

# Introduction to Android Studio

Course Code: ELEE1146

Course Name: Mobile Applications for Engineers

Credits: 15

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# Meet Android

- Open-source mobile platform
- 11 major platform releases so far
- 2.5 billion monthly active Android devices
- 2+ billion monthly active Google Play users



# Meet Android

- **Form Factors**

- Most popular are Galaxy family, fold, etc
- OS also powers tablets, netbooks, e-readers, MP4 playert, Smart TVs, Smart white appliances and Vehicles

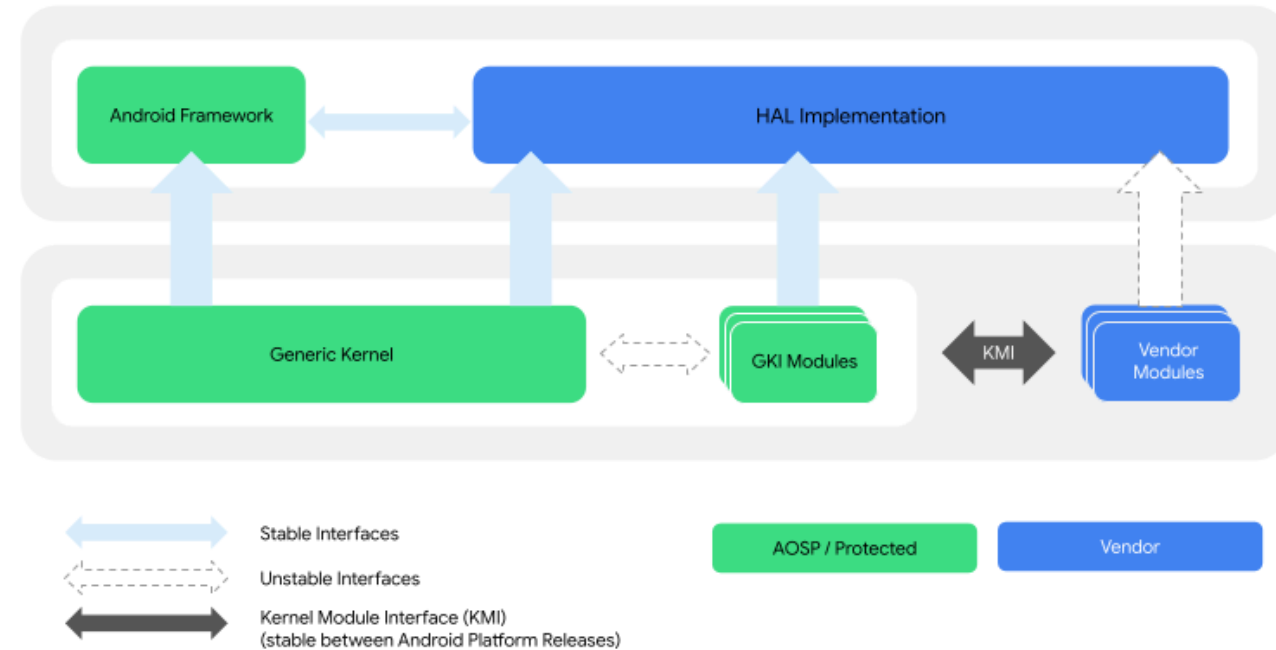
- **Emulator**

- Duplicates how the app looks and feels on a particular device



# Monolithic Kernel

- Arm and X86 Architecture
- Android kernel is based on an upstream [Linux Long Term Supported \(LTS\) kernel](#).
- HAL
  - Hardware abstraction layer provides abstraction for the hardware to kernel (software) using device drivers and firmware



# Versions

- 14 Platform Versions and 34 API levels

Platform Version	API Level	VERSION_CODE	Culmative Usage	Year
Android 15.0	35	VANILLA ICE CREAM	0.0%	Q4 2024
Android 14.0	34	UPDSIDE DOWN CAKE	25.7%	2023
Android 13.0	33	TIRAMSU	48.0%	2022
Android 12.0	31 - 32	SNOW CONE	63.8%	2021
Android 11.0	30	RED VELVET CAKE	78.0%	2020
Android 10.0	29	QUINCE TART	86.0%	2019
Android 9.0	28	PIE	91.1%	2018
Android 8.0	26 - 27	OREO	95.5% - 92.7%	2017
Android 7.0	24 - 25	NOUGAT	97.1% - 95.9%	2016

# Programming and Environment

- **Writing Android Apps**

- `Java` and `Kotlin` are Object-oriented programming languages patterned after the `C++` language
- You can also write apps in `C++` called native development.

- **Android Studio**

- An `integrated development environment (IDE)` for building and integrating application development tools and open-source projects.
- Android Studio `IDE` is exclusively dedicated to the purpose of creating Android applications
- Includes the `Android Software Development Kit (SDK)`

# Emulator vs Simulator

- **Simulator**

- is designed to create an environment that contains all of the software variables and configurations that will exist in an app's actual production environment.

- **Emulator**

- attempts to mimic all of the hardware features of a production environment and software features.

- **Android Emulator**

- Design, develop, prototype, and test Android apps without using a physical device
- Mimics almost every feature of a real Android handset, except placing phone

calls

## What about Kotlin

- Kotlin is an open-source programming language that can run on Java Virtual Machine (JVM). The language can run on numerous platforms.
- It is a language that combines Object Oriented Programming (OOPs) and functional programming in an unrestricted, self-sufficient and distinctive platform.
- In 2019, Google announced Kotlin as its preferred programming language for over 60% of Android application developers.



# Getting Oriented with Market Deployment

- Platform consists of the Android OS, application development tools, and marketplace Apps are compiled into package files with an `.apk` extension
- Google Play (<http://play.google.com>) sells and deploys all apps
- Programs must meet minimum standards
- Apps are free or paid (If you want to charge for your app, the standard split is 70/30 between developer and wireless carrier)
- Also sold through Amazon ([amazon.com/appstore](http://amazon.com/appstore)) and iTunes (both charge a \$99 registration fee)

# Opening Android Studio to Create a New Project

- We will be using Android Studio Koala | 2024.1.1 Patch 1 July 11, 2024
- Download and install the Android Studio from <https://developer.android.com/studio/archive>.
- Search for th "Android Studio Koala | 2024.1.1 Patch 1 July 11, 2024"
- Make sure you have enough space on the disk, it takes > 3GB and you would also need extra space to run it.

