
Application Development for Mobile Computer

<Week 2>

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Introduction to Android

Android

- Android is based on Linux, an open-source operating system.
- Android apps are developed using Java or Kotlin.
- Most of the core parts of the Android OS, libraries, and some Google apps are open-source.
- Android apps can be distributed not only through Google Play Store but also in various other ways.

Android 

Introduction to Android

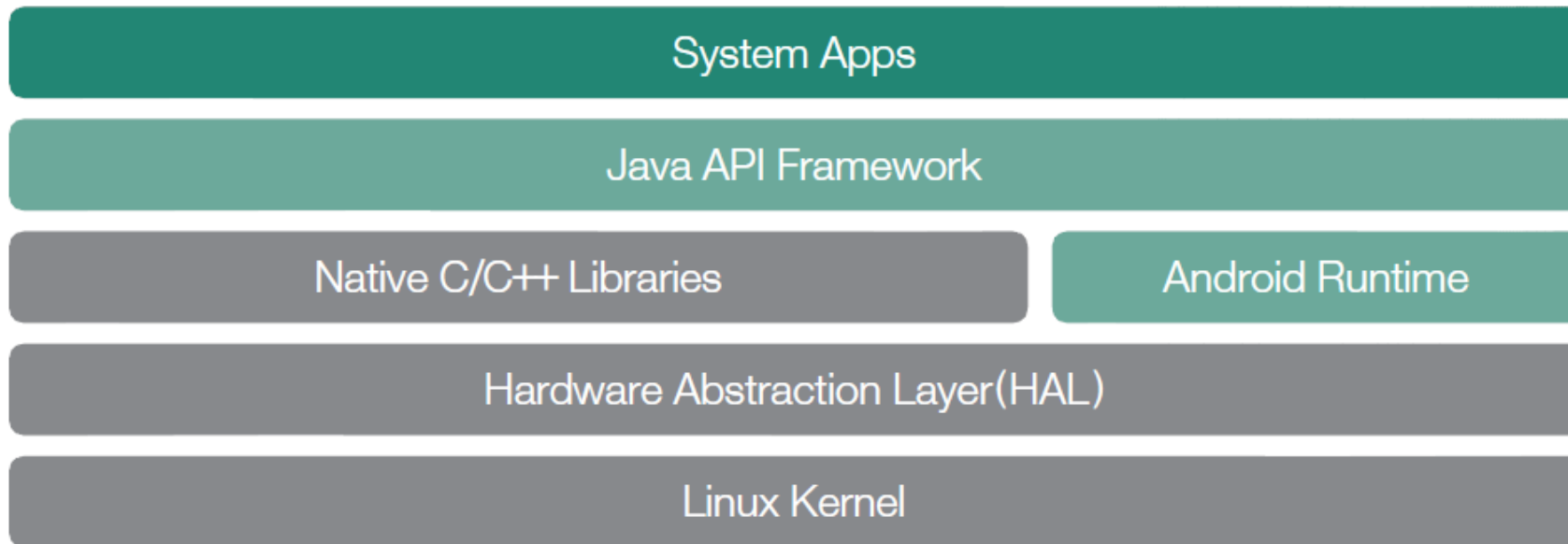
Android OS

- The structure of the Android platform combines the Linux kernel and the Java API framework.
- In the past, explanations of the Android platform always mentioned the JVM (actually Dalvik VM, but usually written as JVM) because apps ran on the Java Virtual Machine.
- Now, **Android Runtime (ART) is used instead of the JVM.**
- Therefore, although the JVM is no longer present, apps still run on a virtual machine, adopting the execution model of Java.

Introduction to Android

Android OS

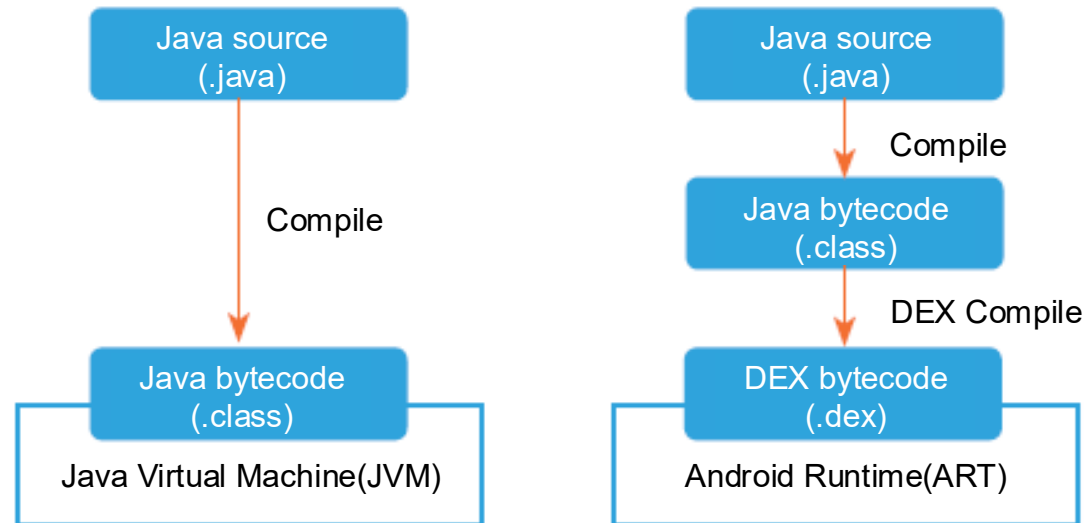
- Linux kernel: Android is an open-source software stack based on Linux.
- Android Runtime (ART): Responsible for running applications.
- Java API Framework: Provides Java APIs used for app development.



