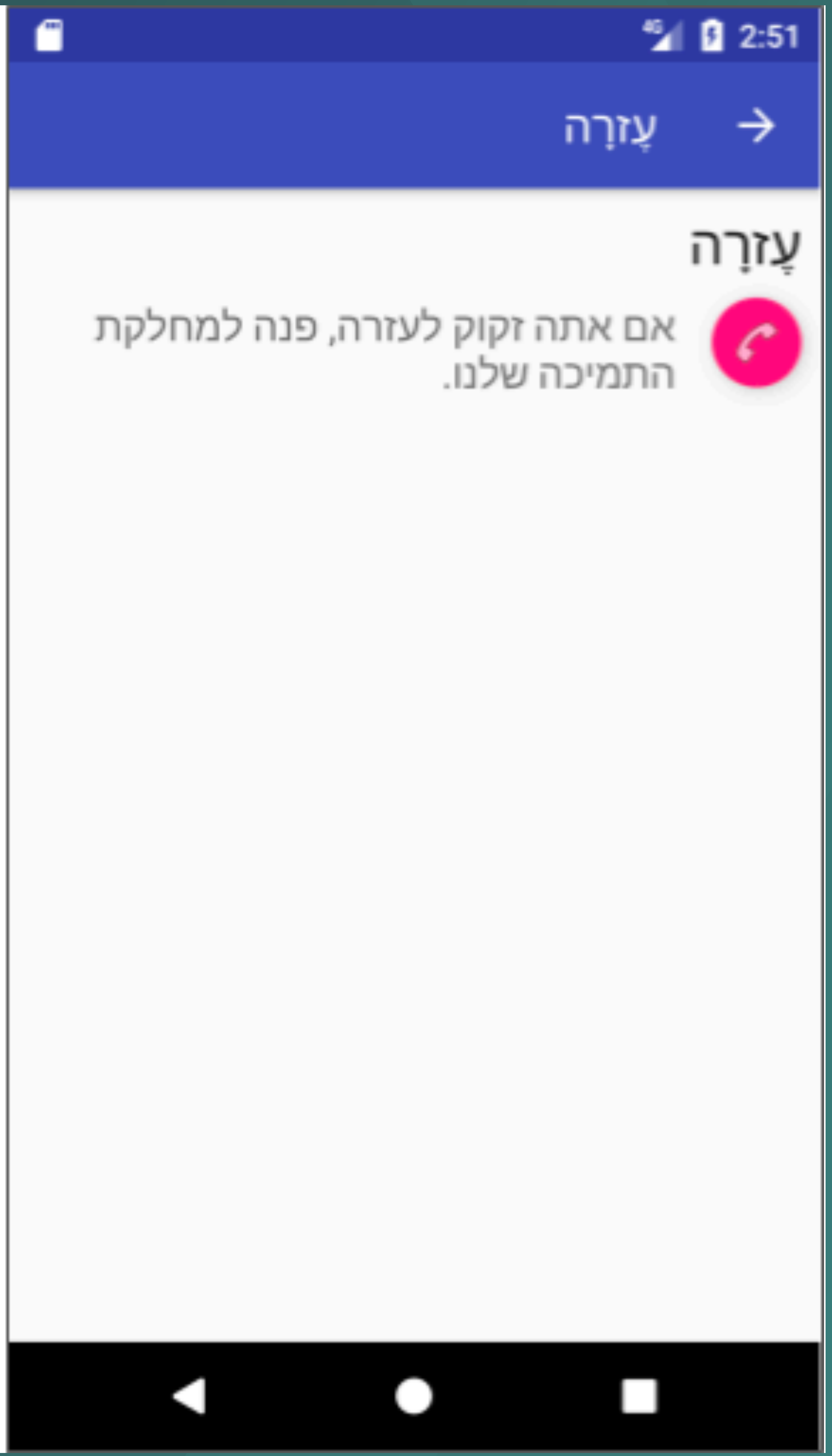
developer.android.com/guide/topics/appwidgets/index.html

Language Support



חבילת נוגט

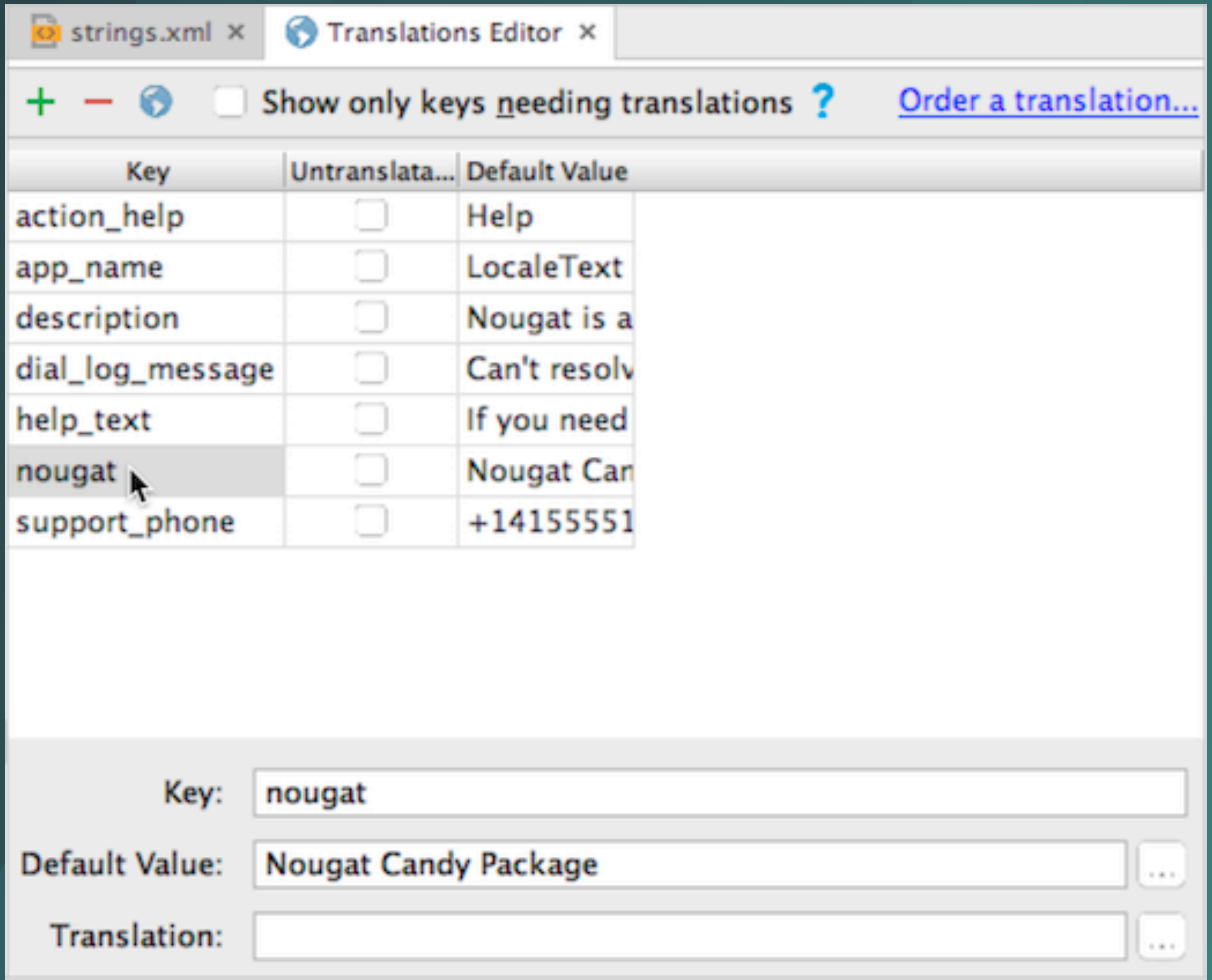
נוגעת היא משפחה של קונפליקטים
שנעשו עם סוכר או דבש, אגוזים קלויים
(שקדים, אגוזי מלך, פיסטוקים, אגוזי לוז
ואגוזי מקדמיה), מקציפים את חלבוני
הביצה, ולפעמים פירות מסוכרים
קצוצים. הוא משמש במגוון של ממתקים
ו שוקולדים.



עֶזְרָה

אם אתה זקוק לעזרה, פנה למחלקת
התמיכה שלנו.

