Mobile Application Development

Lecture 1
Mobile Computing & Development Introduction

Lecture Summary

- Introduction and Motivations
- Mobile device History/Timeline
- Market Growth (Causes / Effects)
- Existing Mobile Platforms
- Mobile Devices Characteristics
- Mobile Development Challenges


social-media-marketing
crowdsourcing
retail
local
seo
rewards
college
mobile-apps
iphone
e-commerce
photo-sharing
real-time
smartphone
technology
networking
web-development
blogging
marketplace
restaurant
fashion
media
apps
deals
lead-generation
travel
twitter
online
restaurants
ecommerce
ipad
social-networking
sports
collaboration
sharing
google
cloud
publishing
ios
html5
news
app
social-commerce
analytics
photo
internet
web
loyalty
videos
location-based
social-network
startup
social-media
saas
community
entrepreneurship
application
tablet
web-design
hosting
health
facebook
video
design
daily-deal
location
marketing
coupons
classifieds
gaming
entrepreneurs
development
games
real-estate
search
music
startups
mobile
social
android
b2b
digital
photos
blog
activities
productivity
jobs
entertainment
group-buying
daily-deals
photography
groupon
content
education
advertising
recommendations
business
consulting
free
platform
network
movies
reviews
food
events
friends
small-business
cloud-computing
dating
gamification
shopping
software
discount
discounts
enterprise
internet-marketing
innovation
geolocation
peer-to-peer
security
venture-capital
curation

Mobile Computing

Mobile computing is a form of human–computer interaction by which a computer is expected to be transported during normal usage.

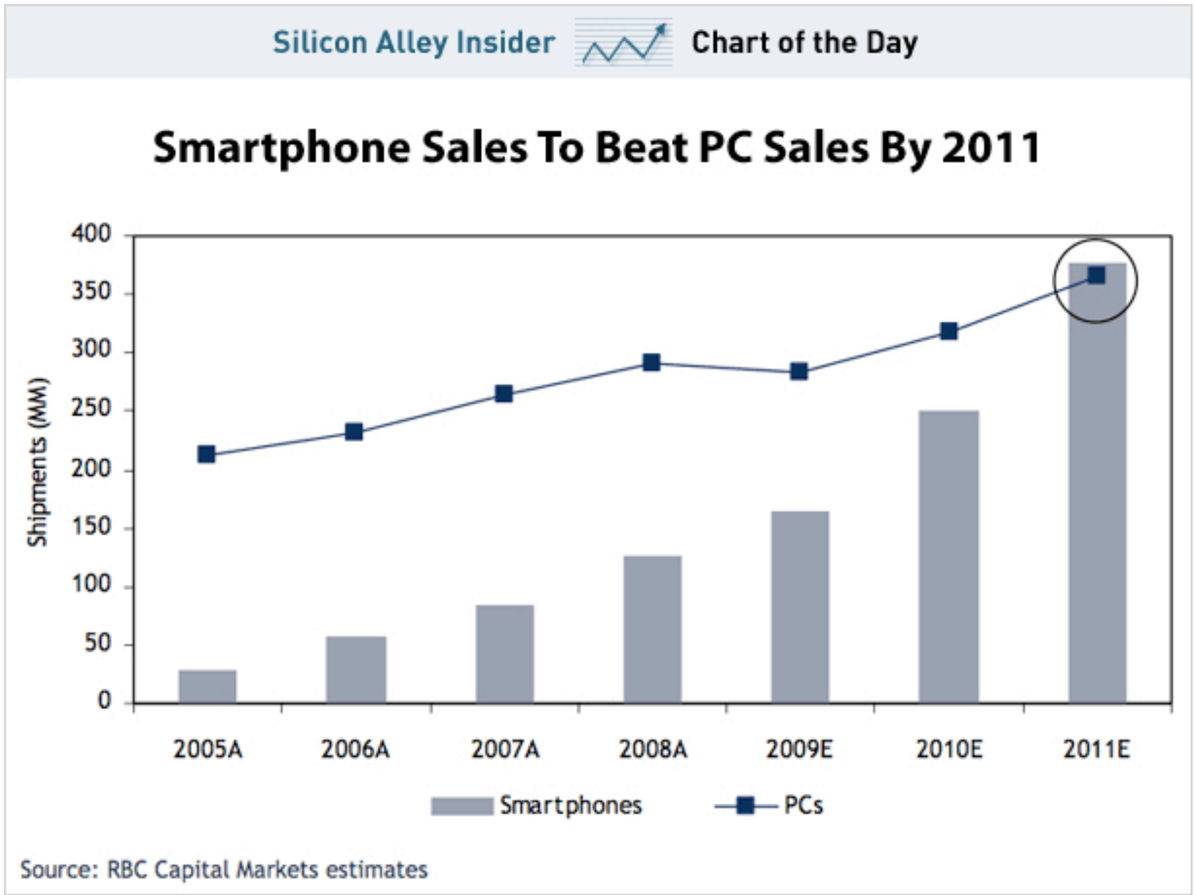
Mobile computing has three aspects:

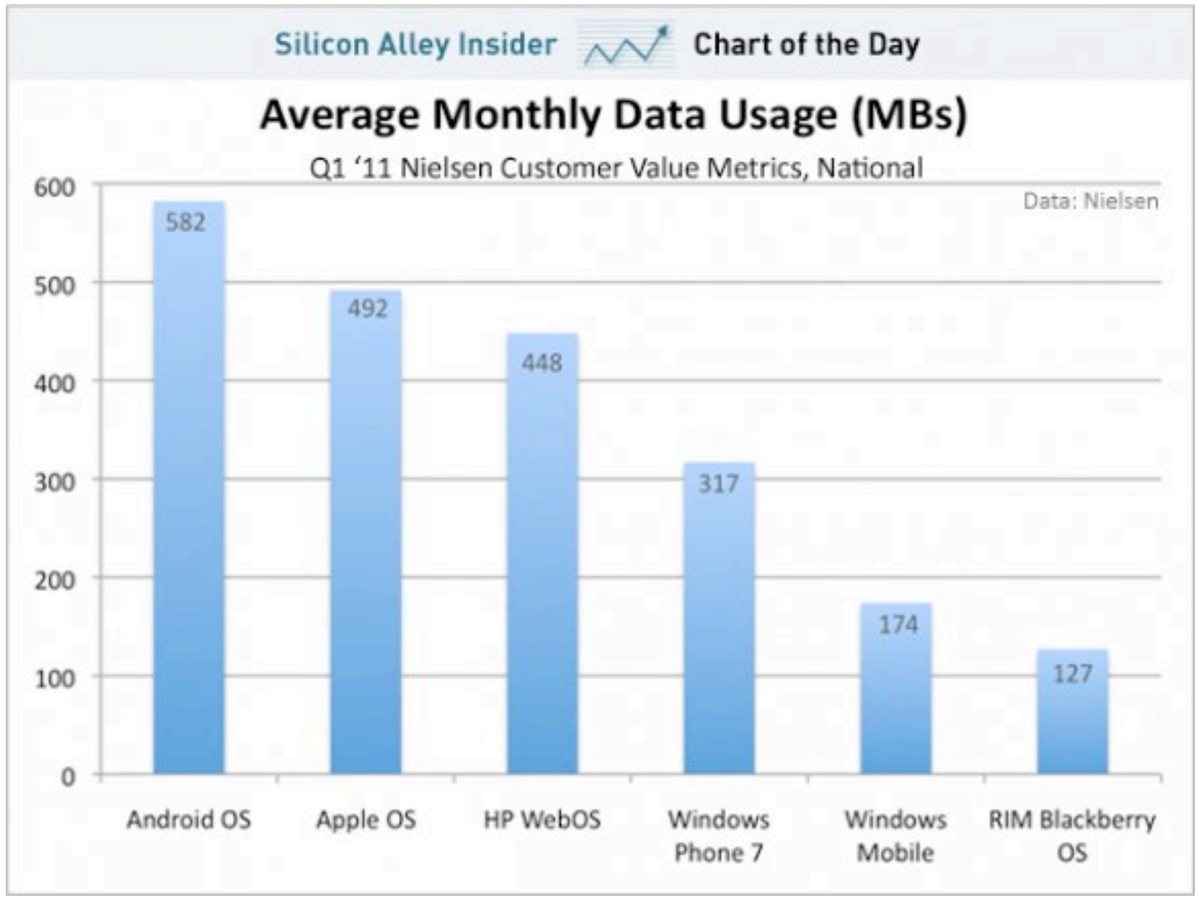
- **Mobile Communication:** addresses communication issues in ad-hoc and infrastructure networks as well as communication properties, protocols, data formats and concrete technologies.
- **Mobile Hardware:** related to hardware, e.g., mobile devices or device components.
- **Mobile Software:** deals with the characteristics and requirements of mobile applications.

Techniques and Technologies that enable people to access computing services Anytime, and Anywhere.

