Programming

for

Mobile Devices

spring 2021, IE & IR, 2th year

Course 1 and 2

History and **Introduction**

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Course I Introduction

The main goal of this course:
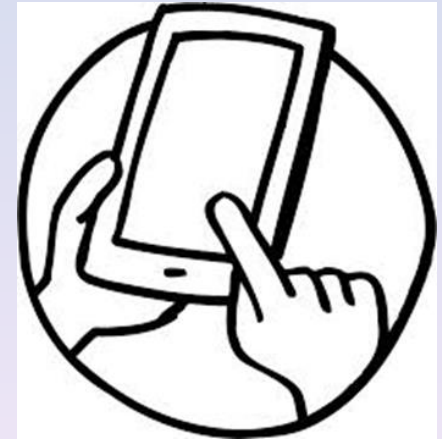
Development students' abilities/skills to:

understand,

design

and

develop apps

for mobile devices

This course is about (theory and labs):

1. Mobile phones' history

2. General hardware structure of a smartphone

3. Operating platforms – short presentation

4. Programming platforms - short presentation

5. Mobile apps development rules

   Rules for design and develop mobile games

6. Mobile apps testing

7. Security solutions in mobile devices

9. Input/Output operations

10. Working with files

11. Working with Databases

……

… and projects …

…

and finaly… Evaluation of your knowledge

(don't worry about this)

An expert is one that knows

more and more

about

less and less.

The more you study the more you know.

The more you know, the more you forgot.

The more you forgot, the less you know.

The less you know, the less you forgot.

The less you forgot, the more you know.

So, why study?

Interactive courses

a very good answer ⬄ 2 points

a good answer ⬄ 1 point

10 points = a line → an additional point to the final written test

during a course will be more questions

maximum number of lines that can be accumulated by a student = 5

More about examination:

- after some classes/courses, I will give you short homeworks: each of them will have between 0.2 and 0.5 points contribution to the final writtten test;

- at labs, you will have only a projects scored with 0.5 points each, in   labs activity account

- final grade = average between final written test grade and lab's grade

Regarding to final written test, I will give you a list with subjects (between 15 and 20) before 2 weeks.

Regarding to individual projects:

-source code and documentation must be send to me via email

-the projects will be presented in front of all

-questions about implementation will be

Copy-paste and plagiarism are prohibited

Standard Copy (student <- student or student <- other sources) is also prohibited

So, in this first course

about SMARTPHONES

- a little history
- hardware structure
- operating systems
- programming environments

Why a little history ?

Who does't know history,

does't understand the present

and

can't anticipate the future !

So, a little history:

from telegraph (past)

to smartphone (present)

something new (near future)

or

About *future of future... God knows what will be*

The distant future

May be, anything could be anything you want:

a table -> a keyboard

a window or a wall -> screen/display

a finger -> a mouse cursor

power of mind + technology => The future

A little history: from telegraph to smartphone

Alessandro Volta, 1800, voltaic pile, first *electrical battery* that could continuously provide an electrical current to a circuit.
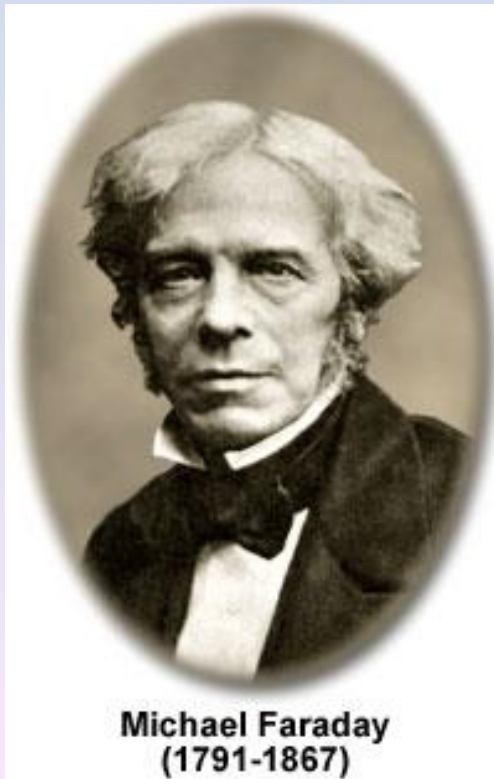

Alessandro Volta
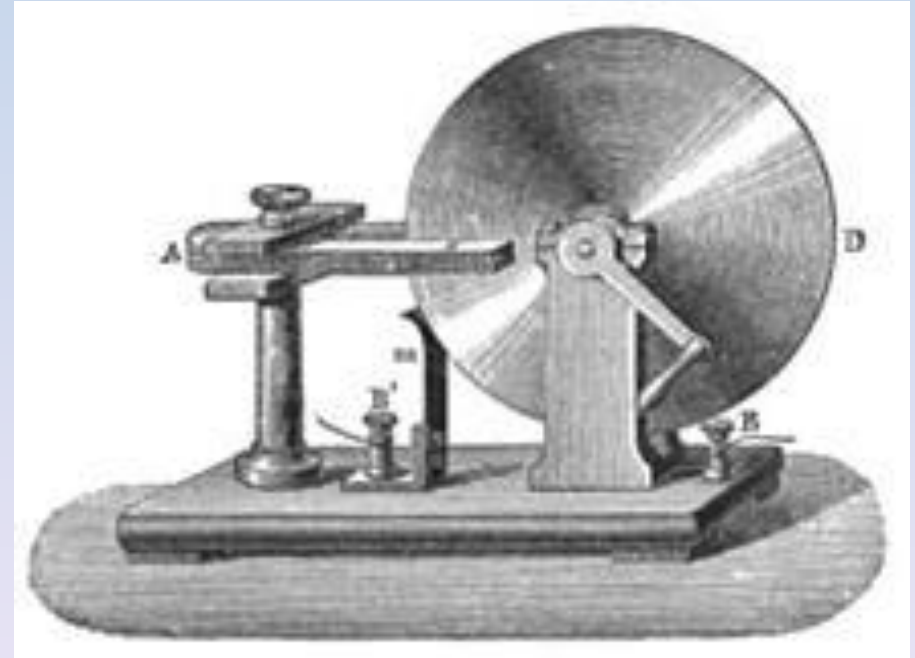(1745-1827)

