

## Lab 1 – Introduction to Android & Hello World Example

2022/9/12

Name	Internal codename	Version number(s)	API level	Initial stable release date
Android 1.0	_	1.0	1	September 23, 2008
Android 1.1	Petit Four	1.1	2	February 9, 2009
Android Cupcake	Cupcake	1.5	3	April 27, 2009
Android Donut	Donut	1.6	4	September 15, 2009
Android Eclair	Eclair	2.0 - 2.1	5 – 7	October 27, 2009
Android Froyo	Froyo	2.2 – 2.2.3	8	May 20, 2010
Android Gingerbread	Gingerbread	2.3 – 2.3.7	9 – 10	December 6, 2010
Android Honeycomb	Honeycomb	3.0 - 3.2.6	11 - 13	February 22, 2011
Android Ice Cream Sandwich	Ice Cream Sandwich	4.0 - 4.0.4	14 – 15	October 18, 2011
Android Jelly Bean	Jelly Bean	4.1 - 4.1.2	16	July 9, 2012
Android KitKat	Key Lime Pie	4.4 – 4.4W.2	19 – 20	October 31, 2013
Android Lollipop	Lemon Meringue Pie	5.0 - 5.1.1	21 – 22	November 4, 2014
Android Marshmallow	Macadamia Nut Cookie	6.0-6.0.1	23	October 2, 2015
Android Nougat	New York Cheesecake	7.0 - 7.1.2	24 – 25	August 22, 2016
Android Oreo	Oatmeal Cookie	8.0-8.1	26 – 27	August 21, 2017
Android Pie	Pistachio Ice Cream	9	28	August 6, 2018
Android 10	Quince Tart	10	29	September 3, 2019
Android 11	Red Velvet Cake	11	30	September 8, 2020
Android 12 – Android 12L	Snow Cone – Snow Cone v2	12 – 12.1	31 - 32	October 4, 2021
Android 13	Tiramisu	13	33	August 15, 2022

Android versions history

#### References: https://en.wikipedia.org/wiki/Android\_version\_history



## Platform Architecture

- Linux Kernel
- Hardware Abstraction Layer (HAL)
- Android Runtime (ART)
- Native C/C++ Libraries
- Java API Framework
  - View System
  - ✤ Resource Manager
  - Notification Manager
  - Activity Manager
  - Content Providers

#### References: https://developer.android.com/guide/platform

## New Android Language: Kotlin



## **Application Fundamentals**

- The Android operating system is a multi-user Linux system
- By default, the system assigns each app a unique Linux user ID
- Each process has its own virtual machine (VM)
- Every app runs in its own Linux process

## APP Components

Activities	Handle UI and interact with user Ex: A photo app calls an email app to share photos
Services	Run background process Ex: Music playback
Broadcast Receivers	Receive system events Ex: Alarm, battery low,
Content Providers	Manage APP data Ex: SQLite database

### Recommended app architecture



References: https://developer.android.com/topic/architecture

## Activities

- Activity enables one app to invoke another app
- One screen, one activity
- Use **Intent** to communicate

### Services

- Running in background
- Create a background service
- Send work requests to a service
- Report work status
- Bound services

## **Broadcast Receivers**

- Send or receive broadcast messages from the Android system and other Android apps
- Publish-subscribe design pattern
- Messages are wrapped in **Intent**



## Content Providers

- Sharing data with other apps
- Sending data to a widget
- Returning custom search suggestions through the search framework using <u>SearchRecentSuggestionsProvider</u>
- Synchronizing application data with your server using an implementation of <u>AbstractThreadedSyncAdapter</u>
- Loading data in your UI using a <u>CursorLoader</u>

#### References: https://developer.android.com/guide/topics/providers/content-provider-basics

## Intent and Intent Filters

- A message object used to invoke other components
- Starting an activity
- Starting a service
- Delivering a broadcast
- Explicit intents and implicit intents



References: https://developer.android.com/guide/components/intents-filters#java

## Other Components

Fragments	Represent a behavior or a portion of user interface in an Activity
Views	UI elements that are drawn onscreen including buttons, lists forms etc.
Layouts	View hierarchies that control screen format and appearance of the views
Intents	Messages wiring components together
Resources	External elements, such as strings, constants and drawable pictures
Manifest	Configuration file for the application

## Android Jetpack



Start Jetpack: https://developer.android.google.cn/jetpack/

## Install Android Studio



Android Studio provides the fastest tools for building apps on every type of Android device.



