

SSE3052: Embedded Systems Practice

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Agenda

- Let's boot new android kernel on the “Android Emulator”
 - Create new project on android studio
 - Create new AVD (Android Virtual Device)
 - Download android kernel (*goldfish*) source code
 - Compile it
 - Run AVD by compiled new kernel image
 - Check the kernel version is updated

Environment Setup

- (Virtual) Device
- Compiler
- Kernel

Environment Setup

- (Virtual) Device
 - Download Android Studio
 - Create an AVD (Android Virtual Device)
- Compiler
- Kernel

(Virtual) Device

Install required libraries

1. Open Terminal. (Ctrl + Alt + 't')
2.

```
sudo apt-get install libc6:i386 libncurses5:i386  
libstdc++6:i386 lib32z1 libbz2-1.0:i386
```

(Virtual) Device

Download Android Studio

- Go to <https://developer.android.com/studio>.
- Download.

Android Studio downloads

| Platform | Android Studio package | Size | SHA-256 checksum |
|---------------------|---|--------|--|
| Windows (64-bit) | android-studio-ide-192.6200805-windows.exe Recommended | 749 MB | a04513b59dc8c4edfa6313eff212604fda98d2722e17bc564fd68de1bdbbbba1 |
| | android-studio-ide-192.6200805-windows.zip No .exe installer | 752 MB | 0d08b8ae547226756e20993521fbf67427db857952f263885bc62827c89dc92d |
| Windows (32-bit) | android-studio-ide-192.6200805-windows32.zip No .exe installer | 751 MB | d36a8a1b3ffaedcb41dd7c00e82f0c179fc2be695b5de5431e0ec27e315476fa |
| Mac (64-bit) | android-studio-ide-192.6200805-mac.dmg | 762 MB | 518e31af08dfb00c44550fc71a470dde5d6e3e8c3a7f4a5e0ddf91af806e9c0 |
| Linux (64-bit) | android-studio-ide-192.6200805-linux.tar.gz | 766 MB | 8dacfc396730a1ca8c005f560518277baaba37a16f256c84d45d2d67a04bc7e5 |
| Chrome OS | android-studio-ide-192.6200805-cros.deb | 647 MB | 214c463b6f672c06a770620c2b732484e657df8c96ebf621b07985d0f6c68e51 |

See the [Android Studio release notes](#).

(Virtual) Device

```
$cd ~/Downloads
```

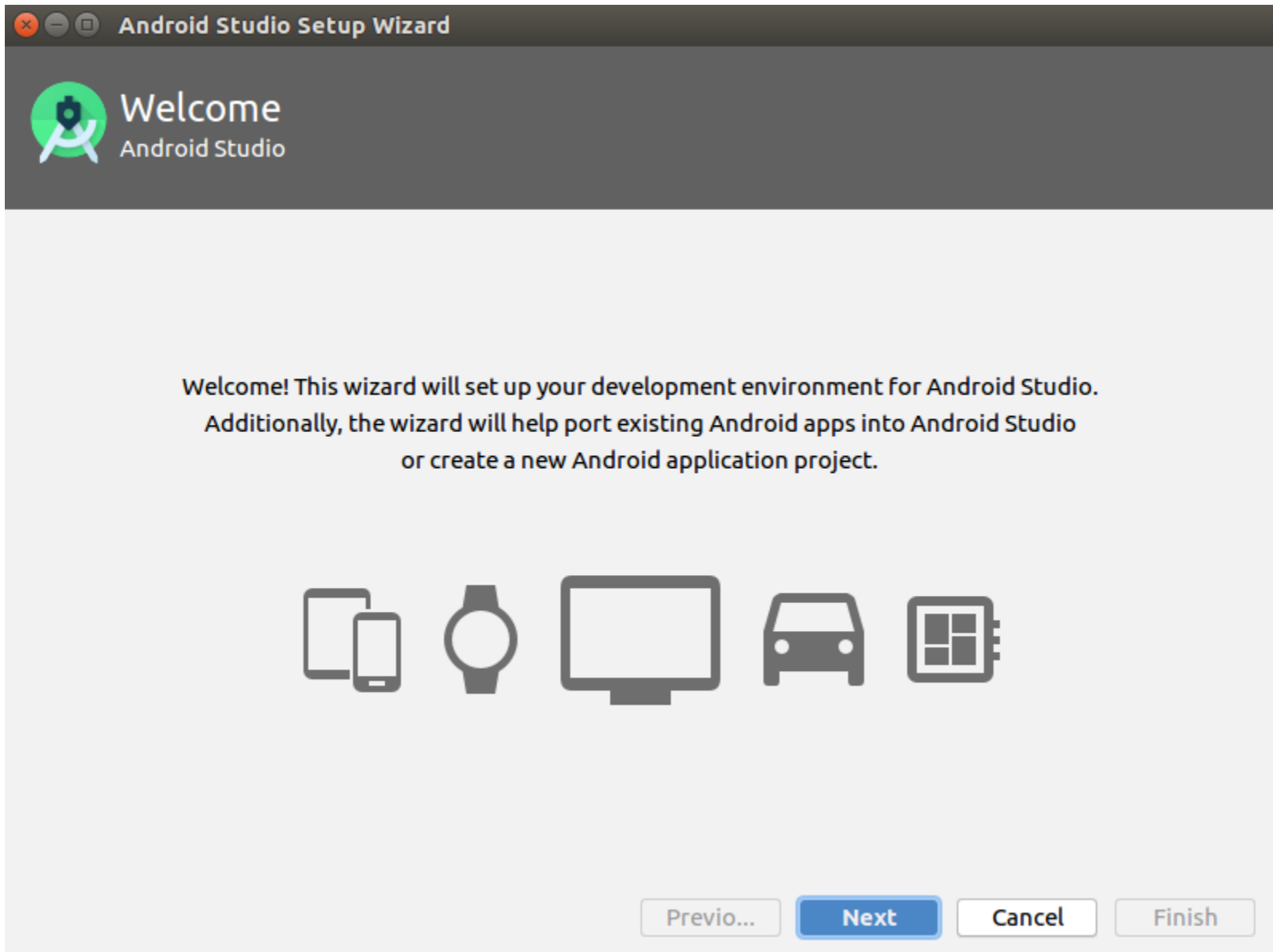
```
$mv android-studio-ide-192.6200805-linux.tar.gz [Your Workspace]
```

