

OpenGL ES: iPhone and Android

CSCI 4239/5239

**Advanced Computer Graphics
Spring 2019**

Apple iOS Devices

- Supports OpenGL ES 1.1 or 2.0
 - Newer devices support 1.1 AND 2.0
- User interface is Objective C
 - Links to C and C++ code
- Develop with Xcode on Mac only
- Emulator for all devices
 - Slower than native devices
 - Almost perfect emulation

Getting iOS Tools

- Download Xcode from Apple
 - 4GB download
- Provides compiler, frameworks, etc
- Create project in Xcode
- Select target iPhone/iPad
- Emulator launched on run
- Get command line tools also

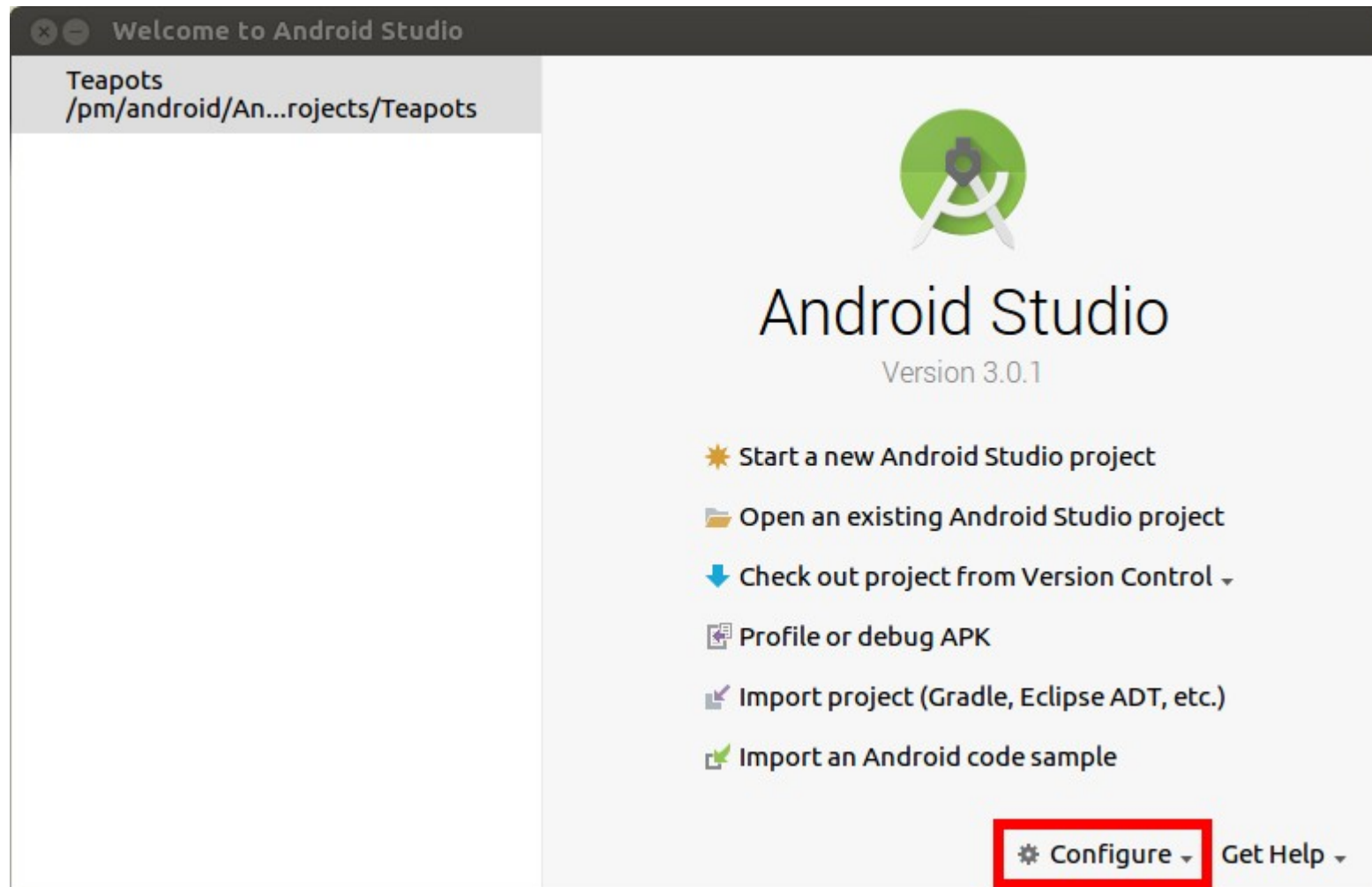
Android Devices

- Supports OpenGL ES 1.1 or 2.0
 - Newer devices support 1.1 AND 2.0
- User interface is Java
 - Link to C/C++ code with JNI
- Emulator for phones and tablets
 - Slower than native devices
