

MOBA1: MOBILE APPLICATIONS 1

DEVICES AND PLATFORMS

Speaker notes

Auf den PDFs presentation-notes.pdf ist jeweils zusätzliches Material enthalten, das im Unterricht nicht in der Präsentation enthalten ist:

- Ergänzende Hinweise, die nur mündlich gegeben wurden
- Informationen, welche eher am Rande zum Thema passen, aber für manche interessant sein könnten
- Speziell in dieser Einführung: einige Teile aus früheren MOBA1-Einführungen, welche die geschichtliche Entwicklung im Bereich der Smartphones dokumentieren, für den aktuellen Stand der Technik aber weniger wichtig sind

OVERVIEW

- Introduction to MOBA1
- Mobile Devices
- Mobile Platforms
- Mobile Applications

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- Mobile Applications

TOPICS MOBA1

1. Introduction, Mobile Platform
2. Design & Development of Mobile Apps (1)
3. Design & Development of Mobile Apps (2)
4. Kotlin
5. Android (1)
6. Android (2)
7. Android (3)
8. Android (4)
9. Beacons

TOPICS MOBA1

10. Mobile Web: Overview, Basics
11. Mobile Web: Style & Layout
12. Mobile Web: Device APIs, Cordova/Capacitor
13. Presentations: Projects and Labs
14. Presentations: Projects and Labs

OUTLOOK: MOBA2 (PLANNED)

1. Mobile Web: Component driven UIs
2. Mobile Web: React.js
3. Mobile Web: Ionic/React
4. React Native (1): Basics, Navigation
5. React Native (2): Components and APIs
6. iOS Introduction
7. Swift
8. SwiftUI (1)
9. SwiftUI (2)
10. SwiftUI (3)
11. Presentations: Projects and Labs
12. Presentations: Projects and Labs

LESSONS AND SELF-STUDY

- Lecture: two lessons per week
- Practical exercises: also two lessons
- Self-study

PREVIOUS KNOWLEDGE

- HTML, CSS, JavaScript (WBE)
- Programming in C and Java

ASSESSMENT

Weight	Type
20%	Exercises and presentations during class time
80%	Final exam

EXERCISES AND PRESENTATIONS

- Small mobile project
- Exercises on most topics
- Presentation: project results

EXERCISES AND PRESENTATIONS

- Small mobile project / presentation (teams of 2)
up to 5 points (project: 3, presentation: 2)
- Solved exercises / presentation
up to 5 points

Points acquired during class time count for the semester finals
(weighted, 20%)

If the practical results are inferior to the semester finals, only the latter count for the course grade

FINAL EXAM

- Mobile Project, 3h, on-site
- Open book, internet allowed except communication

Changes are possible depending on the Corona situation...

DOCUMENTS

In electronic form in Moodle:

- Slides
- Exercises
- Additional material

MOODLE

<https://moodle.zhaw.ch/course/view.php?id=2155>

- Weekly schedule
- Documents
- Course details and conditions
- Forum (?)

PRACTICAL LESSONS AND LECTURES

PRACTICAL LESSONS

- Tasks explained
- You work with your notebooks
- Teamwork is appreciated

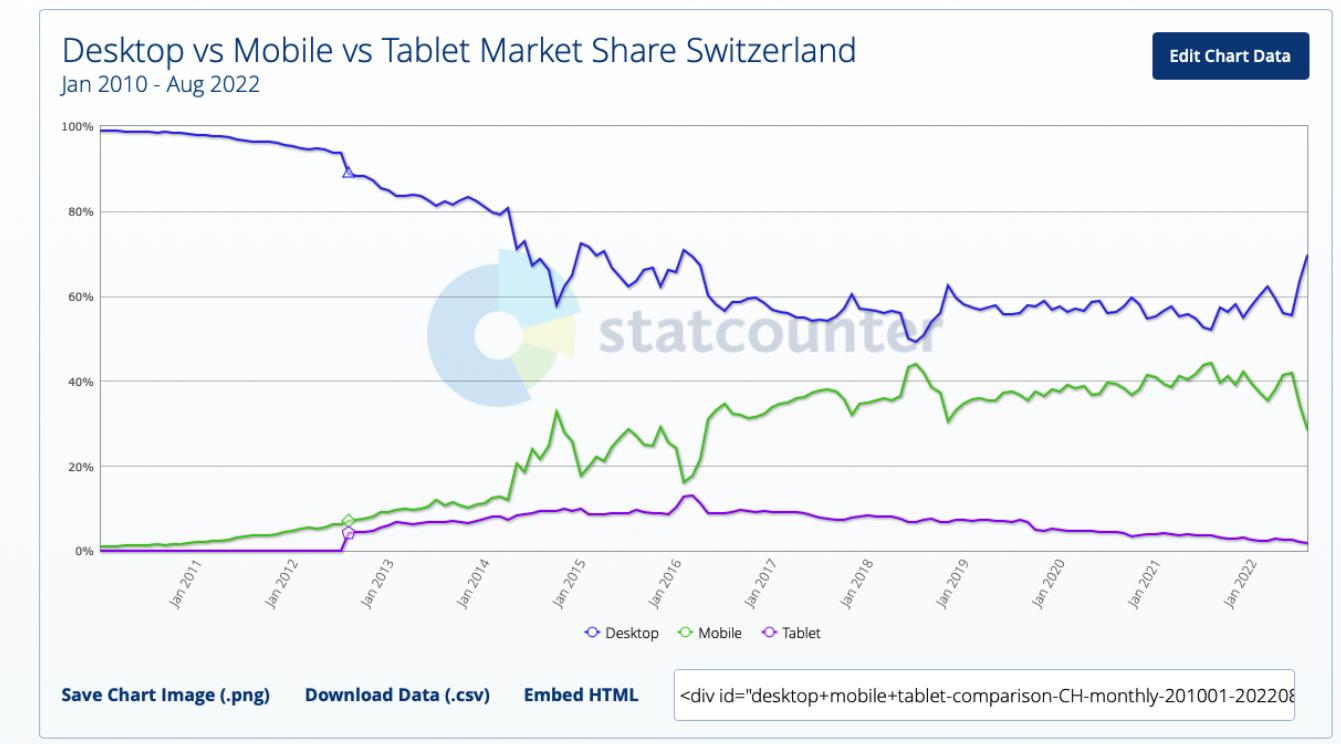
LECTURES

- Private conversations disturbing
- Interaction and participation appreciated
- Take notes

