Mobile Application Development

Produced by

Eamonn de Leastar (edeleastar@wit.ie)
David Drohan (ddrohan@wit.ie)
Dr. Siobhan Drohan (sdrohan@wit.ie)

Department of Computing, Maths & Physics
Waterford Institute of Technology

http://www.wit.ie

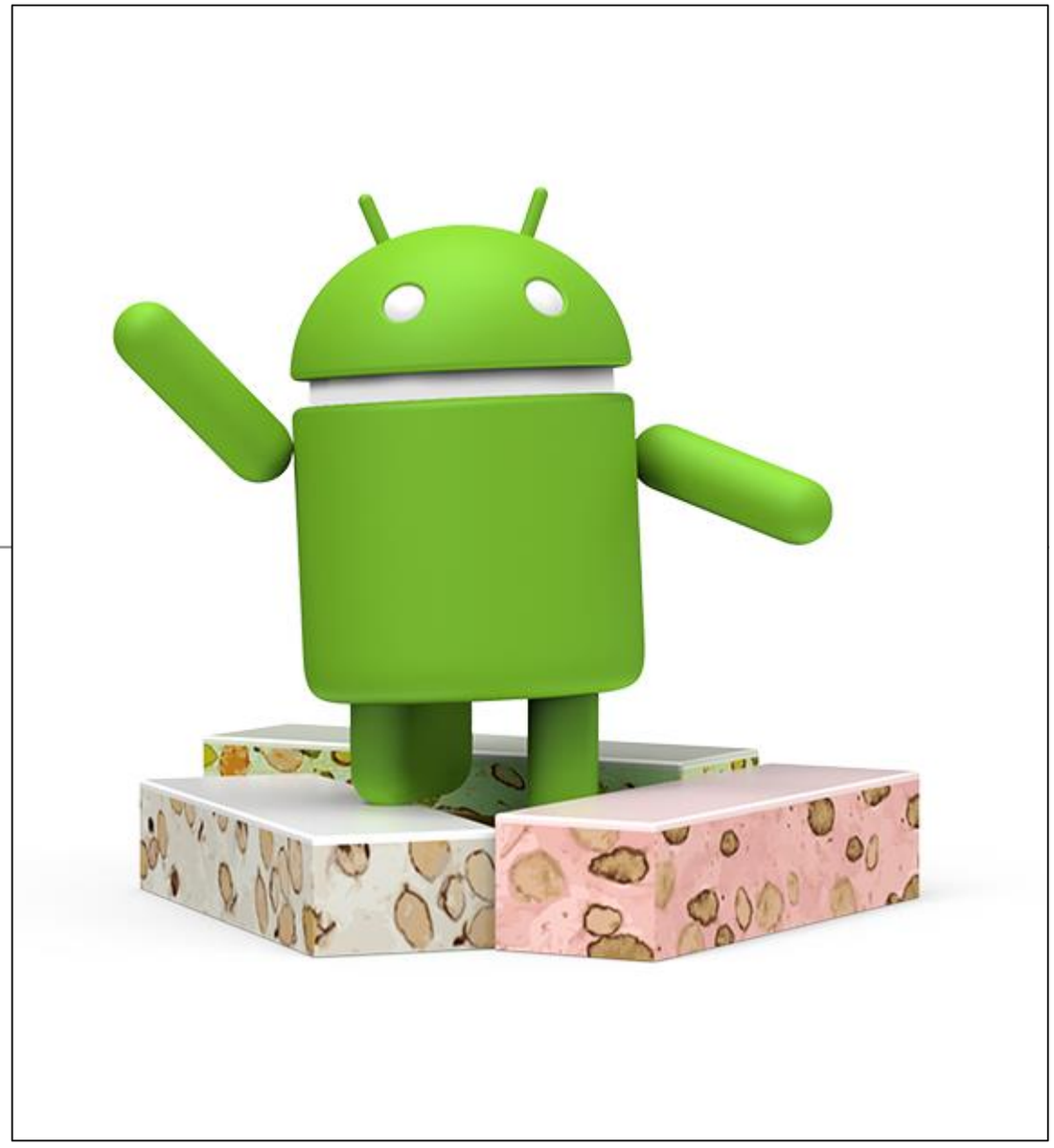
http://elearning.wit.ie

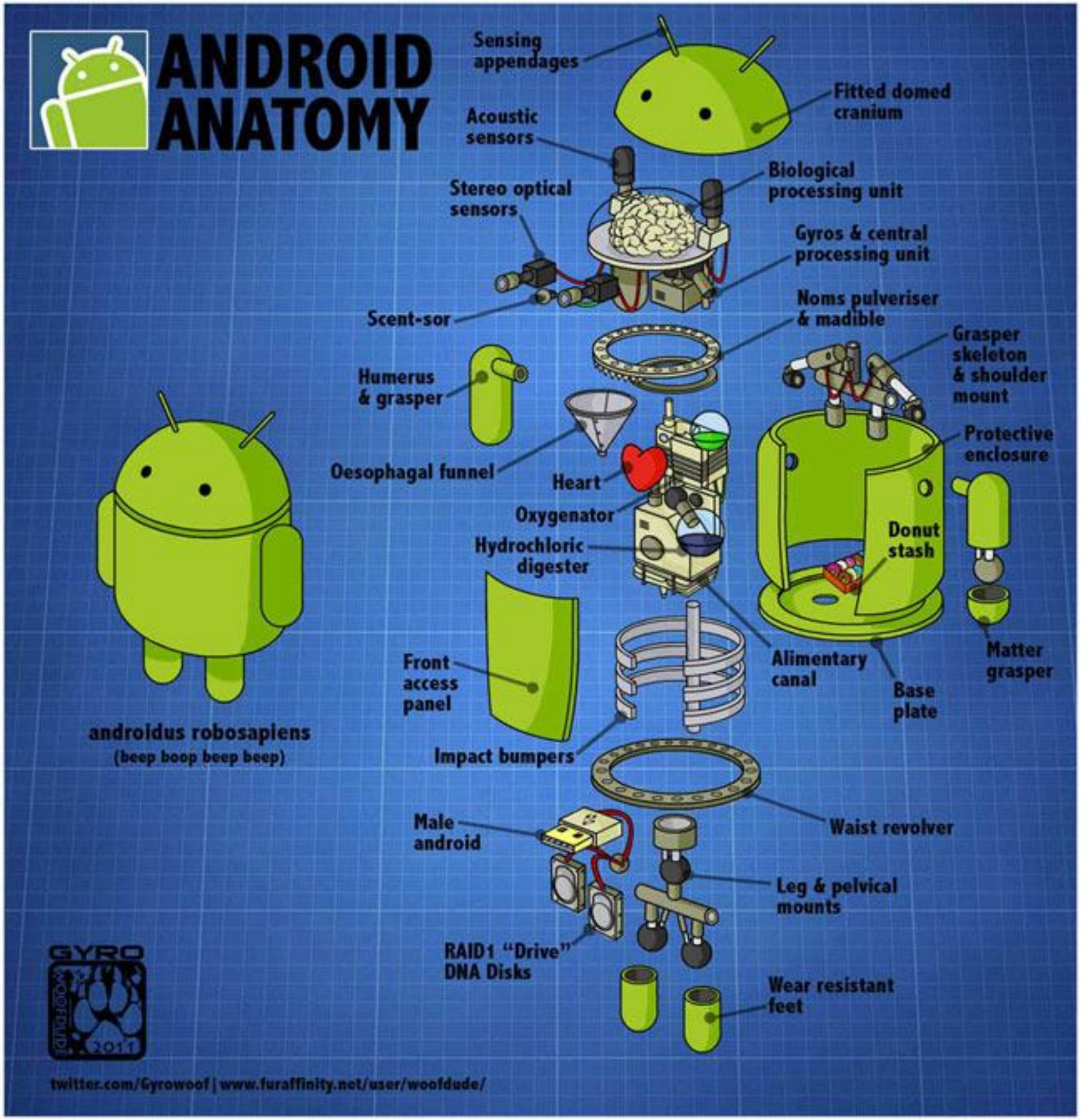
Waterford Institute *of* Technology
INSTITIÚID TEICNEOLAÍOCHTA PHORT LÁIRGE

eLearning support unit

Introducing Android

Nougat 7.0




ANDROID ANATOMY
Sensing appendages
Fitted domed cranium
Acoustic sensors
Biological processing unit
Stereo optical sensors
Gyros & central processing unit
Noms pulveriser & madible
Scent-sor
Grasper skeleton & shoulder mount
Humerus & grasper
Protective enclosure
Oesophagal funnel
Heart
Oxygenator
Donut stash
Hydrochloric digester
Front access panel
Alimentary canal
Matter grasper
Base plate
Impact bumpers
androidus robosapiens
(beep boop beep beep)
Waist revolver
Male android
Leg & pelvical mounts
RAID1 "Drive" DNA Disks
Wear resistant feet
GYRO
2011
twitter.com/Gyrowoof | www.furaffinity.net/user/woofdude/

Topic List

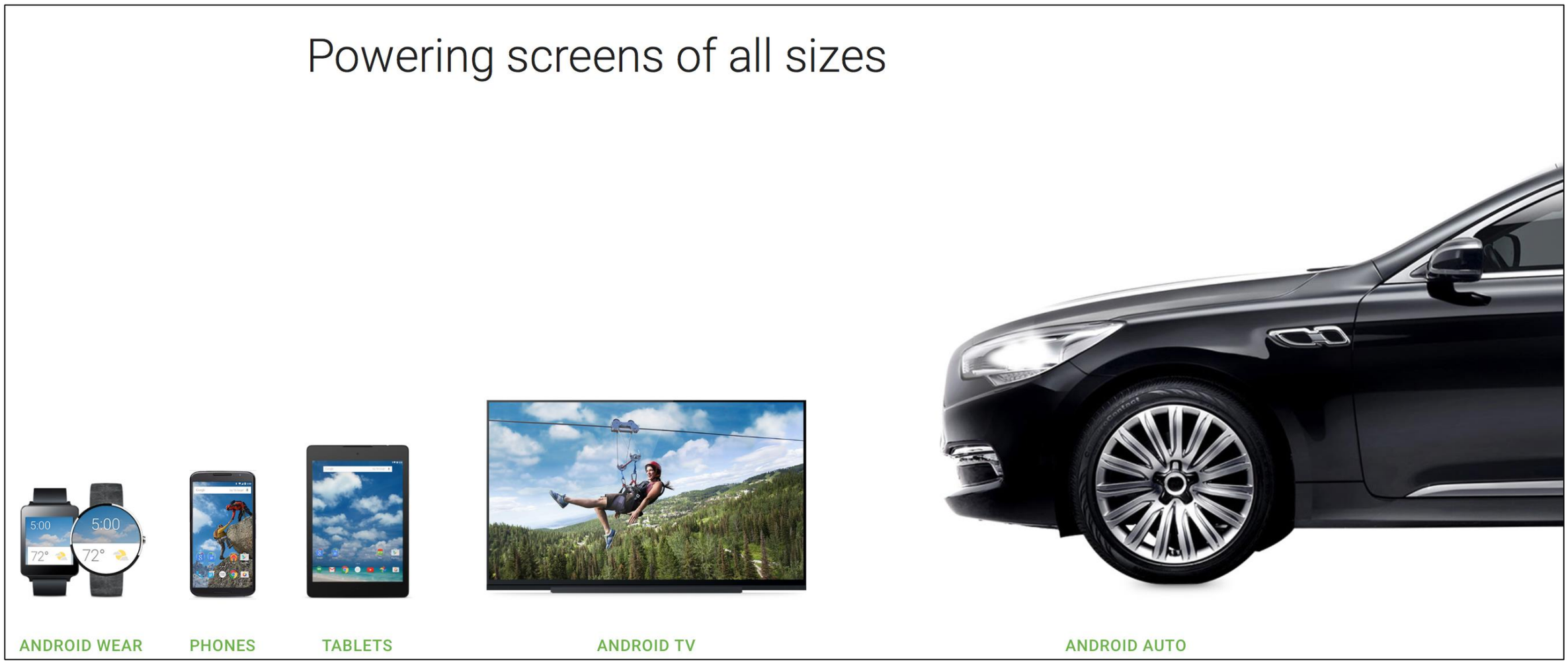
- Background.
- Android Version and Adoption.
- Android vs iOS.
- Developing apps in Android.

Topic List

- Background.
- Android Version and Adoption.
- Android vs iOS.
- Developing apps in Android.

