Lecture 01: Touch & Input
IN721: Design and Development of Applications for Mobile Devices
Semester One, 2020

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Te Kura Matatini ki Otago, Ōtepoti, Aotearoa

Administration

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Lecture 01: Touch & Input Topics

- Brief History
- Linux Kernel
- Software Stack
- Open-Source Community
- QEMU
- Kotlin
- Android Studio
- ArrayAdapters
- Inner class

Brief History

- Founded in Palo Alto, California in October 2003
- Early intentions were to develop an advanced operating system for digital cameras
- Google acquired Android Inc in July 2005
- Developed by a group of developers known as the Open Handset Alliance (OHA)
- De facto software for numerous smartphone manufacturing companies

Brief History

- Mascot of Android is a green robot
- Designed by Irina Blok on November 5, 2007 when Android was announced
- No official name, though the Android team at Google call it **Bugdroid**
- One of most recognisable icons in the technology world

Linux Kernel

- Based on the Linux kernel's LTS branches
- Android targets versions 4.14, 4.4 & 4.9 of the Linux kernel
- A Linux distribution according to the Linux Foundation

Software Stack

- Application
- Application framework
- Libraries
- Android runtime
- Hardware abstraction layer
- Linux kernel

Open-Source Community

- Android's source code is released by Google under an open-source license

Market Share

- Android - 74.3%
- iOS - 24.76%
- Reference - StatCounter (Mobile OS Market Share)

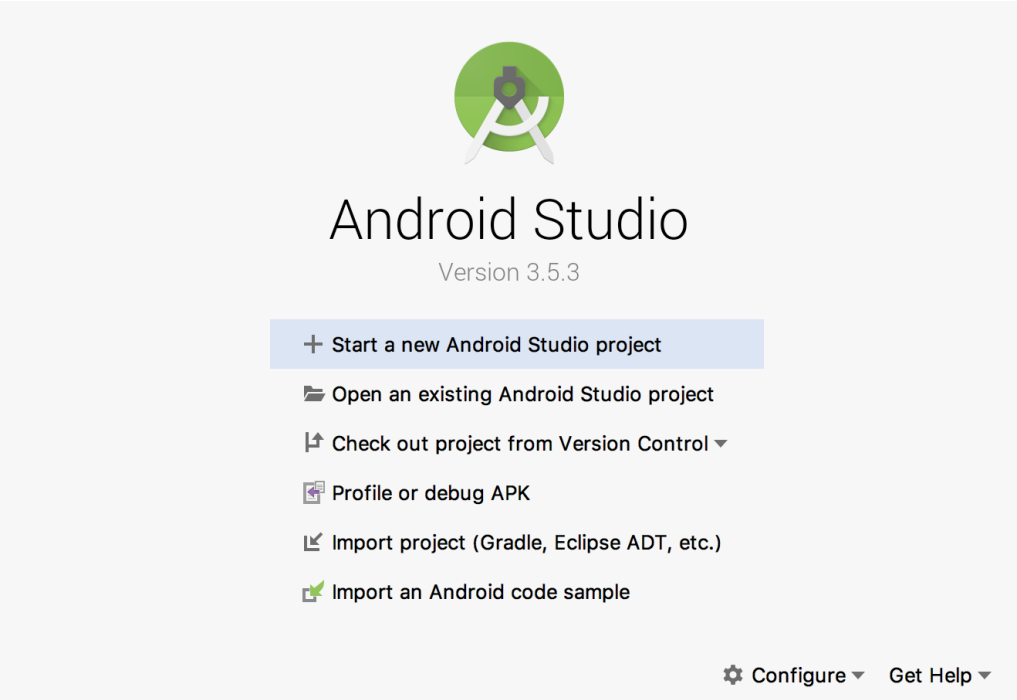
QEMU

- Quick EMUlator
- Open-source competitor to VMware Workstation, VirtualBox, HyperV
- Android emulator is built on top of the QEMU emulator