The Volta's voltaic pile
Note: don't try to replace your smartphone's battery with that

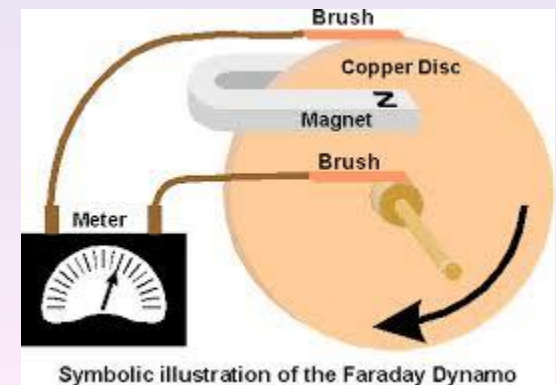**A little history: from telegraph to smartphone**

Michael Faraday, 1831, *electric dynamo* which can generate electric power

Michael Faraday (1791-1867)

Electric-dinamo: first electric generator

Symbolic illustration of the Faraday Dynamo

Note: don't try to replace your smartphone's charger with that

Communications were, are and will be one of the human evolution engines

A little history: from telegraph to smartphone

William Fothergill Cooke and Charles Wheatstone, in 1837, patented the first commercial electrical telegraph

The first comercial telegraph   A Morse key

A little history: from telegraph to smartphone

?

Do you know what Morse code is

and

by who was invented?

The answer: what is Morse code.......

Samuel Morse developed a code (bearing his name) (1840s) that assigned a set of dots and dashes to each letter of the English alphabet

Morse Code Alphabet Chart

A	·—	B	—···	C	—·—·	D	—··
E	·	F	··—·	G	——·	H	····
I	··	J	·———	K	—·—	L	·—··
M	——	N	—·	O	———	P	·——·
Q	——·—	R	·—·	S	···	T	—
U	··—	V	···—	W	·——	X	—··—
Y	—·——	Z	——··	0	—————	1	·————
2	··———	3	···——	4	····—	5	·····
6	—····	7	——···	8	———··	9	————·

Hello World ⇔ .... . .-.. .-.. --- .-- --- .-. .-.. -..

The code is still used. Along the time, it saved many human lifes. You can learn it.

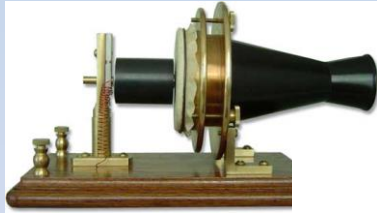1876: Alexander Graham Bell, the first telephone

1877: *Bell Telephone Company*

=>

1886: more than 150000 people had phones (in US)

1915: Bell succeeded, the first intercontinental phone call

A little history: from telegraph to smartphone

Old phones

A little history: from telegraph to smartphone

?

Do you know what a telephone is?

A little history: from telegraph to smartphone

Definition: A (tele)phone is a device that converts the human voice, into electric signals suitable for transmission via cables or other transmission media over long distances.

Emitter   *Transmitter*   *Receiver*

Artificial human voice

Radio waves

Radio waves

Electric signals

Electric signals

BUG

Original Human voice
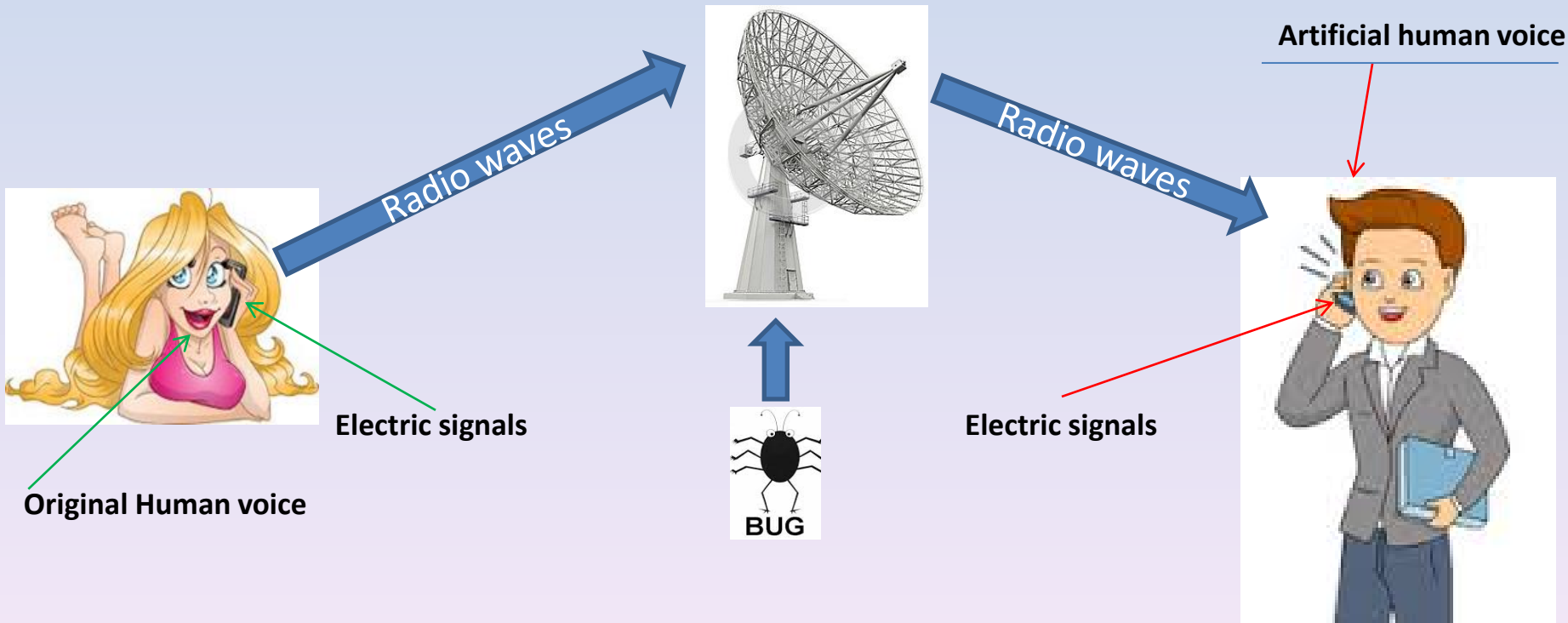
Note: In most cases, the artificial voice is the same as original voice