^ Android Studio Koala | 2024.1.1 Patch 1 July 11, 2024

## Installers

ChromeOS: [android-studio-2024.1.1.12-cros.deb](#) (991.5 MB)  
Mac (Apple Silicon): [android-studio-2024.1.1.12-mac\\_arm.dmg](#) (1.2 GB)  
Mac (Intel): [android-studio-2024.1.1.12-mac.dmg](#) (1.3 GB)  
Windows (64-bit): [android-studio-2024.1.1.12-windows.exe](#) (1.2 GB)

## SHA-256 checksums

7d65b4c7d47a80799100ad2900b5d77ad5f5843e2352467ccc108932ecdca5e4 [android-studio-2024.1.1.12-cros.deb](#)  
6443f976927ffc3f977d980fb572461ebda3e77db666fbc6ed094937506d3469 [android-studio-2024.1.1.12-mac\\_arm.dmg](#)  
1f4c31bbb92249034737c81f8713941e09c4171b583f432a1091cbd5f90f8c2a [android-studio-2024.1.1.12-mac.dmg](#)  
049f91189fd7a8815c9e2a06664e4bbb92de51684d328e0fe34b8e088b9c7496 [android-studio-2024.1.1.12-windows.exe](#)

## Zip files

Linux: [android-studio-2024.1.1.12-linux.tar.gz](#) (1.2 GB)  
Windows (64-bit): [android-studio-2024.1.1.12-windows.zip](#) (1.2 GB)

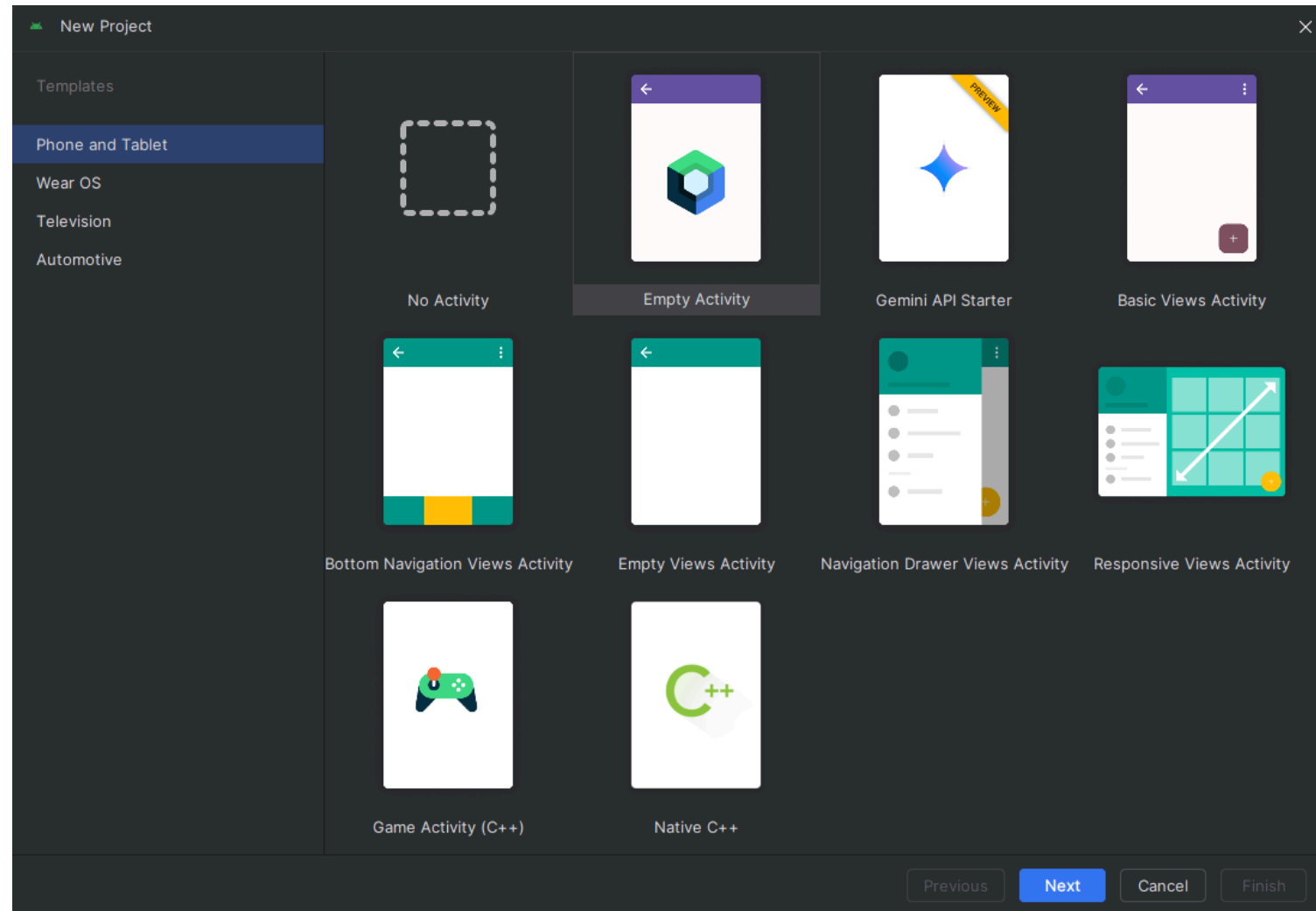
## SHA-256 checksums

42f8bf31ce0d124ddd11195f662a30064d8f9aab206e5e66839e876a6bc6eda2 [android-studio-2024.1.1.12-linux.tar.gz](#)  
386ecb9807a68ac410257178b6aa06c5da504ffc0f4b49feab99cf3748510c77 [android-studio-2024.1.1.12-windows.zip](#)

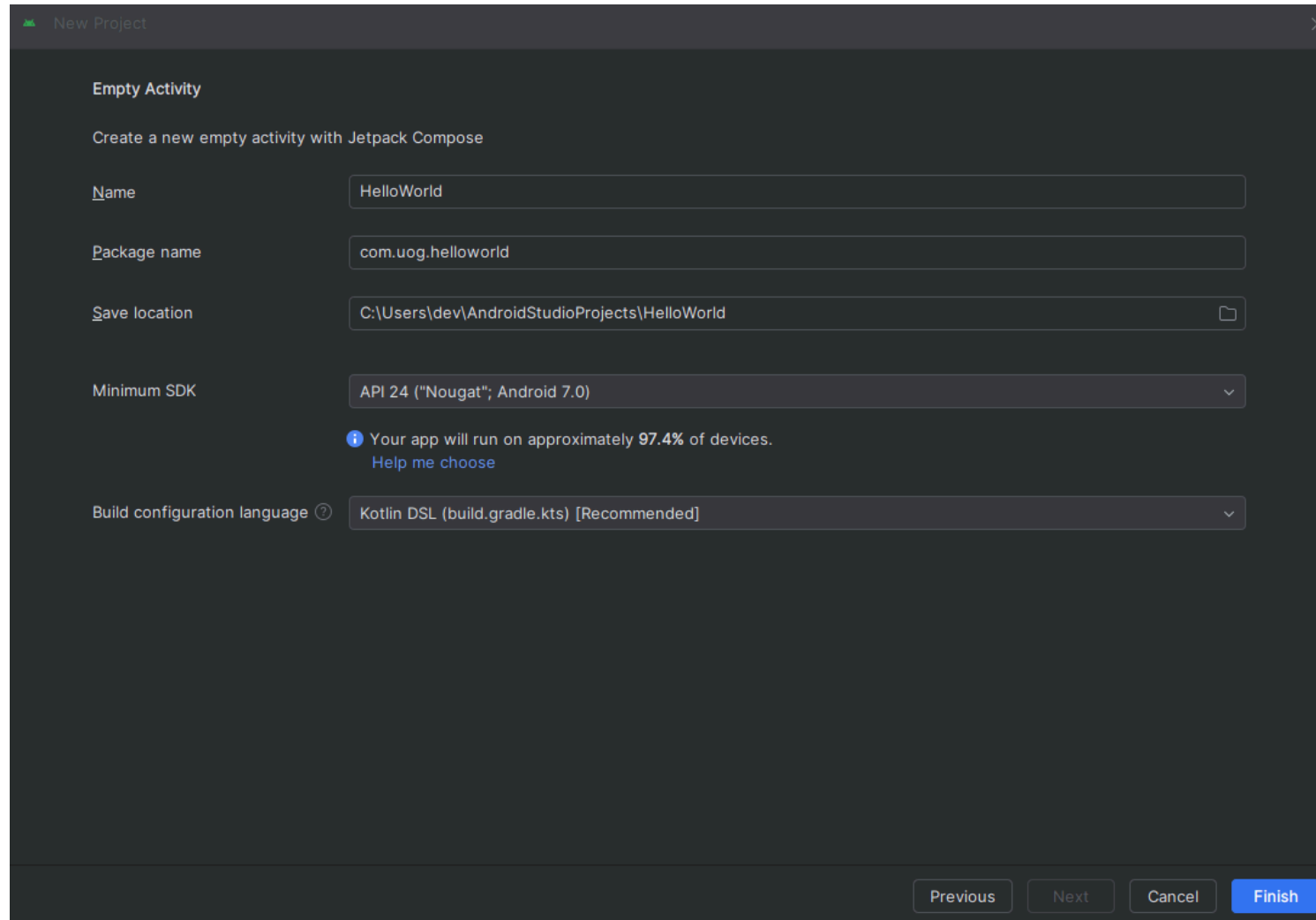
# Opening Android Studio to Create a New Project (cont'd)



