MOBILE COMPUTING COURSE

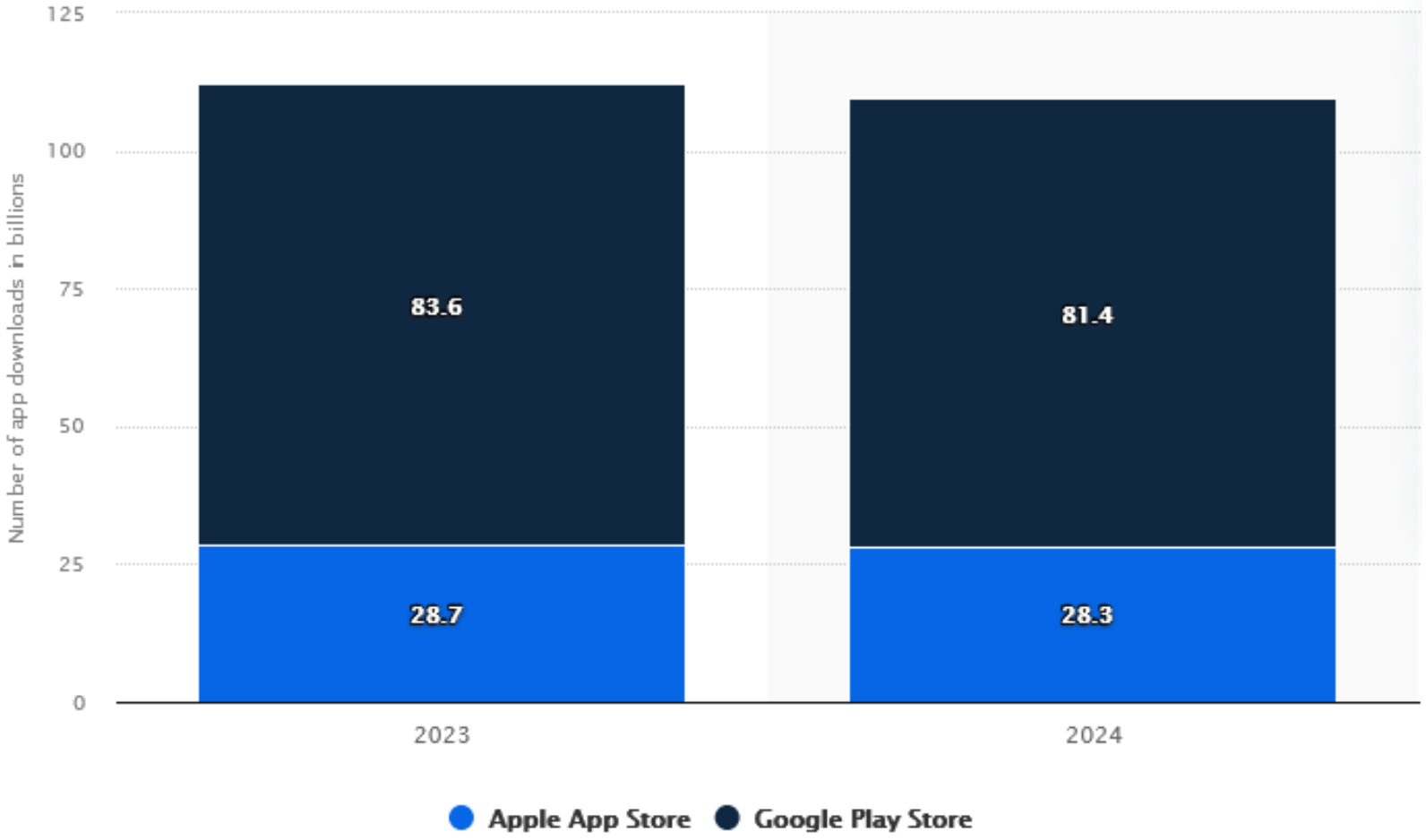
By Dr. Ahmad Barghash

LECTURE 1: INTRODUCTION TO MOBILE APPLICATIONS DEVELOPMENT

AHMAD BARGHASH

You will learn a general introduction about the mobile applications development.

APP DOWNLOAD



Introduction to Android

- Open software platform for mobile development.
- Initial release in September 2008
- A complete stack – OS, Middleware, Applications.
- An Open Handset Alliance (OHA) project.
  - OHA is a consortium of 84 companies to develop open standards for mobile devices. Companies include:

- Powered by Linux operating system.
- Number of papers on Android (as of 25 Oct 2019):
  - In ACM Digital Library: 7,240 papers and books……~31400 in Feb 2025
  - In IEEE Xplore Digital Library: 10,727 papers, conferences, and books…..~25000 in Feb 2025

Android Versioning

- Android OS is based on Linux.
- More than 17 official versions in 16 years.
- Android releases have a code name, version number, and API (Application programming interface) level.
- Android OS has a fast update cycle – new updates every 6 to 9 months.
- Most recent:
  - Android 15 Feb, 2024
- https://en.wikipedia.org/wiki/Android_version_history
- Sweet names were used to add a sense of humor .. but not anymore.

Android Version Fragmentation

- Why as a developer do you care about the fragmentation of
  - Android versions, API level
    - Each new release includes many new features and tools for developers.
    - What is available to me?
    - Some newer functionality available for older versions via the Support Library.
  - screen sizes.
  - Manufacturers.

ANDROID VERSIONS SUMMARY

Android Version	Code Name	API Level	Release Date
Android 1.0		1	23 September 2008
Android 1.1		2	9 February 2009
Android 1.5	Cupcake	3	27 April 2009
Android 1.6	Donut	4	15 September 2009
Android 2.0	Eclair	5	26 October 2009
Android 2.0.1	Eclair	6	3 December 2009
Android 2.1	Eclair	7	12 January 2010
Android 2.2	Froyo	8	20 May 2010
Android 2.2.1	Froyo	8	18 January 2011
Android 2.2.2	Froyo	8	22 January 2011
Android 2.2.3	Froyo	8	21 November 2011
Android 2.3	Gingerbread	9	6 December 2010
Android 2.3.1	Gingerbread	9	December 2010
Android 2.3.2	Gingerbread	9	January 2011
Android 2.3.3	Gingerbread	10	9 February 2011
Android 2.3.4	Gingerbread	10	28 April 2011
Android 2.3.5	Gingerbread	10	25 July 2011
Android 2.3.6	Gingerbread	10	2 September 2011
Android 2.3.7	Gingerbread	10	21 September 2011

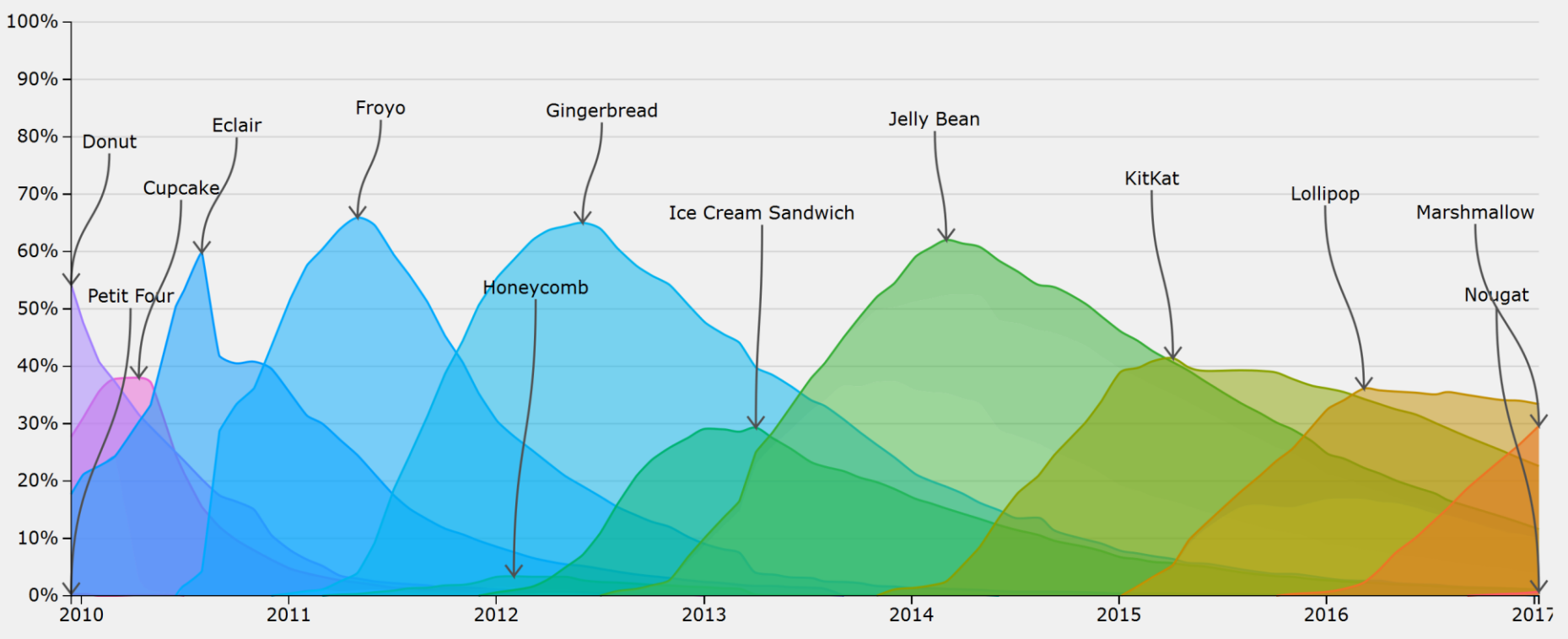
ANDROID VERSIONS SUMMARY

Android 3.0	Honeycomb	11	22 February 2011
Android 3.1	Honeycomb	12	10 May 2011
Android 3.2	Honeycomb	13	15 July 2011
Android 3.2.1	Honeycomb	13	20 September 2011
Android 3.2.2	Honeycomb	13	30 August 2011
Android 3.2.3	Honeycomb	13	
Android 3.2.4	Honeycomb	13	December 2011
Android 3.2.5	Honeycomb	13	January 2012
Android 3.2.6	Honeycomb	13	February 2012
Android 4.0	Ice Cream Sandwich	14	19 October 2011
Android 4.0.1	Ice Cream Sandwich	14	21 October 2011
Android 4.0.2	Ice Cream Sandwich	14	28 November 2011
Android 4.0.3	Ice Cream Sandwich	15	16 December 2011
Android 4.0.4	Ice Cream Sandwich	15	29 March 2012
Android 4.1	Jelly Bean	16	9 July 2012
Android 4.1.1	Jelly Bean	16	23 July 2012
Android 4.1.2	Jelly Bean	16	9 October 2012
Android 4.2	Jelly Bean	17	13 November 2012
Android 4.2.1	Jelly Bean	17	27 November 2012
Android 4.2.2	Jelly Bean	17	11 February 2013
Android 4.3	Jelly Bean	18	24 July 2013