A little history: from telegraph to smartphone

The beginnings of mobile telephony

- **1848: the earliest fictional descriptions of a mobile phone:**

    science fiction novel *Space Cadet* by Robert Heinlein.

- 1926, Germany, phone connections in trains: link between Hamburg and Berlin. *This service was only to 1st class travelers*
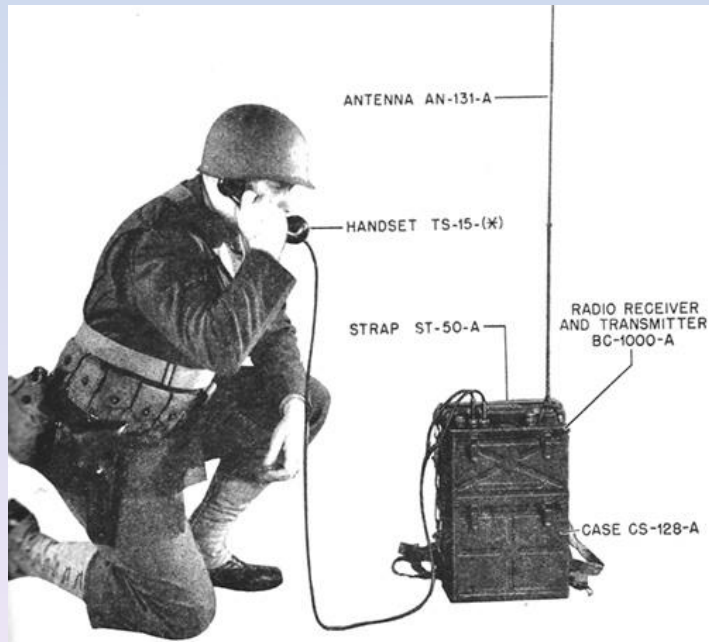
train's railroad worked as antenna

about 300 Km

A little history: from telegraph to smartphone

The beginnings of mobile telephony

In the Second World War, US army used wireless/radio telephony connections

SCR 320 or "walkIE & IR-talkIE & IR"
- made by Motorola in 1940
- about 17Kg
- 4,8Km range

SCR 536 (called "handy-talkIE & IR" at first)
-made by Motorola in 1942
-about 5kg
-a variant for aircraft

A little history: from telegraph to smartphone

The beginnings of mobile telephony

- wireless telephones for automobiles became available in the 1946s

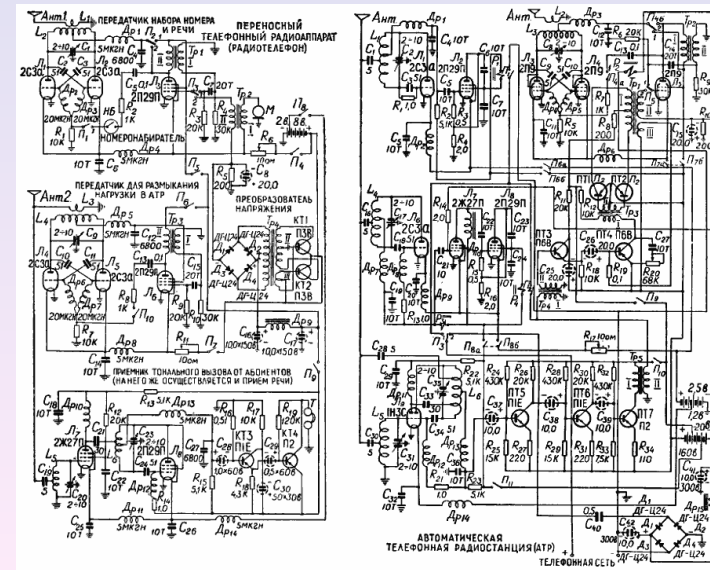
- 36 kg
- Only 3 channels available in urban area

? Do you know what mean "only 3 channell"

The beginnings of mobile telephony

In the USSR (Union of Soviet Socialist Republics, 1922–1991), in 1961 was presented a mobile telephone **ALTAI**

- only 70 g weight

- it could fit on a palm.

- about 30 km radius

- with batteries

- 10 years before first Motorola mobile-phone

A little history: from telegraph to smartphone

A classification of mobile phones

ZERO generation (0G)

1949: MTS (Mobile Telephone Service), services provided by AT & T Company.

Now, those services seem primitive because:

- the user had to <u>press a button on the handset to talk</u> and then <u>release the button to listen</u>.