Introduction to Android

Android

- Android does not run Java classes directly at runtime but compiles them into DEX files.
- These DEX files are executed in the Android Runtime (ART), which interprets them

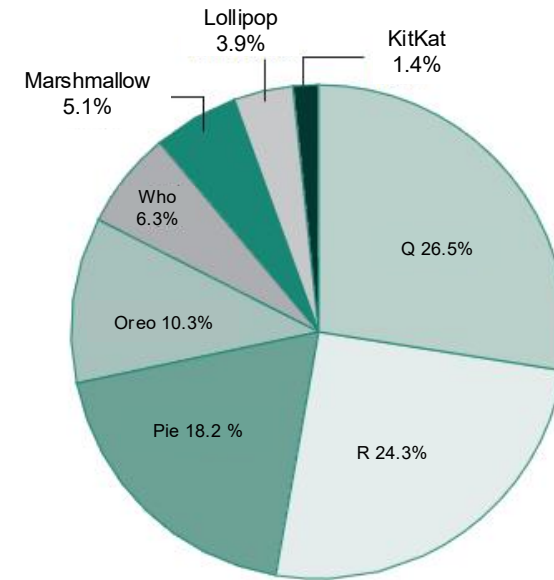


Android Versions

Android Versions

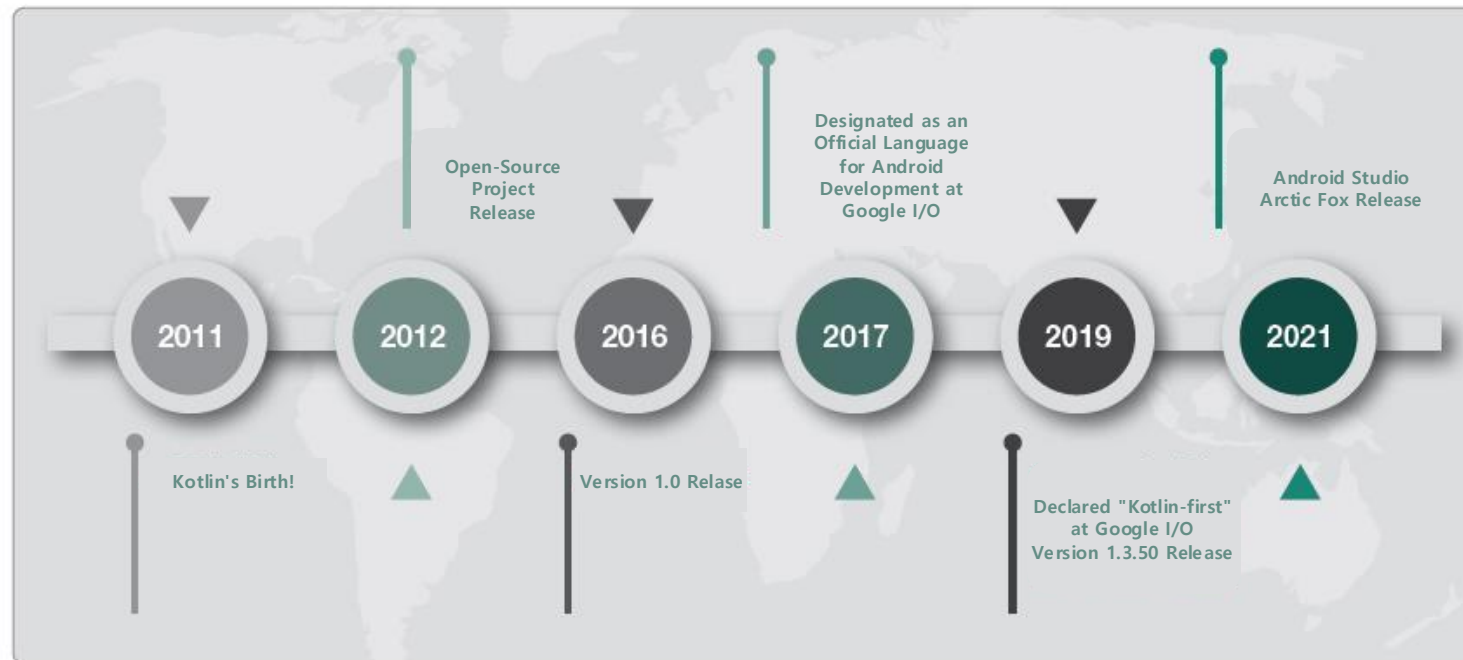
- Android has an API level that exists separately from the platform version.
- Depending on the API level, new features may be added, or major code changes may be required.

Platform Version	Code Name	API Level	Version Code
12.0	Android 12	31	S
11.0	Android 11	30	R
10.0	Android 10	29	Q
9.0	Pie	28	P
8.1	Oreo	27	O_MR1
8.0	Oreo	26	O
7.1.1	Nougat	25	N_MR1
7.0	Nougat	24	N
6.0	Marshmallow	23	M



Kotlin

- In the past, Java was mainly used as the primary app development language.
- At Google I/O in May 2017, Kotlin was announced as an official language, and since then more companies have gradually adopted it for app development.



Kotlin

- Kotlin supports functional programming.
- In object-oriented programming, logic is written only in functions inside a class.
- In functional programming, logic can be written anywhere without such restrictions.

Java code - Object-Oriented Programming

```
class Hello {  
    public static void main(String args[]) {  
        System.out.print("Hello World");  
    }  
}
```

Kotlin code - Functional Programming

```
System.out.print("Hello World");
```

Kotlin

- When developing Android apps, Kotlin requires writing logic inside classes.
- Kotlin is 100% compatible with Java.
- Code written in Kotlin is usually much shorter compared to Java.

