Mobile Applications Development
CSCI 448
Lecture 00

Android Overview

Dr. Jeffrey Paone

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- Office Hours: T 1-3, R 10-12, by appointment
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Google AADC

- Associate Android Developer Certification

GOOGLE CERTIFIED

Jeffrey Paone

has successfully completed the Google Developers Certification Program requirements and is recognized as an

Associate Android Developer

Website

- https://cs-courses.mines.edu/csci448/

CSCI 448 - Mobile Application Development

Spring 2023

Home | Syllabus | Assignments | Schedule | Resources | Links

Announcements

01/09/2023

Assignment and Lab due dates posted.

Final Project details, deliverables, and due dates posted.

The Schedule page has been posted with daily topic list, assigned & due dates, daily readings, and

Required Textbook

- **Kickstart Modern Android Development with Jetpack and Kotlin First Edition**
- https://www.amazon.com/Kickstart-Modern-Android-Development-Jetpack/dp/1801811075
  - Amazon Print $44.99
  - Kindle $22.39
- https://www.packtpub.com/product/kickstart-modern-android-development-with-jetpack-and-kotlin/9781801811071
  - Packt eBook $5 / mo (currently)
  - Print + eBook $44.99

What To Expect

- Project Based
  - 13 Lab Tutorials spanning 5 apps
  - 4 Individual Assignments spanning 4 apps
  - 1 Team Project spanning 1 app
    - Details will follow…it starts Friday and goes all semester!
- Three Take Home Exams (details to follow)
  - 2/27 – 3/03
  - 4/03 – 4/07
  - 4/24 – 4/28

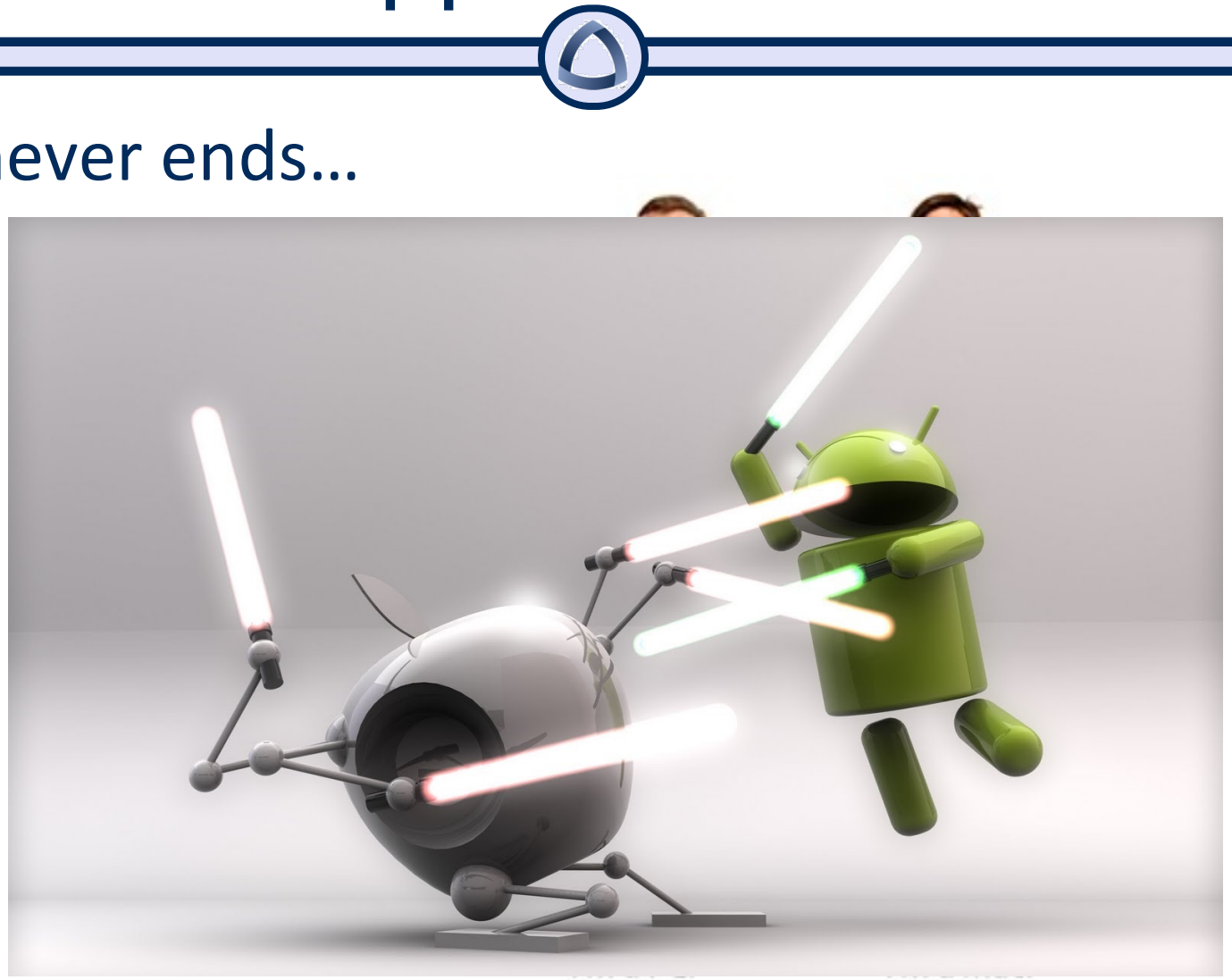
Grading

- 40% Programming Assignments
- 20% Labs
- 20% Final Project
- 15% Exams
- 5% Participation

Computing / Labs

- CK 130, Computer Commons set up for mobile development
- No Device Required
  - Can use virtual emulators
- Can set up personal computer – recommended!