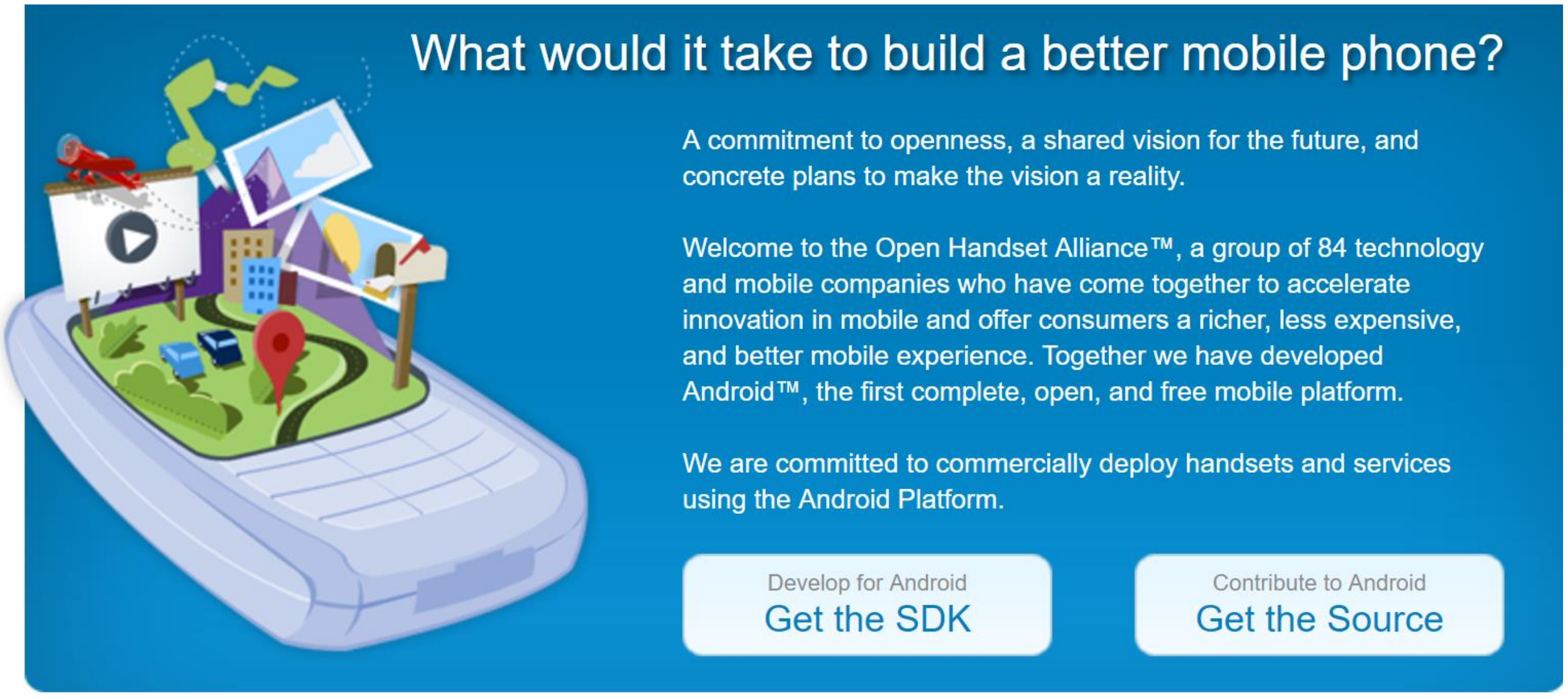
Background

- Android is a comprehensive, open source platform designed for mobile devices.



Background

- Android is championed by Google; owned by Open Handset Alliance.



Mobile Operators

Sprint
中国电信 CHINA TELECOM
NTT DoCoMo
Telefonica
T-Mobile
中国移动通信 CHINA MOBILE
Bouygues Telecom
China unicom中国联通
vodafone
TELECOM ITALIA
Designing The Future KDDI
SoftBank

Software Companies

Google
ebay
Living Image
SkyPoP
myriad mobile software
SONiVOX sound that rocks.
OMRON
NUANCE
Ascender Corporation
pv
SVOX

Commercialization Companies

embinux
sasken
WIND RIVER
BORQS
noser
WIPRO Applying Thought
Aplix Corporation
tat
TELECA

Semiconductor Companies

ARM
freescale semiconductor
intel
QUALCOMM
AKM
CYPRESS PERFORM
csr
BROADCOM.
Audience
ATHEROS
ST ERICSSON
MIPS TECHNOLOGIES
Synaptics
RENESAS
MARVELL
VIA Telecom
Texas Instruments
NVIDIA

Handset Manufacturers

GARMIN
htc smart mobility
SAMSUNG
LG Electronics
acer
ASUS Rock Solid · Heart Touching
HUAWEI
KYOCERA
ALCATEL mobile phones
MOTOROLA
TOSHIBA
Sony Ericsson
FIH
ZTE中兴
lenovo 联想移动

Open Handset Alliance

http://www.openhandsetalliance.com

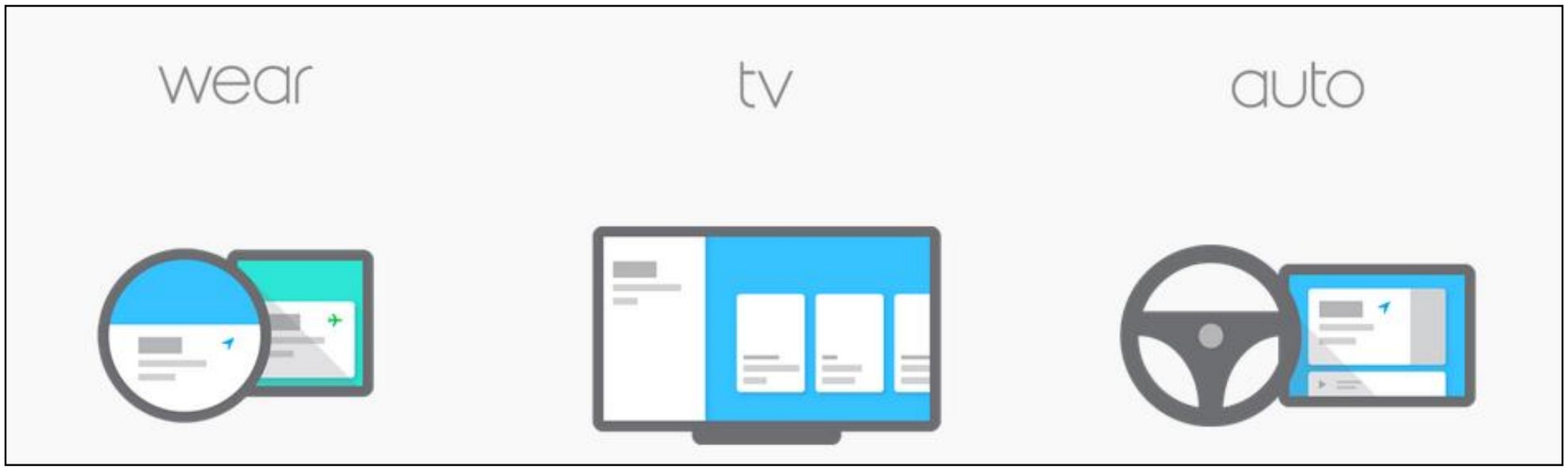
Background

- Android, along with IOS, is revolutionising the mobile space.
- Unlike IOS, Android is an open platform that ***separates the hardware from the software*** that runs on it.

Background

Separating hardware from software that runs on it…

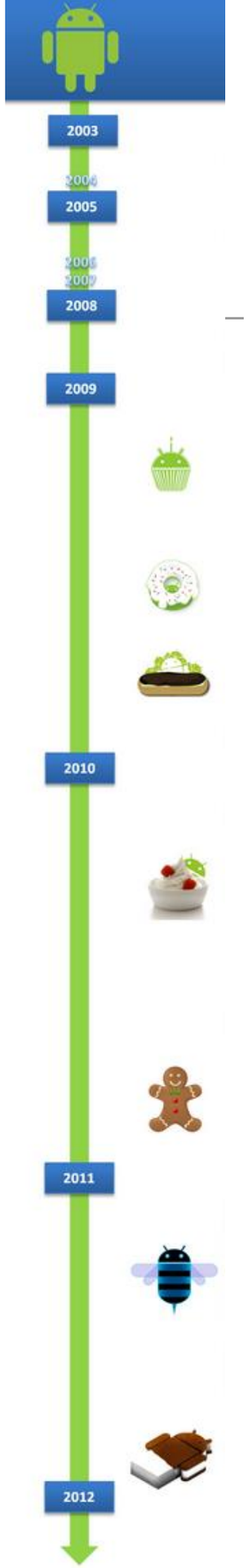
- …allows for a much larger number of devices to run the same applications
- …and creates a much richer ecosystem for developers and consumers.



Designed for Mobile Devices

- When designing Android, the team considered which mobile device constraints were not likely to change in the foreseeable future:
  - Battery power / battery performance → not likely to get much better anytime soon.
  - Memory / Speed → small size of mobile devices means that they will generally be limited in terms of memory and speed.
  - However, screen size, resolution, chipset may vary considerably.
- These constraints have been taken into consideration throughout the platform.

History



- In 2005, Google buys Android, Inc.
- In 2007, the Open Handset Alliance is announced. Android is officially open sourced.
- In 2008, the Android SDK 1.0 is released. The G1 phone, manufactured by HTC and sold by the wireless carrier T-Mobile USA, follows shortly afterward.
- 2009 sees a proliferation of Android-based devices. New versions of the operating system are released: Cupcake (1.5), Donut (1.6), and Eclair (2.0 and 2.1). More than 20 devices run Android.
- In 2010, Android is second only to BlackBerry as the best-selling smart phone platform. Froyo (Android 2.2) is released and so are more than 60 devices that run it.
- In 2011, Android is the #1 mobile platform by number of new activations and number of devices sold. The battle for dominating the tablet market is on.
- In 2012, GoogleTV, powered by Android and running on Intel x86 chips, is released. Android is now running on everything from the smallest of screens to the largest of TVs.
- In 2013, Google Glass, a wearable computing platform with an optical head-mounted display powered by Android is released to a select few.
- Beyond phones, tablets, and TVs, Android continues to be the big challenger to Embedded Linux as the platform for developing a number of specialized devices, such as home automation systems, car dashboards and navigation systems, as well as NASA satellites.

Topic List

- Background.
- Android Version and Adoption.
- Android vs iOS.
- Developing apps in Android.