# Opening Android Studio to Create a New Project (cont'd)



# Opening Android Studio to Create a New Project (cont'd)



The screenshot shows the 'New Project' dialog in Android Studio. The dialog is titled 'New Project' and has a close button (X) in the top right corner. The main heading is 'Empty Activity'. Below this, it says 'Create a new empty activity with Jetpack Compose'. There are five input fields: 'Name' with the value 'HelloWorld', 'Package name' with the value 'com.uog.helloworld', 'Save location' with the value 'C:\Users\dev\AndroidStudioProjects\HelloWorld', 'Minimum SDK' with a dropdown menu showing 'API 24 ("Nougat"; Android 7.0)', and 'Build configuration language' with a dropdown menu showing 'Kotlin DSL (build.gradle.kts) [Recommended]'. Below the 'Minimum SDK' field, there is a blue information icon and the text 'Your app will run on approximately 97.4% of devices.' with a link 'Help me choose'. At the bottom right, there are four buttons: 'Previous', 'Next', 'Cancel', and 'Finish'.

New Project

Empty Activity

Create a new empty activity with Jetpack Compose

Name HelloWorld

Package name com.uog.helloworld

Save location C:\Users\dev\AndroidStudioProjects\HelloWorld

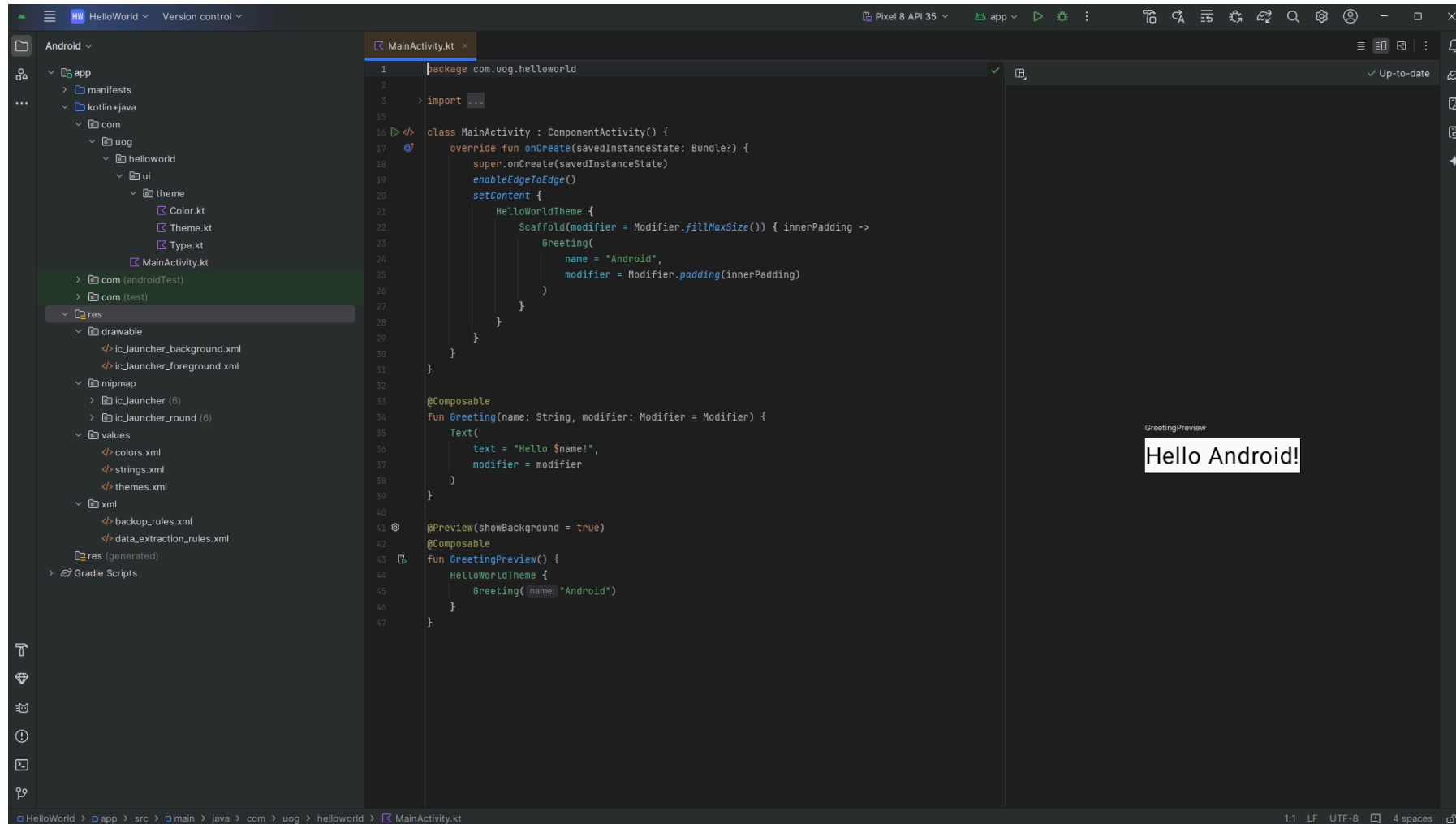
Minimum SDK API 24 ("Nougat"; Android 7.0)

ⓘ Your app will run on approximately 97.4% of devices.  
[Help me choose](#)

Build configuration language Kotlin DSL (build.gradle.kts) [Recommended]