iOS vs Android

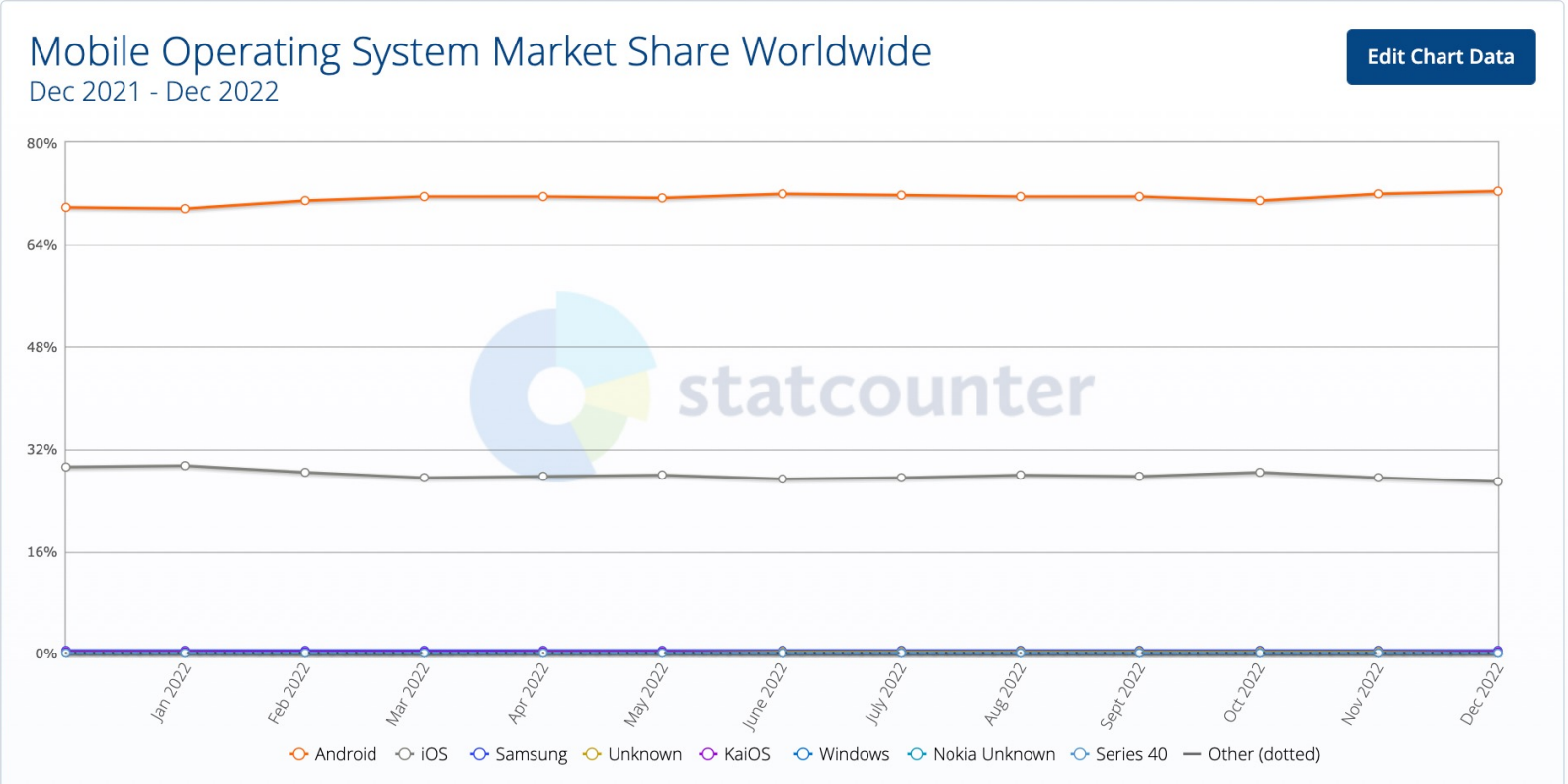


- It never ends…

iOS vs Android (as of Dec 2022)

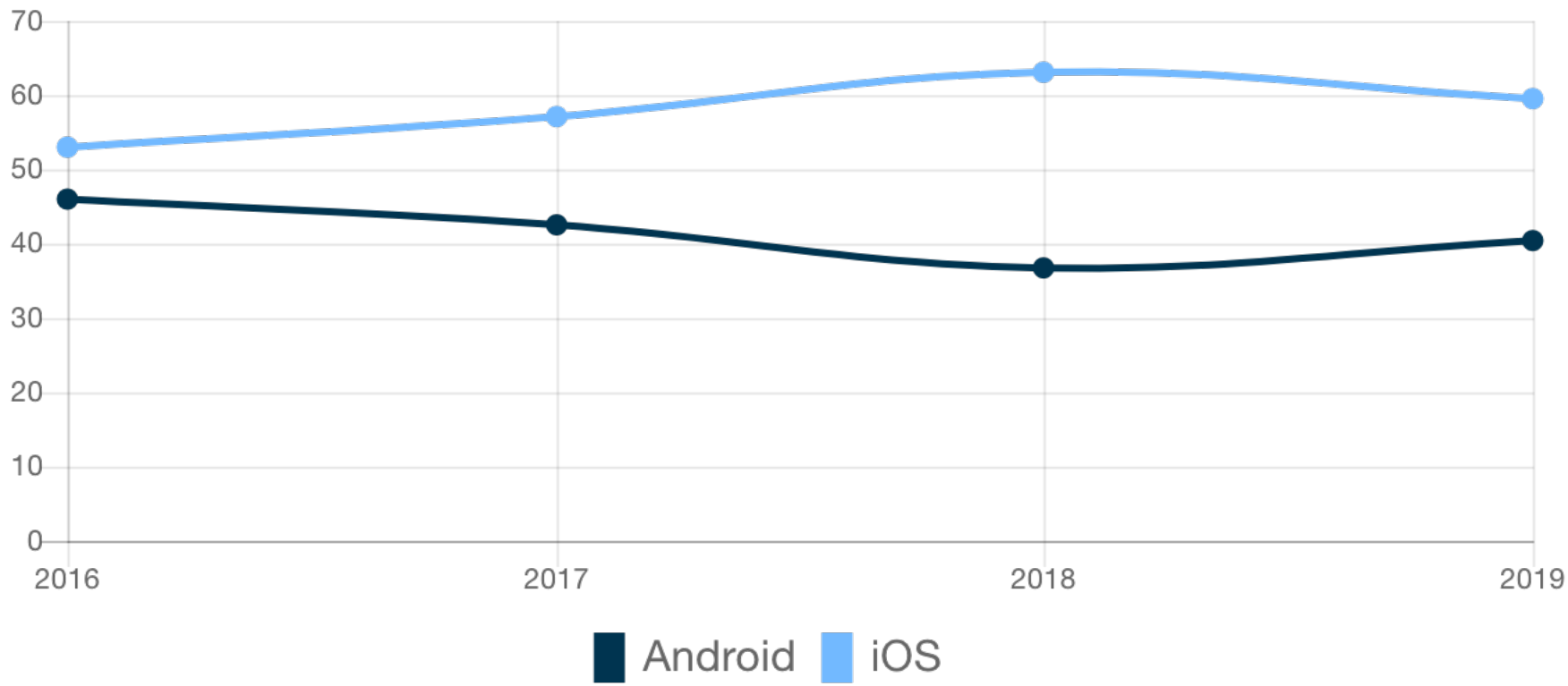
Android	iOS	Samsung	Unknown	KaiOS	Windows
72.37%	26.98%	0.36%	0.13%	0.11%	0.02%

Mobile Operating System Market Share Worldwide - December 2022



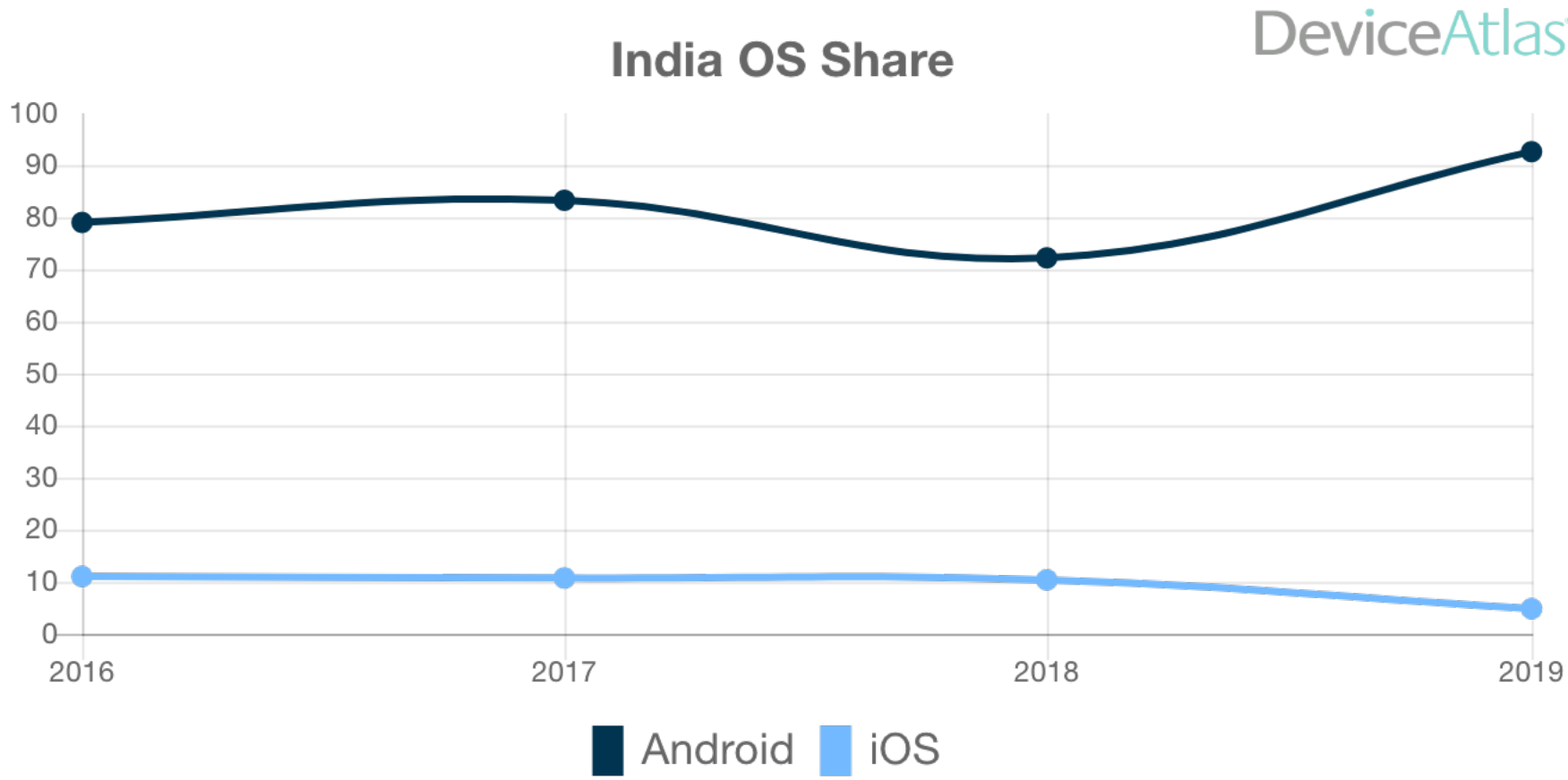
http://gs.statcounter.com/os-market-share/mobile/worldwide/