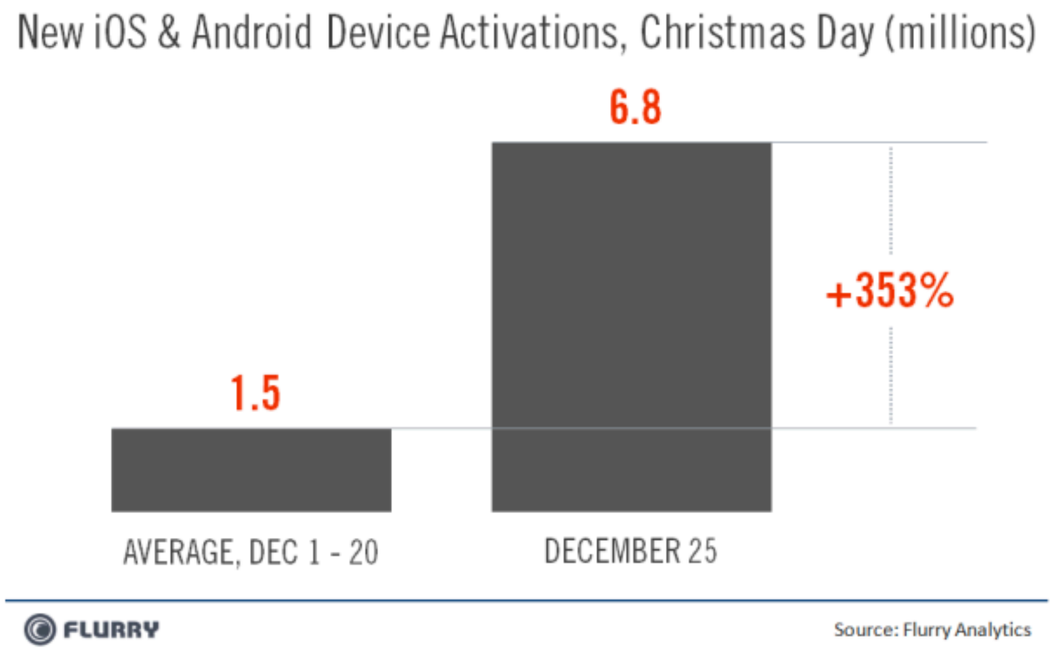
Source: http://en.wikipedia.org/wiki/Mobile_computing

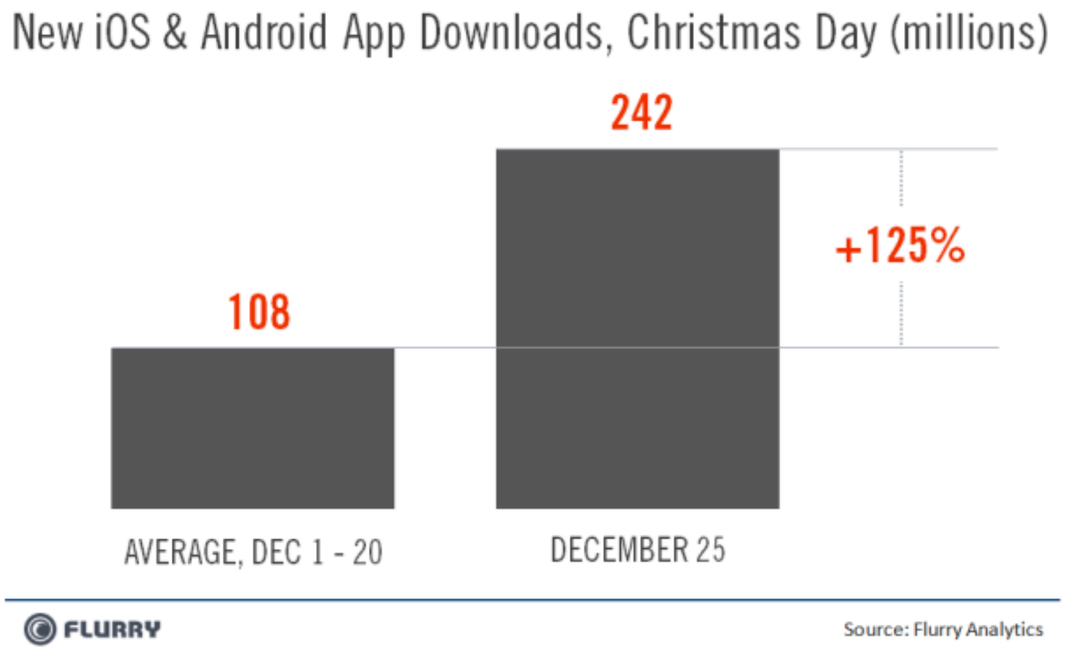
Market Growth (2011-2012)



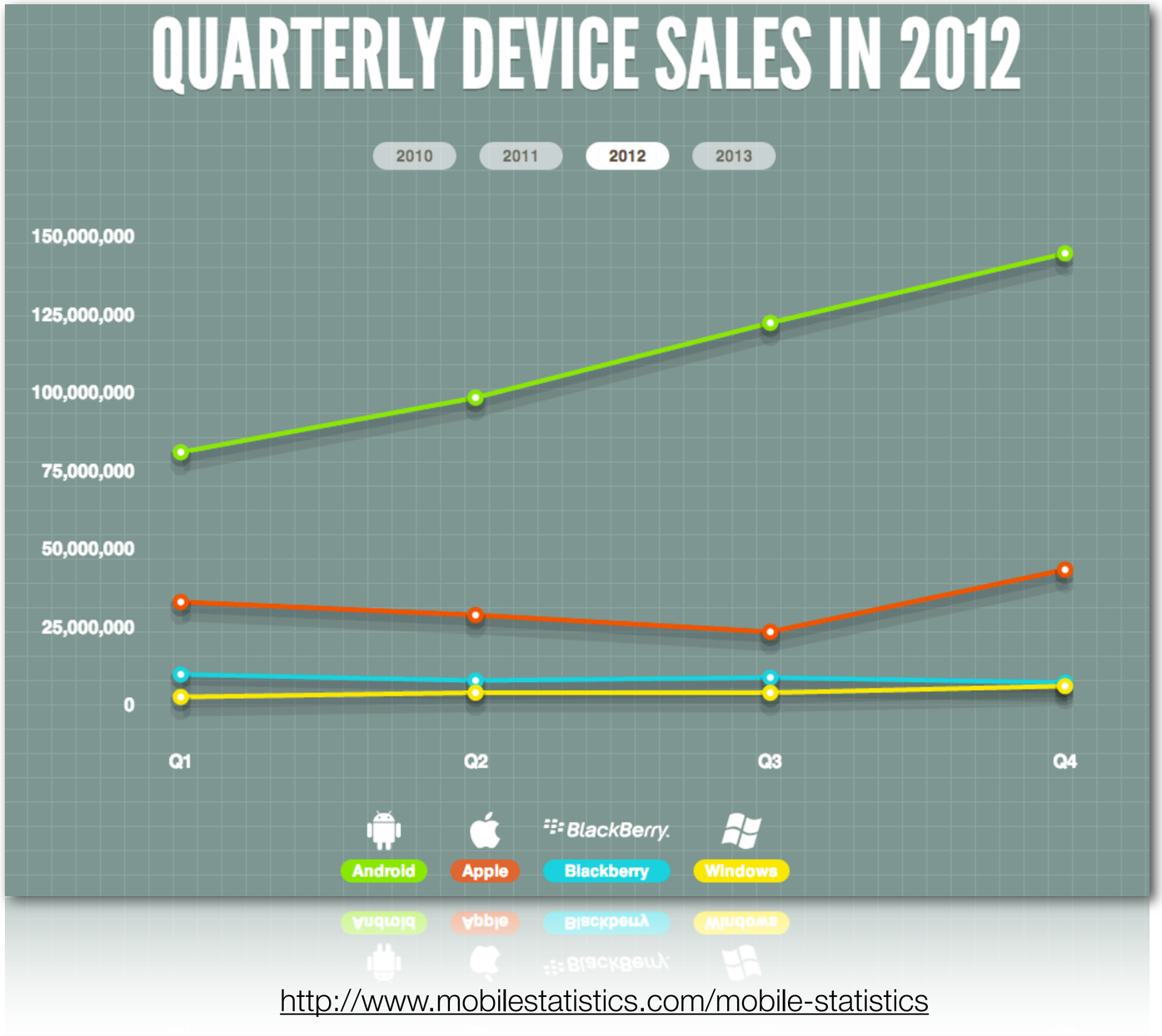


Market Growth



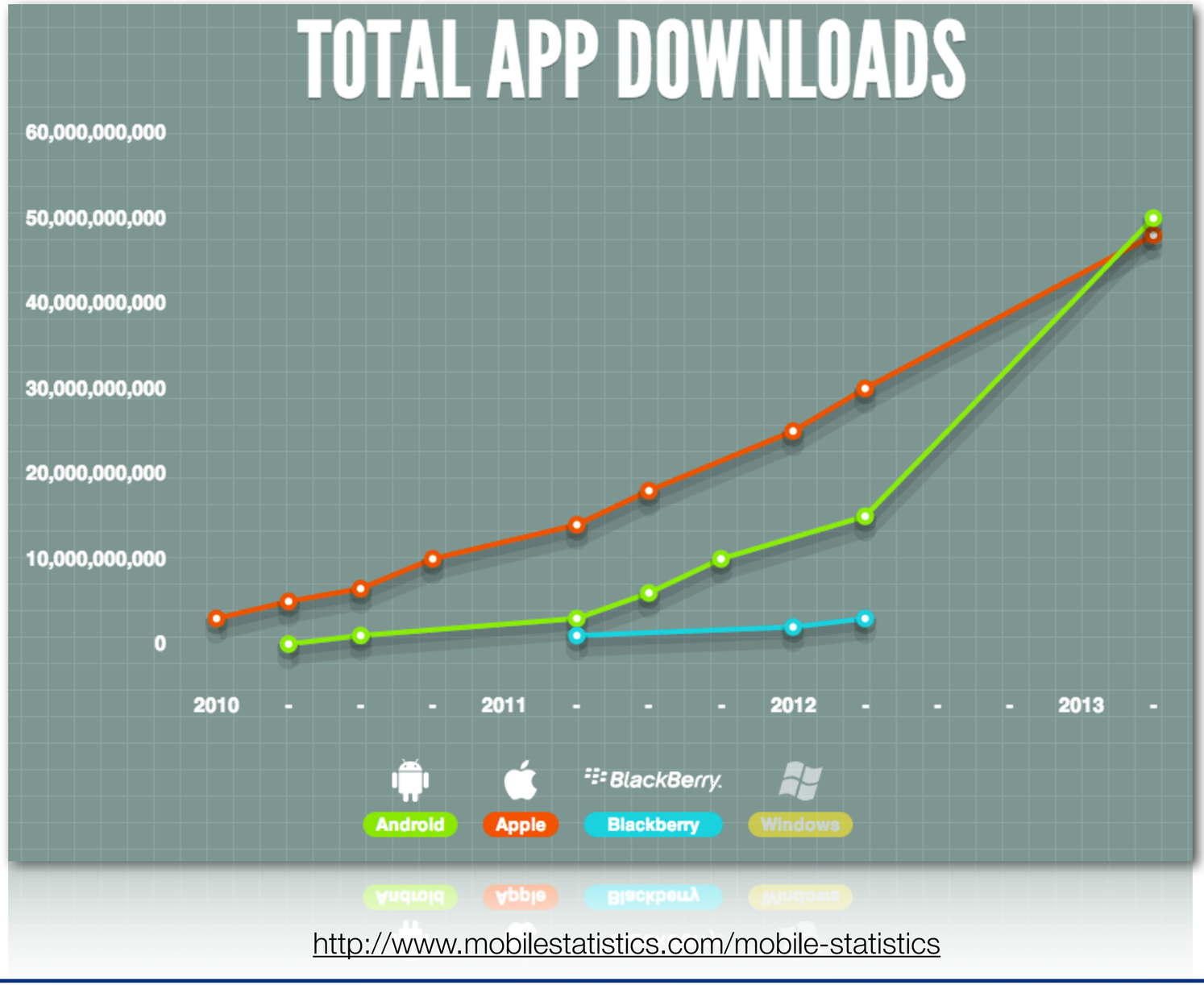


Market Growth



http://www.mobilestatistics.com/mobile-statistics

Market Growth



http://www.mobilestatistics.com/mobile-statistics

Course Motivations

Social Accounts

Address Book

Phone Calls

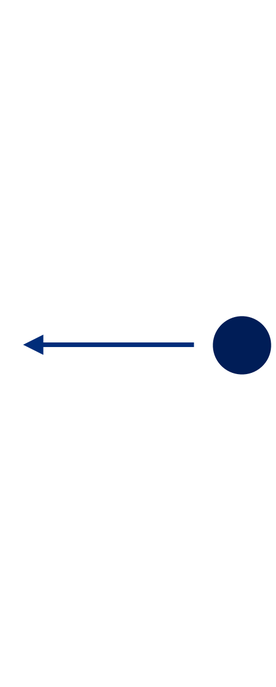
Location
(GPS, 3G, WiFi)