Previous Next Cancel Finish

# Opening Android Studio to Create a New Project (cont'd)

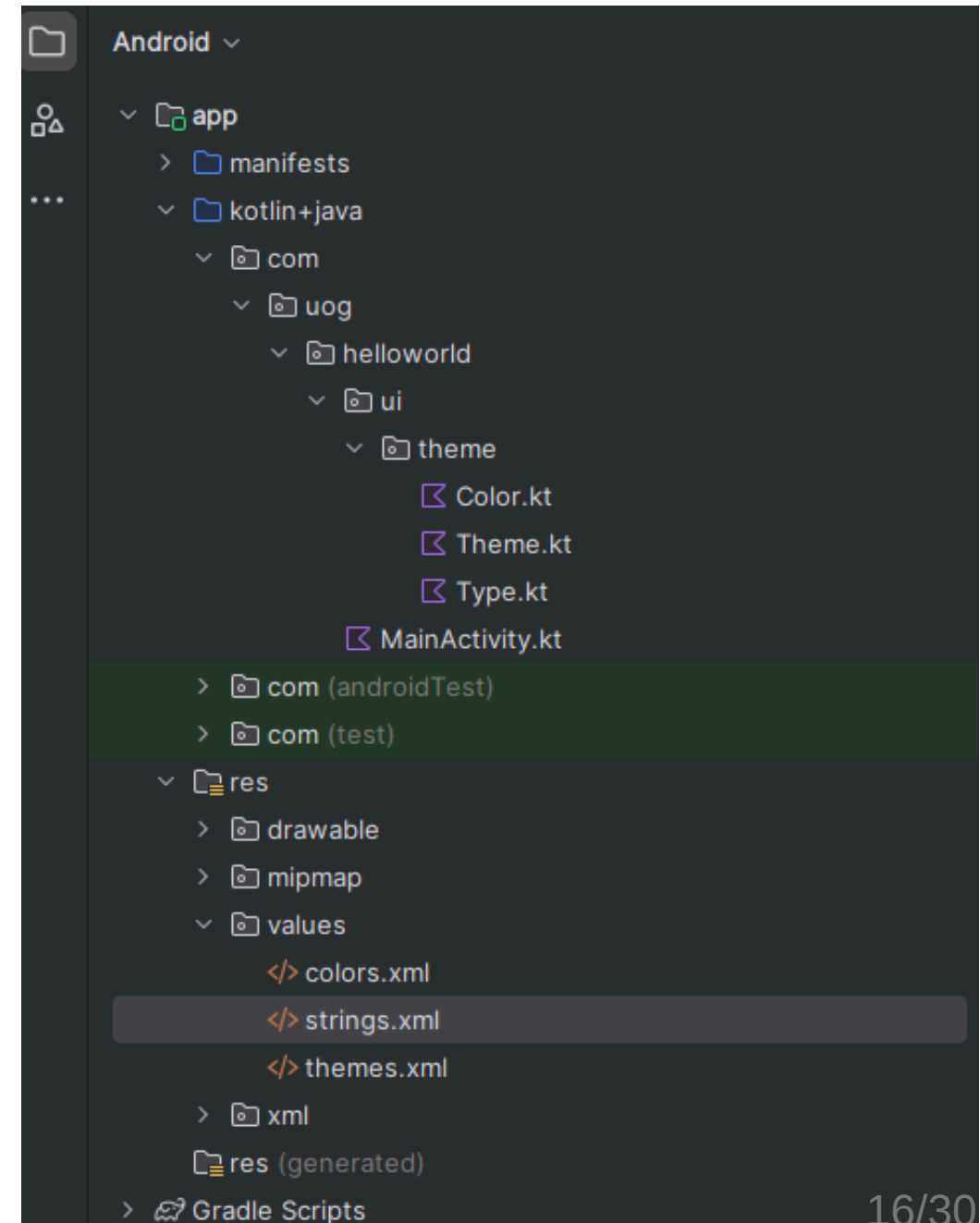


# Building the User Interface

- **Must** be intuitive
- Interface **must** not distract from functionality
- Jetpack Compose (new!)
  - Can design interface without writing large amounts of code
- XML (old, like really old!)
  - Java / Kotlin code or XML layout files are needed

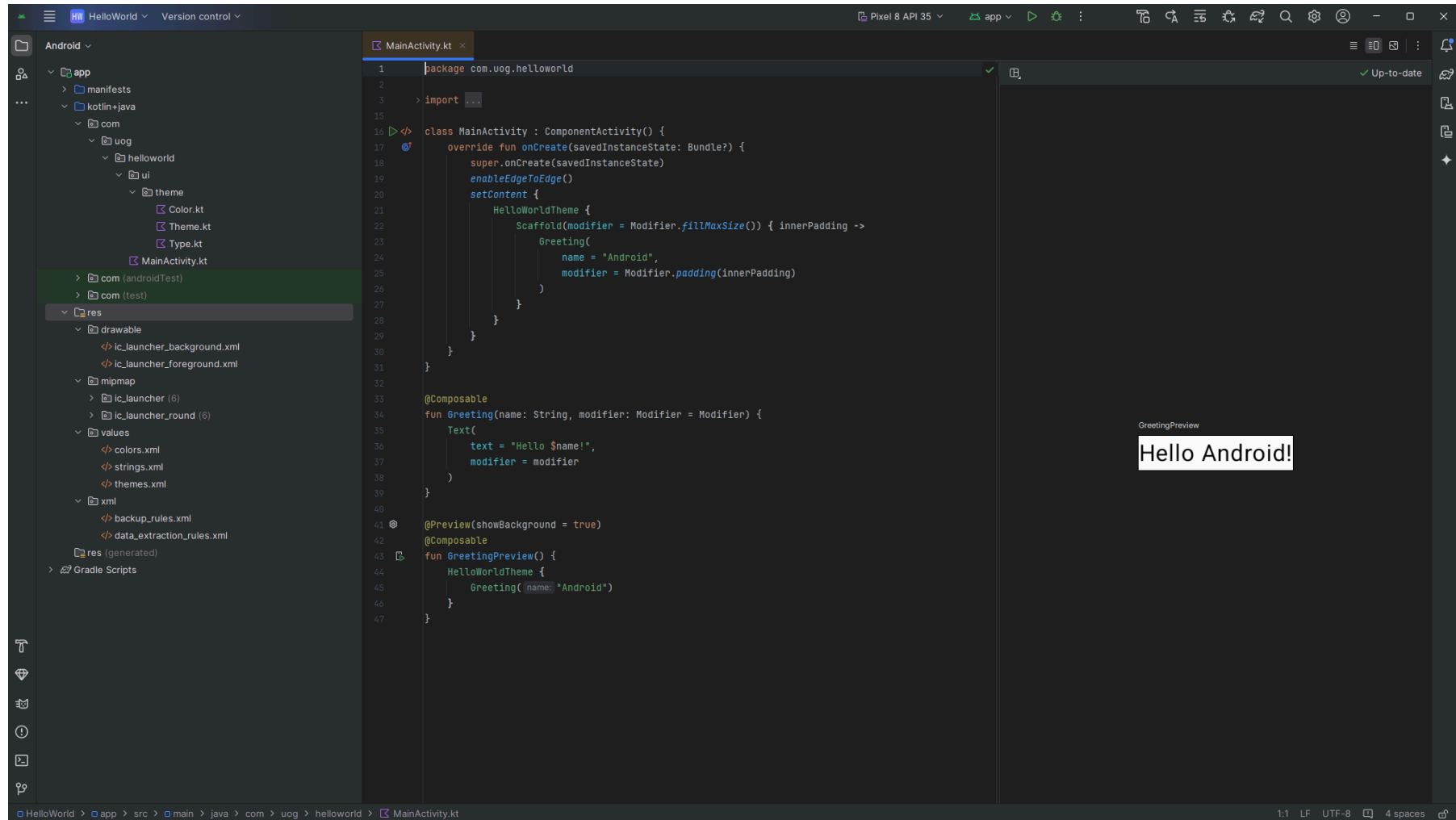
# Taking a Tour of the Android Project View