US Stats

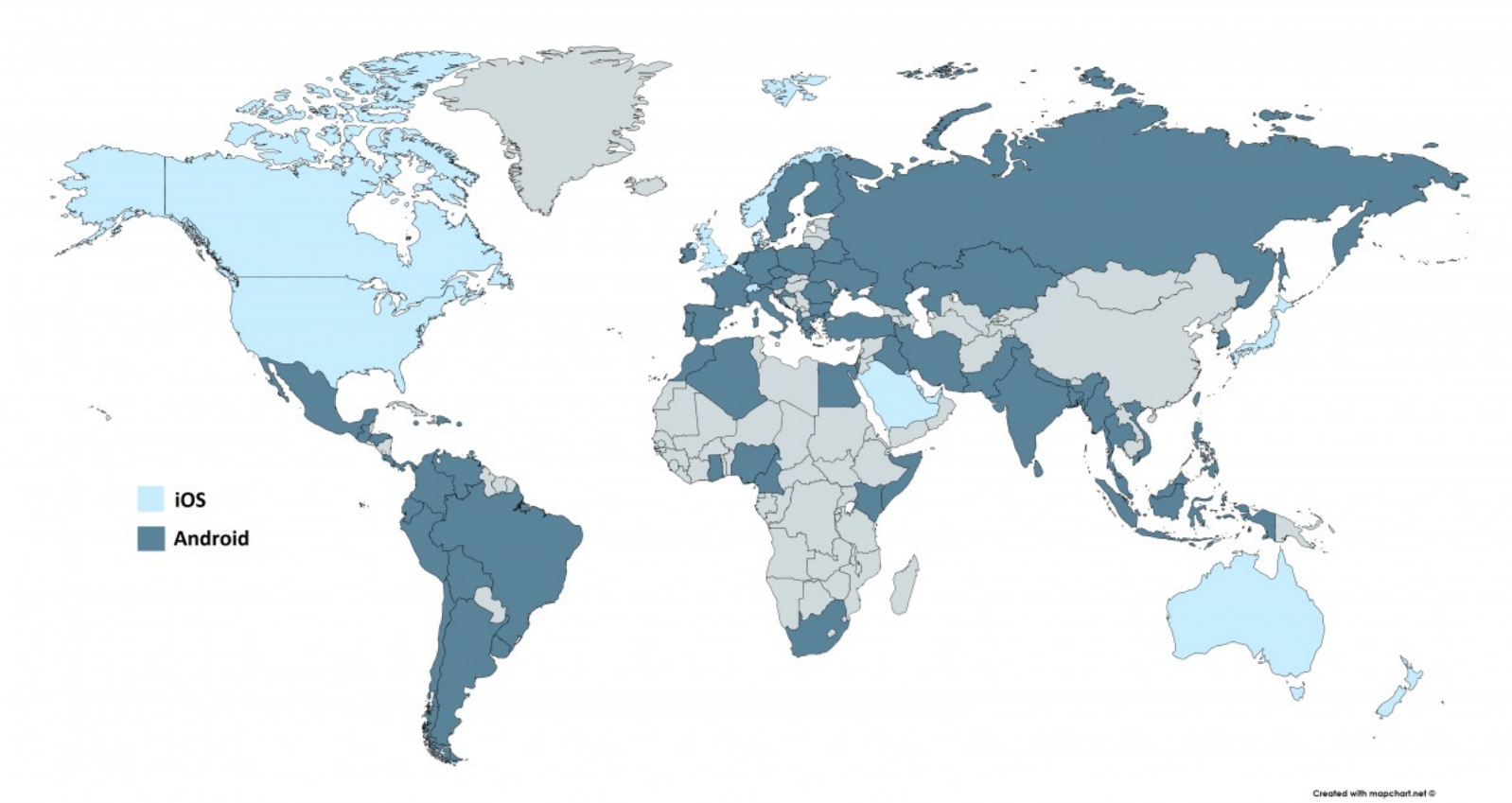


https://deviceatlas.com/blog/android-v-ios-market-share

India Stats


India OS Share
DeviceAtlas
100
90
80
70
60
50
40
30
20
10
0
2016
2017
2018
2019
Android
iOS

iOS vs Android (Worldwide 2019)



https://deviceatlas.com/blog/android-v-ios-market-share

iOS vs Android (Worldwide 2022)

Country	iOS	Android
North America	53.55%	46.24%
United States	59.71%	40.09%
Canada	50.90%	48.74%
South America	11.36%	88.37%
Asia	15.85%	83.53%
Japan	62.79%	37.07%
Europe	27.00%	72.87%
UK	46.60%	53.24%
Germany	29.01%	70.34%
Africa	10.16%	87.22%
Australia	41.40%	58.80%

https://www.sossupport.net/blog/android-vs-ios-market-share-per-country-2022/

We'll Do Native Android Development

- Android Studio free to download
- Free to deploy to any physical device
- ❖Can develop on any OS
- One time $25 Google Dev. Fee
- Opposed to iOS:
  - Develop on Mac
  - $99/yr to be Apple Developer
    - $299/yr to be Enterprise

Topics To Cover*

- Kotlin
- Program Architecture & Activity Lifecycle
- Compose for UI
- Jetpack Libraries & Components
- Theming
- Network Resources
- Locations & Maps
- Databases (Local & Cloud)
- Notifications
- Testing & Publishing Your App
- And more!

*in no particular order and may change as semester goes on

Beyond Android

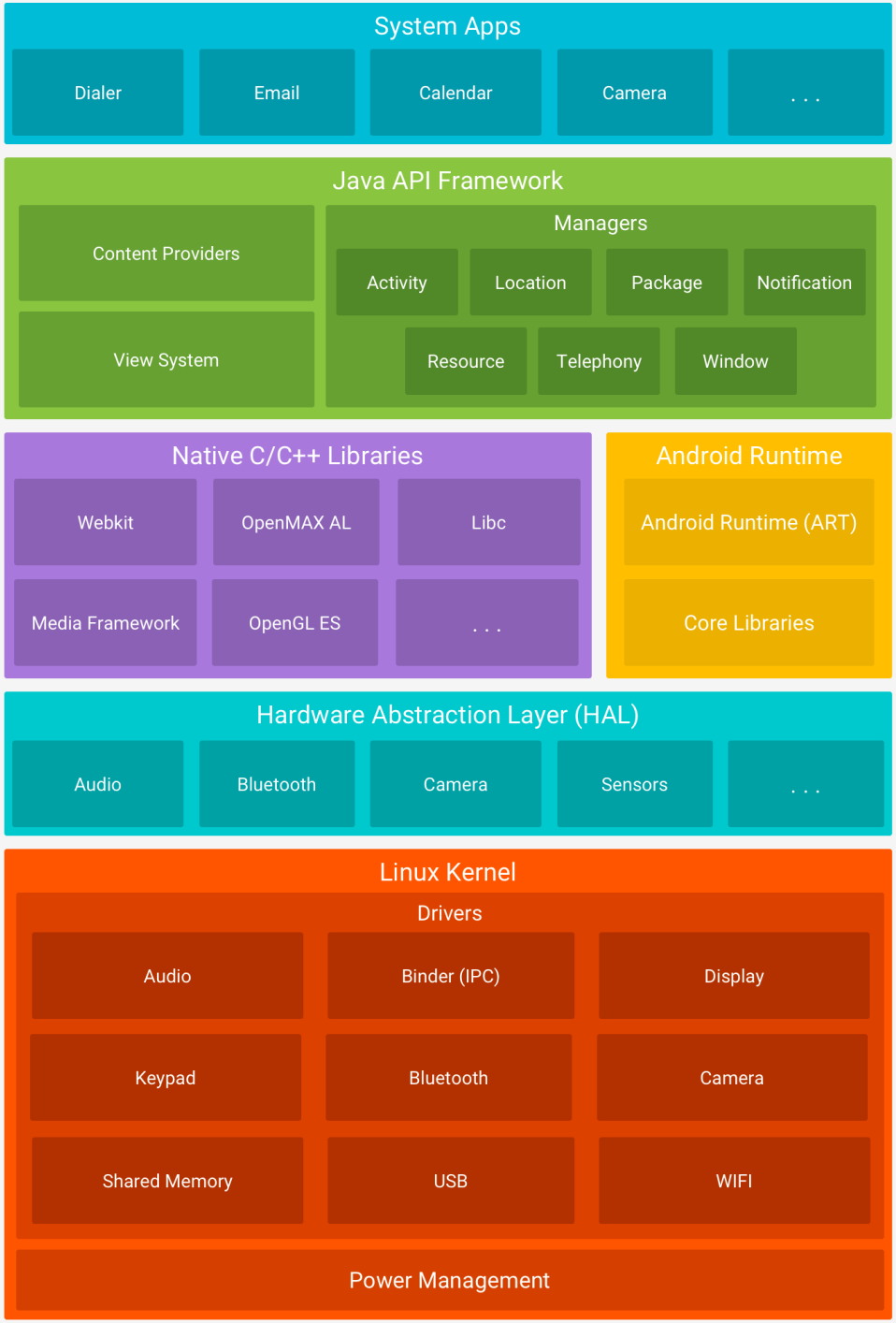
- App structure & design → Software Engineering
  - Design Patterns
    - Creational
    - Structural
    - Behavioral
  - Design Principles