Android Versions
through the years

Alpha
1.0
09/08

Beta
1.1
02/09

Cupcake
1.5
04/09

Donut
1.6
09/09

Eclair
2.0-2.1
10/09

Froyo
2.2-2.2.3
05/10

Gingerbread
2.3-2.3.7
12/10

Honeycomb
3-3.2.6
02/11

Ice Cream Sandwich
4-4.0.4
10/11

Jelly Bean
4.1-4.3.1
07/12

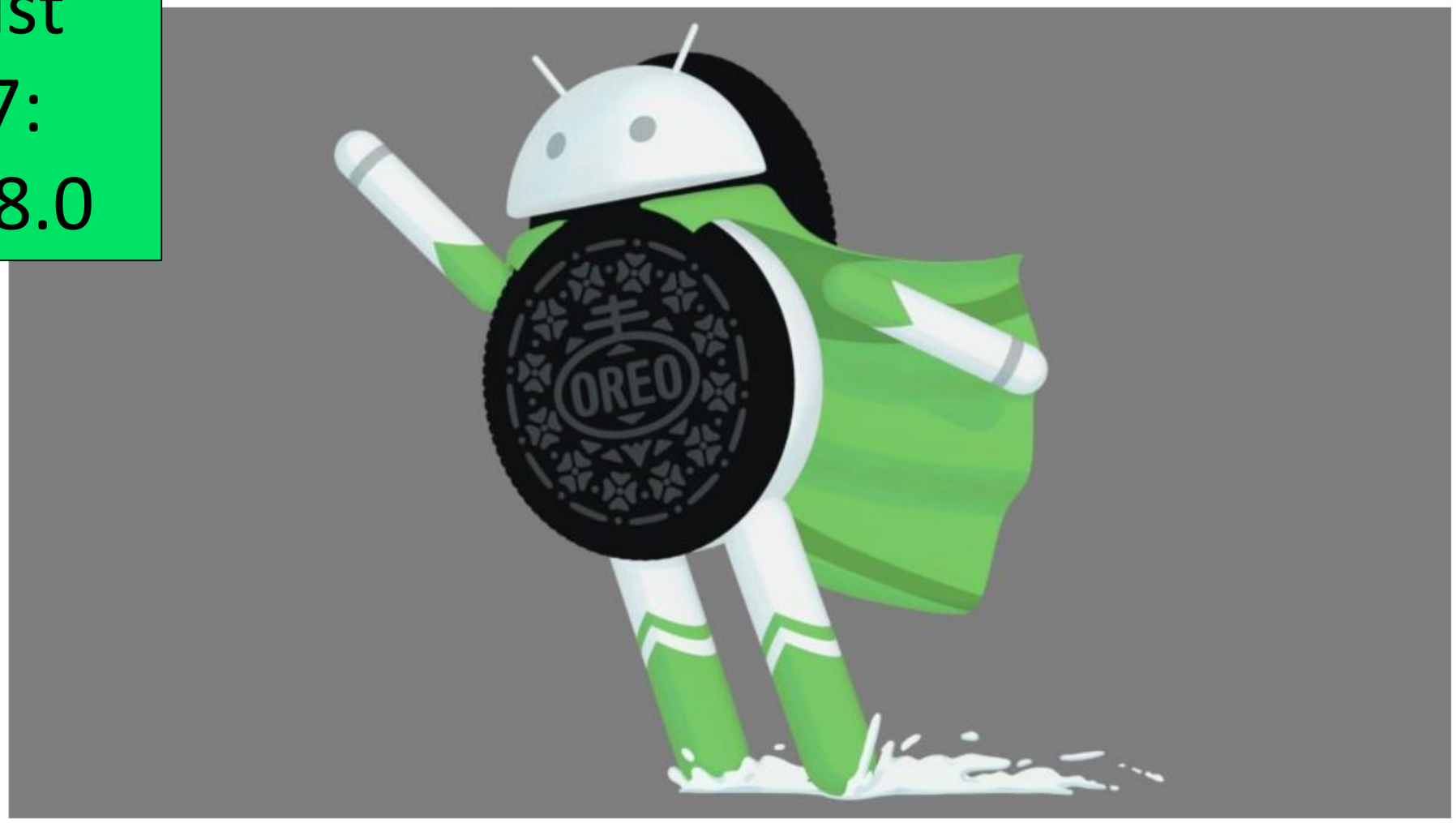
Kit Kat
4.4-4.4.4
10/13

Lollipop
5.0-5.1.1
11/14

Marshmallow
6-6.0.1
10/15

Nougat
7.0
09/16

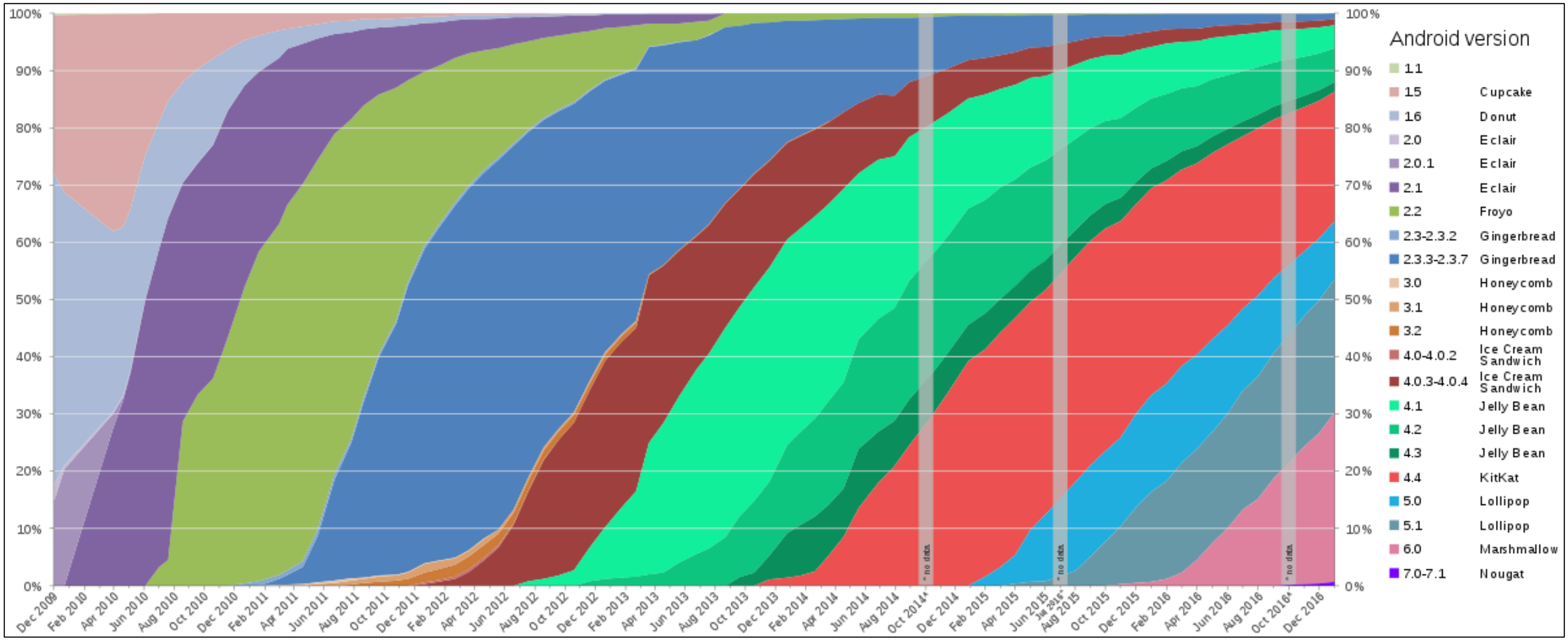
August 2017: Oreo 8.0



Update: *Google has unveiled Android Oreo, its latest major operating system update that will be the backbone of Android devices moving forward. The fleet of Pixel and Nexus devices are the first to be supported, but many companies, including HTC, have confirmed that its recent flagship phones will be updated to Android Oreo.*

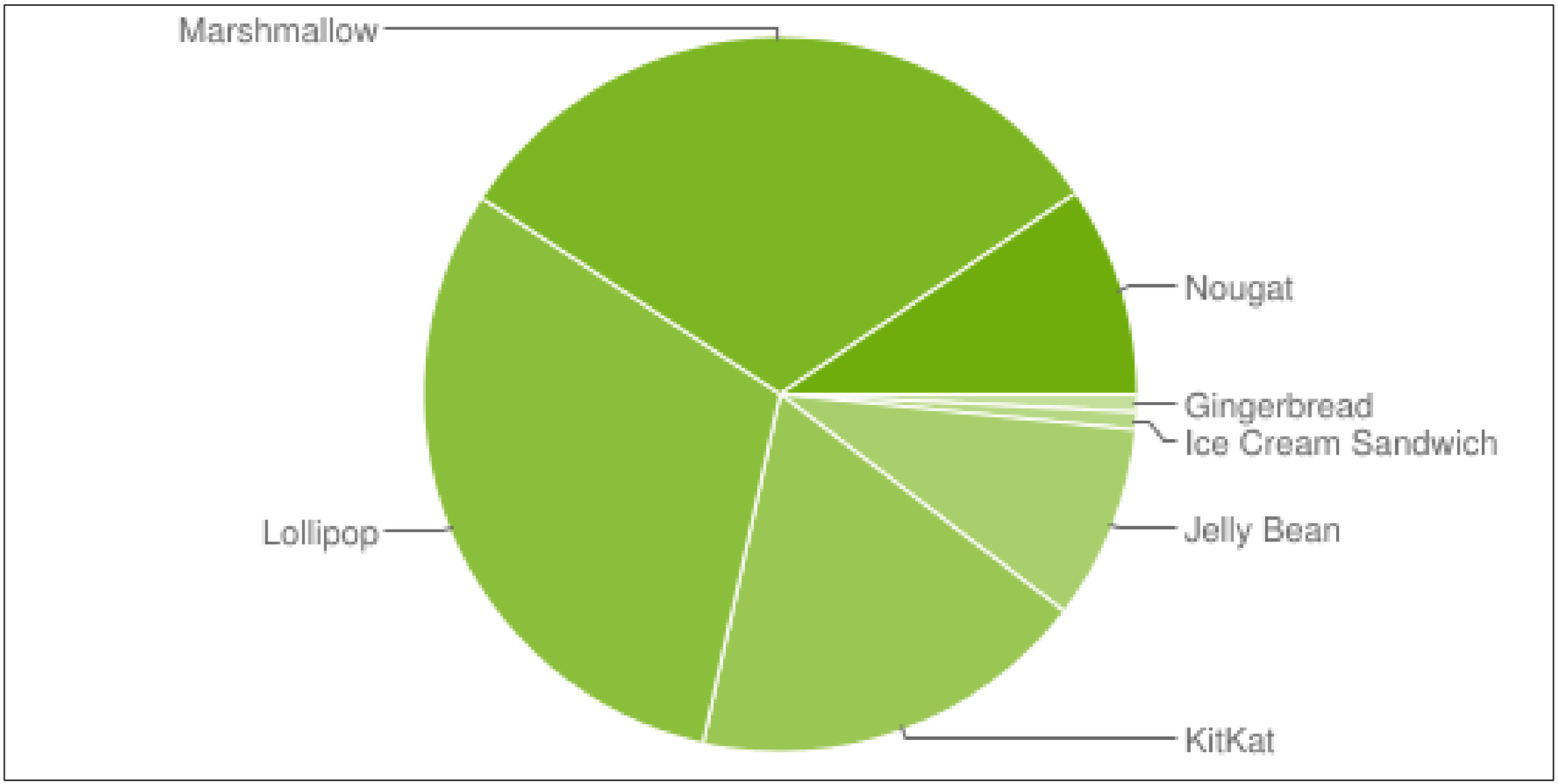
http://www.techradar.com/news/android-oreo-features-release-date

Data collected from Dec 2009 to Dec 2016.



Percentage of devices running a given Android version

Data collected during a 7-day period ending on June 5, 2017.



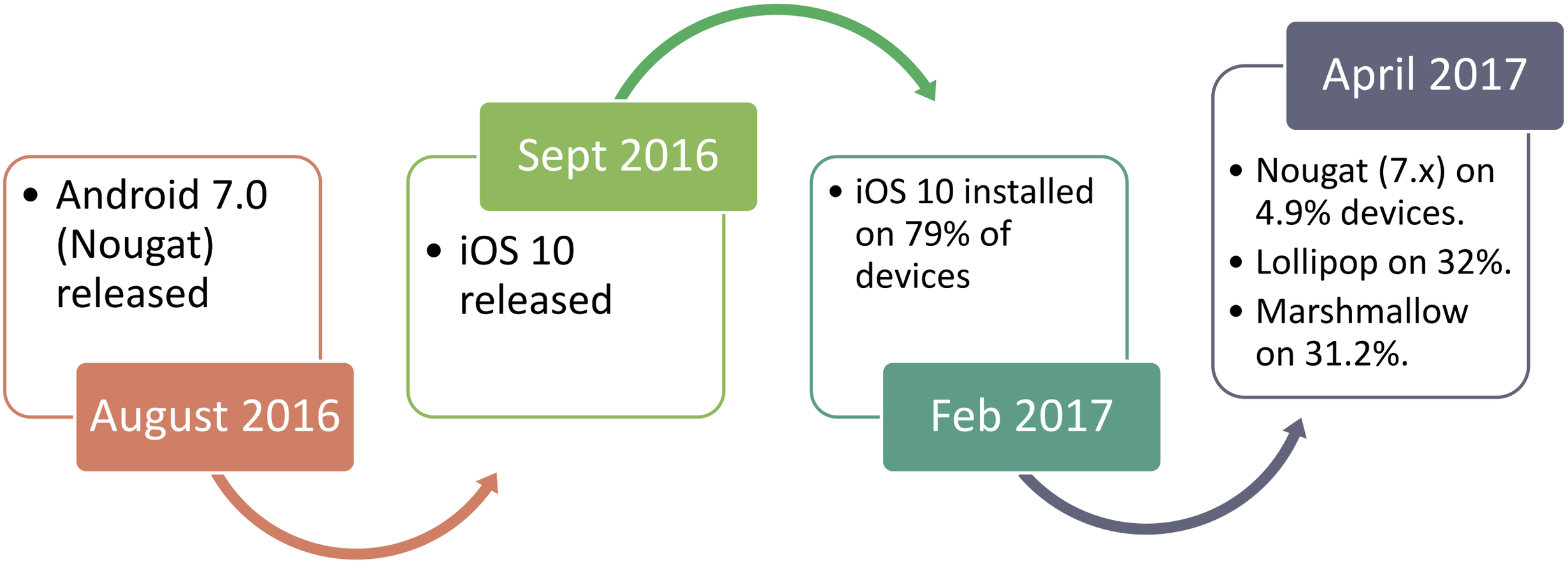
Devices running a given Android version

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

Android Market Fragmentation (OS Versions)

- The android market has massive fragmentation of version use.
- *Why is this?*
- *And how does it compare to iOS?*

Android Market Fragmentation (OS Versions)



https://www.digitaltrends.com/mobile/android-distribution-news/

Android Market Fragmentation (OS Versions)

- Android Nougat 7.x → approx. 8 months → 4.9% uptake.
- Apple iOS 10 → approx. 5 months → 79% uptake.
- Recall from earlier:

- Unlike IOS, Android is an open platform that ***separates the hardware from the software*** that runs on it. This allows for a much larger number of devices to run the same applications and creates a much richer ecosystem for developers and consumers.