Shared Data

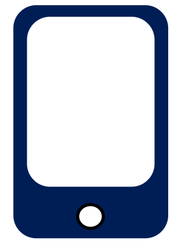
Browsing Data

Photos / Videos

.....



WiFi
WiFi Direct
3G/4G
Bluetooth
NFC



NFC

Payment

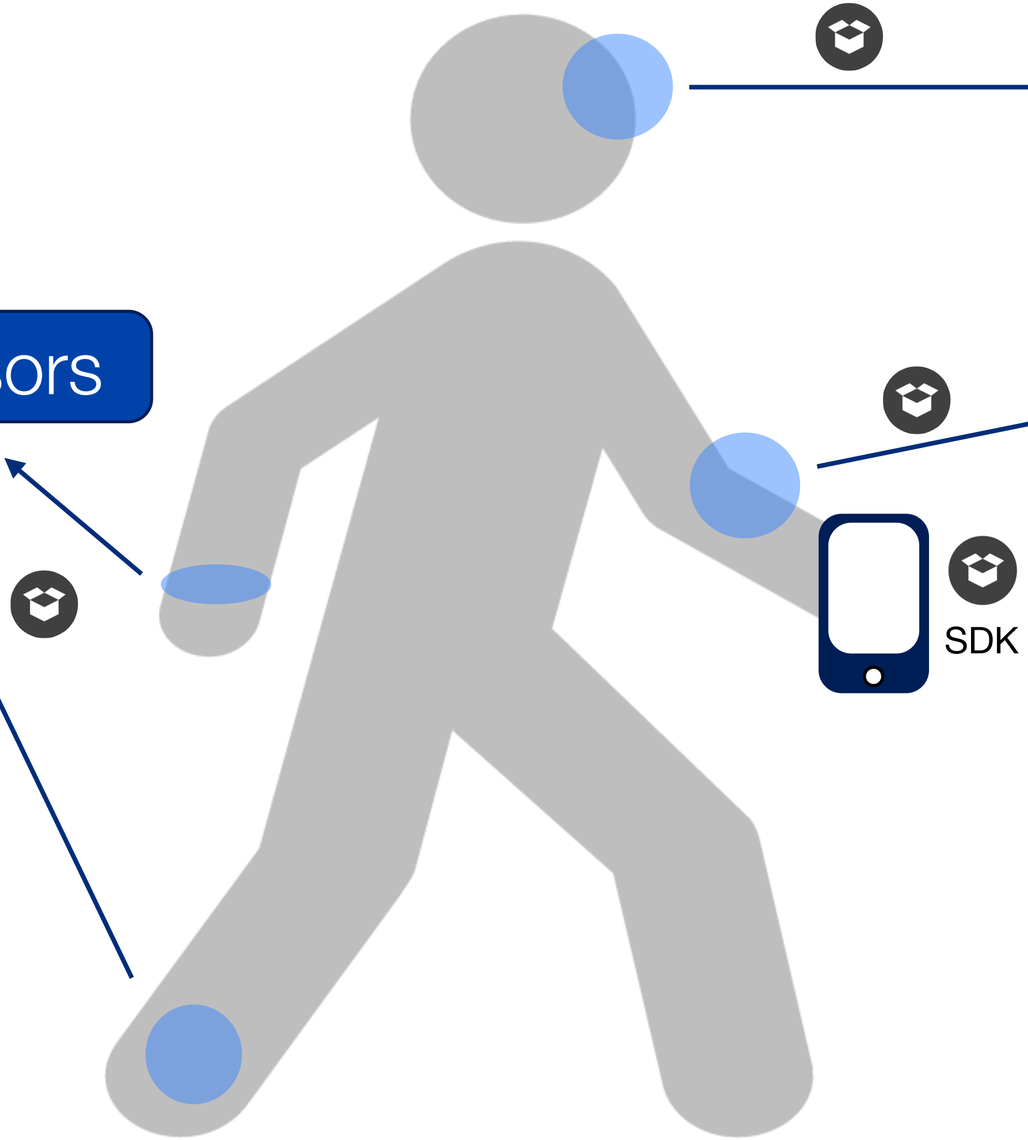
Remote
Services

Smart
TV/Display

We are living in the "Mobile-Centric" World !

Course Motivations

Motion Sensors



Glasses

Smart Watch

SDK

"Mobile handsets & tablets are attraction points for surrounding smart devices and services"

1983

Motorola's DynaTAC
$3,995
2.5 Pounds
30 min of call autonomy

First Commercial Phone

1993

IBM Simon
$899
mobile phone, PDA, Fax, touchscreen and QUERTY virtual keyboard

Nokia 1011
GSM Phone, monochrome display, 12 h standby, 90 min conversation

Apple MessagePad
$999-$799
PDA Device, touchscreen, handwriting recognition, QUERTY virtual keyboard

First GSM Phone & First Publicity Available Smartphone

1996/1997

Nokia Communicator 9000

E-Mail, SMS, Web*, Notes, Calendar, Multiple applications, TextWeb

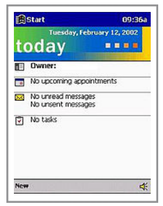
Palm Pilot 1000
Palm OS, Network Access, Data Sync, Pers. Info. Management.

Web Functionalities, Multiple Applications

1999/2002

Nokia 7110
WAP Technology, E-mail, Sport Results, News, Music Download

Windows Mobile PocketPC 2000
Office Suite, Media Player, Internet Explorer, MSN, Outlook



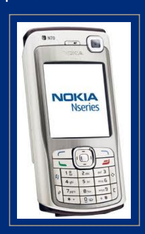
Blackberry 5810
GPRS Connectivity, QWERTY keyboard, 8MB Flash Memory, Internet Browsing

Sony Ericsson T68i
Camera Phone 0.1 Megapixel, Color Display, SMS/MMS, GPRS, Bluetooth, IrDa

WAP, MP3, GPRS, Digital Camera, Flash Memory, Internet Browsing

2003/2006

Nokia N70
2.0 Megapixel, Audio/Video play and recording, Java Support, Symbian OS, C++ Applications, Internet Browser, Maps, Multitasking



Blackberry 8800
GPRS/EDGE, QWERTY keyboard, Internet Browser, Maps, Multitasking

Microsoft Windows Mobile 5
WiFi, GPS, Support, .NET and Java Development, Maps, Multitasking

WiFi, GPS, EDGE, UMTS, Third Part Applications, Advanced Multimedia Capabilities, Rich User Interfaces, Multitasking

> 2006 ?

Year

Università degli Studi di Parma

Mobile Platform SDK

Multi-touch events and controls, Accelerometer support, View hierarchy, Localization, Camera support Media, audio mixing and recording Video playback, Image file formats Animation, OpenGL ES, Networking, SQLite database, Location, Threads, TCP/IP Sockets, Power management, File system, Security

2007

Apple announces the first version of the iPhone. combining Internet, Phone and Multimedia + Advanced Rich UI

Full Browser (Flash ?) Advanced SDK, Rich Functionalities and User Interface

2008

Apple and Google provide easy to use IDE (Integrated Development Environment) to simplify developer activities, build high quality application with advanced features and rich UI

Apple & Google introduce the App Store and the Android Market

Google announces the first release of Android OS.

HTC sells the first devices: HTC Dream

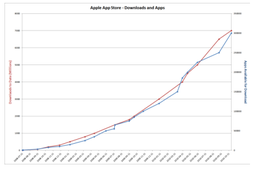
Multiple Third Part Applications, Dedicated Market, Additional Embedded Sensors

2009

Apple introduces the App Store for iPhone / iPod Touch

Growing Market

3,000,000,000+ Downloads on App Store



Periodic SDK updates, with new functionalities, Improved Development Tools

2010

Apple release the first version of the iPad and Samsung announces the Galaxy Tab

The same Operating System for smartphone and tablet. (SDK & Applications)

2011

iOS 5 and Android v4.x Ice Cream Sandwich have been released including Cloud Services support, HD multimedia features, Social Network integration, WiFi System Update, Synchronization, etc ..,

Microsoft announces the new release of Windows Phone OS (7.5) and the partnership with Nokia.

