Unit II: Android Application Development

CTE308- AS2025

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Learning Outcomes

- At the end of the lesson, you are expected to be able to:
  - Android is an ecosystem
  - Android platform architecture
  - Android History and Versions
  - Challenges of Android app development
  - App fundamentals

What is Android?

- Android is a software stack for mobile devices that includes:
  - ▷ **Operating System**
  - ▷ **Middleware and**
  - ▷ **Key applications.**

- An **Android SDK** provides the tools and APIs necessary to develop applications on the Android platform using the Java/Kotlin programming Language

What is Android?

- Mobile operating system based on Linux kernel
- Designed primarily for touch screens
- Most widely used mobile OS. Over 70% of all smartphones uses android OS.
- Founded in Palo Alto, California in 2003.
- Deployed in powers devices such as watches, TVs, and cars
- The number of available apps in the Google Play Store was most recently placed at 2.43 million apps, after surpassing 1 million apps in July 2013.
- Highly customizable for devices / by vendors
- Open source

How do you interact with Android?

- Touch gestures:
  - ▷ **Swiping**
  - ▷ **Tapping**
  - ▷ **Pinching**

- Virtual keyboard for characters, numbers, and emoji.
- Support for Bluetooth, USB controllers and peripherals.

Android and Sensors

- Sensors can discover user action and respond
  - Device contents rotate as needed
  - Walking adjusts position on map
  - Tilting steers a virtual car or controls a physical toy
  - Moving too fast disables game interactions
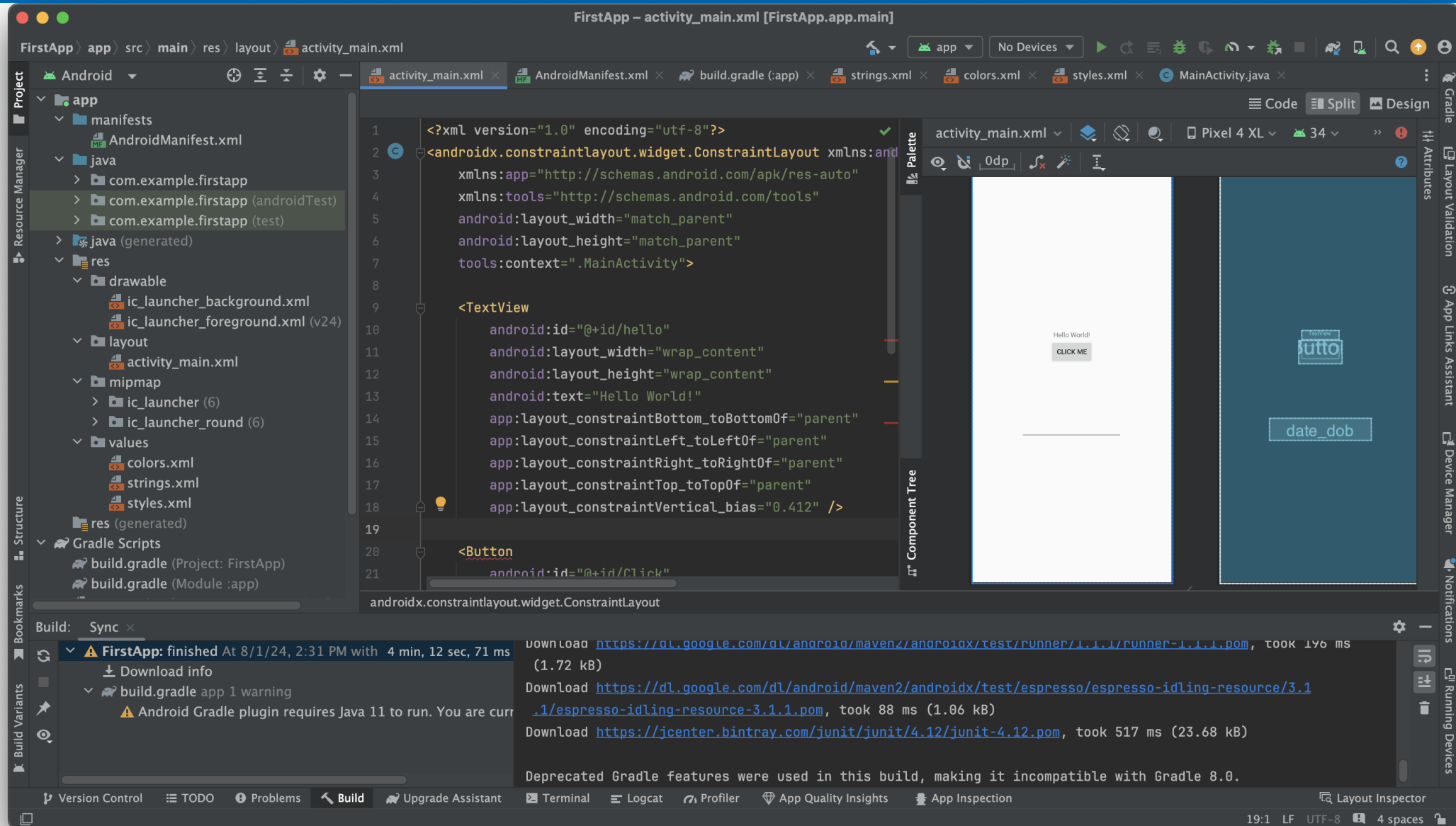
Apps Example