Android Studio Chipmunk | 2021.2.1 Patch 2 for Windows 64-bit (929 MiB)

Download options

**Release notes** 

Download Android Studio: https://developer.android.com/studio

## Android Studio

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Learn Android Studio	Adjust colors for red-green vision deficiency How it works Requires restart. For protanopia and deuteranopia. Keymap	
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	All settings	

- Choose the color theme you want
- Click "All settings" to check plugin version

## Check Android SDK version

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	Manager for the Android SDK and Tools used by the IDE			
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Menus and Toolbars				
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Passwords	Android API 32 (Sv2)	32	1	Not installed
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	Android 11.0 (R)	30		Not installed
Memory Settings	Android 10.0 (Q)	29		Not installed
File Colors	Android 9.0 (Pie)	28		Not installed
Scopes 🛛	Android 8.1 (Oreo)	27		Not installed
Notifications	Android 8.0 (Oreo)	20		Not installed
Quick Lists	Android 7.0 (Nougat)	23		Not installed
Path Variables	Android 6.0 (Marshmallow)	23		Not installed
Kouman	Android 5.1 (Lollipop)	22		Not installed
	Android 5.0 (Lollipop)	21		Not installed
> Editor	Android 4.4W (KitKat Wear)	20		Not installed
Plugins	Android 4.4 (KitKat)	19		Not installed
> Version Control	Android 4.3 (Jelly Bean)	18		Not installed
> Build, Execution, Deployment	Android 4.2 (Jelly Bean)	17		Not installed
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- Go to Appearance & Behavior →
   System Settings → Android SDK
- Android SDK version should be 12 (API level 31)

## Check Android SDK Build-Tools version

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Quick Lists		Google Play Instant Development SDK	19	0	Not installed
Path Variables		Google Play Licensing Library			Not installed
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		Google USB Driver	13		Not installed
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Plugins		Intel x86 Emulator Accelerator (HAXM installer)	7.6	.5	Installed
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- You can choose to click "Show Package Details to select a specific version
- Please check the box to install these SDK Tools

## Create an Android Project

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		More Actions 🗸				
*						

### • Click New Project

## Create an Android Project (Cont.)



- Choose "Empty Activity"
- Click "Next"

## Create an Android Project (Cont.)

🛋 New P	roject					
	Empty Activity					
	Creates a new en	npty activity				
	Name	Lab1				
	Package name	com.lab1.helloworld				
	Save location	C:\Users\USER\Desktop\Lab1				
	Language	Java			-	
	Minimum SDK	API 23: Android 6.0 (Marshmallow)				
		<ul> <li>Your app will run on approximately 96.2% of devices.</li> <li>Help me choose</li> </ul>				
		Using legacy android.support libraries will prevent you from using the latest Play Services and Jetpack libraries				
			Previous	Cancel	Fin	nish

- Remember the "Save location" you set
- Language choose "Java"
- Click "Finish"

## Project Files

- app > java > com.lab1.helloworld > MainActivity
- app > res > layout > activity\_main.xml
- app > manifests > AndroidManifest.xml
- Gradle Scripts > build.gradle

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• minSdk (lowest possible) <= targetSdk == compileSdk (latest SDK) <= build-Tools Version (latest Build-Tools)

## Dependencies

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## Run Your App

- On real device (Your phone)
  - Enable USB debugging
  - Settings  $\rightarrow$  System  $\rightarrow$  About Phone  $\rightarrow$  Build number (CLICK 7 TIMES)
  - Developer options -> USB Debugging (Allow)
  - 🔹 Click Run 👂



References: https://developer.android.com/studio/run/device

## Create Android Virtual Device

### Click Device Manager

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## Create Android Virtual Device (Cont.)

- Click "Create Device"
- Select a device  $\rightarrow$  Next



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Tablet	Pixel 4a		5.8"	1080x23	440dpi		5.7" 2280px		
Automotive	Pixel 4 XL			1440x30	560dpi				
	Pixel 4	⊳							
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New Hardware	Profile Import Hard	lware Profiles			C				Clone Device
?								Next	

## Download System Image



### Click Download

# Today's Assignment

## Simple Text Sending APP

- Create a layout that includes a text box and a button
- Sending the content of the text box to another activity



https://developer.android.com/training/basics/firstapp/building-ui

## Hierarchy of Layouts



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## Change UI Strings

- app > res > values > strings.xml
- strings.xml -> <u>Open Editor</u>
- Add Key 🛨
- Add two string pairs (key => value):
  - edit\_message => "Enter a message"
  - button\_send => "Send"