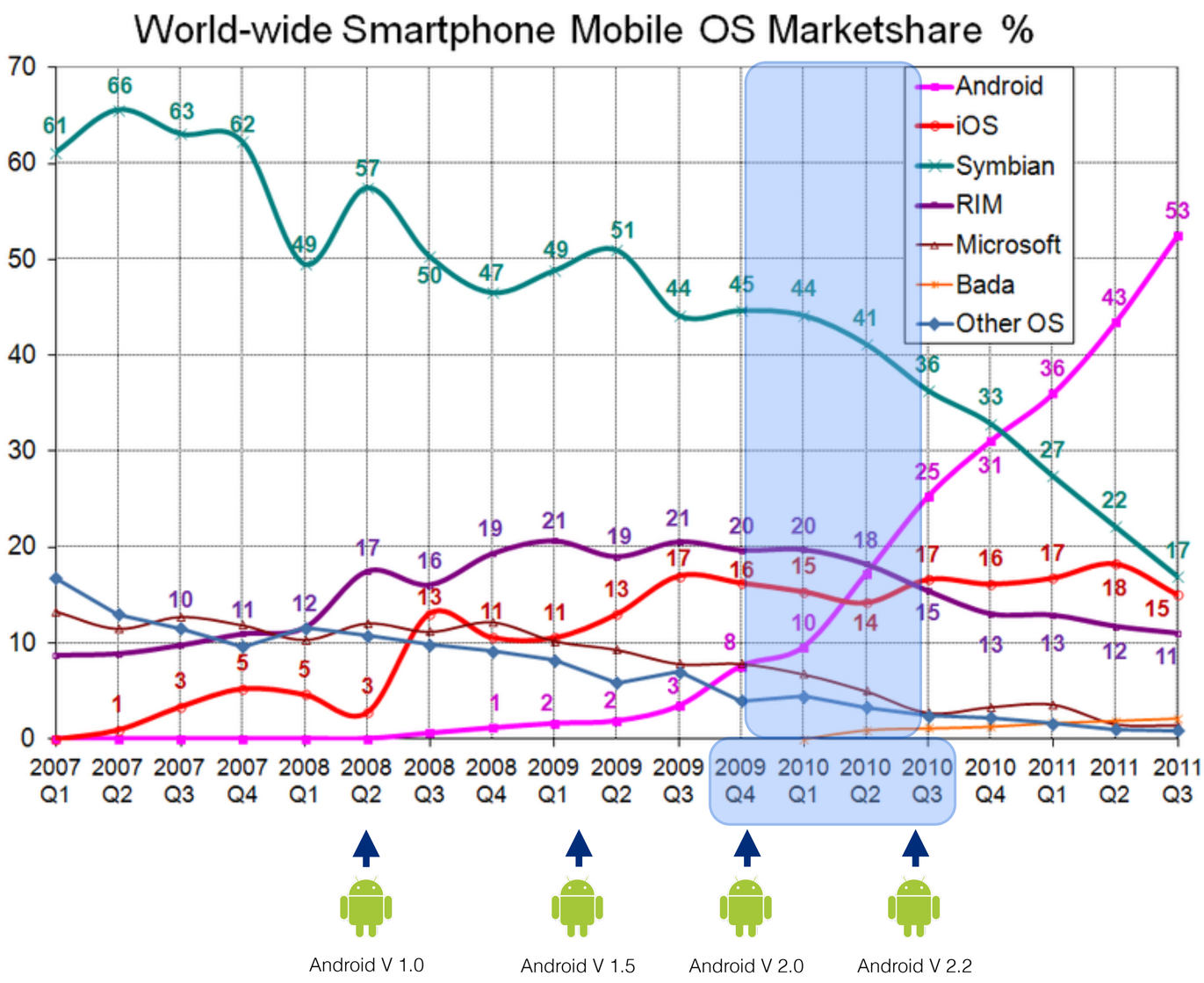
Extended support for external devices and networking (NFC, WiFi Direct, Arduino), Advanced Multimedia Features, Cloud Services

2012

2013/2014 ?

Market Growth Reasons

- Hardware Spec.
  - CPU / GPU
  - RAM + Storage
  - Networking (WiFi, Bluetooth, NFC)
  - Cellular Network (GPRS, EDGE, UMTS, HSDPA)
- New Generation Operating Systems
  - Rich User Interface
  - Multitouch
  - Multitasking
- Advanced SDK with hundreds of new API for each new release
- New Developer Tools
  - Editor
  - UI Design
  - Database & Application Flow
  - Performance & Behavior Analysis
  - Complete Emulator
  - Easy Deployment



[2009Q4 ; 2010Q3]

- From Android 2.0 to 2.2 in 7 months
- 2.0 New Features:
  - Bluetooth 2.1 support
  - Numerous new camera features
  - Improved typing speed on virtual keyboard
  - Refreshed browser UI with bookmark thumbnails, double-tap zoom and support for HTML5
  - Optimized hardware speed and revamped UI
  - Support for more screen sizes and resolutions
  - Improved Google Maps 3.1.2
  - MotionEvent class enhanced to track multi-touch events
- 2.2 New Features
  - Speed, memory, and performance optimizations
  - Updated Market application with batch and automatic update features
  - Push Notification
- New Users use Android
- Symbian users start switching to Android
- **New Developers start using Android** !
- **Symbian Developers start switching to Android!**

Android Applications Available From 16000 To 80000

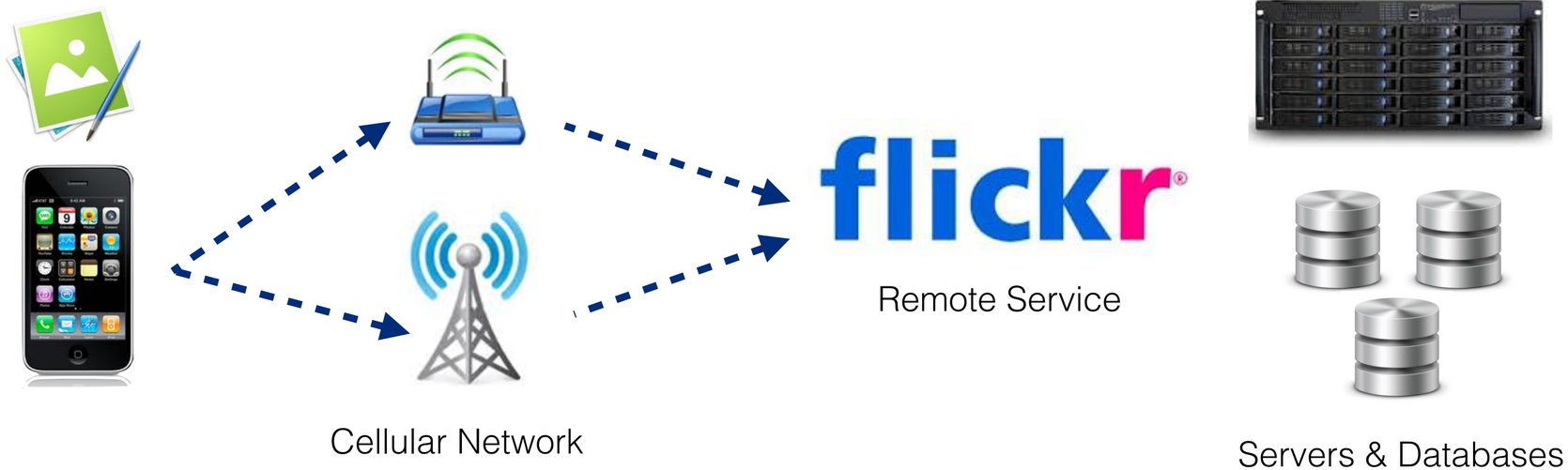
Source: http://en.wikipedia.org/wiki/File:World-Wide-Smartphone-Market-Share.png, http://en.wikipedia.org/wiki/Android_Market

Market Growth Effects

- New Emerging Technologies
  - Cross Platform Solutions (HTML5, Javascript and CSS)
  - Speech Recognition & Voice Interaction
  - Ad-hoc communication (WiFi-Direct, NFC)
- Changes in existing solutions, applications and development process
  - Increased number of client (Search Engines, Web Pages, Peer-to-Peer and Games)
  - Customized content design
  - Geo-referenced information
  - Authentication (OAuth ?)
  - Networking (Increased number of active user over WiFi and Cellular Network)
  - Device heterogeneity
  - Porting of mobile world solution to desktop OS

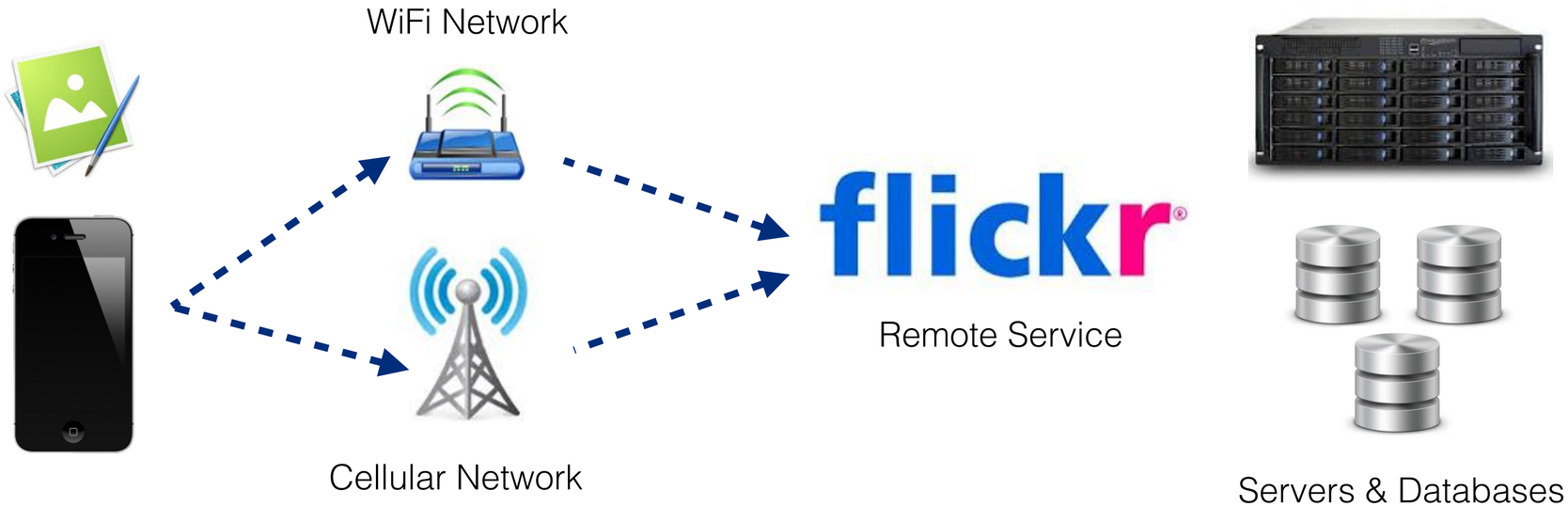
2009

Camera: 3MP
File JPG100 **1.0 MB**



2011

Camera: 8MP
File JPG100 **2.0 MB**



facebook

NBC NEWS

“What a difference 8 years makes: St. Peter’s Square in 2005 and yesterday”

