Week 1: Introduction to Android

UW PCE Android Application Development Program Course 1 – Android Development Fundamentals

Agenda

- Class introductions
- House rules
- Syllabus
- Introduction to Android
- IDE, environment setup & configuration
- First apps

Introductions

- Instructor:
  - Chuks Onwuneme
  - Ex-Nokia Symbian Engineer
  - iOS
  - Android
  - Co-founder, Personify.iT, Inc.
  - Founder, Kekwanu Labs, LLC

Introductions

- Name
- Current Role
- Any Android experience?
- Why are you taking this class?
- What do you hope to get out of this class?

House Rules

- Inclusiveness
- Integrity
- Expectations
  - Homeworks
  - Attendance
  - Contact
  - Class discussion forum

Syllabus

Introduction to Android

What is Android?

- Mobile OS based on the Linux kernel.
- Developed by Google.
- Designed primarily for touch screen devices
  - Smartphones
  - Tablets
  - Specialized UI for TVs (Android TV), cars (Android Auto) and wrist watches (Android Wear)
- Android is Open Source. Code is available
  - https://source.android.com/source/downloading.html
  - Browse here:
    - http://grepcode.com/project/repository.grepcode.com/java/ext/com.google.android/android/

Android – Historical stats

- Introduced in 2007, amidst skepticism
  - 1.0 – clunky ;)
- Strong competition from major players
  - Nokia (Symbian, Series 40, etc)
  - Microsoft (Windows Mobile)
- Market share
  - 2.9% in 2nd qtr. 2009
  - 33% in 4th qtr. 2010, overtaking Symbian OS
  - 52.5% in 3rd qtr. 2011
  - 81.3% in 3rd qtr. 2013, outselling Windows, iOS and Mac OS devices combined
  - By end of 2013, 1.5 billion Android smartphones sold since 2010
  - By the end of this year, 3billion Android smartphones would have sold!
- Staggering! Wouldn't you want to build apps for this market?

Android - Fragmentation

- Too many devices and OEMs
  - Various screen sizes
  - Hardware variations
  - Software differentiation

- Difficulty in building applications that run consistently across devices
- iOS, Windows Phone, (Blackberry), etc win
- The Android platform is “addressing” most of these issues.

Android – Fragmentation 2

- Amazon – Kindle, Fire Phone (Fire OS)
- HTC Sense UI
- Samsung Touch Wiz – Galaxy family

Android – Fragmentation 3

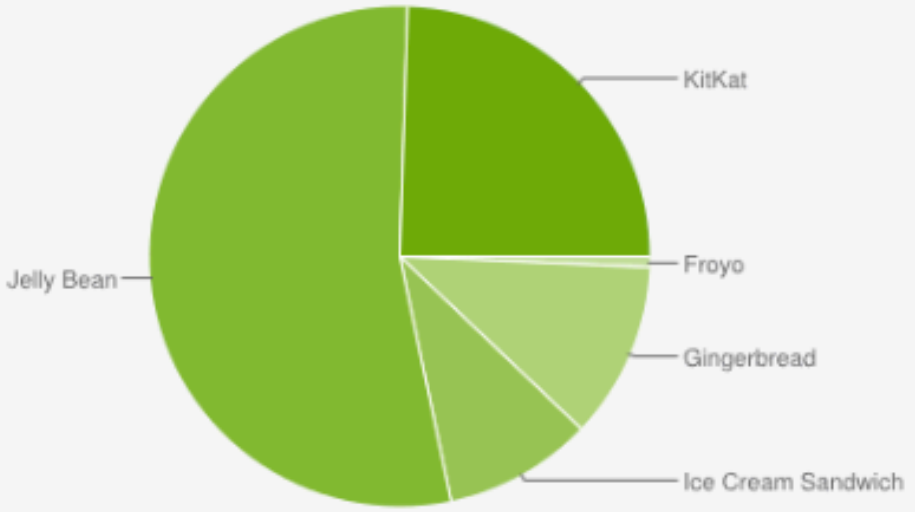
- Android updates
- Tablets
- Nexus devices
  - “Pure” or “stock” Android
  - Nexus 5 (phone)
  - Nexus 7 (tablet)
  - HTC One (Nexus) via Google Play Store
  - Samsung Galaxy (Nexus) via Google Play Store