- **Kotlin+Java folder** – contains Kotlin and Java source code
- **Res folder** – contains images, music, and video
- **Manifests folder** – contains the `AndroidManifest.xml`, which contains information about the application that Android needs to run



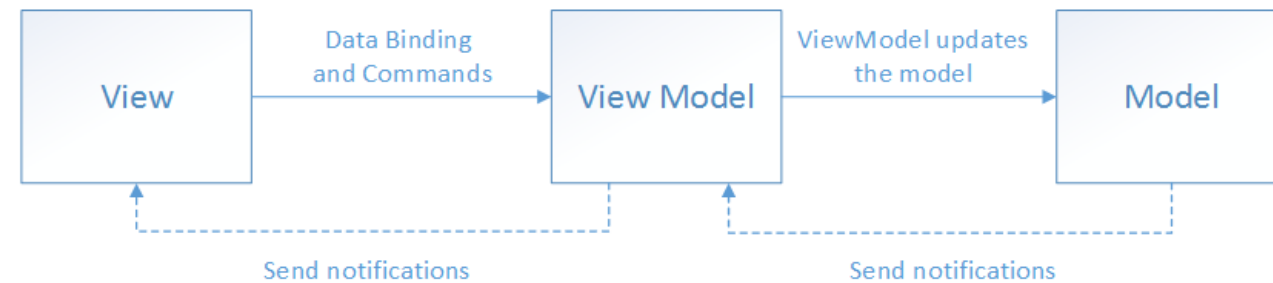


# Designing the App



# Jetpack Compose

- Is a declarative framework.
- The technique works by conceptually regenerating the entire screen from scratch, then applying only the necessary changes.
- **Composables** execute in any order, and in parallel, be skipped and run frequently
- Model-View-ViewMode architecture (MVVM)



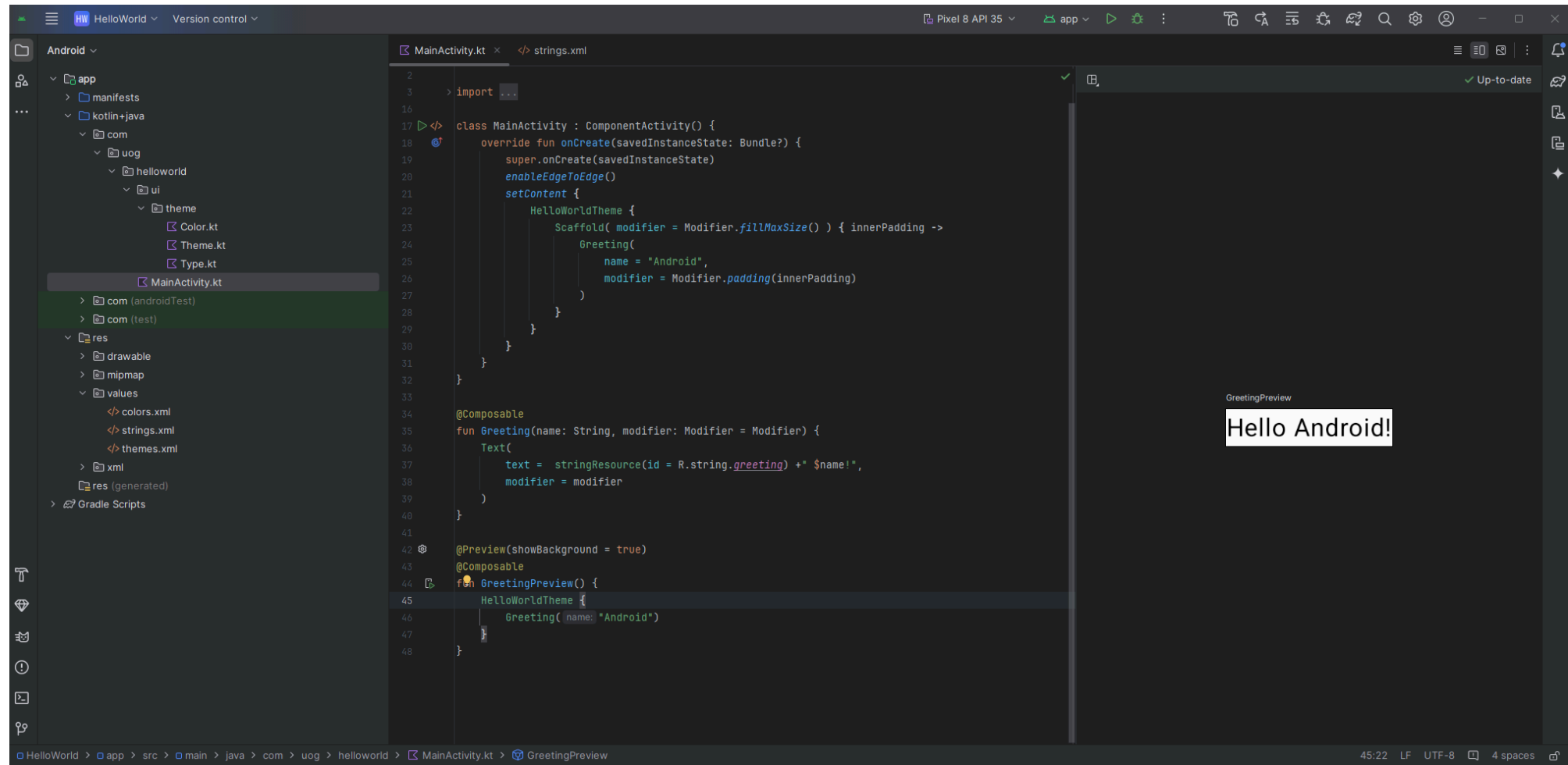
# State and Composition

Key Term:

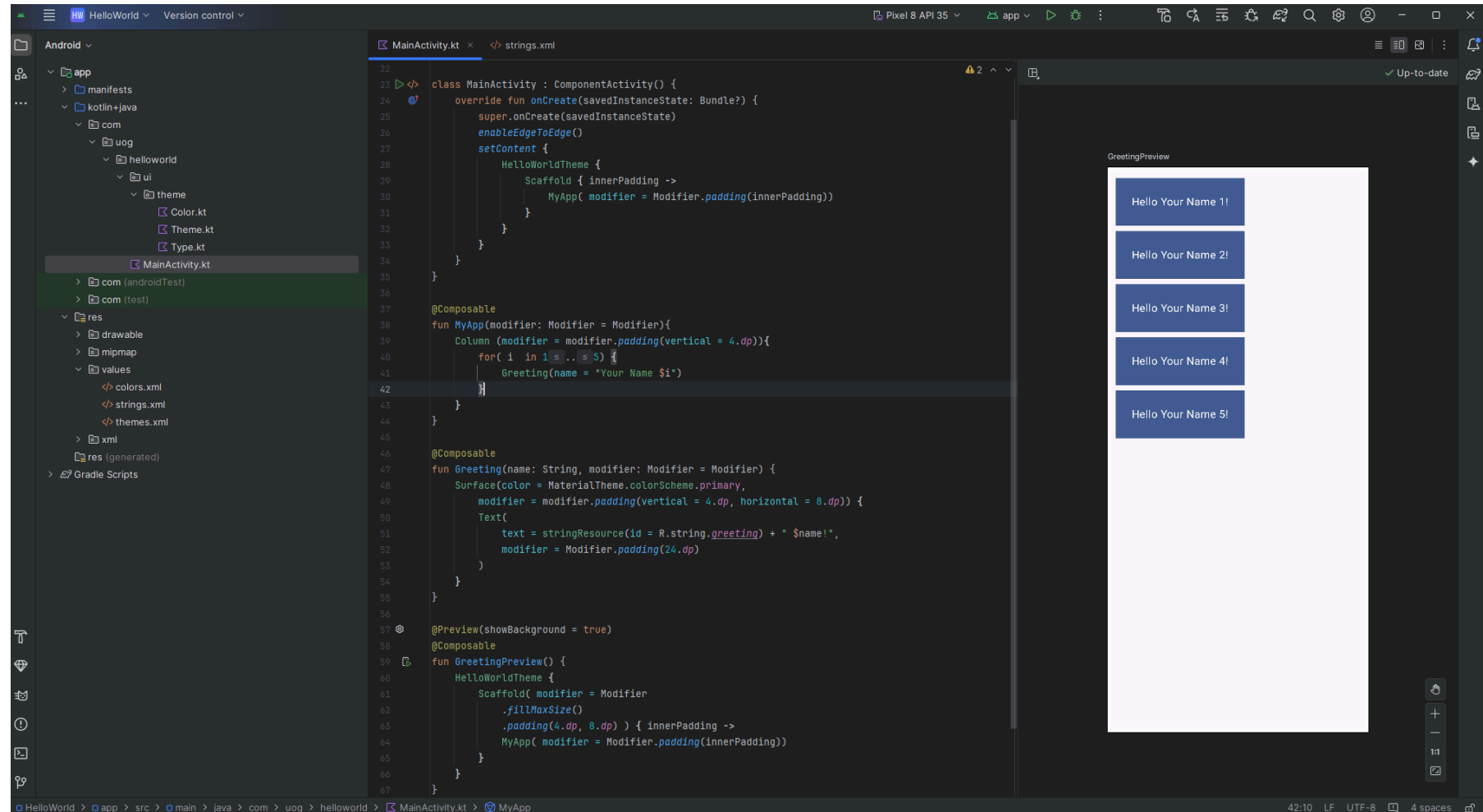
- **Composition:** a description of the UI built by Jetpack Compose when it executes composables.
- **Initial composition:** creation of a Composition by running composables the first time.
- **Recomposition:** re-running composables to update the Composition when data changes.

```
@Composable
private fun HelloContent() {
    Column(modifier = Modifier.padding(16.dp)) {
        Text(
            text = "Hello!",
            modifier = Modifier.padding(bottom = 8.dp),
            style = MaterialTheme.typography.bodyMedium
        )
        OutlinedTextField(
            value = "",
            onChange = { },
            label = { Text("Name") }
        )
    }
}
```

# Referencing the String



# Modifying the Jetpack Compose UI Components

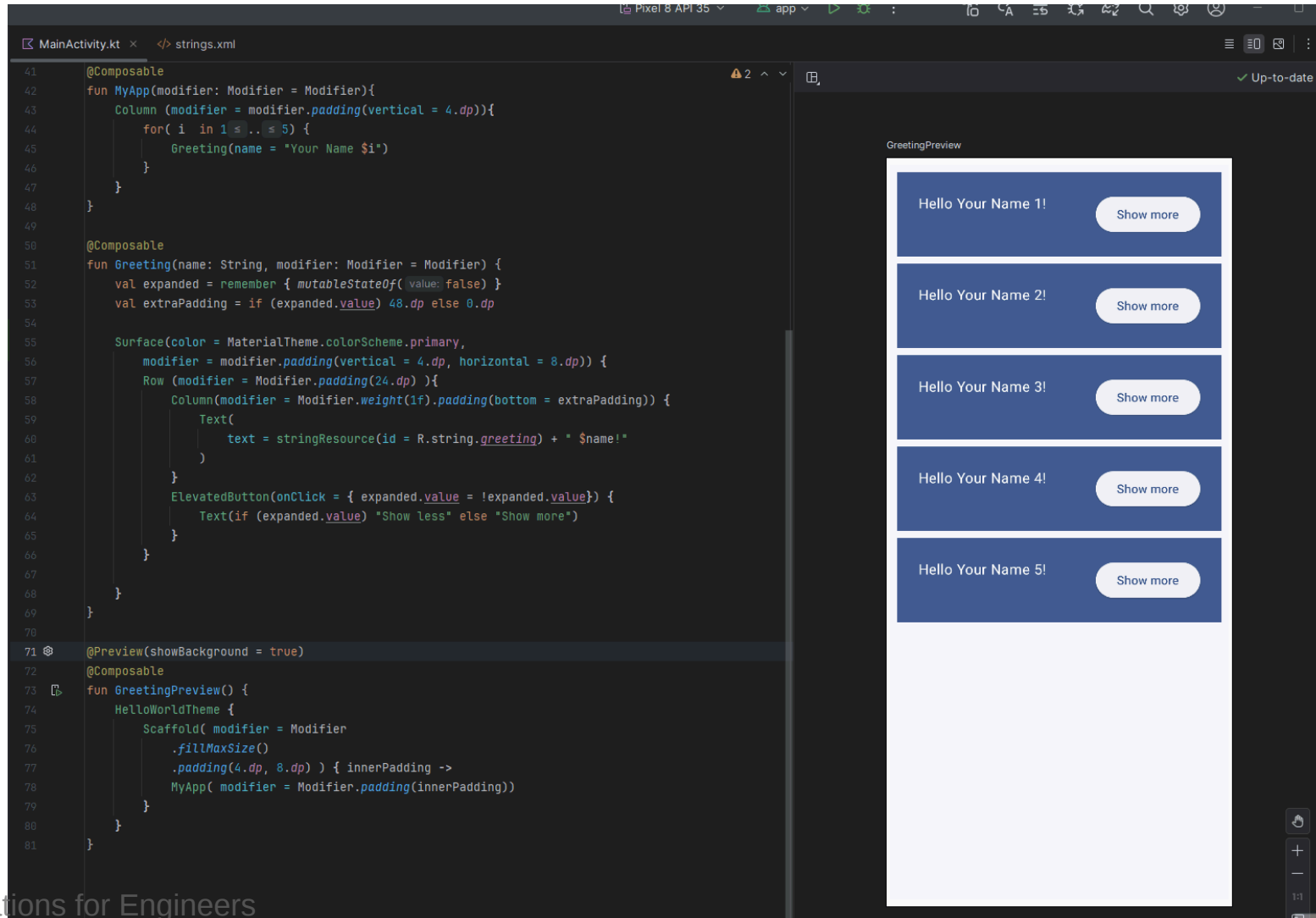


# State in composable

- **Composable functions** can use the `remember` API to store an object in memory.
- A value computed by `remember` is stored in the Composition during **initial composition**, and the stored value is returned during **recomposition**.
- `remember` can be used to store both **mutable** and **immutable** objects.