ANDROID VERSIONS SUMMARY

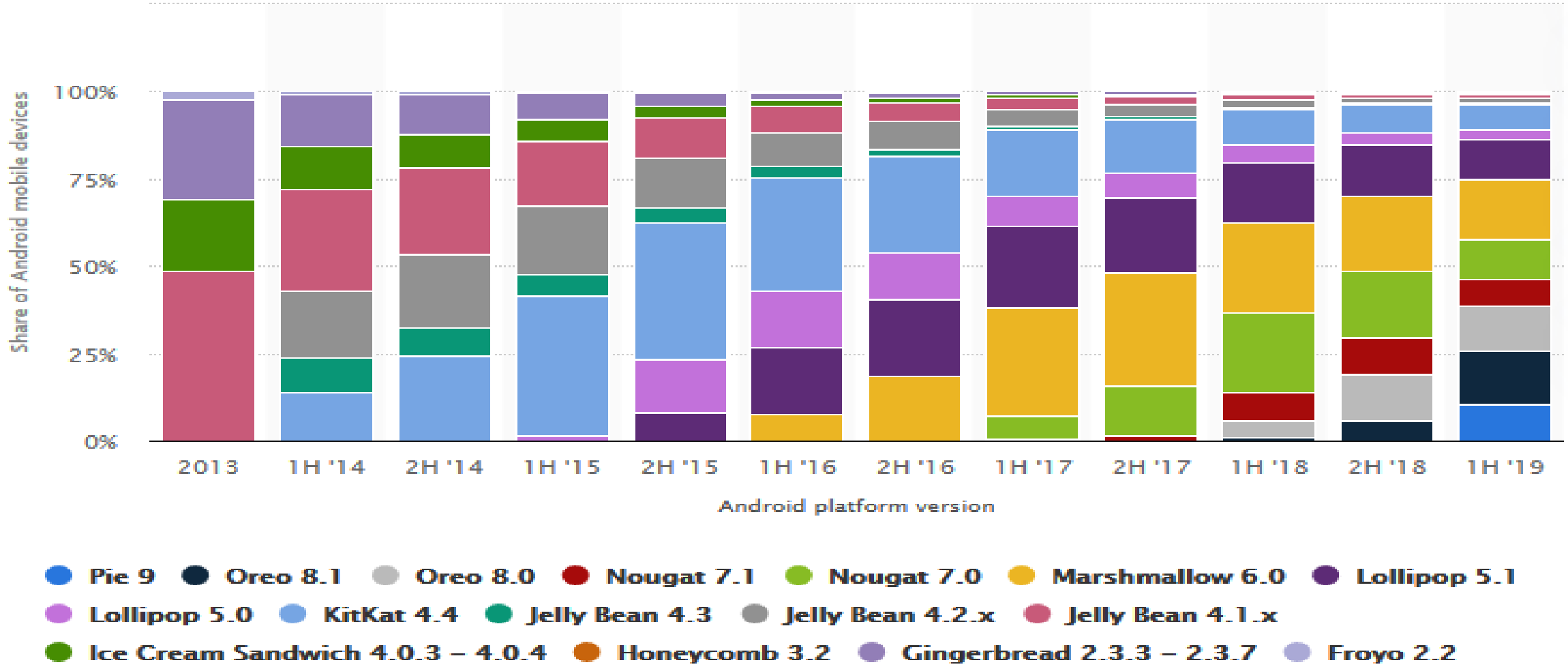
Android 4.4	Kit Kat	19	31 October 2013
Android 4.4.1	Kit Kat	19	5 December 2013
Android 4.4.2	Kit Kat	19	9 December 2013
Android 4.4.3	Kit Kat	19	2 June 2014
Android 4.4.4	Kit Kat	19	19 June 2014
Android 4.4w	Kit Kat (wearables)	20	25 June 2014
Android 4.4W.1	Kit Kat (wearables)	20	6 September 2014
Android 4.4W.2	Kit Kat (wearables)	20	21 October 2014
Android 5.0	Lollipop	21	12 November 2014
Android 5.0.1	Lollipop	21	2 December 2014
Android 5.0.2	Lollipop	21	19 December 2014
Android 5.1	Lollipop	22	9 March 2015
Android 5.1.1	Lollipop	22	21 April 2015
Android 6.0	Marshmallow	23	5 October 2015
Android 6.0.1	Marshmallow	23	7 December 2015
Android 7.0	Nougat	24	22 August 2016
Android 7.1	Nougat	25	4 October 2016
Android 7.1.1	Nougat	25	5 December 2016
Android 7.1.2	Nougat	25	4 April 2017
Android 8.0	Oreo	26	21 August 2017
Android 8.1	Oreo	27	5 December 2017
Android 9.0	Pie	28	6 August 2018
Android 10	Android 10	29	3 September 2019

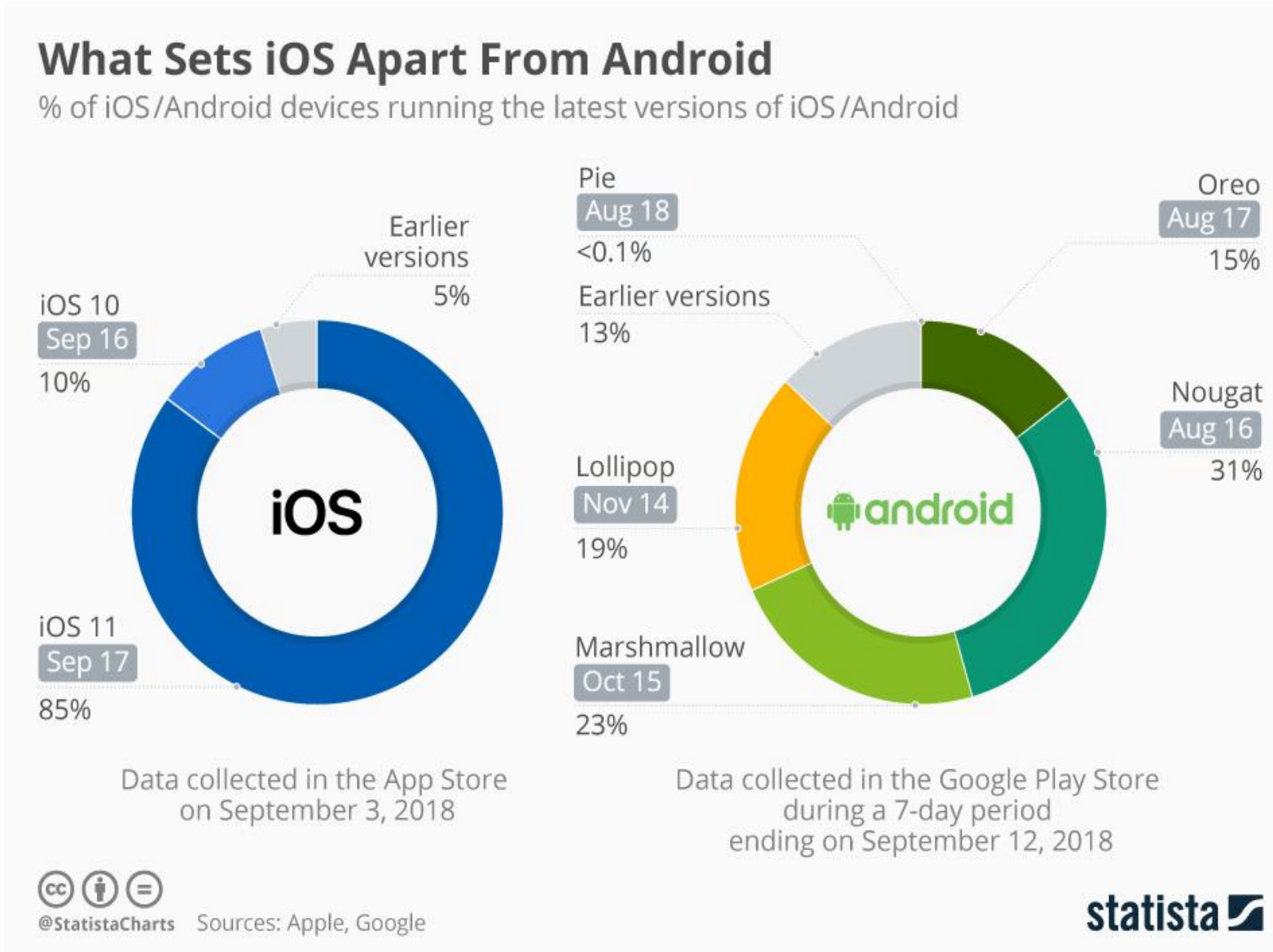
Dominant Version



- http://www.bidouille.org/misc/androidcharts

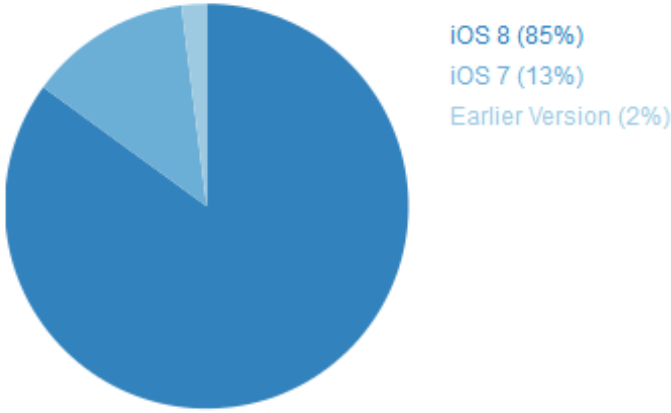
Android versions



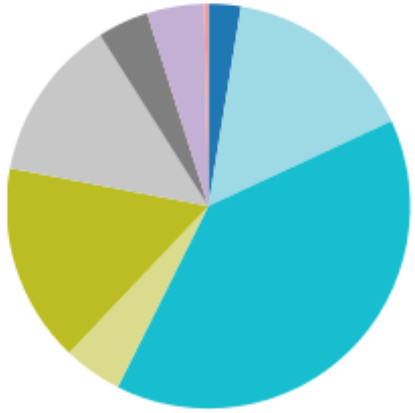


Problem in Android But Not That Big Problem With iOS

COMPARISON WITH IOS



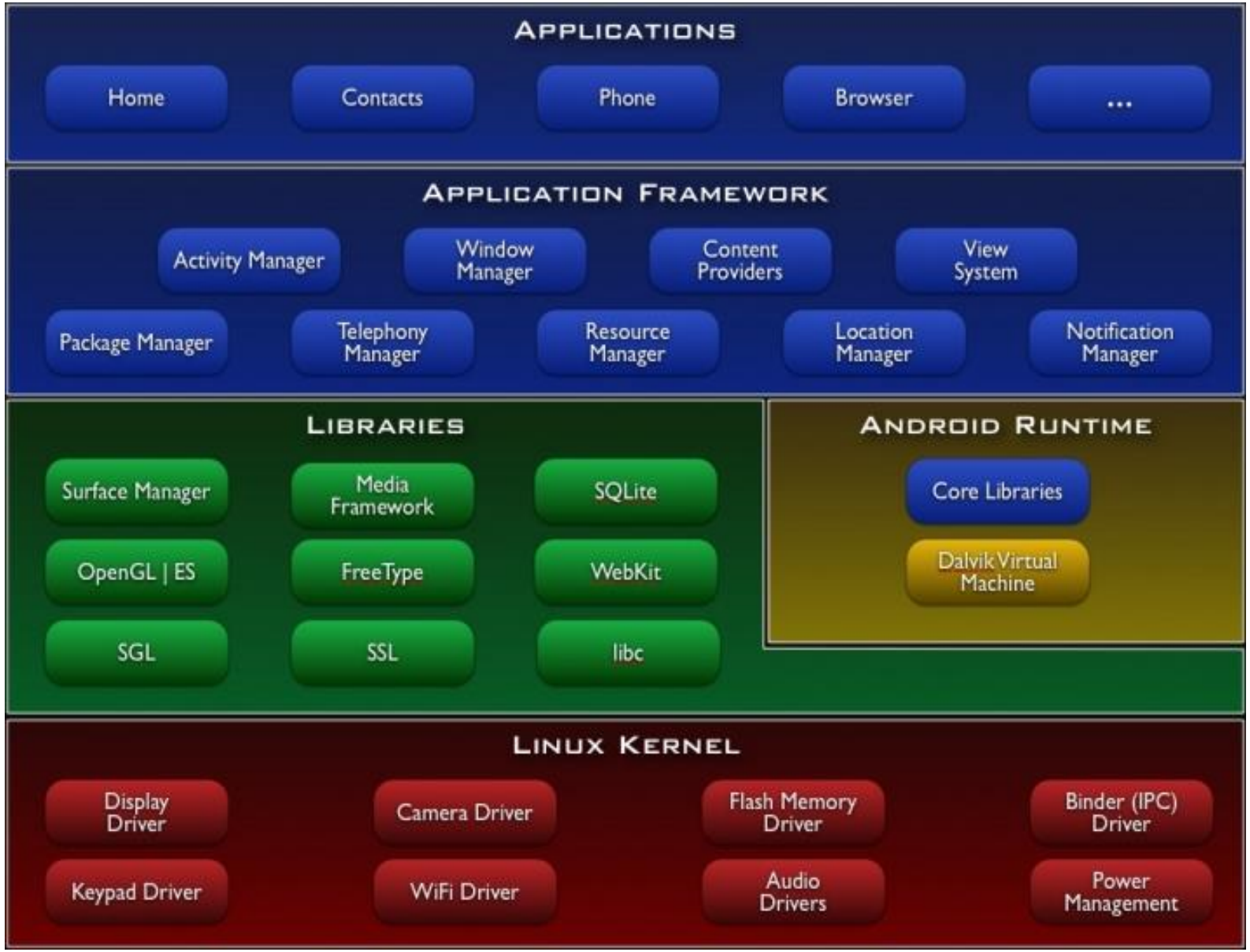
iOS 8 (85%)
iOS 7 (13%)
Earlier Version (2%)



