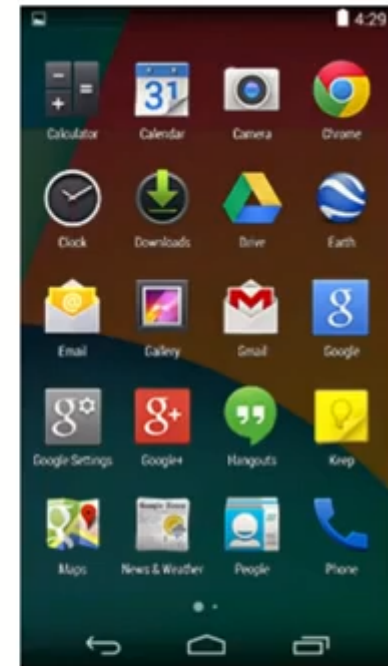


# **CENG 427 Programming of Mobile Devices**

Lecture Notes

# Android

- mobile OS maintained by **Google**
- originally purchased from Android, Inc. in 2005
- runs on phones, tablets, watches, TVs, ...
- based on **Kotlin/Java** (dev languages) and **Linux** (kernel)
- the #1 mobile OS worldwide, and now #1 overall OS worldwide!
- has over 1 million apps published in Play Store
- code is released as open source (periodically)
  - easier to customize, license, pirate, etc. than iOS



# Why develop Android App?

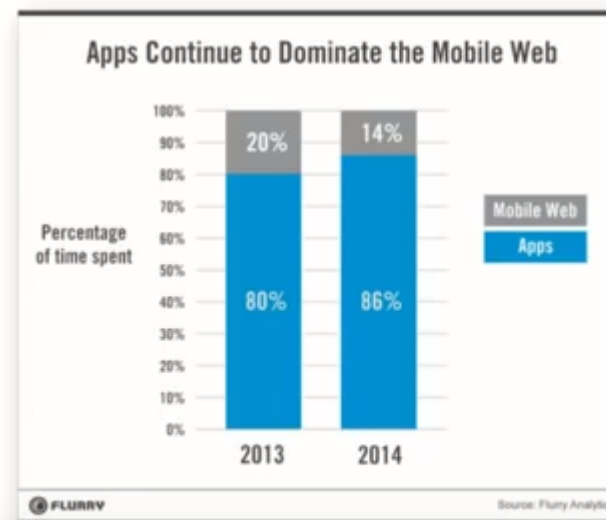
- Why not just write a **web site**? Android has a browser...
- better, snappier UI with a more consistent user experience
- able to use different kinds of widgets/controls than in a web page
- more direct access to the device's hardware (camera, GPS, etc.)
- users highly prefer apps over mobile web browsing



Mobile Web App



Native App on iOS



# Why not iOS?

Why not write apps for **iOS**, which runs on iPhones and iPads?

- free dev tools (Apple charges \$\$\$)
- more liberated app store (can make an app and put on your phone or others')
- Android has a larger install base



# Android Architecture

- Android OS provides libraries for many system features like contacts, phone dialing, notifications, 2D/3D graphics, database access, security / encryption, camera, audio, input/output, ...
- Android code is compiled into a special **Dalvik** binary format



# Android Versions

Code name	Version number(s)	Initial release date	API level
No codename	1	September 23, 2008	1
	1.1	February 9, 2009	2
Cupcake	1.5	April 27, 2009	3
Donut	1.6	September 15, 2009	4
Eclair	2.0 – 2.1	October 26, 2009	5 – 7
Froyo	2.2 – 2.2.3	May 20, 2010	8
Gingerbread	2.3 – 2.3.7	December 6, 2010	9 – 10
Honeycomb	3.0 – 3.2.6	February 22, 2011	11 – 13
Ice Cream Sandwich	4.0 – 4.0.4	October 18, 2011	14 – 15
Jelly Bean	4.1 – 4.3.1	July 9, 2012	16 – 18
KitKat	4.4 – 4.4.4	October 31, 2013	19 – 20
Lollipop	5.0 – 5.1.1	November 12, 2014	21 – 22
Marshmallow	6.0 – 6.0.1	October 5, 2015	23
Nougat	7.0 – 7.1.2	August 22, 2016	24 – 25
Oreo	8.0 – 8.1	August 21, 2017	26 – 27
Pie	9	August 6, 2018	28
Android 10	10	September 3, 2019	29