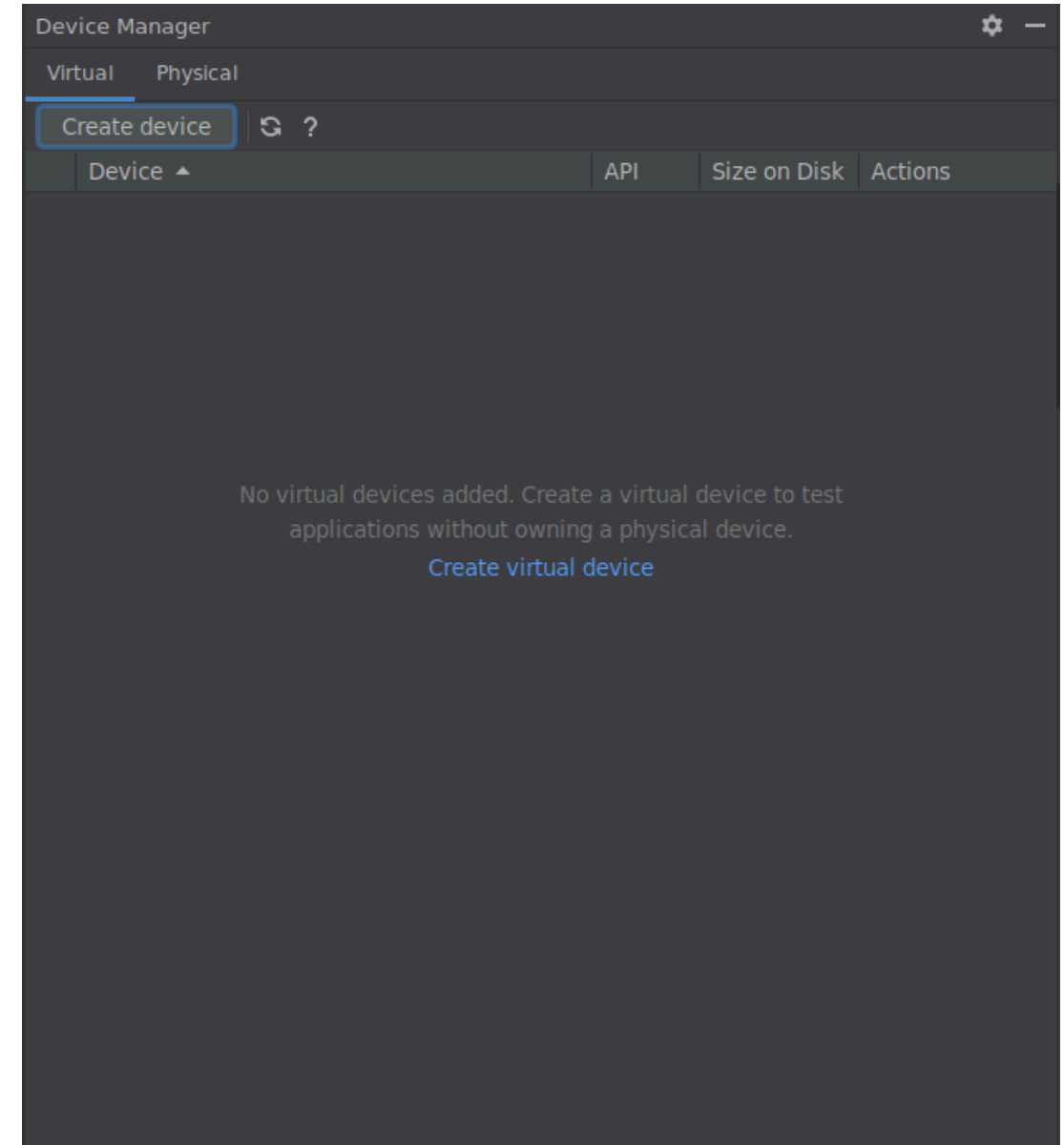
```
@Composable
fun HelloContent() {
    Column(modifier = Modifier.padding(16.dp)) {
        //val mutableState = remember { mutableStateOf(default) }
        //val (value, setValue) = remember { mutableStateOf(default) }
        var name by remember { mutableStateOf("") }
        if (name.isNotEmpty()) {
            Text(
                text = "Hello, $name!",
                modifier = Modifier.padding(bottom = 8.dp),
                style = MaterialTheme.typography.bodyMedium
            )
        }
        OutlinedTextField(
            value = name,
            onChange = { name = it },
            label = { Text("Name") }
        )
    }
}
```

# Modifying the Jetpack Compose UI Components




# The Virtual Device

- **Android Virtual Device (AVD)** – Android Studio displays an emulator configuration for design and layout purposes
- Click Device Manager on the menu and Create Virtual Device at the bottom of the screen






# The Virtual Device (Cont'd.)

 Select Hardware

### Choose a device definition


Category	Name ▾	Play Store	Size	Resolution	Density
Phone	Resizable (Experimen...		6.0"	1080x...	420dpi
Tablet	Pixel XL		5.5"	1440x...	560dpi
Wear...	Pixel 6 Pro		6.7"	1440x...	560dpi
Desk...	Pixel 6		6.4"	1080x...	420dpi
TV	Pixel 5		6.0"	1080x...	440dpi
Auto...	Pixel 4a		5.8"	1080x...	440dpi
	Pixel 4 XL		6.3"	1440x...	560dpi
	Pixel 4		5.7"	1080x...	440dpi

New Hardware ProfileImport Hardware Profiles↺Clone Device...

 **Pixel 6 Pro**

PreviousNextCancelFinish

# The Virtual Device (Cont'd.)

 System Image


### Select a system image

Recommendedx86 ImagesOther Images

Release Name	API Level ▼	ABI	Target
<b>API 34</b> ⬇	34	x86_64	Android API 34 (Google)
<b>Tiramisu</b> ⬇	33	x86_64	Android 13.0 (Google)
<b>Sv2</b> ⬇	32	x86_64	Android 12L (Google)
<b>S</b> ⬇	31	x86_64	Android 12.0 (Google)
<b>R</b> ⬇	30	x86	Android 11.0 (Google)
<b>Q</b> ⬇	29	x86	Android 10.0 (Google)
<b>Pie</b> ⬇	28	x86	Android 9.0 (Google)
<b>Oreo</b> ⬇	27	x86	Android 8.1 (Google)
<b>Oreo</b> ⬇	26	x86	Android 8.0 (Google)
<b>Marshmallow</b> ⬇	25	x86	Android 7.1.1 (Google)