Version Adoption Rates

Android adoption traditionally lags behind Apple…

…because…

…Apple can make its latest iOS available for all users at once as it makes all the hardware and the software!

Version Adoption Rates

Android → fragmented!

- Google lets many different hardware makers use its Android software; it can't control when all phones update to the latest software. So, the newest version of Android is always made available for Google's lineup of Nexus smartphones and tablets, but it can't release software updates to every single Android phone at once.

- Smartphone manufacturers often add their own modifications to Android (it is open source after all), which means that the update needs to be approved by each individual carrier first.

→ **Depending on which phone you own, it could take ages to receive the latest software update.**

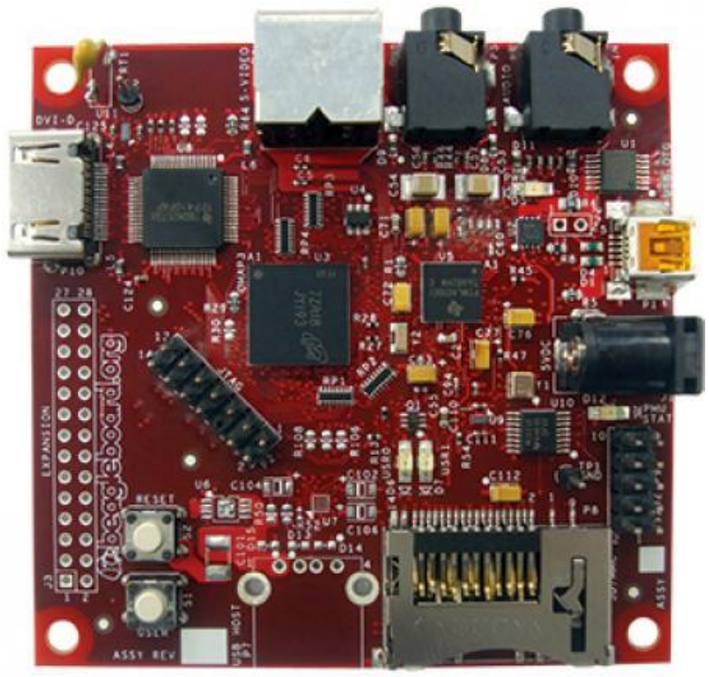
Android Market Fragmentation (Versions)

- Original Equipment Manufacturers (OEMs) tended to be very slow in upgrading their OS versions.
  - However, this has changed with Google's strong push to get everyone onto the latest versions.
- Unfortunately, some users can be stuck with older versions because they have yet to upgrade their devices to one with the hardware capable of handling the newer version.

Open Source

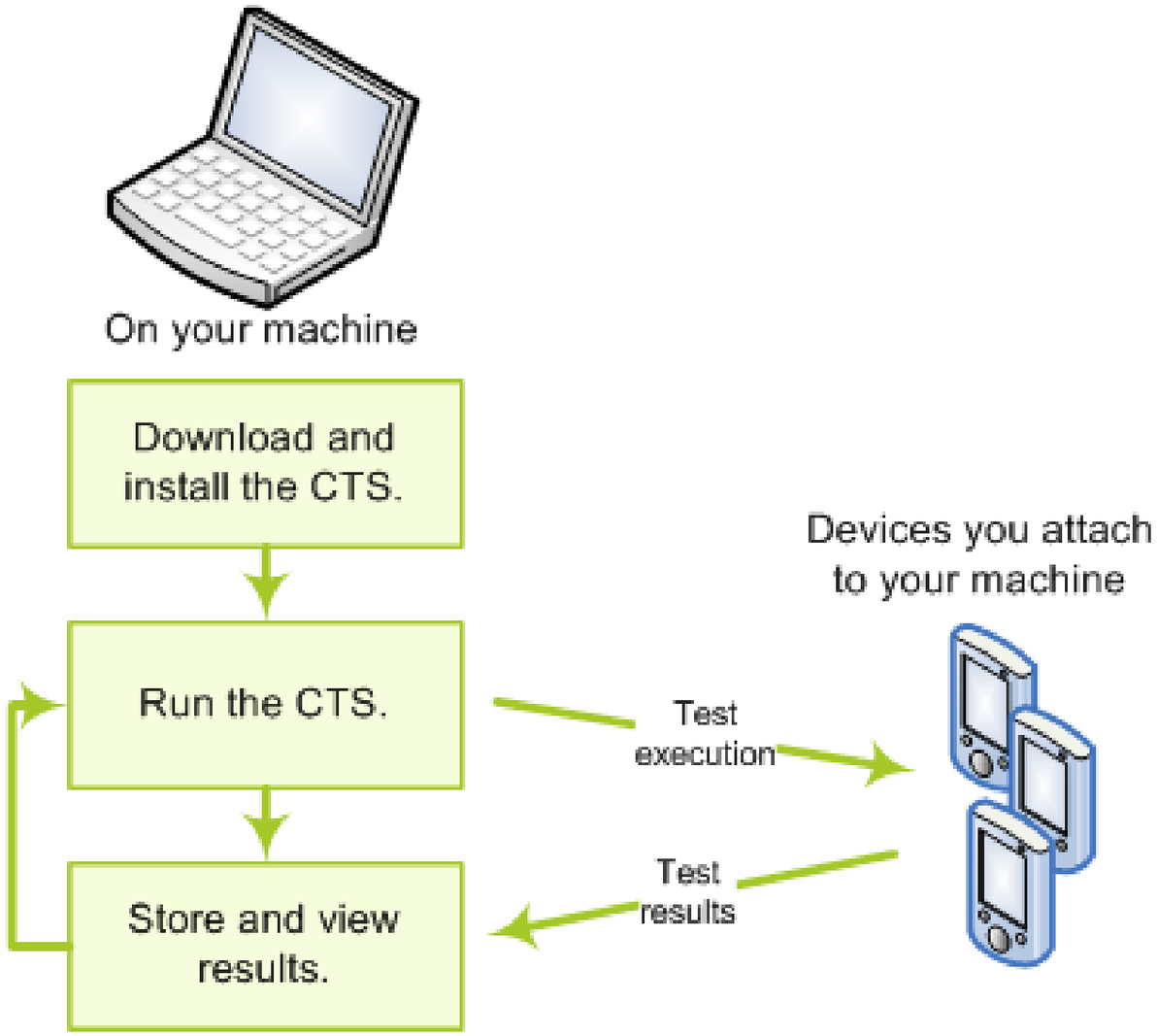
- Android is an open source platform.
- Aside from the Linux kernel itself, Android is licensed under business-friendly licenses (Apache/MIT/BSD) so that others can freely extend it and use it for variety of purposes; and you don’t need to push the updates back to the community if you don’t want to.
- Manufacturers can port Android OS to specific hardware, with minimal legal issues.

BeagleBoard, a low-cost development kit



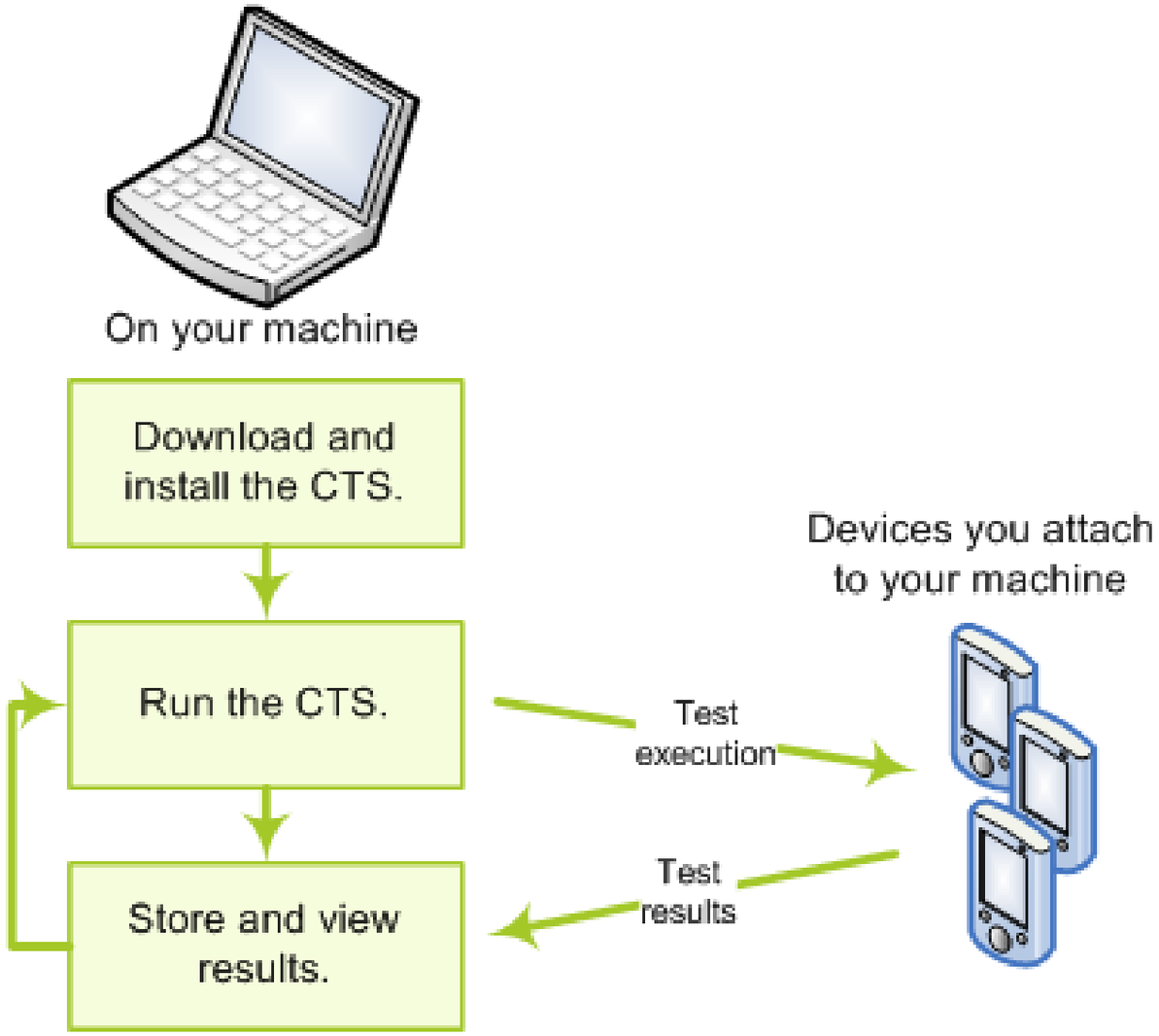
Compatibility Test Suite (CTS) – What?

- Created by Google.
- The Compatibility Test Suite (CTS), defines what it means to be an Android-compatible device.
- CTS is a combination of automated tests as well as a document that specifies what an Android device must have, should have, or what features are simply optional.



Compatibility Test Suite (CTS) – Why?

- The goal of CTS is to ensure that, for a regular consumer, an average app from the market will run on an average Android device if that device claims to be supporting a certain version of Android.
- It is designed to prevent "fragmentation" of the Android operating system.
- Optional self-test for compatibility!



Compatibility is optional

- CTS was completely avoided by Amazon with the Kindle Fire and phone series of devices, built on top of the Android OS.
- Note that manufacturers by no means have to adhere to CTS.
- Anyone is welcome to download and “remix” Android in any way they see fit.
- Android has been customized for everything from cars to satellites, and from photocopiers to washing machines.

Area	Description
Signature tests	For each Android release, there are XML files describing the signatures of all public APIs contained in the release. The CTS contains a utility to check those API signatures against the APIs available on the device. The results from signature checking are recorded in the test result XML file.
Platform API Tests	Test the platform (core libraries and Android Application Framework) APIs as documented in the SDK Class Index to ensure API correctness, including correct class, attribute and method signatures, correct method behavior, and negative tests to ensure expected behavior for incorrect parameter handling.
Dalvik VM Tests	The tests focus on testing the Dalvik VM.
Platform Data Model	The CTS tests the core platform data model as exposed to application developers through content providers, as documented in the SDK android.provider package: contacts, browser, settings, etc.
Platform Intents	The CTS tests the core platform intents, as documented in the SDK Available Intents.
Platform Permissions	The CTS tests the core platform permissions, as documented in the SDK Available Permissions.
Platform Resources	The CTS tests for correct handling of the core platform resource types, as documented in the SDK Available Resource Types. This includes tests for: simple values, drawables, nine-patch, animations, layouts, styles and themes, and loading alternate resources.