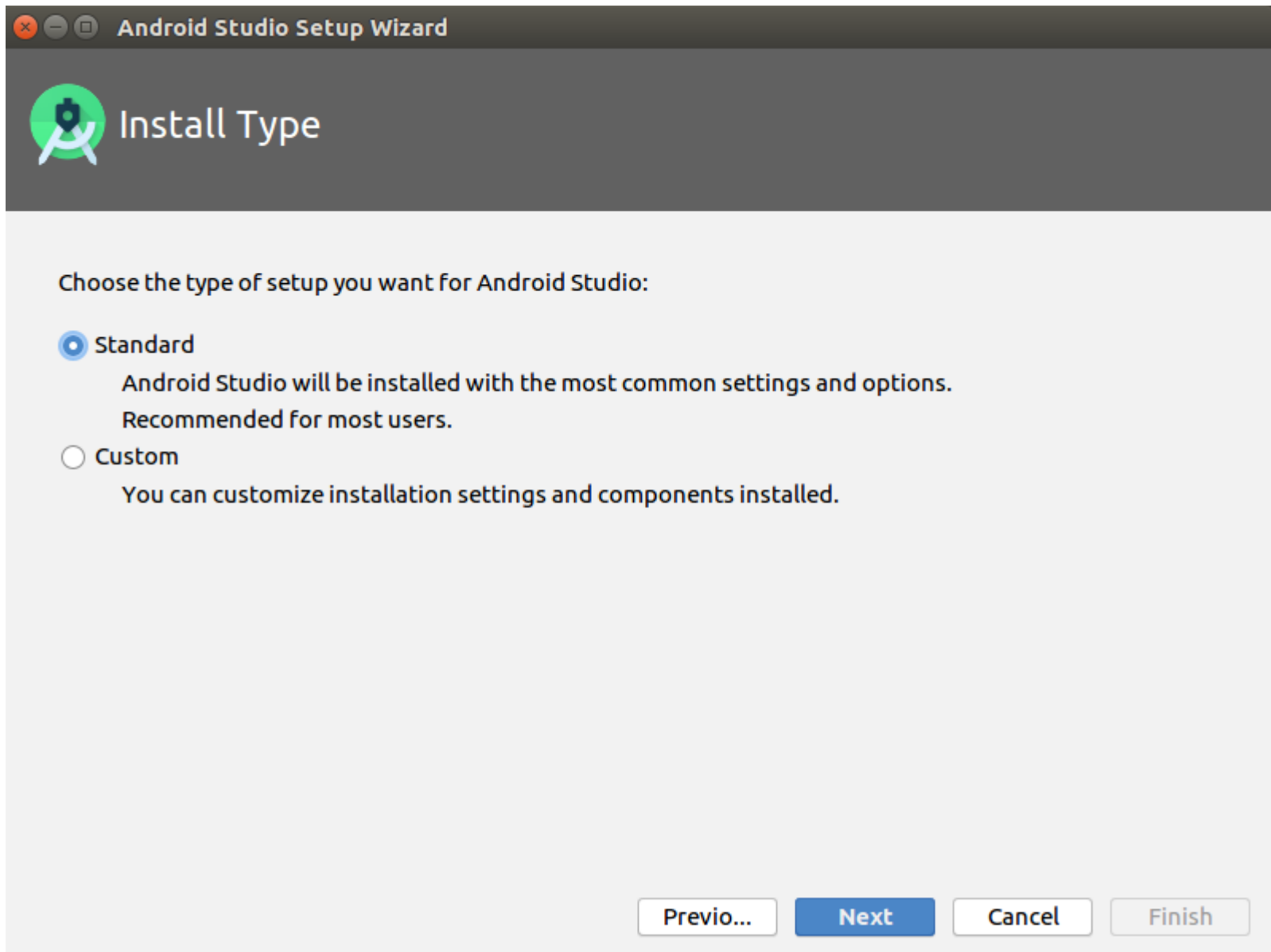
```
$cd [Your Workspace]
```

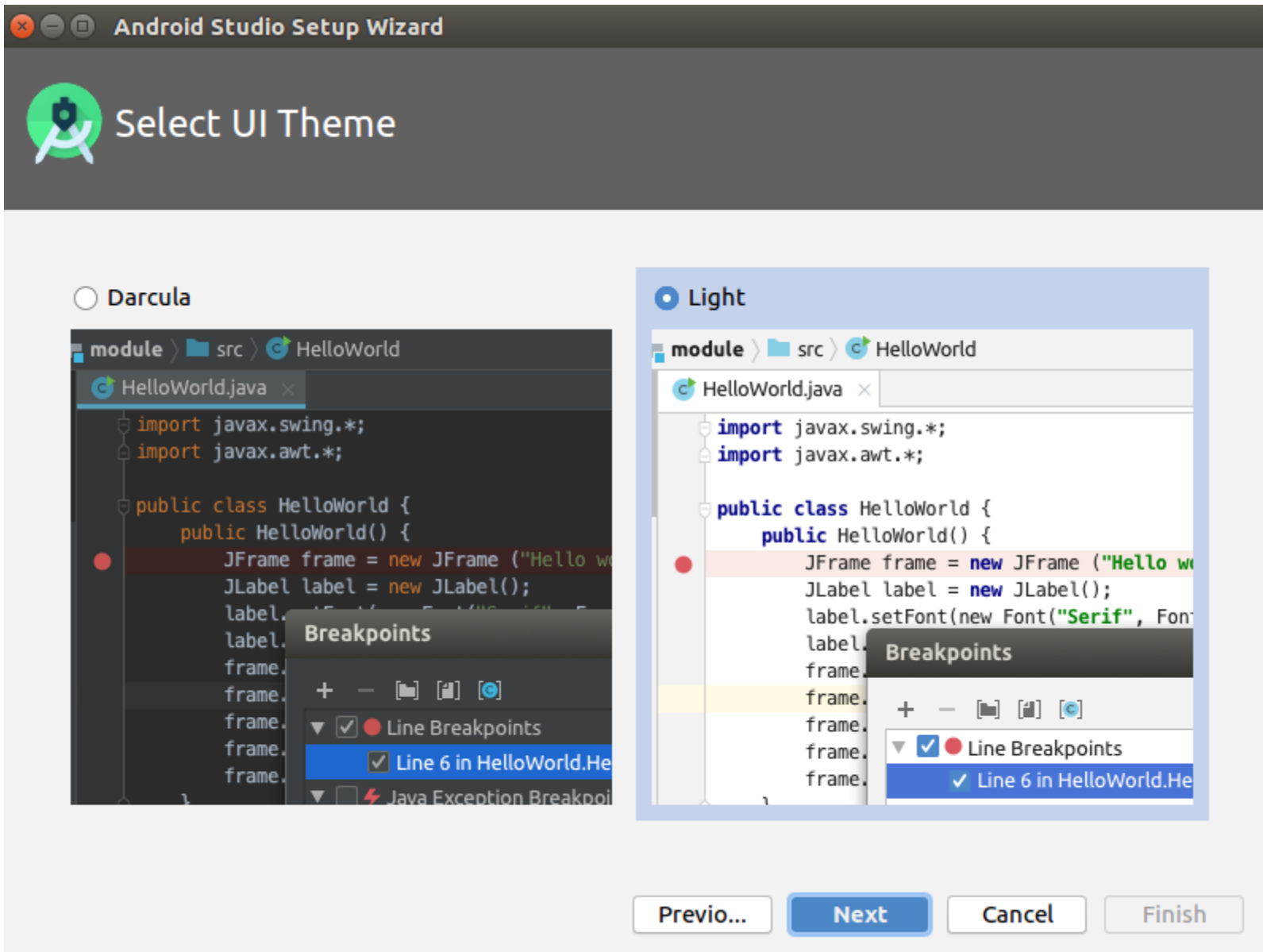
```
$tar -xf android-studio-ide-192.6200805-linux.tar.gz
```

