CET325

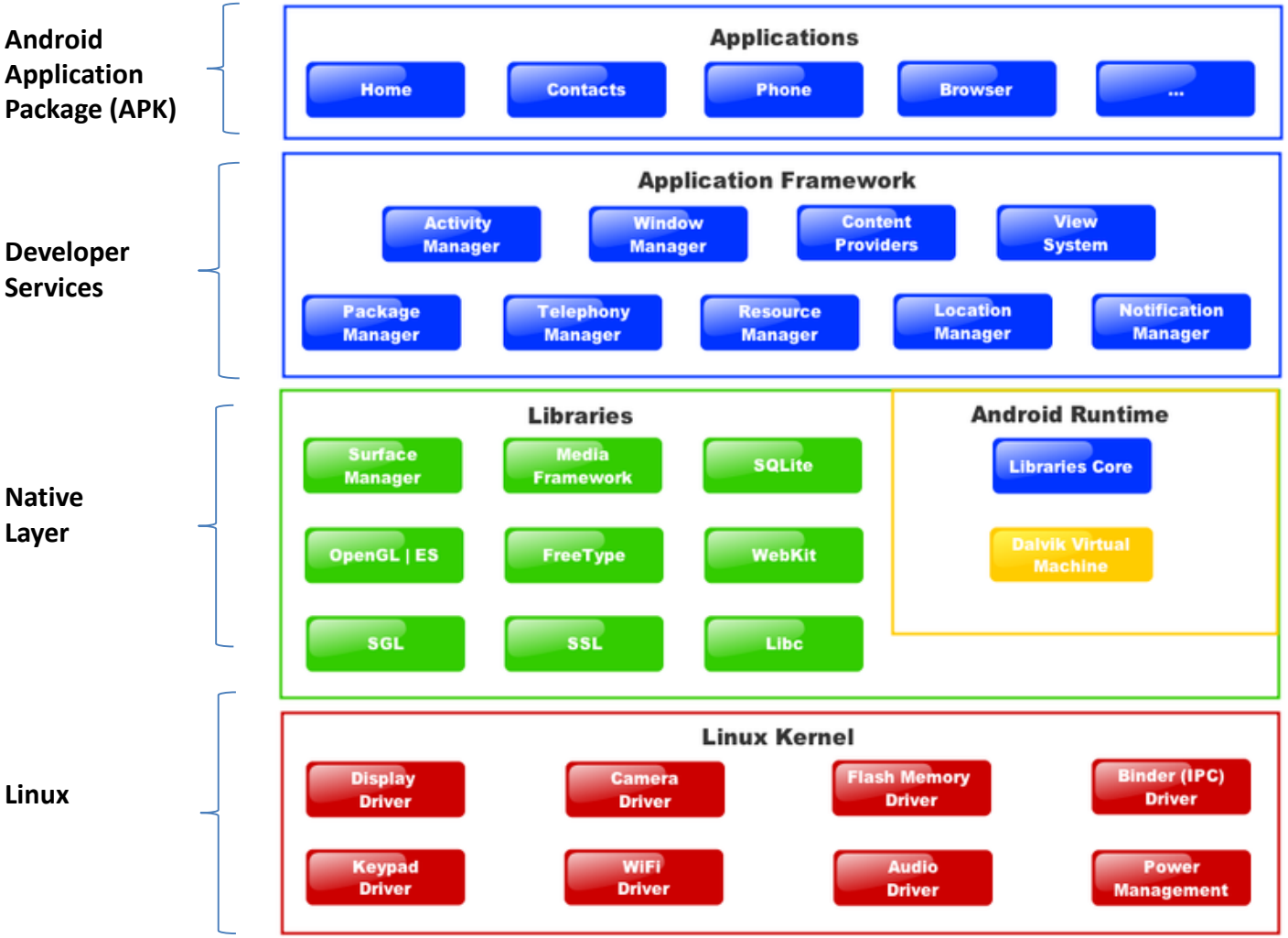
Advanced Mobile Development

Lecture 3A

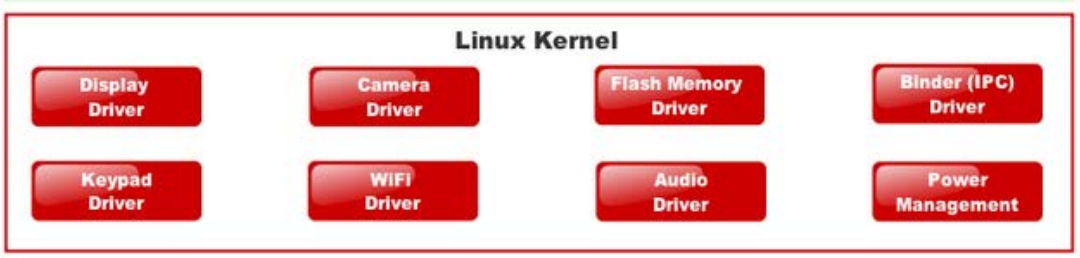
Agenda

- Android Architecture
- Development Tools for Android

Android Stack Architecture

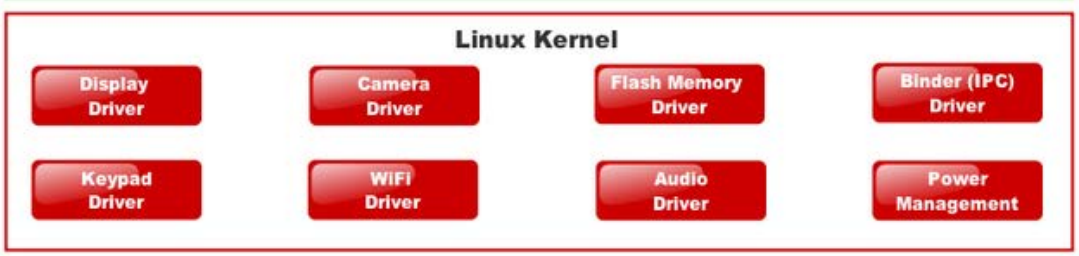


Linux Kernel



- Portability
  - Brings us some level of hardware abstraction
- Security
  - Android relies heavily on Linux for security. The kernel is the sole enforcer of Android permissions. Allows for simple, yet powerful security.
- Features
  - Support for memory and power management, and networking and radio functionality.

Linux Kernel



- Note!
  - Android is not a separate flavour of Linux in the way that Ubuntu or Fedora are.
