



# Mobile System Software

CSE 3203

Overview of Mobile Systems

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# Content Overview



- Mobile OS
  - General: history, market, features
  - Notable mobile OSs
  - Focus on two major current OS: iOS, Android
  - Comparison
- App Store
  - General: concepts, business model, etc.
  - Focus on two major ones: Google Play, Apple App Store

# Mobile OS



- Operating System (OS) is a base infrastructure software component of a computing system. It controls all basic operations of the device and support higher level applications.
- A mobile operating system, or mobile OS, is an operating system that is specifically designed to run on mobile devices.
  - A mobile OS runs on limited resources (computing power and storage) emphasizing communication.
  - [http://www.webopedia.com/TERM/M/mobile\\_operating\\_system.html](http://www.webopedia.com/TERM/M/mobile_operating_system.html)
- Note:
  - While some computers such as typical laptops are 'mobile', the operating systems usually used on them are not considered mobile ones, as they were originally designed for desktop computers that historically did not have or need specific mobile features.
  - Some mobile devices can run desktop OS. This distinction is becoming blurred in some newer operating systems that are hybrids made for both uses.
  - [https://en.wikipedia.org/wiki/Mobile\\_operating\\_system](https://en.wikipedia.org/wiki/Mobile_operating_system)

# Key Features of Mobile OS



- Mobile OS combine features of traditional desktop operating system with features useful for mobile or handheld use
- General OS features (just like all OS)
  - Device/hardware interfacing
  - Resource (memory, storage) management
  - I/O management
  - File management
  - User management
  - Application management
  - Task/event management
- Mobile OS unique features
  - Direct support and management of integrated hardware parts like touchscreen, camera, mic, sensors, etc.
  - Usually there is a second OS just for the communication.

# Notable Mobile OS

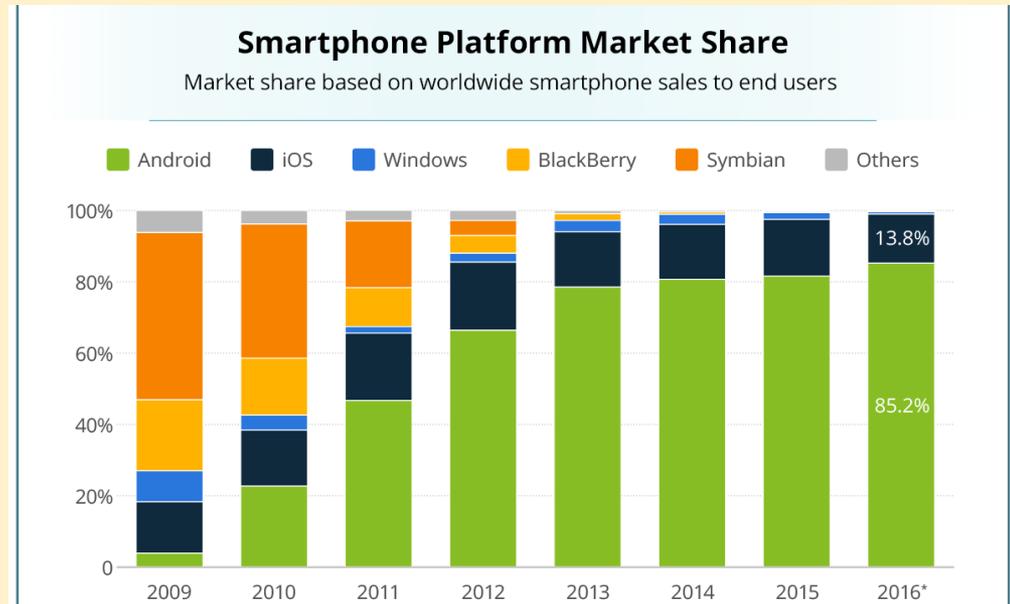


- Apple iOS
- Google Android
- Microsoft Windows 10 Mobile, formerly Windows Phone
- Blackberry 10 (Blackberry OS is discontinued)
- Nokia Symbian (discontinued)
- Some others
  - See some old ones from <https://www.addictivetips.com/mobile/an-introduction-to-modern-mobile-operating-systems/>