Add another language resource to the app



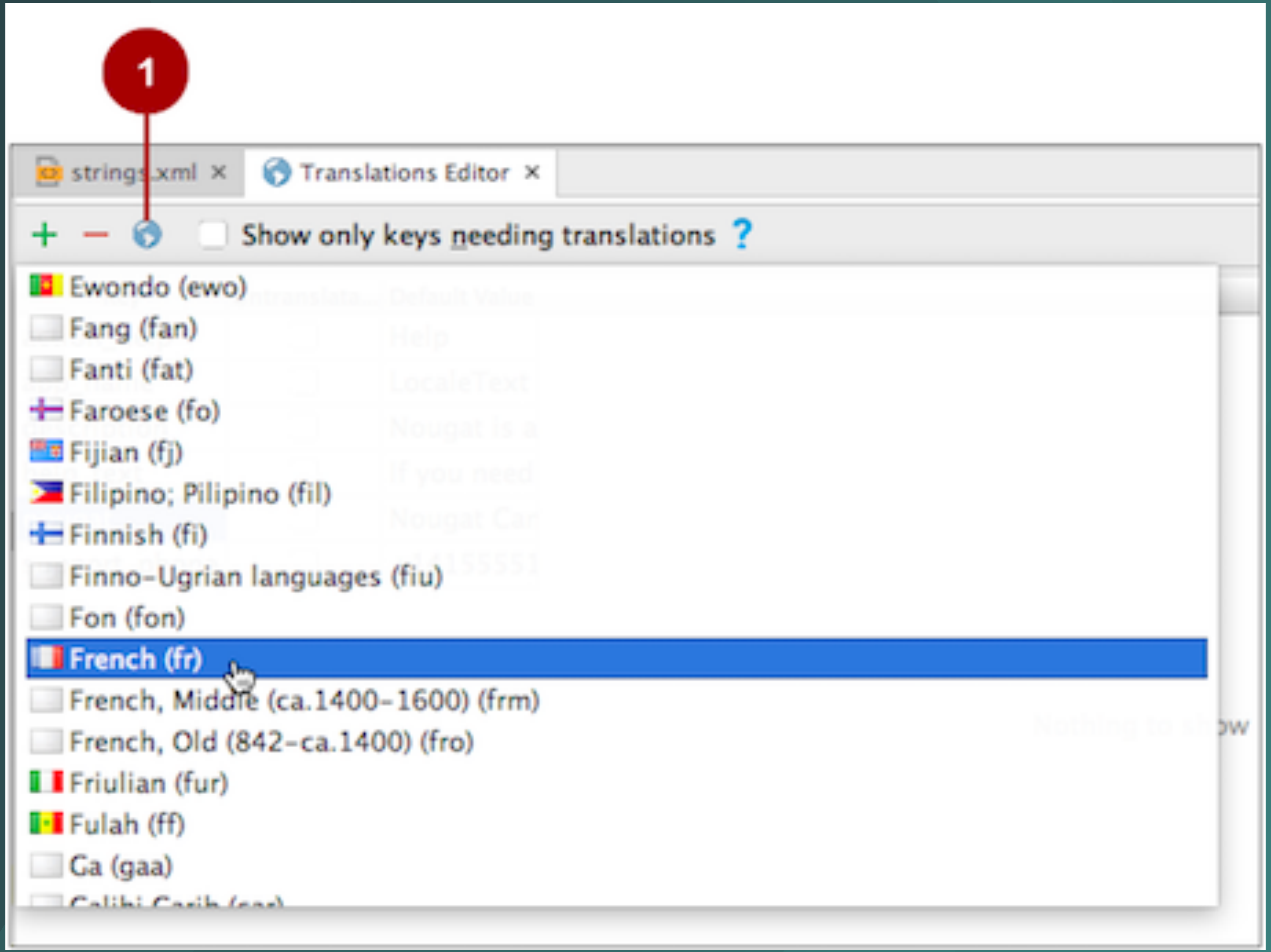
Key	Untranslata...	Default Value
action_help	□	Help
app_name	□	LocaleText
description	□	Nougat is a
dial_log_message	□	Can't resolv
help_text	□	If you need
nougat	□	Nougat Can
support_phone	□	+14155551

Key: nougat

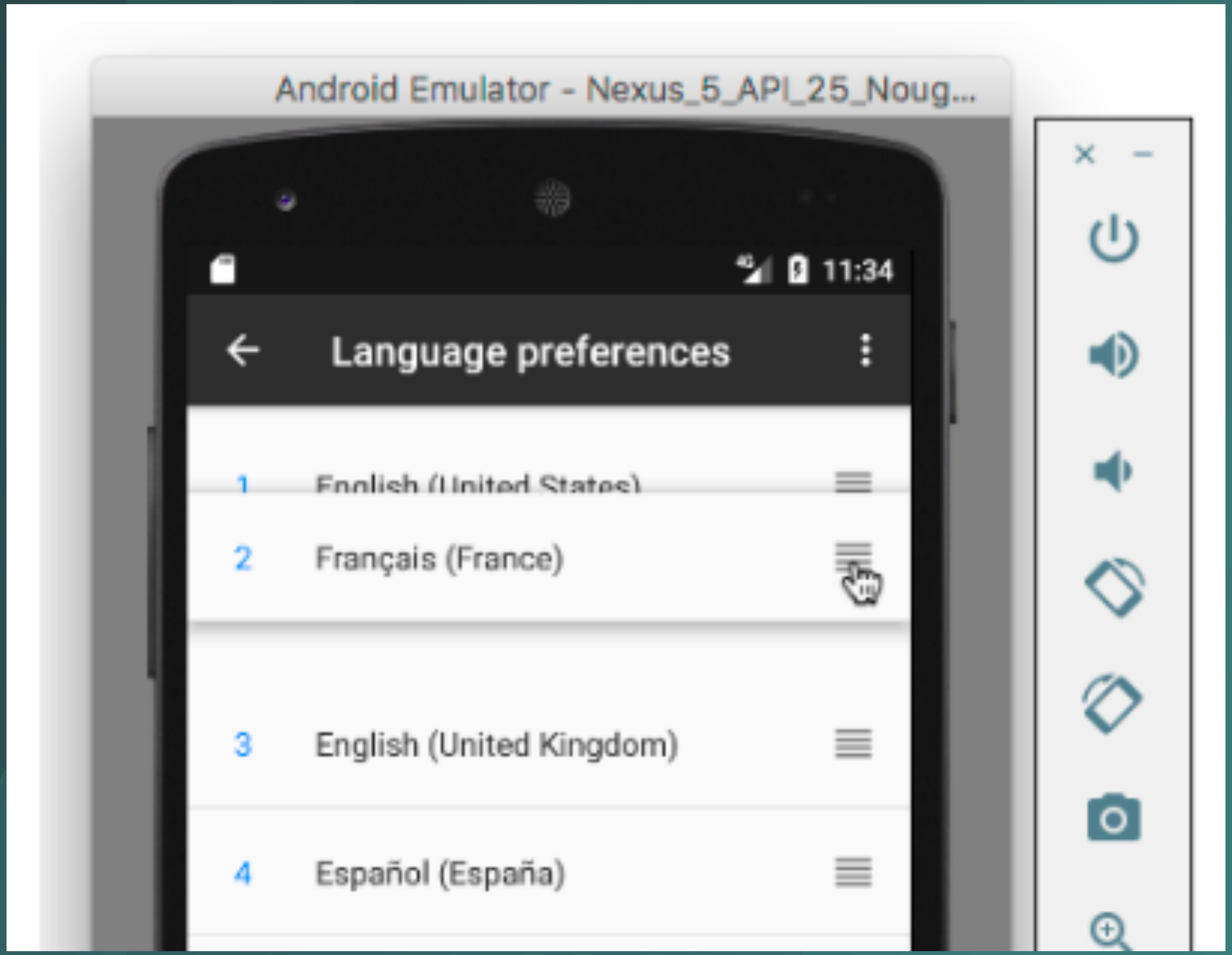
Default Value: Nougat Candy Package

Translation:

Add another language resource to the app



Run the app and switch languages



Android Emulator - Nexus_5_API_25_Noug...