Kotlin

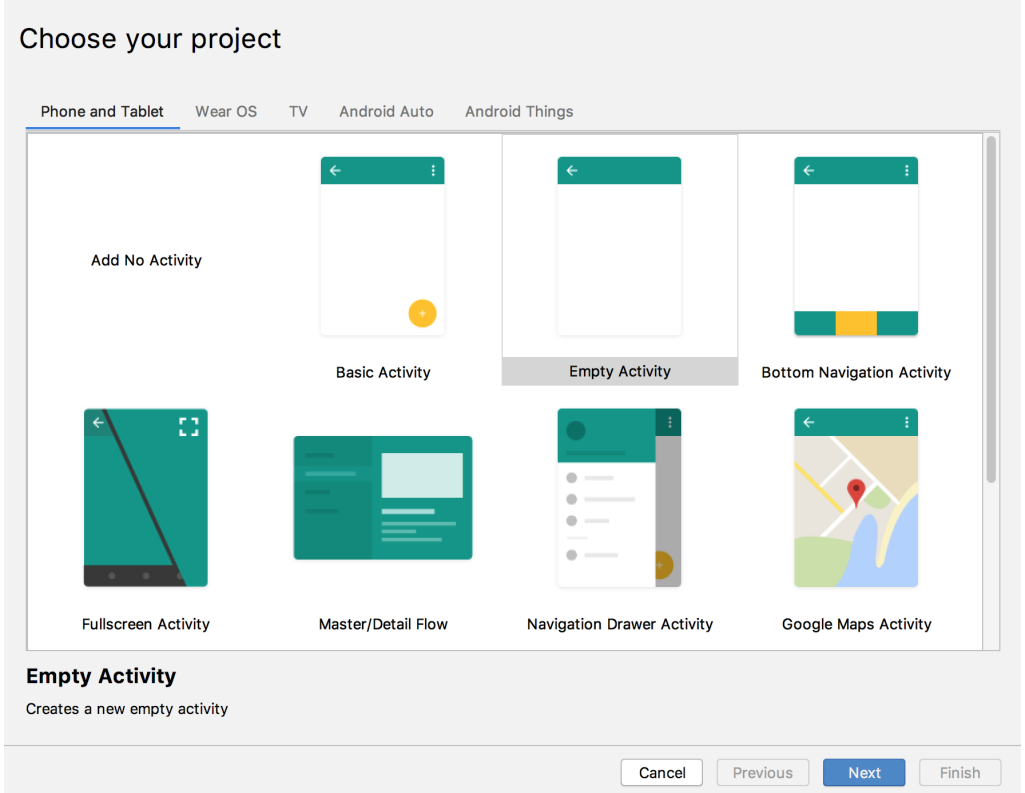
- Cross-platform
- Statically typed
- Type inference
- Interoperable with Java
- Preferred programming language for Android application developers
- One of my favourite programming languages

Android Studio: Application Setup



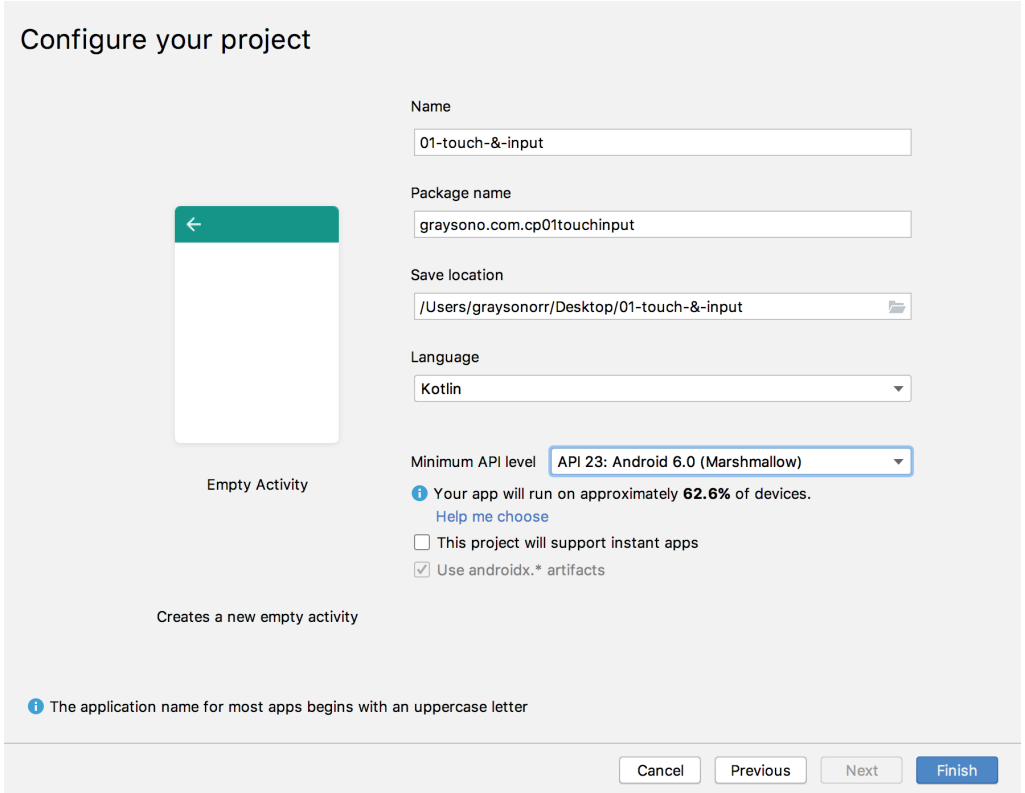
Android Studio: Application Setup

- Choosing a project
  - Basic activity
  - Empty activity
  - Bottom navigation activity



Android Studio: Application Setup

- Configuring a project
  - Name
  - Package name
  - Save location
  - Language
  - Minimum API level



Android Studio: Application Setup

- Android platform version
- Cumulative distribution

ANDROID PLATFORM VERSION	API LEVEL	CUMULATIVE DISTRIBUTION
4.0 Ice Cream Sandwich	15	
4.1 Jelly Bean	16	99.6%
4.2 Jelly Bean	17	98.1%
4.3 Jelly Bean	18	95.9%
4.4 KitKat	19	95.3%
5.0 Lollipop	21	85.0%
5.1 Lollipop	22	80.2%
6.0 Marshmallow	23	62.6%
7.0 Nougat	24	37.1%
7.1 Nougat	25	14.2%
8.0 Oreo	26	6.0%
8.1 Oreo	27	1.1%