# Mobile OS Market Share



- Multiple sources show Android and iOS are the dominant mobile OS currently
    - Android is consistently above 80% world wide
    - In US iOS is slightly more than Android
- <http://gs.statcounter.com/os-market-share/mobile/united-states-of-america#monthly-201707-201807>



<http://www.businessinsider.com/smartphone-market-share-android-ios-windows-blackberry-2016-8>

For more data sources:

- <https://www.netmarketshare.com/operating-system-market-share.aspx?id=platformsMobile>
- [https://en.wikipedia.org/wiki/Usage\\_share\\_of\\_operating\\_systems#Mobile\\_devices](https://en.wikipedia.org/wiki/Usage_share_of_operating_systems#Mobile_devices)
- [https://en.wikipedia.org/wiki/Mobile\\_operating\\_system#Market\\_share](https://en.wikipedia.org/wiki/Mobile_operating_system#Market_share)

# Mobile OS vs Desktop OS Usage



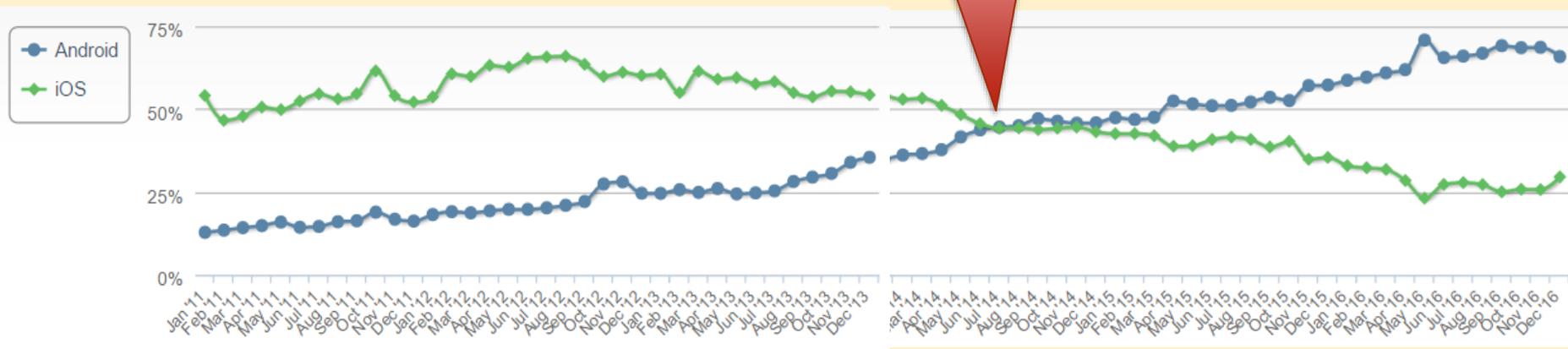
- Mobile OS usage has exceeded desktop OS
  - March 27, 2016, was the first day when mobile OS became majority
  - May 28, 2016, was the day when smartphones became a most used platform
  - Since October 27, 2016, desktop-minority has persisted every day
  - Source:  
[https://en.wikipedia.org/wiki/Usage\\_share\\_of\\_operating\\_systems#Mobile\\_devices](https://en.wikipedia.org/wiki/Usage_share_of_operating_systems#Mobile_devices)