# Version Issues

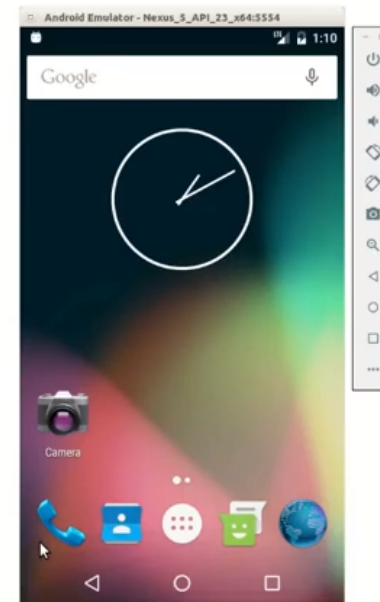
- Check your phone's version of Android:
  - Settings → System → About Device → Android version
  - "Why wouldn't my phone have the newest Android version? Can't I just update it?"
- Several companies affect whether your device is up-to-date:
  - Google; phone manufacturer; service provider; ...



- If any company in the chain doesn't want to push out an update for your device, it can become out of date.

# Virtual Devices (AVDs)

- emulator / software simulation of an Android device
- when you click "Run" in Android Studio, it builds your app, installs it on the virtual device, and loads it
- must set up virtual device first in Android Studio
- alternative: install your app on your actual Android device!
  - pro: app runs faster, better "real" test
  - con: need device plugged into dev PC



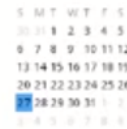


# Android Terminology

- **activity**: a single screen of UI in app
  - the fundamental unit of a GUI
- **view**: visible onscreen items
  - **widget**: GUI control such as a button
  - **layout**: invisible container to position/size widgets
- **event**: action that occurs when user interacts with widgets
  - e.g. clicks, typing, scrolling
- **action bar**: top menu of common actions



# Android Widgets



9:26:00 pm

AnalogClock

Button

CheckBox

DatePicker

DigitalClock



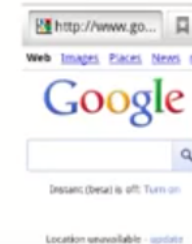
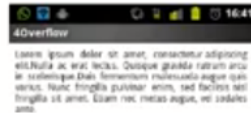
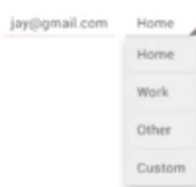
EditText

Gallery

ImageView/Button

MapView

ProgressBar



RadioButton

Spinner

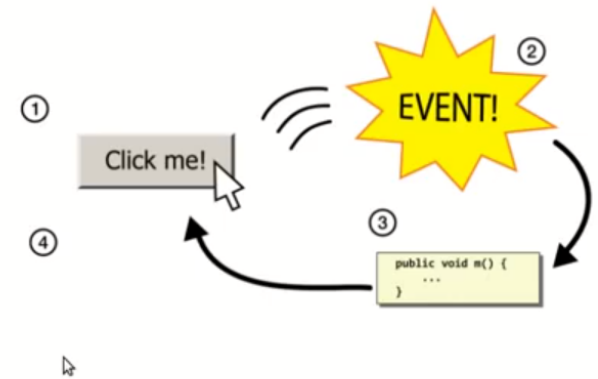
TextView

TimePicker

WebView

# Android Events

- **event:** An external stimulus your program can respond to.
  - Mouse motion / tapping, Keys pressed,
  - Timers expiring, Network data available
- **event-driven programming:** Overall execution of your program is largely dictated by user events. (GUIs)
- To respond to events, you must:
  - Write methods to handle each kind of event ("listener" methods).
  - Attach those methods to particular GUI widgets.



# Thanks

## Reference

**Stanford CS193A 2019 Course, Marty Stepp**