Java code - ButtonActivity.java

```
CheckBox check = findViewById(R.id.check);
ImageView image = findViewById(R.id.image);
check.setOnCheckedChangeListener(new CompoundButton.OnCheckedChangeListener() {
    public void onCheckedChanged(CompoundButton buttonView, boolean isChecked) {
        if (isChecked) {
            image.setVisibility(View.VISIBLE);
        } else {
            image.setVisibility(View.GONE);
        }
    }
});
```

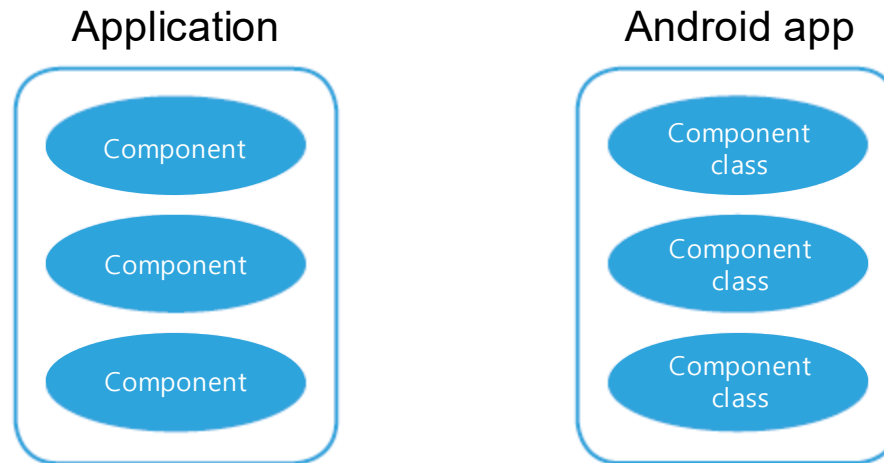
Kotlin code - ButtonActivity.kt

```
binding.check.setOnCheckedChangeListener { buttonView, isChecked ->
    binding.image.visibility = if(isChecked).View.VISIBLE else View.GONE
}
```

Android App Development

Android Components

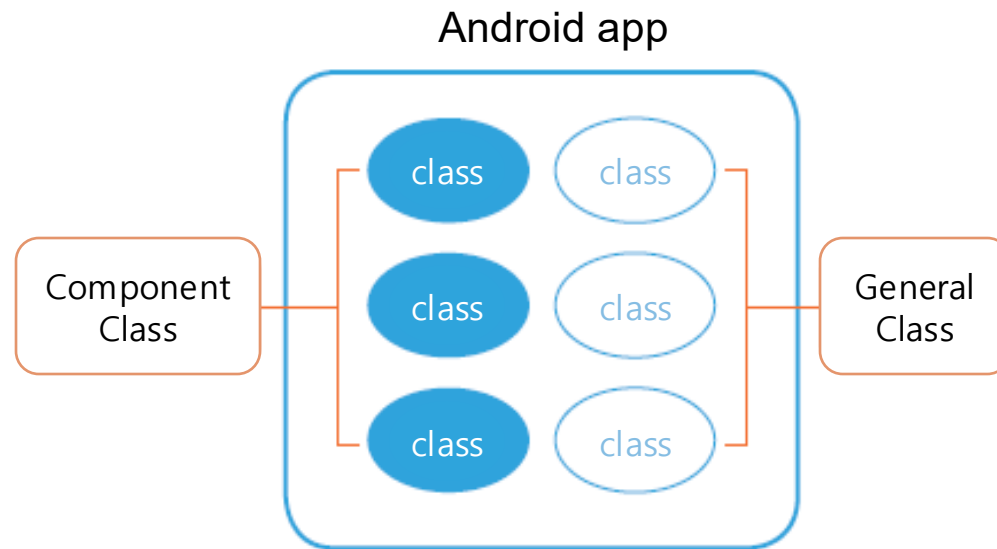
- A component is a building block of an application.
- A component is an independent unit of execution within an app.



Android App Development

Android Components

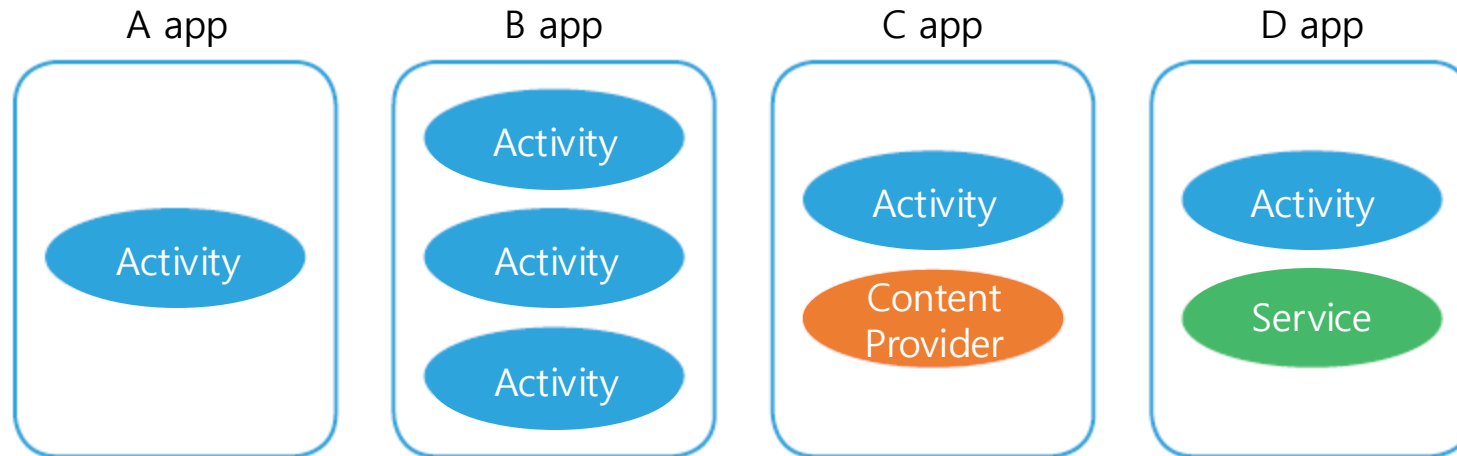
- An app is made up of many classes, mainly divided into component classes and regular classes.
- If the lifecycle (from object creation to destruction) is managed by developer code, it is a regular class.
- If the lifecycle is managed by the Android system, it is a component class.