5.1 (Lollipop) (2.6%)
5.0 (Lollipop) (15.5%)
4.4 (Kit Kat) (39.3%)
4.3 (Jelly Bean) (4.7%)
4.2 (Jelly Bean) (15.9%)
4.1 (Jelly Bean) (13%)
4.0.3 - 4.0.4 (ICS) (4.1%)
2.3.3-2.3.7 (Gingerbread) (4.6%)
2.2 (Froyo) (0.3%)

Android - iOS Comparison

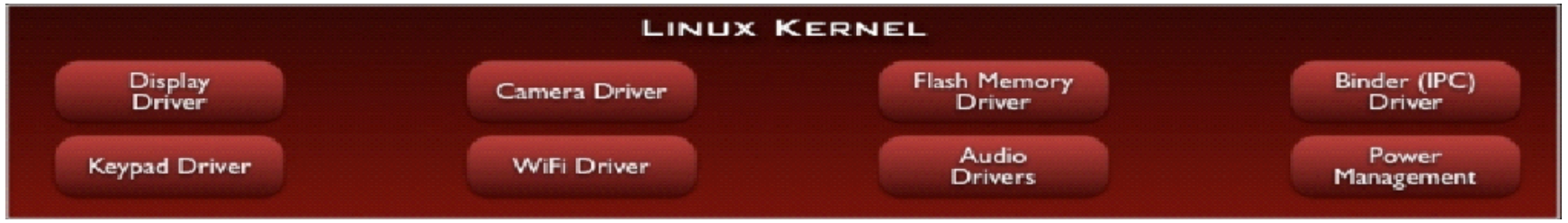
AUGUST 2015



Android Architecture

Linux Kernel

- C language
- Device drivers
- Memory management
- Process management
- Networking

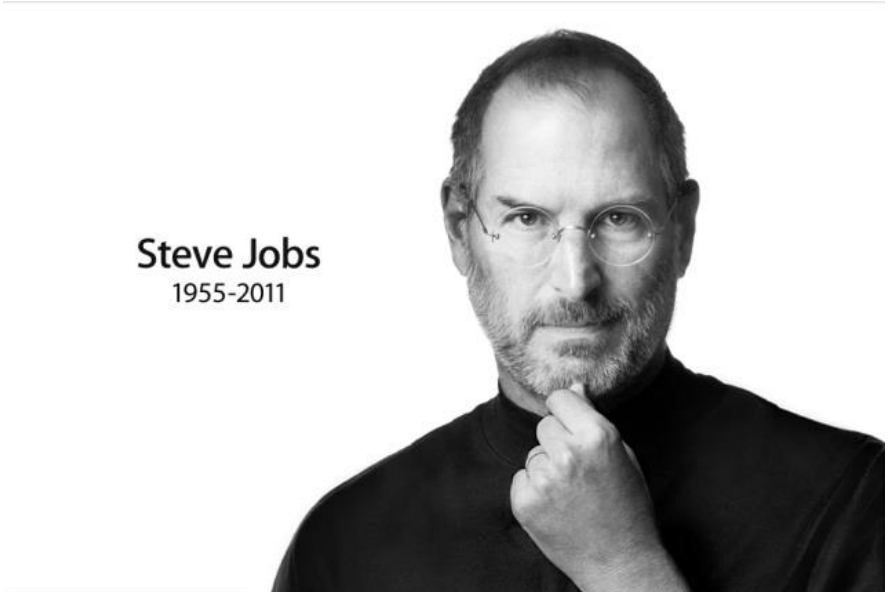


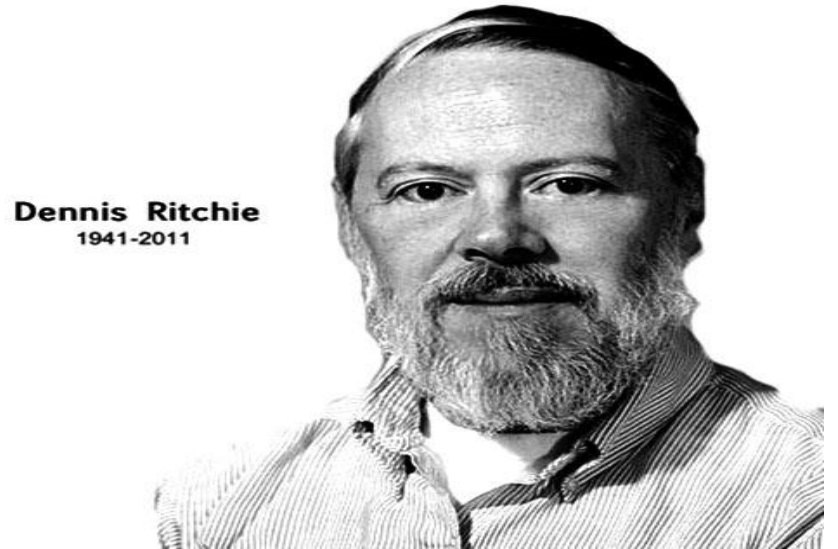
Libraries

- C/C++ libraries
- Surface manager – Handling UI Windows
- 2D and 3D graphics
- Media codecs, SQLite (database engine), Browser engine

C language

- (1970s) Pioneered by Dennis Ritchie
- Mid-level language
- (1983) Standardized by The American National Standards Institute (ANSI)
- (1999) Last major changes adopted





ANDROID RUNTIME

- Dalvik VM (Executes android applications)
  - Dex files (Dalvik executable: Android compiled code file)
  - Compact and efficient class files
  - Limited memory and battery power
- Core Libraries
  - Collections, I/O etc…

Application Framework

- API (Application programming interface) interface.
- Activity manager – manages application life cycle.

Applications

- Built in and user apps.
- Can replace built in apps.

Basic Stats of Android Apps

ANDROID APPS/GOOGLE PLAY STORE

Number of available apps in the Google Play Store
2.9m

Pokémon GO revenue in the Google Play Store in November 2019
27.4m USD

Average monthly unique visitors of the Facebook mobile app in the U.S.
155.7

Pentration rate of eBay's app amongst Android users in the United States
19.77%

Facebook users in the United States
250.2m

Meta global revenue in Q3 2024
46.8bn USD

Country with the most users in 2024
India

Android Smart Phones

ANDROID SMARTPHONES

Android's global market share

85.9% → Became 72% 2024

Smartphone unit sales worldwide with Android OS 2Q'18

329.5m

Android's market share in the United States

44.29%

Android version share Oreo 8.0 in May 2019

12.9%

Android Tablet Stats

ANDROID TABLETS

Number of tablet users worldwide 2017

1.14bn

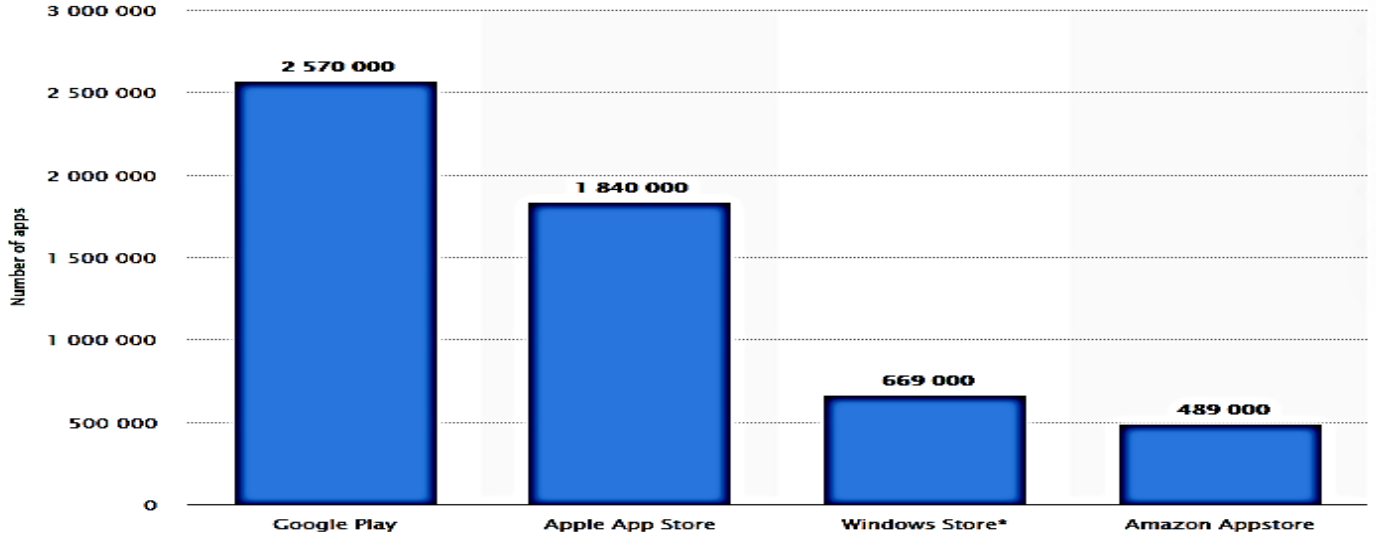
Samsung's market share of global tablet shipments