11:34

Language preferences

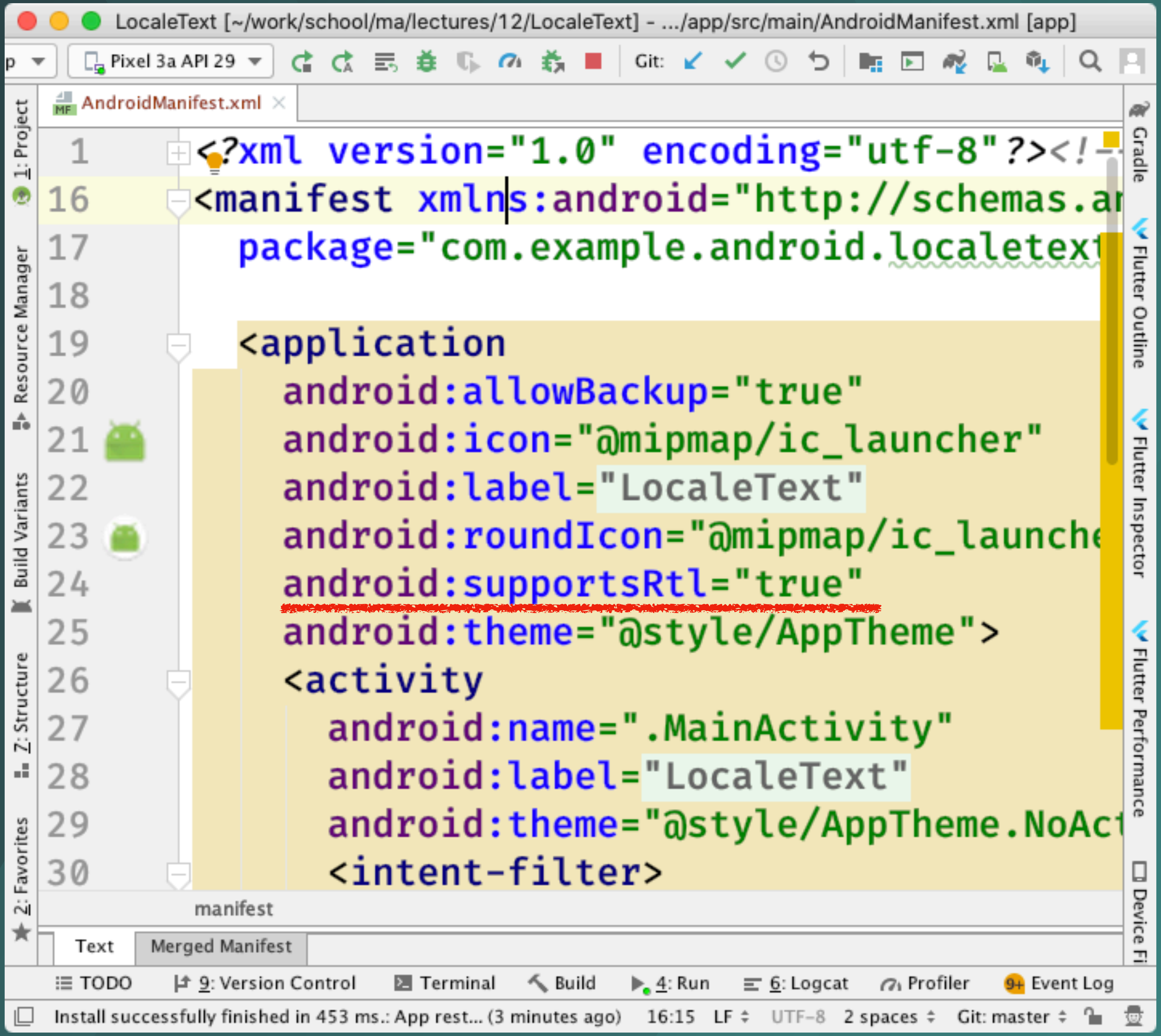
1 English (United States)

2 Français (France)

3 English (United Kingdom)

4 Español (España)

Add a right-to-left (RTL) language



LocaleText [~/work/school/ma/lectures/12/LocaleText] - .../app/src/main/AndroidManifest.xml [app]

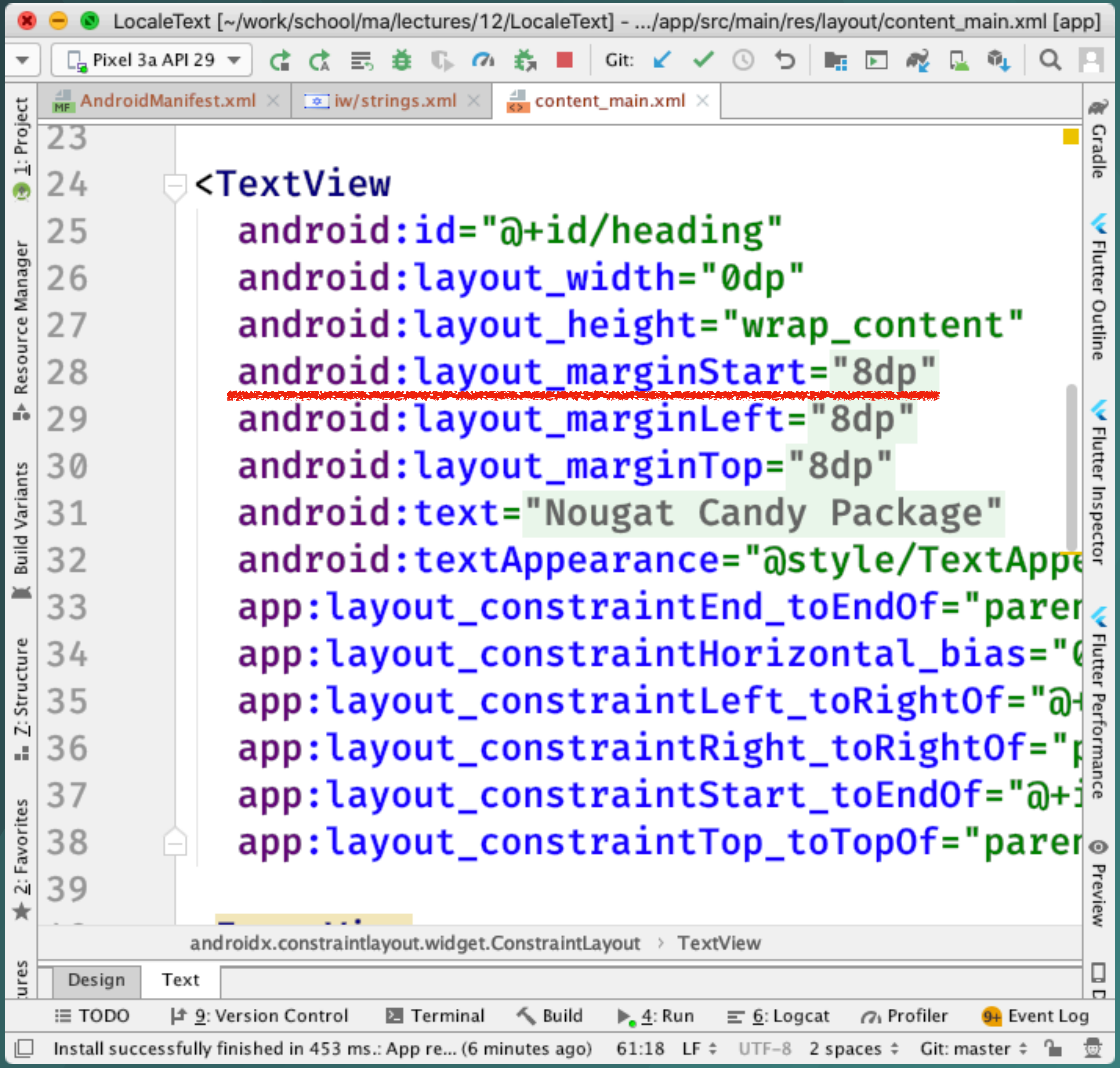
```
<?xml version="1.0" encoding="utf-8"?><!-
<manifest xmlns:android="http://schemas.ar
  package="com.example.android.localetext

  <application
    android:allowBackup="true"
    android:icon="@mipmap/ic_launcher"
    android:label="LocaleText"
    android:roundIcon="@mipmap/ic_launche
    android:supportsRtl="true"
    android:theme="@style/AppTheme">
    <activity
      android:name=".MainActivity"
      android:label="LocaleText"
      android:theme="@style/AppTheme.NoAct
      <intent-filter>
```

Install successfully finished in 453 ms.: App rest... (3 minutes ago)

Add a right-to-left (RTL) language

DEMO



LocaleText [~/work/school/ma/lectures/12/LocaleText] - .../app/src/main/res/layout/content_main.xml [app]

```
<TextView
    android:id="@+id/heading"
    android:layout_width="0dp"
    android:layout_height="wrap_content"
    android:layout_marginStart="8dp"
    android:layout_marginLeft="8dp"
    android:layout_marginTop="8dp"
    android:text="Nougat Candy Package"
    android:textAppearance="@style/TextAppe
    app:layout_constraintEnd_toEndOf="parer
    app:layout_constraintHorizontal_bias="0
    app:layout_constraintLeft_toRightOf="@+
    app:layout_constraintRight_toRightOf="p
    app:layout_constraintStart_toEndOf="@+i
    app:layout_constraintTop_toTopOf="parer
```

Install successfully finished in 453 ms.: App re... (6 minutes ago)   61:18 LF ÷ UTF-8 2 spaces ÷ Git: master ÷