Common Software Platforms

Feature	iOS	Android	webOS	Windows Mobile	Windows Phone	BlackBerry OS	Symbian	Maemo	MeeGo	bada
Company	Apple	Open Handset Alliance/Google	Palm, Inc (HP)	Microsoft	Microsoft	RIM	Symbian Foundation	Nokia	Linux Foundation	Samsung
Current Version	5.0.1	4.0.3	2.2.4 (Phones) 3.0.5 (Tablet)	6.5.3	7,5	7.0.0	10,1	5,0	1.1.2	2,0
OS Family	Darwin	Linux	Linux	Windows CE 5.2	Windows CE 7	Mobile OS	Mobile OS	Linux	Linux	Proprietary RTOS or Linux
Supported CPU Architecture	ARM	ARM, MIPS, Power Architecture, x86	ARM	ARM	ARM	ARM	ARM	ARM	ARM, x86	ARM
Programmed in	C, C++, Objective-C	C, C++, Java	C	Many, C++, .NET, Lazarus	Many, .NET (Silverlight/XNA)	Java	C++	C/C++	C++	C++
License	Proprietary EULA except for open source components	Free and open source	Free and open source except closed source modules	Proprietary	Proprietary	Proprietary	Eclipse Public License	Free and open source except closed source components[64]	Free and open source	Proprietary

Source: http://en.wikipedia.org/wiki/Mobile_operating_system

New Mobile Platforms

ubuntu

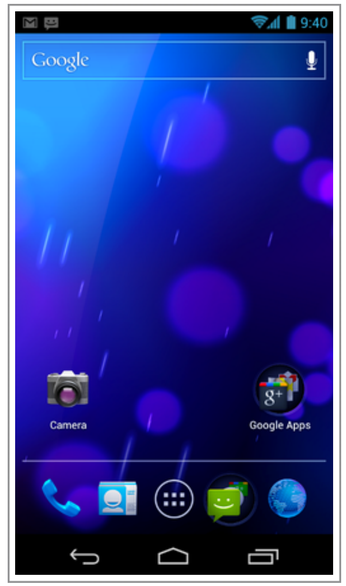
mozilla

facebook ?

OS Improvements

- Phone Functionality
- Additional applications
- Reduced development tools
- Games

- Multitasking
-Third Part Applications
- First Developer Tools & SDK
- Multiple Network Interfaces (WiFi, BT)
- Primordial Web Browser
- Advanced Built-In Apps (Notes, Office Application Maps)



- Rich User Interface
- Advanced Multitasking / Networking
- Background Services
- Embedded Sensors
- Full Web Browser
- 3D Apps/Games
- **New Generation SDK and Developer Tools**
- Application Market

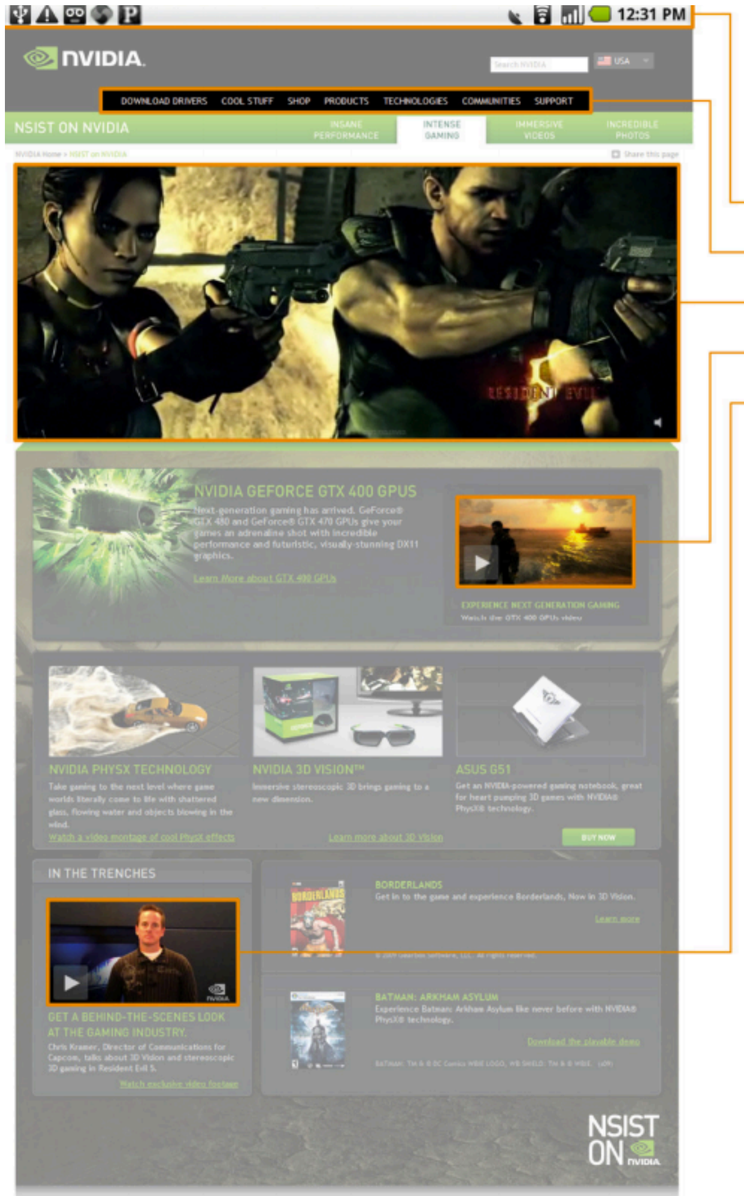
Model	CPU	Storage Capacity	RAM	Display	Camera	Sensors	Network
iPhone	412 MHz ARM	4/8/16 GB	128 MB	320 x 480	1.92 MP	accelerometer, multitouch, proximity sensor	GSM, EDGE, GPRS, WiFI b/g, BT
iPhone 3G	412 MHz ARM	8/16 GB	128 MB	320 x 480	1.92 MP	accelerometer, multitouch, proximity sensor, aGPS, ambient light sensor,	GSM, EDGE, UMTS, 3G, GPRS, WiFI b/g, BT
iPhone 3GS	600 MHz ARM	8/16/32 GB	256 MB	320 x 480	3 MP auto focus	3-axis accelerometer, multitouch, proximity sensor, ambient light sensor, digital compass	GSM, EDGE, UMTS, 3G, GPRS, WiFI b/g, BT
iPhone 4	800 MHz Apple A4	8/16/32 GB	512 MB	640 x 960	5 MP, auto focus, flash	3-axis accelerometer, 3-axis gyroscope, aGPS, multi-touch, proximity and ambient light sensors, digital compass	GSM, EDGE, UMTS, 3G, GPRS, WiFI b/g,n, BT
iPhone 4S	800MHz, DualCore, Apple A5	16/32/64 GB	512 MB	640 x 960	8 MP, LED flash, face detection, video stabilization	3-axis accelerometer, 3-axis gyroscope, aGPS, multi-touch, proximity and ambient light sensors, digital compass	GSM, EDGE, UMTS, 3G, GPRS, HSDPA, WiFI b/g,n, BT4
iPad 1	1 GHz Apple A4	16/32/64 GB	256 MB	1024x768	-	3-axis accelerometer, 3-axis gyroscope, aGPS, multi-touch, proximity and ambient light sensors, digital compass	EDGE, UMTS, 3G, WiFI b/g,n
iPad 2	1 Ghz DualCore Apple A5	16/32/64 GB	512 MB	1024x768	0.7 MP Front Camera & 0.3 MP Back Camera	3-axis accelerometer, 3-axis gyroscope, aGPS, multi-touch, proximity and ambient light sensors, digital compass	EDGE, UMTS, 3G, WiFI b/g,n
iPad 3	1GHz Dual-core Apple A5X Quad Core GPU	16/32/64 GB	1 GB	2048x1536	5 MP	3-axis accelerometer, 3-axis gyroscope, aGPS, multi-touch, proximity and ambient light sensors, digital compass	4G, WiFI b/g,n, BT4
Google Galaxy Nexus S	1 GHz ARM	16 GB	512 MB	480 x 800	5 MP	3-axis gyroscope, multi-touch, aGPS, proximity and ambient light sensors, digital compass, NFC	EDGE, UMTS, 3G, WiFI b/g,n, BT 2.1
Google Galaxy Nexus	1.2 GHz dual-core	16/32 GB	1 GB	720x1280	5 MP	accelerometer, gyroscope, GPA, aGPS,barometer, digital compass, proximity sensor, dual microphones for active noise cancellation, NFC	EDGE, UMTS, 3G, WiFI b/g,n, BT 3, Wi-Fi hotspot
Asus EEEPad Transformer Prime	NVIDIA® Tegra® 3 Quad-core CPU	32/64 GB	1 GB	1280X800	8 MP	3-axis accelerometer, 3-axis gyroscope, aGPS, multi-touch, proximity and ambient light sensors, digital compass	802.11 b / g / n, Bluetooth 2.1

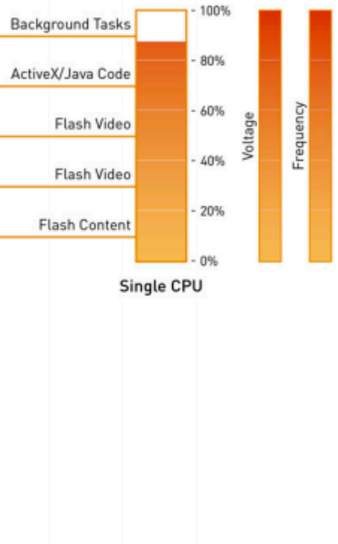
Source: http://en.wikipedia.org/wiki/Comparison_of_smartphones