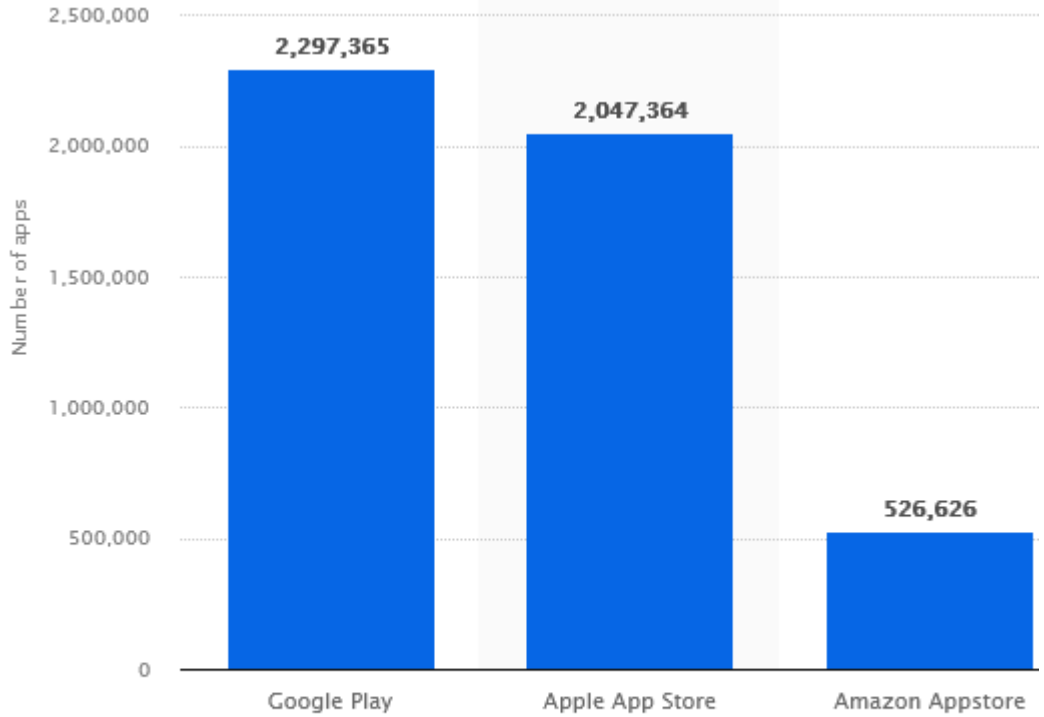
16.1% → 17.9% (2024)

Android's share of tablet OS market worldwide

66.2% → 45% (2024)