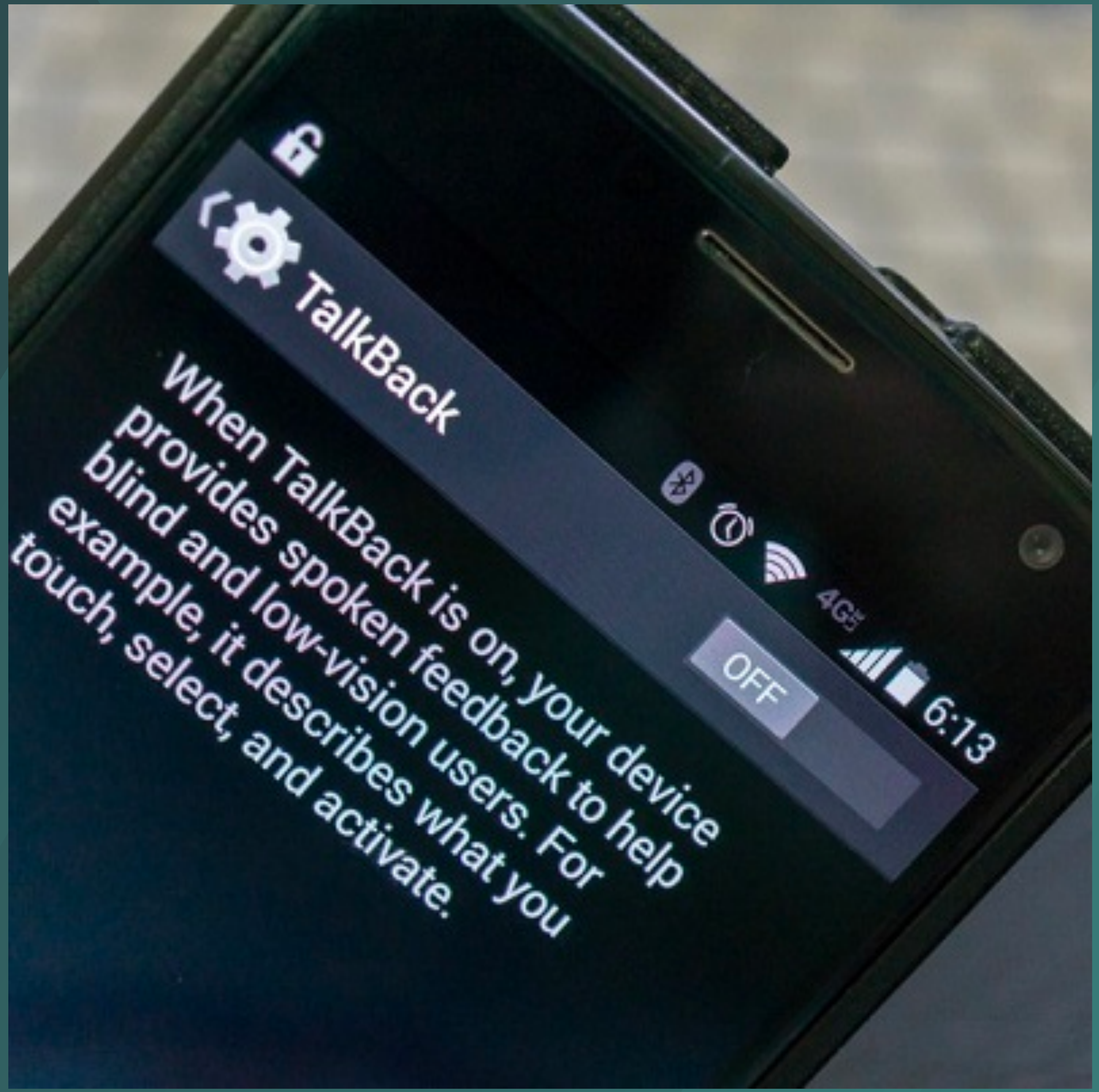
developer.android.com/training/basics/supporting-devices/languages.html

Accessibility

- Blindness
- Low vision.
- Color blindness.
- Deafness or hearing loss.
- Restricted motor skills.

TalkBack

- Settings > Accessibility > TalkBack
- Settings > Accessibility > TalkBack > Settings > Launch TalkBack tutorial.



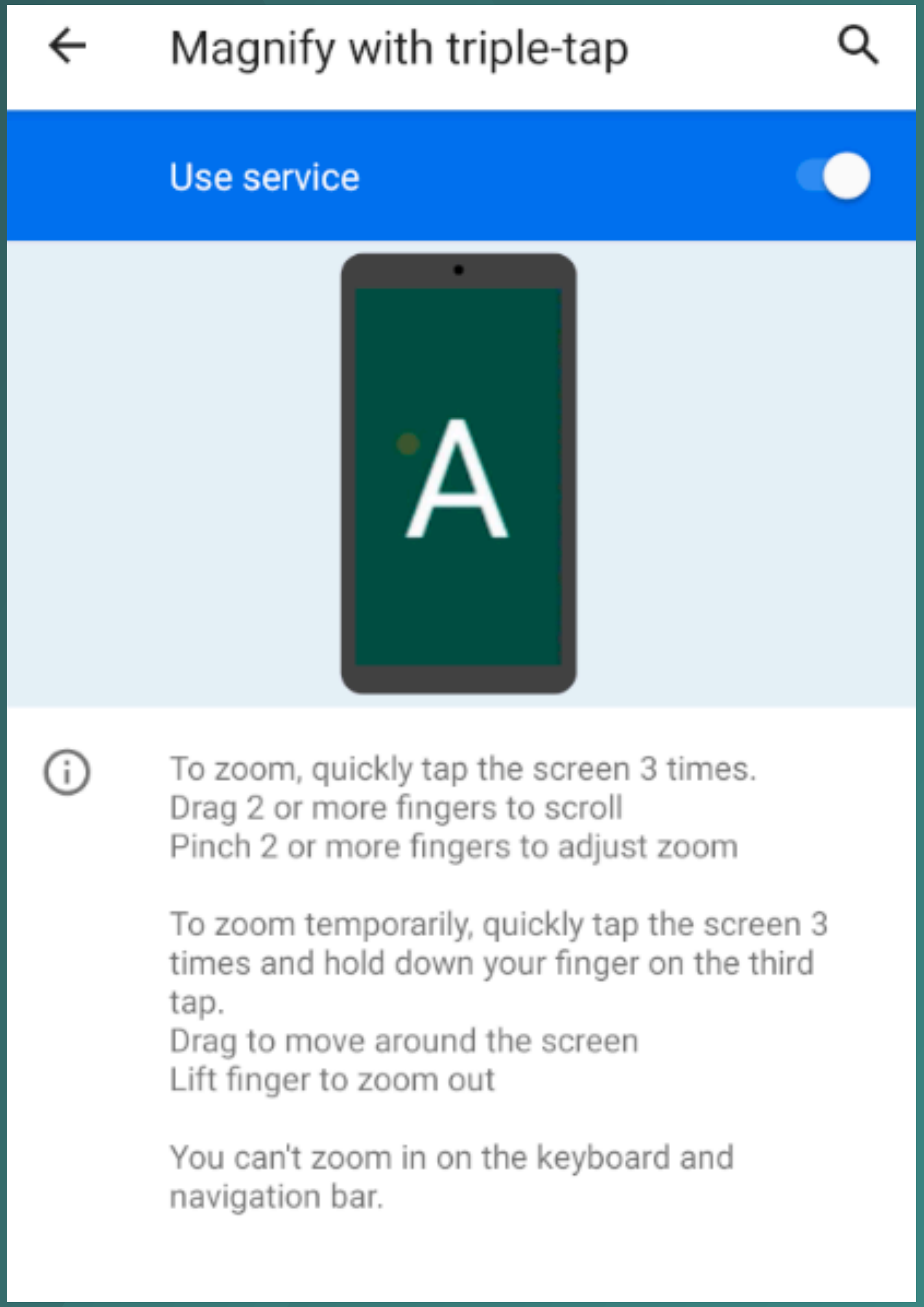
TalkBack

When TalkBack is on, your device provides spoken feedback to help blind and low-vision users. For example, it describes what you touch, select, and activate.

Font and Color

DEMO

- Settings > Accessibility > Magnification gesture.
- Settings > Accessibility > Font size.
- Settings > Accessibility > High contrast text.