 - OpenGL ES 2.0 emulator much improved

Android Tools

- Download Android Studio
 - <https://developer.android.com/studio/>
 - About 750MB ZIP file
- Unzip and find studio.sh or studio.exe
- Use Configure to download SDK, NDK
- Add Android tools to PATH
 -/SDK/tools
 -/SDK/platform-tools
 -/SDK/ndk-bundle
- Create AVDs

Initial SDK Configuration



Select and install SDK Tools

Default Settings

Appearance & Behavior > System Settings > Android SDK

Manager for the Android SDK and Tools used by Android Studio

Android SDK Location: [Edit](#)

SDK Platforms: **SDK Tools** SDK Update Sites

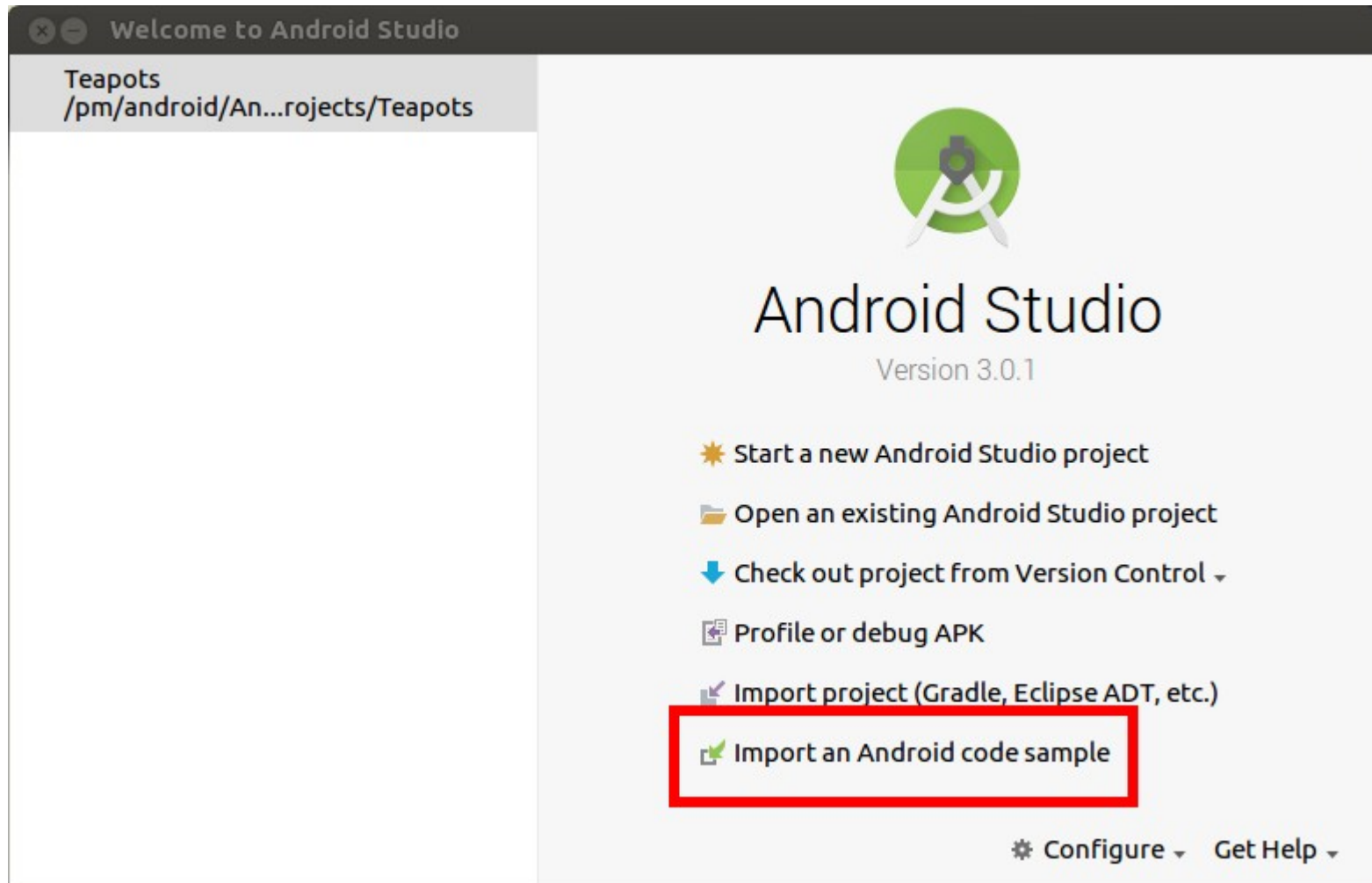
Below are the available SDK developer tools. Once installed, Android Studio will automatically check for updates. Check "show package details" to display available versions of an SDK Tool.