- only three radio channels were available i.e. only three calls they could run simultaneously

A little history: from telegraph to smartphone

ZERO generation (0G)

1964: MTS was replaced by Improved Mobile Telephone Service (IMTS).

- had more channels.

- in general, these "mobile phones" were as briefcase and were usually mounted in cars or trucks

A little history: from telegraph to smartphone

First generation (1G)

The first **semi-smartphone**: *Nokia Mobira Senator*

- was released in 1982
- international calls can be made.
- about 10 kg

prohibited for girls   permitted only for boys with strong muscles

Second generation (2G)

Motorola International 3200

Finally, it is handheld !

Now we call it "a brick"

A little history: from telegraph to smartphone

1989: the first *pocket phone*, Motorola MicroTAC

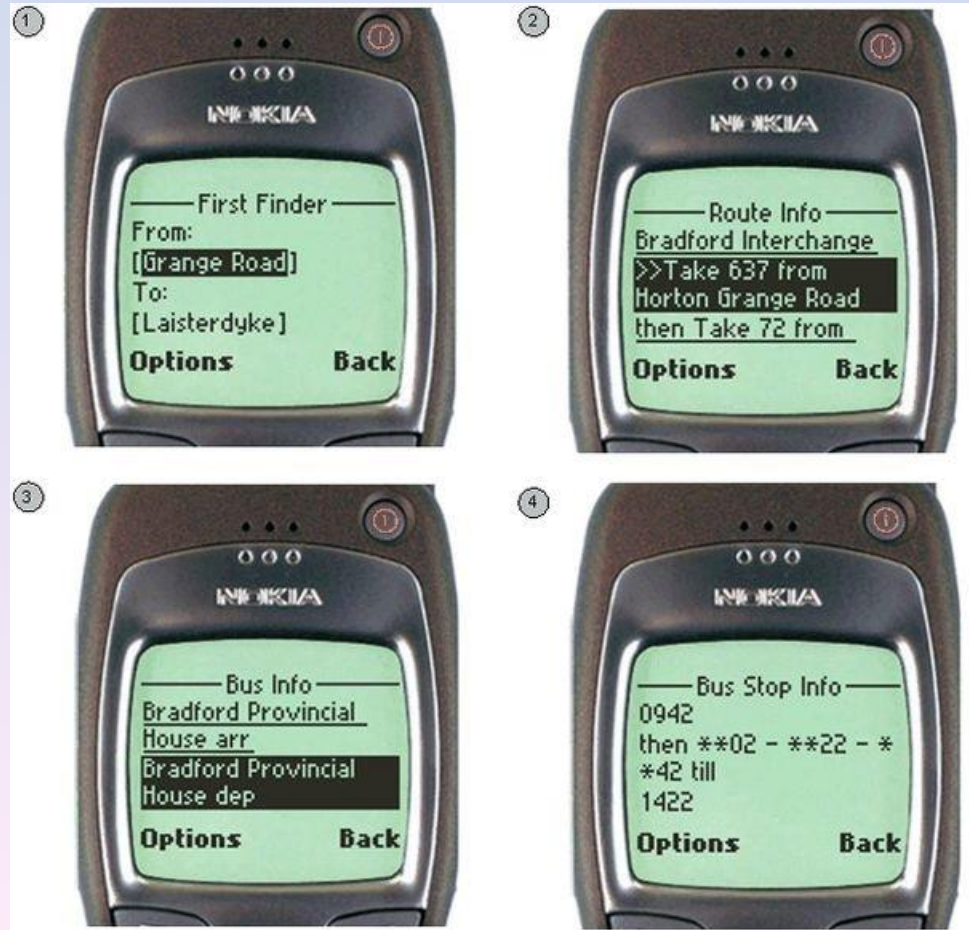**A little history: from telegraph to smartphone**

1998: The first cell phone without external antenna, Nokia 8810

A little history: from telegraph to smartphone

1999: the first mobile phone which incorporate WAP (Wireless Application Protocol) a rudimentary web access (only text mode) but a revolutionary step for the mobile Internet.

Nokia 7110

A little history: from telegraph to smartphone

1999: The first mobile phone that incorporate an integrated browser (GeoSentric) was **Benefon Esc**.

A primitive GPS and Infrared port.

Even if the maps were presented only in shades of gray (see photo), it allowed users to upload maps to track the position and movement.
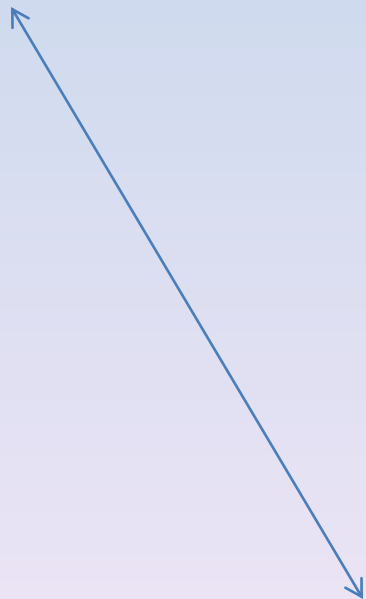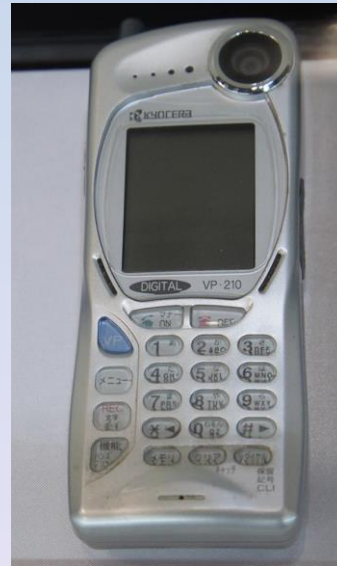
A little history: from telegraph to smartphone