Marshmallow

Security

Fingerprint Authentication
Confirm Credential

System

App Linking
Adoptable Storage Devices

Multimedia

4K Display Mode
Support for MIDI
Create digital audio capture and playback objects
APIs to associate audio and input devices
List of all audio devices
Updated video processing APIs
Flashlight API
Reprocessing Camera2 API
Updated ImageWriter objects and Image Reader class

User Input

Voice Interactions
Assist API
Bluetooth Stylus Support

User Interface

Themeable ColorStateLists

Wireless & Connectivity

Hotspot 2.0
Improved Bluetooth Low Energy Scanning

Android for Work

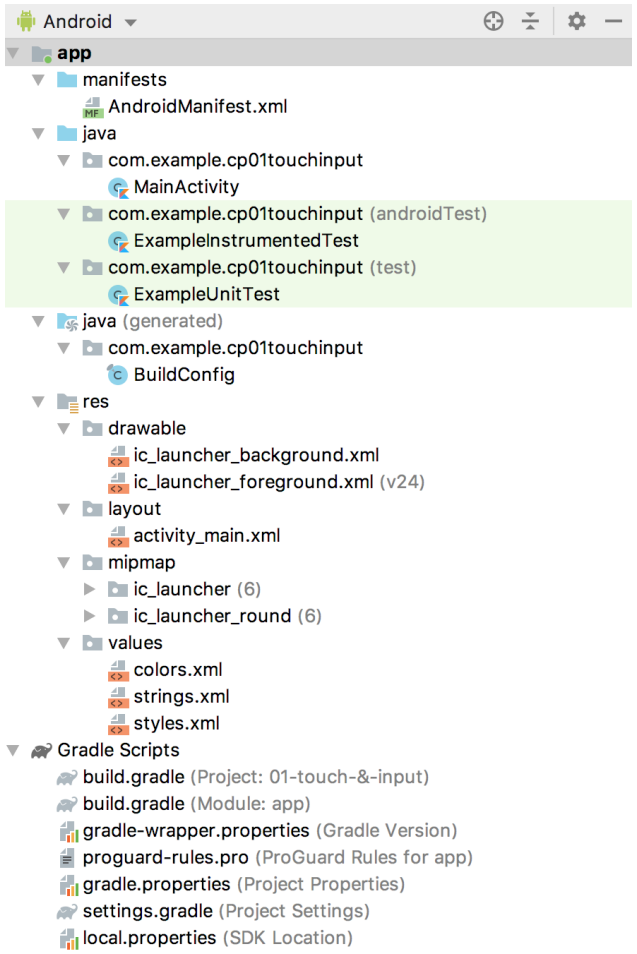
Controls for Corporate-Owned, Single-Use devices
Silent install and uninstall of apps by Device Owner
Silent enterprise certificate access
Auto-acceptance of system updates
Delegated certificate installation
Data usage tracking
Runtime permission management
Work status notification