Android App Development

Android Components

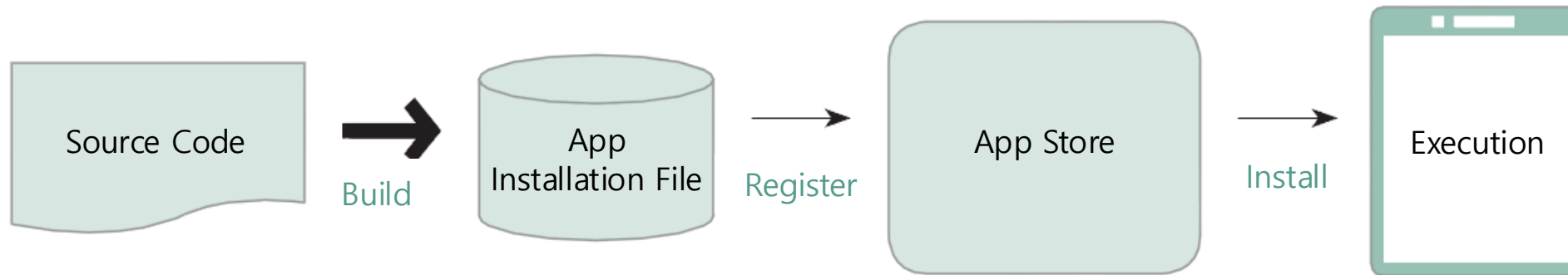
- Activity: A component that provides the user interface (screen).
- Service: A component that performs background tasks.
- Content Provider: A component that shares app data.
- Broadcast Receiver: A component that responds to system events.



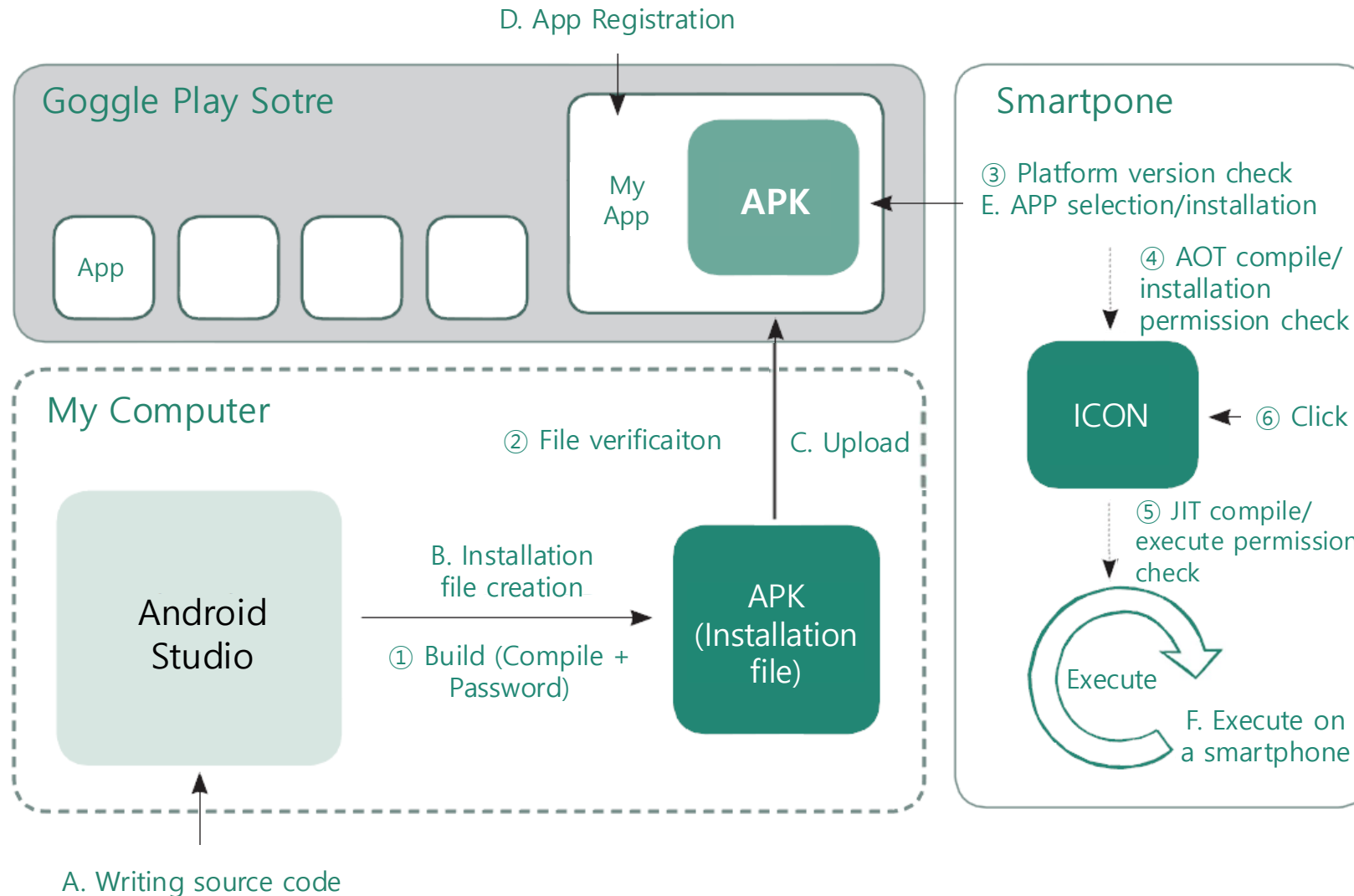
Android App Development

Development Process

- Write the source code.
- Use build commands to convert it into an installable Android package.
- Upload the app to the Google Play Store.
- Register the app in the Google Play Console.
- On a smartphone, open the Play Store, select the app, and install it.
- Tap the app icon to launch it.