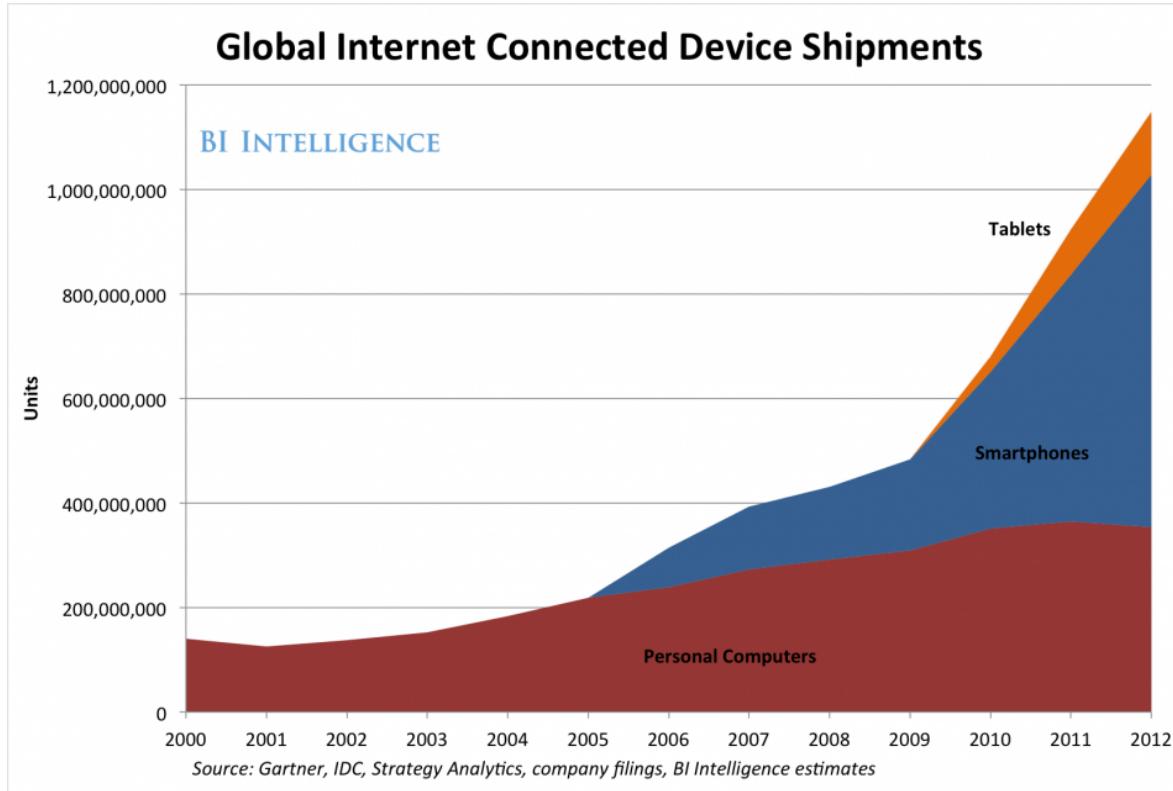
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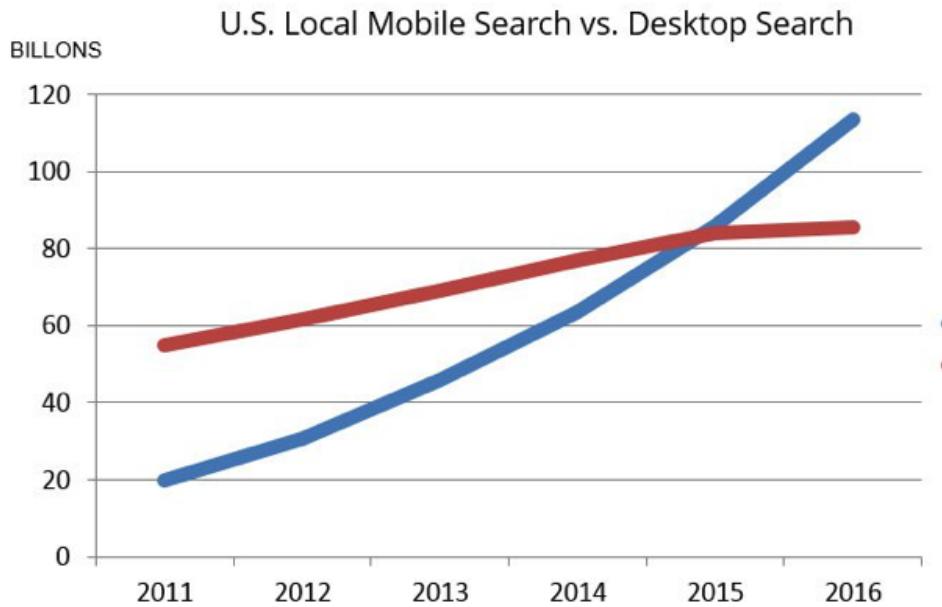
SMARTPHONE AND TABLET MARKET



DEVICE SHIPMENTS



US MOBILE SEARCH VS DESKTOP SEARCH



The graph [...] highlights the rate at which Mobile has surpassed Desktop search, specifically in this instance in the form of Local Search i.e. users searching for local businesses.

Another Article:

Desktop Vs Mobile: Do Devices Change Our Behaviour? <https://www.nathalienahai.com/2015/11/desktop-vs-mobile-do-devices-change-our-behaviour/>

[...] Due to varying keyboard sizes and portability, another key factor to consider is that search queries actually change depending on the device at hand. For example, a third of all mobile searches are location based, and due to the smaller selection of search results shown on smaller screens, when using our smartphones we'll tend to favour top results more strongly.

FEATURE PHONE TO SMART PHONE



↓ more ↓



Quelle:
<https://www.samsung.com>

Speaker notes

Feature Phones

- Globally one third of all phones sold in Q3 2014 were feature phones
- Install base was much higher than that
- Apps typically developed using Java ME or BREW (Qualcomm)
- But: Android was increasingly taking over the low-cost handset market

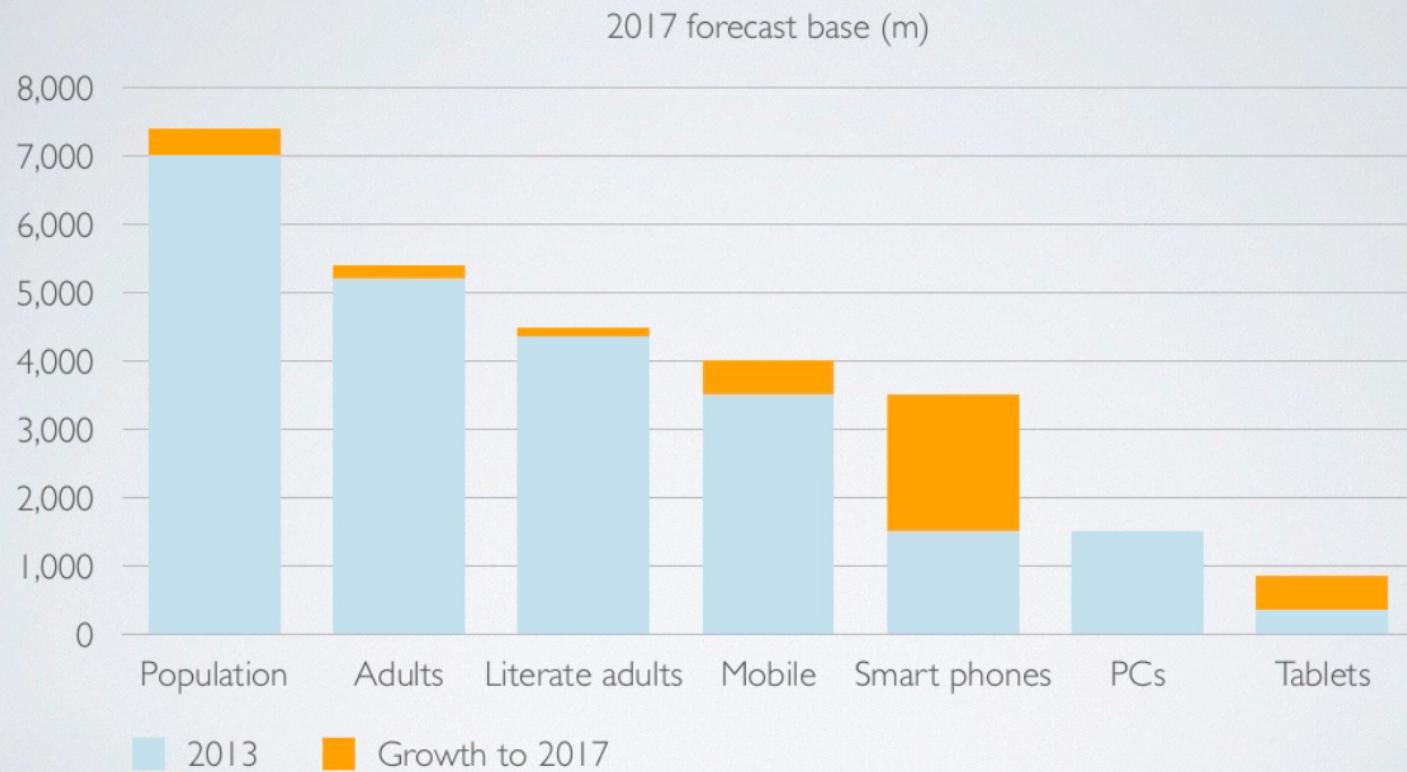
MOBILE DEVICES



MOBILE DEVICES ??