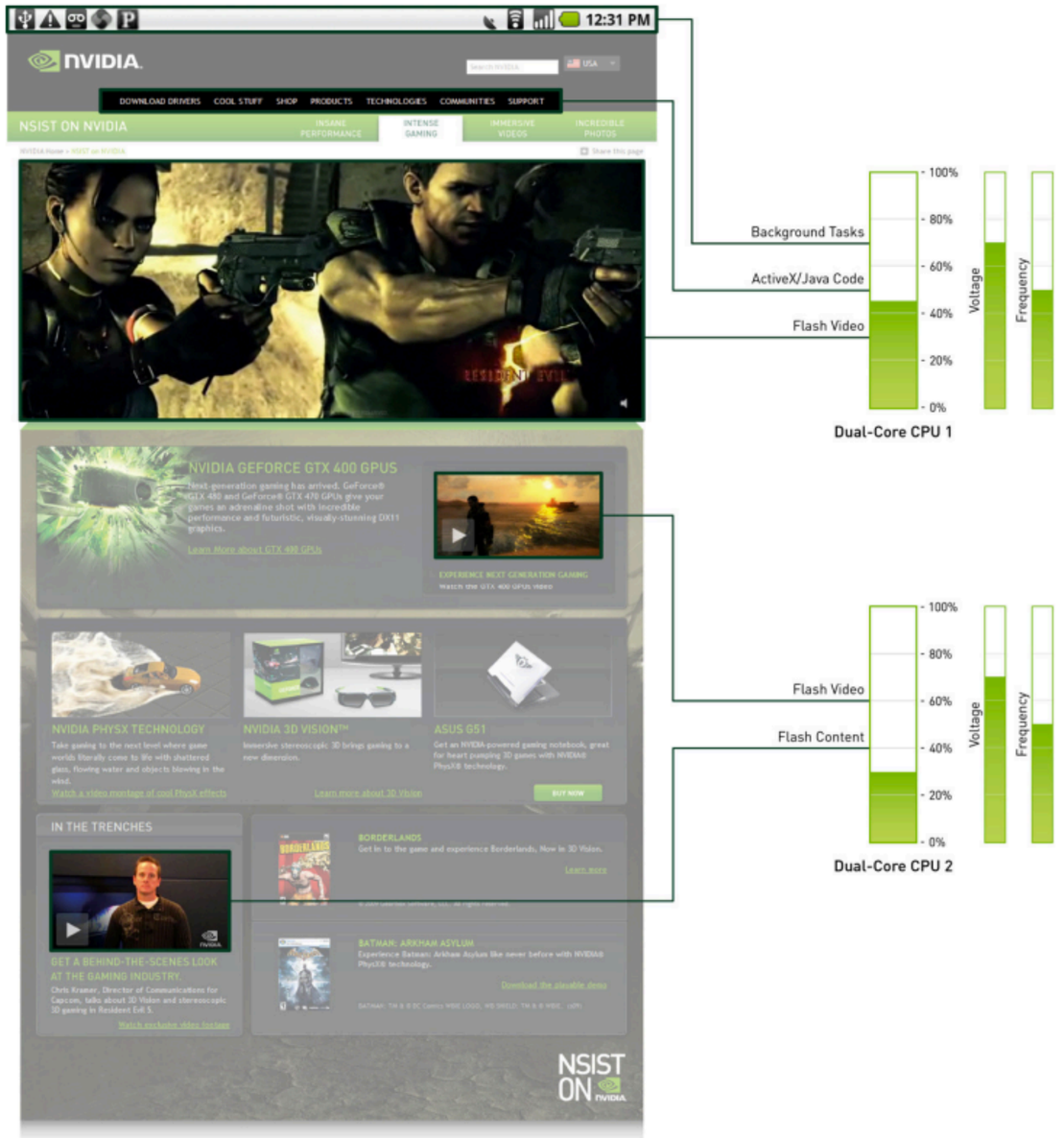
- A7 chip with 64-bit architecture (ARM v8, 1.3 GHz, DualCore CPU)
- Image Signal Processor (ISP)
- M7 Motion Coprocessor
- Graphics processing unit (GPU)

- Octa Core Processor
- 1,6 GHz Quad
- 1,2 GHz Quad

manufactured by Samsung :)







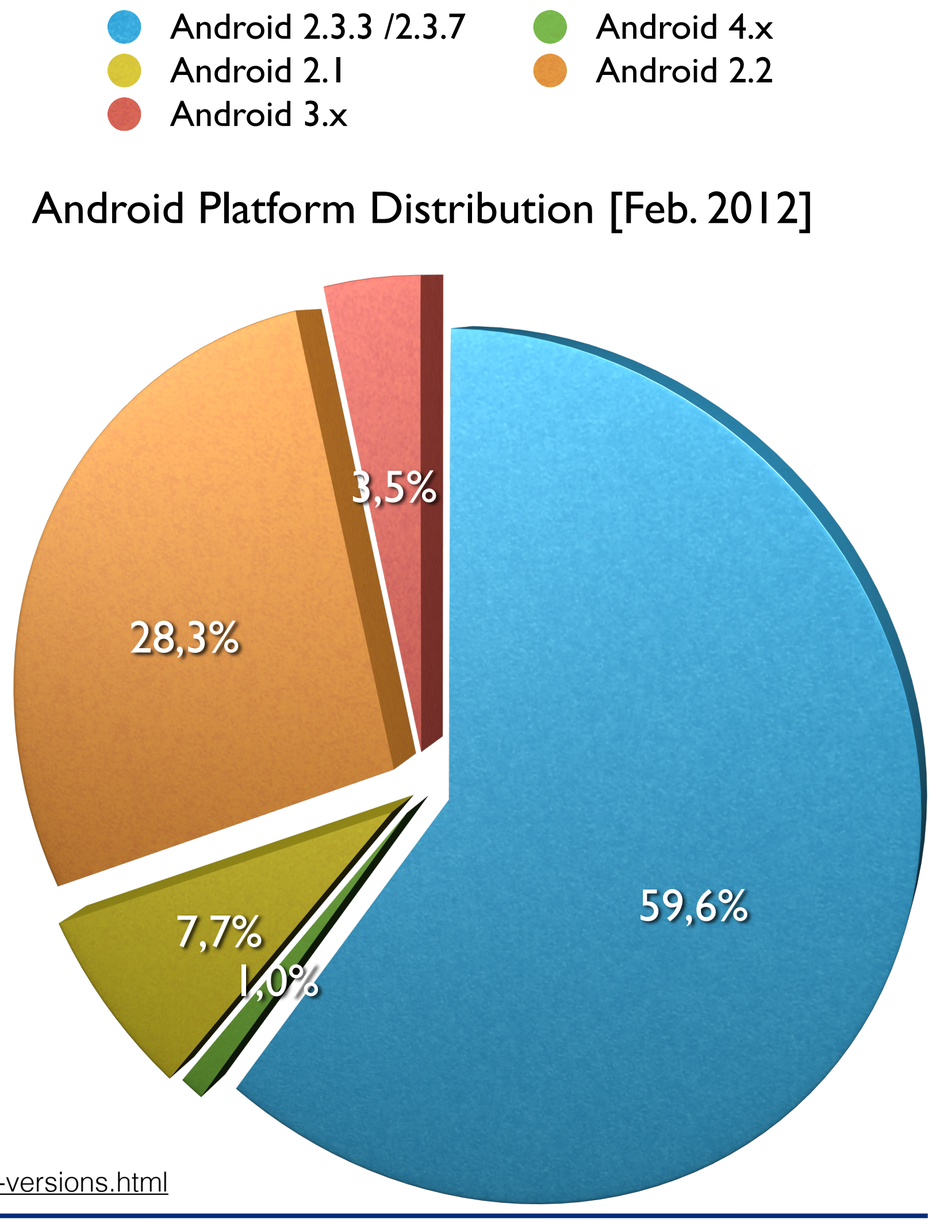
Source: http://www.nvidia.com/content/PDF/tegra_white_papers/Benefits-of-Multi-core-CPUs-in-Mobile-Devices_Ver1.2.pdf

Mobile Devices Characteristics

- Limited resources ?
  - CPU: 412MHz –> 1.6GHz Quad/Octa Core
  - 256MB -> 1GB RAM
- Limited storage capabilities ? (64GB)
- Embedded Sensors
  - Accelerometers
  - Proximity Sensors
  - Compass
  - Gyroscope
  - GPS
- Networking
  - WiFi
  - Bluetooth
  - NFC (Near Field Communication)
- Power management
  - Battery life
  - Data safety in case of power loss
- Reliability
  - Phone functionality always highest priority
  - “Always on”

Mobile Development Challenges

- Manage Device Heterogeneity (OS, Hardware, Application Updates, Display)
- Application Design
  - Rich User Interface
  - User friendly application
  - Reduced number of click
  - Offline & Online functionalities
- Performance & Energy Consumption
  - Low resources if compared with traditional PC Hardware
  - Multi-Threading
  - Background Process / Service
  - Remote Services Interaction
- User Expectations
  - Advanced functionalities (Video Streaming, Realtime Games, etc ...)