https://developer.android.com/about/versions/marshmallow/android-6.0.html

Cancel OK

Android Studio: Application Setup

- Directory structure



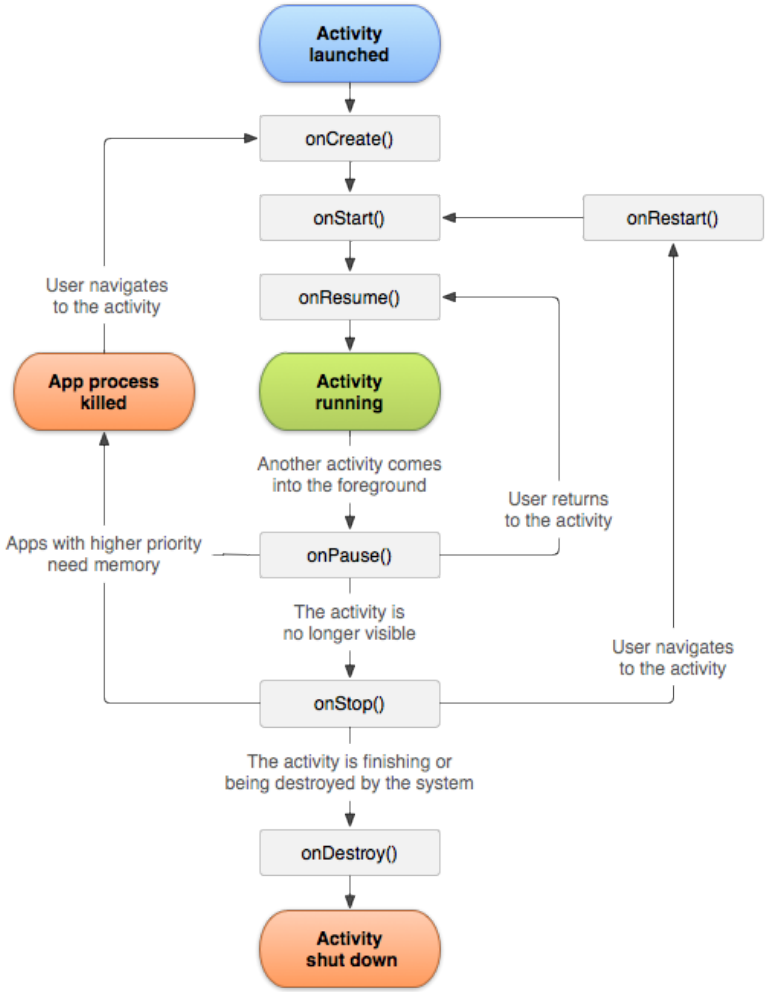
Android Studio: MainActivity.kt

- AppCompatActivity
- Activity lifecycle - onCreate()

MainActivity.kt

```kotlin
package com.example.cp01touchinput

import androidx.appcompat.app.AppCompatActivity
import android.os.Bundle

class MainActivity : AppCompatActivity() {

    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        setContentView(R.layout.activity_main)
    }
}
```

Android Studio: Activity Lifecycle



Inner Class

- Interface - OnClickListener
- android.view.View.OnClickListener
- A callback to be invoked when a view is clicked
- Public methods - onClick(v: View!): Unit

MainActivity.kt

```kotlin
package com.example.cp01touchinput

import androidx.appcompat.app.AppCompatActivity
import android.os.Bundle
import android.view.View
import android.widget.Toast
import kotlinx.android.synthetic.main.activity_main.*

class MainActivity : AppCompatActivity() {

    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        setContentView(R.layout.activity_main)
        btnClick.setOnClickListener(ButtonOnClickListener())
    }

    inner class ButtonOnClickListener : View.OnClickListener {
        override fun onClick(view: View?) {
            Toast.makeText( context: this@MainActivity,  text: "Click Me", Toast.LENGTH_LONG).show()
        }
    }
}
```

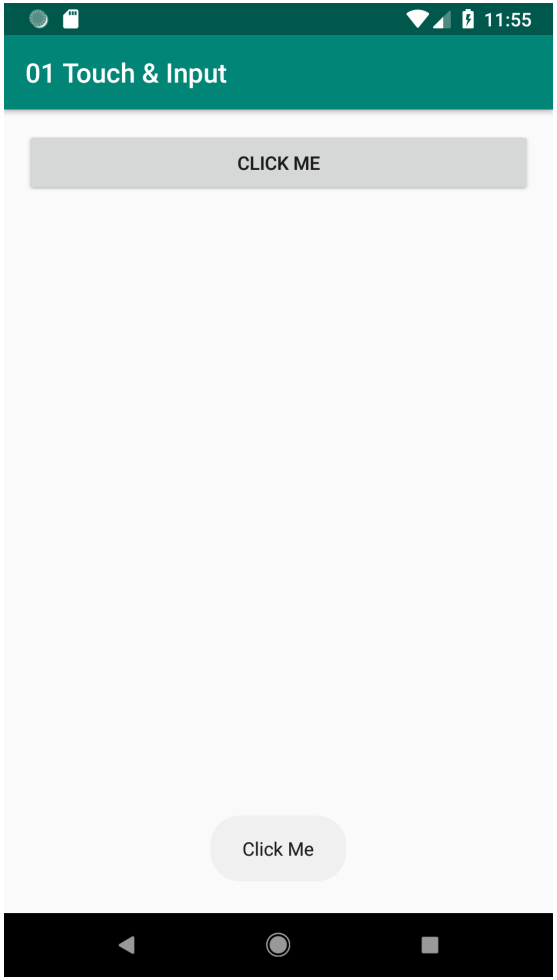
Alternative To Inner Class

- Simplified

MainActivity.kt

```
1   package com.example.cp01touchinput
2
3   import androidx.appcompat.app.AppCompatActivity
4   import android.os.Bundle
5   import android.view.View
6   import android.widget.Toast
7   import kotlinx.android.synthetic.main.activity_main.*
8
9   class MainActivity : AppCompatActivity() {
10
11      override fun onCreate(savedInstanceState: Bundle?) {
12          super.onCreate(savedInstanceState)
13          setContentView(R.layout.activity_main)
14          btnClick.setOnClickListener(View.OnClickListener { it: View!
15              Toast.makeText( context: this@MainActivity,  text: "Click Me", Toast.LENGTH_LONG).show()
16          })
17      }
18  }
```

Emulator - OnClickListener



ArrayAdapter

- arrayOf - Kotlin

MainActivity.kt

```kotlin
package com.example.cp01touchinput

import androidx.appcompat.app.AppCompatActivity
import android.os.Bundle
import android.widget.ArrayAdapter
import android.widget.Spinner
import kotlinx.android.synthetic.main.activity_main.*

class MainActivity : AppCompatActivity() {

    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        setContentView(R.layout.activity_main)
        val daysOfWeek = arrayOf("Mon", "Tue", "Wed", "Thu", "Fri", "Sat", "Sun")
        populateSpinner(spnDaysOfWeek, daysOfWeek)
    }

    private fun populateSpinner(spinner: Spinner, array: Array<String>) {
        val layoutID: Int = android.R.layout.simple_spinner_item
        spinner.adapter = ArrayAdapter( context: this@MainActivity, layoutID, array)
    }
}
```