To zoom, quickly tap the screen 3 times.
Drag 2 or more fingers to scroll
Pinch 2 or more fingers to adjust zoom

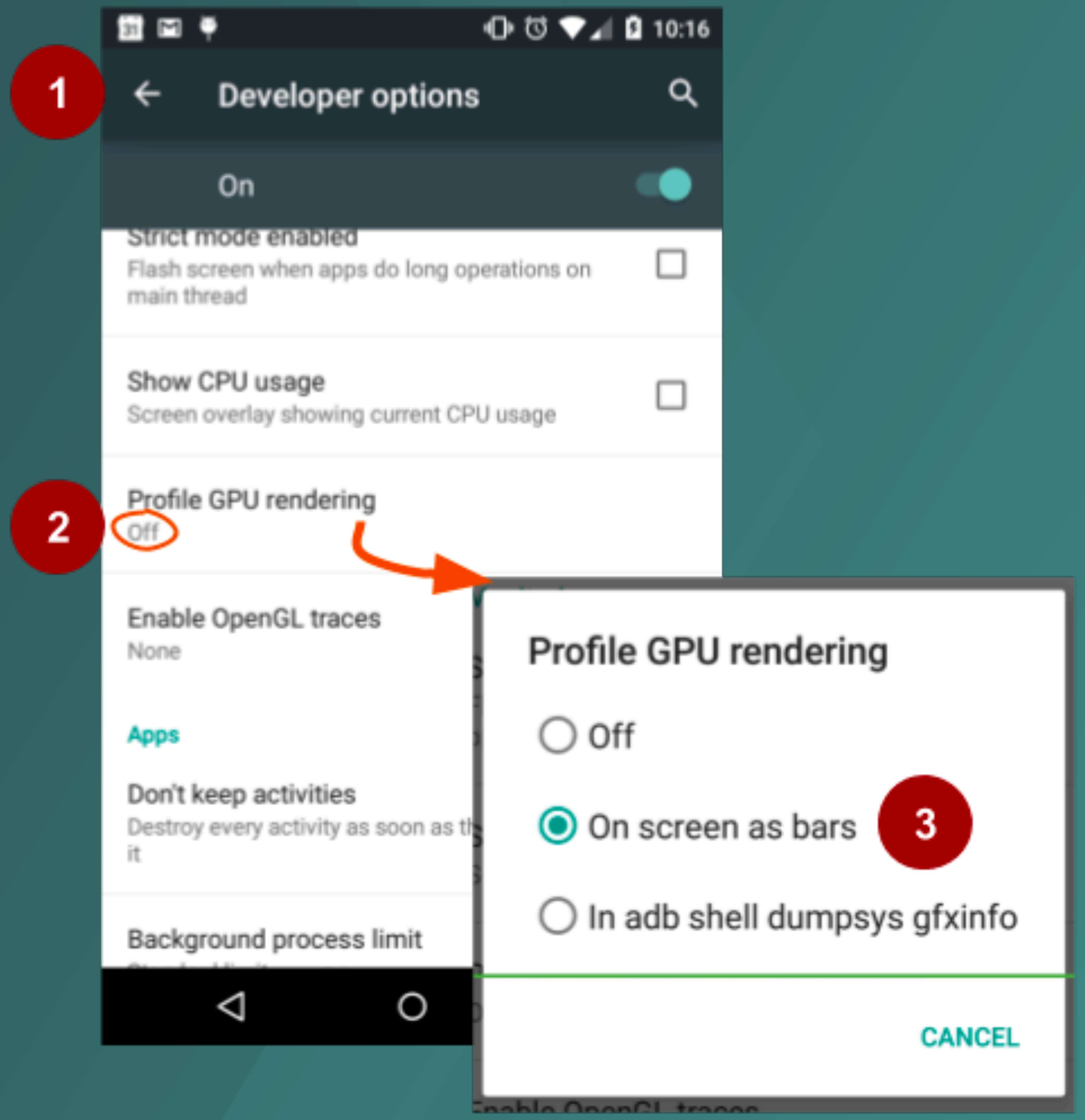
To zoom temporarily, quickly tap the screen 3 times and hold down your finger on the third tap.
Drag to move around the screen
Lift finger to zoom out

You can't zoom in on the keyboard and navigation bar.

