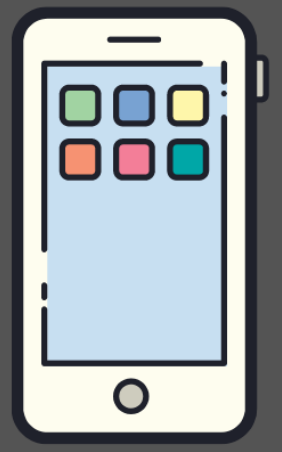


MOBILE DEVELOPMENT

Intro to Android Development and the Android Architecture

Outline

- Overview of Android Development
  - What is Android?
  - Android Versions
  - General Approach
- Overview of the Android Architecture

What is Android?

- Android is a mobile operating system that is based on a modified version of Linux
- Originally developed by a startup, Android, Inc., which was eventually purchased by Google in 2005

Image: *https://commons.wikimedia.org/wiki/File:Android_logo_2019.svg*
Course reference: *DiMarzio, J. (2017), Ross, J. (2018).*

What is Android?

- Most of the Android code was released under the open-source Apache License
  - Open use of the source code
  - Can be extended / added to
- The open nature of Android is a driving force for its popularity among device vendors

Image: https://commons.wikimedia.org/wiki/File:Android_logo_2019.svg
Course reference: *DiMarzio, J. (2017), Ross, J. (2018).*

What is Android?

- Android offers a unified approach to application development
  - Developers need only develop for Android
  - Resulting apps should be able to run on numerous different devices that support Android

Image: https://commons.wikimedia.org/wiki/File:Android_logo_2019.svg
Course reference: *DiMarzio, J. (2017), Ross, J. (2018).*

What is Android?

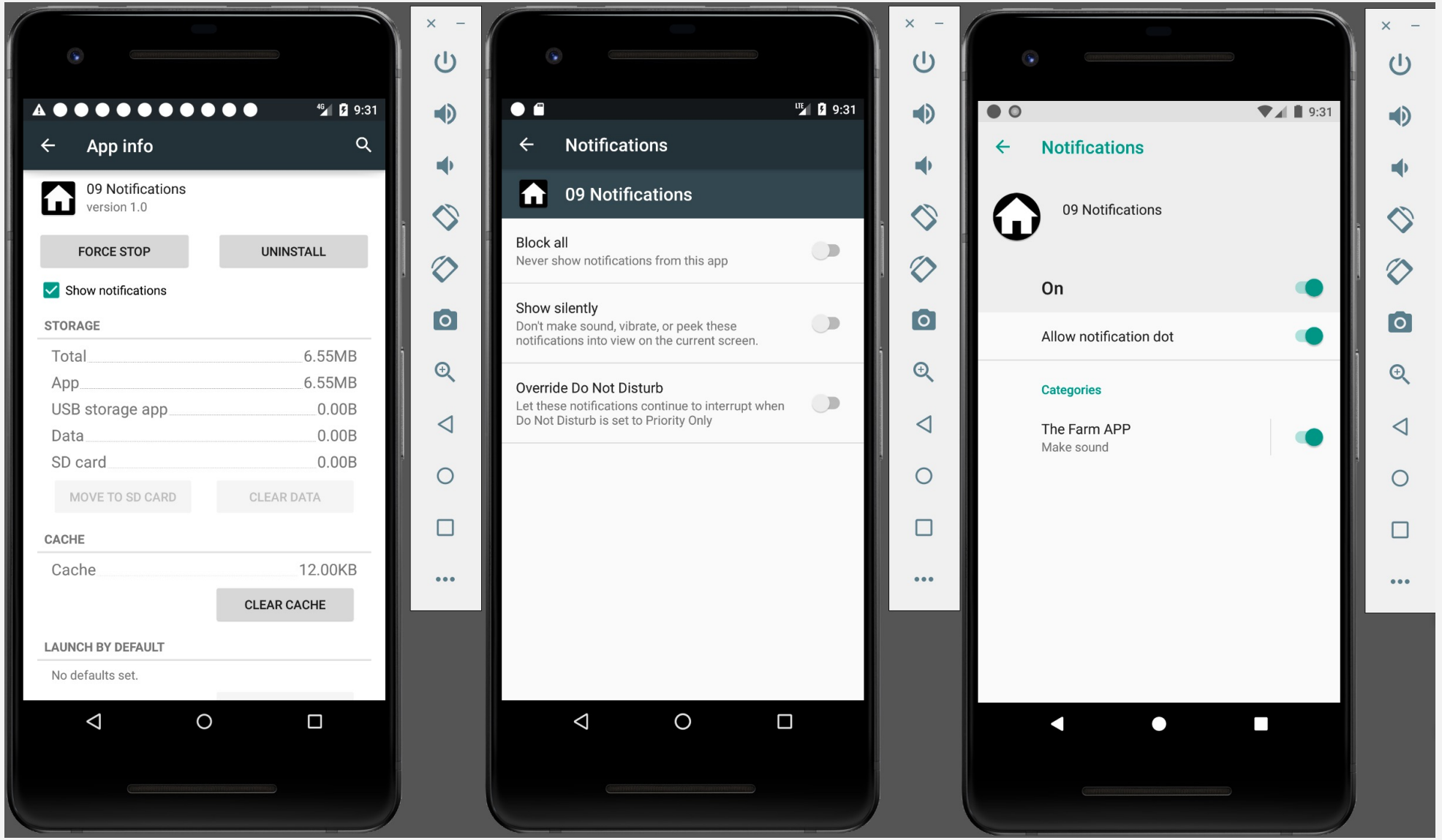
- However… there are a lot of versions of Android
  - Each has improvements over the previous
  - Some features are implemented differently