  - Some typical Linux functionality is not available in Android, eg the X11 window manager or the ability to add someone as a Linux user.
  - Android also adds to the Linux kernel, e.g. fast IPC based on Binder.

Native Layer

- Written mostly in C/C++
- Includes HAL, native libraries, native daemons, and native tools.
- HAL:
  - Hardware abstraction layer
  - Provides unified device driver model
  - ‘Buffer’ between kernel space and remainder of stack
    - Flexible licencing

Native Layer

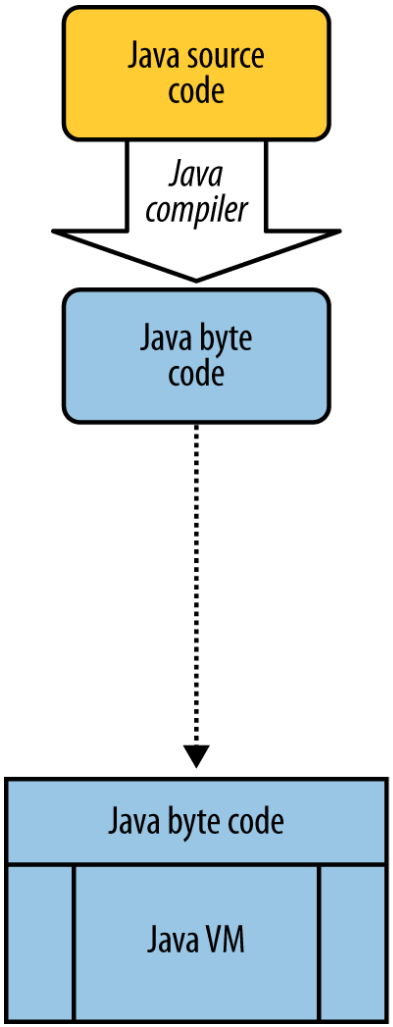
- Native Libraries:
  - Supports the Android Application Framework Layer
  - Both purpose built and open source
    - Purpose built: *Bionic (libc), Binder (ipc), Framework Libraries*
    - Open source: *SQLite, Apache Harmony (java lib), OpenGL, OpenSSL, Webkit*