- Notebooks
- Netbooks
- Feature Phones
- Personal Digital Assistants
- Smartphones
- Tablets
- Smartwatches
- SmartTags, AirTags
- Calculator watches
- Handheld game consoles
- Head-mounted displays
- Wearable computers
- Portable media players
- Digital still cameras (DSC)
- Digital video cameras (DVC) or digital camcorders
- Personal navigation devices (PND)

The world in 2017



MOBILE DEVICES IN MOBA 1/2

- In MOBA1/2 we focus on Smartphones
- With some comments on other devices
- Priority on devices with widespread mobile OSs

FEATURES OF MOBILE DEVICES

- Smaller screens (here, smartphones and tablets differ)
- Different input concepts (touch, keyboard, stylus)
- Slow, unstable network connection
- Less powerful processors
- Batteries – minimize power consumption

DEVICE SENSORS

- Camera
- Microphone
- Geolocation, GPS
- Accelerometer
- Gyroscope
- Magnetometer
- Battery state
- Proximity sensor

Speaker notes

Geolocation-API: Possibilities

- Local weather, traffic or other information
- Indication of certain facilities in the proximity
- Interaction with people nearby
- Suitable defaults in search results
- Suitable settings depending on location

INSIDE IPHONE 13 PRO VS 12 PRO

Teardown



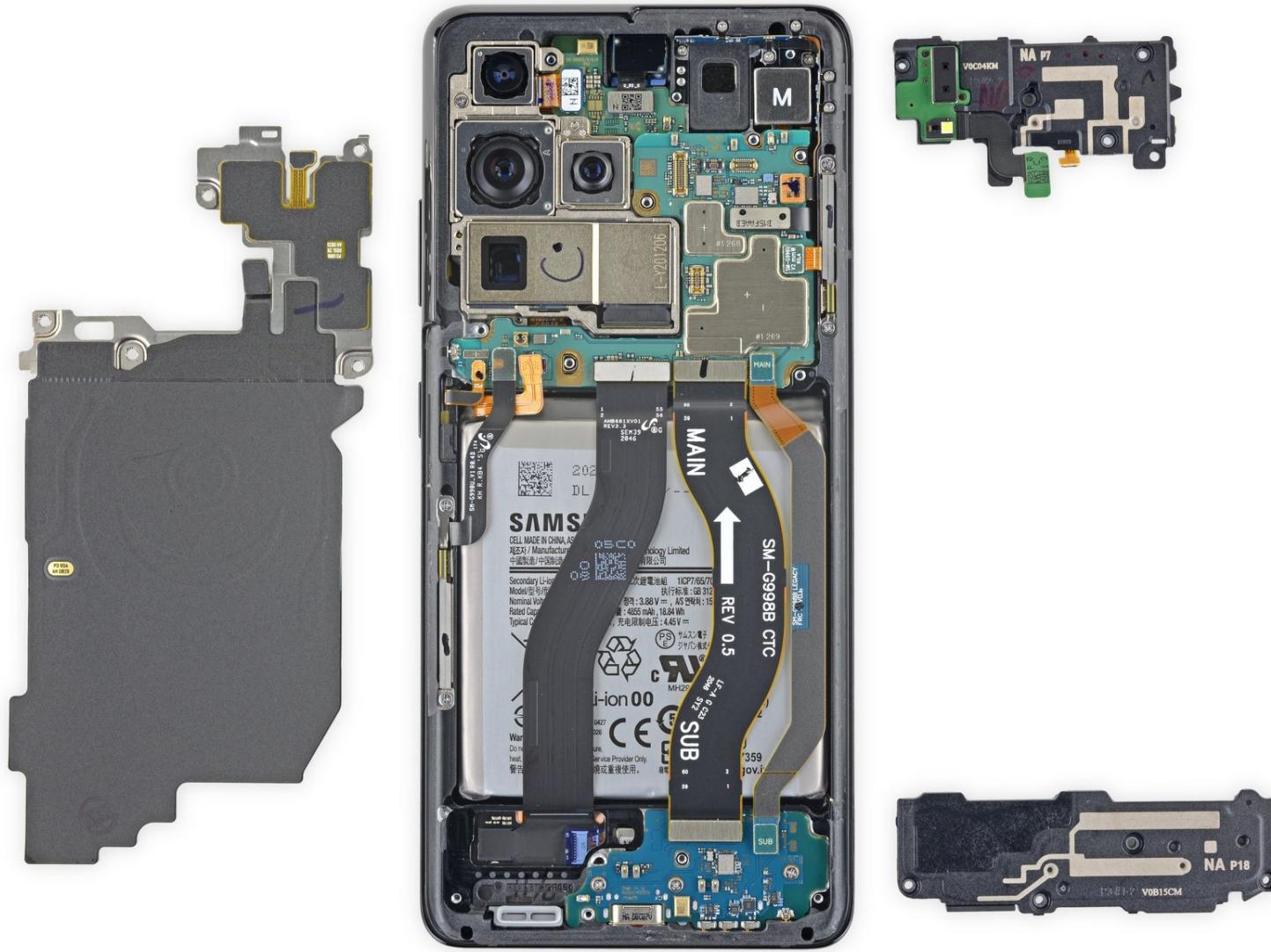
Speaker notes

iPhone 6s Taptic Engine

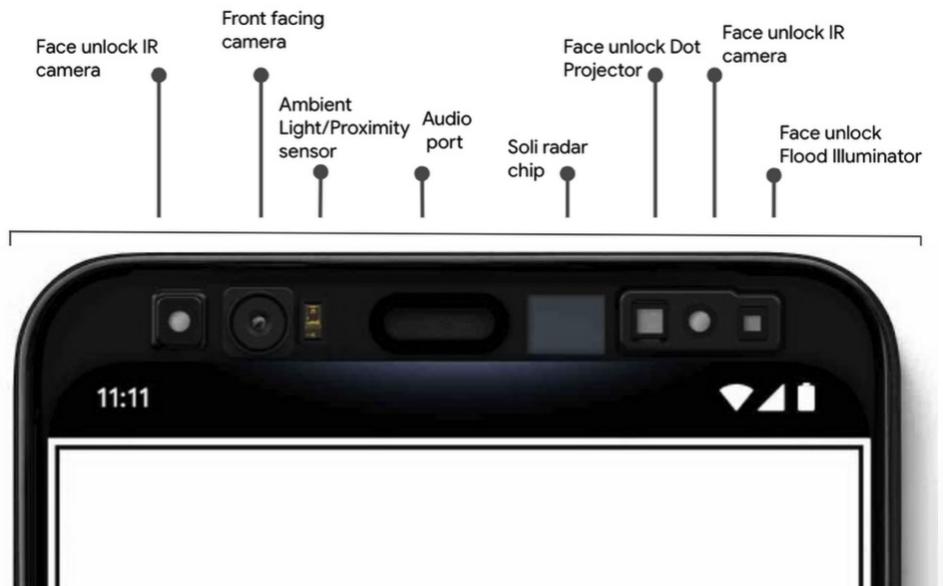




INSIDE SAMSUNG GALAXY S21 ULTRA



GOOGLE PIXEL 4 SOLI RADAR



- Google's Pixel 4 had built-in radar
- Pixel 5 and 6: radar sensor was ditched

Speaker notes

- <https://atap.google.com/soli/technology/>
- <https://www.cnet.com/news/project-soli-is-the-secret-star-of-googles-pixel-4-self-leak/>

PROBLEM: FRONT CAMERA, SENSORS



- Google Pixel 6a
- Fingerprint unlock
- 8 MP front camera

DYNAMIC ISLAND (APPLE)



- iPhone 14 Pro
- Front camera, Face ID sensors integrated in UI

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Mobile platform wars over?

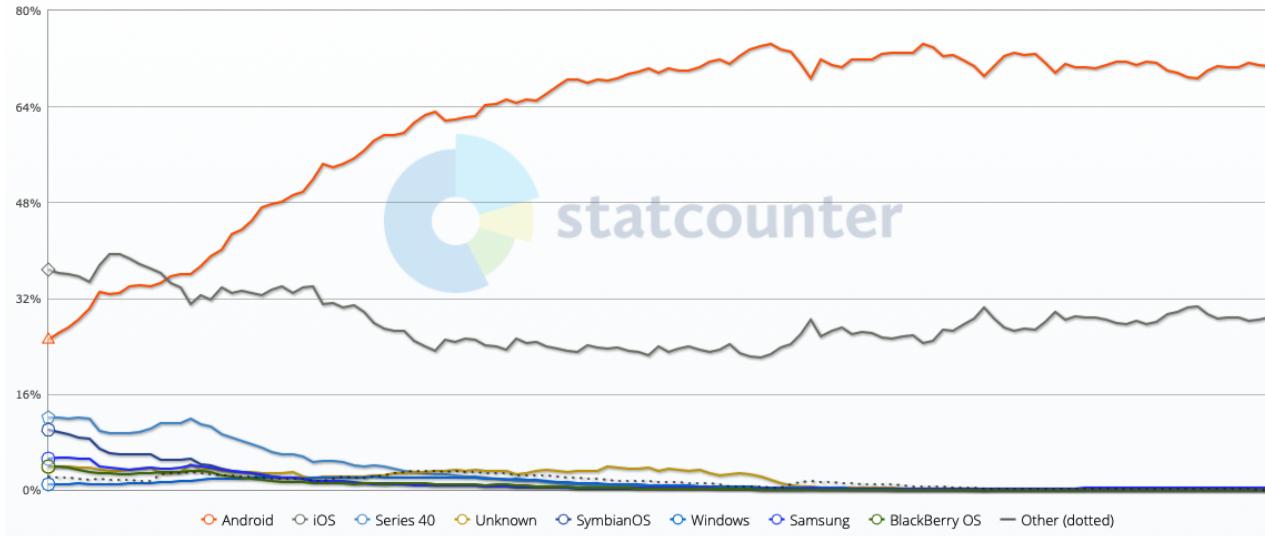
- Apple and Google's Android have won: unlikely that other platforms will be relevant
- Apple camped out at the high end, Android taking the rest
- But Google's control of Android is partial
- Facebook and Amazon trying to extract value
- Samsung's position uncertain