Date	Version	Nickname	API Level
Sep 2008	1.0	Android	1
Apr 2009	1.5	Cupcake	3
Sep 2009	1.6	Donut	4
Oct 2009	2.0	Eclair	5
May 2010	2.2	Froyo	8
Dec 2010	2.3	Gingerbread	9
Feb 2011	3.0	Honeycomb	11
Oct 2011	4.0	Ice Cream Sandwich	14
July 2012	4.1	Jelly Bean	16
Oct 2013	4.4	KitKat	19
Nov 2014	5.0	Lollipop	21
Oct 2015	6.0	Marshmallow	23
Aug 2016	7.0	Nougat	24
Aug 2017	8.0	Oreo	26
Aug 2018	9.0	Pie	28
Sep 2019	10.0	Android 10 / Q	29
Sep 2020	11.0	Android 11 / R	30
Oct 2021	12.0	Android 12 / S	31
Aug 2022	13.0	Android 13 / T	33

Sources: *https://source.android.com/setup/start/build-numbers and Android Platform/API Version Distribution via Android Studio (as of 20 Jan 2023)*

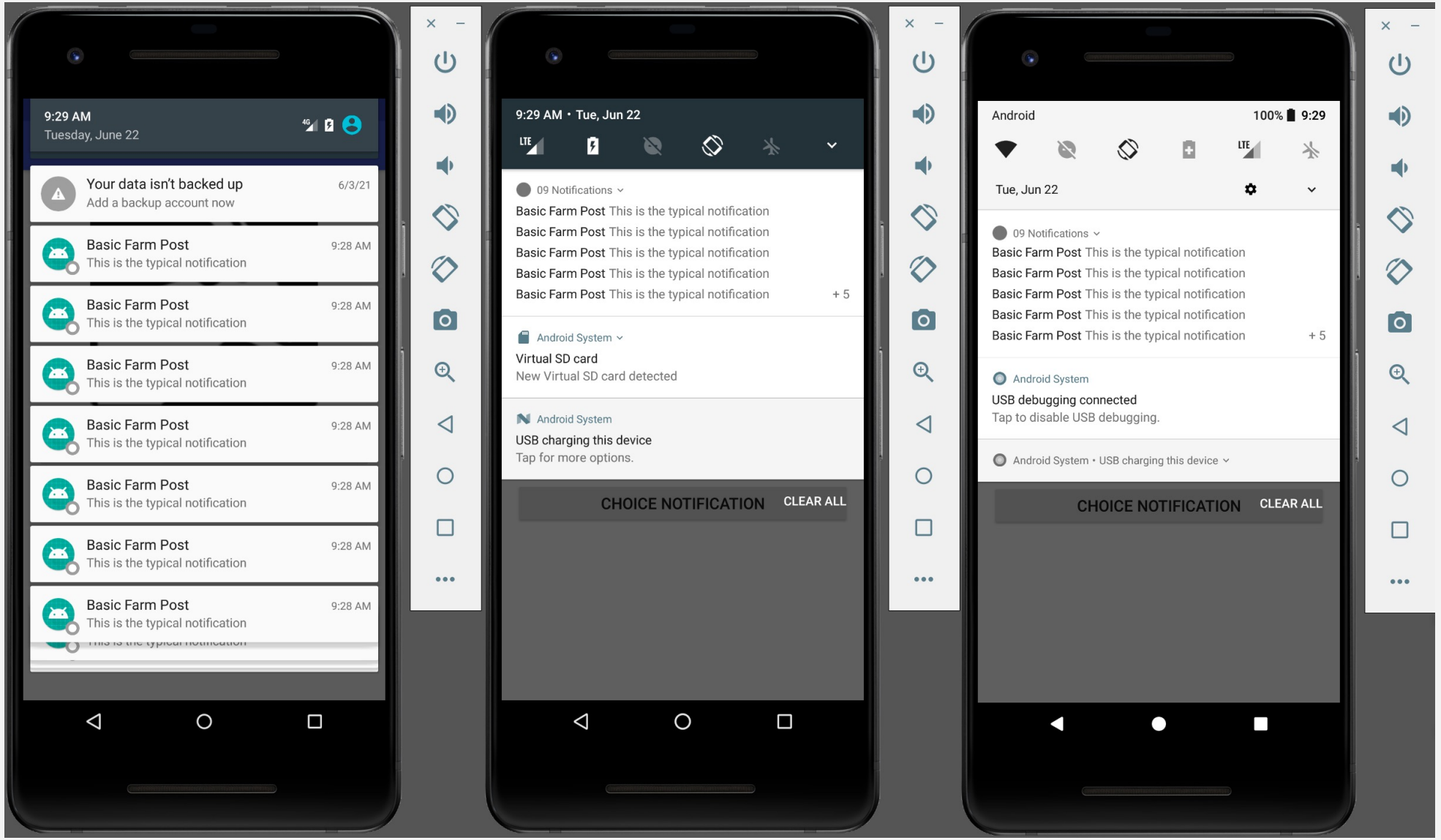
An example of changes across API…

API 21 | API 24 | API 26



An example of changes across API…

API 21 | API 24 | API 26



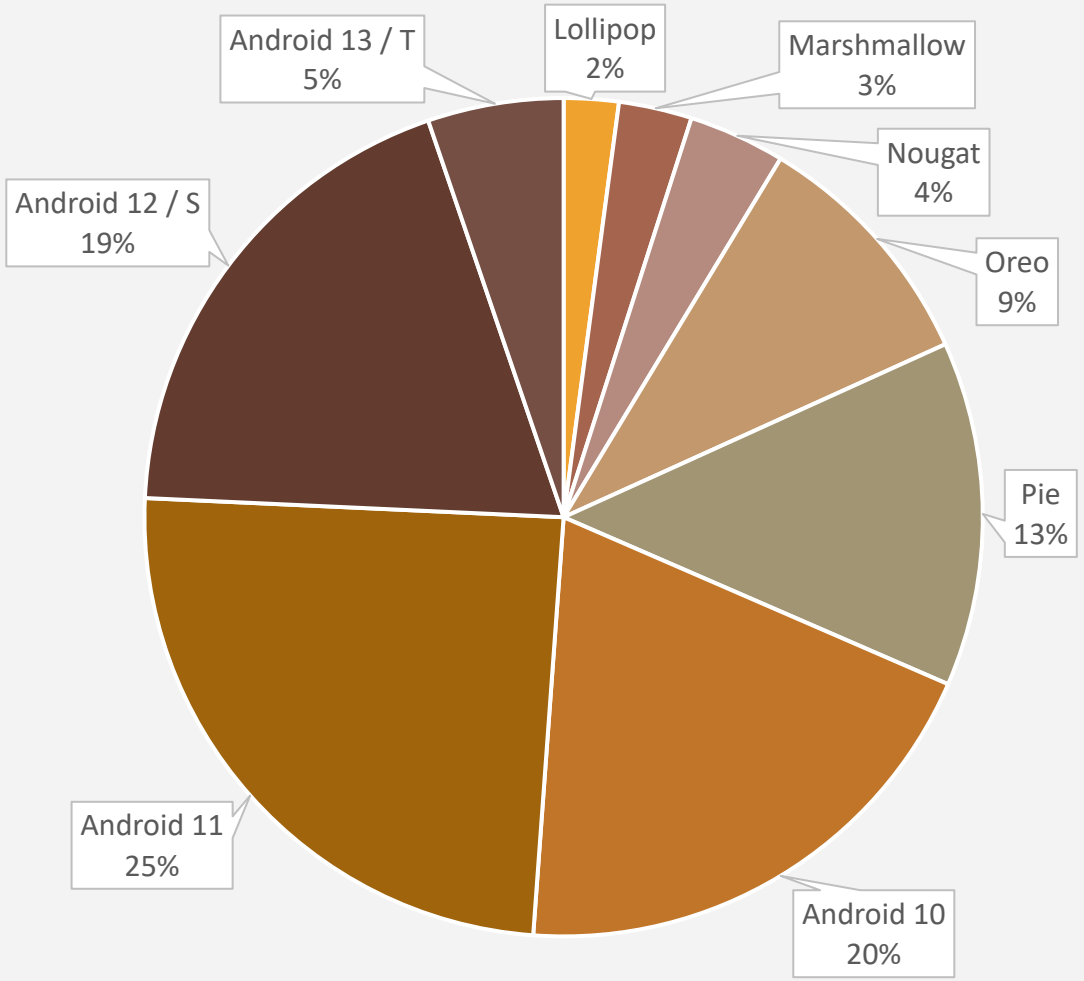
What is Android?