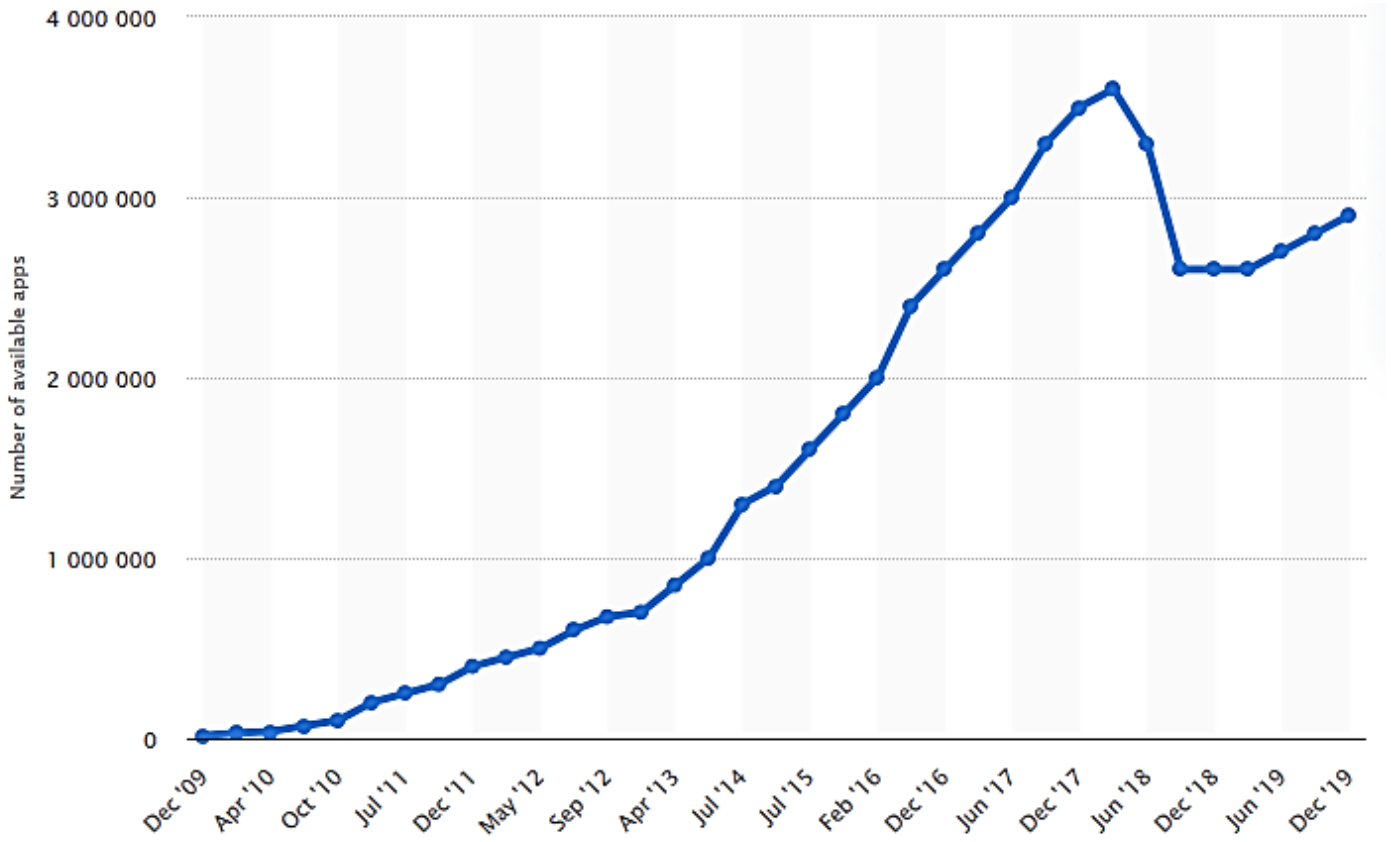
Apps Per Store

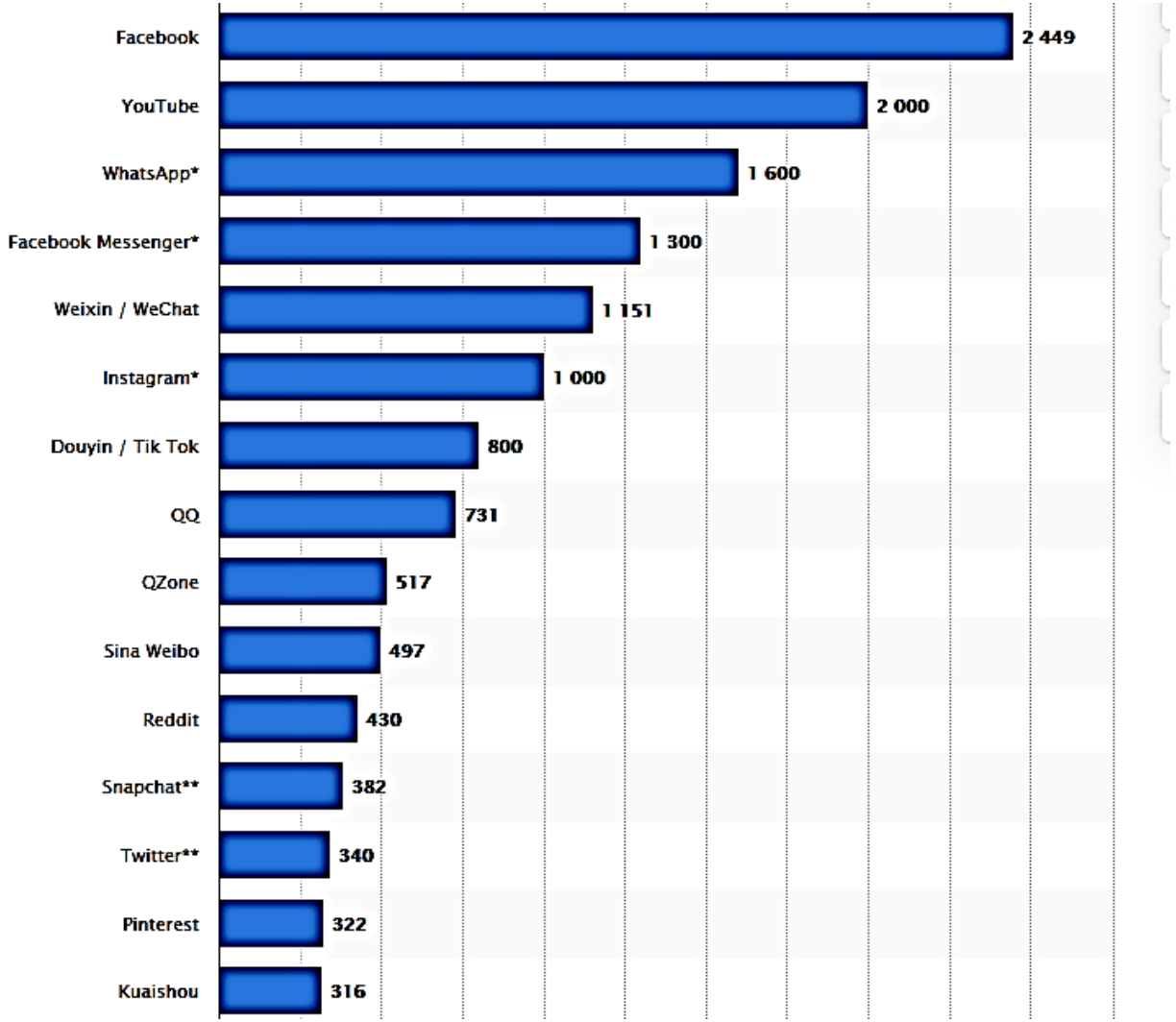




Details: Worldwide; August 2024

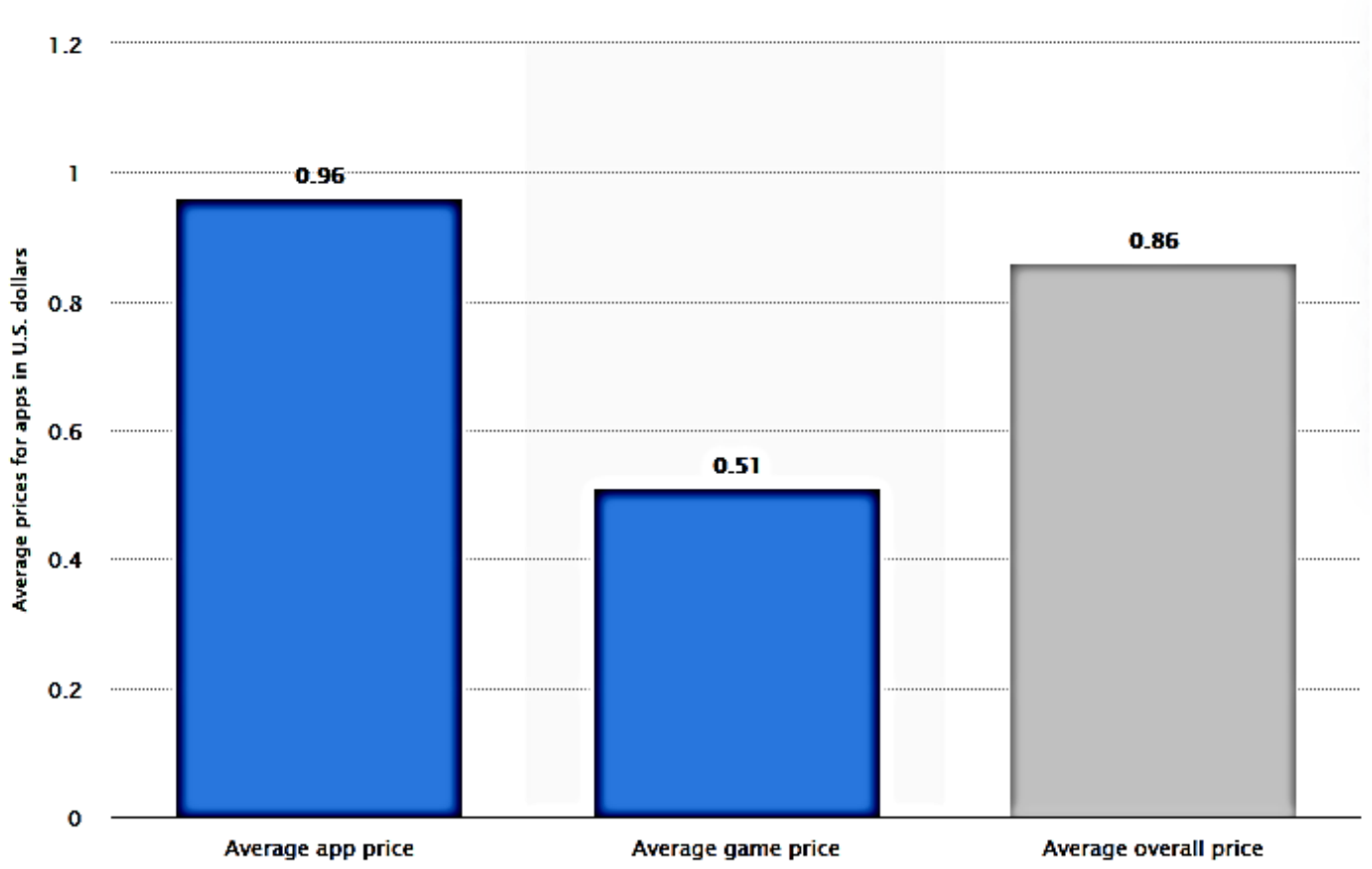
Apps in Google Store





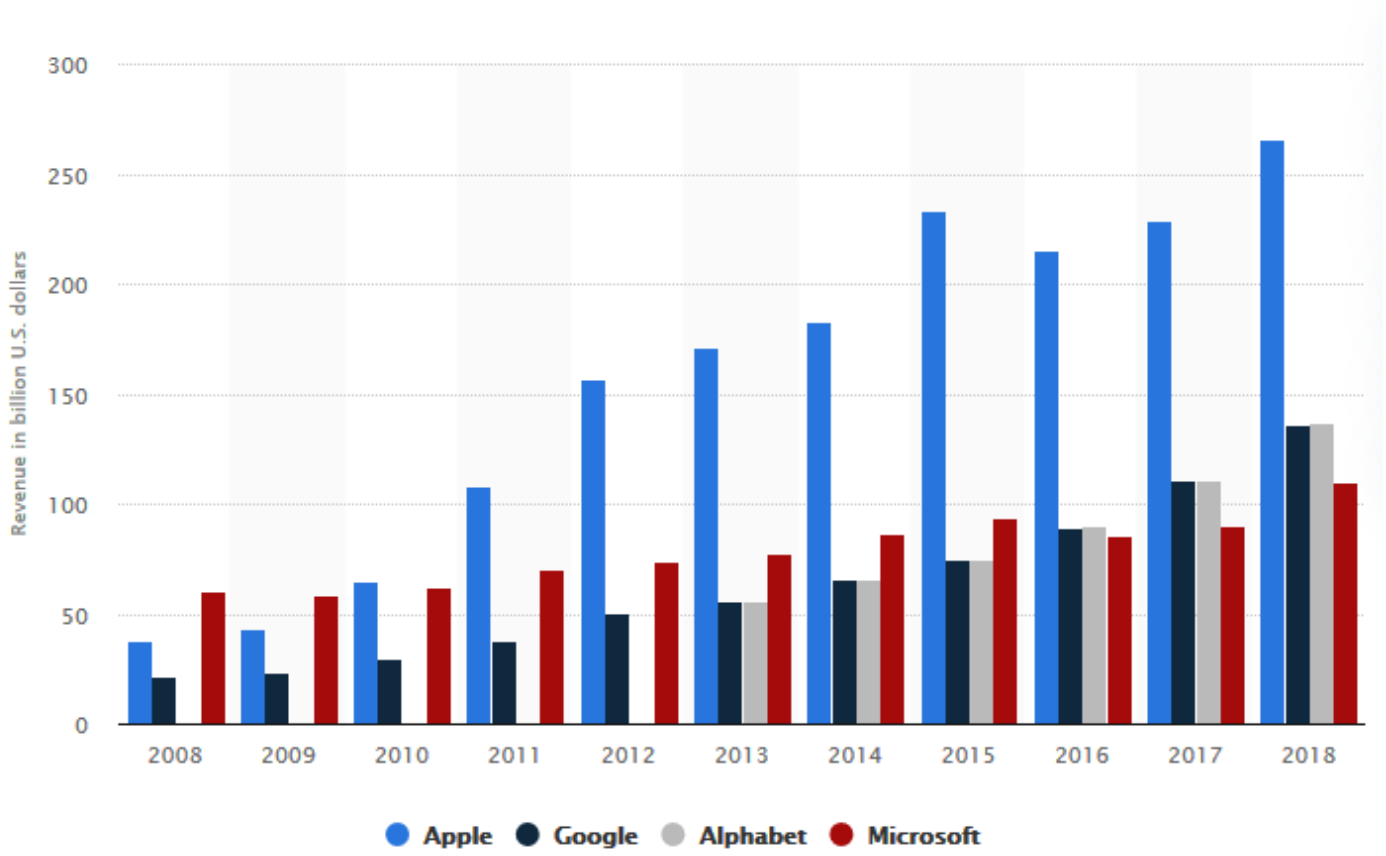
Active Users 2020

Average App Price

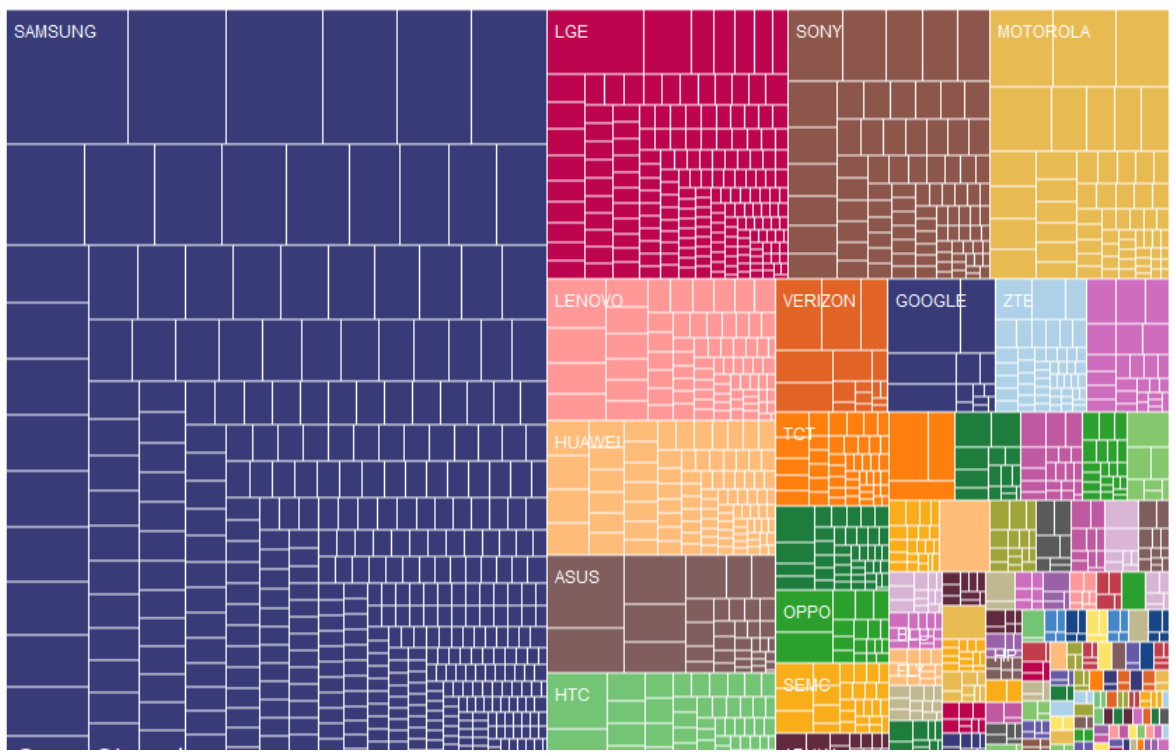