ANDROID AND IOS

- Dominate the smartphone market
- Also at the top in terms of developer mindshare
- But: Mobile space changes continuously

Mobile & Tablet Operating System Market Share Worldwide
Aug 2012 - Aug 2022

Edit Chart Data



Source:
[statcounter](#)

Different focus for innovation

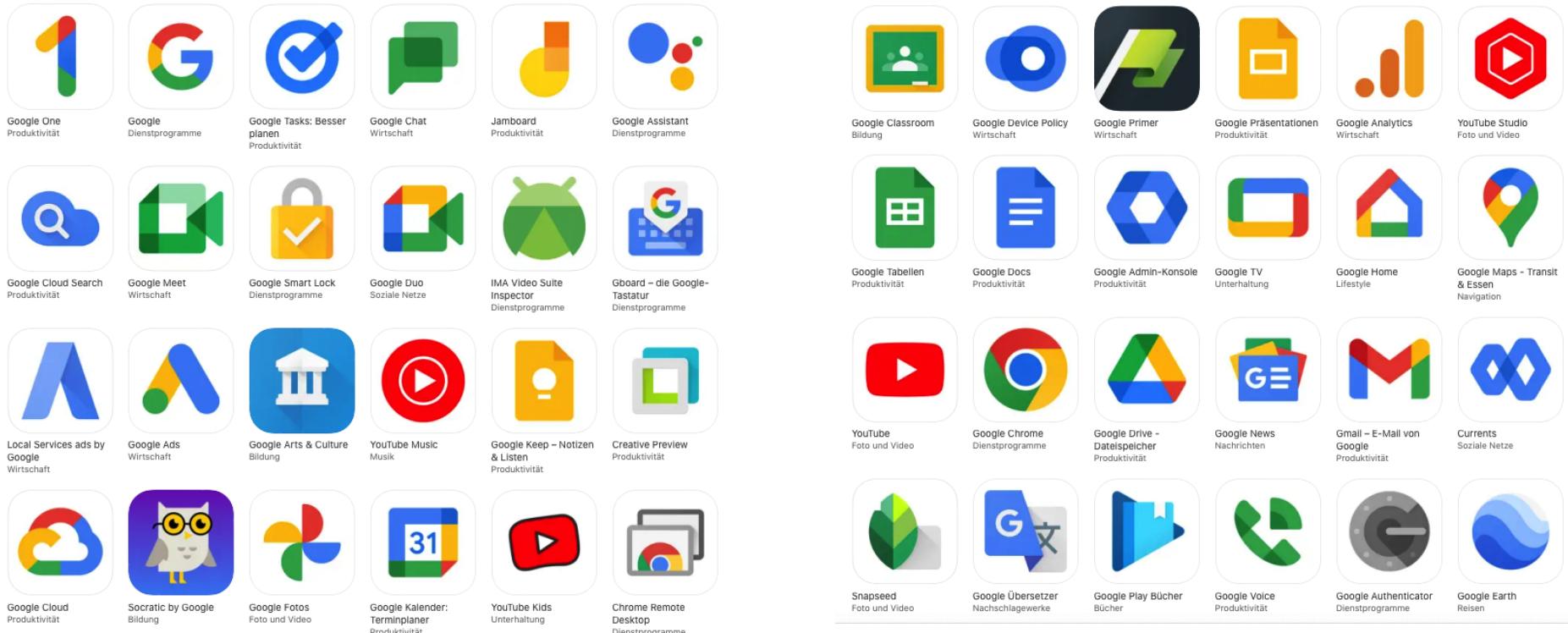
Apple

- Integrated hardware & software
- Fingerprints, Bluetooth, Airdrop, 64 bit etc
- Move innovation down the stack (hard for Google)
- Directed discovery (iBeacon)

Google

- Systemic fragmentation, little hardware control
- Google Now, Maps, Plus, semantic search etc
- Move innovation up the stack (hard for Apple)
- Predictive discovery (Now)

GOOGLE APPS FOR IOS

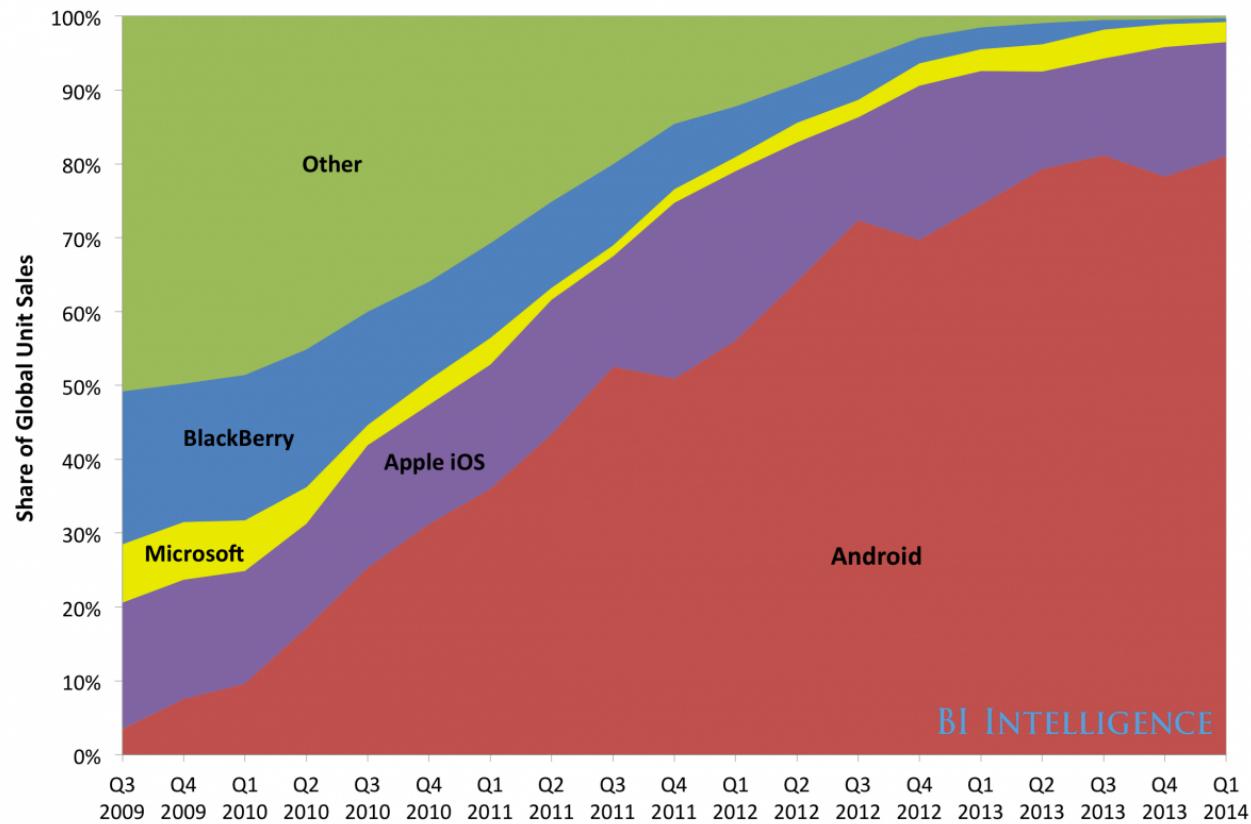


ANDROID'S PURPOSE

- Spreading the use of Google services across the mobile web
- Makes economic sense to offer Android for free
- In 2009 device vendors needed an answer to the iPhone
- Android was available (and free...)
- Most device vendors jumped on the Android bandwagon
- Except for Apple, Nokia, and BlackBerry
- Nokia and BlackBerry failed