Android Versions & Distribution

- Google Play Store captures installed version data
- Information available at:
  - https://developer.android.com/about/dashboards/

Version	Codename	API	Distribution
2.2	Froyo	8	0.7%
2.3.3 - 2.3.7	Gingerbread	10	11.4%
4.0.3 - 4.0.4	Ice Cream Sandwich	15	9.6%
4.1.x	Jelly Bean	16	25.1%
4.2.x		17	20.7%
4.3		18	8.0%
4.4	KitKat	19	24.5%

Data collected during a 7-day period ending on September 9, 2014.
Any versions with less than 0.1% distribution are not shown.

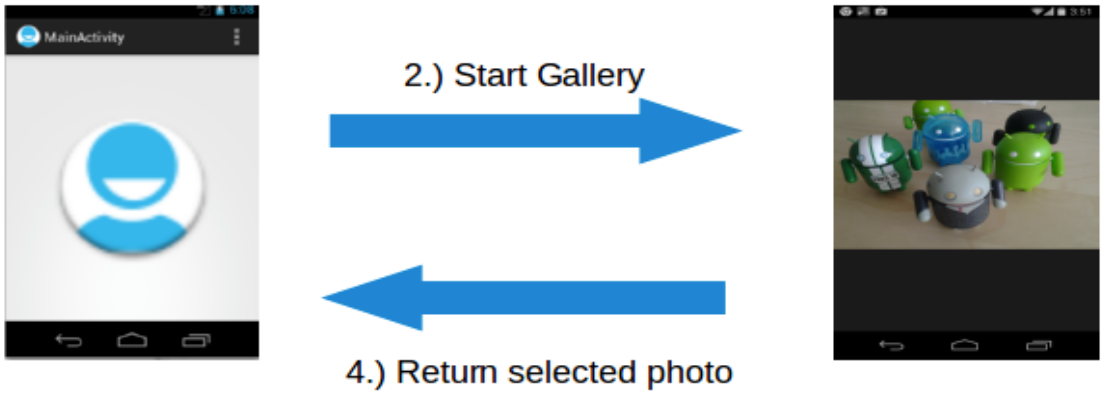


Android OS – features (some)

- Based on Linux kernel
- Supports background processing
- Provides rich user interface library
- Supports 2D and 3D graphics using the OpenGL – ES (OpenGL) standards
- Grants access to the file system as well as embedded SQLite database