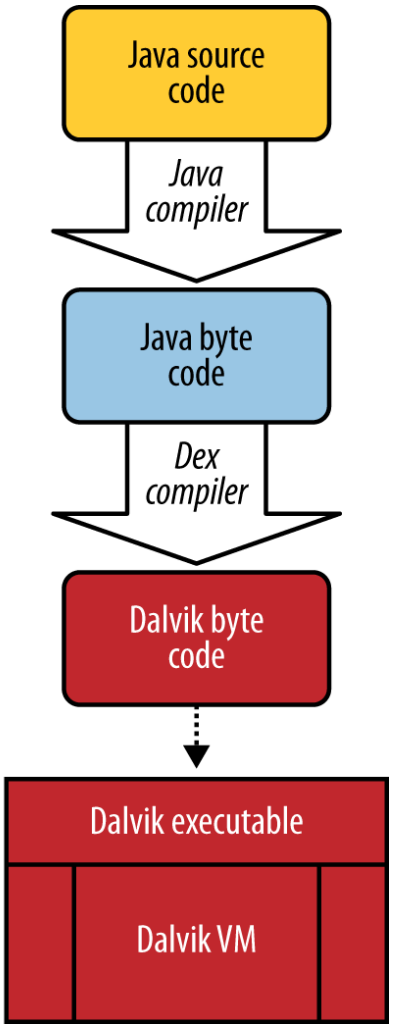
Native Layer

- Dalvik
  - Designed in 2005
  - Purpose-built virtual machine, focusing strictly on mobile devices.
  - Designed with limited battery life and device size in mind.
  - Dalvik VM has a tiny memory footprint
  - Replaced by Android RunTime (ART) on Android 5.0 and later

Native Layer – Dalvik

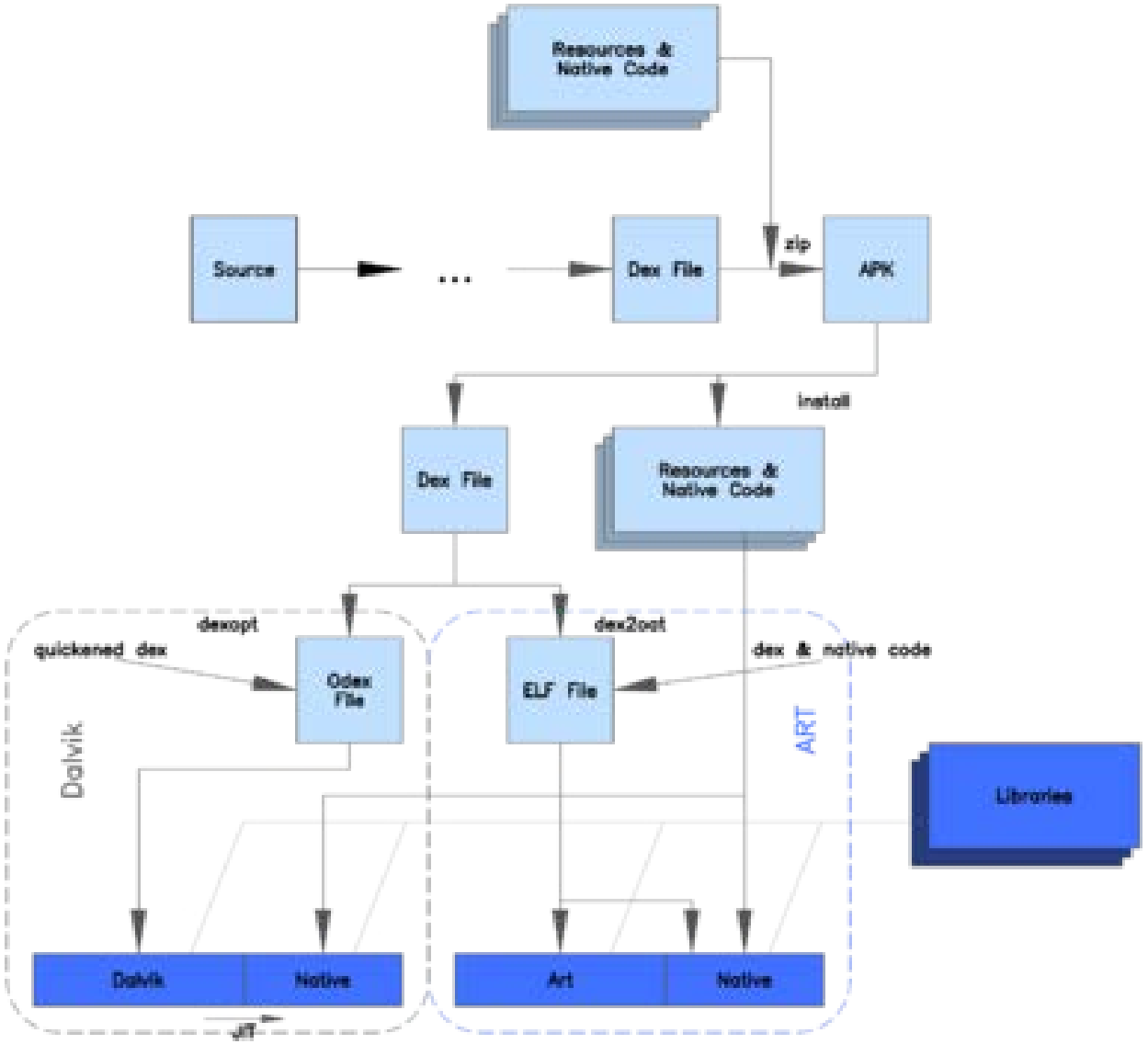
- Java versus Dalvik
- Conceptually there is little difference
- Both use VM code model
  - Rationale: circa 2005 the Java language was undergoing many changes, but the byte code was pretty standardised.
- Both have automatic garbage collection.
- Dalvik is designed to run on low memory
- DVM has been designed so a device can run multiple VM instances efficiently
- Dex compiler input is Bytecode