- What is the relationship between components? Why? Benefits?

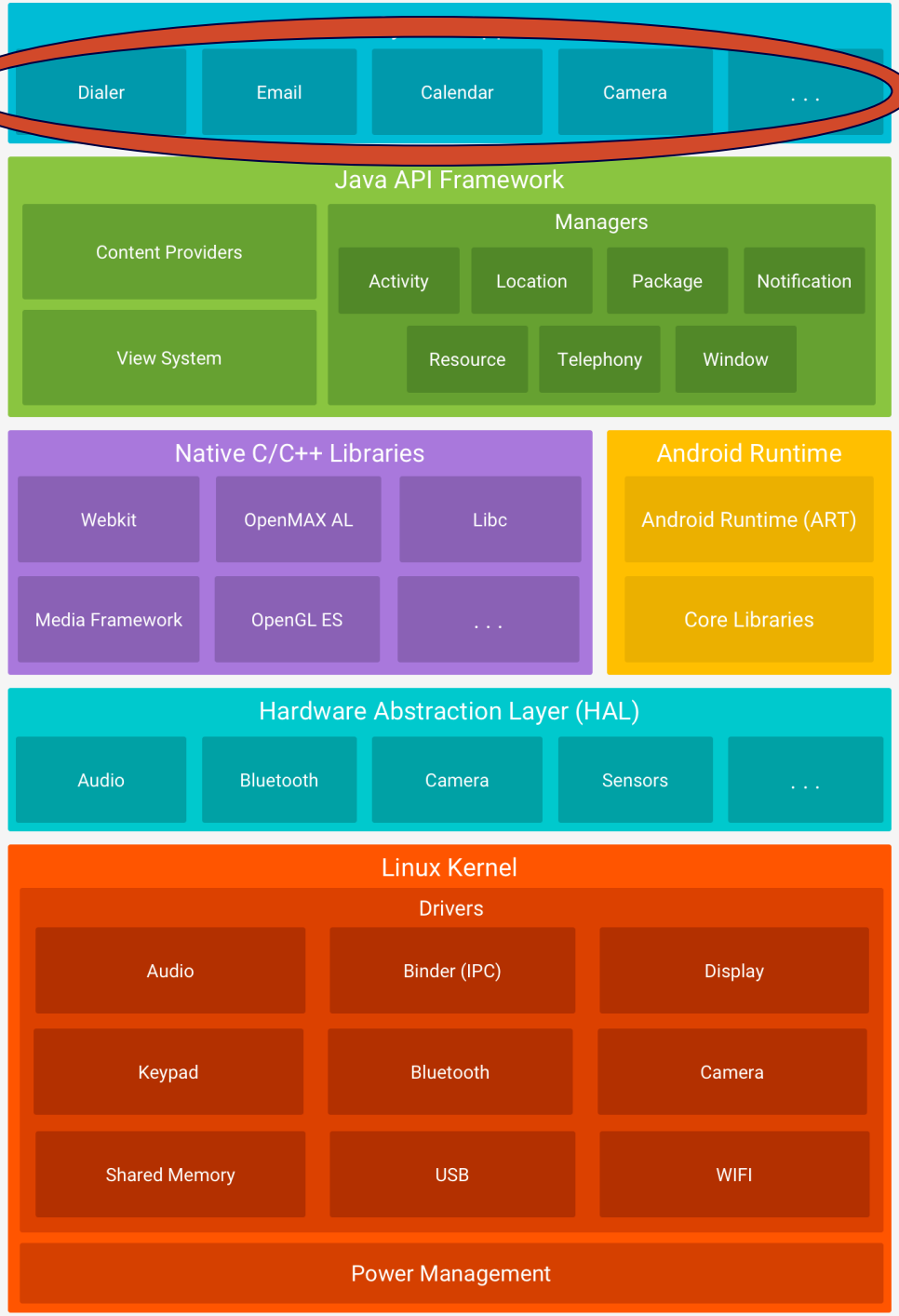
Android

- A Software Stack for mobile devices
- Uses Linux to provide core services
  - Security
  - Memory management
  - Process management
  - Power management
  - Hardware drivers

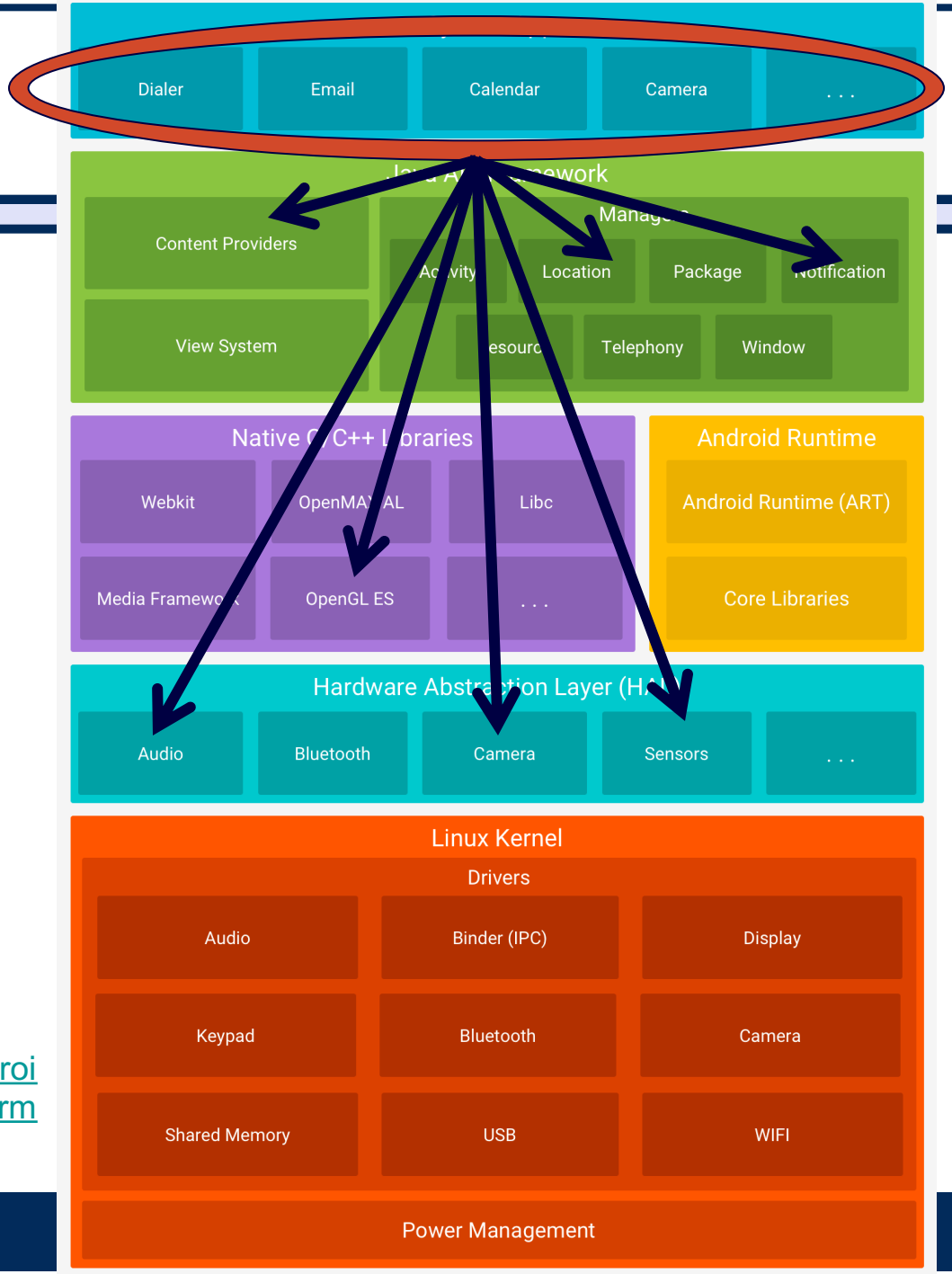
- A Softw
- Uses Lir
  - Securi
  - Memc
  - Proces
  - **Power**
  - Hardw