# iOS vs Android Market Share



- The crossover

Summer 2014

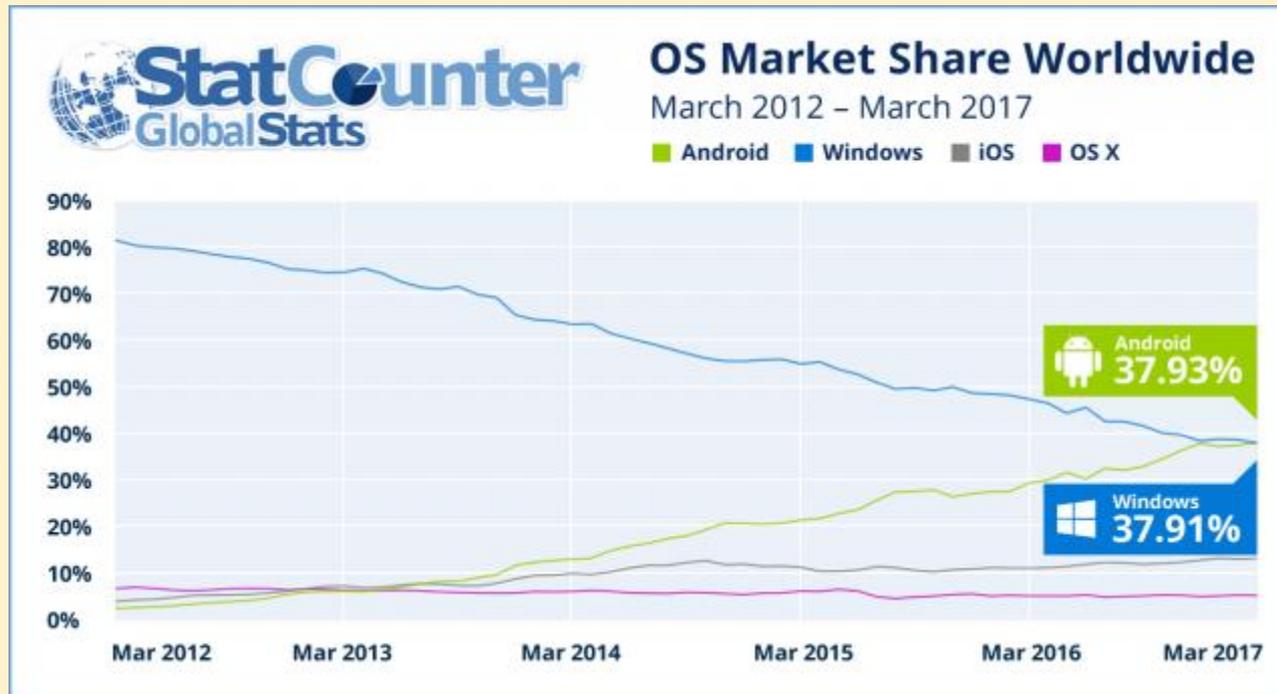


<https://www.netmarketshare.com/mobile-phones.aspx?qprid=9&qpcustomb=1&qpcustom=iOS,Android&qpsp=60&qpnp=12&qptimeframe=Q>

# Android vs Windows



- Android surpasses Windows as the most-used operating system worldwide

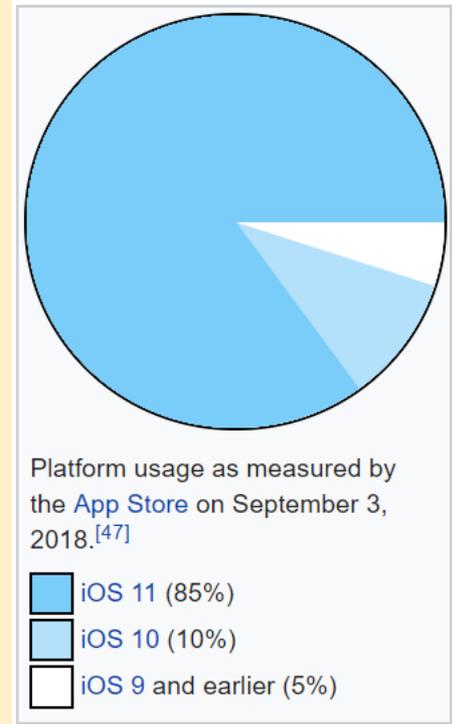


<https://www.extremetech.com/mobile/247026-android-surpasses-windows-used-operating-system-worldwide>