- While newer versions are released often, do not assume that devices are at or upgrade to the latest version

Date	Version	Nickname	API Level	Cumulative Distribution
Sep 2008	1.0	Android	1	-
Apr 2009	1.5	Cupcake	3	-
Sep 2009	1.6	Donut	4	-
Oct 2009	2.0	Eclair	5	-
May 2010	2.2	Froyo	8	-
Dec 2010	2.3	Gingerbread	9	-
Feb 2011	3.0	Honeycomb	11	-
Oct 2011	4.0	Ice Cream Sandwich	14	-
July 2012	4.1	Jelly Bean	16	-
Oct 2013	4.4	KitKat	19	-
Nov 2014	5.0	Lollipop	21	99.3%
Oct 2015	6.0	Marshmallow	23	97.2%
Aug 2016	7.0	Nougat	24	94.4%
Aug 2017	8.0	Oreo	26	90.7%
Aug 2018	9.0	Pie	28	81.2%
Sep 2019	10.0	Android 10 / Q	29	68.0%
Sep 2020	11.0	Android 11 / R	30	48.5%
Oct 2021	12.0	Android 12 / S	31	24.1%
Aug 2022	13.0	Android 13 / T	33	5.2%

Sources: *https://source.android.com/setup/start/build-numbers and Android Platform/API Version Distribution via Android Studio (as of 20 Jan 2023)*

In case you were wondering…



Data sources: *Android Platform/API Version Distribution via Android Studio*

What is Android?

- Hence, despite a unified front, development of Android applications should consider the how versions differ from each other

Date	Version	Nickname	API Level	Cumulative Distribution
Sep 2008	1.0	Android	1	-
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Sources: *https://source.android.com/setup/start/build-numbers and Android Platform/API Version Distribution via Android Studio (as of 20 Jan 2023)*

So… what is Android?

- Android is a mobile OS deployed on different devices
  - Many of these devices run on different Android APIs
- Functionality may differ from version to version
  - As developers, we'd need to be aware that the apps we develop may need to be structured different to accommodate more users
- However, changes in versions isn't that big of an issue
  - Its just important that we have this in mind when learning mobile development.

Questions so far?

Android Architecture

- Linux kernel
  - Contains all the low-level device drivers for hardware components
- Hardware Abstraction Layer (HAL)
  - Provides standard interfaces that expose device hardware capabilities to the higher-level Java API framework
  - Consists of modules, which implements an interface for a specific type of hardware component