https://developer.android.com/guide/platform



https://developer.android.com/guide/platform



https://developer.android.com/guide/platform

Android Features

- **Application Framework** enabling reuse and replacement of components
- **Virtual machine** optimized for mobile devices
  - <=4.4 (KitKat): **Dalvik**
  - >=5.0 (Lollipop): **Android Runtime (ART)**
- **Integrated browser** based on WebKit engine
- **Optimized graphics** using custom 2D library and OpenGL ES 3D library (or Vulkan)
- **SQLite** for structured data storage
- **Media support** for common audio, video, image formats
- **Bluetooth, 3/4/5G, WiFi, Camera, GPS, Compass, gyroscope, accelerometer, other sensors** (hardware dependent)
- **IDE** including device emulator and debugging tools

Android Runtime

- Each app its own Linux process
- Each process has its own VM
- Permissions set so app's files visible only to that app

A Brief History of Android

- 2002 – T-Mobile Sidekick released
- 2003 – Rubin starts An
- 2005 – Google buys Ar
- 2007 – iPhone release
- 2008 – T-Mobile G1 &
- 2009 – Cupcake, Donu
  - Google Maps, Speech-t
- 2010 – Nexus One & F
  - Tethering

A Brief History of Android

- 2011 – Ice Cream Sandwich (SDK 4.0)
  - UI overhaul, Near Field Communication
- 2012 – Jelly Bean (SDK 4.1)
  - Google Now
- 2013 – KitKat (SDK 4.4)
  - “Ok, Google”, smaller OS footprint
- 2014 – Lollipop (SDK 5.0)
  - Material Design (UI overhaul)

A Brief History of Android

- 2015 – Marshmallow (SDK 6.0)
  - Split screen
  - Run time app permissions
- 2016 – Nougat (SDK 7.0)
  - Doze mode (battery saver!)
  - Flatter UI
  - Quick Switch Apps
  - JIT compiler (faster)
  - And more emojis

A Brief History of Android

- Oct. 2017 – Oreo (SDK 8.0)
  - Faster
  - Picture in Picture
  - Instant Apps
  - Power Management
  - And yes, more emojis
  - Plus more

A Brief History of Android

- Aug. 2018 – Pie (SDK 9.0)
  - Power Management
  - Dark mode (it's all the rage)
  - Indoor Navigation
  - Multicamera support
  - Other nifty features
  - And 157 more emojis

A Brief History of Android

- Oct. 2019 – 10 (SDK 10.0 – Quince Tart)
  - Bye bye back button (gesture based navigation)
  - System wide dark mode
  - Theme options!
  - Live Caption in real time
  - Permission use frequency
  - Better sharing
  - Better support for foldable phones
  - And more!

A Brief History of Android

- Oct. 2020 – 11 (SDK 11.0 – Red Velvet Cake)
  - Trash folder
  - Notification updates
  - Native Screen Recording
  - Permission updates

A Brief History of Android

- Oct. 2021 – 12 (SDK 12.0 – Snow Cone)
  - UI Updates
  - Accessibility
  - Permission updates
  - Harder, better, faster, stronger
- Oct. 2022 – 13 (SDK 13.0 – Tiramisu)
  - Apps need permission to notify you
  - MaterialYou

Android API Levels

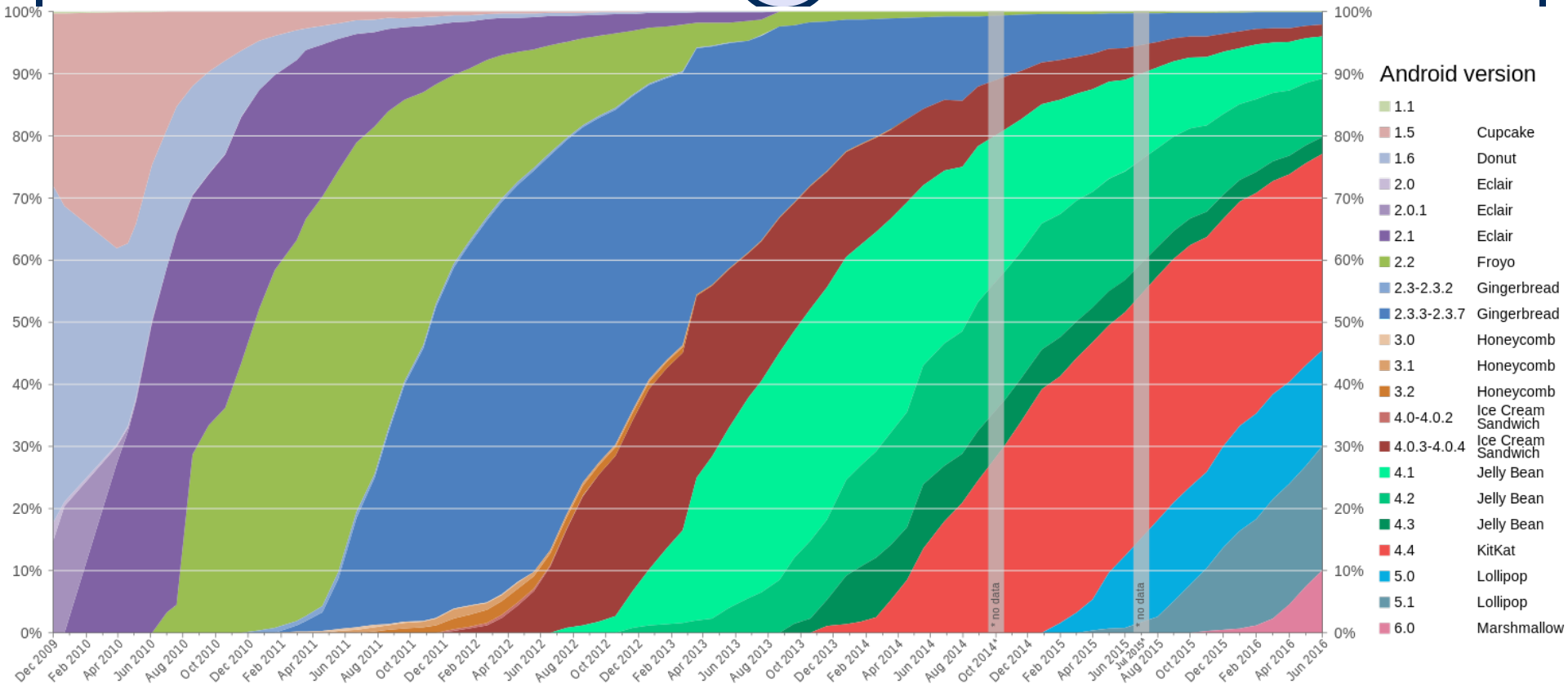
Codename	Version	API level/NDK release
Android13	13	API level 33
Android12L	12	API level 32
Android12	12	API level 31
Android11	11	API level 30
Android10	10	API level 29
Pie	9	API level 28
Oreo	8.1.0	API level 27
Oreo	8.0.0	API level 26
Nougat	7.1	API level 25
Nougat	7.0	API level 24
Marshmallow	6.0	API level 23
Lollipop	5.1	API level 22
Lollipop	5.0	API level 21
KitKat	4.4 - 4.4.4	API level 19
Jelly Bean	4.3.x	API level 18
Jelly Bean	4.2.x	API level 17
Jelly Bean	4.1.x	API level 16
Ice Cream Sandwich	4.0.3 - 4.0.4	API level 15, NDK 8
Ice Cream Sandwich	4.0.1 - 4.0.2	API level 14, NDK 7
Honeycomb	3.2.x	API level 13
Honeycomb	3.1	API level 12, NDK 6
Honeycomb	3.0	API level 11
Gingerbread	2.3.3 - 2.3.7	API level 10
Gingerbread	2.3 - 2.3.2	API level 9, NDK 5
Froyo	2.2.x	API level 8, NDK 4
Eclair	2.1	API level 7, NDK 3
Eclair	2.0.1	API level 6
Eclair	2.0	API level 5
Donut	1.6	API level 4, NDK 2
Cupcake	1.5	API level 3, NDK 1
(no codename)	1.1	API level 2
(no codename)	1.0	API level 1