Native Layer – Android RunTime (ART)

- Android >= 5.0
- ART introduces the use of ahead-of-time (AOT) compilation by compiling entire applications into native machine code upon their installation.
- By eliminating Dalvik's interpretation and JIT compilation, ART improves the overall execution efficiency and reduces power consumption.



Application Framework

- Developer libraries and services
- Numerous Java libraries specific to Android
- Access to most of the standard Java libraries
  - GUI classes AWT and Swing have been removed and replaced with Android specific UI libraries

Applications

- Can be preinstalled on the device by the carrier or can be downloaded from the Android markets.

- Android Application Package (APK)
  - Manifest file (outlines components, permissions, versions, min API)
  - Dalvik/ART executable – runs your application
  - Resources – images, video clips, XML layout files etc.
  - Native libraries
  - Digital signature

Application Distribution

- Apps must be signed before they can be installed on a device.
  - For distribution it will be signed with your own key.
  - Full details: http://developer.android.com/tools/publishing/app-signing.html

- Apps may be distributed across Google Play or across smaller boutiques.

Application Distribution

- Should we worry about Viruses, Malware, Spyware, etc.?

Application Distribution

- Should we worry about Viruses, Malware, Spyware, etc?

- Android has a decentralised application distribution system.
  - All of the above are possible.
  - There have been reports of phishing attacks via fake banking apps
- Android leaves it to the marketplace to sort itself out and relies on reports for policing Google Play.

Application Distribution

International Business Times

News World Business Politics Technology Science Sport Entertainment Opinion Lifestyle Video Subscribe to newsletter

Technology CyberSecurity

Android malware masquerading as fake bank app empties accounts by locking users out of their phones

By India Ashok
May 28, 2016 08:27 BST

The malware is called Fanta SDK and has been around since December 2015. (Reuters)

IBT VIDEO

FBI paid more than $1.3m to break into San Bernardino iPhone

Application Distribution

BBC Sign in News Sport Weather iPlayer TV Rad

NEWS

Home UK World Business Politics Tech Science Health Education Entertain

Technology

Apple's App Store infected with XcodeGhost malware in China

21 September 2015 | Technology Share

Affected applications include Tencent's hugely popular WeChat app, a music downloading app and a car hailing app

Apple has said it is taking steps to remove malicious code added to a number of apps commonly used on iPhones and iPads in China.