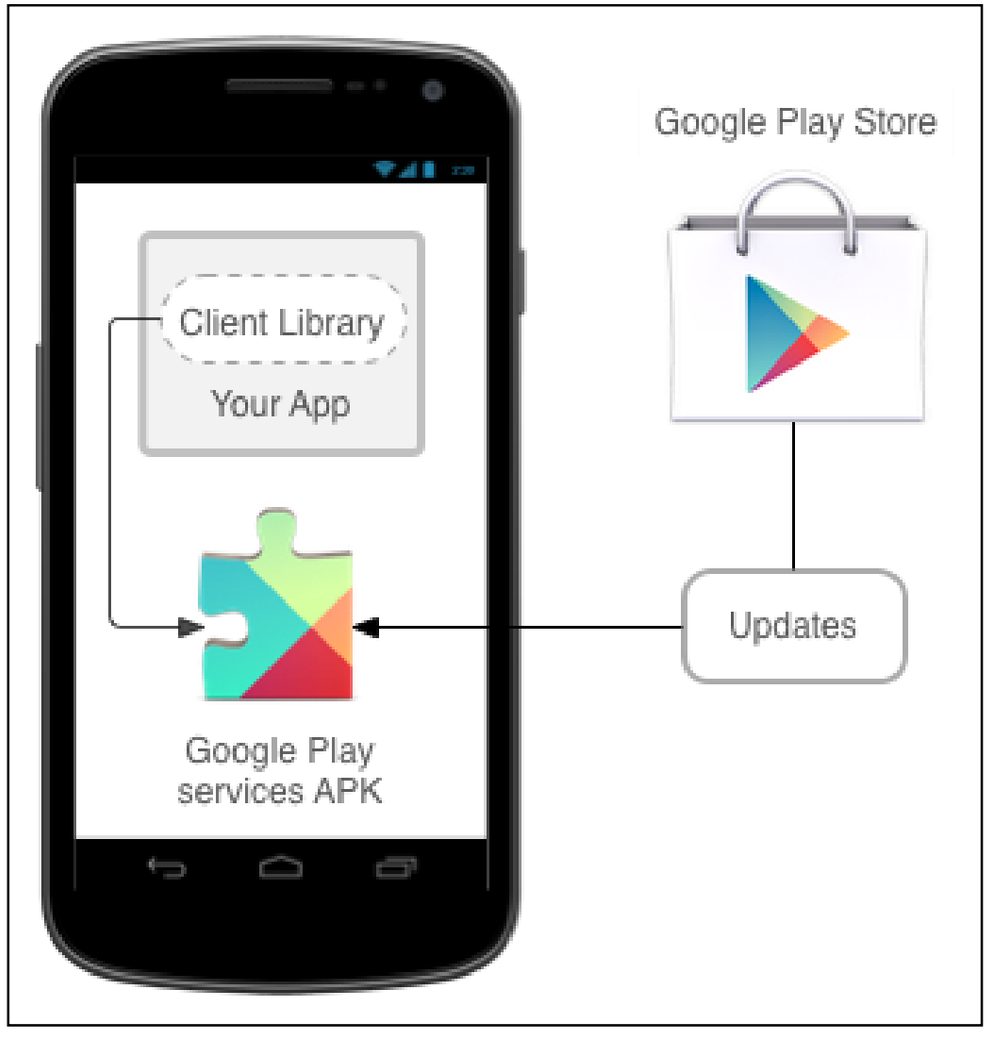
Why Compatibility? Google Play Services

- The major reason manufacturers would want to ensure Android compatibility is access to Google Play, and its rich set of apps.

- **Google Play Services** is an app that constantly checks your installed apps have the latest available versions.

- It allows apps to take advantage of the latest, Google-powered features such as Maps, Google+, and more, with automatic platform updates distributed as an APK through the Google Play store.

- Makes it faster for devices to receive updates and easier for developers to integrate some new features into their apps.



APK: file format used for installing software on Android OS

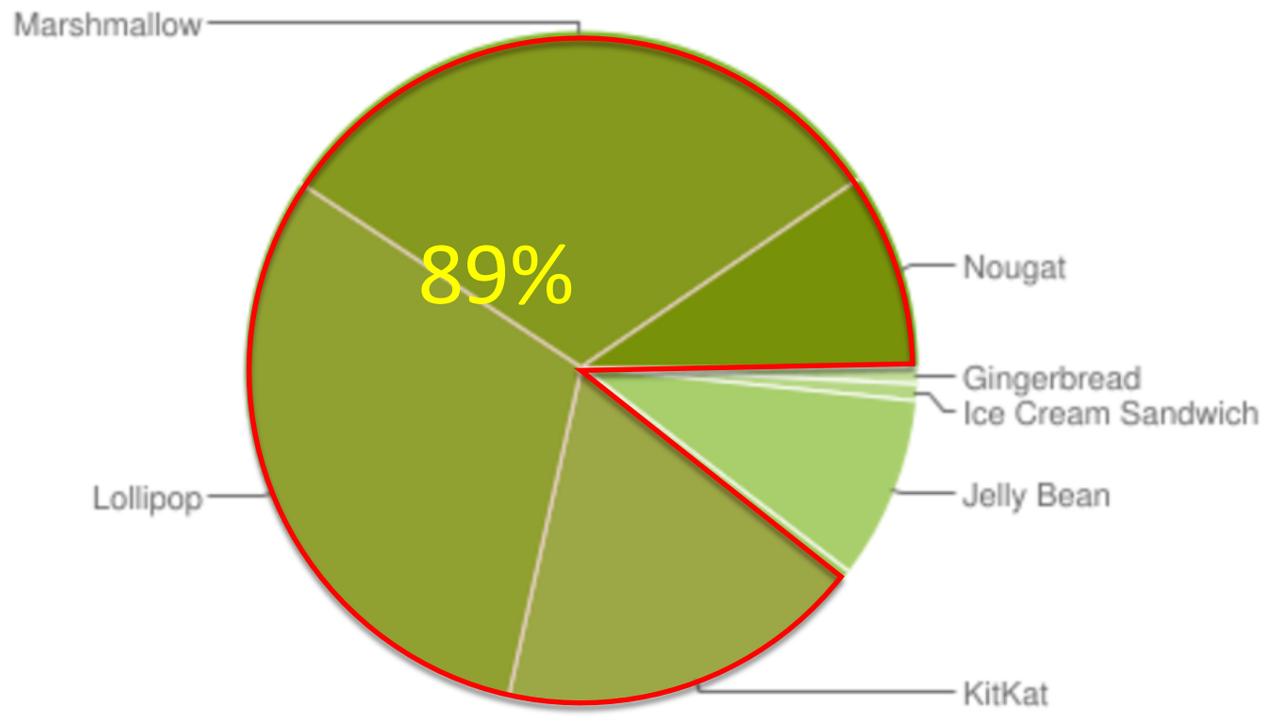
Android Versions and the API level

- The Android OS version number itself partly tells the story of the software platform's major and minor releases.

- What is most important is the API level.

- OS Version numbers change all the time, sometimes because the APIs have changed, and other times because of minor bug fixes or performance improvements.

Version	Codename	API	Distribution
2.3.3 - 2.3.7	Gingerbread	10	0.8%
4.0.3 - 4.0.4	Ice Cream Sandwich	15	0.8%
4.1.x	Jelly Bean	16	3.1%
4.2.x		17	4.4%
4.3		18	1.3%
4.4	KitKat	19	18.1%
5.0	Lollipop	21	8.2%
5.1		22	22.6%
6.0	Marshmallow	23	31.2%
7.0	Nougat	24	8.9%
7.1		25	0.6%



Data collected during a 7-day period ending on June 5, 2017.

Any versions with less than 0.1% distribution are not shown.

Version	Codename	API	Distribution
2.3.3 - 2.3.7	Gingerbread	10	0.8%
4.0.3 - 4.0.4	Ice Cream Sandwich	15	0.8%
4.1.x	Jelly Bean	16	3.1%
4.2.x		17	4.4%
4.3		18	1.3%
4.4	KitKat	19	18.1%
5.0	Lollipop	21	8.2%
5.1		22	22.6%
6.0	Marshmallow	23	31.2%
7.0	Nougat	24	8.9%
7.1		25	0.6%

Data collected during a 7-day period ending on June 5, 2017.

Any versions with less than 0.1% distribution are not shown.

- As an app developer, you need to know which API level your application is ***targeting;*** the API level will determine which devices can and cannot run your application.
- A developers' objective may be to have an application run on as many devices as possible:
- shoot for the lowest API level possible. Keep in mind the distribution of Android versions on real devices out there.

Version 7.0 – Android Nougat

- Provides a lot of major improvements and refinements over Marshmallow (6.0), along with quite a few nice new usability changes:
  - Over 1500 emojis including 72 new ones.
  - Use two or more languages at the same time.
  - Quick switch between apps (double tap).
  - Multi-view window (run two apps side-by-side).
  - Bundled notifications.
  - Notification direct reply.
  - And more…
- API Level : 24 and 25 (7.1 Nougat)

Android 7.0 Nougat Google Apps

https://www.android.com/versions/nougat-7-0/

Version 8.0 – Android Oreo

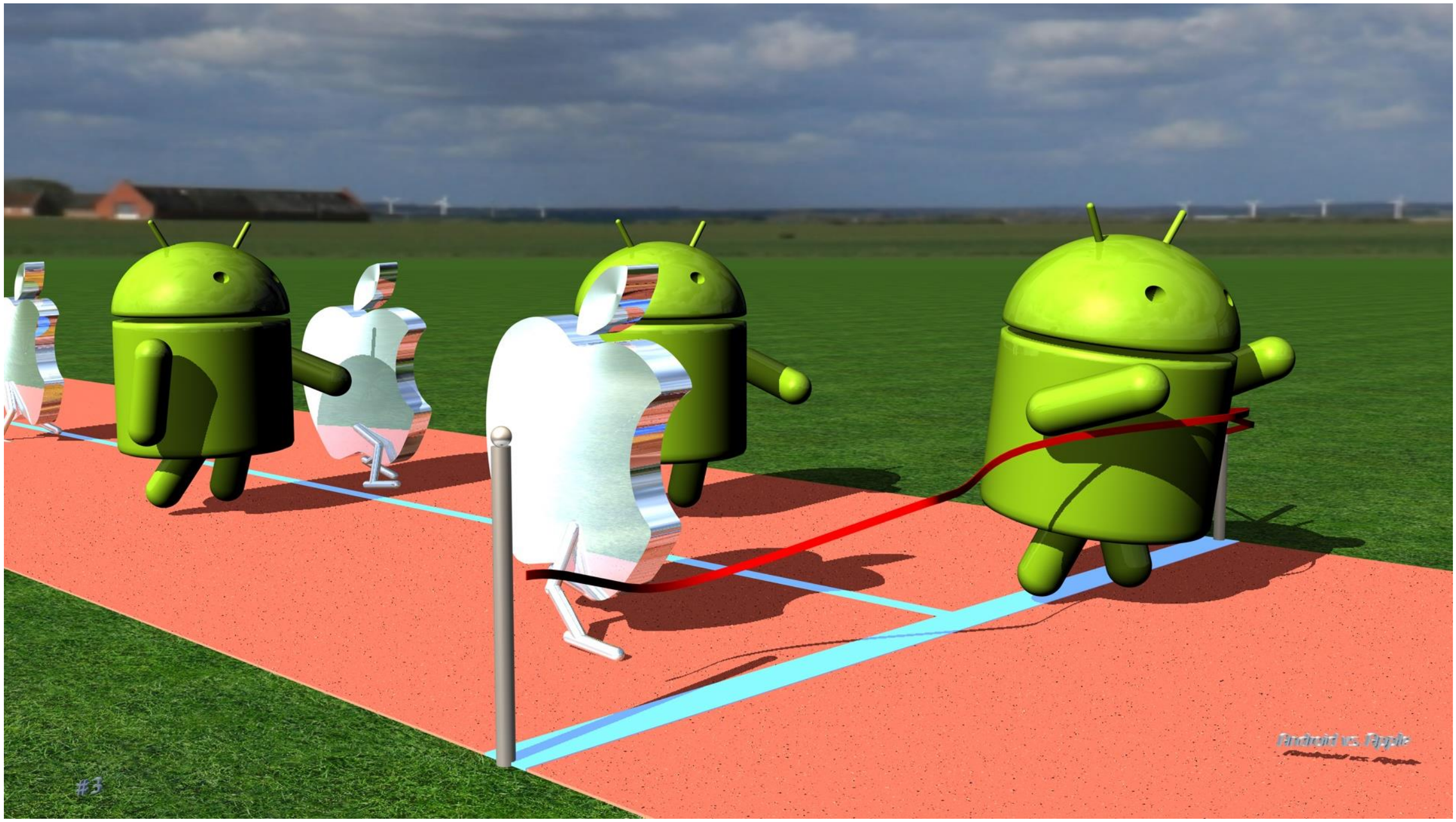
- Released on 21st August 2017.
  - 2x faster to boot up
  - Minimises background app activity
  - Autofill remembers app logins
  - Picture in Picture lets you see two apps at once
  - Notification dots quickly show you what's new, and can be swiped off screen
  - Android Instant Apps launch within your browser with no installation
  - Google Play Protect scans apps to keep your device and data safe
  - Improved battery life
  - Redesigned emoji library with more than 60 new emoji
- API Level : 26

http://www.techadvisor.co.uk/new-product/google-android/android-oreo-news-release-date-new-features-3647595/