↓ more ↓

Global Smartphone Market Share By Platform



Source: IDC, Strategy Analytics

Speaker notes

Android

- Open Handset Alliance led by Google
- Publicly available since November 2007

[The Rise of Android](#)

ANDROID DIFFERENTIATION

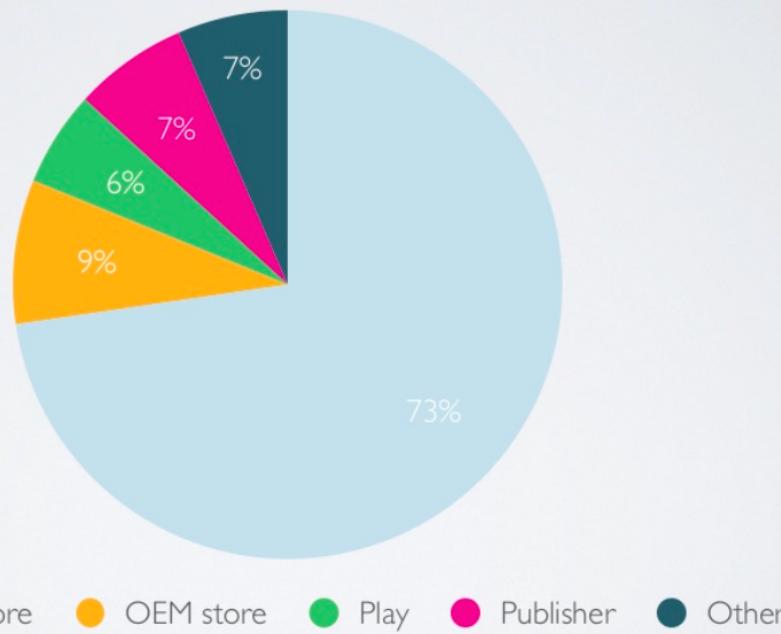
- Google allowed Android differentiation
- Purpose: Get device vendors to adopt it
- Vendors could create their own interface layer
- They could also change default apps, including the browser
- Samsung TouchWiz, HTC Sense, MotoBlur, ...
- **Differentiation is the positive slant on fragmentation**

T-MOBILE G1: 1ST ANDROID SMARTPHONE



(Chinese Android isn't Google)

Chinese Android app install vectors

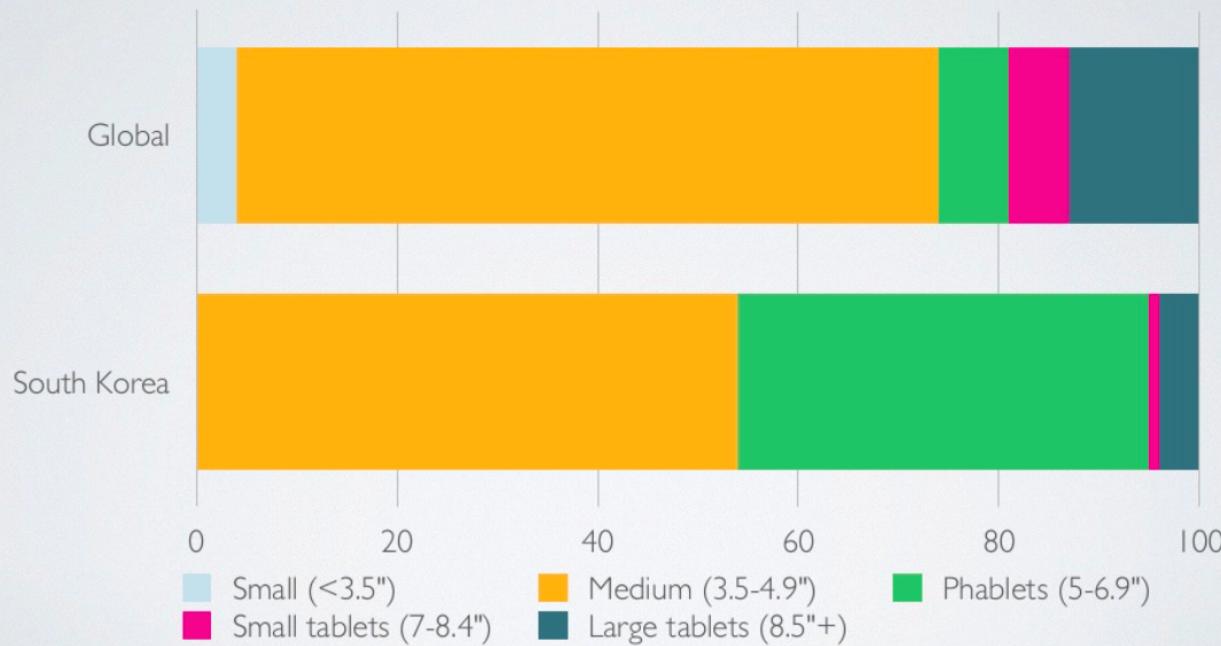


REGIONAL DIFFERENCES

- Regional market share of each platform varies significantly
- China is the largest smartphone market today
 - Typically based on the Android Open Source Platform (AOSP)
 - No Google Play Store, no Google Mobile Services

Blurring definitions

Estimated Android user base, August 2013 (%)



ANDROID: DEVELOPMENT

- Programming language for Android was based on Java
- Subset of the Java libraries and packages supported
- Preferred language is now Kotlin
- Android SDK available for Windows, Mac OS X, and Linux
- Android Studio: prepacked IDE based on IntelliJ

<https://developer.android.com>

ANDROID: MONETIZATION

- Advertising, click- or view-based
- Different in-app billing possibilities

<https://developers.google.com/ads>

IOS: HISTORY (1)

- iPhone unveiled by Steve Jobs January 9th 2007
- OS named iPhone OS
- November 2010: launch of the fourth generation of the OS
 - renamed to iOS
 - launch of the original iPad
- New version each year

And Then Steve Said, ‘Let There Be an iPhone’

IOS: HISTORY (2)

- iOS 7 was touted as a major UI refresh
- iOS 8 with new frameworks and services, Apple Watch
- iOS 9 with split view on iPad, better Siri, faster graphics
- iOS 10 with haptic feedback, better Siri, better search
- iOS 11...16 with ?? ([various improvements](#))
 - iOS 14 with Widgets on Home Screen
 - iOS 16: lock screen customization

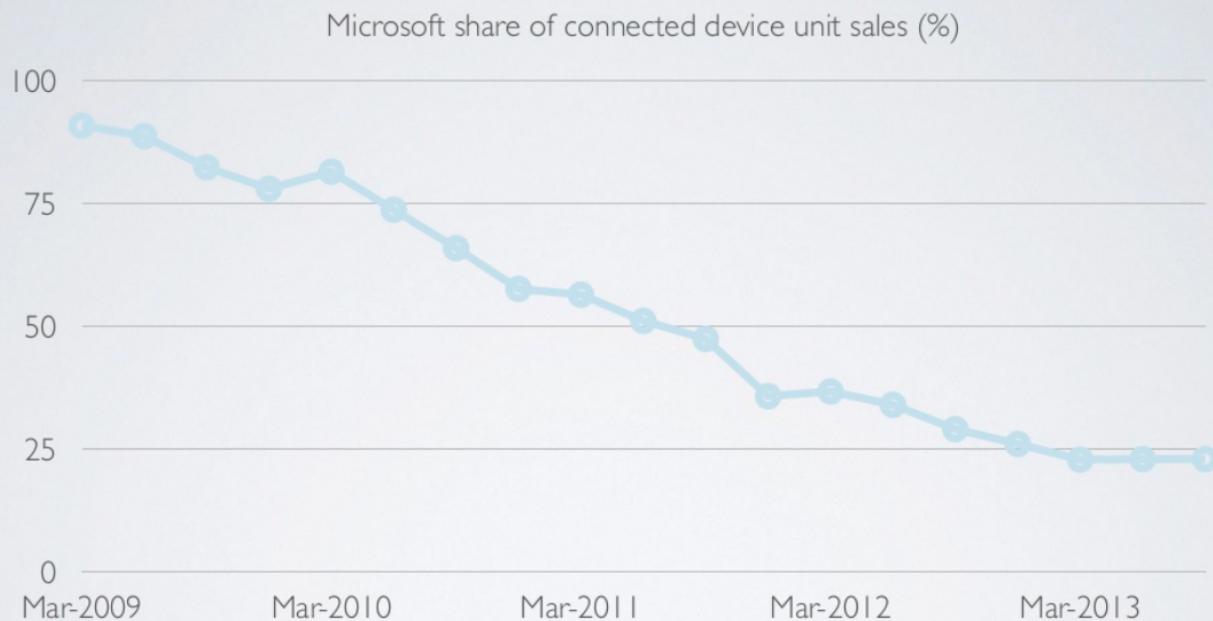
→ [Release notes for developers](#)