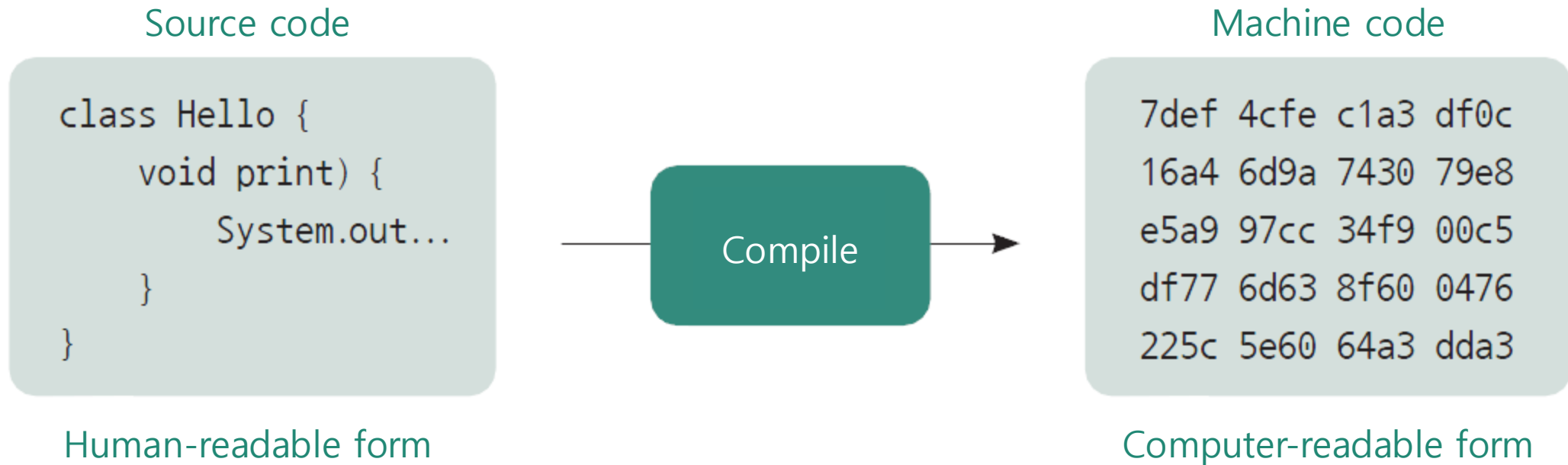
Android App Development



Android App Development

Compile

- Converting human-readable source code into machine code that a computer can understand.



Android App Development

Build in Linux

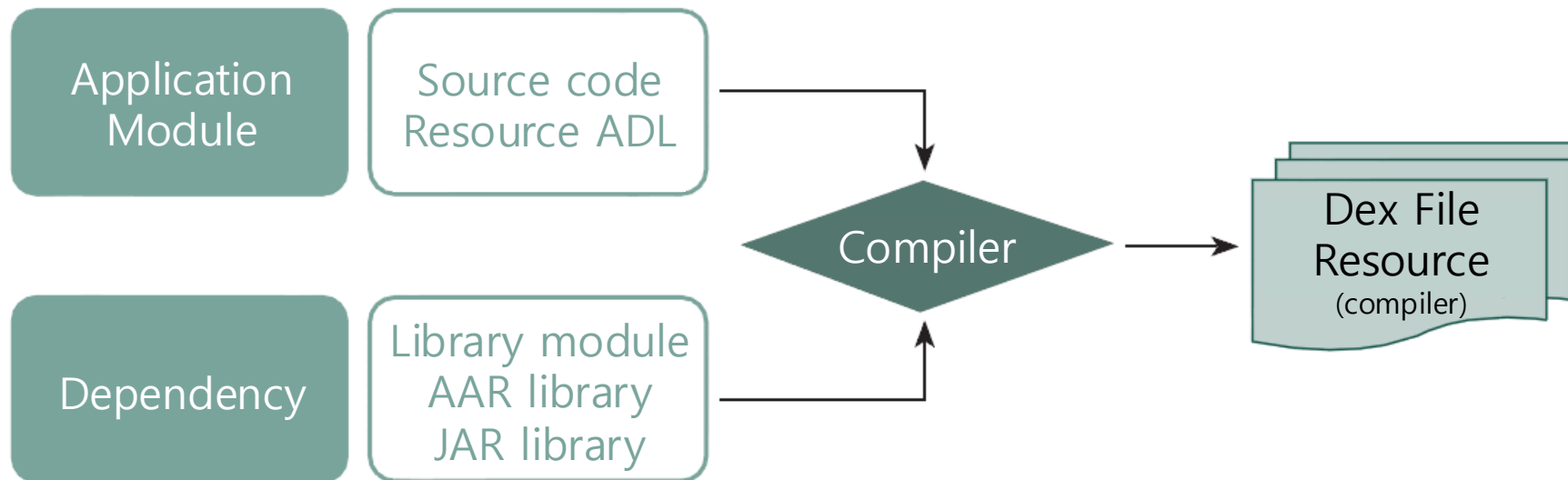
- Translating (compiling) the source code into machine code and linking it with the libraries used, to produce the final executable file.