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Tools and Technology Stack

- We will be developing ***native*** applications.
  - Using the native language of the platform

- Rationale
  - Performance
  - Fast / fluid animation
  - Full access to hardware
  - Multi-touch support
  - Latest APIs

IDE Options

- Google provided two Android IDE options:
  - **Android SDK/ADT bundle**. A version of **Eclipse IDE** that comes preconfigured with the latest Android SDK and the latest android development tools (ADT) plugin.
    Last version 08/2015, no longer supported
  - **Android Studio**. Google's new Android IDE based on **IntelliJ® IDEA** *Frequently updated.*
    We will use 2.1.3, 08/2016
    Last version 2.2.1, 10/2016

- We will be using Android Studio
  - Standard (de facto)
  - Fast, automated, integrated installation
  - Supportive online community

Revisions

The sections below provide notes about successive releases of Android Studio, as denoted by revision number.

Android Studio v2.2.1 *(October 2016)*

This is a minor update to Android Studio 2.2. It includes several bug fixes and a new feature to enable extra logging to help us troubleshoot Instant Run issues—to help us improve Instant Run, please enable extra logging and report any issues.

Android Studio v2.2.0 *(September 2016)*

Android Studio v2.1.3 *(August 2016)*

Android Studio v2.1.2 *(June 2016)*

Android Studio v2.1.1 *(May 2016)*

Android Studio v2.1.0 *(April 2016)*

Android Studio v2.0.0 *(April 2016)*

Android Studio v1.5.1 *(December 2015)*

Android Studio v1.5.0 *(November 2015)*

Android Studio v1.4.1 *(October 2015)*

Android Studio v1.4.0 *(September 2015)*

Android Studio

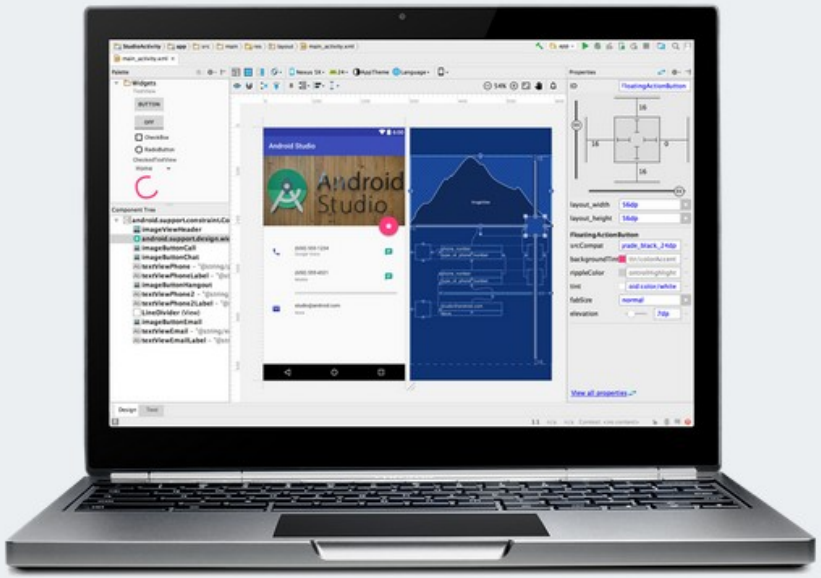
Android Studio

The Official IDE for Android

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

World-class code editing, debugging, performance tooling, a flexible build system, and an instant build/deploy system all allow you to focus on building unique and high quality apps.

DOWNLOAD ANDROID STUDIO
2.2.0.12 FOR WINDOWS *(1615 MB)*



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Android Studio

- Built on IntelliJ IDEA Community Edition
- Flexible Gradle-build based system
- A unified environment where you can develop for all Android devices
- A fast and feature-rich emulator
- Build variants and multiple APK generation
- App signing capabilities
- Expanded template support for Google Services and various device types
- Rich layout editor
- Lint tools to catch performance, usability, version compatibility, etc.