Software Development Kit (SDK)

- Development tools:
  - Debugger
  - Monitors
  - Editors

- Libraries (maps, wearable)

- Virtual devices (emulators)

- Documentation (developers.android.com)
  - Sample code

Android Studio

- Official Android IDE
- Develop, run, debug, test, and package apps
- Monitors and performance tools
- Virtual devices
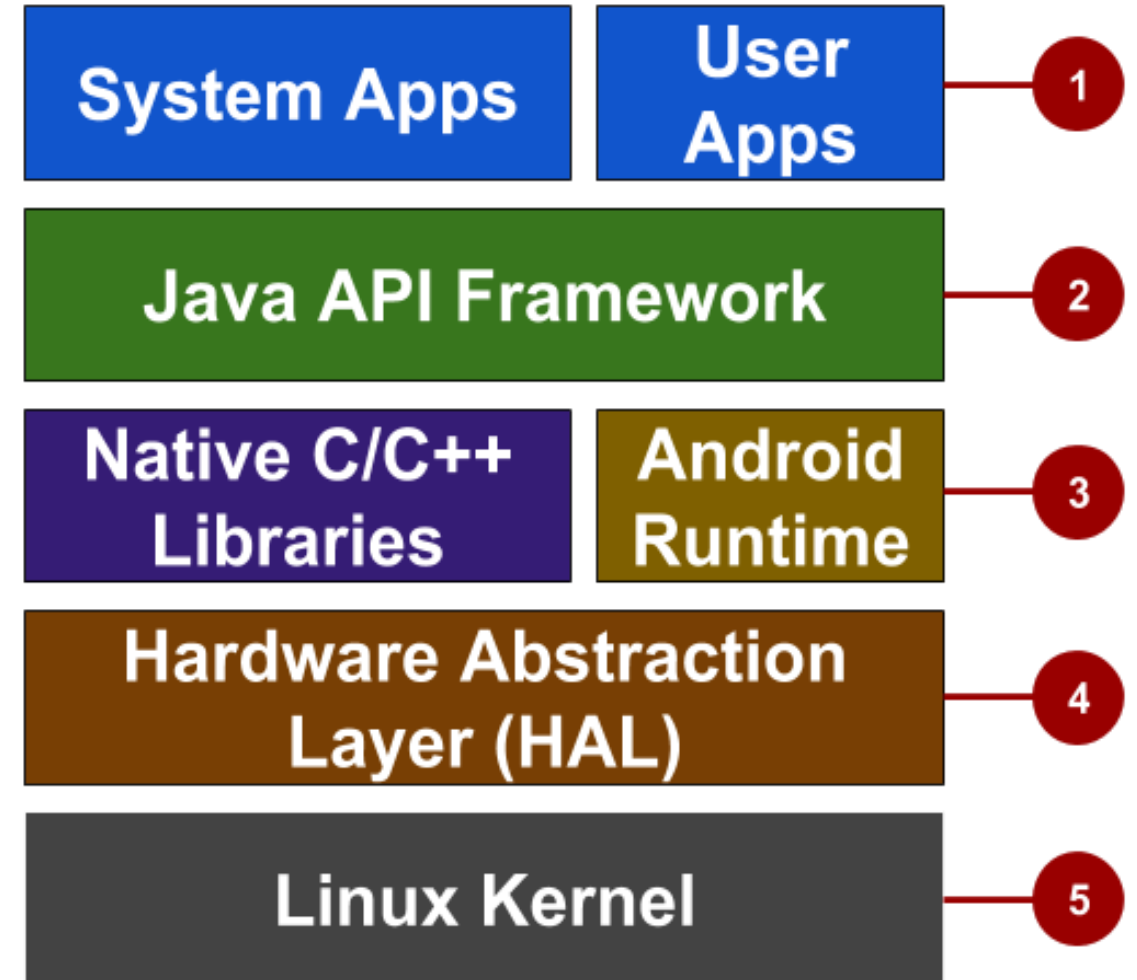- Project views
- Visual layout editor