developer.android.com/guide/topics/ui/accessibility/index.html

GPU Profiling

- Settings
  - Developer options
    - Monitoring
      - Profile GPU rendering



1

Developer options

On

Strict mode enabled
Flash screen when apps do long operations on main thread □

Show CPU usage
Screen overlay showing current CPU usage □

2

Profile GPU rendering
Off

Enable OpenGL traces
None

Apps

Don't keep activities
Destroy every activity as soon as th
it

Background process limit

Profile GPU rendering

○ Off

● On screen as bars

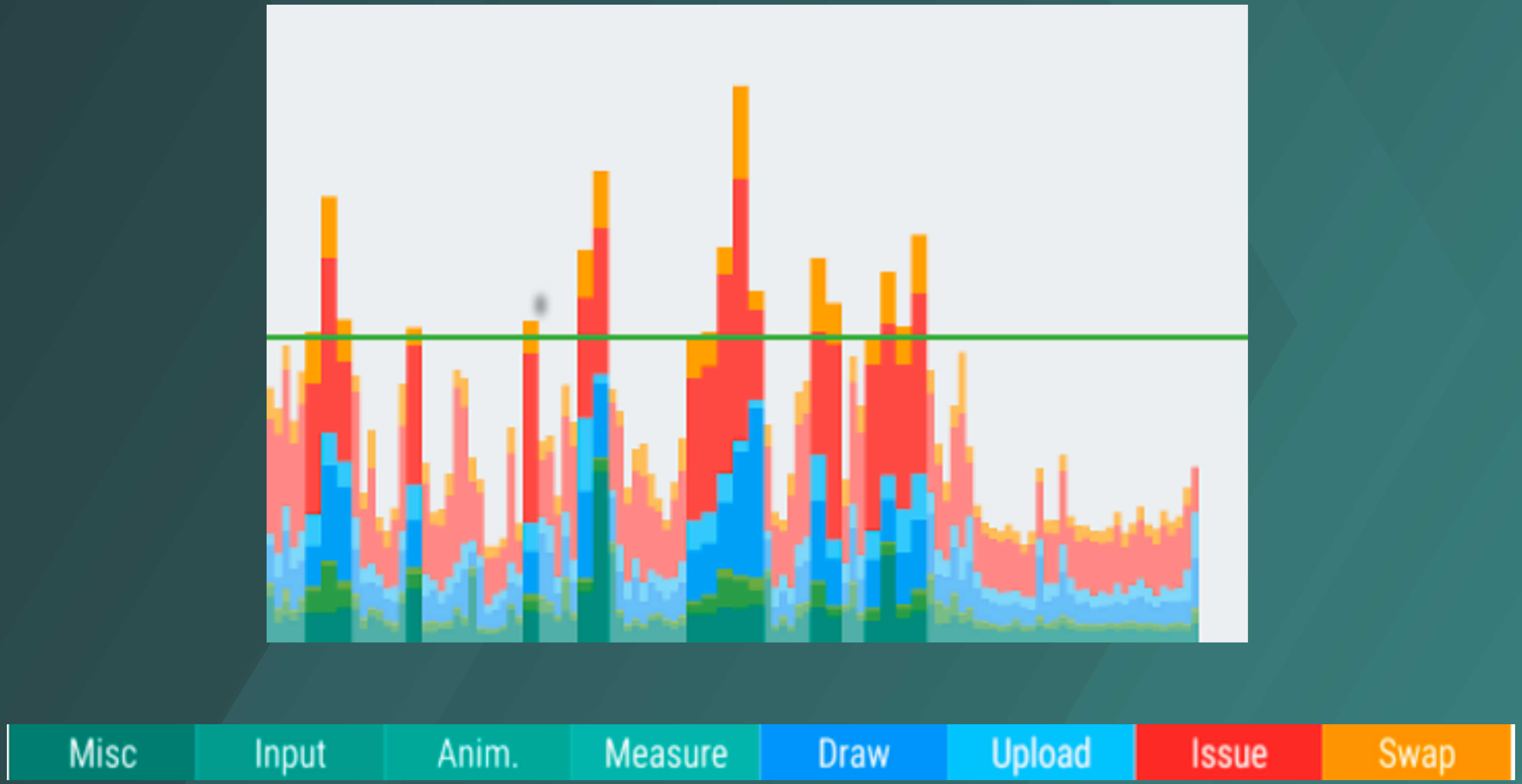
3

○ In adb shell dumpsys gfxinfo

CANCEL

GPU Profiling

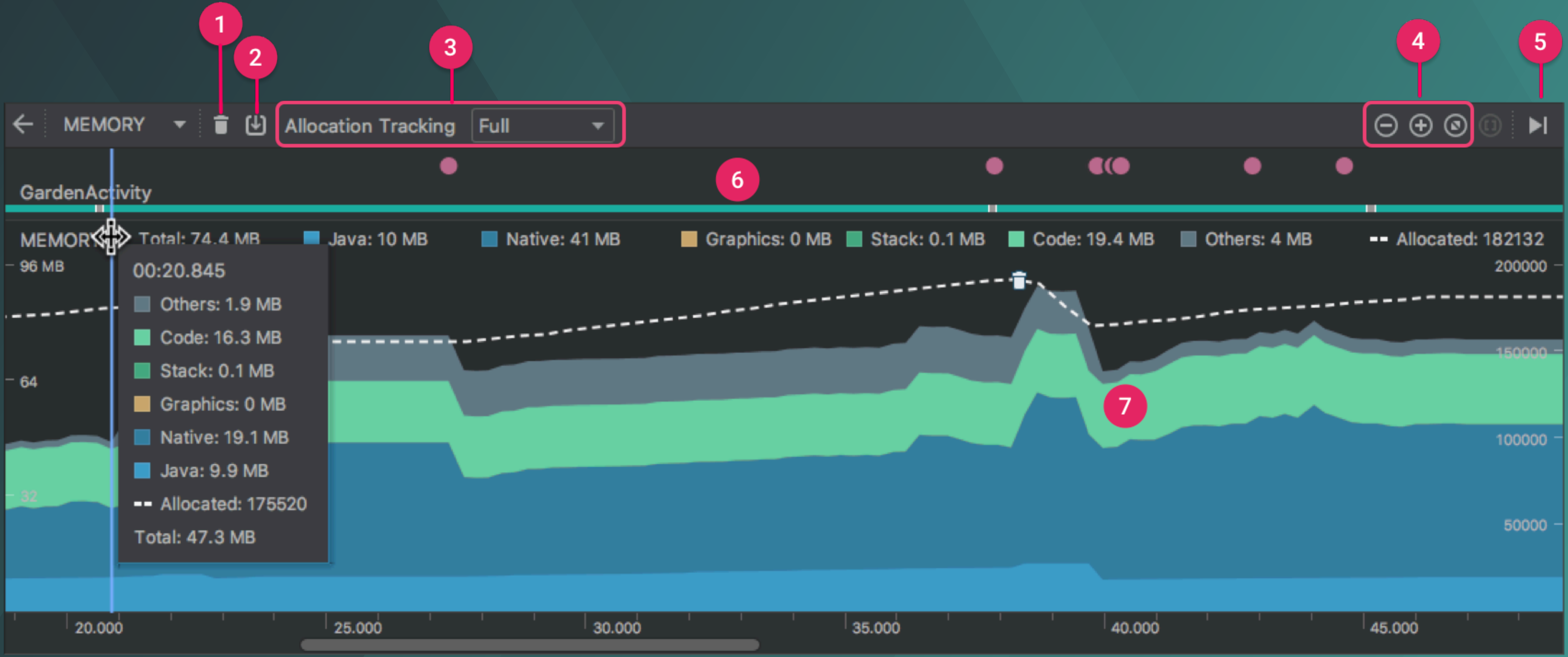
DEMO



developer.android.com/topic/performance/rendering/inspect-gpu-rendering#profile_rendering

Memory Profiling

DEMO



MEMORY Total: 74.4 MB ▨ Java: 10 MB ▨ Native: 41 MB ▨ Graphics: 0 MB ▨ Stack: 0.1 MB ▨ Code: 19.4 MB ▨ Others: 4 MB -- Allocated: 182132

00:20.845

▨ Others: 1.9 MB

▨ Code: 16.3 MB

▨ Stack: 0.1 MB

▨ Graphics: 0 MB

▨ Native: 19.1 MB

▨ Java: 9.9 MB

-- Allocated: 175520

Total: 47.3 MB

developer.android.com/studio/profile/memory-profiler.html#overview

ViewBinding

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

    <TextView
        android:id="@+id/mainTitle"
        tools:text="Main Title" />

    <TextView
        android:id="@+id/subTitle"
        tools:text="Main Subtitle" />
</RelativeLayout>
```

ViewBinding

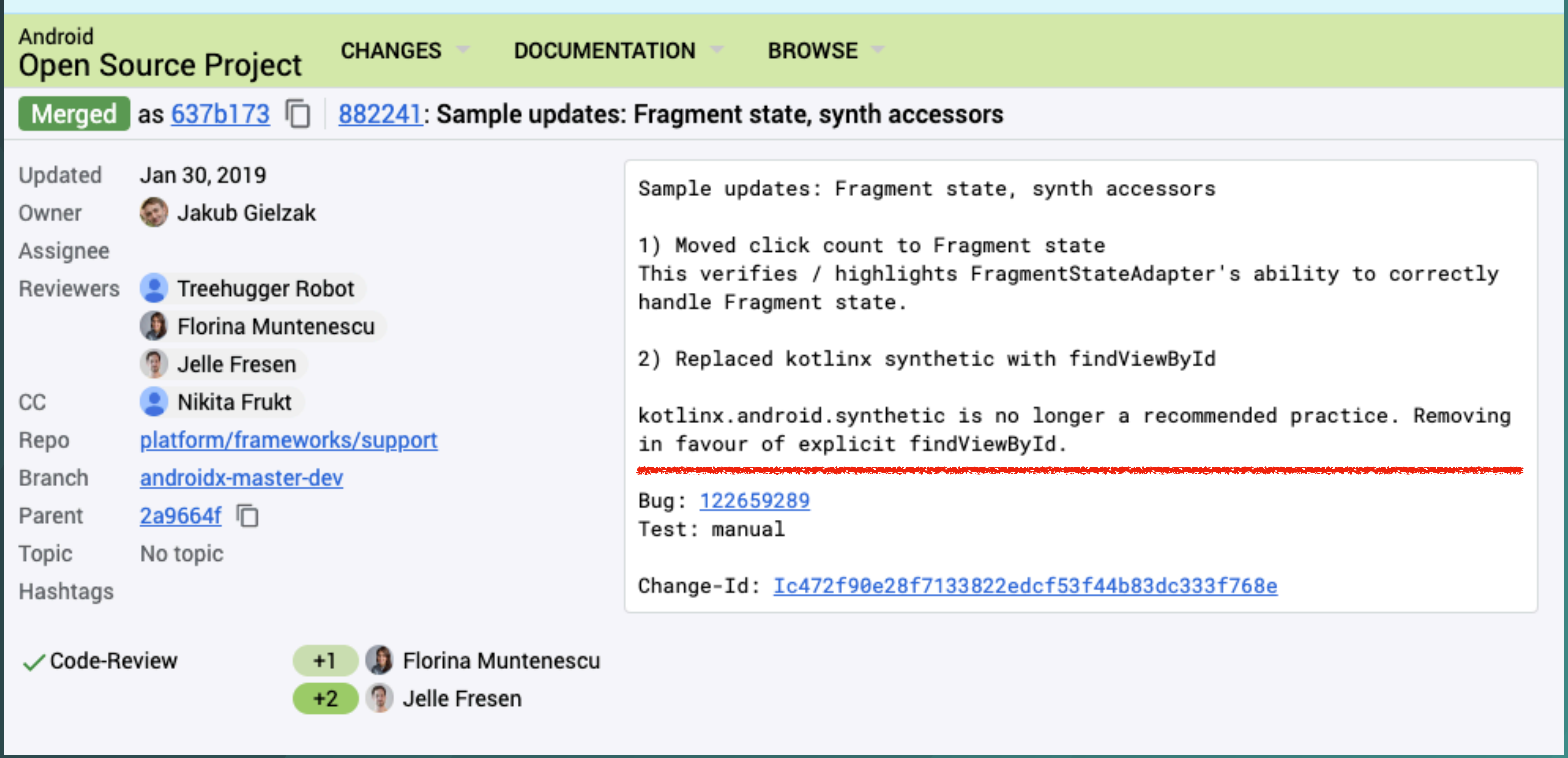
```
public class MainActivity extends AppCompatActivity {
    private TextView txtViewMainTitle;
    private TextView txtViewSubTitle;

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

        txtViewMainTitle = findViewById(R.id.mainTitle;
        txtViewSubTitle = findViewById(R.id.subTitle);

        txtViewMainTitle.setText("This is my main title");
        txtViewSubTitle.setText("This is my subTitle");
    }
}
```

ViewBinding



Merged as 637b173 | 882241: Sample updates: Fragment state, synth accessors

Updated	Jan 30, 2019
Owner	Jakub Gielzak
Assignee	
Reviewers	Treehugger Robot Florina Muntenescu Jelle Fresen
CC	Nikita Frukt
Repo	platform/frameworks/support
Branch	androidx-master-dev
Parent	2a9664f
Topic	No topic
Hashtags	

```
Sample updates: Fragment state, synth accessors

1) Moved click count to Fragment state
This verifies / highlights FragmentStateAdapter's ability to correctly
handle Fragment state.

2) Replaced kotlinx synthetic with findViewById

kotlinx.android.synthetic is no longer a recommended practice. Removing
in favour of explicit findViewById.