1999: The first mobile phone with a video camera was:

Kyocera Visual Phone VP-210

!!!! Only 0.1 megapixels

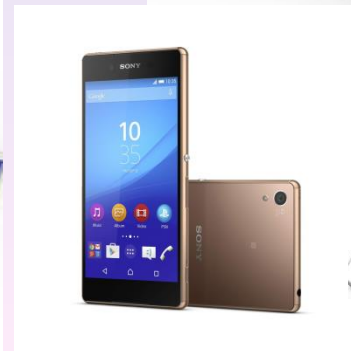|	main camera	front camera
Sony Xperia Z3 Compact	20.7Mp	2.2Mp

Current mobile phones (2019):

- Apple iPhone 8, iPhone 8 Plus
- Samsung Galaxy S8, Galaxy S8 Plus
- Samsung Galaxy Note 8
- Samsung Galaxy X
- Samsung Galaxy S20, S21
- Google Pixel 2
- Xiaomi Mi6
- Xiaomi Mi Mix 2
- Huawei P10
- LG G6
- HTC 11
- OnePlus 4
- Nokia Android phones
- New Sony Xperia
- Moto G5 & G5 Plus

....

and so on, and so on... we are on the future

A little history: from telegraph to smartphone

Conclusions:

SMARTPHONES

at first, were **semi-smartphones**, i.e. phones that besides standard dial service offered e-mail, displaying images or audio files players for mp3.

Why are called *Semi* ?

Mainly, because they lacked an operating system

A little history: from telegraph to smartphone

Conclusions:

Smartphones - Non-standard definitions:

- a phone that can run a full operating system;

- a device that combines a cell phone with a minicomputer that can be held in hand (hand-held computer) and that provides access to Internet, email, data storage capacity, etc;

- [Collins English Dictionary 2012] "a mobile phone with a computer facility that may be able to interact with other computer systems, send emails and access the web"

My definition:

- a computer that fits in your palm / pocket

- you can use it for almost anything

- you can't live without it

Curiosity

a ton of smartphones contains 300 grams of gold

Question1:

Approximately how much gold is in your phone?

Question2:

How many phones are needed to collect 1 ton of gold?

?

What does the name "Steve Job" mean for you?

?

Which is the most important thing he did for us?

Modern architectures:

modular

&

reconfigurable

? How are these terms: synonyms, opposite or distinct ?

Reconfigurable - the problem-

When we have thousands of available hardware resources, we can build a huge variety of processing systems (computers, mobile devices or embedded systems).

Architecture

Von Neumann

fixed resources

Designed for a single processor

VS.

Reconfigurable

variable resources

Originally designed for a particular purpose, it can be changed / adjusted in terms of hardware resources for other purposes

Reconfigurable systems are designed to fills the gap between hardware and software, meaning that these reconfigurable systems provide more performance than software and more flexibility than hardware

PERFORMANCE

RECONFIGURABLE HARDWARE

FLEXIBILITY

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Reconfigurable – remember old knowledge -

Do you remember about logical gates?

·(AND)		A·B
(OR)		A+B
(NOT)		$\bar{A}$
(NAND)		$\overline{A \cdot B}$
(NOR)		$\overline{A + B}$
(XOR)		$A\bar{B}+\bar{A}B$
(XNOR)		$\overline{A\bar{B} + \bar{A}B}$

Do you remember about logical circuits?
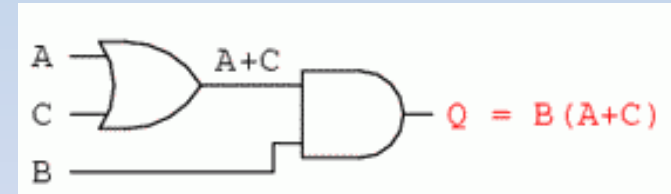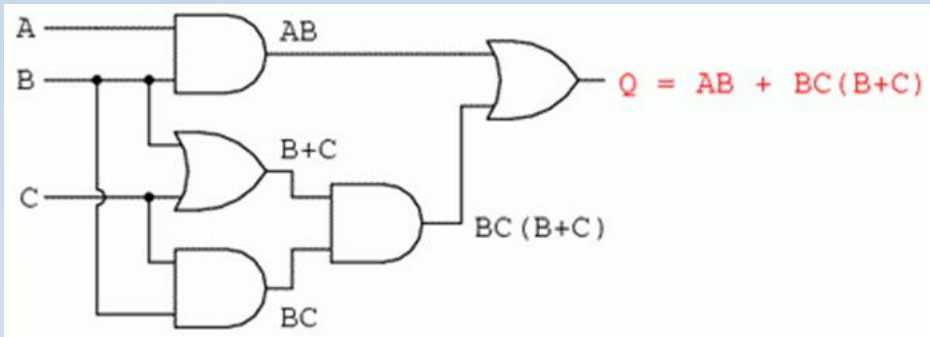
Both circuits do the same function (after first expression simplification)

i.e. the circuits **are** equivalents in function

but:

- first circuit needs 5 gates (15 transistors)
- second circuit needs only 2 gates (6 transistors)
- different electrical connections are between logical gates

i.e. the circuits **are not** equivalents in hardware

?

the question is...

Could we have for one hardware circuit, more logical functions (alternatively, not at the same time)?

i.e.

Could we change the functionality of a hardware circuit, depending on needs, without a hardware intervention (more exactly after manufacture)?