Name	Version	Status
<input checked="" type="checkbox"/> Android SDK Build-Tools		Installed
<input type="checkbox"/> Android Studio Debugging tools		Not Installed
<input checked="" type="checkbox"/> CMake		Installed
<input type="checkbox"/> LLD		Not Installed
<input type="checkbox"/> Android Auto API Simulators	1	Not installed
<input type="checkbox"/> Android Auto Desktop Head Unit emulator	1.1	Not installed
<input checked="" type="checkbox"/> Android Emulator	27.1.7	Installed
<input checked="" type="checkbox"/> Android SDK Platform-Tools	27.0.1	Installed
<input checked="" type="checkbox"/> Android SDK Tools	26.1.1	Installed
<input type="checkbox"/> Documentation for Android SDK	1	Not installed
<input type="checkbox"/> Google Play APK Expansion library	1	Not installed
<input type="checkbox"/> Google Play Licensing Library	1	Not installed
<input type="checkbox"/> Google Play services	46	Not installed
<input type="checkbox"/> Google Web Driver	2	Not installed
<input type="checkbox"/> Instant Apps Development SDK	1.1.0	Not installed
<input checked="" type="checkbox"/> NDK	16.1.4479499	Installed
<input type="checkbox"/> Support Repository		
<input type="checkbox"/> ConstraintLayout for Android		Update Available: 1
<input type="checkbox"/> Solver for ConstraintLayout		Update Available: 1
<input checked="" type="checkbox"/> Android Support Repository	47.0.0	Installed
<input checked="" type="checkbox"/> Google Repository	58	Installed