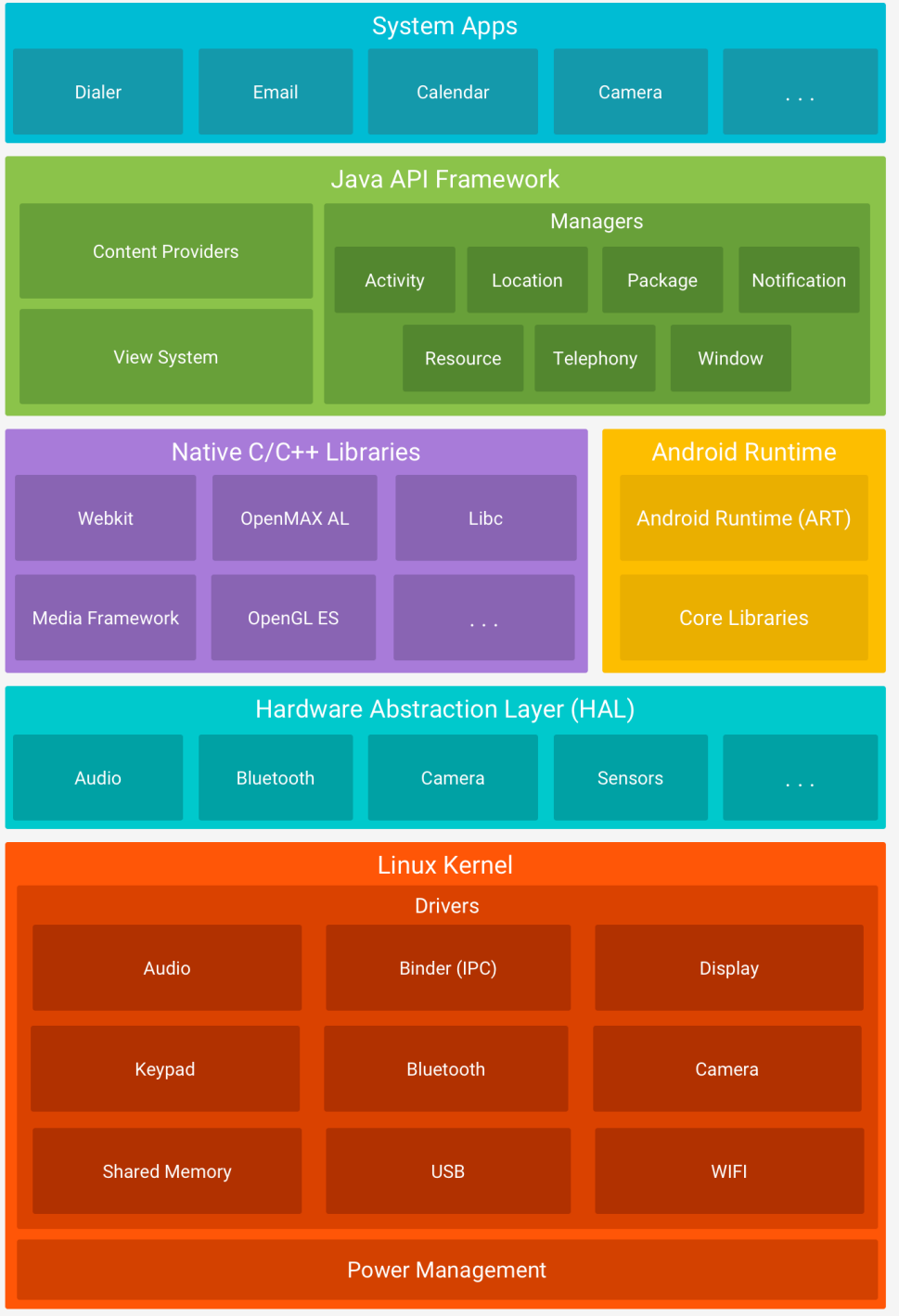

Image: *https://source.android.com/setup*
Course reference: *DiMarzio, J. (2017)*
Other references: *https://developer.android.com/guide/platform*

Android Architecture

- Android Runtime / Dalvik (DVM)
  - Responsible for translating high-level to low-level commands
    - .java -> .class -> .dex -> machine code
  - Each app runs in its own process and with its own instance in the VM
    - x ≥ API 21 uses ART
    - x ≤ API 20 uses DVM