Tools and Technology Stack

- Configuration:
  - Android SDK (API 23) and Android Studio 2.1.3
    - http://developer.android.com/sdk/index.html
  - Java Development Kit JDK 8u101
    - http://www.oracle.com/technetwork/java/javase/downloads/jdk8-downloads-2133151.html

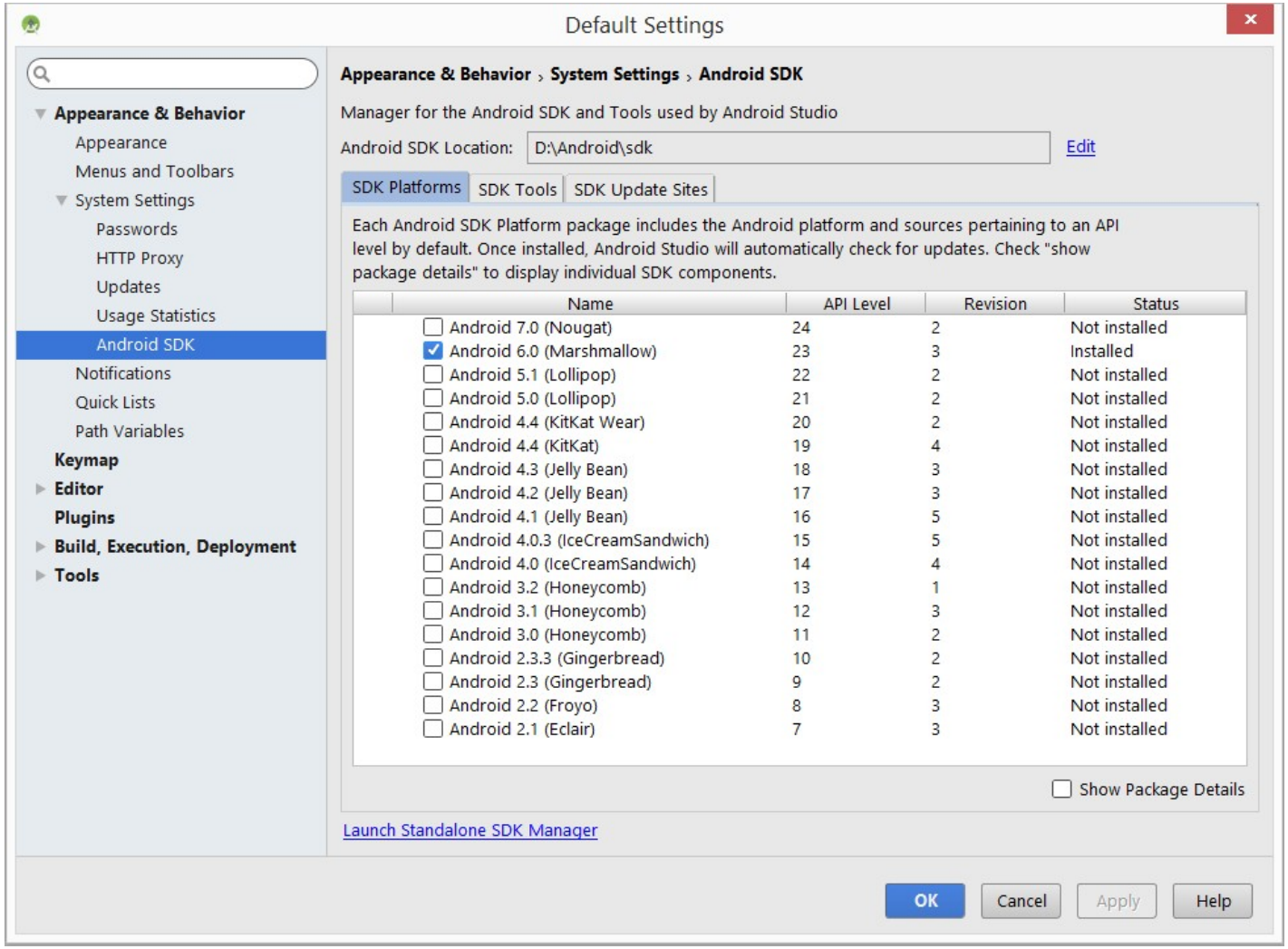
- High Level Overview
  - Android uses a collection of packages (groups of related predefined classes)
    - Android specific
    - Java specific
    - Google specific