Alternative To ArrayOf

- arrays.xml
- values > New > Values resource file

arrays.xml

```xml
<?xml version="1.0" encoding="utf-8"?>
<resources>
    <string-array name="days_of_week">
        <item>Mon</item>
        <item>Tue</item>
        <item>Wed</item>
        <item>Thu</item>
        <item>Fri</item>
        <item>Sat</item>
        <item>Sun</item>
    </string-array>
</resources>
```

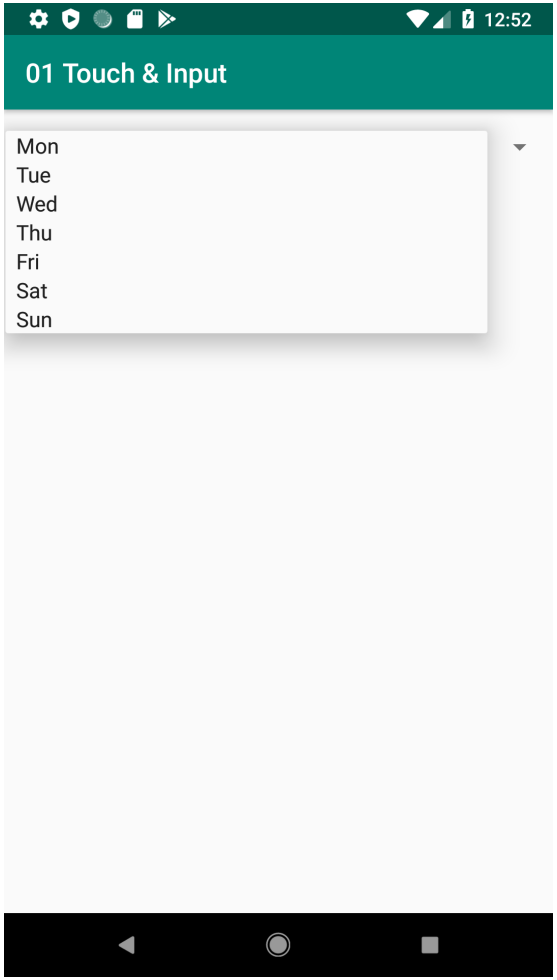
Alternative To ArrayOf

- resources.getStringArray(id: Int)

MainActivity.kt

```
1   package com.example.cp01touchinput
2
3   import androidx.appcompat.app.AppCompatActivity
4   import android.os.Bundle
5   import android.widget.ArrayAdapter
6   import android.widget.Spinner
7   import kotlinx.android.synthetic.main.activity_main.*
8
9   class MainActivity : AppCompatActivity() {
10
11      override fun onCreate(savedInstanceState: Bundle?) {
12          super.onCreate(savedInstanceState)
13          setContentView(R.layout.activity_main)
14          val daysOfWeek = resources.getStringArray(R.array.days_of_week)
15          populateSpinner(spnDaysOfWeek, daysOfWeek)
16      }
17
18      private fun populateSpinner(spinner: Spinner, array: Array<String>) {
19          val layoutID: Int = android.R.layout.simple_spinner_item
20          spinner.adapter = ArrayAdapter( context: this@MainActivity, layoutID, array)
21      }
22  }
```

Emulator - ArrayAdapter



Android Studio: AndroidManifest.xml

- Describes essential information about an application to the Android build tools, Android OS & Google Play
- Manifest file is required to declare:
  - Application's package name
  - Components of the application
  - Permissions
  - Hardware & software features

AndroidManifest.xml

```xml
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.example.cp01touchinput">

    <application
        android:allowBackup="true"
        android:icon="@mipmap/ic_launcher"
        android:label="01-touch-&-input"
        android:roundIcon="@mipmap/ic_launcher_round"
        android:supportsRtl="true"
        android:theme="@style/AppTheme">
        <activity android:name=".MainActivity">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />

                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
    </application>

</manifest>
```