https://source.android.com/docs/setup/about/build-numbers

Andr ation

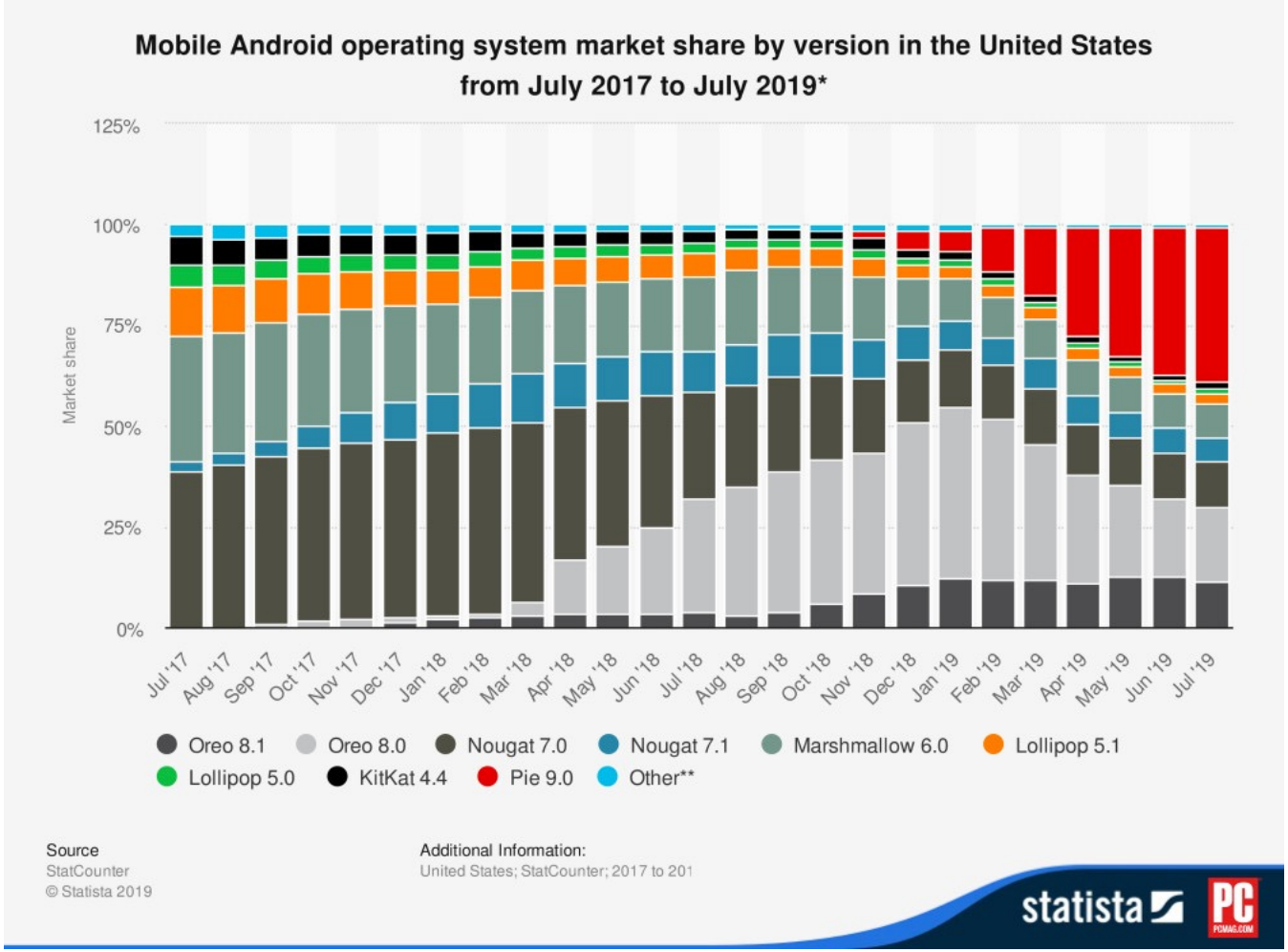
ANDROID PLATFORM VERSION	API LEVEL	CUMULATIVE DISTRIBUTION
4.1 Jelly Bean	16	
4.2 Jelly Bean	17	99.9%
4.3 Jelly Bean	18	99.7%
4.4 KitKat	19	99.7%
5.0 Lollipop	21	98.8%
5.1 Lollipop	22	98.4%
6.0 Marshmallow	23	96.2%
7.0 Nougat	24	92.7%
7.1 Nougat	25	90.4%
8.0 Oreo	26	88.2%
8.1 Oreo	27	85.2%
9.0 Pie	28	77.3%
10. Q	29	62.8%
11. R	30	40.5%
12. S	31	13.5%

Android Version Fragmentation



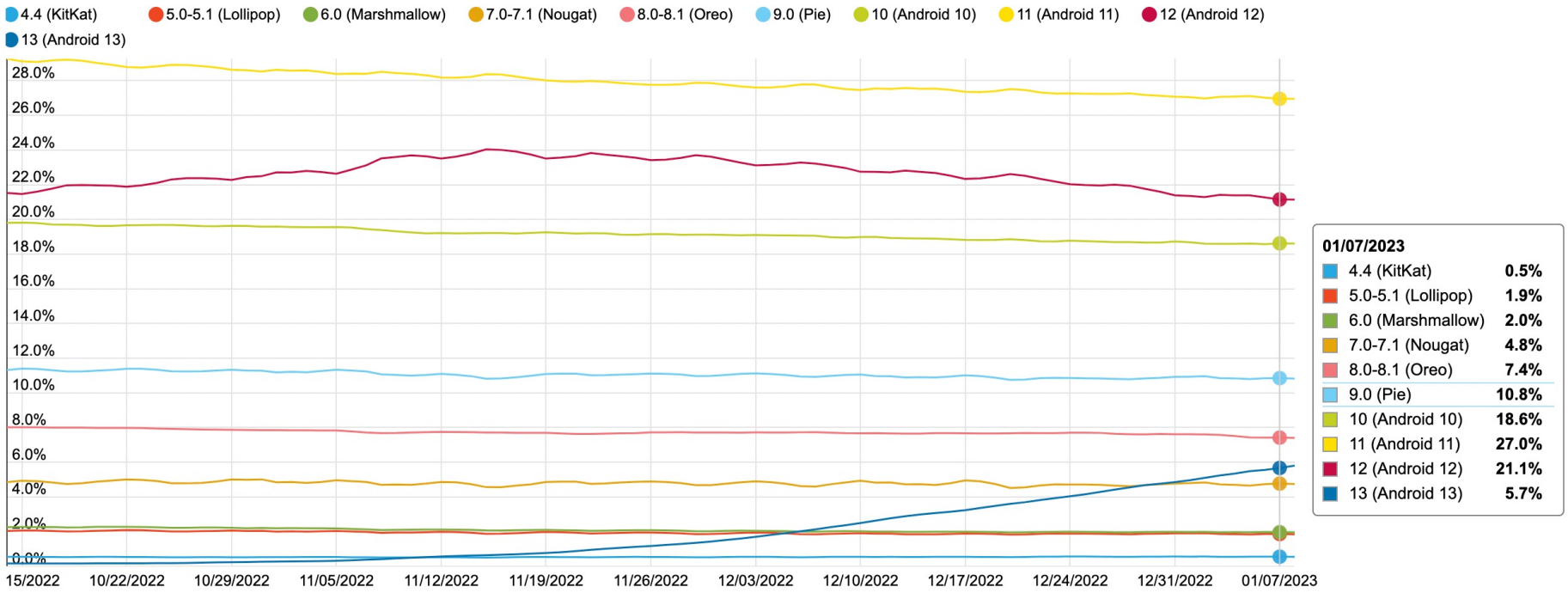
https://upload.wikimedia.org/wikipedia/commons/thumb/e/ee/Android_historical_version_distribution_-_vector.svg/1516px-Android_historical_version_distribution_-_vector.svg.png