Google Play Store

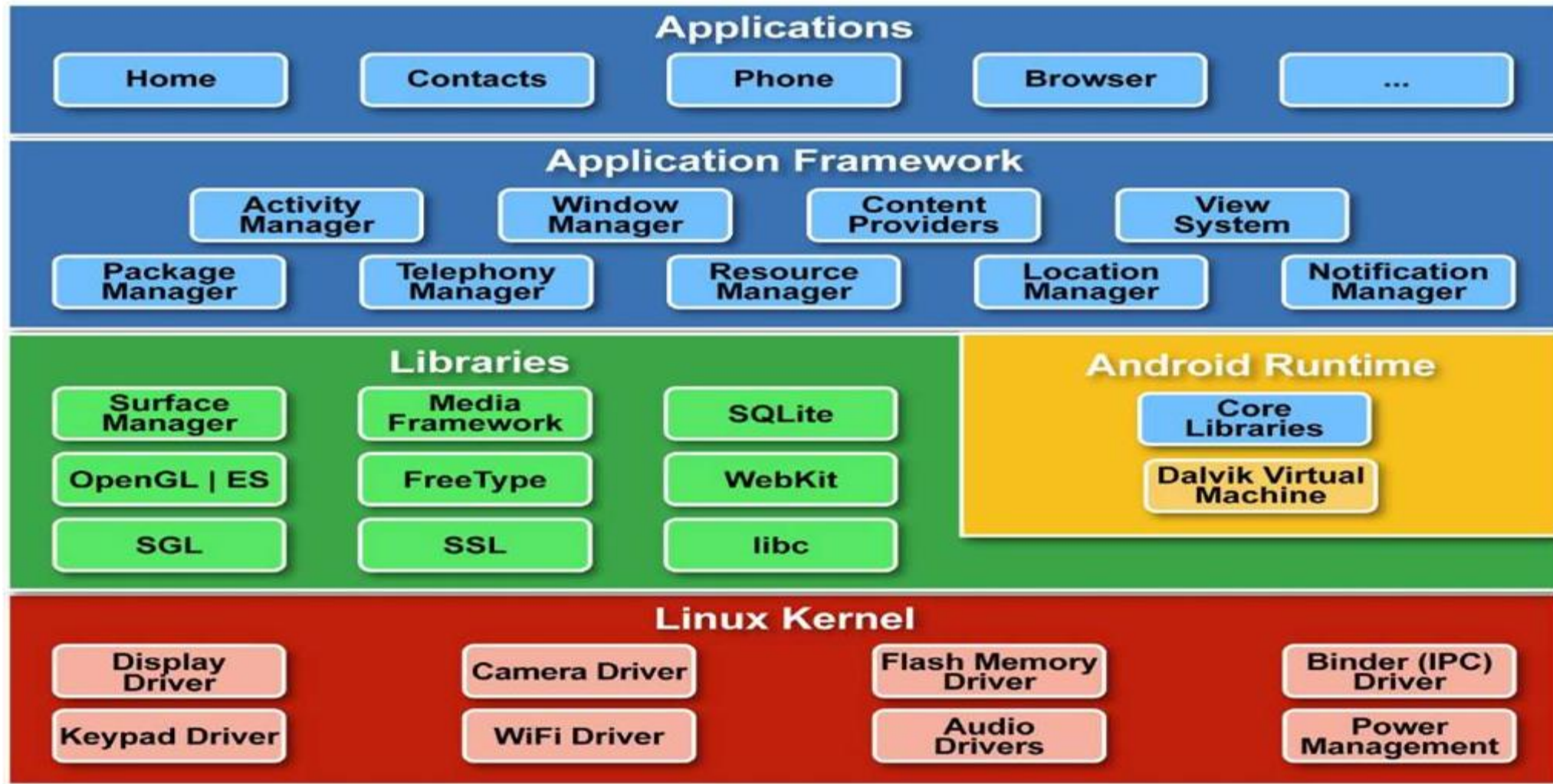▪ Publish apps through Google Play store:

  –Official app store for Android
  –Digital distribution service operated by Google

Android Layered Architecture

1. System and user apps
2. Android OS API in Java framework
3. Expose native APIs; run apps
4. Expose device hardware capabilities
5. Linux Kernel

Android Software Stack

History

- **Andy Rubin** founded Android Incorporation in Palo Alto, California in October, 2003.

- Google acquired Android on 17th August, 2005.
  - Since then it is a subsidiary of google Incorporation.

- Google formed Open Handset Alliance(OHA) on 5th November, 2007

Android Versions

- Android named its version after the sweets (dessert-inspired names)

Android Oreo	Oatmeal Cookie	8.0	26	August 21, 2017	January 2021	24.16.16 (May 2024)	
		8.1	27	December 5, 2017	October 2021		
Android Pie	Pistachio Ice Cream[22]	9	28	August 6, 2018	January 2022		
Android 10	Quince Tart[23]	10	29	September 3, 2019	February 2023		
Android 11	Red Velvet Cake[23]	11	30	September 8, 2020	February 2024		
Android 12	Snow Cone	12	31	October 4, 2021	May 2024		
Android 12L	Snow Cone v2	12.1[a]	32	March 7, 2022			
Android 13	Tiramisu	13	33	August 15, 2022			
Android 14	Upside Down Cake[26]	**14**	34	October 4, 2023			
Android 15	Vanilla Ice Cream[27]	15 Beta 4[28]	35	July 18, 2024[28]	July 2024[28]	24.23.35 (July 2024)[28]	

Legend: ▇ Old version ▇ Older version, still maintained ▇ **Latest version** ▇ Latest preview version

What is an Android App?