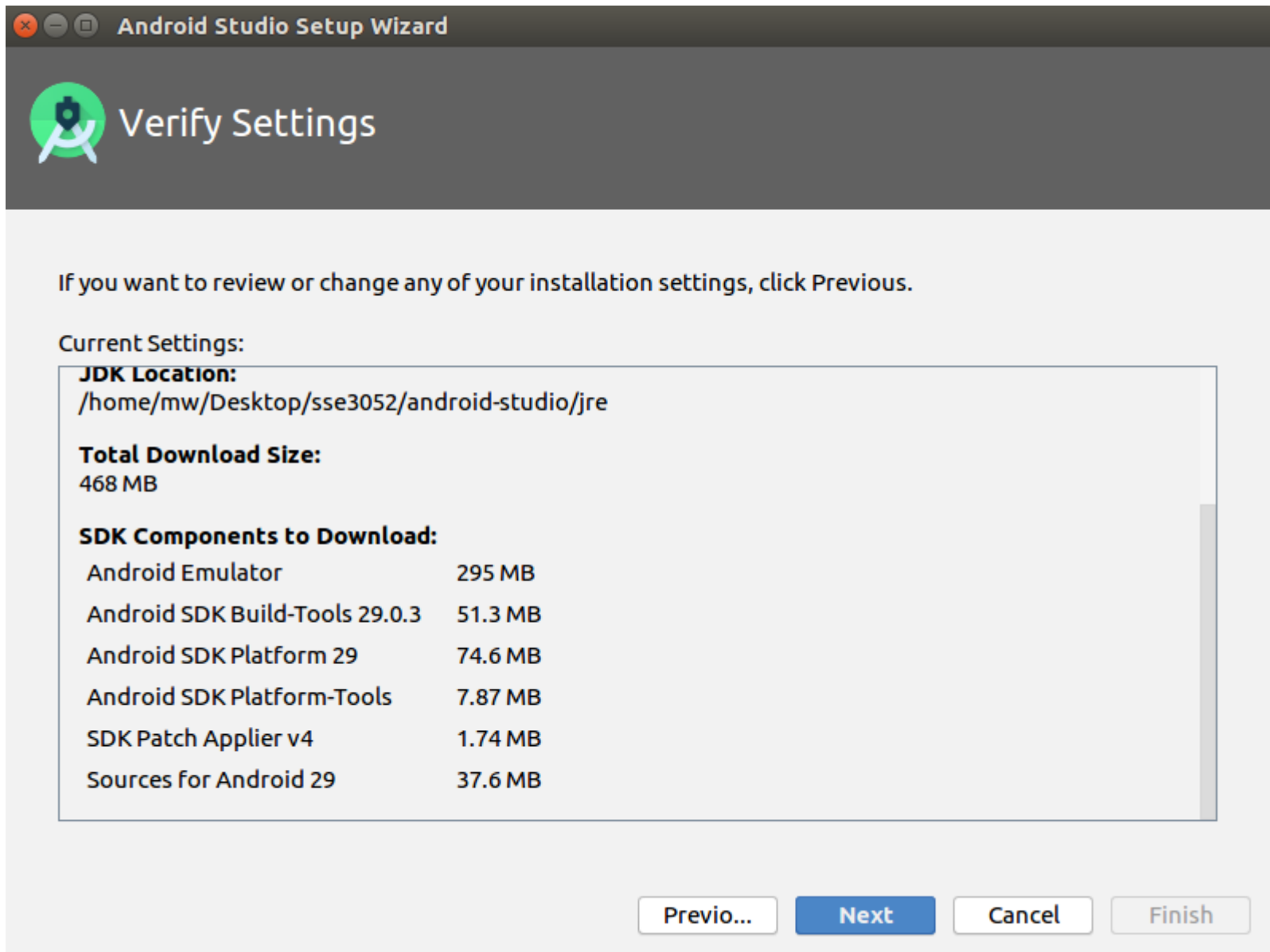
```
$cd android-studio/bin
```

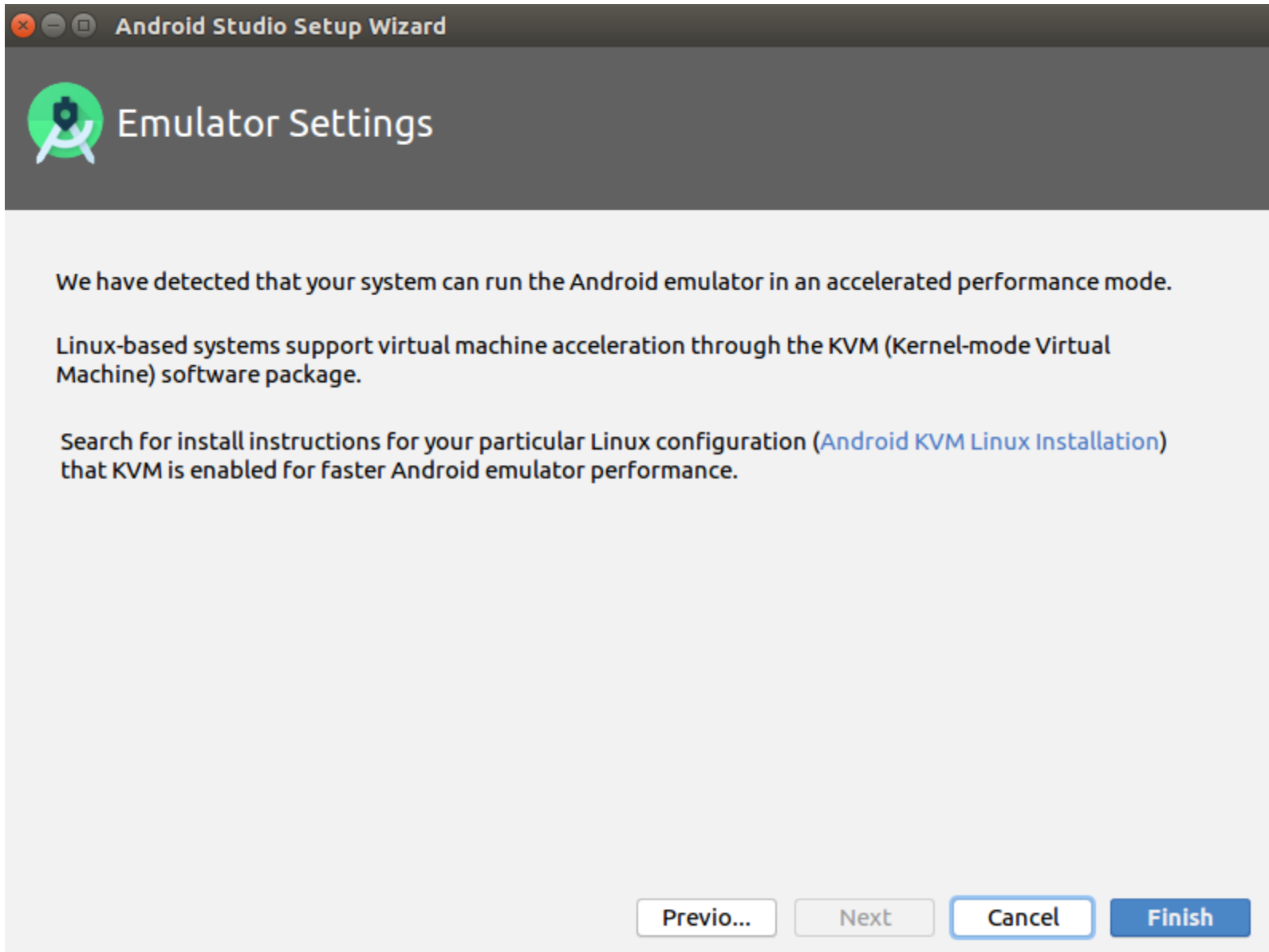
```
$./studio.sh
```

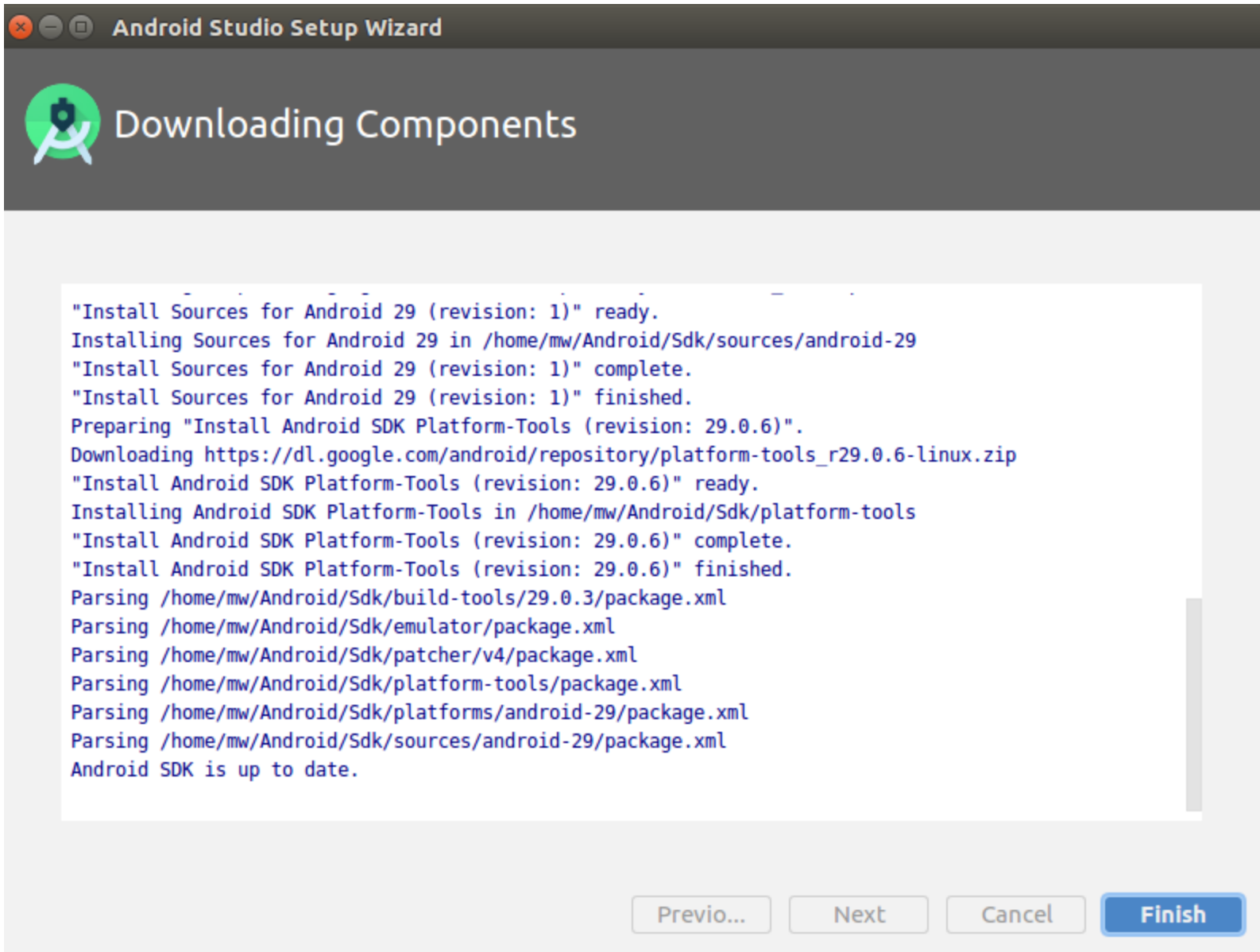


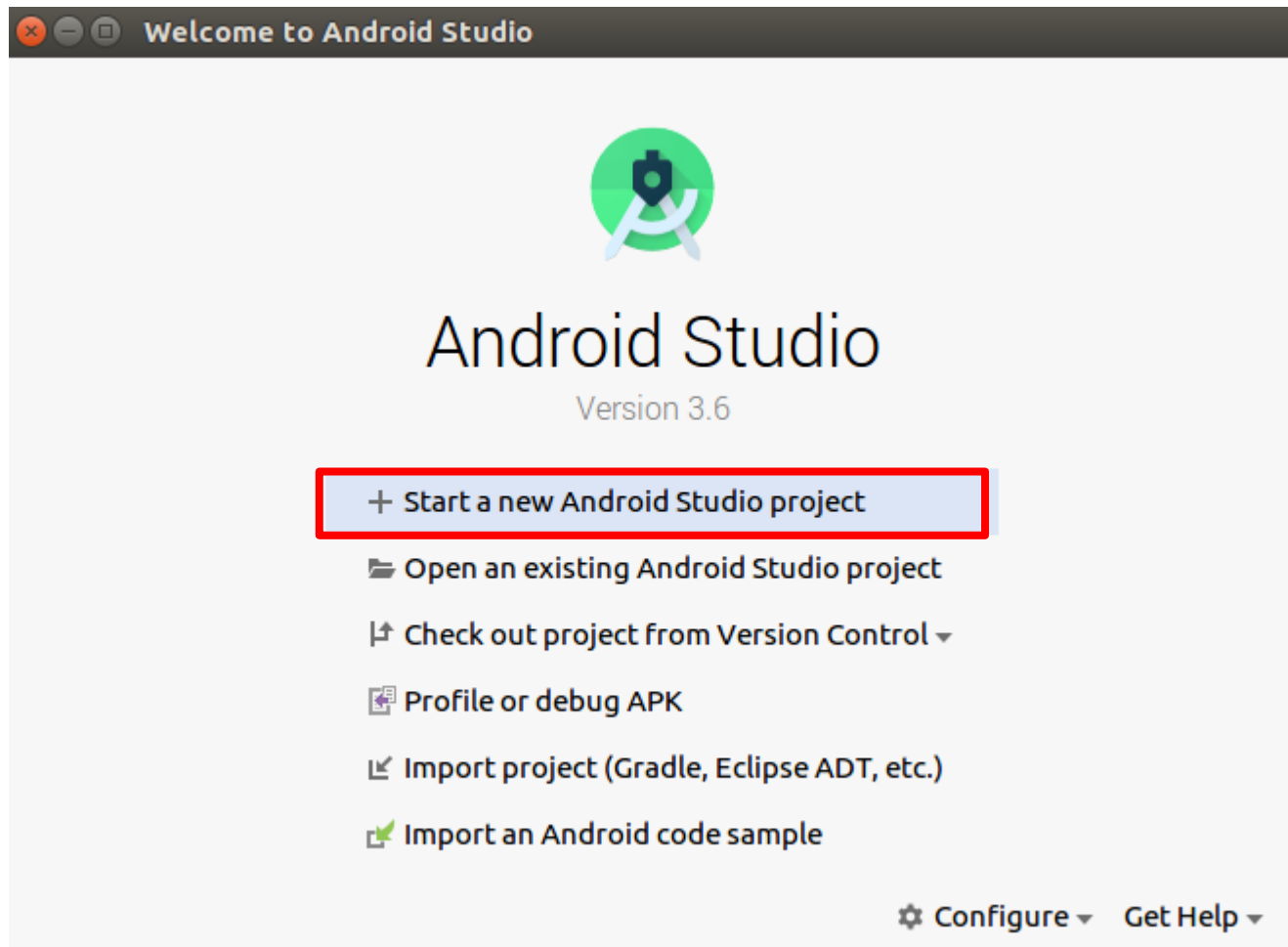


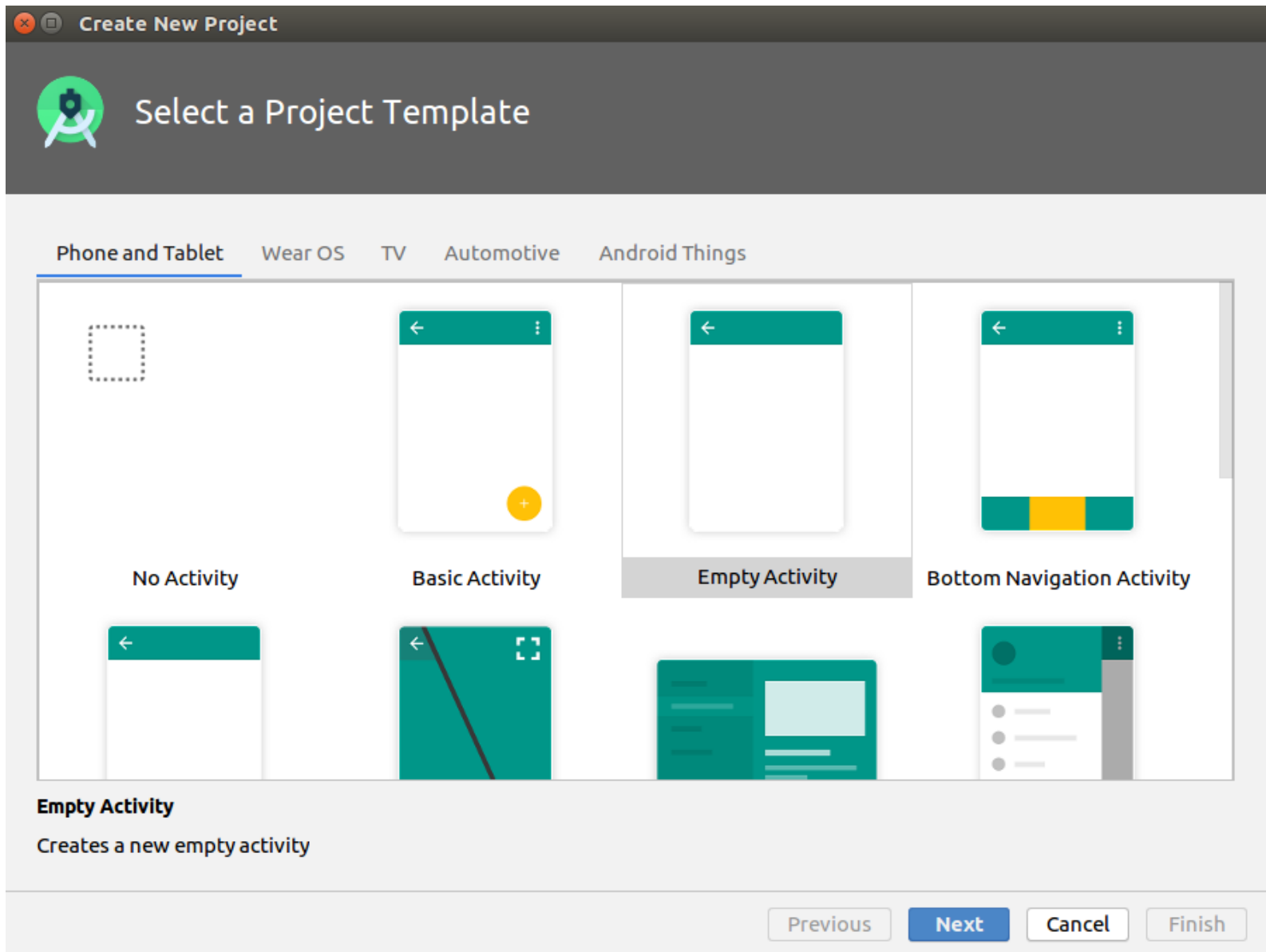









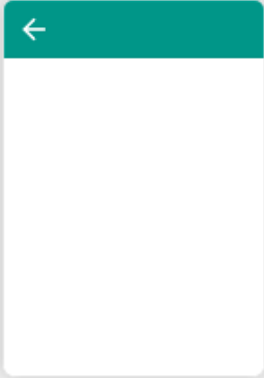




Create New Project



Configure Your Project



Empty Activity

Creates a new empty activity

Name


Package name


Save location


Language

Minimum SDK

API 15: Android 4...IceCreamSandwich)

 Your app will run on approximately **100%** of devices.
[Help me choose](#)

☐ Use legacy android.support libraries 

 The application name for most apps begins with an uppercase letter

Previous

Next

Cancel

Finish

My Application [~/AndroidStudioProjects/MyApplication] - .../app/src/main/java/com/example/myapplication/MainActivity.java - Android Studio