Android Studio

- This configuration is the standard for this module
  - On campus labs
  - To mark your assessment

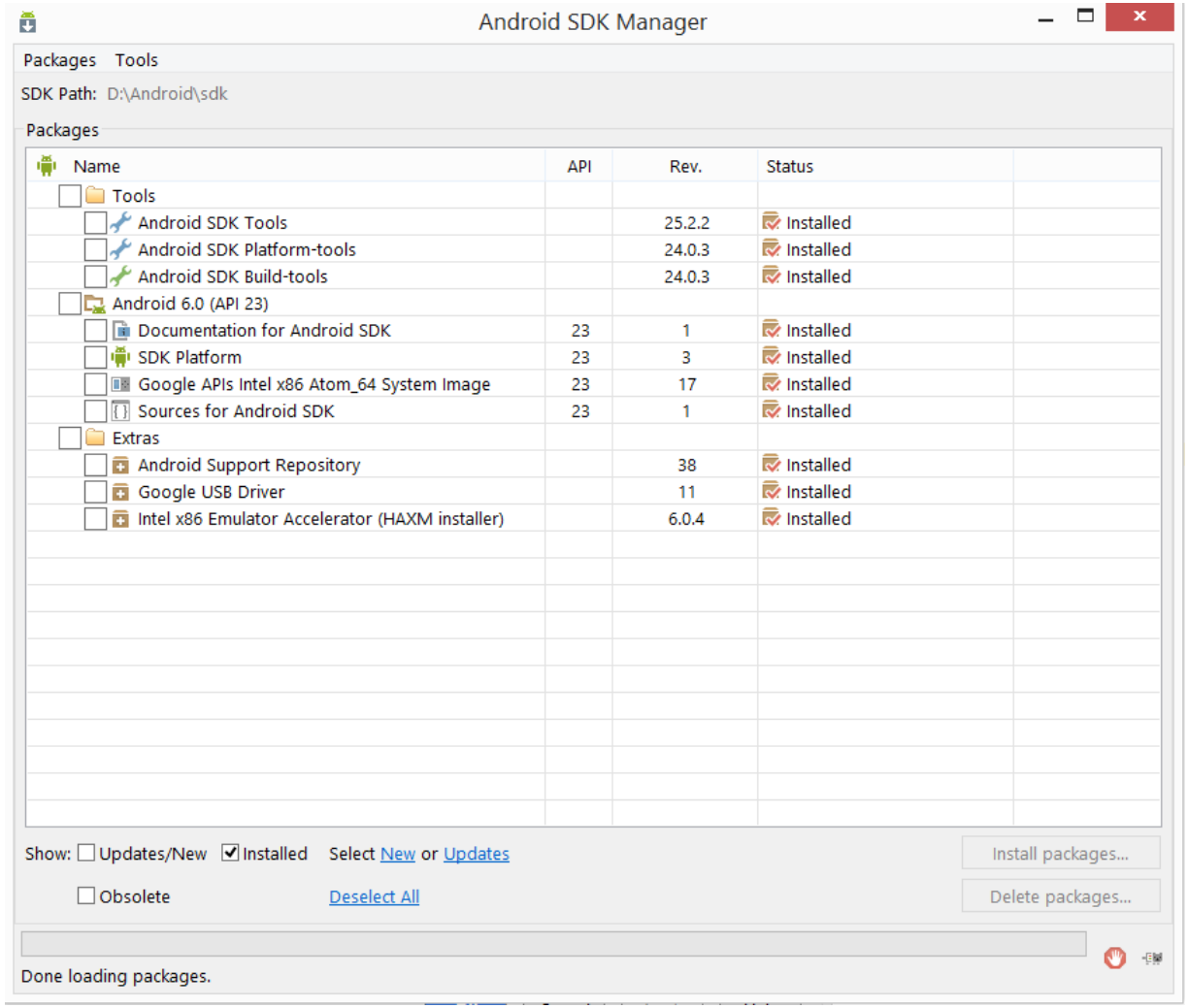
  Strong Advise
  - Install the same configuration on your machine
  - Use the same Android Virtual Device (AVD) to test your project
  - Do not upgrade to any newer version of any tool/package