# Apple iOS



- iOS is a mobile operating system created and developed by Apple Inc. exclusively for its hardware.
- It is the operating system that presently powers many of the company's mobile devices, including the iPhone, iPad, and iPod Touch.
- A Unix-like system
  - The iOS kernel is the XNU kernel of Darwin.
  - XNU is the computer operating system kernel developed at Apple Inc. since December 1996 for use in the macOS and released as free and open-source software as part of the Darwin operating system.
  - Darwin is an open-source Unix operating system released by Apple Inc in 2000.
- A closed and proprietary system
  - Authorized third-party native applications are available through Apple's App Store for devices running iPhone OS 2.0 and higher.
  - Native apps must be written in Swift or Objective-C and compiled specifically for iOS
- The current version is 11 (12 is coming)



<https://en.wikipedia.org/wiki/IOS>

# Google Android

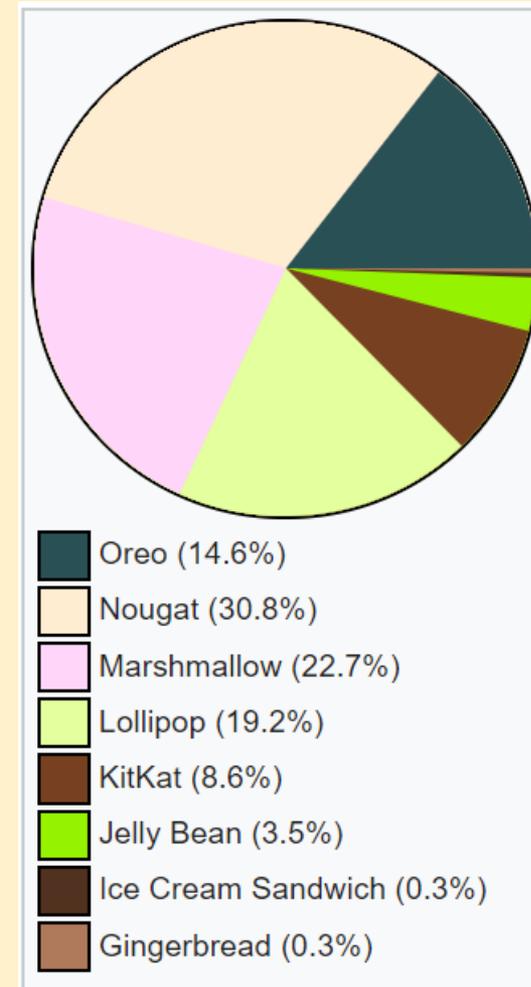


- Android is a mobile operating system developed by Google, based on the Linux kernel and designed primarily for touchscreen mobile devices.
  - Also extended to other devices, including Android TV, Android Auto, WearOS, projector, top box, etc.
- Key facts
  - Initially developed by Android, Inc., which Google bought in 2005
  - Android's source code is released by Google under open source licenses (AOSP)
  - Android's kernel is based on one of the Linux kernel; some consider it to be a Linux distribution

# Android OS Versions and Usage



Version	Code name	Release date	API level
9.0	Pie	August 6, 2018	28
8.1	Oreo	December 5, 2017	27
8.0		August 21, 2017	26
7.1	Nougat	October 4, 2016	25
7.0		August 22, 2016	24
6.0	Marshmallow	October 5, 2015	23
5.1	Lollipop	March 9, 2015	22
5.0		November 3, 2014	21
4.4	KitKat	October 31, 2013	19
4.3	Jelly Bean	July 24, 2013	18
4.2		November 13, 2012	17
4.1		July 9, 2012	16
4.0	Ice Cream Sandwich	October 19, 2011	15
2.3	Gingerbread	February 9, 2011	10



For most recent developments, visit:

<https://developer.android.com/about/dashboards/index.html>

[https://en.wikipedia.org/wiki/Android\\_\(operating\\_system\)#Platform\\_usage](https://en.wikipedia.org/wiki/Android_(operating_system)#Platform_usage)