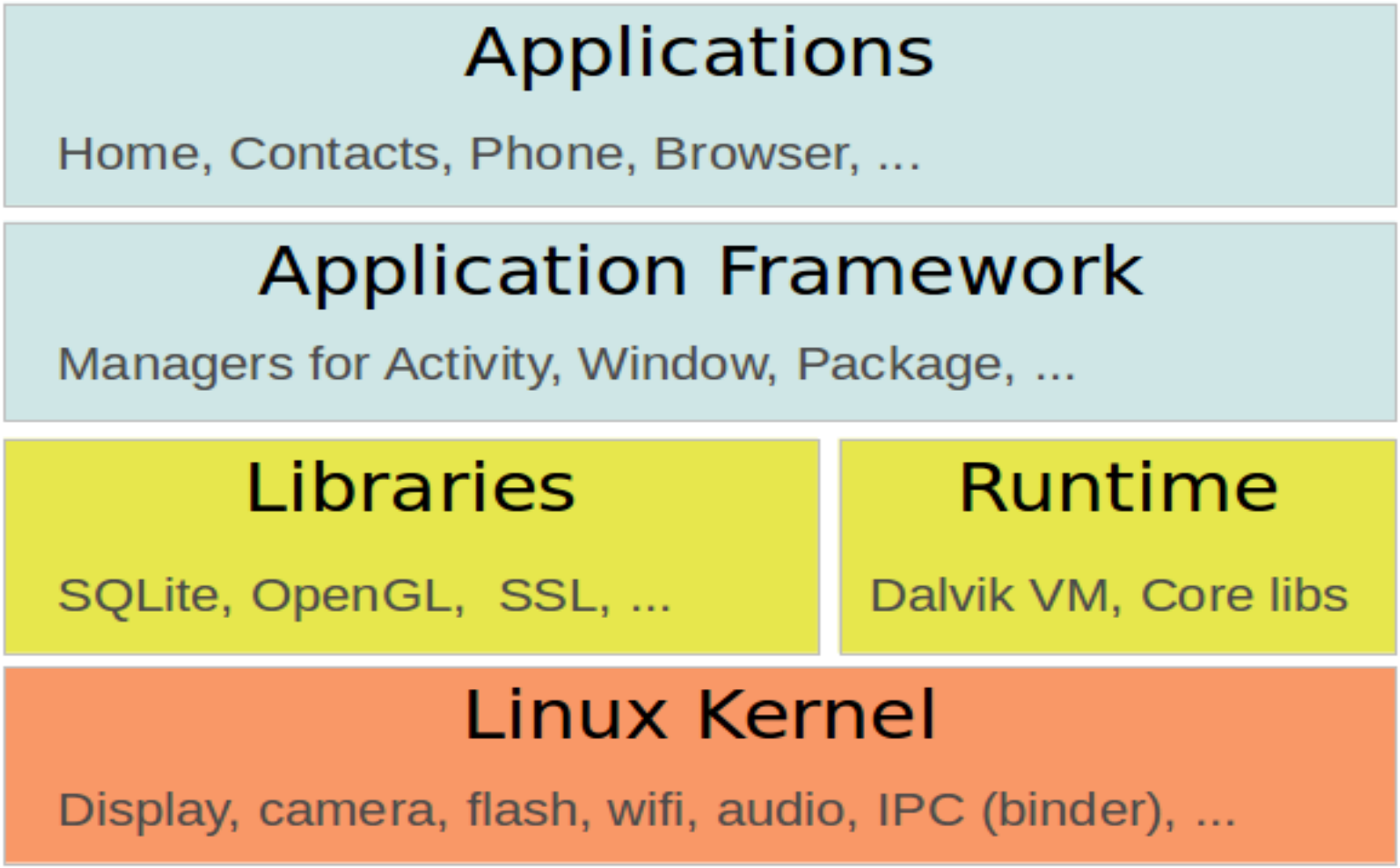
Android OS - tasks

- In Android, the reuse of other components is known as “task”.
- An application can access other Android components to achieve a task.
- E.g. a component in your application can trigger another component in the Android (gallery, e.g.)



Android OS - components

- Full software stack, usually divided into 4 layers

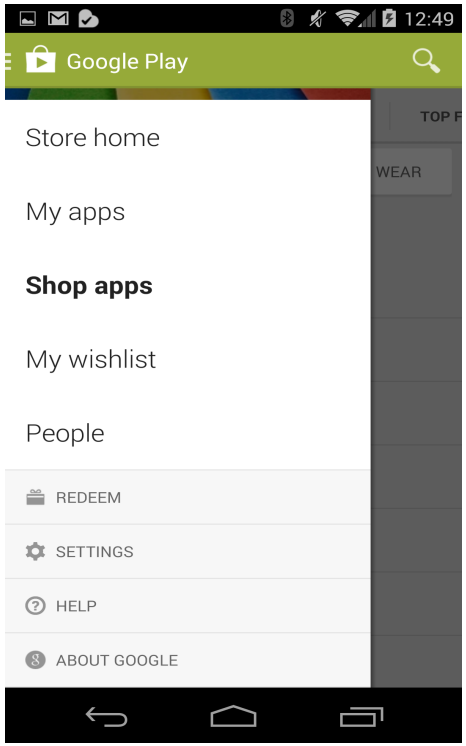


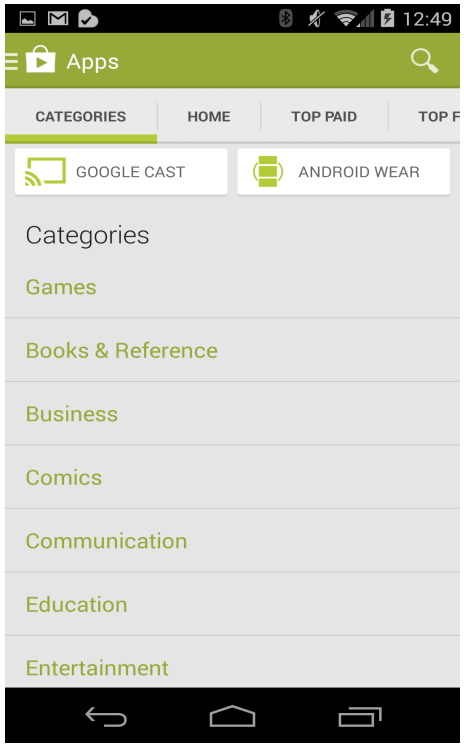
Android OS – components (2)