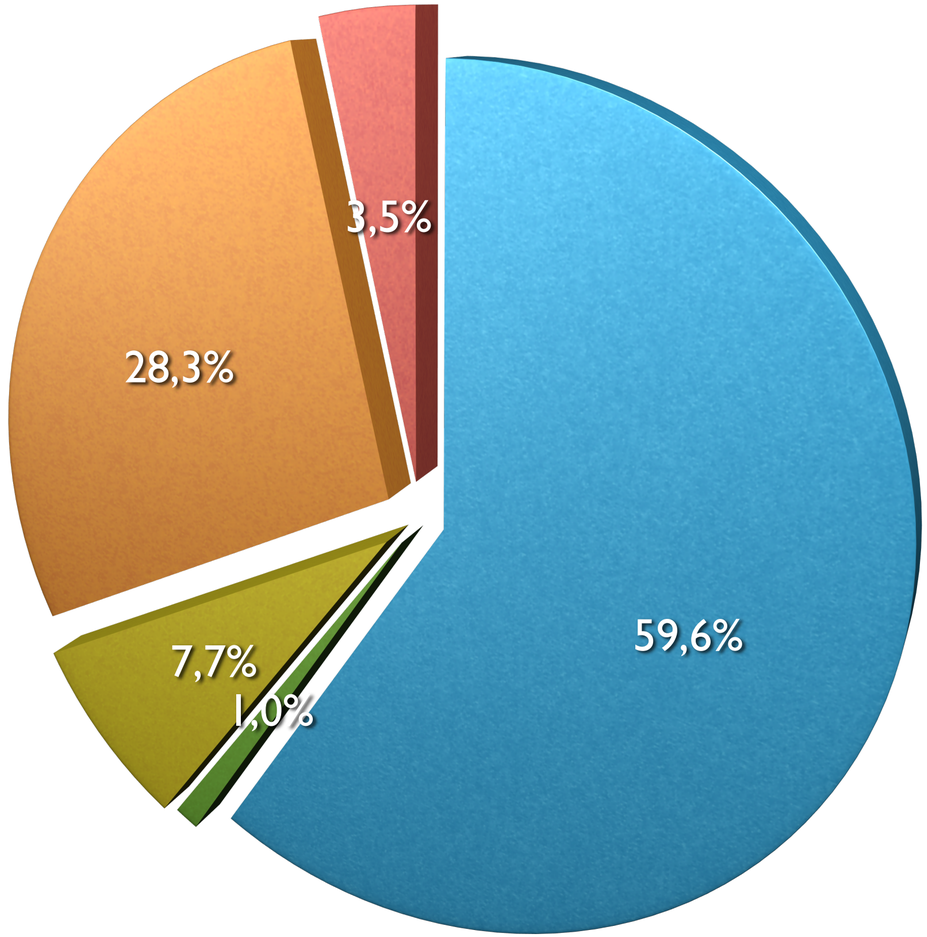


Source: http://developer.android.com/resources/dashboard/platform-versions.html

Android Platform Distribution

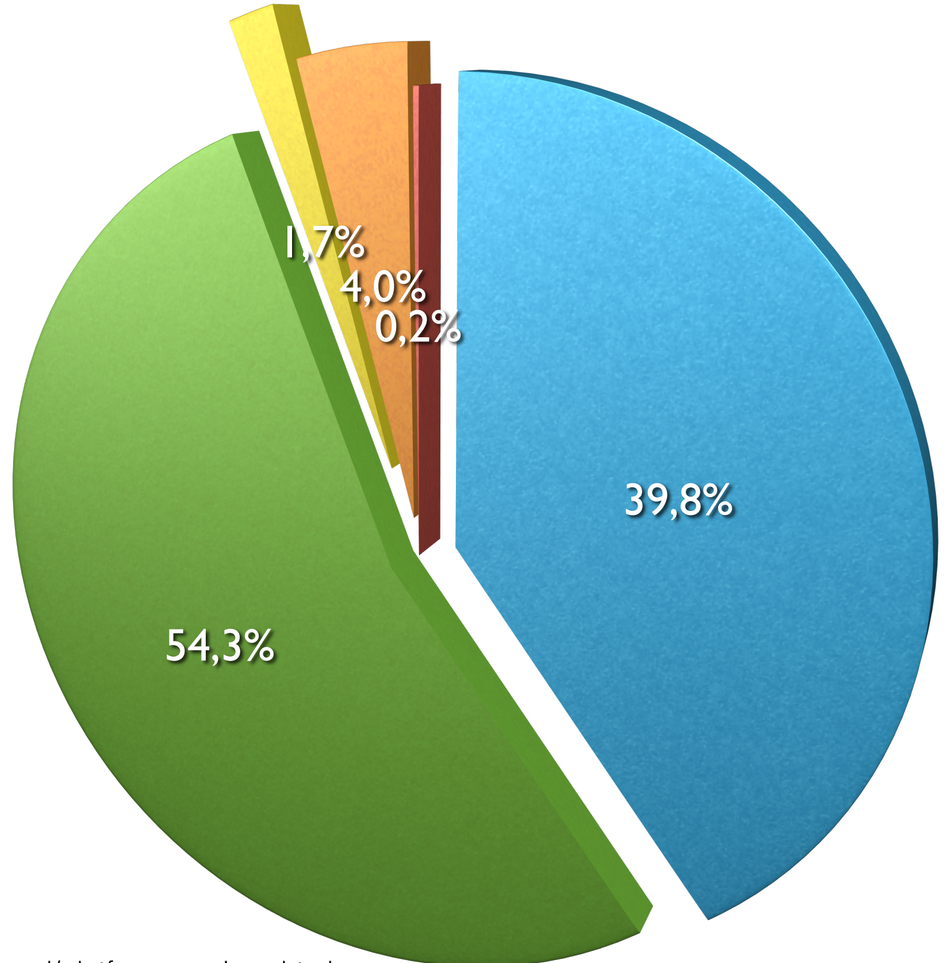
Android 2.3.3 /2.3.7
Android 2.1
Android 3.x
Android 4.x
Android 2.2

Android Platform Distribution [Feb. 2012]



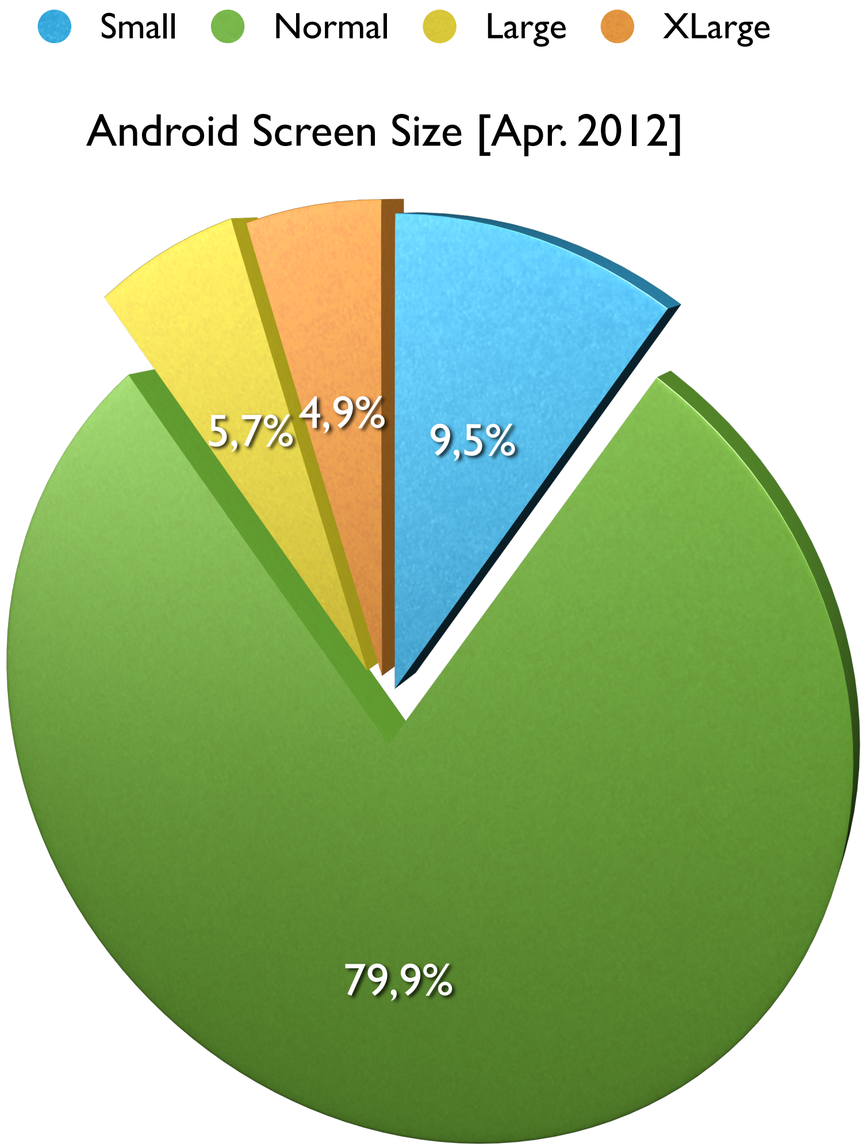
Android 2.3.3 /2.3.7
Android 2.1
Android 3.x
Android 4.x
Android 2.2

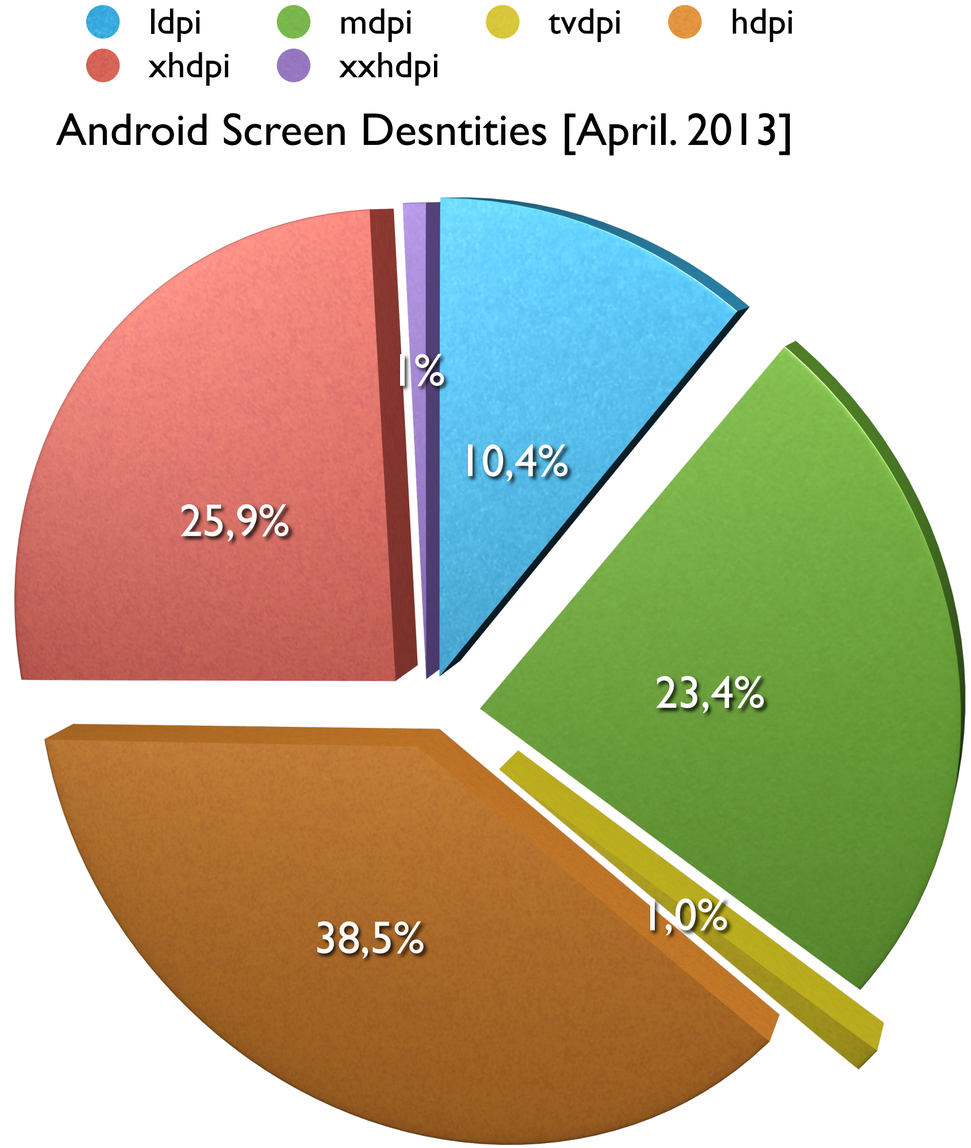
Android Platform Distribution [Apr. 2013]