Android Studio: Resources

- Android resource directories
  - Drawable
  - Layout
  - Mipmap
  - Values

Android Studio: Resources - Drawable

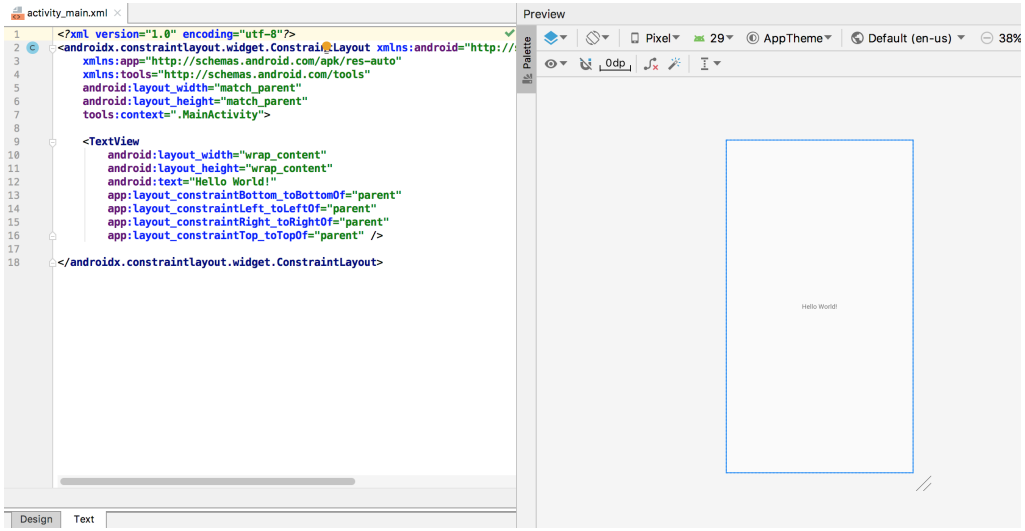
- General abstraction for something that can be drawn
- Type of resource retrieved for drawing things to the screen
- Generic API for dealing with an underlying visual resource
- Examples of drawables - bitmaps & vectors

Android Studio: Resources - Layout

- Defines the structure for a user interface in your application
- All elements in the layout are built using a hierarchy of **View** & **ViewGroup** objects
- **View** objects are called widgets
- **ViewGroup** objects are called layouts
- Two ways to declare a layout:
  - Declare user interface elements in XML - activity_main.xml
  - Instantiate layout elements at runtime

Android Studio: Resources - Layout

- Each layout file must contain exactly one root element
  - Must be a **View** or **ViewGroup** object
- Add additional layout objects or widgets as child elements



Android Studio: Resources - Mipmap

- Drawable files for different launcher icon densities
- Image Asset Studio
- Generate application icons from material icons, custom images & text strings
- Android Asset Studio - Roman Nurik

Android Studio: Resources - Values

- XML files that contain simple values such as colors, strings & styles
- Each child of the <resources> element defines a single resource
- For example, a <string> element creates an R.string resource

Android Studio: Resource Types

- Menu & font - lecture 03
- XML - lecture 08
- Mipmap - lecture 14
- Anim - lecture 26

Android Studio: Gradle

- build.gradle

app

Configure project in Project Structure dialog. Open Project Structur

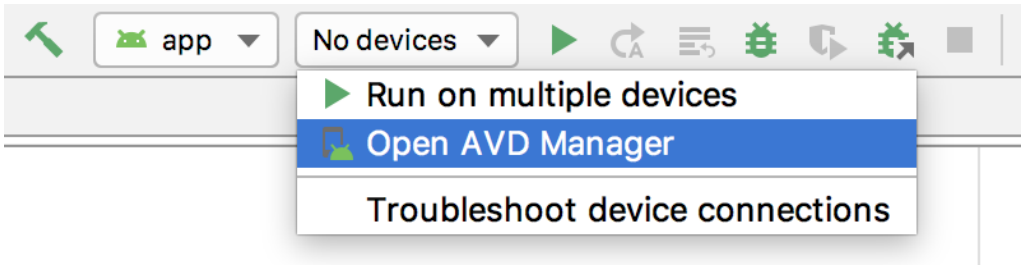
```
apply plugin: 'com.android.application'

apply plugin: 'kotlin-android'

apply plugin: 'kotlin-android-extensions'

android {
    compileSdkVersion 29
    buildToolsVersion "29.0.3"
    defaultConfig {
        applicationId "com.example.cp01touchinput"
        minSdkVersion 23
        targetSdkVersion 29
        versionCode 1
        versionName "1.0"
        testInstrumentationRunner "androidx.test.runner.AndroidJUnitRunner"
    }
    buildTypes {
        release {
            minifyEnabled false
            proguardFiles getDefaultProguardFile('proguard-android-optimize.txt'), 'proguard-rules.pro'
        }
    }
}

dependencies {
    implementation fileTree(dir: 'libs', include: ['*.jar'])
    implementation"org.jetbrains.kotlin:kotlin-stdlib-jdk7:$kotlin_version"
    implementation 'androidx.appcompat:appcompat:1.0.2'
    implementation 'androidx.core:core-ktx:1.0.2'
    implementation 'androidx.constraintlayout:constraintlayout:1.1.3'
    testImplementation 'junit:junit:4.12'
    androidTestImplementation 'androidx.test.ext:junit:1.1.0'
    androidTestImplementation 'androidx.test.espresso:espresso-core:3.1.1'
}
```

Android Studio: Emulator

- Simulates Android devices on your computer
- Test an application on a variety of devices & API levels
- Provides almost all of the capabilities of a real Android device