Details: Worldwide; November 2019

Company Revenue



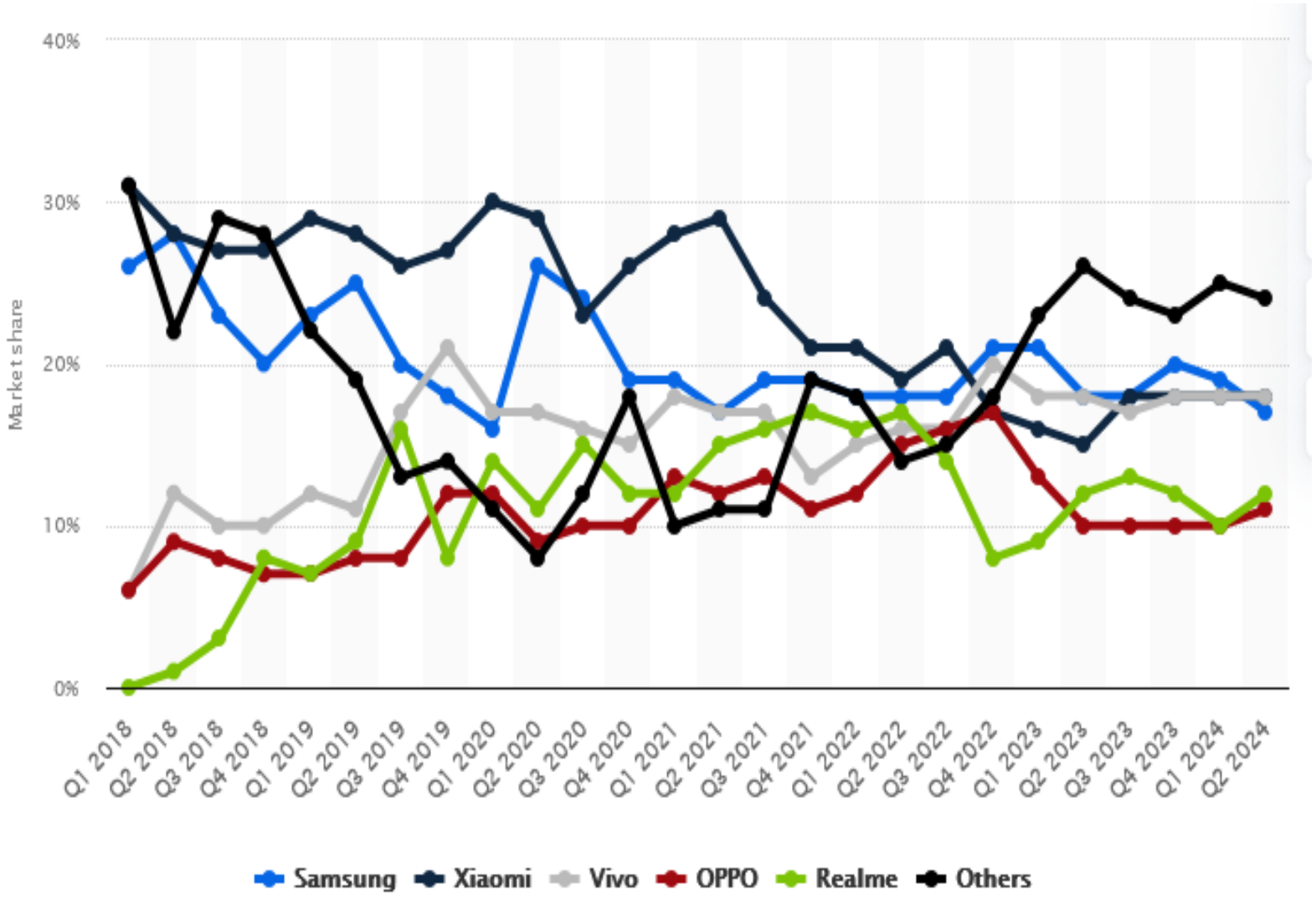
Google Revenue

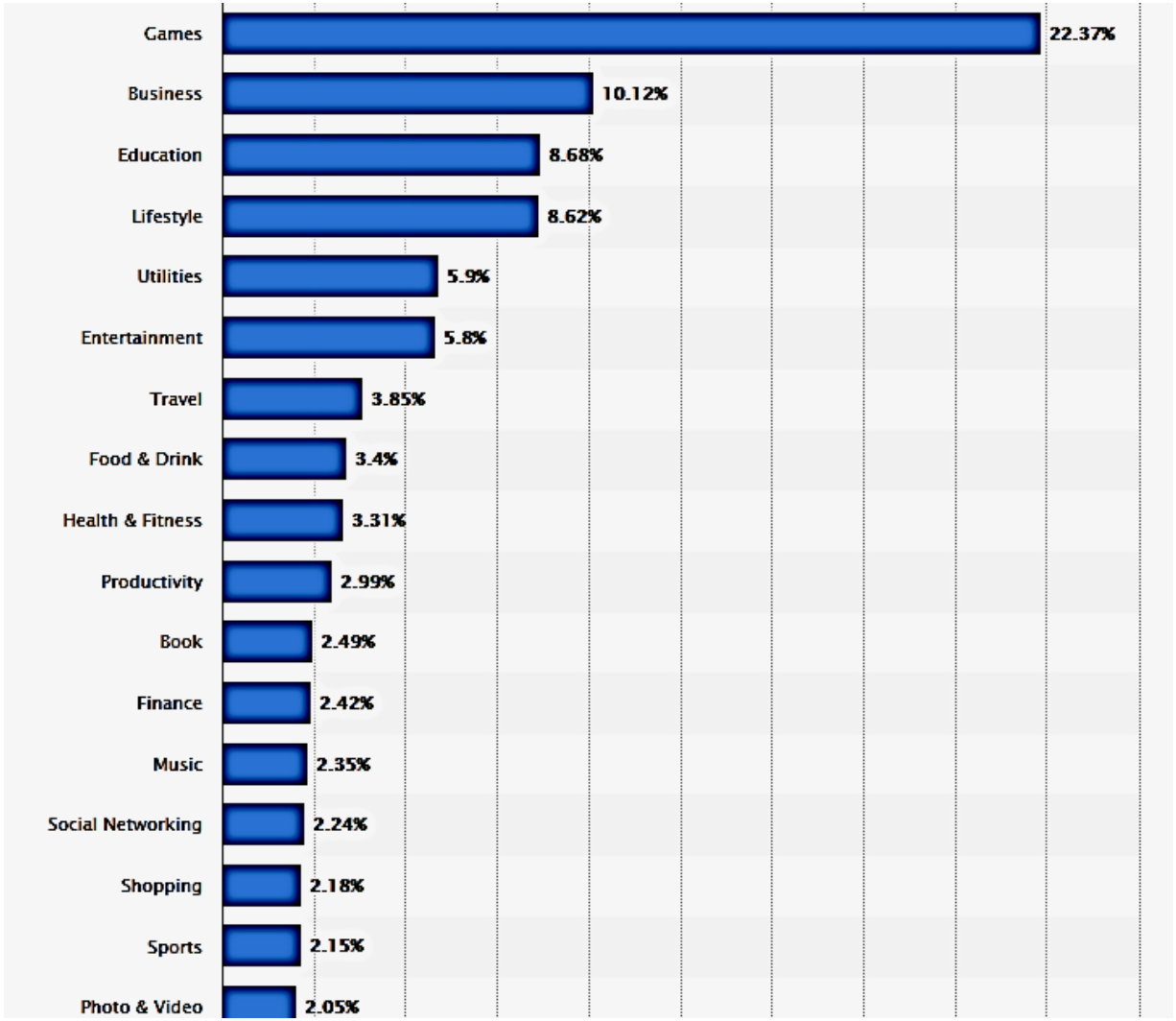


Brand Fragmentation

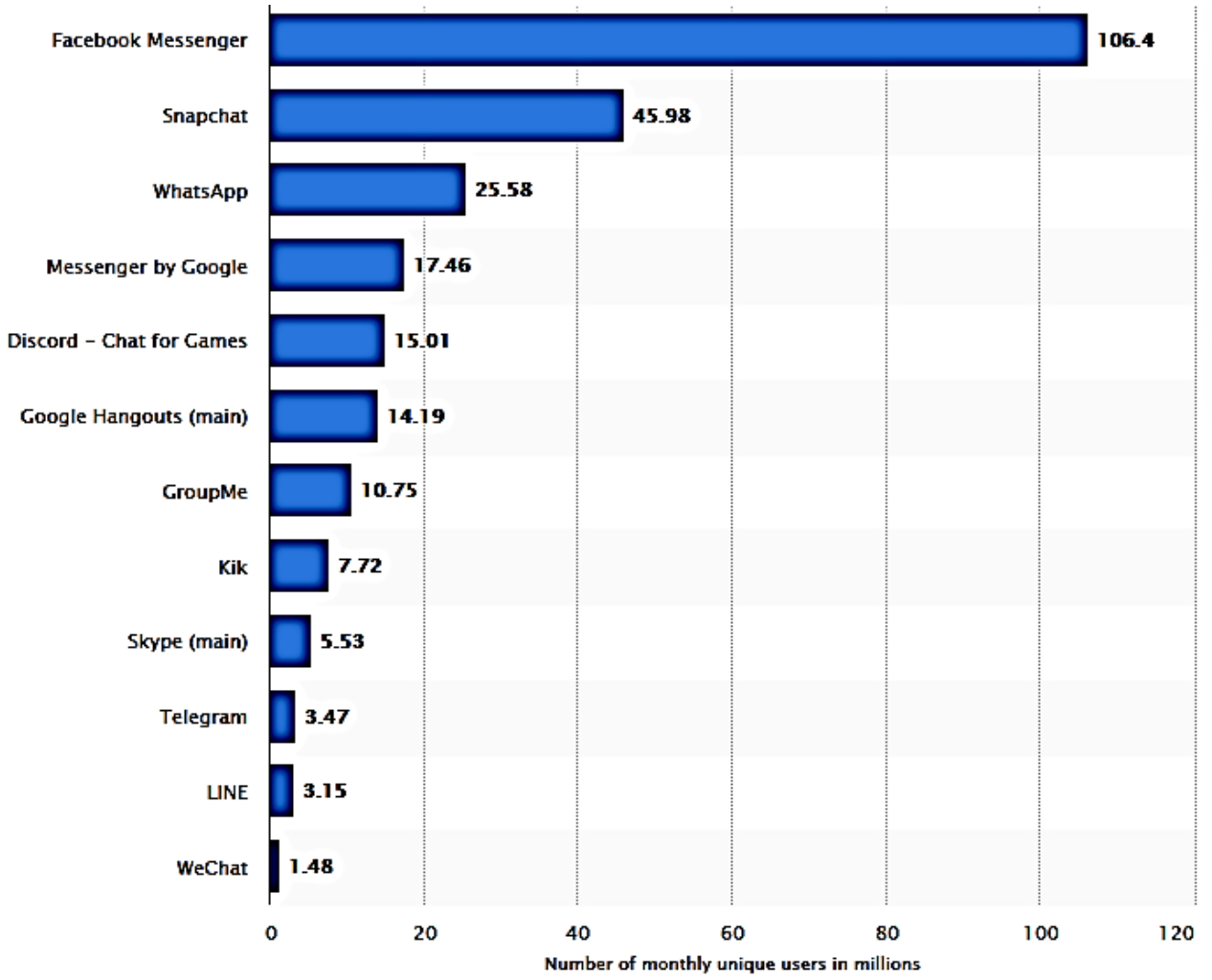
http://opensignal.com/reports/**2015**/08/android-fragmentation/