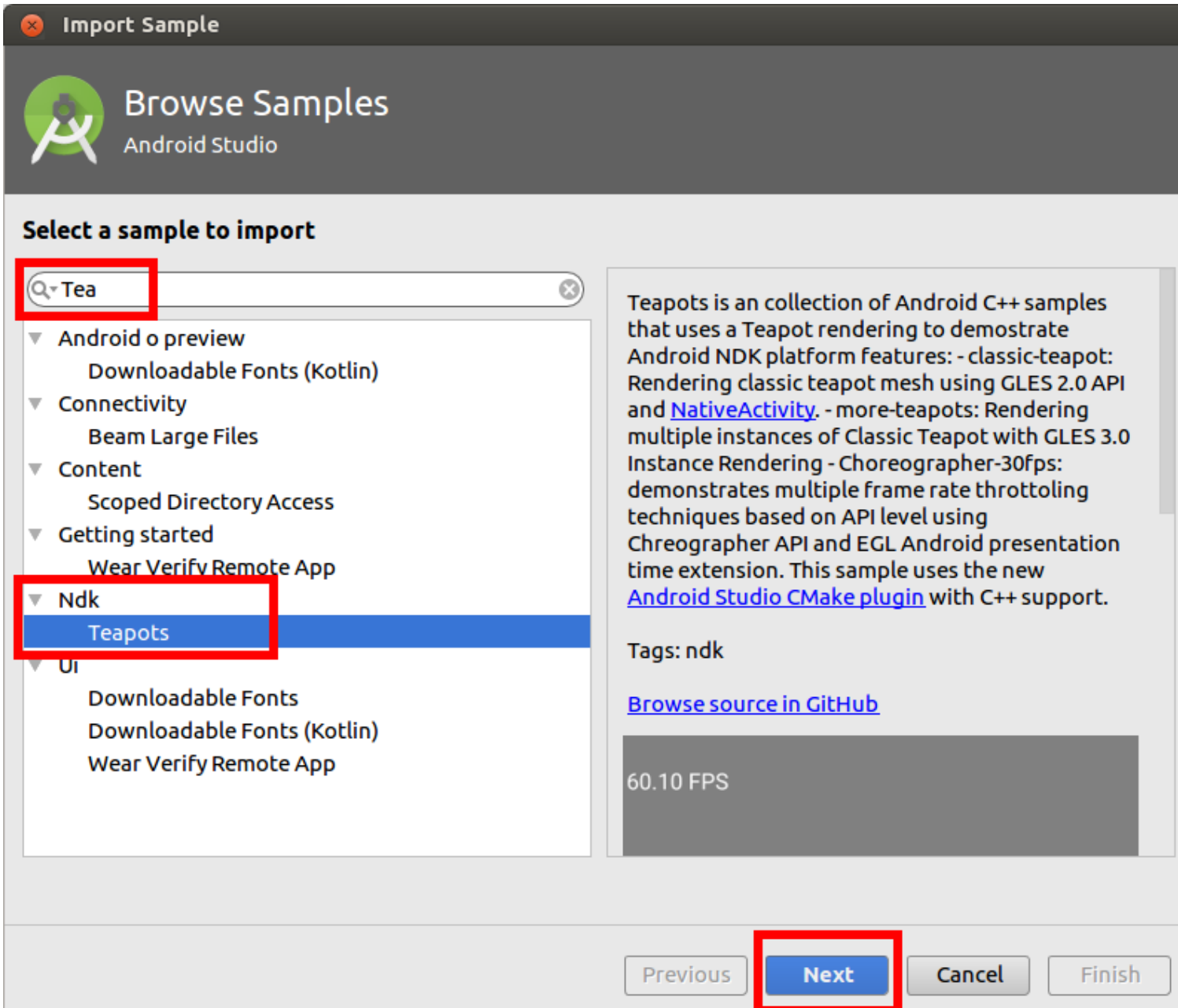
Show Package Details

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

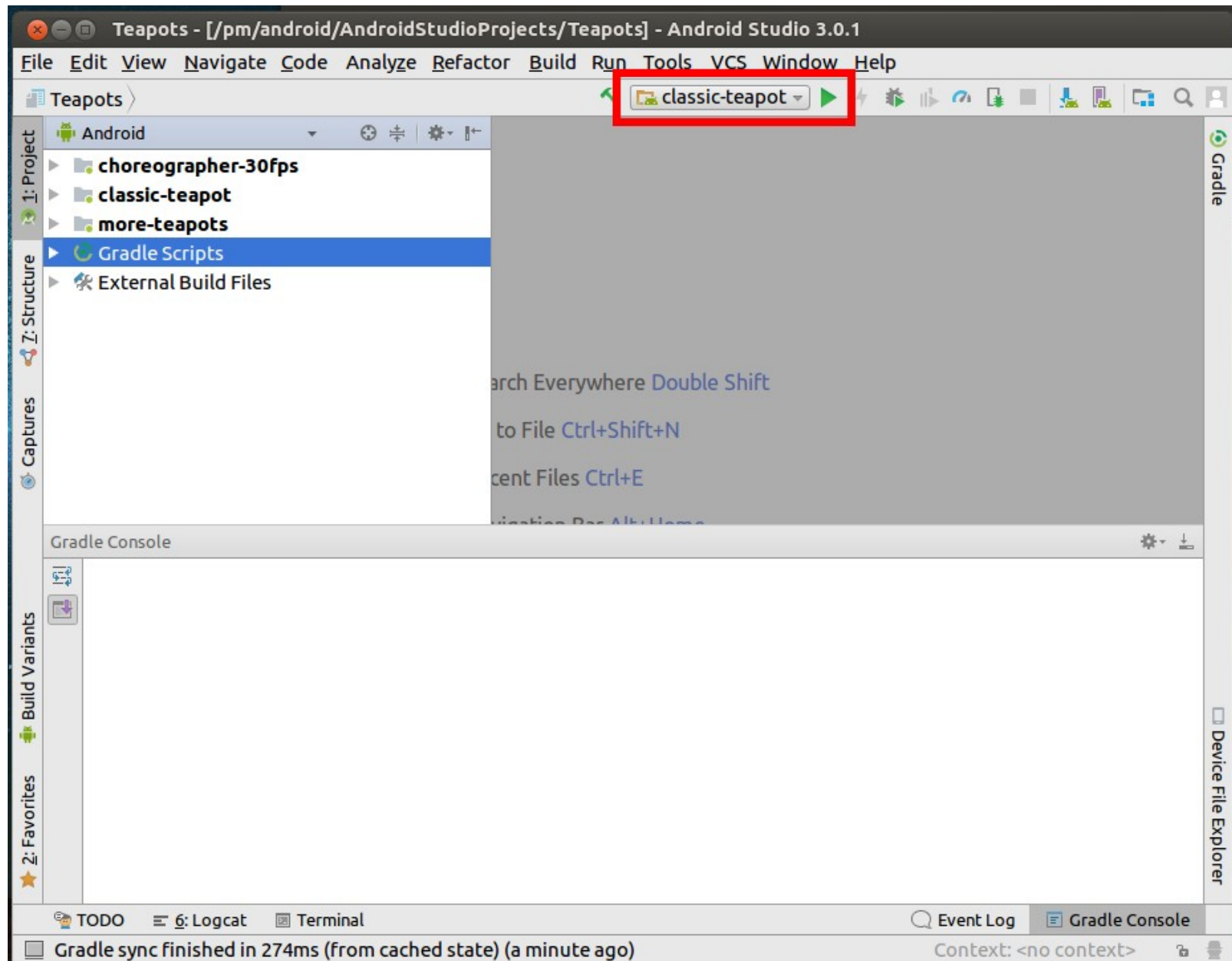
Import Code Example



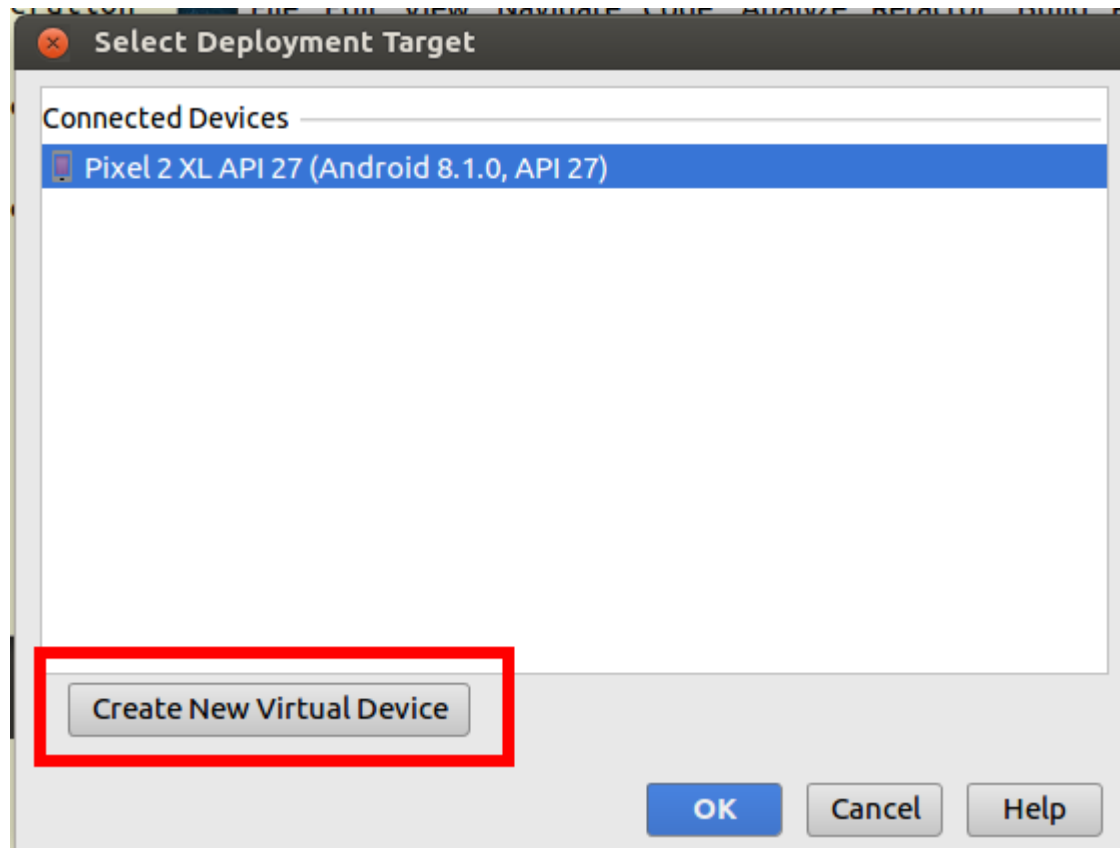
Teapots NDK/OpenGL ES 2.0



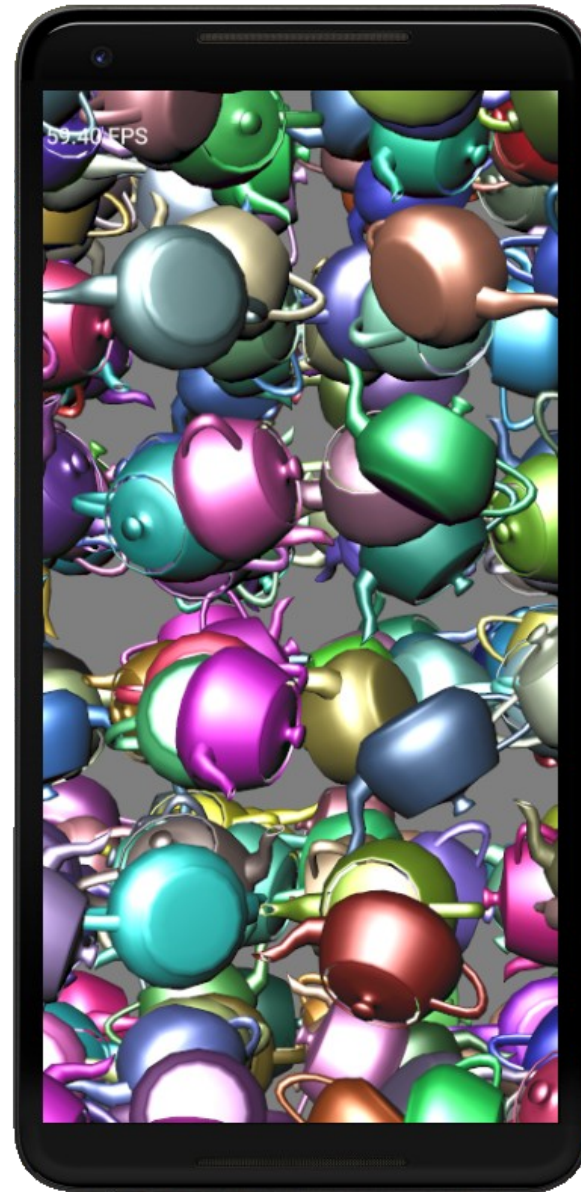