High adoption rate of each iOS version soon after release

APP STORE

- Primary method for deploying apps to consumers
- Each app submitted is reviewed
- Strict rules on how applications run on iOS and use the Sandbox
- Users can control the apps access to their data (i.e. contacts, calendars, photos) or GPS location
- Developers must prepare for cases where the user has denied these type of requests
- Monetization: Ads, selling app, in-app purchases

The irrelevance of Microsoft



MARKET SHARE

Period	Android	iOS	Windows	BlackBerry	Others
2018	85.1%	14.9%	0.0%	0.0%	0.0%
2017	85.0%	14.7%	0.1%	0.0%	0.1%
2016	83.4%	15.4%	0.8%	0.0%	0.4%
2015	78.0%	18.3%	2.7%	0.3%	0.7%
2014	81.2%	15.2%	2.5%	0.5%	0.7%
2013	75.5%	16.9%	3.2%	2.9%	1.5%
2012	59.2%	22.9%	2.0%	6.3%	9.5%

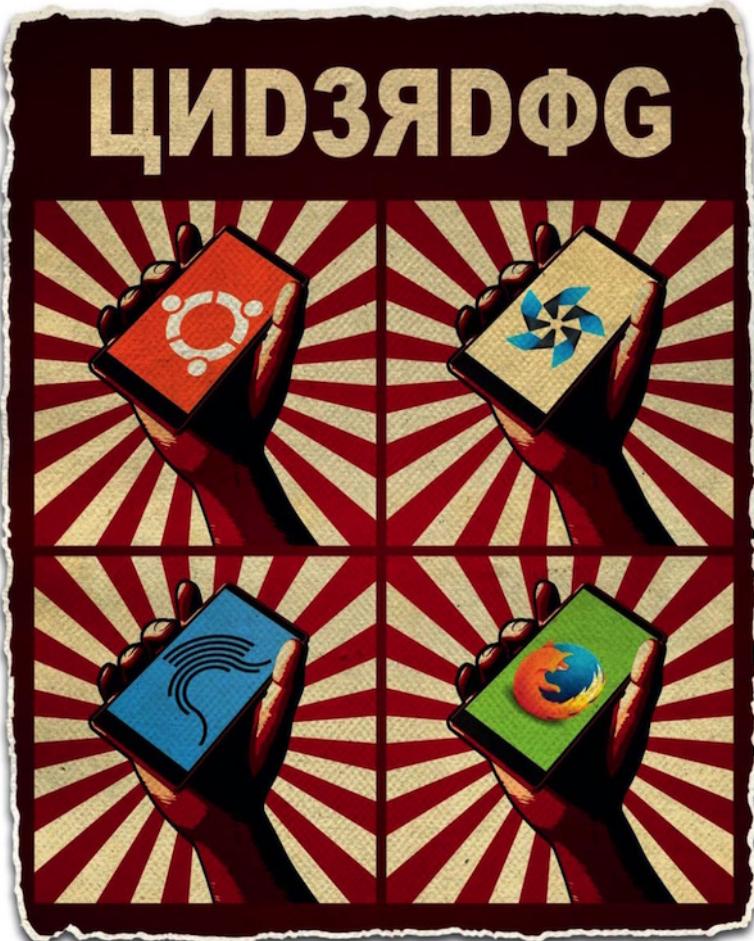
(Source: [IDC](#))

Speaker notes

Android: The discussion around Android's share of the smartphone market became irrelevant a few years back when it became clear that devices running Google's OS would continue to capture roughly 85% of the worldwide smartphone volume. What is interesting is to look at the many micro-trends going on within the platform. Despite a slew of very attractive high-end Android products, IDC continues to see Android average selling prices (ASPs) decline and expectations are that the 1.5 billion Android phones that ship in 2021 will have a collective ASP of \$198, down from \$220 in 2017Q1.

iOS: Coming off the first year in which iPhone shipments declined, expectations are that 2017 volumes will grow 3.8%. IDC slightly lowered its 2017 projections for iOS in its latest forecast to 223.6 million, while increasing its 2018 volumes to 240.4 million. All signs point to late 2017 and certainly 2018 being very strong for Apple as much of its installed base seems ready for a refresh and the next round of iPhones is not likely to disappoint its fans

THE UNDERDOGS



Discontinued or irrelevant

- Firefox OS
- BlackBerry OS
- Ubuntu Phone
- Tizen
- Sailfish OS
- ...

FIREFOX OS (DISCONTINUED)

- Mozilla Foundation
- Linux based, open source
- Aimed at lower end smartphones
- Browser engine Gecko as a runtime environment for apps
- First release published in February 2013
- September 2016: end of development announced

UI

- Smartphone interface called Gaia
 - Home screen, phone app, settings, ...
 - Based on open web technologies
- User interface similar to Android
- Development stopped: December 2015

APPS

- Hosted apps: loaded via a URL
- Packaged apps: installed on the smartphone
 - Can run offline
 - Access to more device features

CARRIERS

- Cooperation with wireless carriers
 - Telefonica
 - Deutsche Telekom
- Geographic focus
 - South America
 - Asia
 - Eastern Europe

DEVICES

- First device: ZTE Open (80USD), 2013, promoted for emerging markets
- Alcatel's One Touch Fire, European market in October 2013 (€90)
- Has not really taken off so far

DEVELOPMENT

- HTML-based
- Uses HTML/JavaScript/CSS as the native development languages
- Easy for a web developer to write native apps
- Need to know: JavaScript API provided by Firefox OS, how to package Apps

MARKETPLACE

- Global AppStore called Marketplace
- Apps often based on mobile web apps
(Facebook, Twitter, ...)
- Few games, other popular apps missing
- Apps are reviewed
- Developers get 70% of the generated revenue

BLACKBERRY OS (DISCONTINUED)

- Ten years ago: number 2 in smartphone business
- Now a niche system
- Although most drawbacks were fixed
- Devices with and without real keyboards

[Blackberry](#)

FOCUS

- Particularly suited for messaging
- BlackBerry hub for messages
 - E-Mails from various accounts
 - Twitter
 - Facebook
 - SMS
 - WhatsApp
 - BlackBerry's chat system BBM
- Business data & apps separated from private data & apps
- Private area: Android runtime available
 - Based on AOSP (Android Open Source Project)
 - No access to Google's Play Store
 - Amazon App Store can be used

DEVELOPMENT

- Development Options
 - C Native SDK
 - C++ Cascades SDK
 - HTML5 WebWorks
 - Android Runtime
 - BlackBerry App Generator
- Distribution: BlackBerry AppWorld

UBUNTU PHONE (DISCONTINUED)

- Also known as *Ubuntu Touch*
- Mobile version of the Ubuntu operating system
- Designed primarily for touchscreen mobile devices
- Qt5-based touch user interface
- April 2017: project terminated

CHARACTERISTICS

- No Home-, Back- or Search-Keys
- Instead, gestures are used
- Scopes to present information on the home screen
 - Videos, Music, Weather, ...
 - Can be activated sequentially (swipe gesture)
 - About 50 Scopes in the Ubuntu App Store
- Sidebar with frequently used apps

OS

- Based on Linux (root access)
- Uses frameworks originally developed for Maemo and MeeGo
- Can be ported to most recent Android smartphones
- First phones with Ubuntu appeared 2015
(originally announced for 2013)
- Can be installed on Google Nexus Smartphones

TIZEN

- Open source, Linux based
- Intel, Samsung, brand of the Linux Foundation
- Contributing: Fujitsu, NTT Docomo, Huawei, Vodafone, Orange
- Designed for various smart devices:
Smartphones, tablets, netbooks, watches, tvs, car multimedia
- Source code mostly open source
- Based on work of Nokia (Maemo), Intel (Moblin, MeeGo),
LiMo Foundation (LiMo) and Samsung (Bada OS)

www.tizen.org

DEVICES

- First public available Tizen device:
Samsung's camera NX300M
- Also: Samsung Smartwatches Gear 2 and Gear 2 Neo
- All Samsung Smart TVs released during 2015 will run Tizen
- January 2015: first Tizen powered smartphone (Z1) launched in India

SAMSUNG Z1

- Sold in India
- 80€
- 4 GB Flash Storage
- 3 MP Camera
- Dualcore processor
- Dual SIM

DEVELOPMENT

- Web Apps (HTML5, CSS, JS)
 - Tizen web browser is one of the best HTML5 implementation on mobile devices
 - Comprehensive list of HTML5 features available
- Also possible: native apps in C++ (Bada Framework)
- Tizen SDK contains an Eclipse-based IDE

APPS

- Main hub for distributing apps will be the TizenStore
- TizenStore tailored to Indian market
- Meets requirements for a successful smartphone OS
- Availability of smartphones missing

SAILFISH OS

- Jolla (founded by former Nokia employees)
- Sailfish OS based on MeGo and Mer (community project)
- Homescreen with tiles
- Controlled with gestures

DEVICES

- Jolla phone November 2013
- Jolla tablet in ??