Bug: 122659289
Test: manual

Change-Id: Ic472f90e28f7133822edcf53f44b83dc333f768e
```

✓ Code-Review	+1	Florina Muntenescu
	+2	Jelle Fresen

android-review.googlesource.com/c/platform/frameworks/support/+/882241

ViewBinding
The Argument Over Kotlin Synthetics

- They Are Kotlin Only.
- They Don’t Expose Nullability.
- The Code Generated Is Not Guaranteed To Be Performant.
- Everything Exists In A Global Namespace.
- Typing Isn’t Guaranteed.

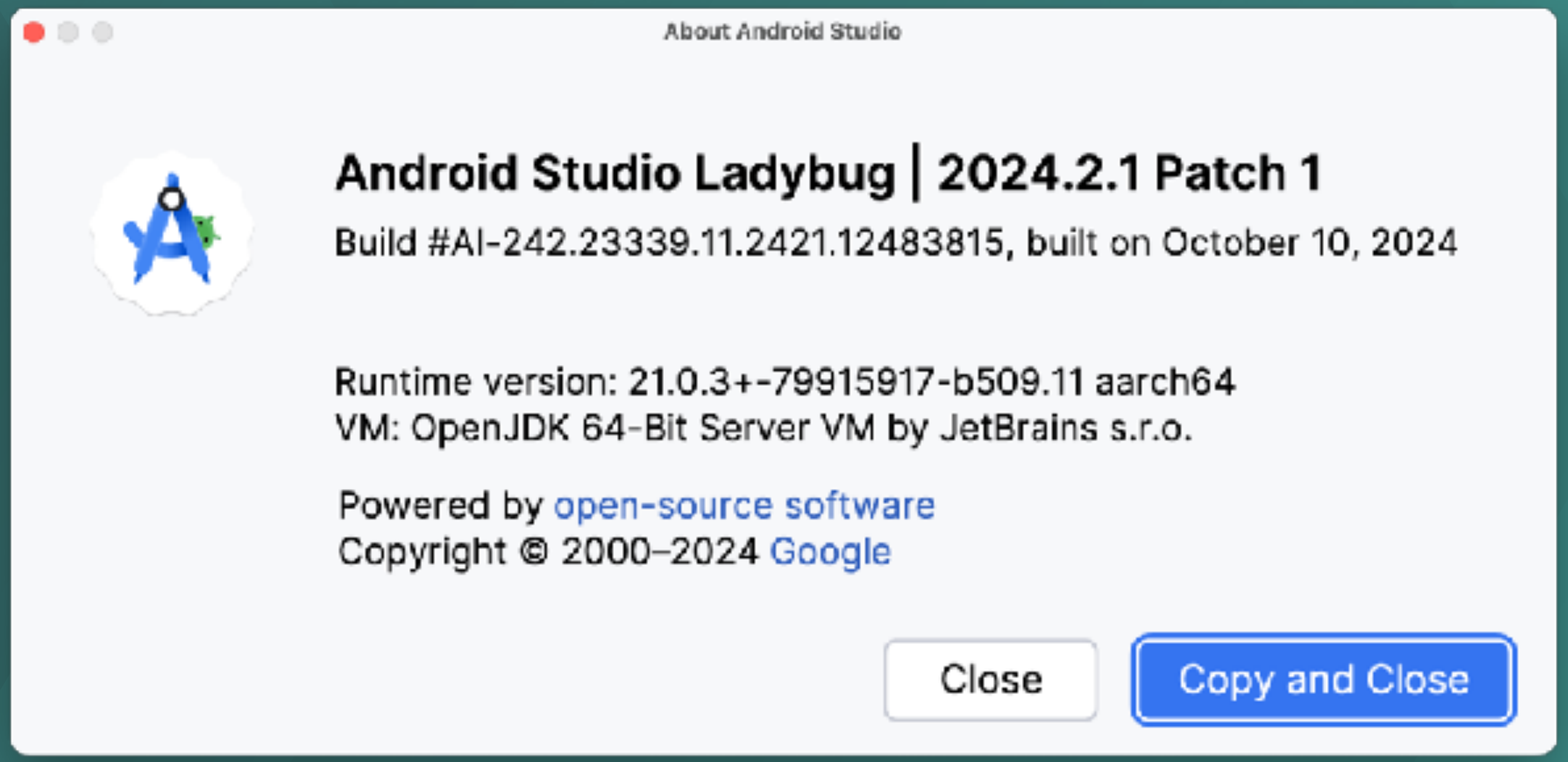
proandroiddev.com/the-argument-over-kotlin-synthetics-735305dd4ed0

ViewBinding

Android Studio 3.6 Canary 11+.

app/build.gradle:

```
android {
    …
    viewBinding {
        enabled = true
    }
}
```



About Android Studio

Android Studio Ladybug | 2024.2.1 Patch 1
Build #AI-242.23339.11.2421.12483815, built on October 10, 2024

Runtime version: 21.0.3+-79915917-b509.11 aarch64
VM: OpenJDK 64-Bit Server VM by JetBrains s.r.o.

Powered by open-source software
Copyright © 2000–2024 Google

ViewBinding

build.gradle:

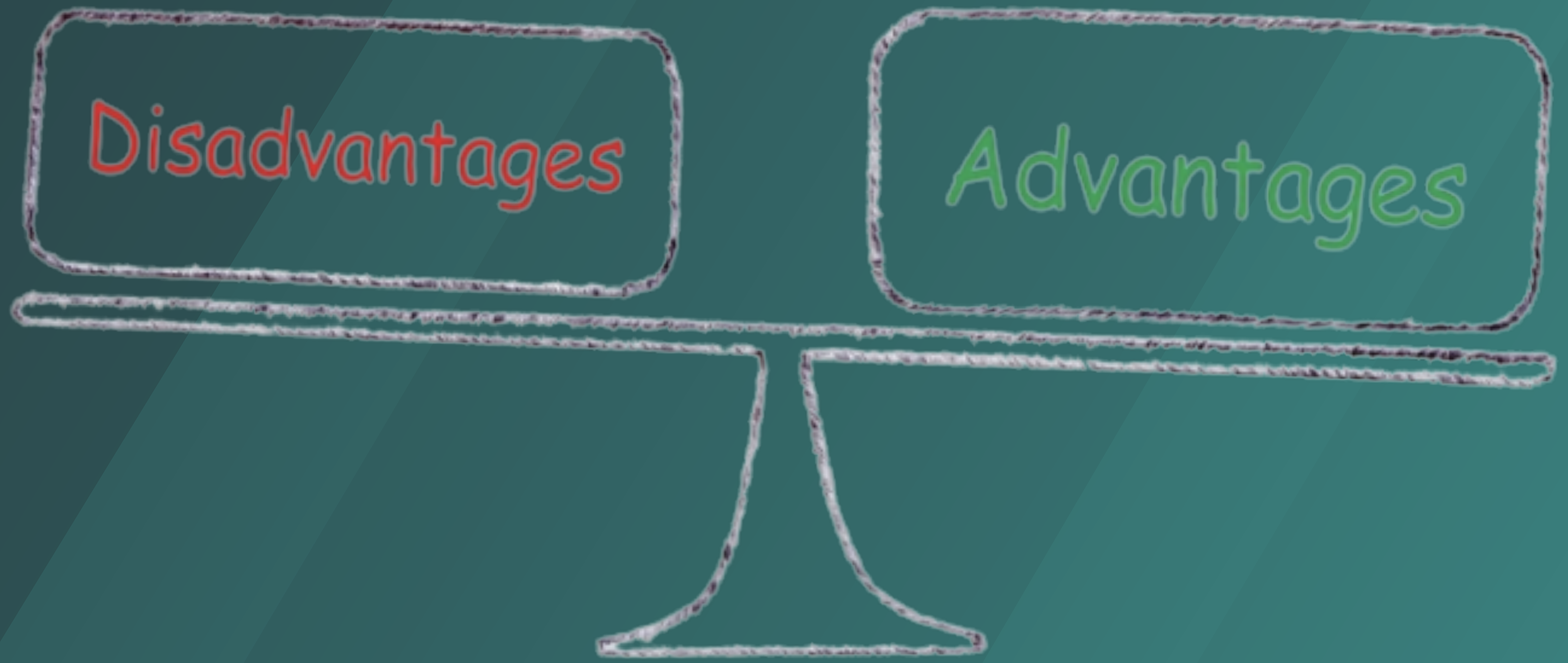
```
buildscript {
    ext.kotlin_version = '2.0.21'
    repositories {
        google()
        mavenCentral()
    }
    dependencies {
        classpath “com.android.tools.build:gradle:8.7.3"
        classpath "org.jetbrains.kotlin:kotlin-gradle-plugin:$kotlin_version"
    }
}
```

ViewBinding

DEMO

- The auto-generated .class increases app size.
- Harder to debug.

- Null safety.
- Type safety.
- Speed.

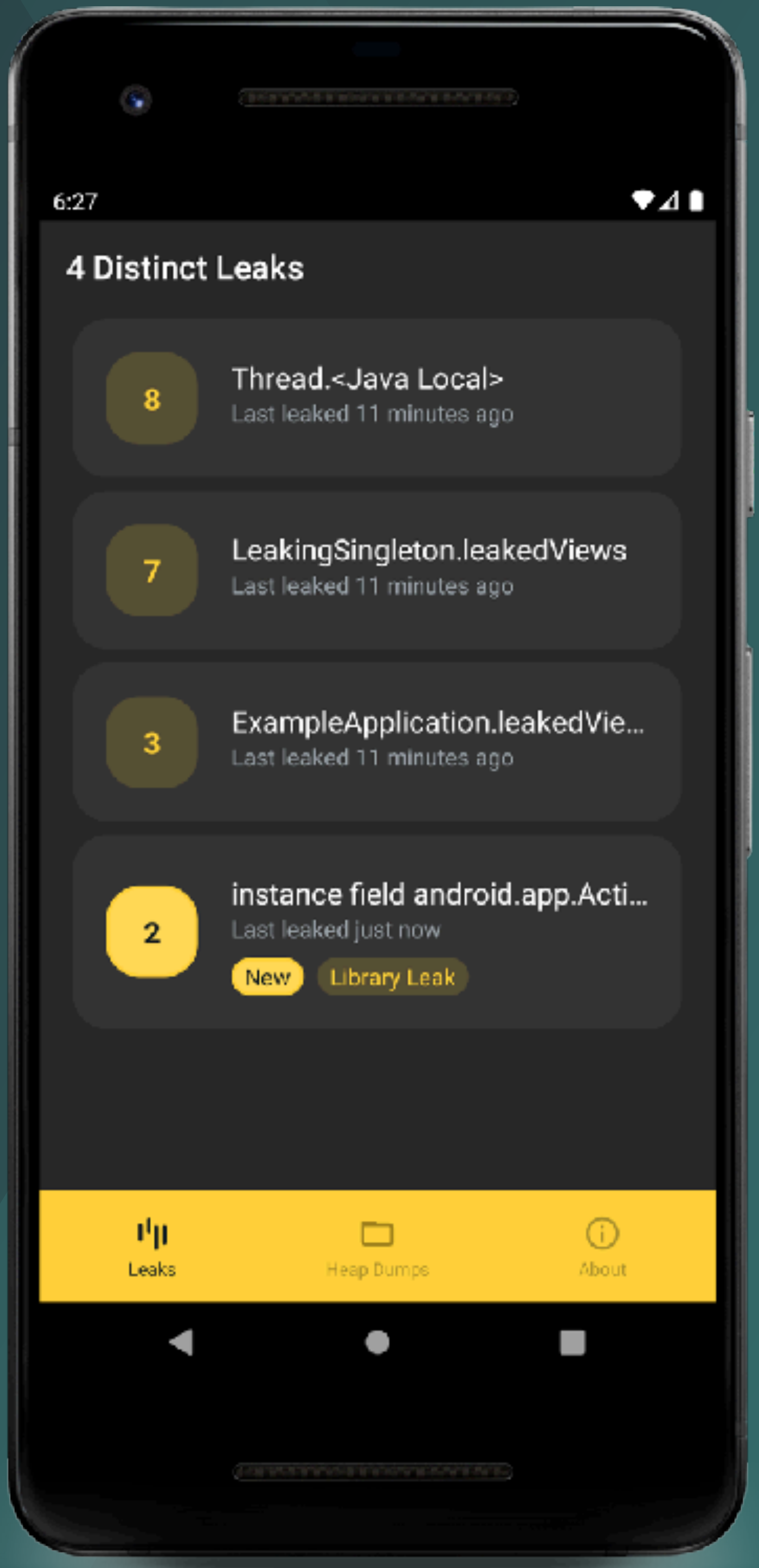


proandroiddev.com/the-argument-over-kotlin-synthetics-735305dd4ed0

Memory Leaks

"A small leak will sink a great ship." - Benjamin Franklin

Memory Leaks



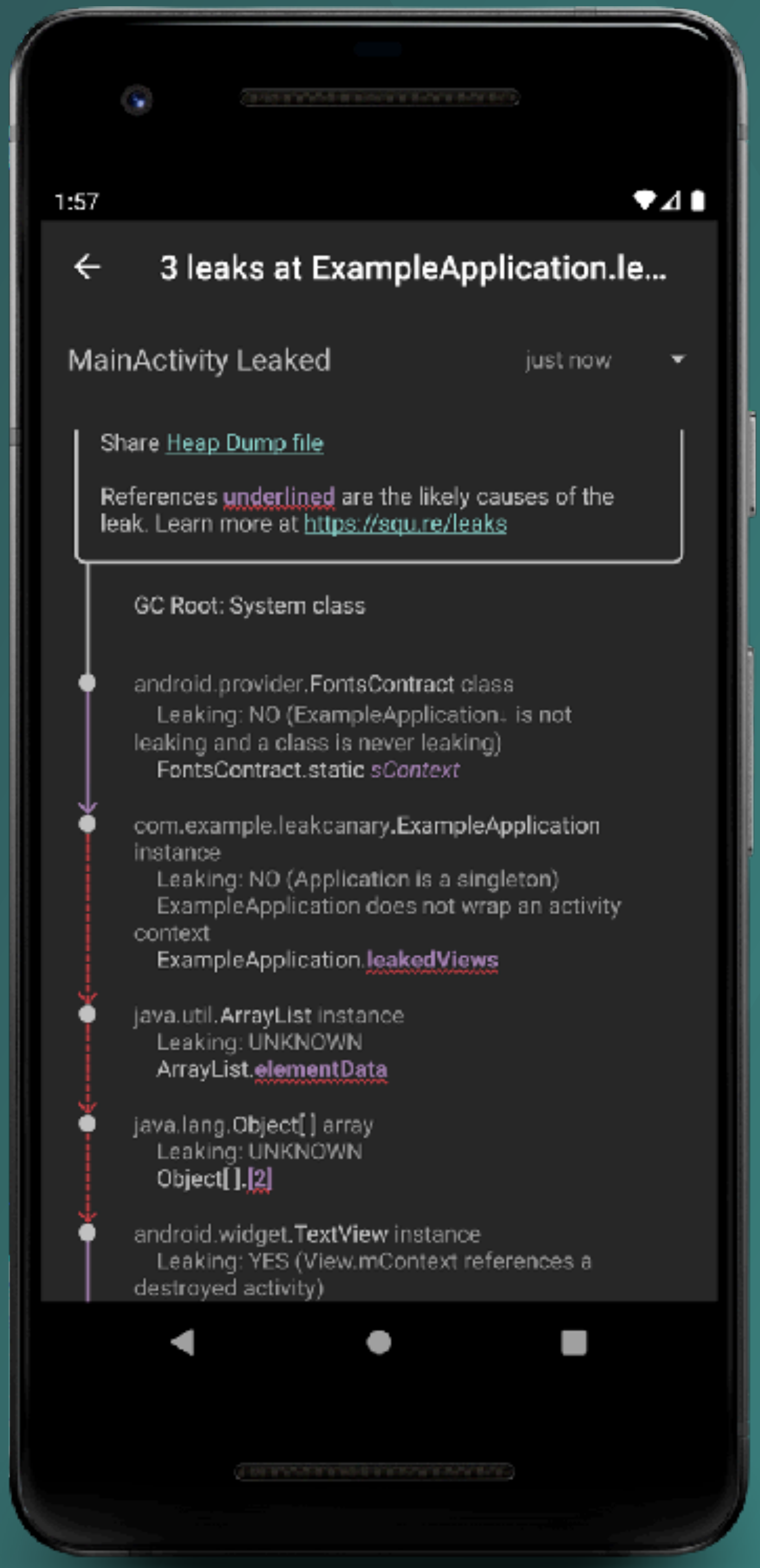
4 Distinct Leaks

8 Thread.<Java Local>
Last leaked 11 minutes ago

7 LeakingSingleton.leakedViews
Last leaked 11 minutes ago

3 ExampleApplication.leakedVie...
Last leaked 11 minutes ago

2 instance field android.app.Acti...
Last leaked just now
New Library Leak



3 leaks at ExampleApplication.le...

MainActivity Leaked

Share Heap Dump file

References underlined are the likely causes of the leak. Learn more at https://squ.re/leaks

```
GC Root: System class

android.provider.FontsContract class
   Leaking: NO (ExampleApplication↓ is not
leaking and a class is never leaking)
   FontsContract.static sContext
com.example.leakcanary.ExampleApplication
instance
   Leaking: NO (Application is a singleton)
   ExampleApplication does not wrap an activity
context
   ExampleApplication.leakedViews
java.util.ArrayList instance
   Leaking: UNKNOWN
   ArrayList.elementData
java.lang.Object[] array
   Leaking: UNKNOWN
   Object[].[2]
android.widget.TextView instance
   Leaking: YES (View.mContext references a
destroyed activity)
```

https://square.github.io/leakcanary

Memory Leaks

```
dependencies {
  // debugImplementation because LeakCanary should only run in debug builds.
  debugImplementation 'com.squareup.leakcanary:leakcanary-android:2.14'
}
```

https://square.github.io/leakcanary

Memory Leaks

DEMO

```
dependencies {
  // debugImplementation because LeakCanary should only run in debug builds.
  debugImplementation 'com.squareup.leakcanary:leakcanary-android:2.10'
}
```

LeakCanary automatically detects leaks of the following objects:

- Destroyed Activity instances.
- Destroyed Fragment instances.
- Destroyed fragment View instances.
- Cleared ViewModel instances.
- Destroyed Service instance.

https://square.github.io/leakcanary

Lecture outcomes

- Identify app widgets, and understand the key parts of an app widget.
- Implement app widget actions when an element of an app widget is tapped.
- Add support for different languages.
- Test your app for accessibility in a variety of ways.
- Use the Profile GPU Rendering tool to visualize Android drawing the screen.
- Use Memory Profiler to collect data about your app.