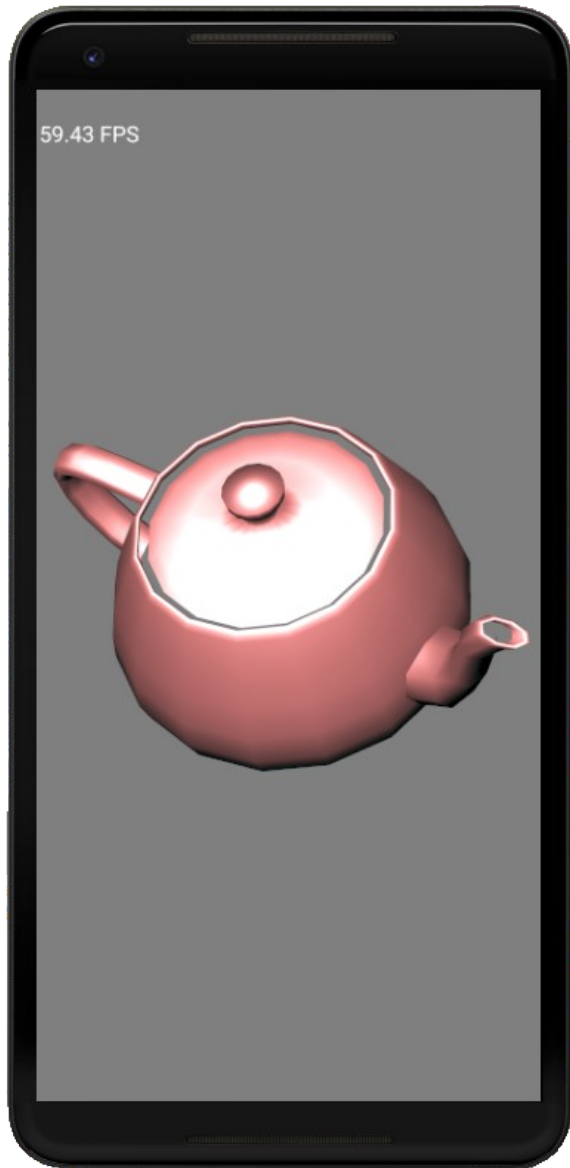
Select Target, Build and Run



Create Virtual Device using Wizard



teapot and more-teapots



Qt Creator

- Xcode lookalike IDE for Qt
- Allows builds for different platforms
 - Desktop
 - iOS
 - Android
- Cross compiles for hardware
- Many examples and tutorials
 - Cube OpenGL ES 2.0

Portable OpenGL ES Code

- Write the bulk of the code in C++
 - OpenGL ES 1.1 will run on all devices
 - OpenGL ES 2.0 will run on newer devices
- Write minimal code in interface language
 - Objective C – link to C/C++
 - Java – call C/C++ using JNI
- Build code using Qt

Assignment 6

- Create an application that displays a scene in 3D on the iPhone/iPad or Android
 - Build objects yourself
 - Explore advanced features such as lighting, textures, ...
- Groups are permitted
 - Pair up with somebody ahead of the curve
 - Presentations are still individual
 - Volunteer if this is your thing