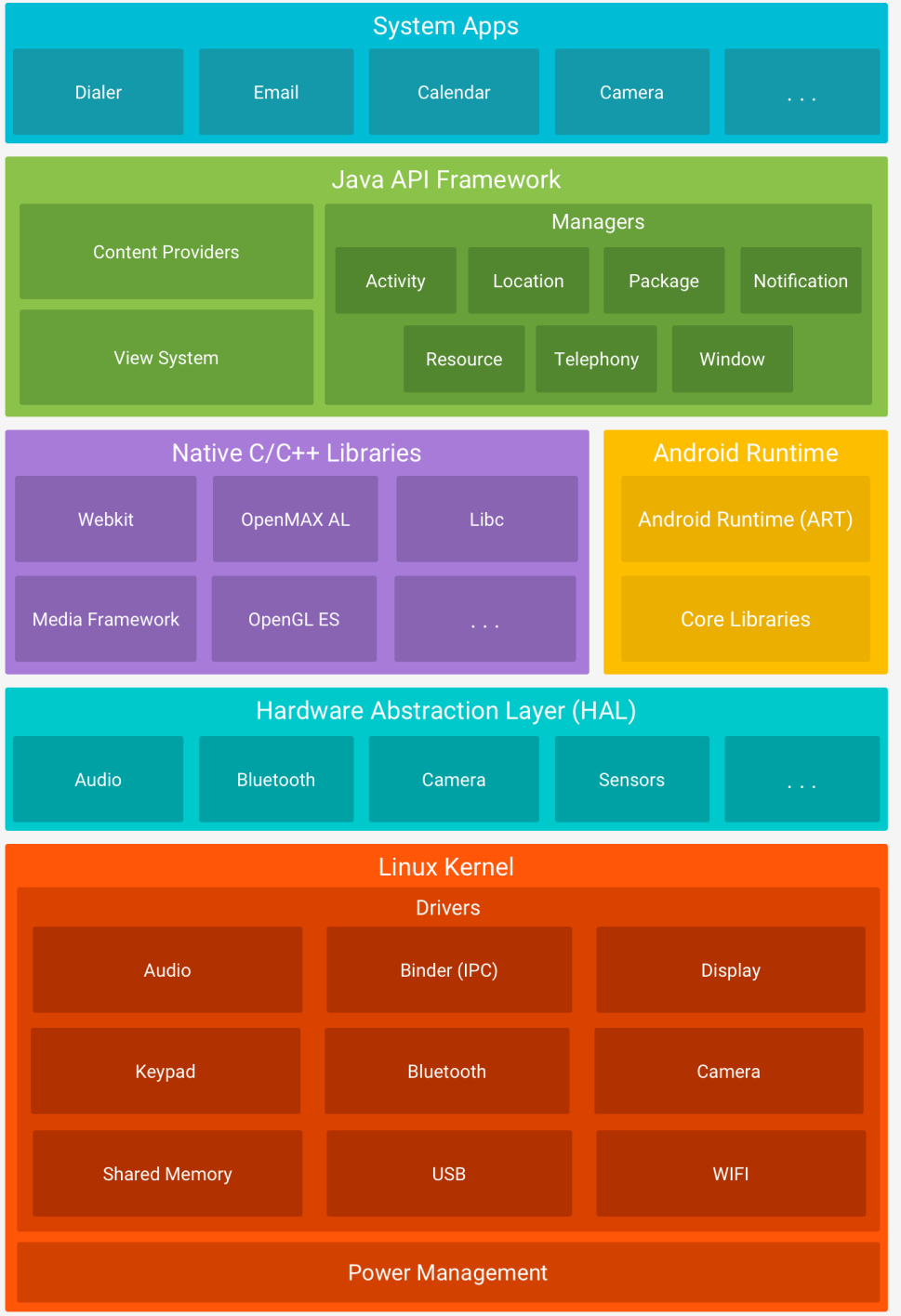

Image: *https://source.android.com/setup*
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Android Architecture

- Libraries
  - Compose of libraries written in Java and C/C++, which allow apps access to different components and services
  - Examples:
    - OpenGL -> Graphics
    - Webkit -> Web browsing
    - SQLite -> Database support