# Android Open Source Project



- Android is developed by Google until the latest changes and updates are ready to be released, at which point the source code is made available to the Android Open Source Project (AOSP), an open source initiative led by Google.
  - <https://source.android.com>
  - <https://www.androidcentral.com/aosp>
- The AOSP code can be found without modification on select devices, mainly the Nexus and Pixel series of devices.
- The source code is, in turn, customized and adapted by original equipment manufacturers (OEMs) to run on their hardware.
- Android's source code does not contain the often proprietary device drivers that are needed for certain hardware components. As a result, most Android devices, including Google's own, ultimately ship with a combination of free and open source and proprietary software, with the software required for accessing Google services falling into the latter category.

# Android One



- Android One is a series of smartphones that run the unmodified Android operating system.
- It is a hardware and software technical standard created by Google intended to provide a consistent user experience and improved security through frequent updates and Google Play Protect.
- <https://www.android.com/one/>

# Android vs. iOS



	Android	iOS
<b>Source</b>	Open source	Closed, with open source components.
<b>Customizability</b>	A lot. Can change almost anything.	Limited unless jailbroken
<b>File transfer</b>	Easier than iOS. Using USB port and Android File Transfer desktop app. Photos can be transferred via USB without apps.	More difficult. Media files can be transferred using iTunes desktop app. Photos can be transferred out via USB without apps.
<b>Available on</b>	Many phones and tablets and other devices from many companies.	iPod Touch, iPhone, iPad, Apple TV (2nd and 3rd generation)
<b>OS family</b>	Linux	X, UNIX
<b>App installation</b>	Support independent third party installation	Only through App Store

For a full comparison, see

[http://www.diffen.com/difference/Android\\_vs\\_iOS](http://www.diffen.com/difference/Android_vs_iOS)

# App Store



- An app store (or app marketplace) is a type of digital distribution platform for computer software, often in a mobile context.
  - App stores typically take the form of an online store, but the products are the apps
  - [https://en.wikipedia.org/wiki/App\\_store](https://en.wikipedia.org/wiki/App_store)
- The app store distribution model provides much bigger capacity to reach out app users, leverages the trust established by a company that runs an app store, and handles apps purchasing transactions.
- Major features
  - users can browse through or search these different app categories, view information about each app (such as reviews or ratings)
  - Acquire (download) the app (including app purchase, if necessary).
  - Payment accepted
  - Provide basic app stats and rankings, like number of downloads
  - Provide user ratings and reviews
  - App update
- App store may be an integral part of OS, like in iOS, or independent like ones found in Android.

# List of App Stores



- Major mobile app store
  - Google Play: <https://play.google.com>
  - Apple App Store
- Other notables
  - Amazon Appstore
  - Windows Store
- More
  - <http://www.businessofapps.com/guide/app-stores-list/>
  - [https://en.wikipedia.org/wiki/List\\_of\\_mobile\\_software\\_distribution\\_platforms](https://en.wikipedia.org/wiki/List_of_mobile_software_distribution_platforms)
  - <https://drfone.wondershare.com/android/android-app-market.html>