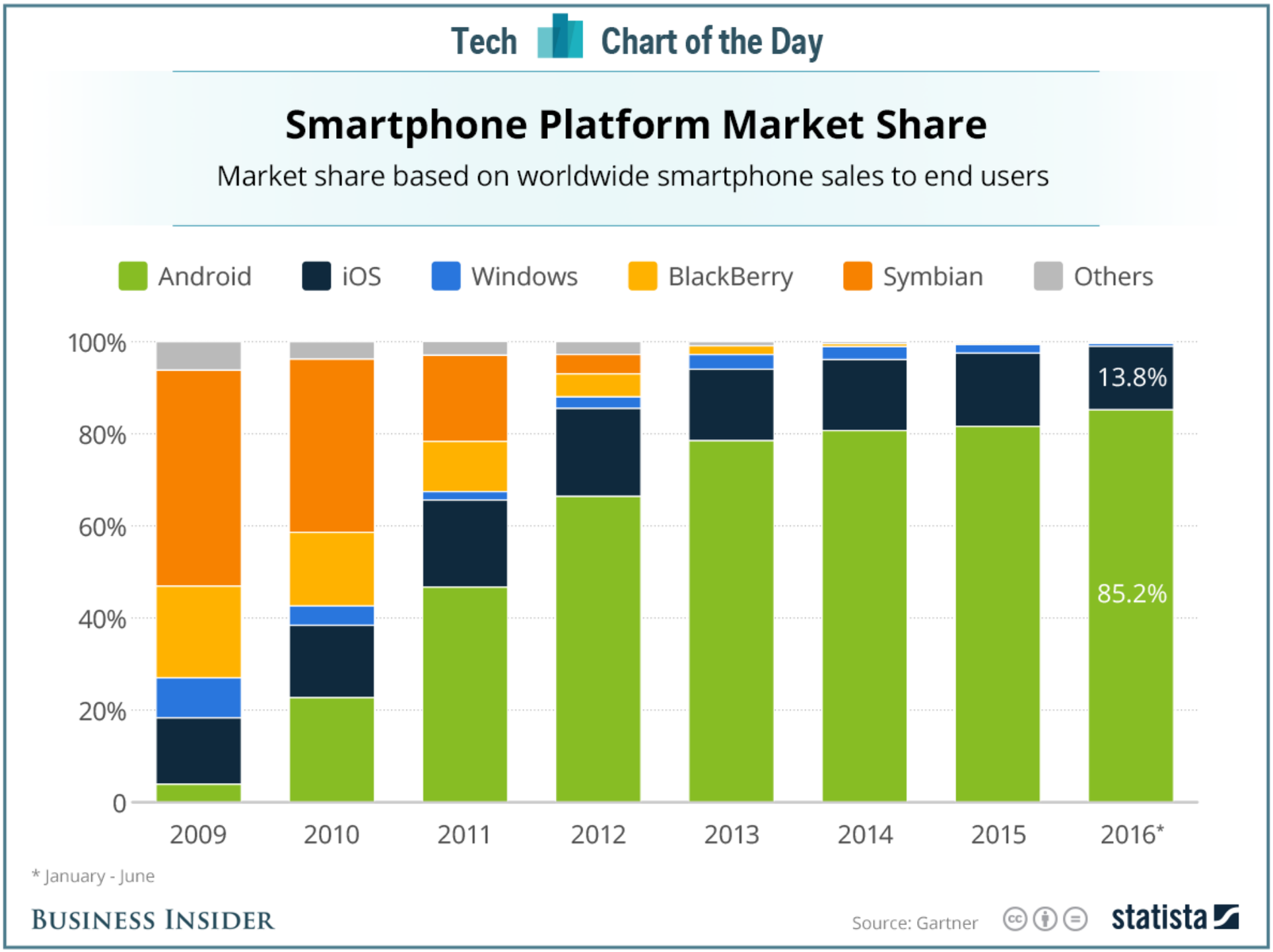
Topic List

- Background.
- Android Version and Adoption.
- Android vs iOS.
- Developing apps in Android.

Android vs iOS

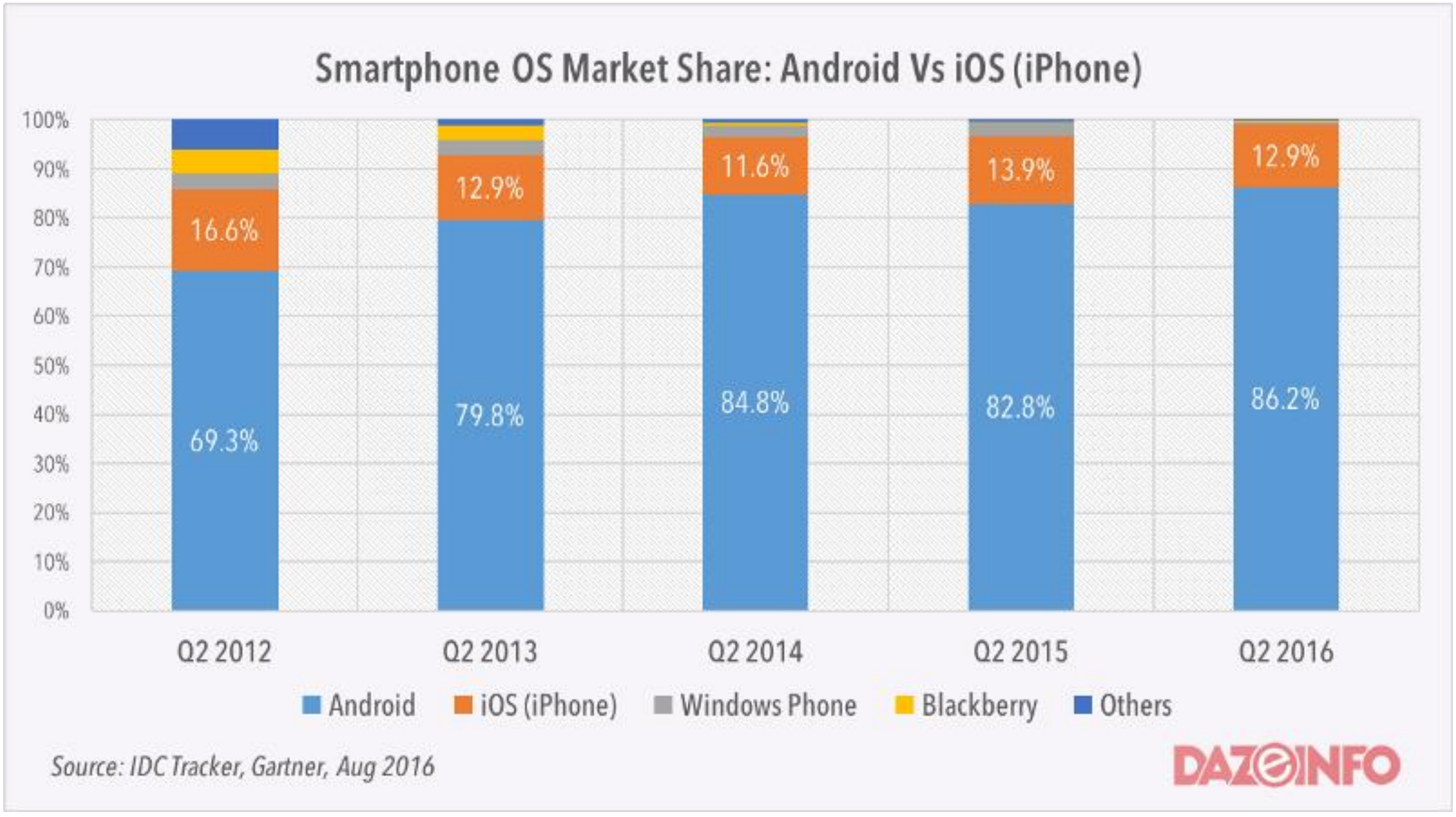


Android vs iOS (Market Share)



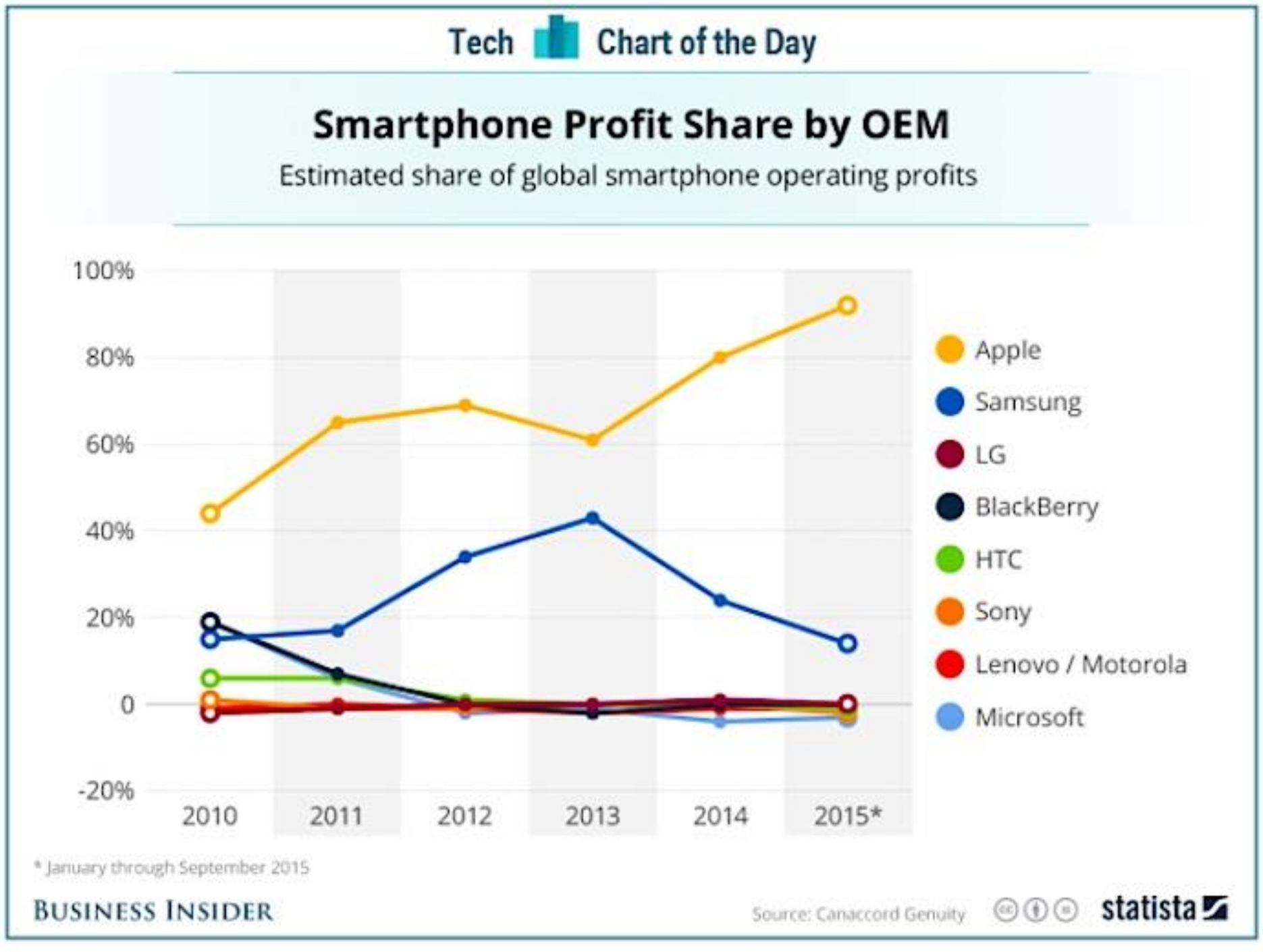
http://uk.businessinsider.com/smartphone-market-share-android-ios-windows-blackberry-2016-8?r=US&IR=T