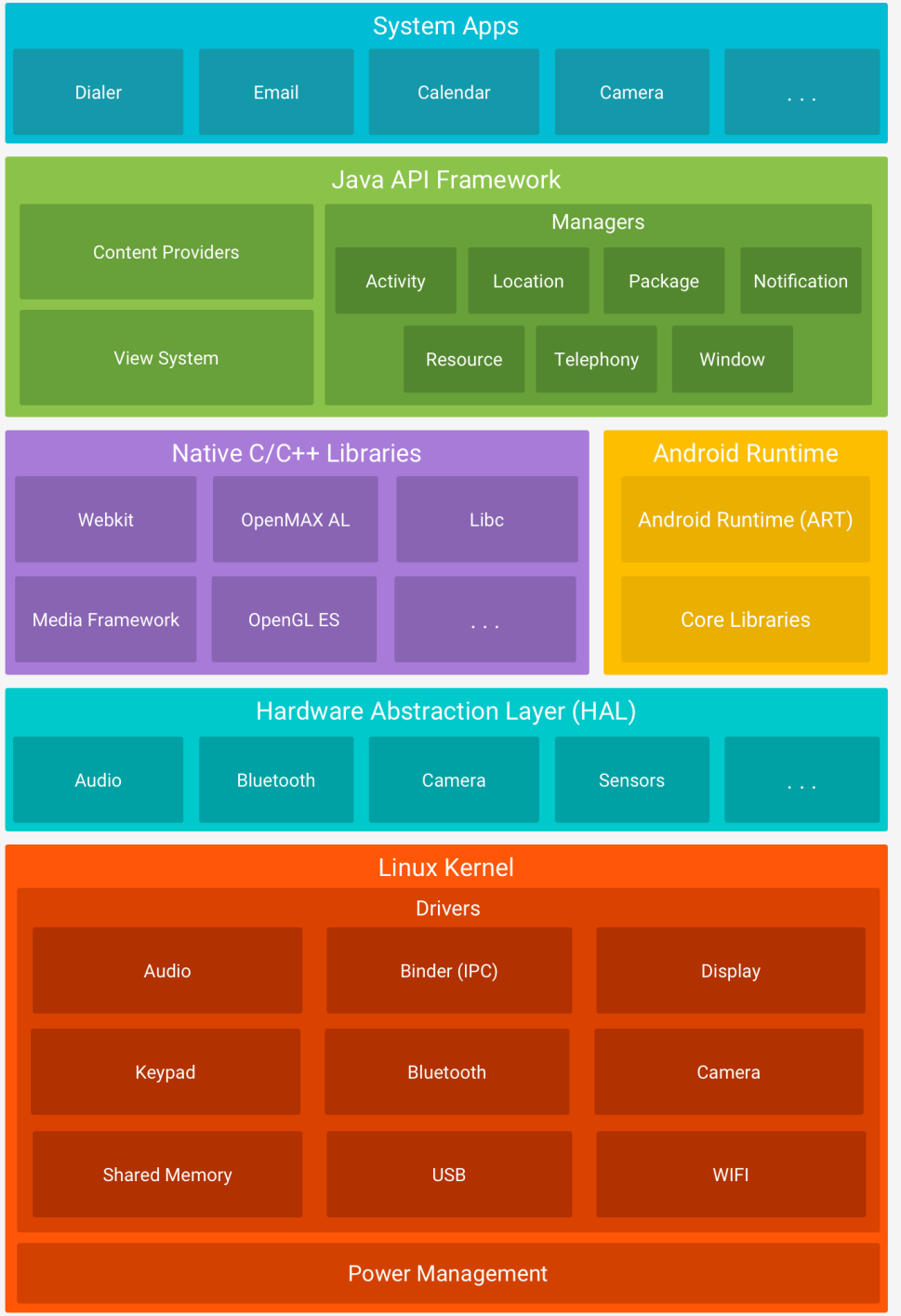

Image: *https://source.android.com/setup*
Course reference: *DiMarzio, J. (2017)*
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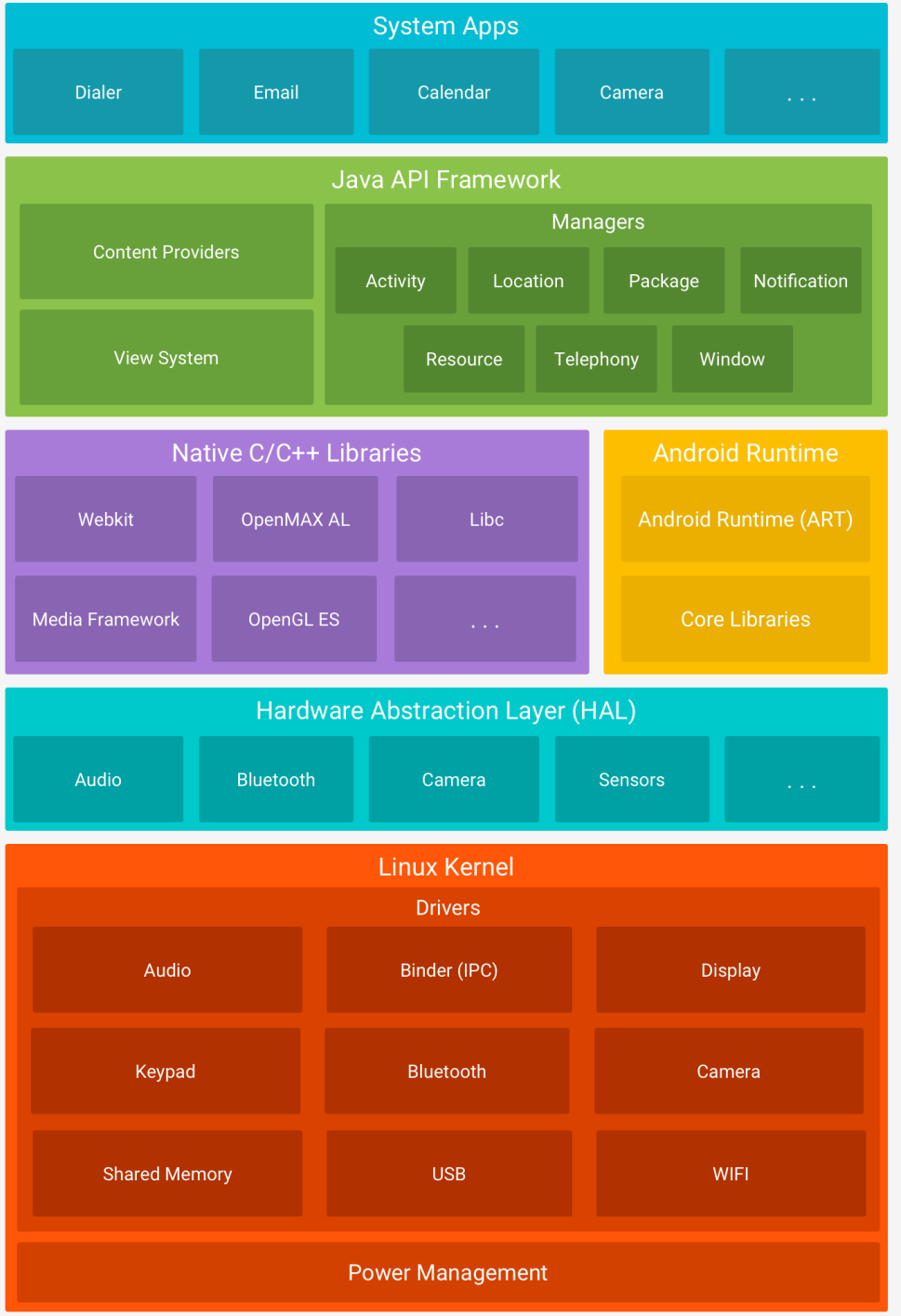
Android Architecture