🗜 Version Control 🛛 🗮 TODO 🛛 🖲 Problems 🗖 Terminal 📰 Logcat 🜈 Profiler 🔮 App Inspection

- Drag & drop "PlainText" & "Button"
- Select both PlainText & Button
- Right click -> Chain > Create Horizontal Chain

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## Set Button & PlainText Margin

- Select the button and open the **Attributes** window
- Set right and Top margin to 16
- Select PlainText and set left and Top margin to 16



## Start Another Activity

- Open MainActivity.java and add "sendMessage()"
- Auto fix error (Alt + Enter)
- Ex: "Import classs"

public void sendMessage(View\_view)

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

/\*\* Called when the user taps the Send button \*/
public void sendMessage(View view) {
 // Do something in response to button

```
activity_mainxml ×  stringsxml ×  Translations Editor ×  MainActivityjava ×
package com.lab1.helloworld;
import androidx.appcompat.app.AppCompatActivity;
import android.os.Bundle;
public class MainActivity extends AppCompatActivity {
    public static final String EXTRA_MESSAGE = "com.lab1.helloworld.MESSAGE";
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
    }
    /*** Called when the user taps the Send button */
    public void sendMessage(View view) {
        Intent intent = new In
        Cannot resolve symbol 'View' :
        EditText editText = (E
        String message = editT Import class Alt+Shift+Enter More actions... Alt+Enter
        intent.putExtra(EXTRA_MESSAGE, message);
        startActivity(intent);
    }
}
```

## Assign sendMessage() to Button onClick



## Build an Intent

```
public class MainActivity extends AppCompatActivity {
  // EXTRA_MESSAGE is just a Key, and you can pick any string (ex: "ABC")
  public static final String EXTRA_MESSAGE = "com.lab1.helloworld.MESSAGE";
  @Override
  protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main);
  /** Called when the user taps the Send button */
  public void sendMessage(View view) {
     Intent intent = new Intent(this, DisplayMessageActivity.class);
```

// R.id.editTextTextPersonName is set in activity\_main.xml > PlainText > attributes > id EditText editText = findViewById(R.id.editTextTextPersonName); String message = editText.getText().toString(); intent.putExtra(EXTRA\_MESSAGE, message); startActivity(intent);

## Explain code in SendMessage()

- The Intent constructor takes two parameters:
  - A Context as its first parameter (this is used because the Activity class is a subclass of Context)
  - The Class of the app component to which the system should deliver the Intent
- The putExtra() method adds the EditText's value to the intent. An Intent can carry data types as key-value pairs called extras.
- Your key is a public constant EXTRA\_MESSAGE because the next activity uses the key to retrieve the text value
- Define keys for intent extras using your app's package name as a prefix to make unique keys
- The startActivity() method starts an instance of the DisplayMessageActivity specified by the Intent

## Create DisplayMessageActivity

- In the Project window, right-click the app folder and select New > Activity > Empty Activity.
- In the Configure Activity window, enter "DisplayMessageActivity" for Activity Name and click Finish (leave all other properties set to the defaults).

ndroid Activity	
Empty Activity	
Creates a new empty activity	
Activity Name	
DisplayMessageActivity	
🗹 Generate a Layout File	
Layout Name	
activity_display_message	
Launcher Activity	
Package name	
com.lab1.helloworld	
Source Language	
Java	
Target Source Set	

## Add a TextView to DisplayMessageActivity

- Open the file app > res > layout > activity\_display\_message.xml
- In the Palette window, click Text and then drag a TextView into the layout
- Create one more constraint from the top of the text view to the top of the layout, so it appears as shown in figure below



## Display the Message

Add the following code in "DisplayMessageActivity.java"

@Override
protected void onCreate(Bundle savedInstanceState) {
 super.onCreate(savedInstanceState);
 setContentView(R.layout.activity\_display\_message);
 // Get the Intent that started this activity and extract the string
 Intent intent = getIntent();
 String message = intent.getStringExtra(MainActivity.EXTRA\_MESSAGE);
 // Capture the layout's TextView and set the string as its text
 TextView textView = findViewById(R.id.textView);
 textView.setText(message);

## Add Navigation

- Open the file at app > manifests > AndroidManifest.xml
- Locate the <activity> tag for DisplayMessageActivity, and replace it with the following

<activity android:name=".DisplayMessageActivity" android:parentActivityName=".MainActivity"> </activity>

## Final Result

- Click Run
- Send "Hello World!" message in your APP!
- Show your result to TA