File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help

app > src > main > java > com > example > myapplication > MainActivity.java

Android > activity_main.xml > MainActivity.java

Resource Manager

- MyApplication [My Application] ~/Android
 - .gradle
 - .idea
 - app
 - libs
 - src
 - androidTest
 - main
 - java
 - com
 - example
 - myapplication
 - MainActivity.java
 - res
 - AndroidManifest.xml
 - test
 - .gitignore
 - build.gradle
 - proguard-rules.pro
 - gradle
 - .gitignore
 - build.gradle
 - gradle.properties
 - gradlew
 - gradlew.bat
 - local.properties
 - MyApplication.iml
 - settings.gradle
 - Gradle Scripts

Build Variants

2: Favorites

3: Structure

```

1 package com.example.myapplication;
2
3 import ...
4
5
6
7 public class MainActivity extends AppCompatActivity {
8
9     @Override
10    protected void onCreate(Bundle savedInstanceState) {
11        super.onCreate(savedInstanceState);
12        setContentView(R.layout.activity_main);
13    }
14 }
15

```

Assistant What's New

What's New in 3.6

This panel describes some of the new features and behavior changes included in this update.

To open this panel again later, select **Help > What's New in Android Studio** from the main menu.

[Read in a browser](#)

Design tools

This version of Android Studio includes updates to several design tools, including the Layout Editor and Resource Manager.

Color picker resource tab

In the color picker for XML or design tools, Android Studio 1 populates the color resources in your app for you to quickly choose and replace color resources values.

Resources Custom

Search

Project

Project

Library

Android Framework

- bright_light_blue
- bright_orange
- carolina_blue
- color_control_light
- color_control_light
- color_on_secondary
- color_on_secondary
- color_primary
- color_primary
- color_primary_dark

Terminal Build TODO

Gradle sync started (a minute ago)

2 processes running... 1:1 LF UTF-8 4 spaces

Event Log

(Menu) Tools – SDK Manager

Settings for New Projects

Appearance & Behavior > System Settings > Android SDK

Manager for the Android SDK and Tools used by Android Studio

Android SDK Location: [Edit](#) [Optimize disk space](#)

SDK Platforms SDK Tools SDK Update Sites

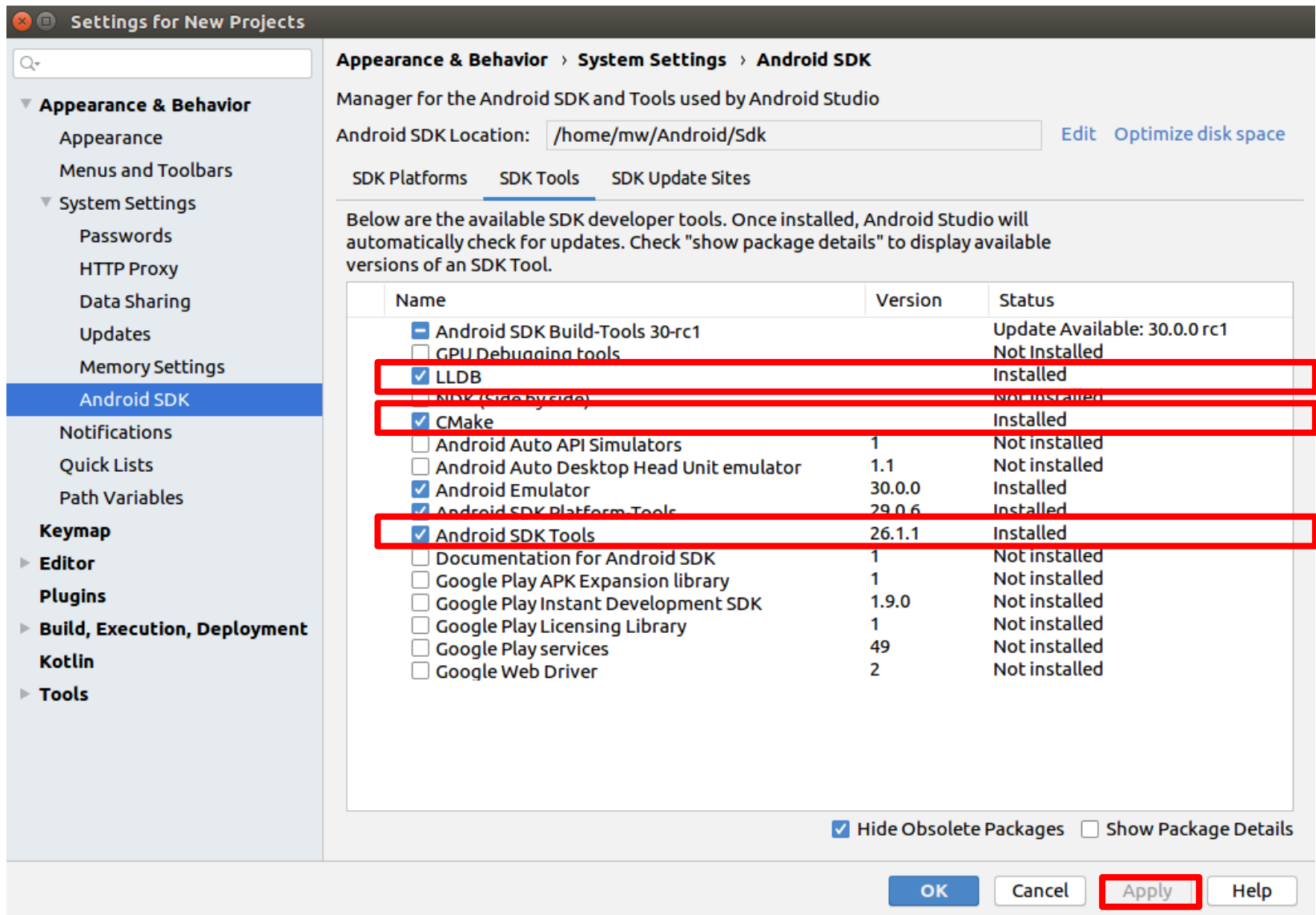
Each Android SDK Platform package includes the Android platform and sources pertaining to an API level by default. Once installed, Android Studio will automatically check for updates. Check "show package details" to display individual SDK components.