- Java API Framework
  - The entire feature-set of the Android OS is available through APIs written in the Java language
    - Content providers
    - View system
    - Different managers



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Course reference: *DiMarzio, J. (2017)*
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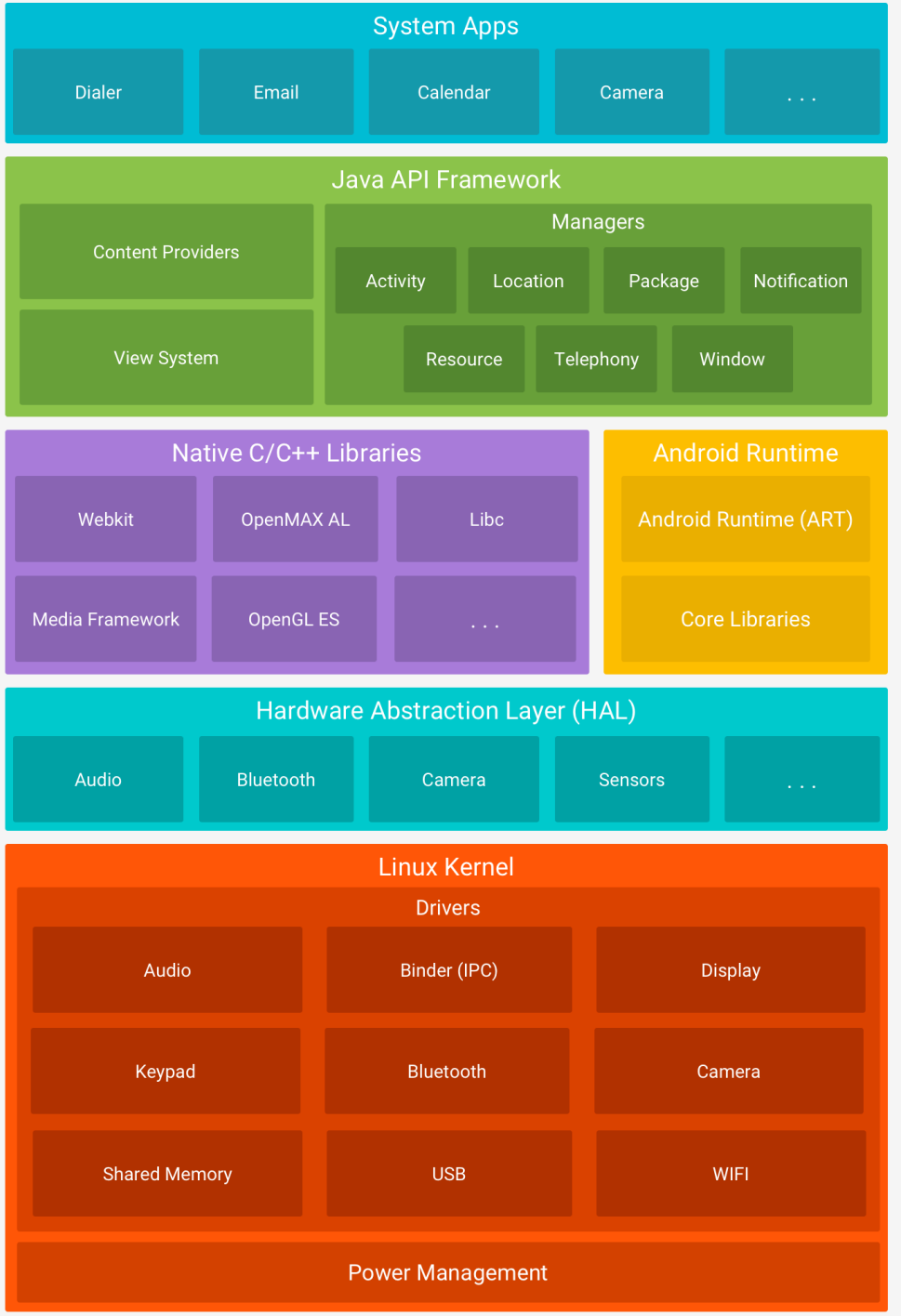
Android Architecture

- System Application
  - Android comes with a set of core apps for email, SMS messaging, calendars, internet browsing, contacts, and more
    - This layer also includes apps that were downloaded and installed
  - Aside from usage by users, core app functionalities can be use by developers for their own app



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Questions so far?

Thanks and see you on campus next session! ☺