↺

### Oreo



API Level

**27**

Android

**8.1**

**Google Inc.**

System Image

**x86**

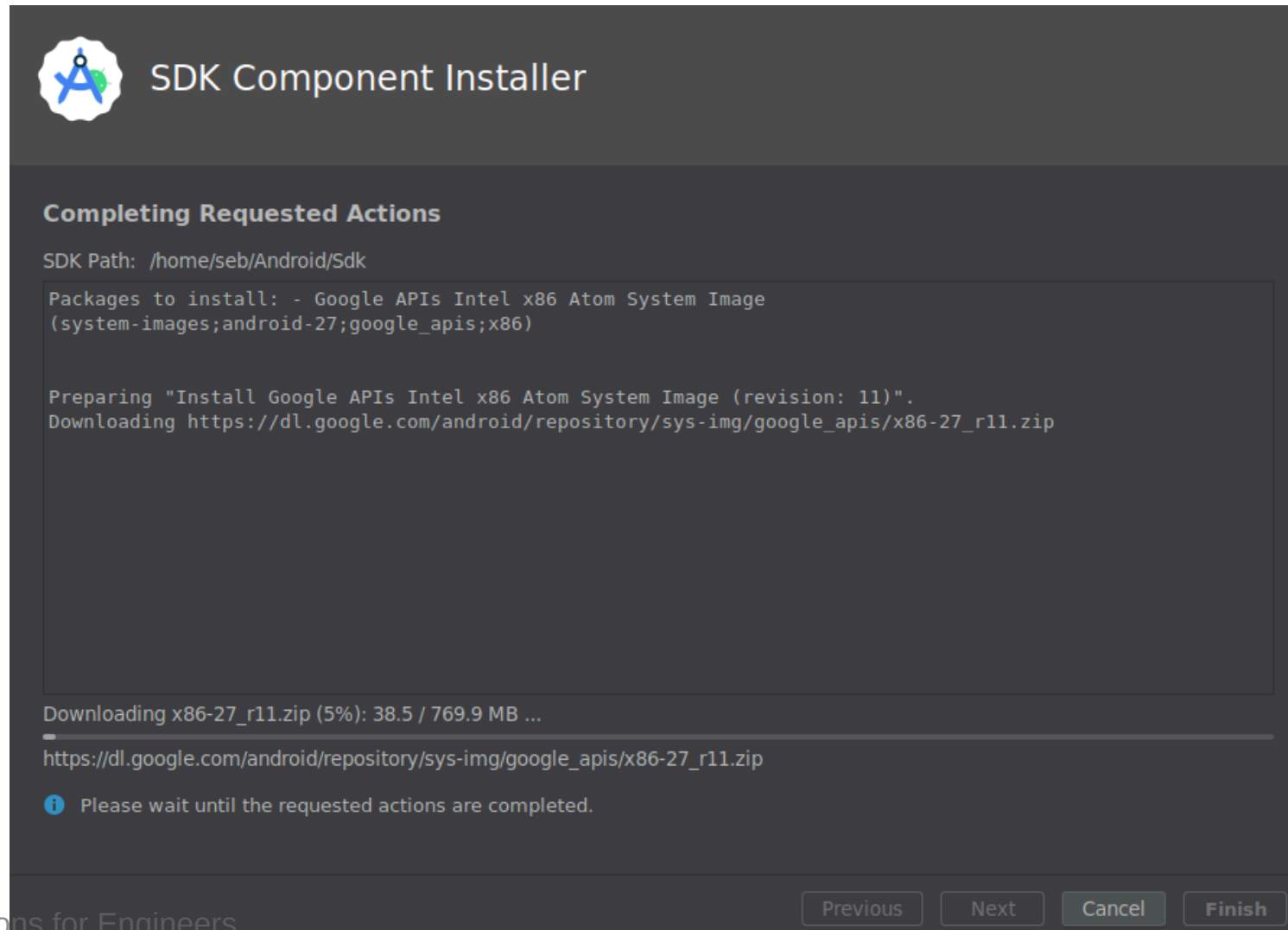
We recommend these images because they run the fastest and support Google APIs.

Questions on API level?  
See the [API level distribution chart](#)


! A system image must be selected to continue.

PreviousNextCancelFinish

# Downloading SDK




# The Virtual Device (Cont'd.)

 Android Virtual Device (AVD)

### Verify Configuration


AVD Name

Pixel 6 Pro API 27

 Pixel 6 Pro

6.7 1440x3120 560dpi


Change...


 Oreo

Android 8.1 x86

Change...

Startup orientation

 Portrait

 Landscape

Emulated Performance

Graphics: Automatic

Device Frame

☒ Enable Device Frame

Show Advanced Settings

Nothing Selected

Previous

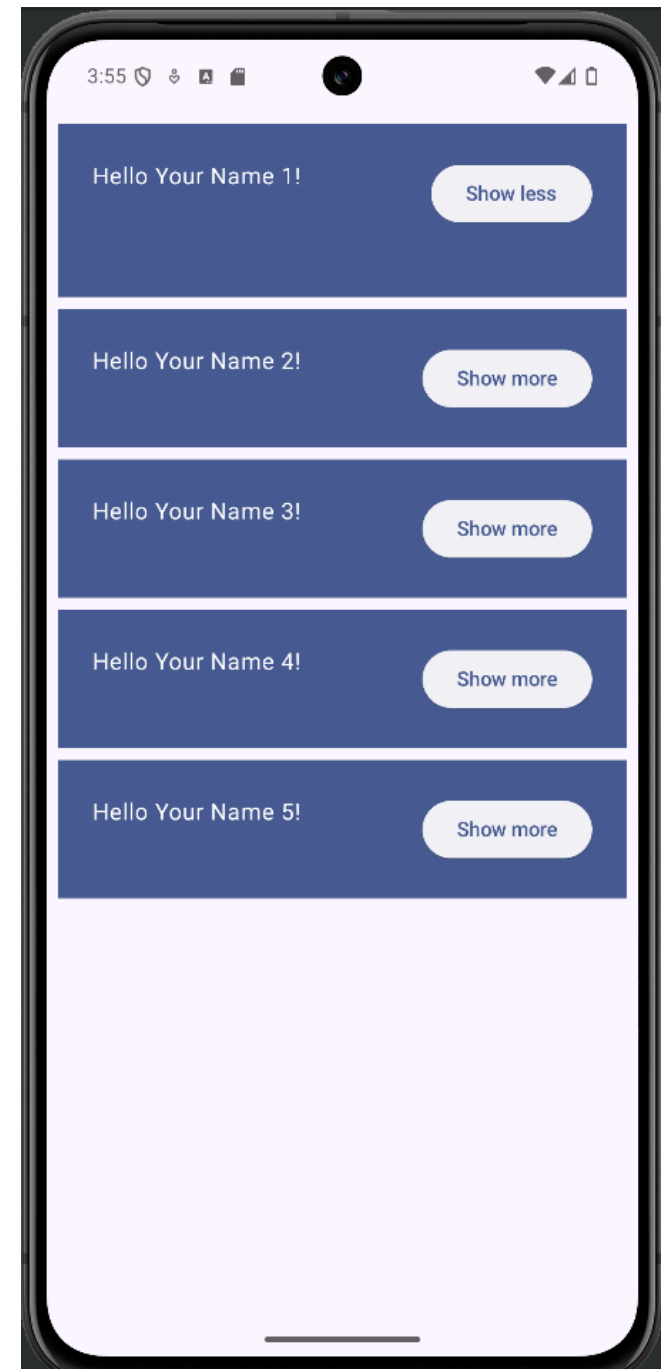
Next

Cancel

Finish

# Testing the Application in the Emulator

- Step 1: Tap or click the Run 'app' button on the toolbar
- Step 2: After you have run the app once and have started the emulator, next time around the Run 'app' button has changed



## Go to for Referencing

- Android JetPack - <https://developer.android.com/jetpack>
- JetPack Compose - <https://developer.android.com/jetpack/androidx/releases/compose>
- API references - <https://developer.android.com/reference>