The answer is **YES** and that is a **reconfigurable** circuit

1984- XiLink Comp. -> Programmable logic processors

? A processor in which instruction set architecture (ISA) can be reconfigured
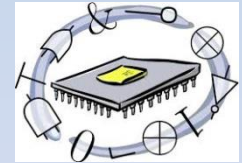
FPGA (**Field Programmable Gate Array**)

FPGA = **a digital integrated circuit configurable/reconfigurable after its manufacturing.**

! in terms of their functionality / logical !
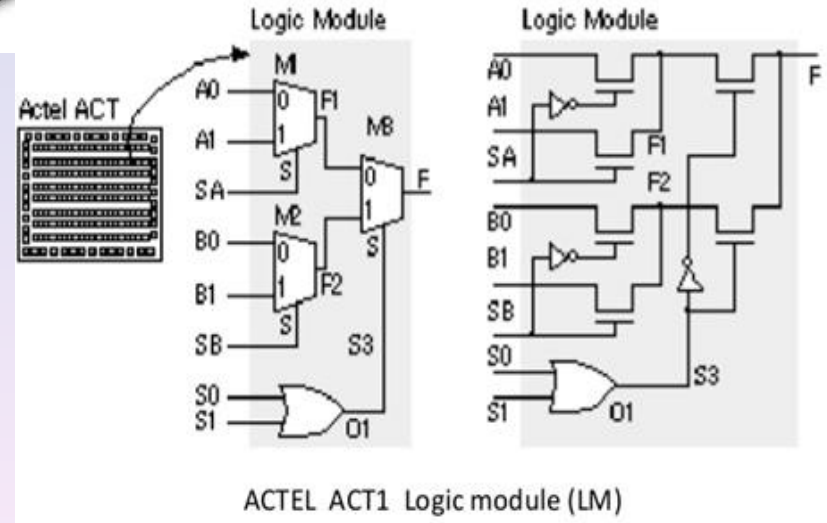
FPGA configuration: with a hardware description language (HDL)

There are C compilers -> HDL (*Impulse C* compiler)

Reconfigurable processors

FPGA (**Field Programmable Gate Array**)

Constructive, a FPGA consist of:

- a set of configurable logic blocks (CLB) that can be programmed / reprogrammed
- a set of connections/links configurable/reconfigurable
- a set of input/output (I/O) ports

Basically, an FPGA is a matrix structure of CLBs

PROGRAMMABLE INTERCONNECT

I/O BLOCKS

LOGIC BLOCKS

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A1 enhanced functionality. Costs of adding new features classic turn into much lower cost of storage memory required for logical design.

A2 Energy consumption: drops by 35-70%

A3 Increasing the speed: 3-7 times

A4 Standardization: in embedded systems: a same type of device (reconfigurable) could perform different tasks, and, in particular, to perform tasks for which the manufacturer nor was thought. And all at a much lower cost!

A5 Lower costs: Reconfigurable systems are upgrade-able, thus extending the life of these devices, which leads to lower costs for. entire life of the system.

D1 physical location of the components entail the deployment of large spaces available for new entitIE & IRs hardware

D2 Routing Problems: to connect the hardware, a big number of needed connection ports must be available to their increased reconfigurable devices

D3 Runtime issues: long physical connections may affect the runtime and sometimes can even generate communication errors.

D4 Consistency: i.e. the basic functionality of device designed by factory, should not be affected by the reconfiguration operations

D5 Development tools: are few and fairly rudimentary, so, too much human intervention is necessary in the process of reconfiguration

Start idea: desktop computers
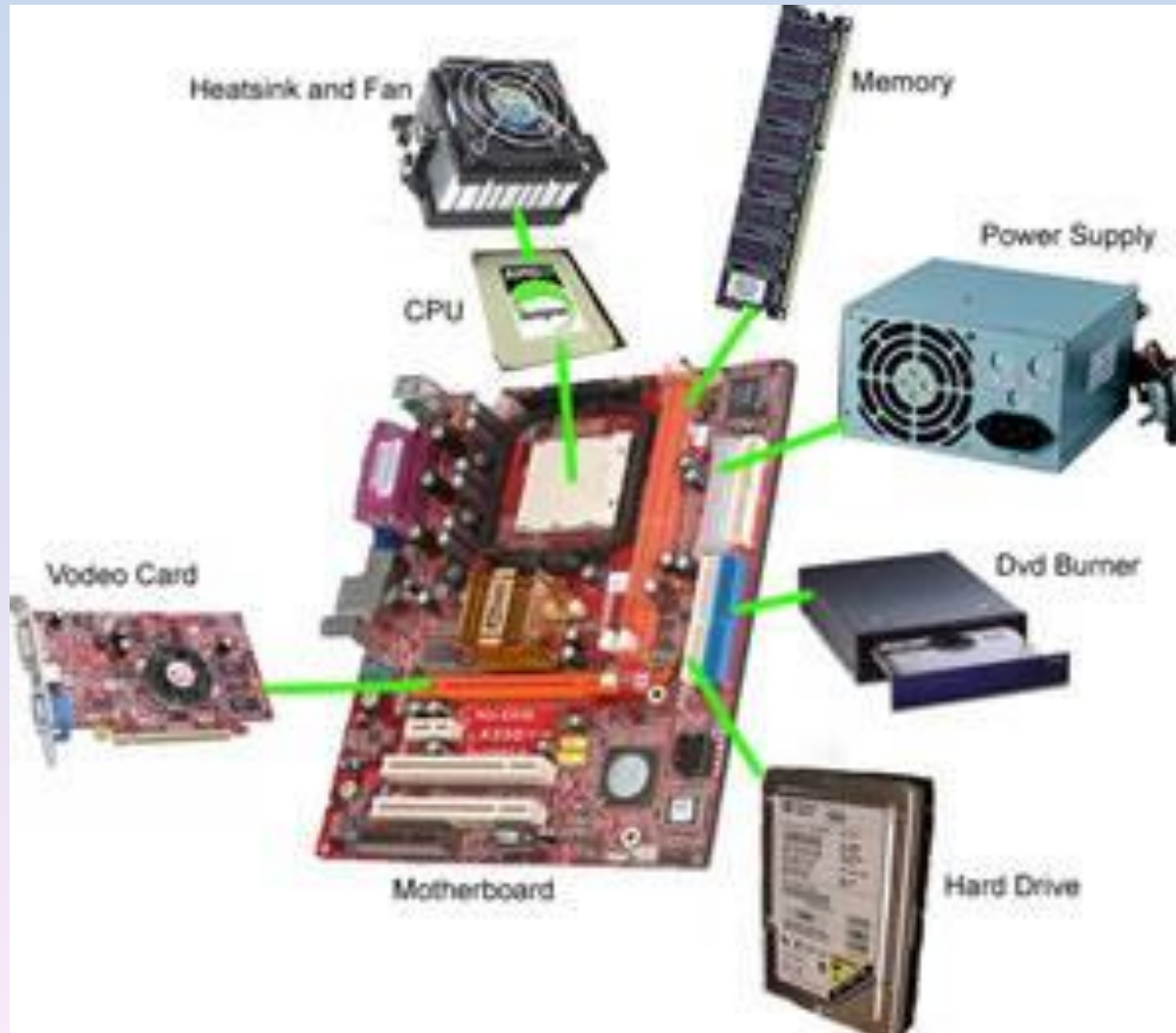
What is a Modular Smartphone?