Company Shipment Share



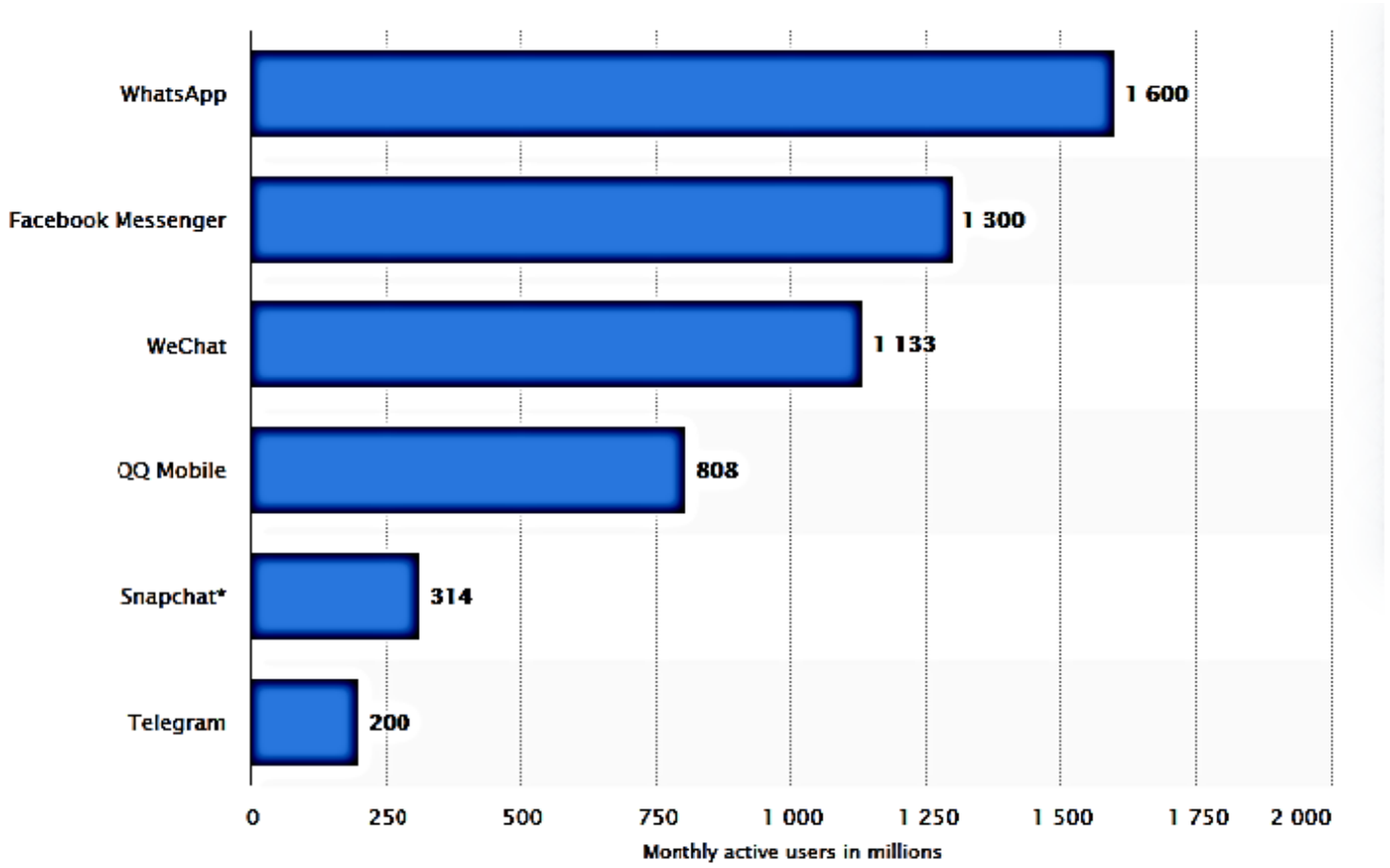


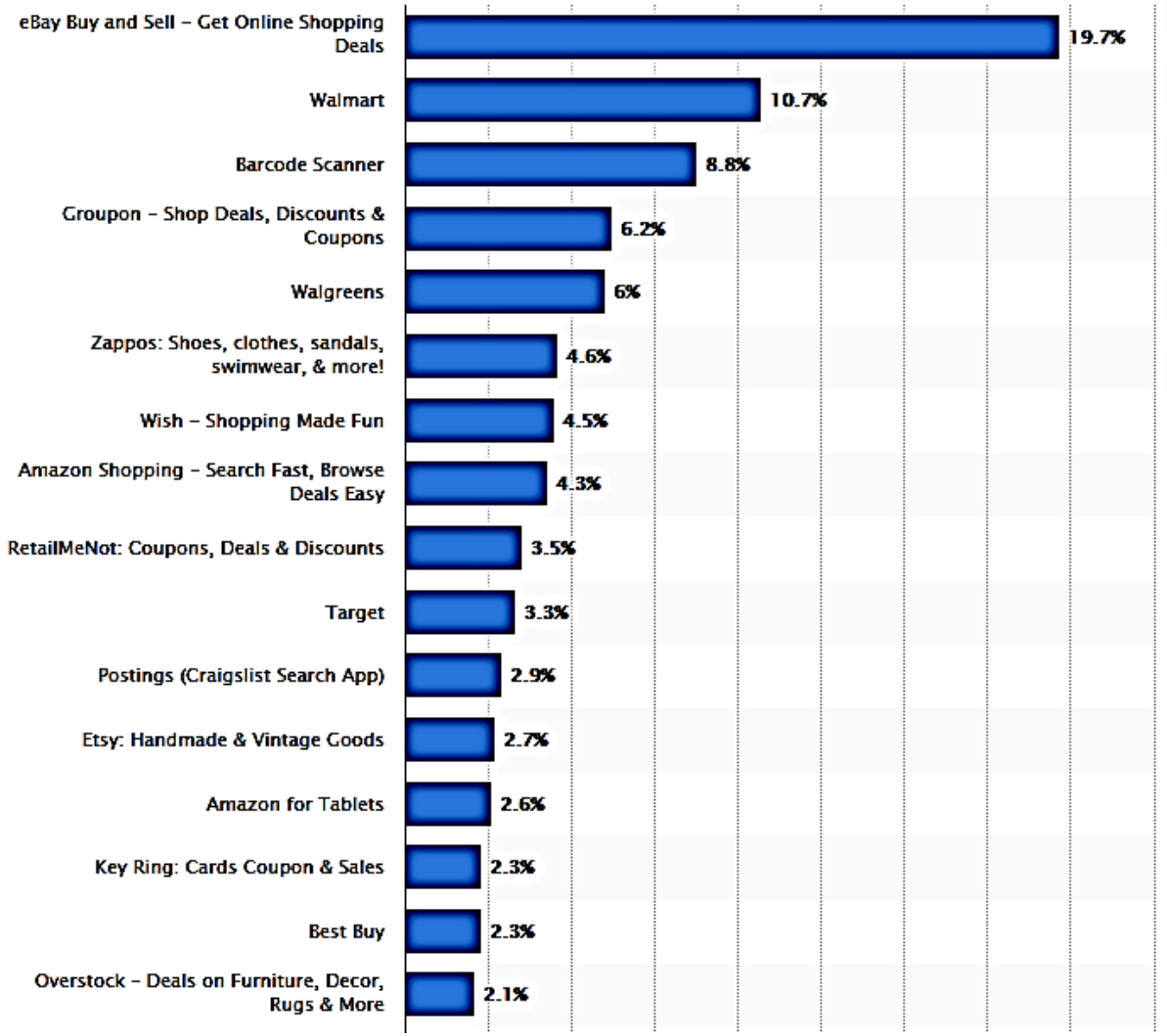
Top Store Categories



Messaging Market (Monthly Users)

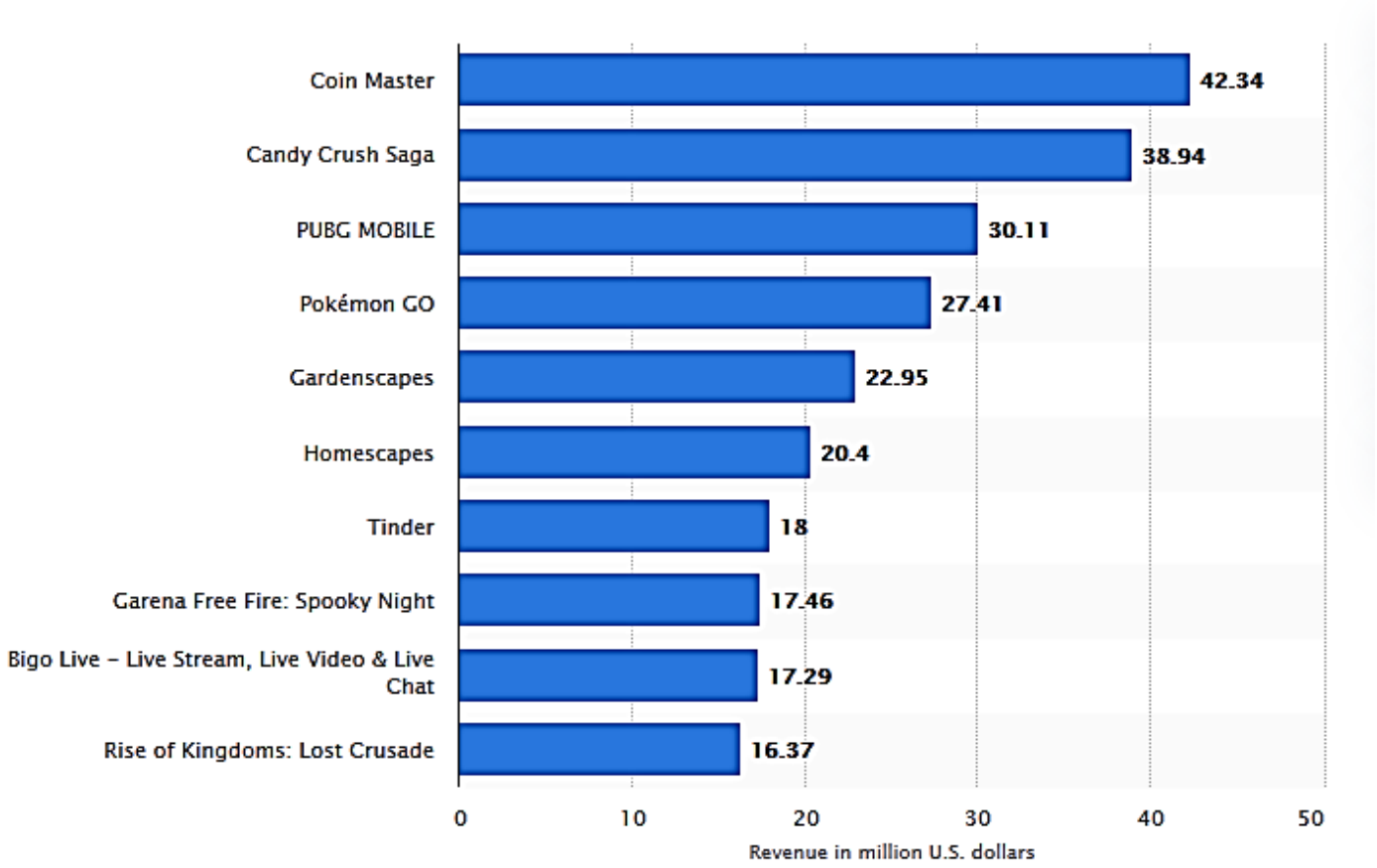
Messenger Active Users



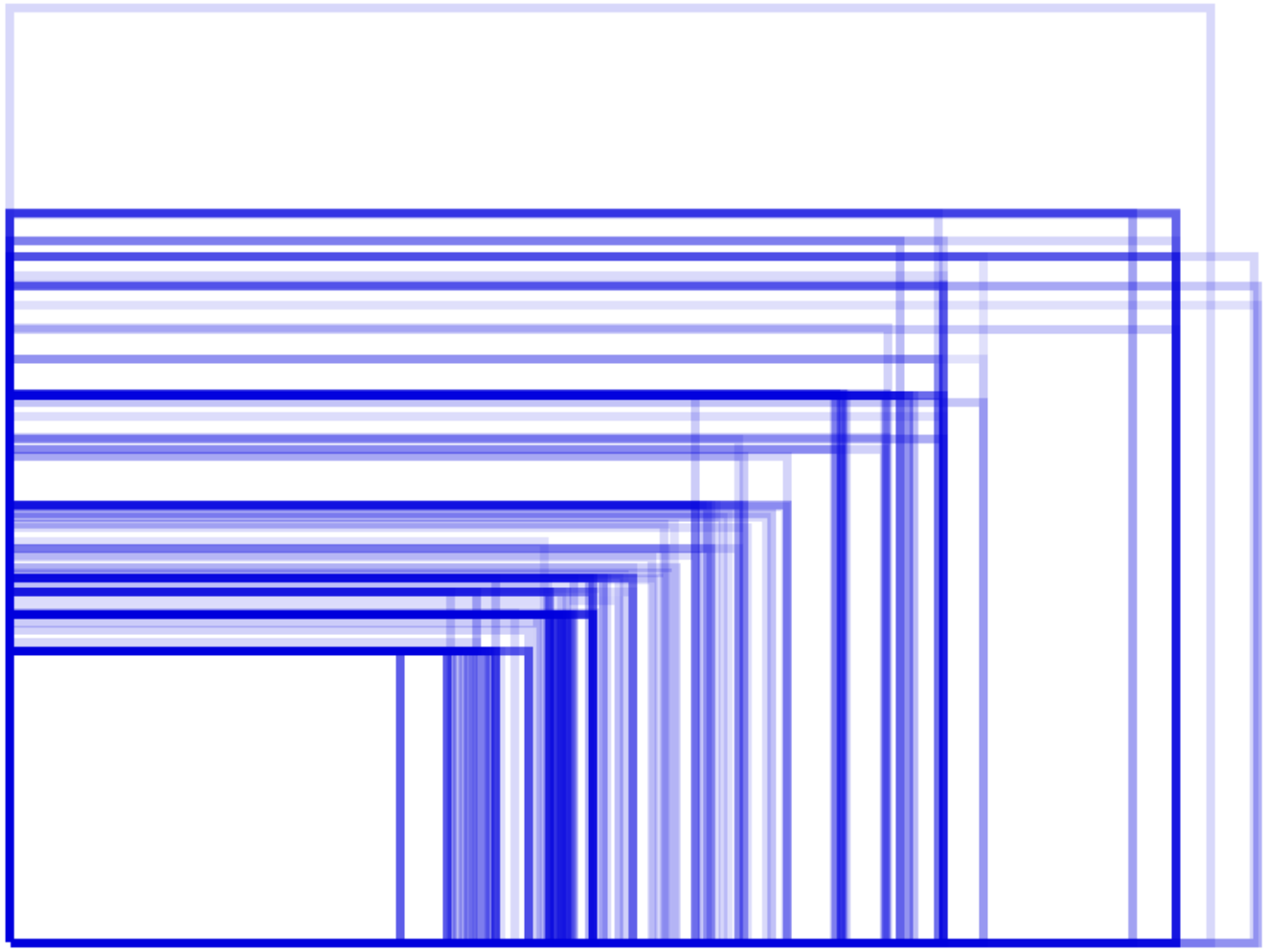

eBay Buy and Sell – Get Online Shopping Deals
19.7%
Walmart
10.7%
Barcode Scanner
8.8%
Groupon – Shop Deals, Discounts & Coupons
6.2%
Walgreens
6%
Zappos: Shoes, clothes, sandals, swimwear, & more!
4.6%
Wish – Shopping Made Fun
4.5%
Amazon Shopping – Search Fast, Browse Deals Easy
4.3%
RetailMeNot: Coupons, Deals & Discounts
3.5%
Target
3.3%
Postings (Craigslist Search App)
2.9%
Etsy: Handmade & Vintage Goods
2.7%
Amazon for Tablets
2.6%
Key Ring: Cards Coupon & Sales
2.3%
Best Buy
2.3%
Overstock – Deals on Furniture, Decor, Rugs & More
2.1%