Android Studio - SDK



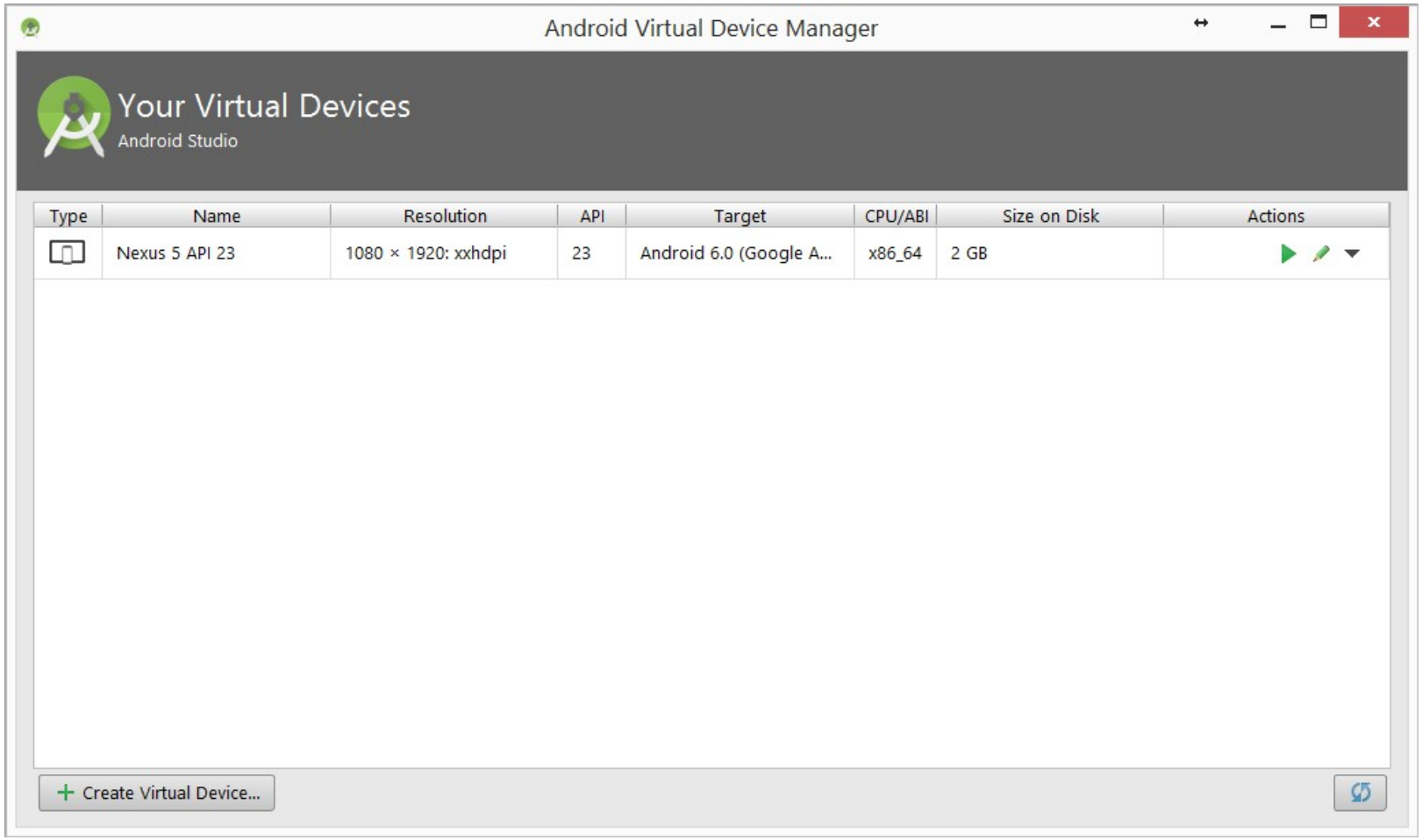
Tools -> Android -> SDK Manager

Android Studio - Packages



Stand Alone SDK Manager

Android Studio - AVD



Tools -> Android -> SDK Manager

Tutorial

- Getting started with Android Studio
- Your first app (HelloWorld)
- Configuration of Android Studio