APPS

- Sailfish OS is able to run
 - Sailfish-native apps
 - Android apps
 - MeeGo-native apps (not all)
 - Linux apps compiled for Sailfish device
- Alien Dalvik runtime for Android apps
 - Android apps run out of the box
 - Yandex and Aptoide shops available in the Jolla Store
 - Google Play Store can be added manually
- Jolla Store with several hundred apps

SYSTEM

- Access to the Linux system
 - Tools like systemd, bash, rpm available
- Active community:
 - together.jolla.com/questions/
 - talk.maemo.org

OLDER PLATFORMS

- Java ME (J2ME)
- Symbian (Nokia)
- Palm OS
- WebOS (Palm → HP → LG)
- Bada OS (Samsung)

FEATURE PHONE PLATFORMS (REP.)

- Globally one third of all phones sold in Q3 2014
- Install base much higher
- Apps typically developed using Java ME or BREW (Qualcomm)

JAVA ME (J2ME)

- Oldest mobile application platform
- Still widely used
- Designed to run primarily on feature phones
- Most mobile phones in use today are feature phones
- Dominates this market segment
- Gradually being phased out by low-end smartphones

OLDER SYSTEMS: SYMBIAN

- Nokia
- Worldwide market share was more than 50%
- Also used by Siemens, Panasonic, Samsung
- Symbian S60 (2008)
- Symbian 3 (2011)
- Cooperation with Microsoft (2011): end of Symbian OS

OLDER SYSTEMS: PALM OS

- Developed by Palm for PDAs in 1996
- Simple, single-tasking environment
- Touch screen
- Devices have a detachable stylus to facilitate making selections
- Handwriting recognition input system called Graffiti

WEBOS

- Developed by Palm in 2009
- Based on web technologies
- 2010: HP acquired Palm
- 2012: WebOS Open Source
- 2013: bought by LG
- Now used in LG's Smart TVs

WINDOWS MOBILE

- Successor of Windows CE
- Predecessor of Windows Phone

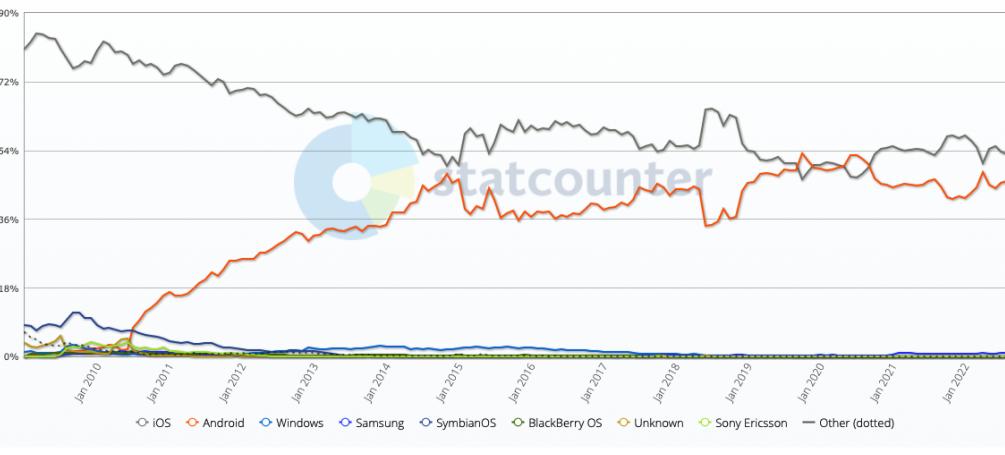
BADA OS

- Samsung 2010
- In large part a copy of Android
- Unsuccessful attempt to gain market share with cheap phones
- Discontinued in 2013

ECOSYSTEM SIZES



Mobile Operating System Market Share Switzerland
Jan 2009 - Aug 2022



- Regional differences

- Sources

[StatCounter](#)

[kantarworldpanel](#)

[netmarketshare](#)

ECOSYSTEM DIFFERENCES

Ecosystem is the key leverage point

For Apple, the ecosystem is what sells hardware

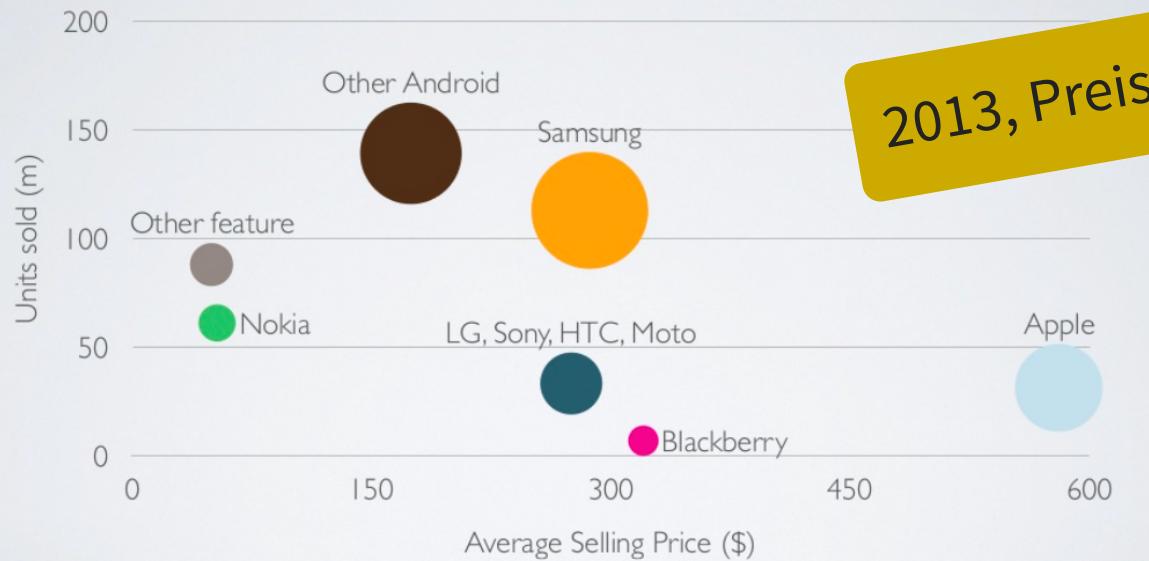


For Amazon, Google and Facebook, the experience on the phone is what drives engagement with all their services

PRODUCT CATEGORIES

Very different products

Global mobile handset industry, Q2 2013



2013, Preise nicht mehr ganz aktuell :)

Bubble area = revenue

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MOBILE APPLICATIONS

- Traditionally we targeted phones
- Then tablets followed
- Today we have a complete range of device types
 - smartwatch, phone, tablet, TV and automotive
 - Each one poses its own usability challenges