Android vs iOS (Market Share)



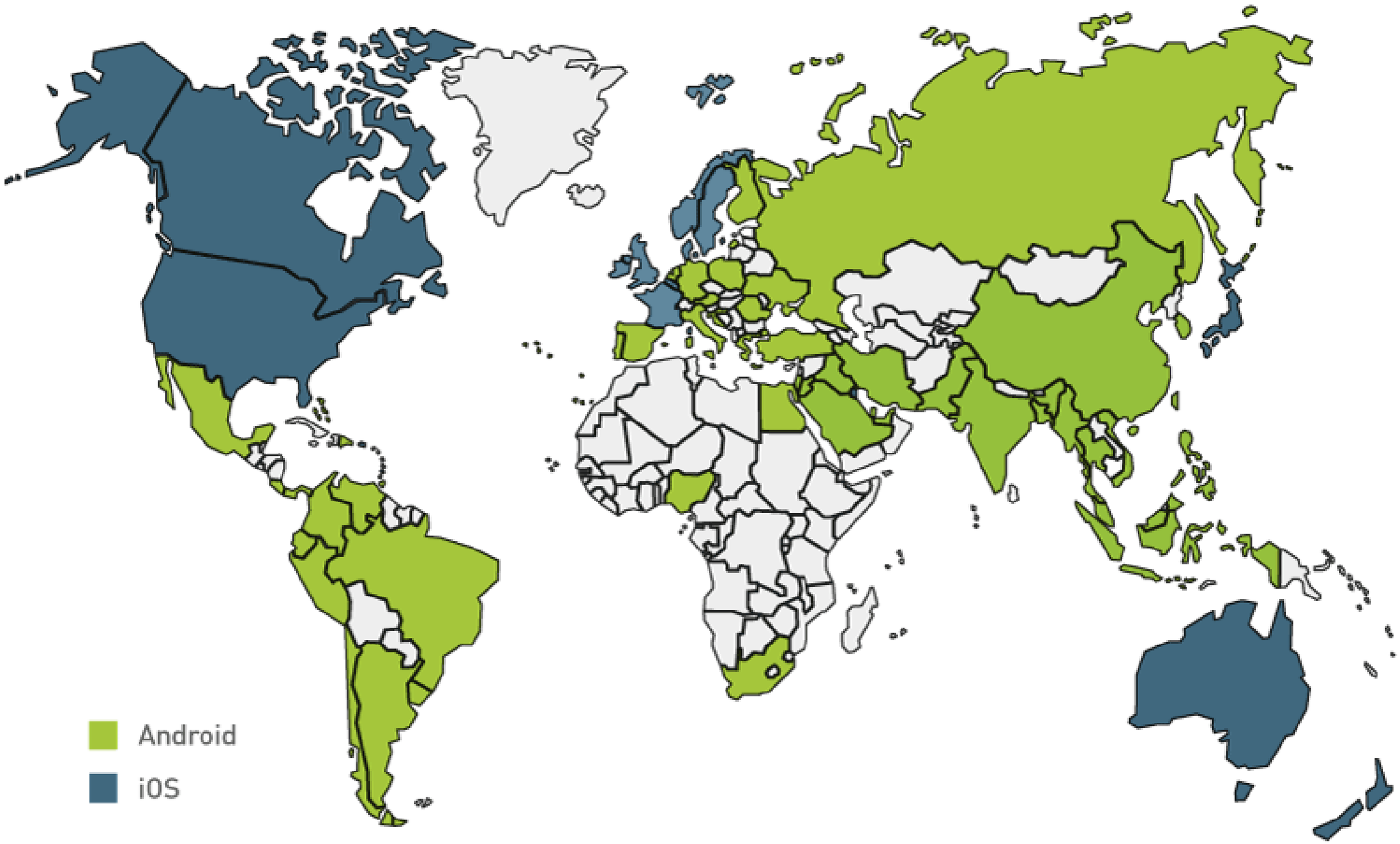
https://android.jlelse.eu/apple-vs-android-a-comparative-study-2017-c5799a0a1683

Android vs iOS (Profit)



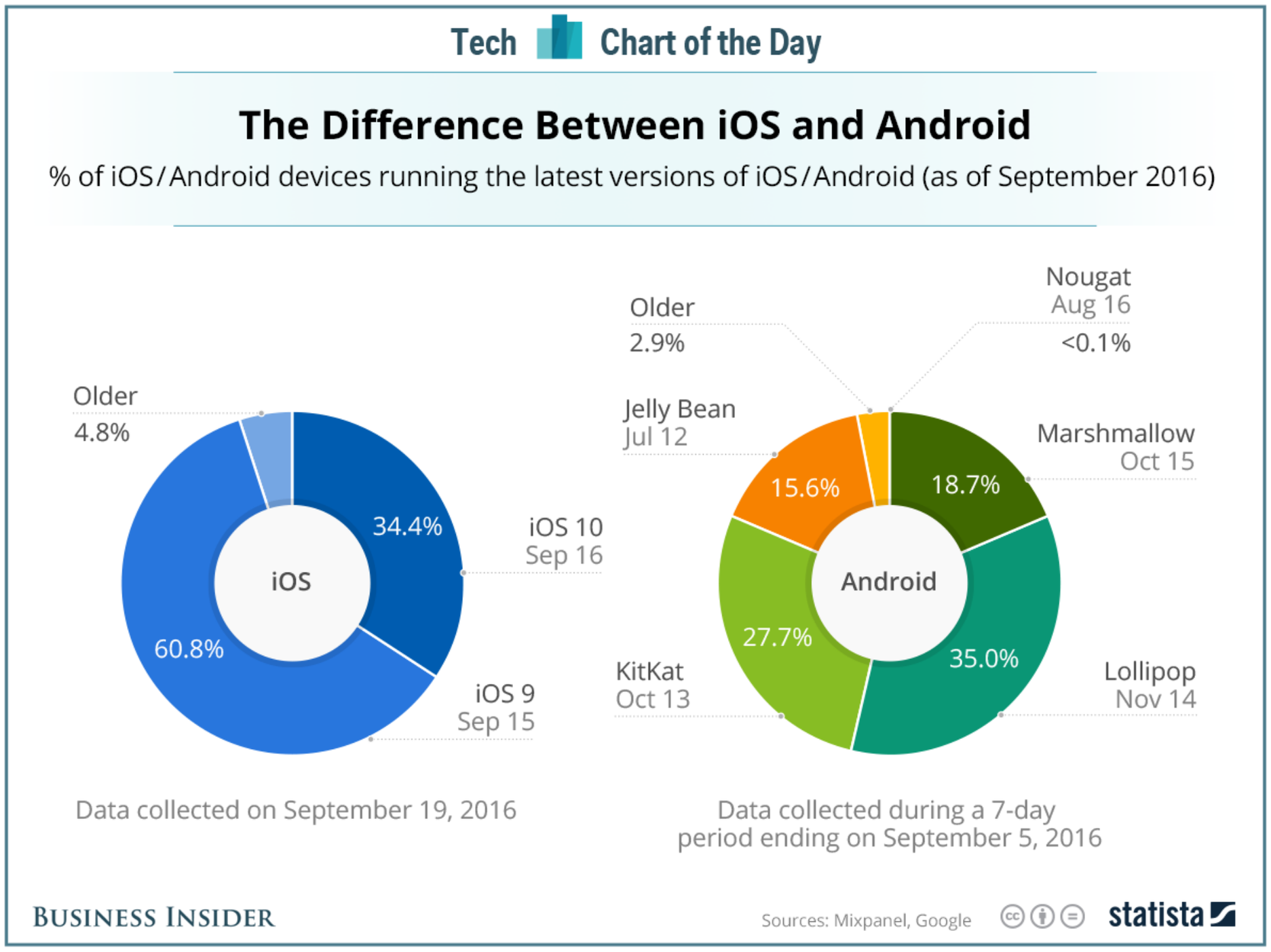
https://www.statista.com/chart/4029/smartphone-profit-share/

Android vs iOS (Geography Distribution)



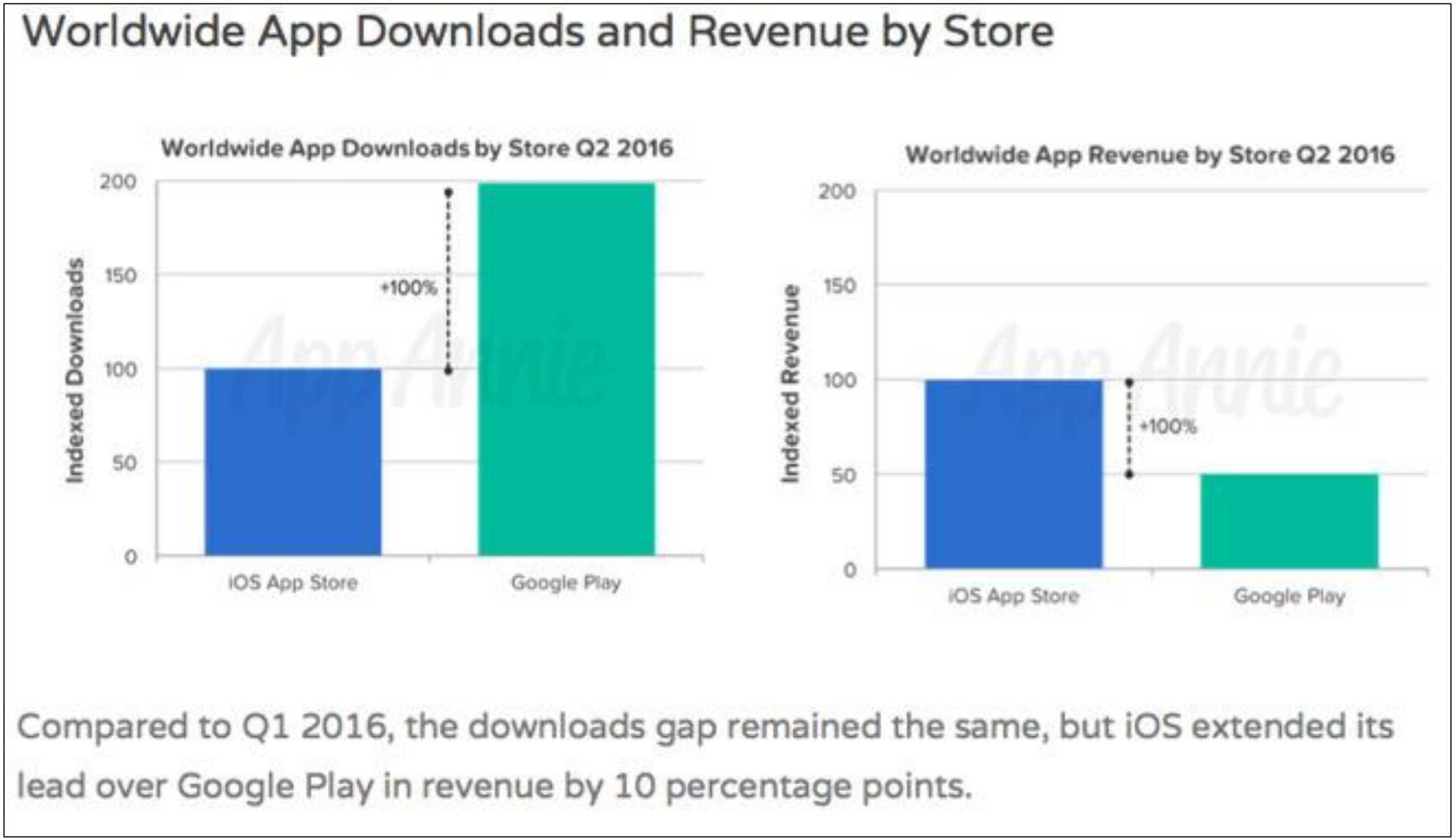
https://android.jlelse.eu/apple-vs-android-a-comparative-study-2017-c5799a0a1683

Android vs iOS (Device Fragmentation)



http://uk.businessinsider.com/ios-vs-android-device-share-chart-2016-9?r=US&IR=T

Android vs iOS (App Download / Revenue)



http://appleinsider.com/articles/16/07/19/apples-ios-app-store-now-generating-4x-revenues-per-app-vs-android-google-play

Android vs iOS (Developing apps)

- iPhone apps can only (mostly) be installed via the App Store
  - iPhone requires you to submit app to the Apple App Store and get approval, even for apps from your own company
    - Unless you setup a Provisioning profile or
    - you use something like TestFlight or
    - jailbreak your phone of course…..