Source: http://developer.android.com/resources/dashboard/platform-versions.html

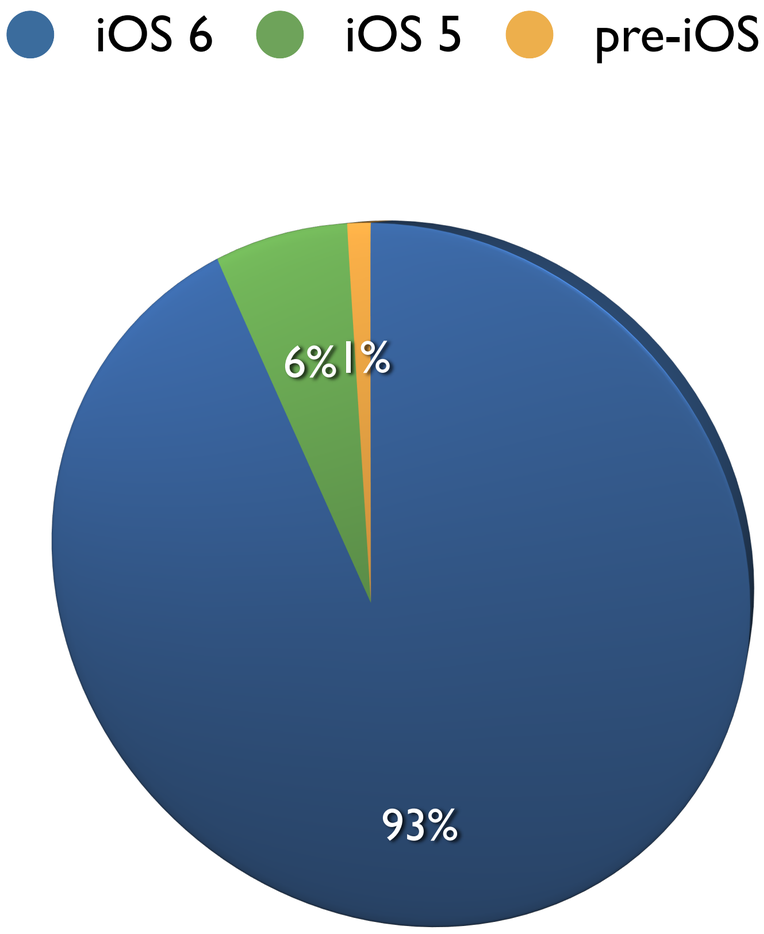
Android Screen Sizes and Densities





Source: http://developer.android.com/resources/dashboard/platform-versions.html

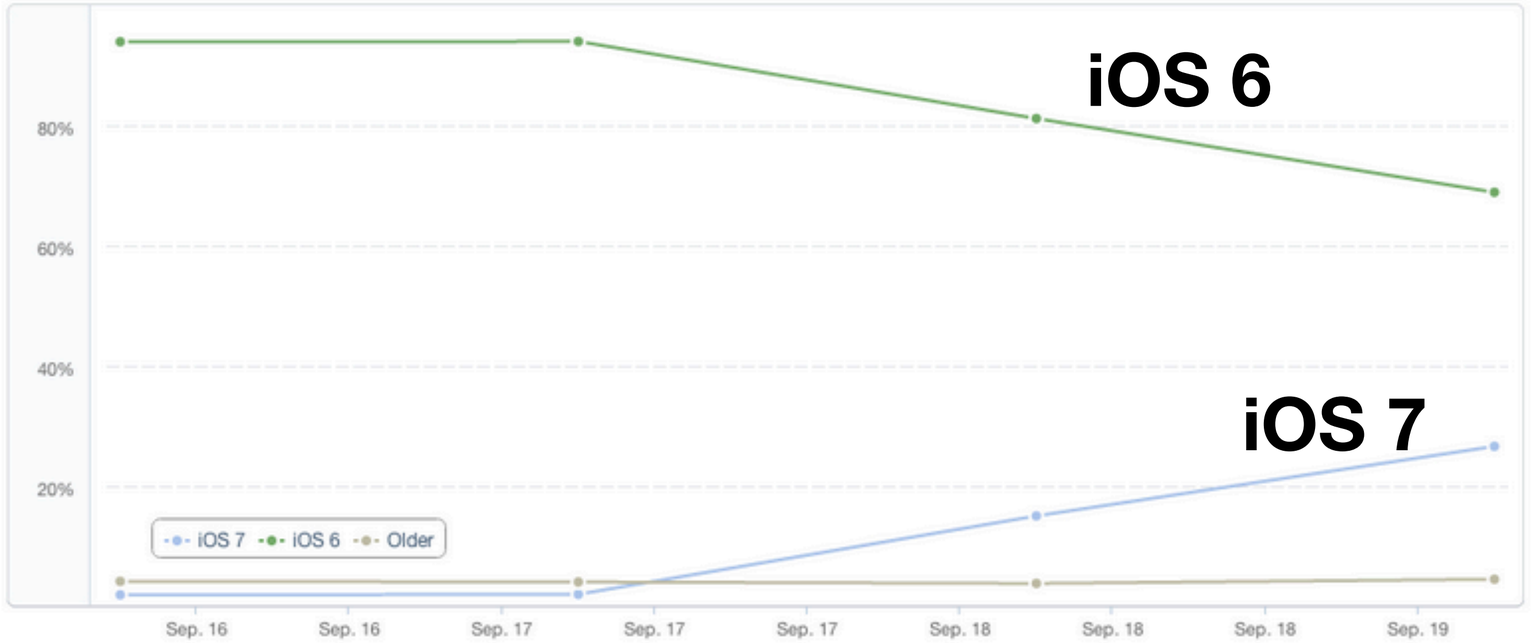
iOS Platform Distribution



- The chart refers to June 2013 (less than a year since iOS 6)
- Apple pushes for the adoption of newer versions of iOS
- iOS developers do not need to put extra effort to support several versions
- iOS developers must keep their apps up to date in order to best support the current version → the work is not over when the app is released but apps must be maintained constantly

Source: http://venturebeat.com/2013/06/21/apple-fragmentation-what-fragmentation/

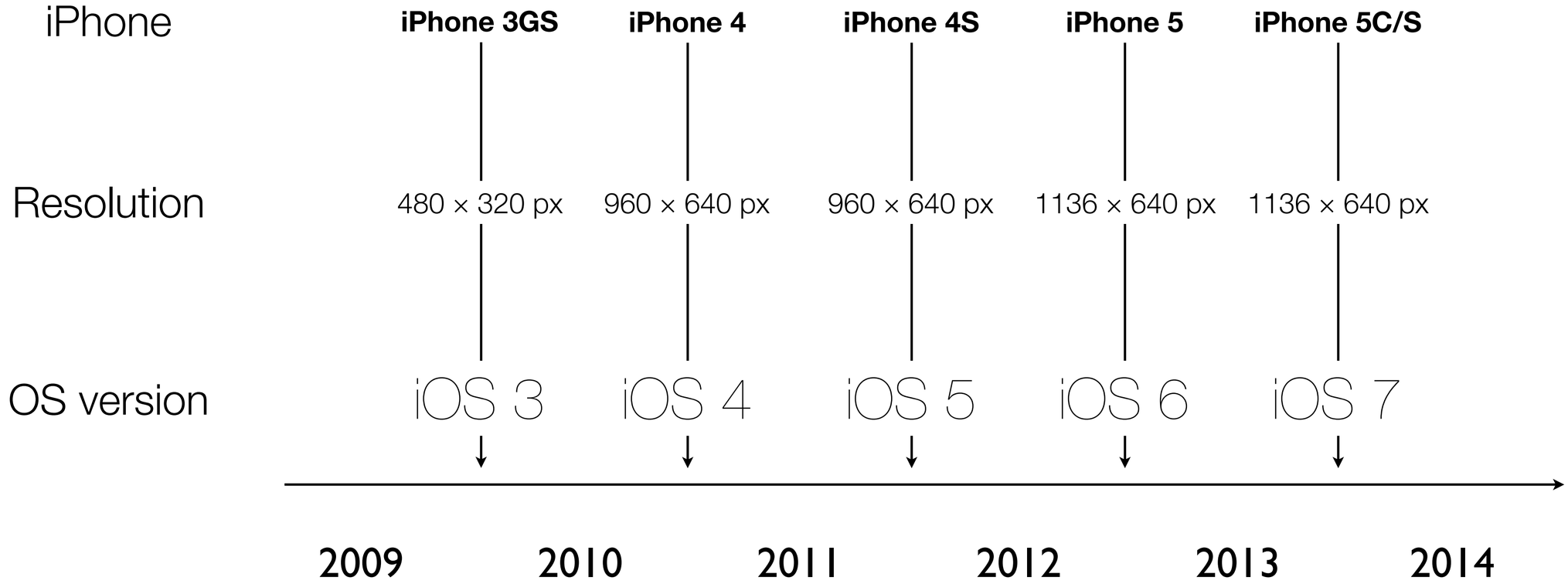
Rate of adoption of iOS versions



~25% of iOS devices moved to iOS 7 in less than 3 days

Source: http://www.businessinsider.com/ios-7-adoption-rate-greater-than-android-2013-9

iPhone timeline



- As for Android, from the release of iPhone 5, iOS devices are starting to support different screen sizes, resolutions, and aspect ratios (3x2,16x10)
- The same consideration can be applied to the iPad, which has a 1024x768 px **[2048x1536 px]** resolution

Mobile Application Development

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