- The Application Framework layer encapsulates the Linux kernel, libraries, and runtime.
- The application framework layer - APIs that provide high level interaction to the Android System
- Native is C/(C++). However, the application framework APIs are provided in Java, hence the programming language of choice is Java.
- Android application developers typically works with the applications and application framework layers

Google Play

- Google Play Service - marketplace Android
  - New apps, updates, services and libraries
    - E.g. for developers - Google Maps, and synchronization of application states between devices





Android Development

- Bookmark this - http://developer.android.com

- Android SDK
  - Contains all tools to create, compile and package Android apps.
  - Most are command line tools
  - JAVA is the primary development language

- Android Debug Bridge (adb)
  - Tool that enables you to connect to virtual or real device for managing or debugging your app.

Android Development (2)

- Android Development Tools (ADT)
  - Based on Eclipse IDE
  - Set of plugins which extend Eclipse with Android capabilities
- Android Studio (AS) from Google
  - Based on IntelliJ IDE
  - Recommended for beginners (and for this class)
- Editors
  - Both ADT and AS provide specialized editors
  - Most of Android configuration are based on XML
  - Can switch between raw XML and structured UI for entering data

Android Development (3) - Exercise

- Installation and setup of IDE and Android environment
  - http://developer.android.com/sdk/index.html
  - Android Studio
    - http://developer.android.com/sdk/installing/studio.html

Android Development - Runtimes

- Dalvik Virtual Machine
  - Process VM for Android
  - Runtime that executes applications for current Android versions
  - JAVA programs are compiled to bytecode for the JVM, which are then translated to Dalvik bytecode and stored in .dex (Dalvik executables) files and .odex

- Android Run Time (ART)
  - New runtime for Android, introduced in KitKat (4.4)
  - Default runtime for new versions of Android
  - Highly optimized, > 30% more efficient than Dalvik.
  - Better garbage collection and battery life

Android Dev. – Security and Permissions

- Each app has its own unique user and group id
  - Private to this user, i.e. other apps have no access
  - Started in its own process, i.e. isolated space
  - Sharing of date between app is explicit via Android component (service or content provider)

- Permissions
  - Predefined permissions for certain tasks
  - Have different levels
    - Some granted automatically by system,
    - Others are granted by user during installation
    - Permissions are Defined in **AndroidManifest.xml** file.

Android Dev. – Android emulator and AVD

- Android emulator
  - Used to run an Android Virtual Device (AVD)

Android Dev. – Android emulator and AVD

- Android emulator
  - Used to test Android apps on different versions and configurations without access to the real hardware
  - Create AVD
    - Define configurations e.g. screen resolutions, memory, etc
    - Can create multiple configurations, and run in parallel

- Genymotion
  - http://www.genymotion.com
  - Highly recommended to use
  - Super fast Android emulator (free and premium)
  - Eclipse and Android Studio plugins

Android Dev. – Setup device for dev.

- Installation via USB
  - Enable USB debugging on your device
  - 3.2 and older: Settings -> Applications -> Development
  - On 4.0 and newer: Settings -> Developer Options
    - On 4.2 and newer, **Developer Options** is hidden by default. To enable it, go to **Settings** -> **About Phone** and tap **on Build Number** seven times. Return to previous screen and go to Developer Options.
- Install and run from IDE
- Install and run from command line
  - adb install MyFirstApp.apk
  - Make sure Android SDK platform-tools/ directory is in PATH

Android Dev. – Exercise

- Create an AVD
- Create a new Android Application
- Run on AVD
- Install and run on Android device

Android Dev. – Logging

- Android Debug Bridge (ADB)
  - logcat

Android Development – The End

- Questions?