A **modular smartphone** is a smartphone developed using modular components that can be replaced (after its manufacturing and not by factory) in order to improve the performance or change the functionality of this device from user point of view.

Other advantages:

-reducing the amount of electronic waste

-reducing costs for the user.

Phoneblocks

2013: Germany, Dave Hakkens

Phoneblocks = motherboard + accessories

similarity with LEGO

or with Lego Mindstorms
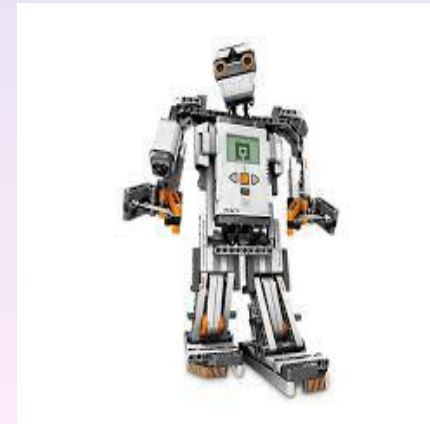
Google Project ARA

-Dave Hakkens initially involved in this project

-Motorola Comp. initially involved in this project

-when Motorola was sold to Lenovo, Google kepts the patents and the working group

Ara Project is/was a modular phone, whose eight components can be easily replaced, based on a system of magnets. Each module can be mounted anywhere, depending on user choice. *Ex: changes including size and battery capacity.*

Why name **Ara**? Because there was a sympathetic designer engineer named Ara

Basic price: 100 $ but some modules cost 300 $

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Google Project ARA

-in the second phase of the project, Google has "nailed" processor, antenna, sensors, battery and display (i.e. these are not replaceable)

so

ARA was not quite so modular

Google's motivation: user cares less the type of processor, its speed and type of RAM and cares more hardware functions.

Compatibility problems: a modest processor will not cooperate with a ultra performant video camera

Dimensions

Initial: small - 45x118x9.7mm, medium - 68x141x9.7mm, big - 91x164x9.7mm

After: more sizes, with 5.3 inches display

The main skeleton contains 6 slots

Any module can be connected with the condition to fit in slot

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Google Project ARA

SOFTWARE

1. The operating system ….obviously Android!

Not provided compatibility with iOS, Windows, Symbian etc.

2. The application ARA (Application Release Automation): allows the user to configure their own smartphone and customize it according to his preferences.

Ara framework contains all the functionality of a smartphone plus six slots available for connecting flexible hardware developments ahead.

At the base are **Greybus**, a software technology developed by Google **that supports instant connections**, ensure efficient energy consumption and transfers data at speeds up to 11.9 Gbps.

Hot-swapping Technology: connecting / disconnecting modules without having to turn off the phone (power-off). ->

All Android Apps will support this technology

Google Project ARA

When we can buy ARA phones?

In 2019? That would have been if Regina Dugan, chief ATAPI Google would not be left in April 2016 for a similar job at Facebook Inc

Before, (May 2015), the same position, Paul Eremenko had gone to work at Silicon Valley Airbus Group.

In September 2016 ARA project was
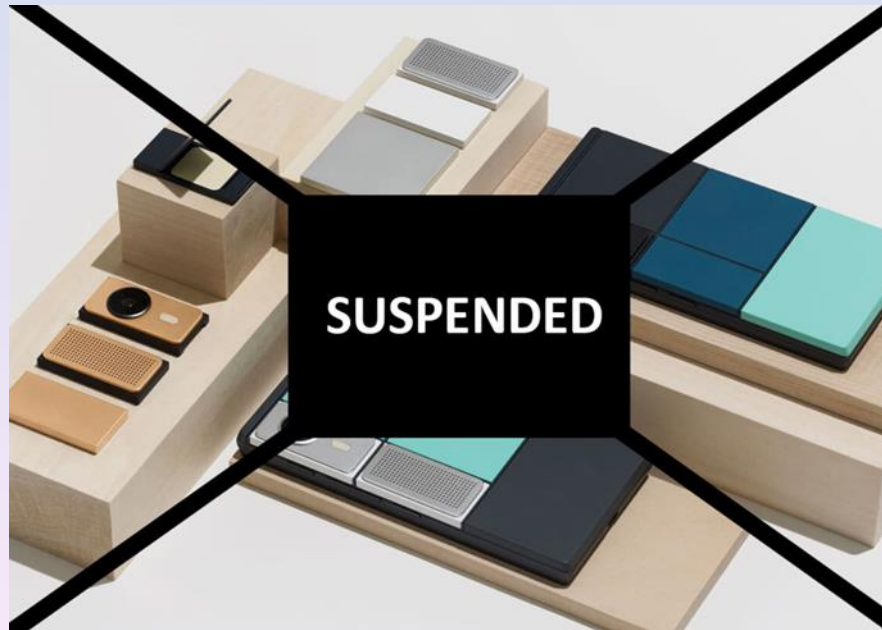
it's true?