# Apple vs. Google App Store

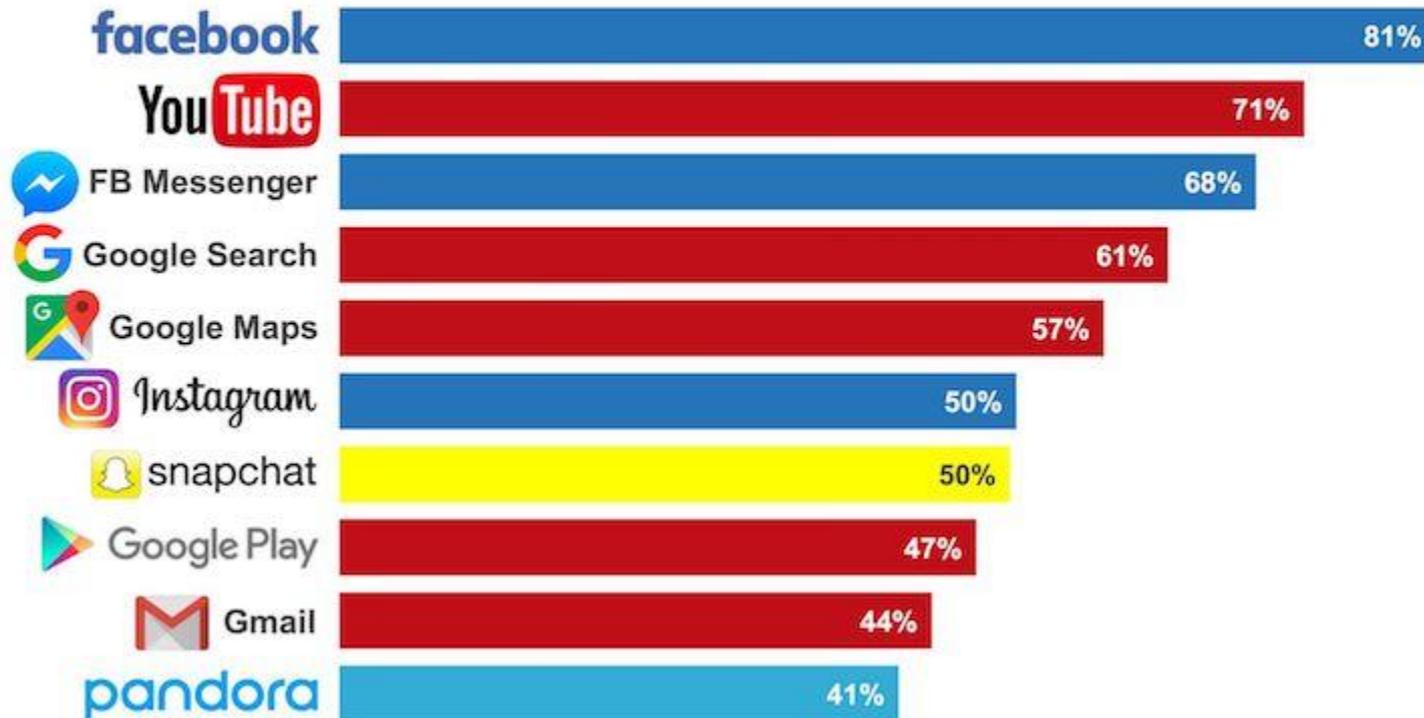


- The Apple's App Store is built on a curated model, it implies Apple's control over apps quality and their compliance to certain standards, defined by Apple.
- The Google's Google Play store app publication process implies much less strict guidelines for Android app developers to comply.
- <http://www.businessofapps.com/data/app-statistics/>
- Apple's iOS App Store now generating 4x revenues per app vs Android Google Play
  - <https://appleinsider.com/articles/16/07/19/apples-ios-app-store-now-generating-4x-revenues-per-app-vs-android-google-play>



## Top 10 Mobile Apps by Penetration of App Audience

Source: comScore Mobile Metrix, U.S., Age 18+, June 2017



<http://www.businessofapps.com/data/app-statistics/>

# More Resources



- <http://www.androidauthority.com>
- <https://www.androidcentral.com/android-history>
- <https://www.android.com/history>
- [https://en.wikipedia.org/wiki/Comparison\\_of\\_mobile\\_operating\\_systems](https://en.wikipedia.org/wiki/Comparison_of_mobile_operating_systems)
- <https://www.informationweek.com/mobile/mobile-applications/smartphone-os-a-22-year-history/d/d-id/1319495>
- **Emulator**
  - <https://www.andyroid.net>
  - <https://visualstudio.microsoft.com/vs/msft-android-emulator/>
  - <https://www.androidauthority.com/best-android-emulators-for-pc-655308/>