- Android apps can be installed through
  - Google App Store / Google Play
  - Amazon App Store
  - USB connection from PC
  - Email
  - Corporate Web site

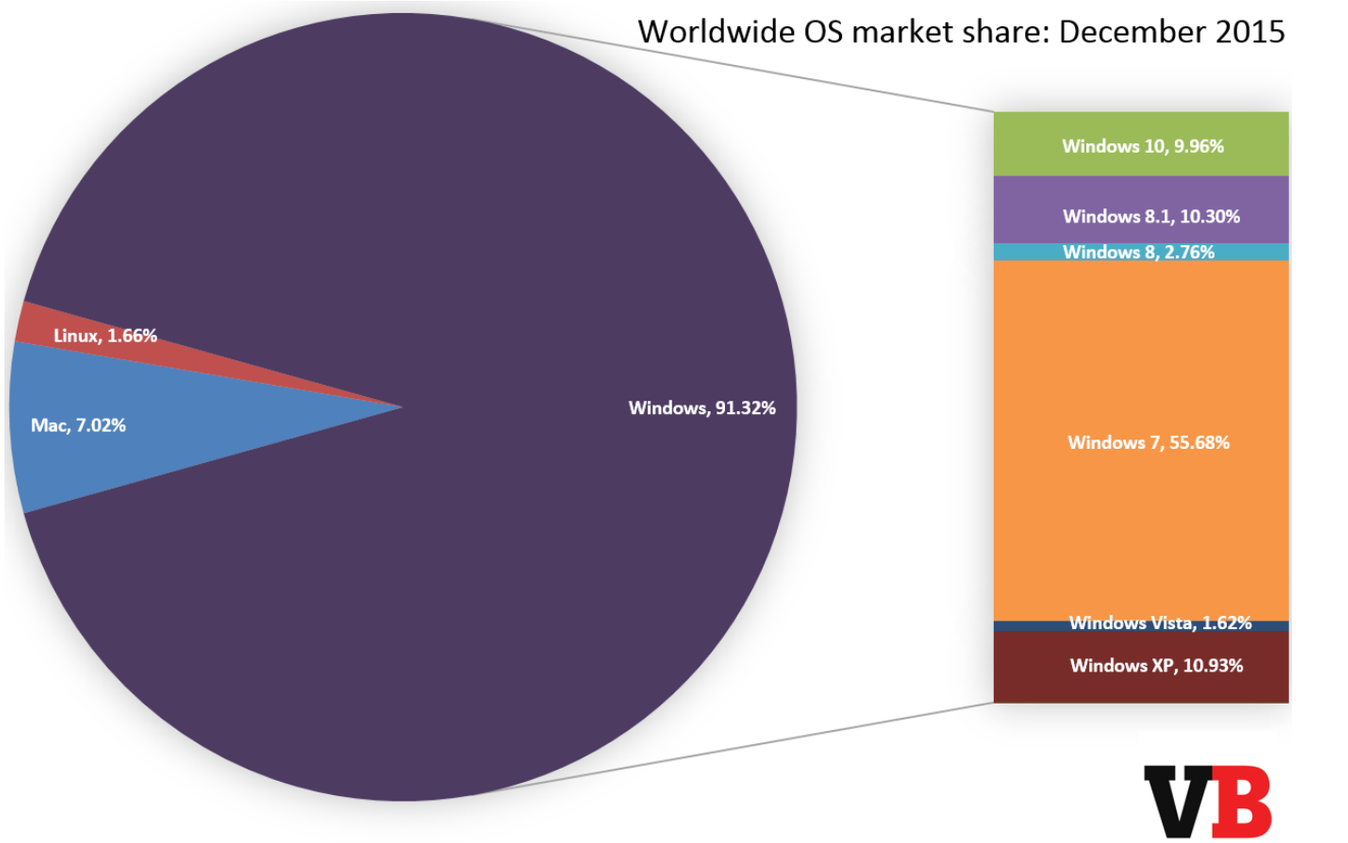
Android vs iOS (Languages for Apps)

- iPhone
  - Objective-C
    - Similar to, but not exactly the same as, C++
    - Virtually no corporate presence for Objective-C, other than for mobile apps.
    - However, Swift becoming more popular.

- Android
  - Java
    - The single most widely used language inside corporations
  - Kotlin
    - JVM language officially supported by Google in May 2017.
  - C/C++
    - Can call native apps (with some difficulty) via an approach similar to JNI (Java Native Interface) for desktop Java.

Android vs iOS (OS for Dev Apps)

- iPhone
  - Macs
- Android
  - Anything with Java/Kotlin and Android Studio
    - Macs
    - PCs
    - Linux
    - Solaris



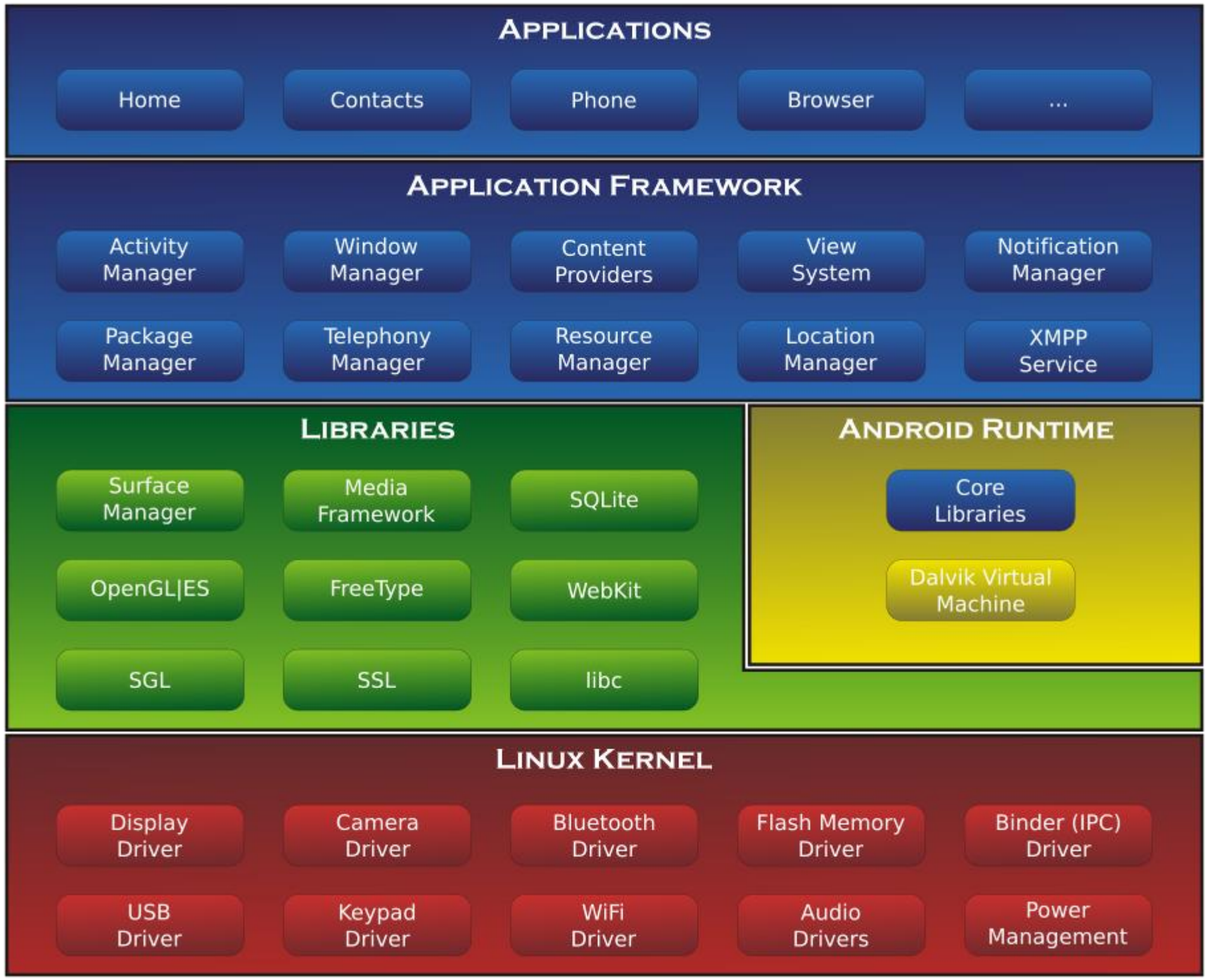
http://venturebeat.com/2016/01/01/windows-10-ends-2015-under-10-market-share/

- Issue
  - Not so much which is cooler and which you personally prefer, but rather which is already installed in corporate environments.

Topic List

- Background.
- Android Version and Adoption.
- Android vs iOS.
- Developing apps in Android.

Android Software Stack



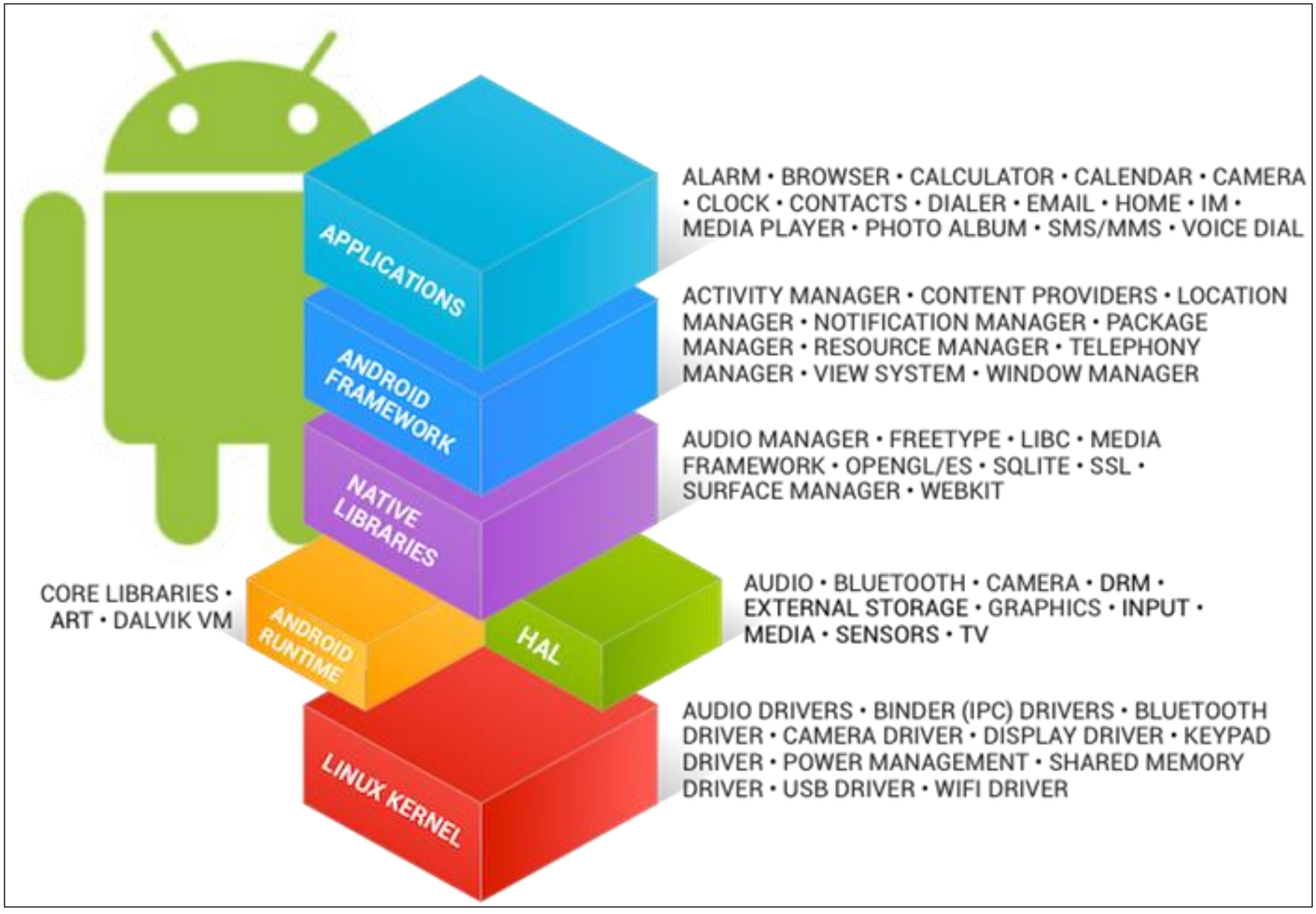
Android is a **comprehensive platform:**

→ it is a complete software stack for a mobile device.

→ It is all you need to start developing for Android; you don't even need a physical device.

Illustration By Smieh - Anatomy Physiology of an Android, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=20067152

Android Software Stack…another view



Questions?

Reference for History of Android