MOBILE APPLICATIONS

- Native
- Web-based
- Hybrid

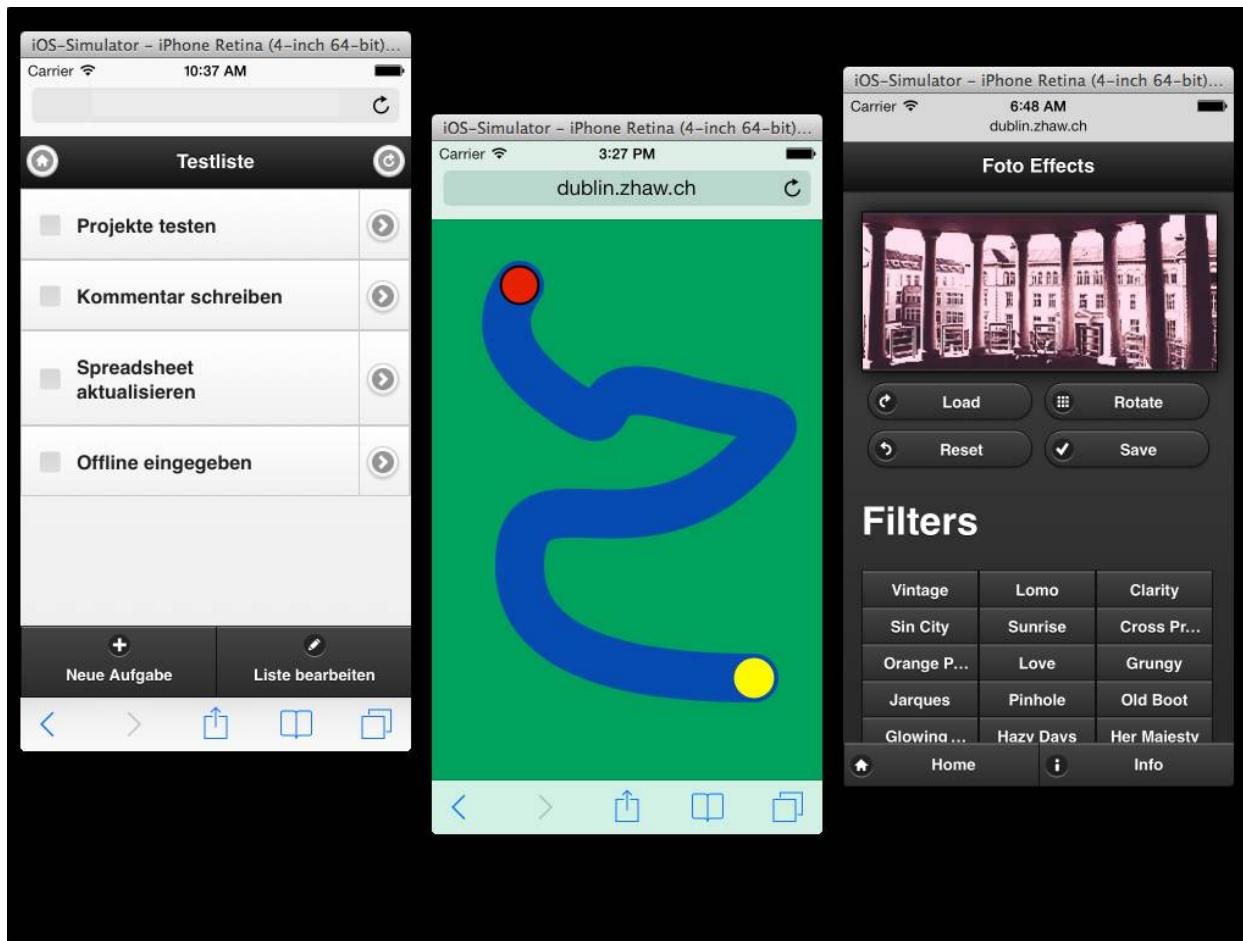
NATIVE MOBILE APPLICATIONS

- Platform specific language
- Platform specific APIs
- Platform specific central app store
- Advantages
 - Usually offer the best performance
 - Deepest integration
 - Best overall user experience
- Disadvantage
 - Most complex development option

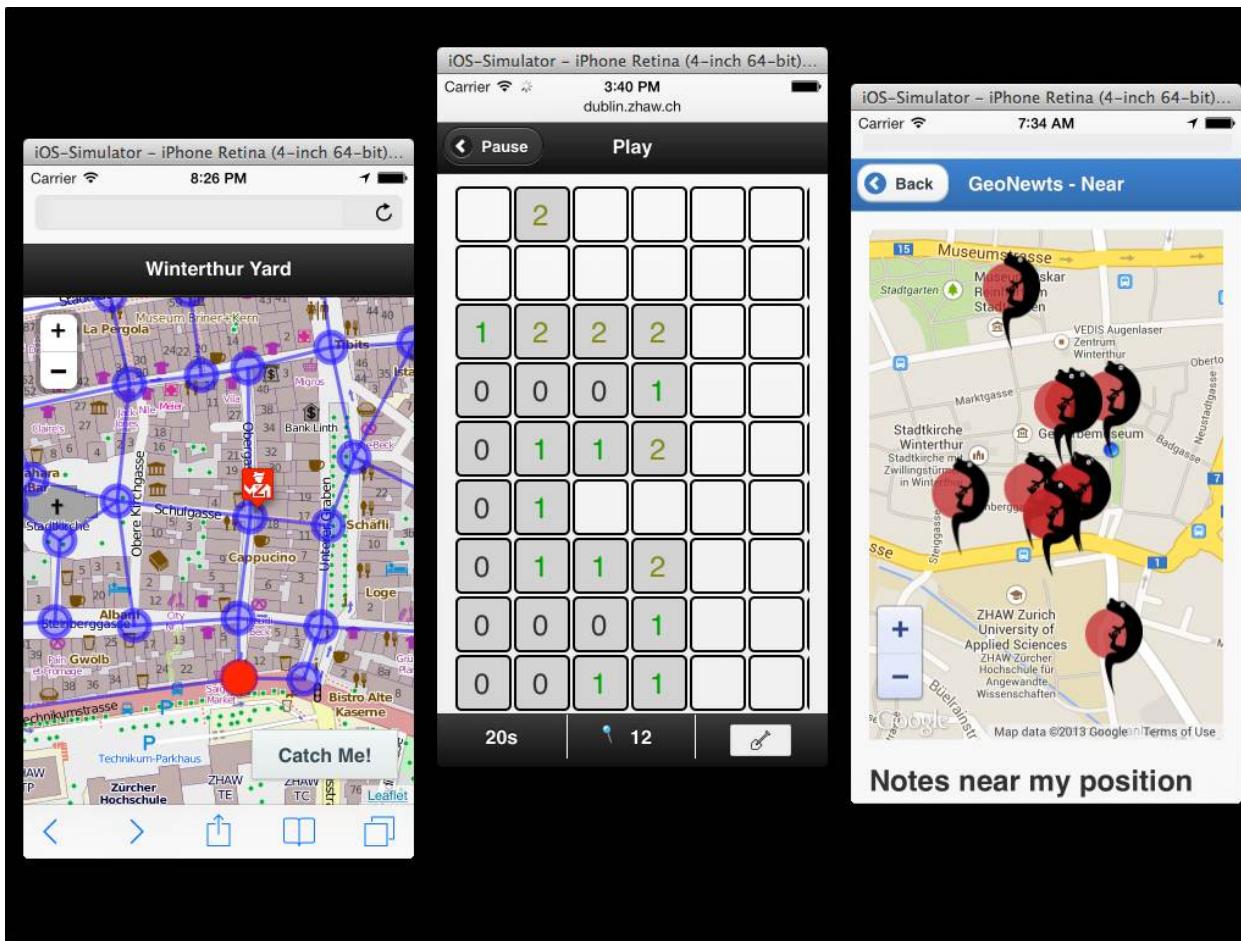
WEB-BASED MOBILE APPLICATIONS

- Based on HTML, JavaScript and CSS
- Do not rely on an app store
- Essentially locally stored mobile sites
- Try to emulate the look-and-feel of an app
- Can be added to the home screen

SAMPLE WBE PROJECTS



SAMPLE WBE PROJECTS



HYBRID MOBILE APPLICATIONS

- Frameworks can build a native wrapper around web apps (examples: Cordova, Capacitor)
- Use native code for enhanced performance and integration
- Use a webview with HTML-based content for other parts
- Allow to revise content and features without using the app stores

SOURCES

- Slides and other material from courses WEB1, WBE
- Mobile Developer's Guide To The Galaxy, 18th Edition, Open XChange,
<https://www.open-xchange.com/resources/mobile-developers-guide-to-the-galaxy/>
- Mobile is eating the world, Benedict Evans, 2013,
<http://de.slideshare.net/bge20/2013-11-mobile-eating-the-world>

Speaker notes

Newstickers (de)

- [Mobile Geeks](#)
- [Appgefahren.de](#)
- [Android Mag](#)