Android App Development

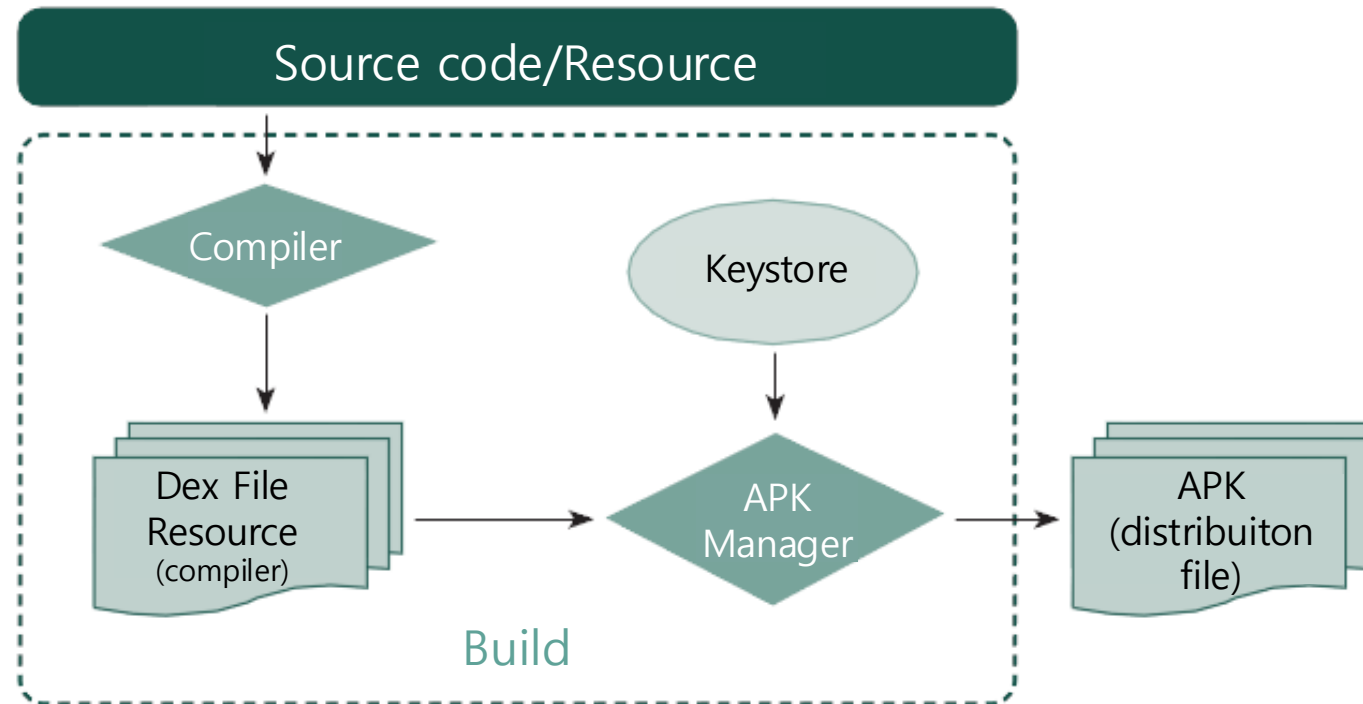
Build in Android

- The difference from Linux compilation is that Android has the concept of resources.
- Android compilation happens in two steps:
 - Step 1: Bytecode generation
 - Step 2: APK file creation