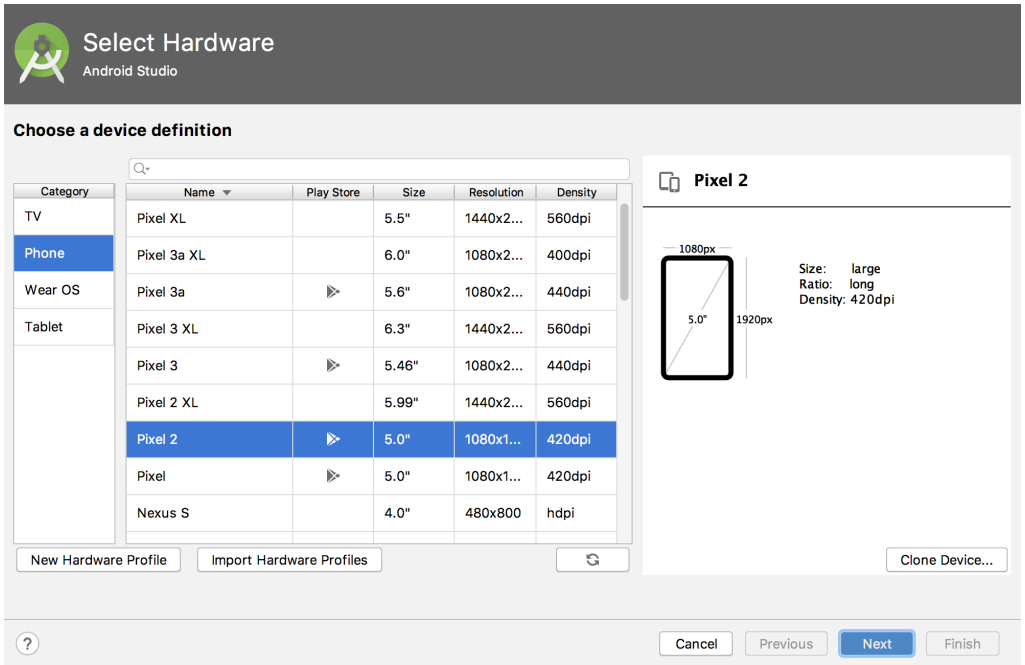
Android Studio: Emulator

- AVD Manager



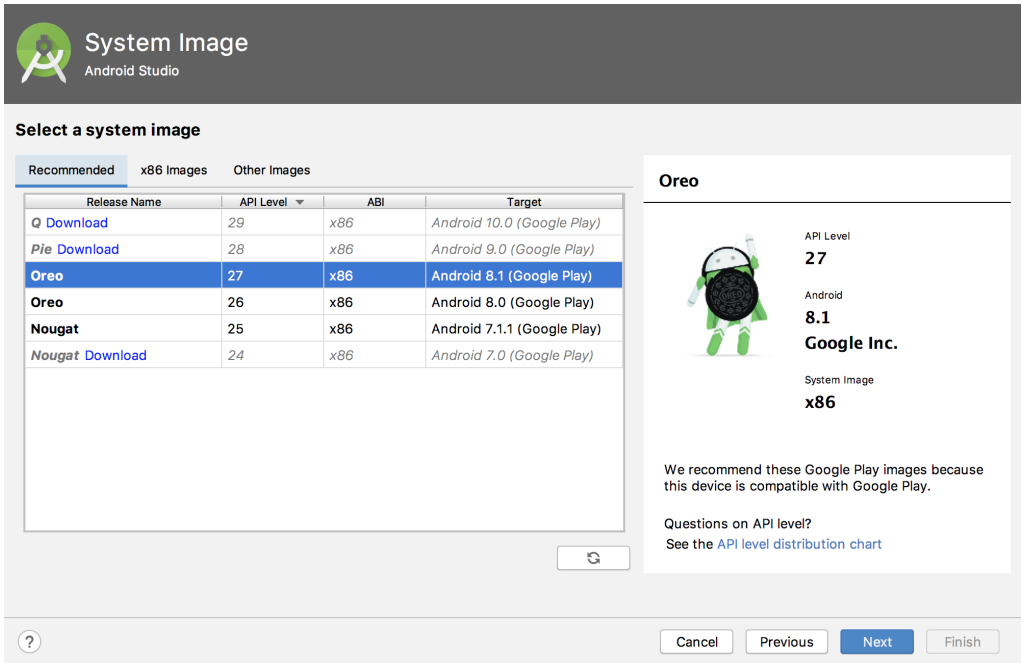
Android Studio: Emulator

- Selecting hardware
  - Category
  - Name



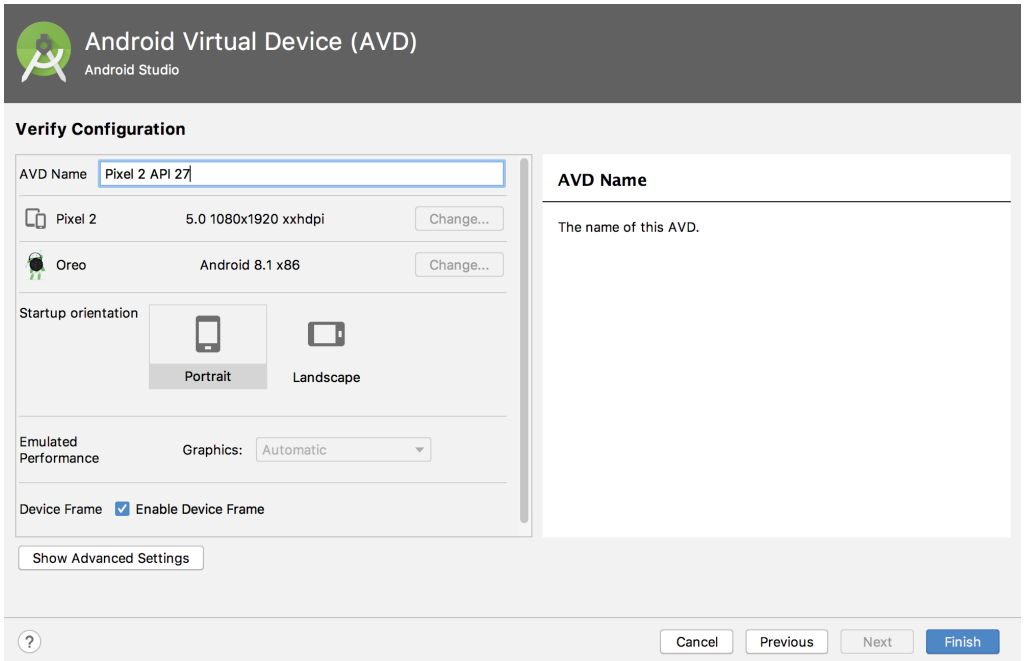
Android Studio: Emulator

- System Image
  - Release name
  - API level

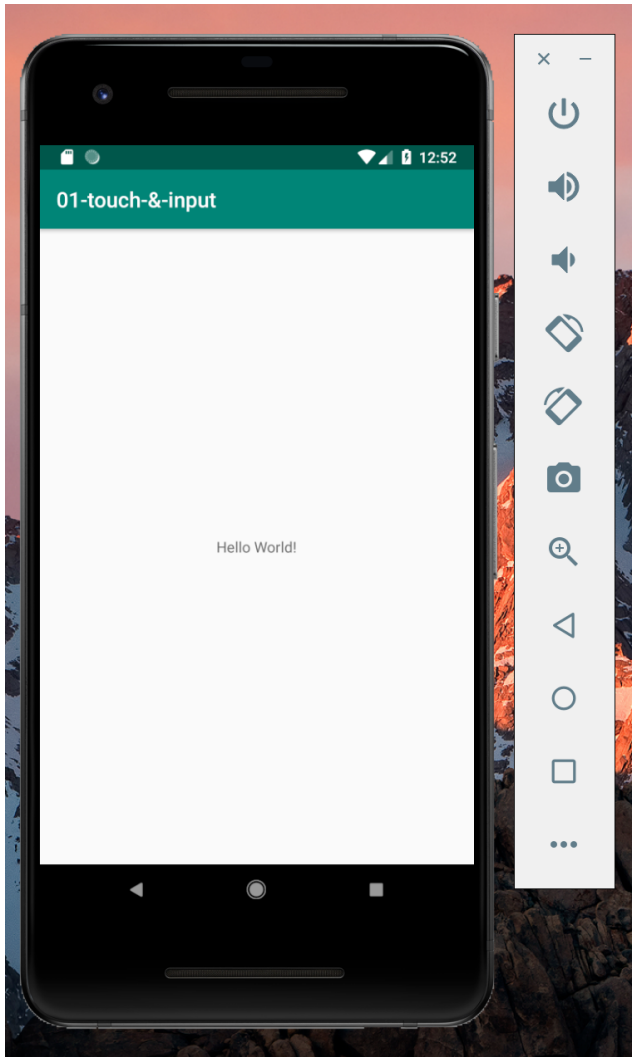


Android Studio: Emulator

- Verifying configuration
  - AVD name
  - Startup orientation



Android Studio: Emulator



Practical

- Two tasks covering today's lecture
- Worth 1% of your final mark for the Design and Development of Applications for Mobile Devices course
- Deadline: Friday, 10 April at 5pm

Assessment 1 & 2

- Two assessments worth worth 20% & 25% - one individual & one group
- Worth 45% of your final mark for the Design and Development of Applications for Mobile Devices course
- Submission via **Assignments** tab on Microsoft Teams & GitHub
- Deadline: refer to course directive

Exams

- Five individual exams worth 6% each
- Worth 30% of your final mark for the Design and Development of Applications for Mobile Devices course
- Submission via **Assignments** tab on Microsoft Teams
- Deadline: refer to course directive

GitHub Repositories

- A1: Language Translator - http://bit.ly/mobile-language-translator
- A2: Wishlist - http://bit.ly/mobile-wishlist
- Practicals - http://bit.ly/mobile-practicals
- Click here to view the **GitHub Classroom Setup** video

Learner Capability Framework

- LCF is based on national & international research
- **iamcapable** - web-based tool
  - Track the development of learner capabilities
  - Produce verified evidence of these capabilities
- Come see me for more information

Formative Assessment

- Formative assessment questions:
  - What are the fourAndroid resource directories?
  - What does the onCreate() method do in the Android activity lifecycle?
- Deadline: Friday, 21 February at 8am
- Click here to fill out the formative assessment