Android Version Fragmentation



https://www.pcmag.com/news/370573/welcome-to-the-fragmentation-party-android-10

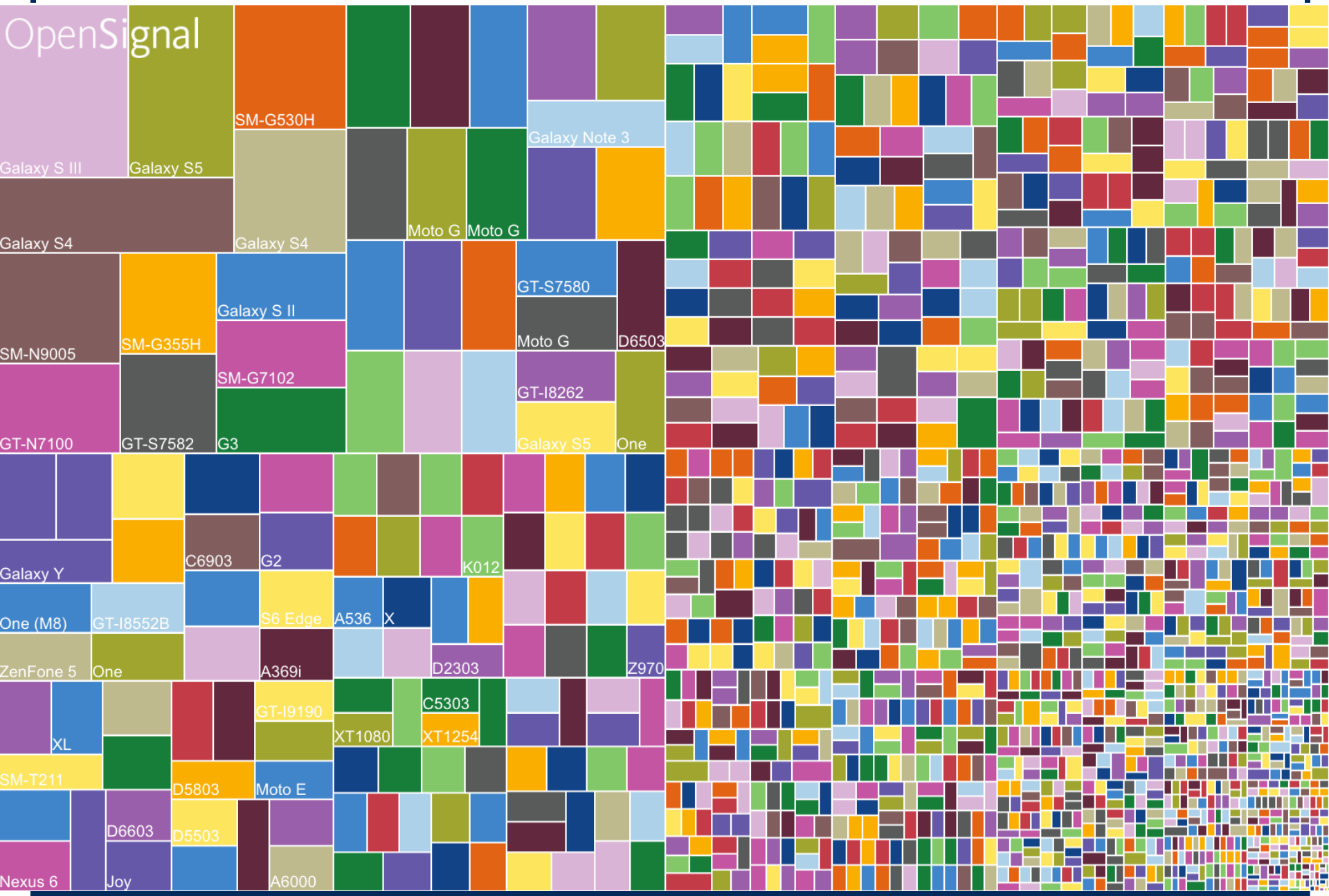
Android Version Fragmentation



https://www.appbrain.com/stats/top-android-sdk-versions

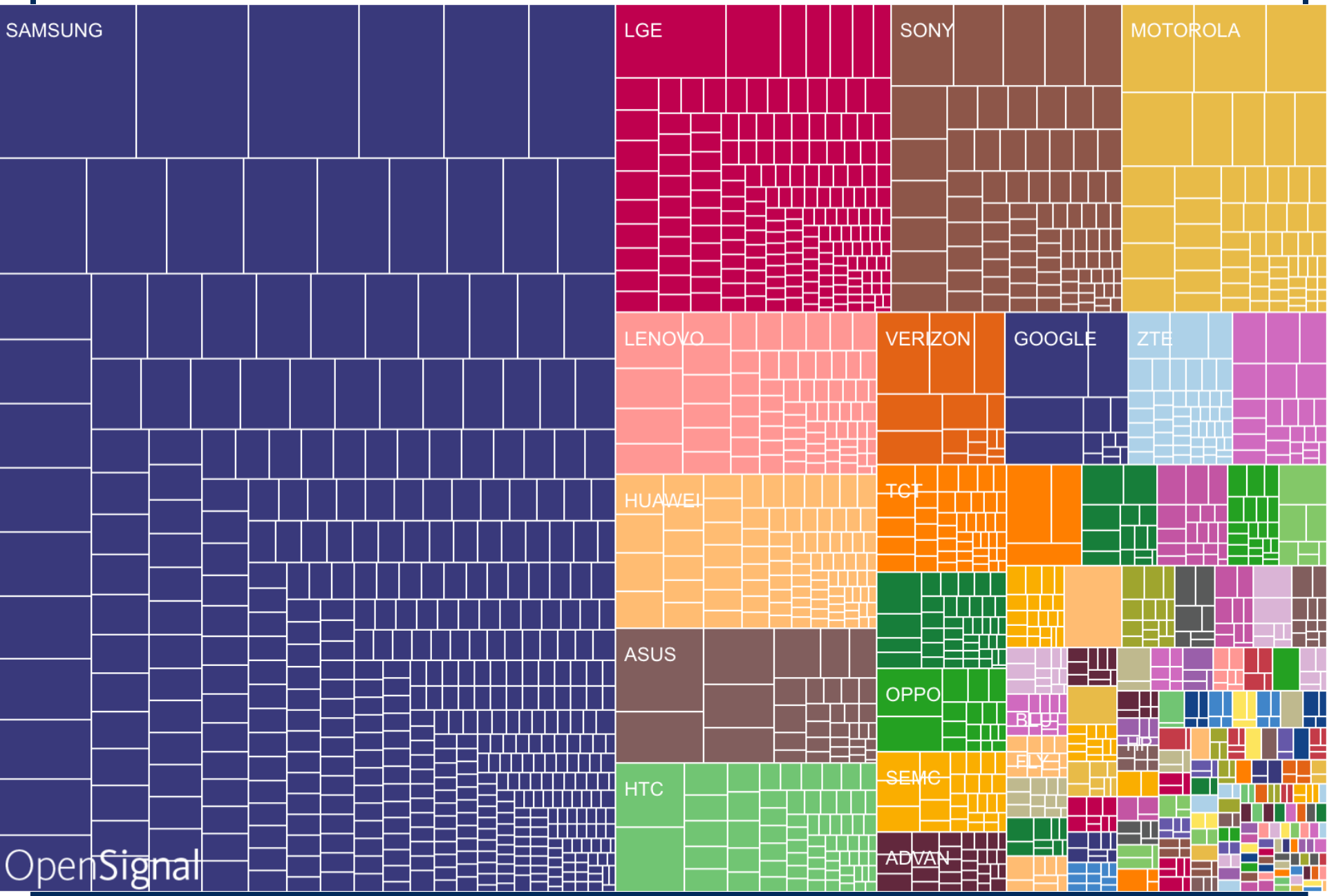
Android Device Fragmentation

- August 2015
- https://opensignal.com/reports/2015/08/android-fragmentation/


OpenSignal
Galaxy S III
Galaxy S5
SM-G530H
Galaxy S4
Galaxy S4
Galaxy Note 3
Moto G
Moto G
GT-S7580
Moto G
D6503
SM-N9005
SM-G355H
Galaxy S II
SM-G7102
GT-N7100
GT-S7582
G3
GT-I8262
Galaxy S5
One
Galaxy Y
C6903
G2
K012
One (M8)
GT-I8552B
S6 Edge
A536
X
ZenFone 5
One
A369i
D2303
Z970
C5303