Retail Apps

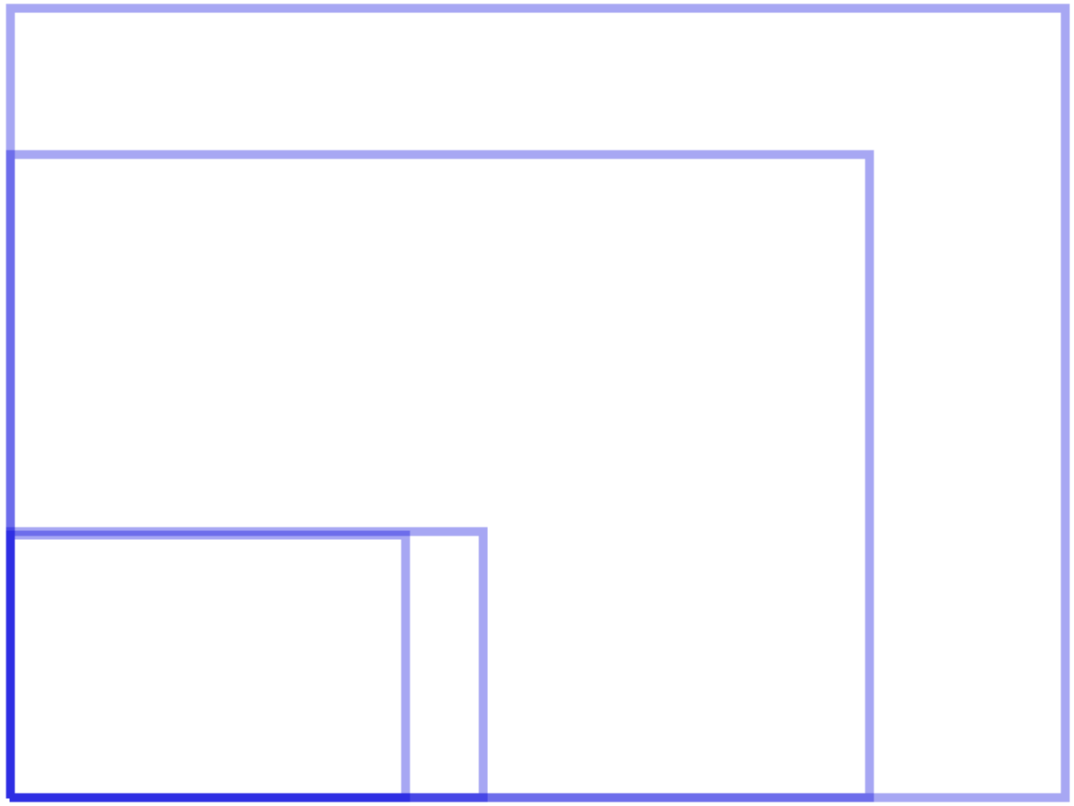
App Revenue


Coin Master
42.34
Candy Crush Saga
38.94
PUBG MOBILE
30.11
Pokémon GO
27.41
Gardenscapes
22.95
Homescapes
20.4
Tinder
18
Garena Free Fire: Spooky Night
17.46
Bigo Live – Live Stream, Live Video & Live Chat
17.29
Rise of Kingdoms: Lost Crusade
16.37
0
10
20
30
40
50
Revenue in million U.S. dollars

iPhone vs. Android

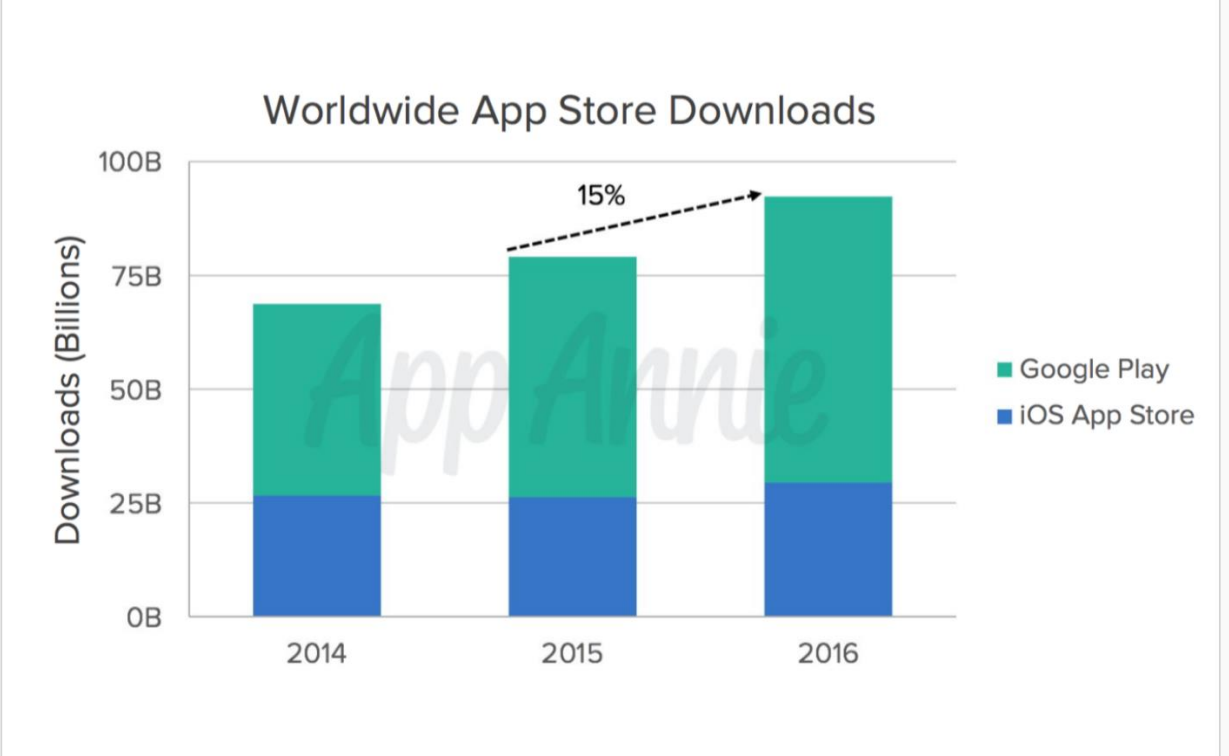


Android Screen Sizes - August 2014

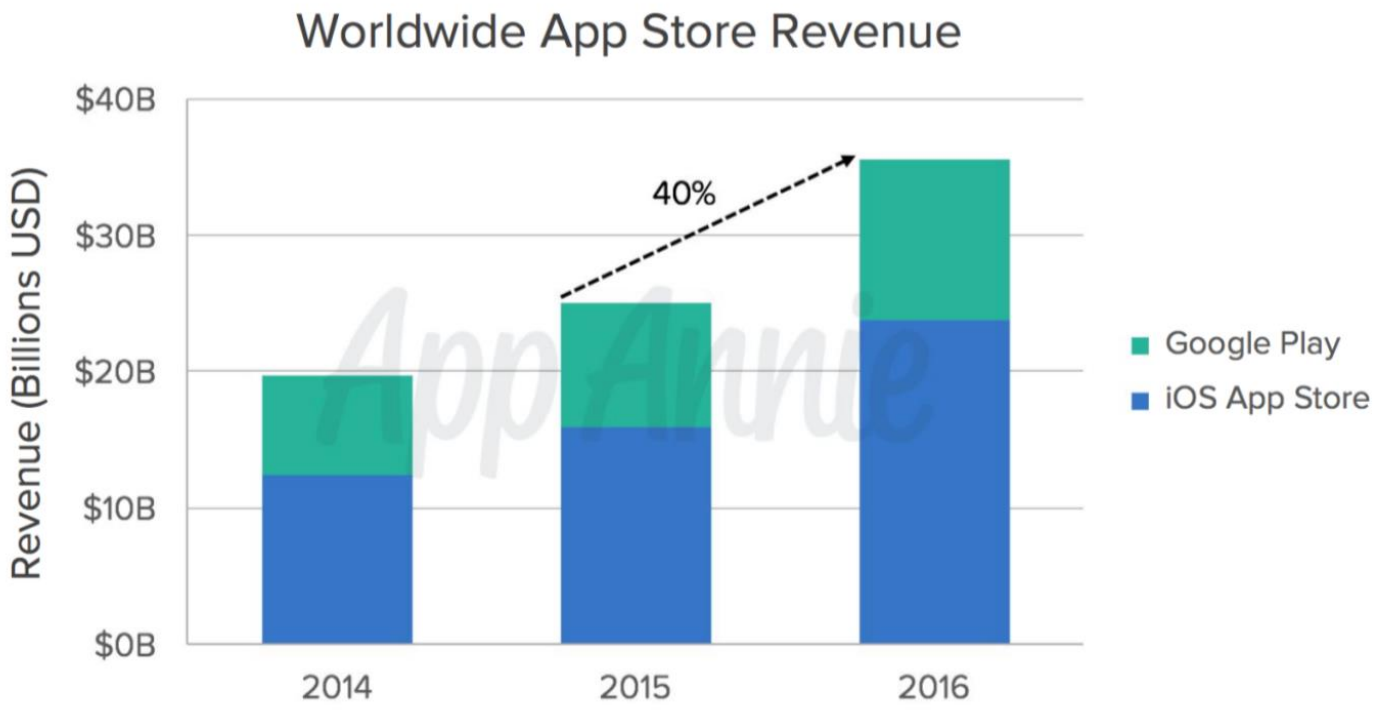


iOS Screen Sizes - August 2014

Android vs iOS



Revenue


Worldwide App Store Revenue
Revenue (Billions USD)
$40B
$30B
$20B
$10B
$0B
40%
2014
2015
2016
Google Play
iOS App Store
AppAnnie

Mobile Development

- Mobile "shops" (contract to develop mobile apps)
  - Mutual Mobile, Chaotic Moon, Nerd Ranch
- Companies tied to mobile
  - Bee Cave Games, Waze, Snapchat, Instagram
- Companies with major mobile apps
  - Facebook, Ebay
- Companies that want mobile apps for customers
  - banks, everybody??
- Companies that want mobile apps for internal use
  - everybody?