| Name | API Level | Revision | Status |
|---|-----------|----------|---------------|
| <input type="checkbox"/> Android R Preview | R | 1 | Not installed |
| <input checked="" type="checkbox"/> Android 10.0 (Q) | 29 | 4 | Installed |
| <input type="checkbox"/> Android 9.0 (Pie) | 28 | 6 | Not installed |
| <input type="checkbox"/> Android 8.1 (Oreo) | 27 | 3 | Not installed |
| <input type="checkbox"/> Android 8.0 (Oreo) | 26 | 2 | Not installed |
| <input type="checkbox"/> Android 7.1.1 (Nougat) | 25 | 3 | Not installed |
| <input checked="" type="checkbox"/> Android 7.0 (Nougat) | 24 | 2 | Installed |
| <input type="checkbox"/> Android 6.0 (Marshmallow) | 23 | 3 | Not installed |
| <input type="checkbox"/> Android 5.1 (Lollipop) | 22 | 2 | Not installed |
| <input type="checkbox"/> Android 5.0 (Lollipop) | 21 | 2 | Not installed |
| <input type="checkbox"/> Android 4.4W (KitKat Wear) | 20 | 2 | Not installed |
| <input type="checkbox"/> Android 4.4 (KitKat) | 19 | 4 | Not installed |
| <input type="checkbox"/> Android 4.3 (Jelly Bean) | 18 | 3 | Not installed |
| <input type="checkbox"/> Android 4.2 (Jelly Bean) | 17 | 3 | Not installed |
| <input type="checkbox"/> Android 4.1 (Jelly Bean) | 16 | 5 | Not installed |
| <input type="checkbox"/> Android 4.0.3 (IceCreamSandwich) | 15 | 5 | Not installed |
| <input type="checkbox"/> Android 4.0 (IceCreamSandwich) | 14 | 4 | Not installed |
| <input type="checkbox"/> Android 3.2 (Honeycomb) | 13 | 1 | Not installed |
| <input type="checkbox"/> Android 3.1 (Honeycomb) | 12 | 3 | Not installed |
| <input type="checkbox"/> Android 3.0 (Honeycomb) | 11 | 2 | Not installed |
| <input type="checkbox"/> Android 2.3.3 (Gingerbread) | 10 | 2 | Not installed |
| <input type="checkbox"/> Android 2.3 (Gingerbread) | 9 | 2 | Not installed |

☒ Hide Obsolete Packages ☐ Show Package Details

OK **Cancel** **Apply** **Help**

(Menu) Tools – SDK Manager



(Virtual) Device

Create an AVD (Android Virtual Device)

- (Menu) Tools – AVD Manager



Virtual devices allow you to test your application without having to own the physical devices.

[+ Create Virtual Device...](#)

To prioritize which devices to test your application on, visit the [Android Dashboards](#), where you can get up-to-date information on which devices are active in the Android and Google Play ecosystem.

Virtual Device Configuration

Select Hardware

Choose a device definition

| Category | Name ▾ | Play Sto... | Size | Resolut... | Density |
|------------|-------------------------|-------------|-------|------------|---------|
| TV | 5.4" FWVGA | | 5.4" | 480x8... | mdpi |
| Phone | 5.1" WVGA | | 5.1" | 480x8... | mdpi |
| Wear OS | 4.7" WXGA | | 4.7" | 720x1... | xhdpi |
| Tablet | 4.65" 720p (Galaxy ...) | | 4.65" | 720x1... | xhdpi |
| Automot... | 4" WVGA (Nexus S) | | 4.0" | 480x8... | hdpi |
| | 3.7" WVGA (Nexus ...) | | 3.4" | 480x8... | hdpi |
| | 3.7" FWVGA slider | | 3.7" | 480x8... | hdpi |

New Hardware Profile

Import Hardware Profiles

↺

4" WVGA (Nexus S)

480px

4.0"

800px

Size: normal

Ratio: long

Density: hdpi

Clone Device...

Previous

Next

Cancel

Finish

Help



System Image

Select a system image

Recommended

x86 Images

Other Images

| Release Name | API Level ▾ | ABI | Target |
|---------------------------------|-------------|--------|-----------------------------|
| Oreo Download | 26 | x86_64 | Android 8.0 (Google APIs) |
| Oreo Download | 26 | x86 | Android 8.0 |
| Oreo Download | 26 | x86_64 | Android 8.0 |
| Nougat Download | 25 | x86_64 | Android 7.1.1 (Google APIs) |
| Nougat Download | 25 | x86 | Android 7.1.1 |
| Nougat Download | 25 | x86_64 | Android 7.1.1 |
| Nougat Download | 24 | x86_64 | Android 7.0 (Google APIs) |
| Nougat Download | 24 | x86_64 | Android 7.0 |
| Nougat Download | 24 | x86 | Android 7.0 |



! A system image must be selected to continue.

Nougat



API Level

24

Android

7.0**Google Inc.**

System Image

x86_64

Questions on API level?

See the [API level distribution chart](#)

Previous


Next

Cancel

Finish

Help

Virtual Device Configuration




Android Virtual Device (AVD)

Verify Configuration

AVD Name


my_avd



4" WVGA (Nexus S)

4.0 480x800 hdpi

Change...




Nougat


Android 7.0 x86_64

Change...

Startup orientation



Portrait



Landscape

Emulated Performance

Graphics:

Automatic

Show Advanced Settings

AVD Name

The name of this AVD.