1. One or more interactive screens

2. Written using **Java/Kotlin Programming Language** and **XML**

3. Uses the Android **Software Development Kit** (SDK)

4. Uses Android libraries and Android Application Framework

5. Executed by Android Runtime Virtual machine (ART)
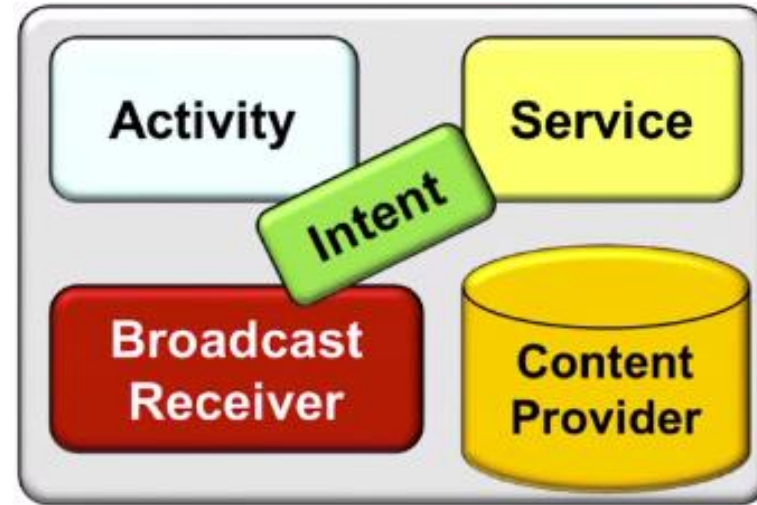
App Development Challenges

- Multiple screen sizes and resolutions

- Performance: make your apps responsive and smooth

- Security: keep source code and user data safe

- Compatibility: run well on older platform versions

- Marketing: understand the market and your users

   (Hint: It doesn't have to be expensive, but it can be.)

App Building Blocks

▪ The **four fundamental building blocks** of Android apps are:

1. **Resources:**
   - layouts, images, strings, colors as XML and media files.

2. **Components:**
   - activities, services, contend provider, Broadcast Receiver, and helper classes as Java code.

3. **Manifest:**
   - information about app for the runtime.

4. **Build configuration:**
   - APK versions in Gradle config files.

Key App Components in Android

- **Activity** is a single screen with a user interface

- **Service** performs long-running tasks in background

- **Content provider** manages shared set of data

- **Broadcast receiver** responds to system-wide announcements

- **Intent** is one of a key components to glue other components.

- Intents are message that describe an action to perform or an event that has occurred.

Component Types

- Think of Android as a "Hotel"
  - App(guest), Android System(hotel manager),
  - Services at request (intents)
    - foreground (activity)- registration
    - background (services) – laundry
  - Calls you when a package has arrived (**broadcast receiver**)
  - Access the city's tour companies (**content provider**)

Android App Development Tools

- Android SDK Bundle
  - Android Platform
  - Android Studio IDE
  - Key development tools
  - System image for Emulator (AVD)

Prerequisite

- Supported operating systems (Windows, Mac OS, Linux)
- Android Studio IDE
- Android Emulator (AVD)
- Hardware Requirement:
  - \>=4GB RAM,
  - \>1GB +SDK, Emulator system images, and
  - \>400 MB Hard drive.

See http://developer.android.com

Testing App

- ▪ Actual mobile device
  - ❖ Phone should have **developer options**
  - ❖ Settings -> About Phone -> Build (Tab 7 times to enable developer options)
  - ❖ Developer options ->Install via USB

- ▪ Emulator
  - ❖ System image/Android Virtual Device (AVD)
  - ❖ Mimicking the actual device

Emulator (AVD)

- Pros
  - ❖ Doesn't require actual phone
  - ❖ Hardware is reconfigurable
  - ❖ Changes are non-destructive

- Cons
  - ❖ Can be very slow
  - ❖ Some features are unavailable (No support of Bluetoot or USB)
  - ❖ Performance/User experience can be misleading

Android SDK Bundle Installation

- **DEMOSTRATION**

Home Work / Lab Work

- Do the following tasks:
  1. Install Android Studio
  2. Try to create simple App (Calculator)
  3. Install Emulator (Choose Android API wisely)

Thank you!