GT-I9190
XT1080
XT1254
XL
SM-T211
D5803
Moto E
D6603
D5503
Nexus 6
Joy
A6000

Brand Fragmentation

- August 2015
- https://opensignal.com/reports/2015/08/android-fragmentation/

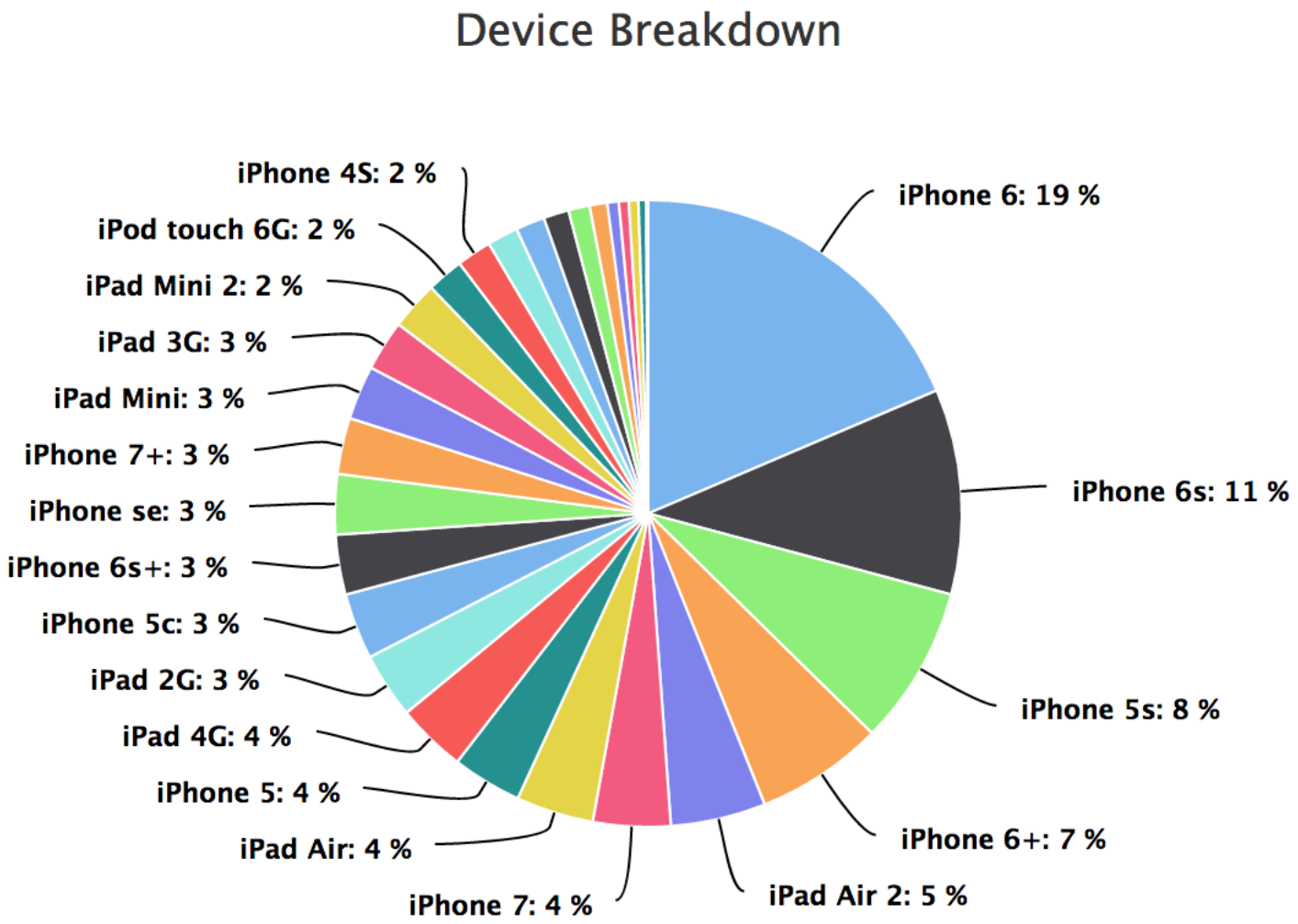

SAMSUNG
LGE
SONY
MOTOROLA
LENOVO
VERIZON
GOOGLE
ZTE
HUAWEI
TCT
ASUS
OPPO
BLU
HP
FLY
SEMC
HTC
ADVAN
OpenSignal

iPhone Device Fragmentation

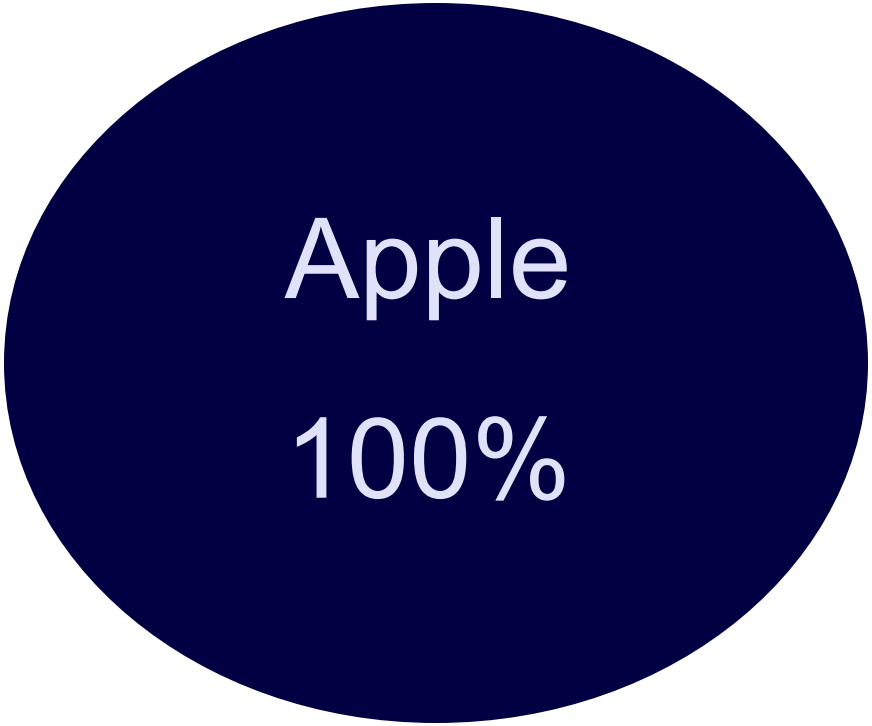
- Jan 2017
- https://david-smith.org/iosversionstats/

iPhone Device Fragmentation

Device Breakdowns



iPhone Brand Fragmentation



To Do By Friday!

- Assignment 0: https://cs-courses.mines.edu/csci448/homework/hw0.html
  - Post to Ed Discussion
  - Submit selfies
  - Complete Google Form