Android App Development

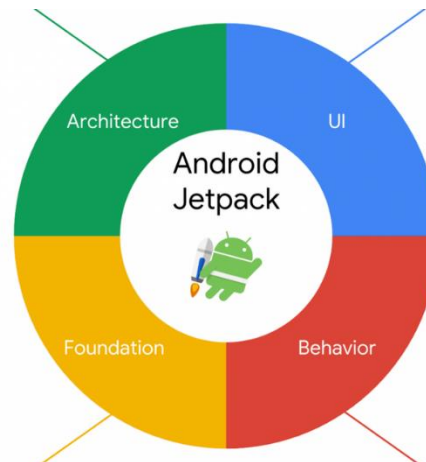
Build in Android



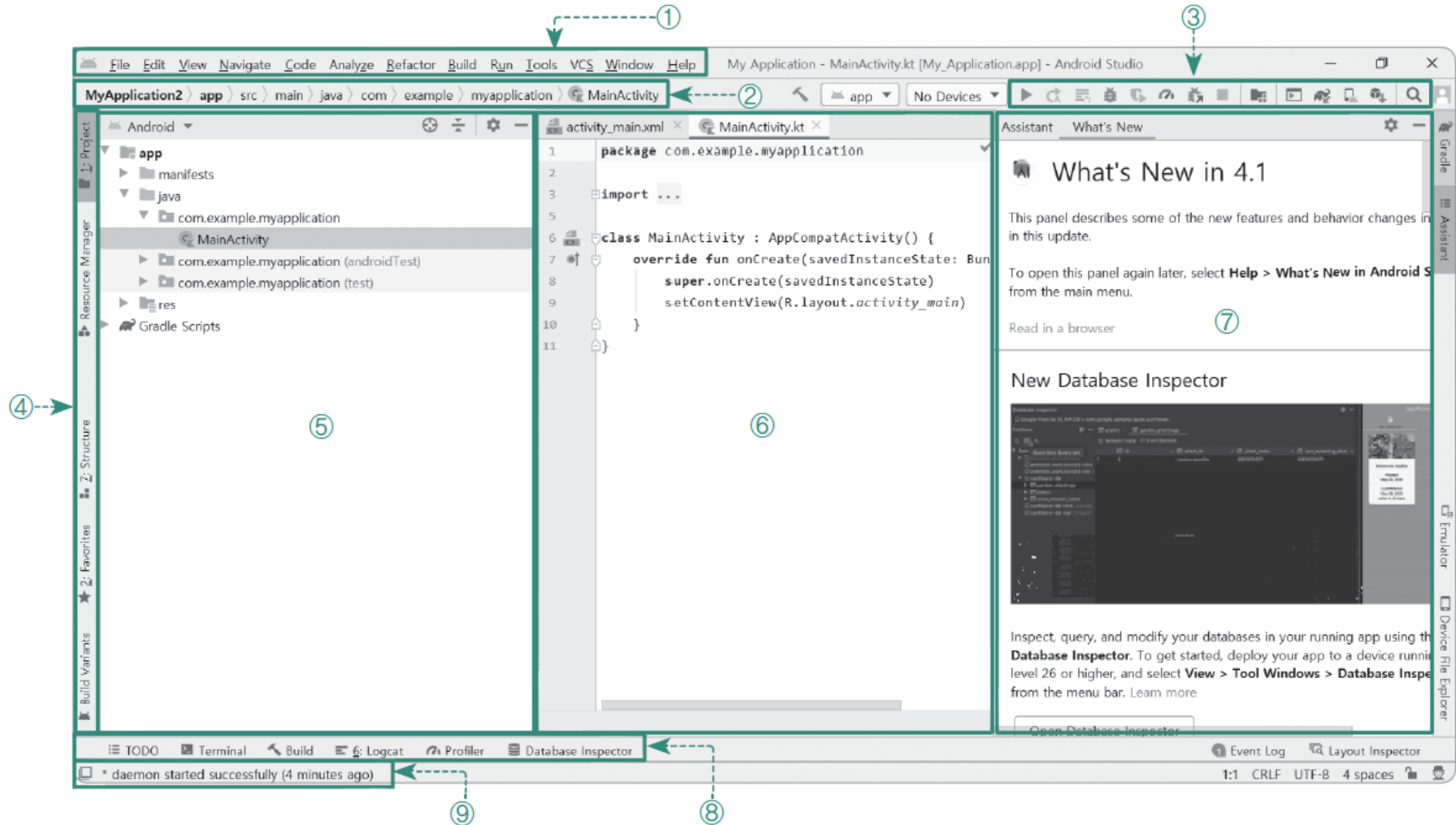
Android App Development

Jetpack

- Consistent libraries: Work uniformly across all versions and devices.
- **Backward compatibility**: Jetpack libraries, built on modern design principles, include compatibility features for older versions, reducing crashes and memory leaks.
- Reduced boilerplate code: Jetpack removes repetitive tasks like background work and lifecycle management, allowing developers to focus on business logic.
- Lower complexity: Provides consistent behavior across versions and devices, simplifying code.