Previous

Next

Cancel

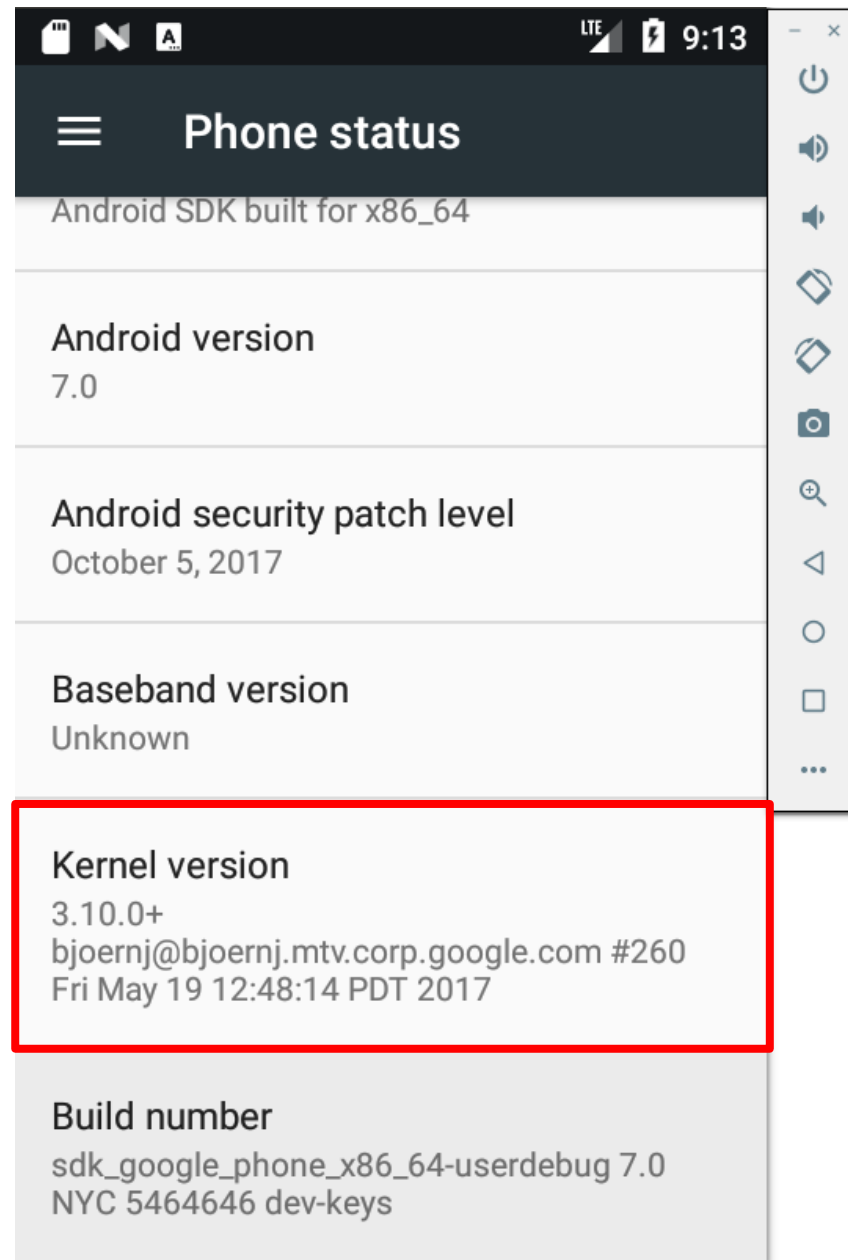
Finish

Help

| Type | Name | Play Sto... | Resolution | API | Target | CPU/ABI | Size on Disk | Actions |
|---|--------|-------------|-----------------|-----|---------------------------|---------|--------------|---|
|  | my_avd | | 480 × 800: hdpi | 24 | Android 7.0 (Google APIs) | x86_64 | 3.1 GB |    |

+ Create Virtual Device...





Environment Setup

- (Virtual) Device
- **Compiler**
- Kernel

Compiler

```
$cd [Your Workspace]
```

```
$git clone https://android.googlesource.com/platform/prebuilts/gcc/linux-x86/x86/x86\_64-linux-android-4.9
```

```
$cd x86_64-linux-android-4.9
```

```
$git checkout 271538
```

Environment Setup

- (Virtual) Device
- Compiler
- **Kernel**
 - Download source code
 - Build
 - Run

Kernel

Download source code

```
$cd ~/
```

```
$git clone https://android.googlesource.com/kernel/g  
oldfish
```

```
$cd goldfish
```

```
$git checkout -b android-goldfish-3.10-n-dev origin/  
android-goldfish-3.10-n-dev
```

Kernel





Build

1. `export ARCH=x86_64`
2. `export CROSS_COMPILE=~/.x86_64-linux-android-4.9/bin/x86_64-linux-android-`
--> use newly downloaded compiler on previous slide
3. `make x86_64_ranchu_defconfig`
4. `make -j4`

Kernel

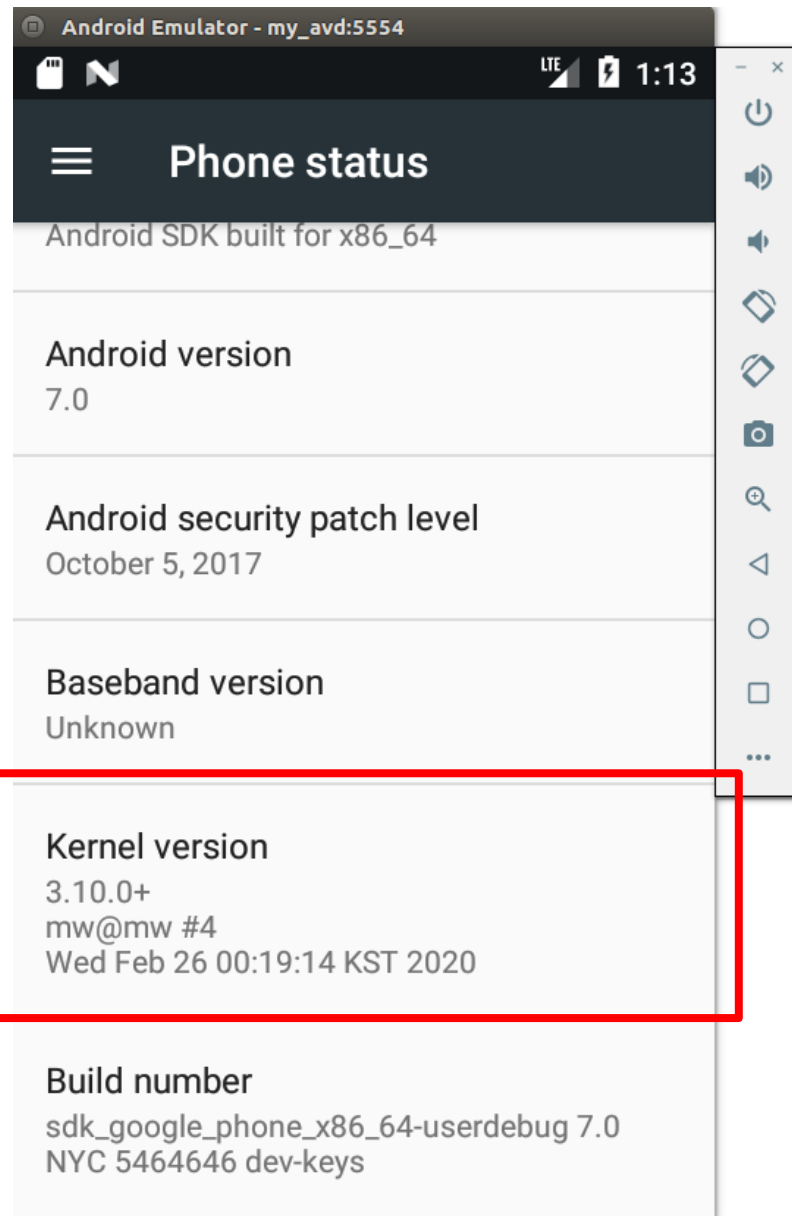
Run

1. `cd ~/Android/Sdk/system-images/android-24/google_apis/x86_64`
2. `mv kernel-ranchu kernel-ranchu.bak`
3. `cp ~/goldfish/arch/x86/boot/bzImage kernel-ranchu`
--> copy boot image of new kernel to emulator
4. (Run!)

| Type | Name | Play Sto... | Resolution | API | Target | CPU/ABI | Size on Disk | Actions |
|---|--------|-------------|-----------------|-----|---------------------------|---------|--------------|---|
|  | my_avd | | 480 × 800: hdpi | 24 | Android 7.0 (Google APIs) | x86_64 | 3.1 GB |    |

+ Create Virtual Device...



Summary

- Today, we booted android emulator with new android kernel
- For the next week,
 - we will learn what is system call,
 - and add a new system call on our android kernel

Lab Report

- Submit report
 - You must include the result(captured emulated device)
 - Format:YourStudentID_lab I.pdf
 - Upload to i-Campus
 - Deadline: 3/10 (Tue.) 23:59

Questions?

- If you have questions,
 - please use i-Campus (토론>수업 Q&A 토론) or email
 - gyusun.lee@csi.skku.edu
 - minwoo.ahn@csi.skku.edu