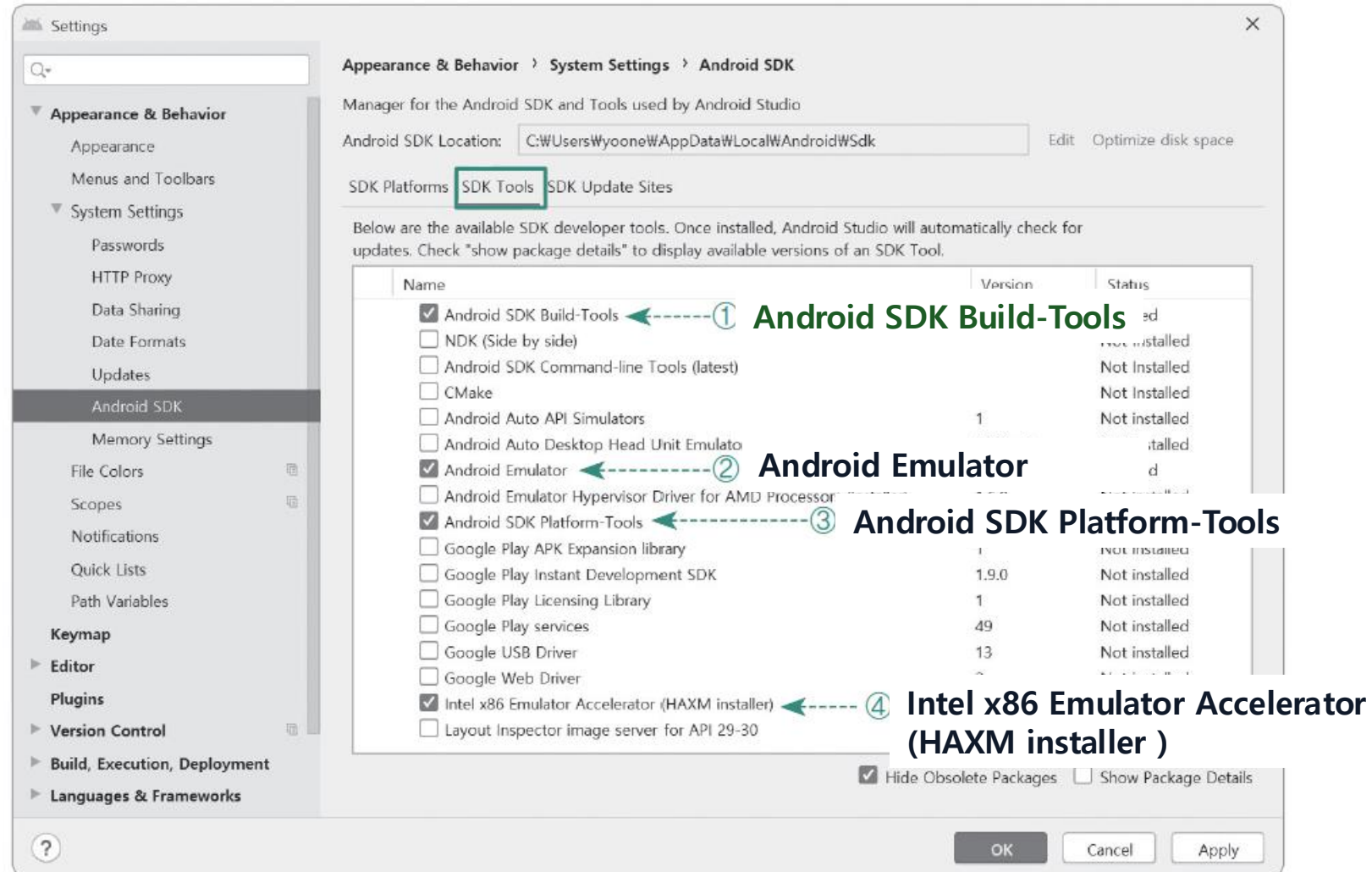


Android Studio



Android Studio

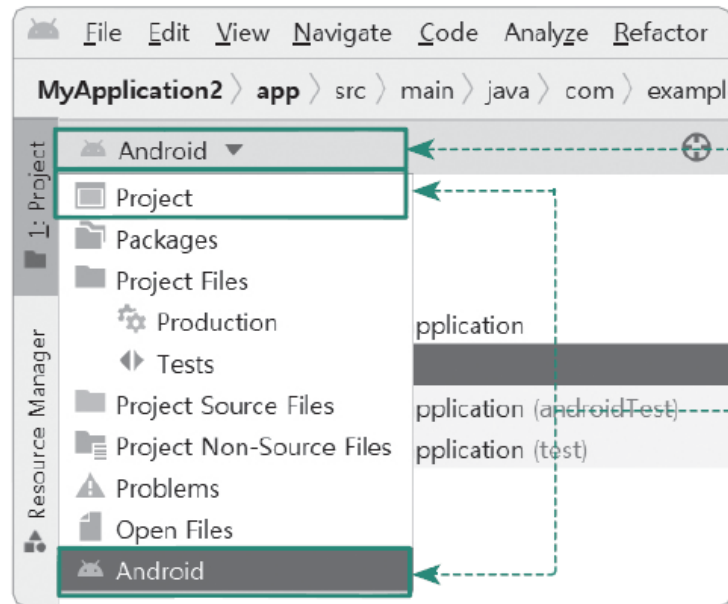
Android SDK



Android Studio

Android Project

- The top-level directory that systematically manages source code, images, music, text files, and other resources.

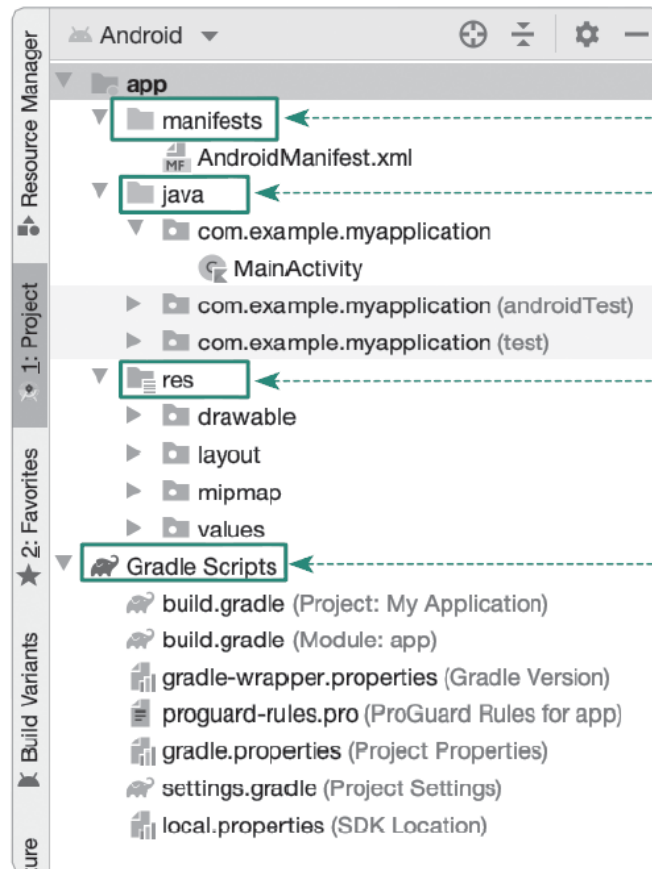


When clicked, the list of views expands.

Mainly uses Project and Android views.

Android Studio

Android View



Directory for installation-related information

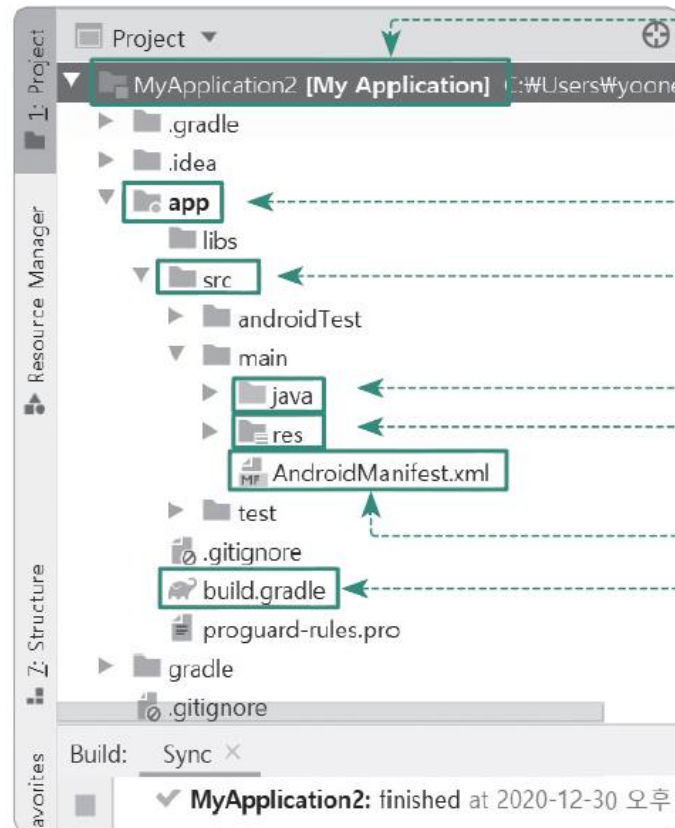
Directory for source code

Directory for resources such as images, layouts, and MP3 files

Directory for build-related configuration information

Android Studio

Project View



Directory for the actual project

Directory containing all app-related sources (code, libraries, images, etc.)

Directory for user-created sources (code, layouts, images, etc.)

Directory containing source code (still shown as java)

Directory for resources such as images, layouts, and MP3 files

Installation information file

Build information file

Android Studio

Emulator



Q & A

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