Or perhaps Google is working in secrecy ?????????????????????????

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A Facebook Project: **Nascent Objects**

Remember: in April 2016 Regina Dugan, chief ATAPI Google left Google for a similar job at Facebook Inc.

? Facebook will bring people to make modular smartphone ?

In September 2016, *Facebook Inc* bought *Nascent Objects Comp.*, a company that started an ambitious project: to build electronic devices from elementary modules (cameras, sensors, batteries, processors, etc.).

Hm, that isn't a new idea: see *Lego Mindstorm*, *Arduino kit*, etc.

Competition starts to become more powerful, especially when Chinese people goes to war

Example: in HPC (supercomputers Tiahne-2, Sunway TaihuLight)

ZTE project – modular smartphones

=>

ZTE Project -> Eco-Mobius (2014) comes from China

Four separate components / upgradeable:

- Display

- Cores (CPU, RAM, ROM)

- Video camera

- Battery
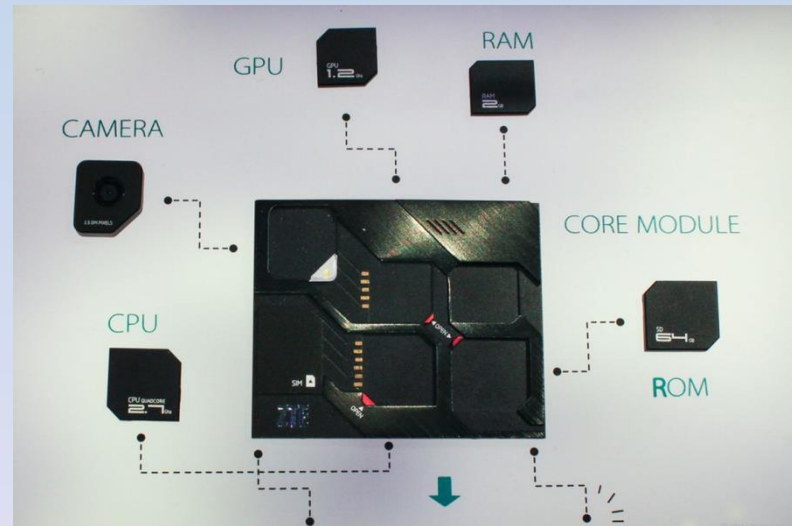
- 3 different screens' size it would be possible:

Motorola Moto Z and **Motorola Moto Z Force**

624 $ 720 $

- Moto Mods: has **hot swappable** modular accessorIE & IRs

 The modules are attached in the back of the phone using permanent magnets and 16-pin connectors.

! Only one module can be attached at a time

! Only a few modules are currently available on the market

Prices:

Video projector module: 300$ Sound-boos speakers module: 80$

The best modular phone in 2017 was Moto Z2 Force: about 2000 RON (700 US $)

Reconfigurable Smartphone

≠

Modular Smartphone

How are these terms: synonyms, opposite or distinct ?

Your opinion is ...

Reconfigurable smartphones

Nowadays, smartphones are not as smart!

They just are able to satisfy a wide variety of requirements but NOT oriented towards individual needs of each user. Fulfilling this need would be indeed a real sign of intelligence!

Current devices have a lot of hard IPs (hardware facilities provided by the manufacturer) that are not currently used, some barely.

Moreover, this variety of features unused by each user generates a waste of hardware and software.

Example: - IP camera for video: a user who uses more Youtube and uses no camera.

Reconfigurable smartphones

Reconfigurable smartphones are based on FPGA

Reprogrammable FPGA provides the ability to reprogram the functions of a smartphone after it was purchased by the user.

Major impediments that do not allow attaching a complex FPGA to provide a great diversity of reconfiguration from a smartphone are:

- too big

- too expensive

- too much energy consumption

That's because the FPGA were originally designed for systems that are not limited to the above.

Reconfigurable smartphones

Reconfiguration methods

1. Reconfigure guided by user: Allows the user to specify IPs of interest, then they can not be reconfigured. The rest can be reconfigured. In fact, the user shall determine its own phone's user profile, i.e. when and what applications will be used.

2. Auto-reconfiguration: Autodetect apps used by the user and a set a new reconfiguration. This working mode involves the presence of CLBs . Depending on the frequency of apps using, the system will decide which IPs will be reconfigured.

This could be a real SMARTphone

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Remember: Smartphone definitions:

- a phone that can run a full operating system;

- a device that combines a cell phone with a minicomputer that can be held in hand (hand-held computer) and that provides access to Internet, email, data storage capacity, etc;

- [Collins English Dictionary 2012] "a mobile phone with a computer facility that may be able to interact with other computer systems, send emails and access the web"

- **a mobile phone which includes functions similar to those found on personal computers: information management, mobile calls, email and Internet access.**

- **A _smartphone_ or _smart_ _phone_ is a mobile phone with an advanced mobile operating system which combines features of a personal computer operating system with other features useful for mobile or handheld use. They typically combine the features of a cell phone with those of other popular mobil devices, such as personal digital assistant (PDA), media player and GPS navigation unit.** *(wikipedia.com)*

General hardware structure of a smartphone
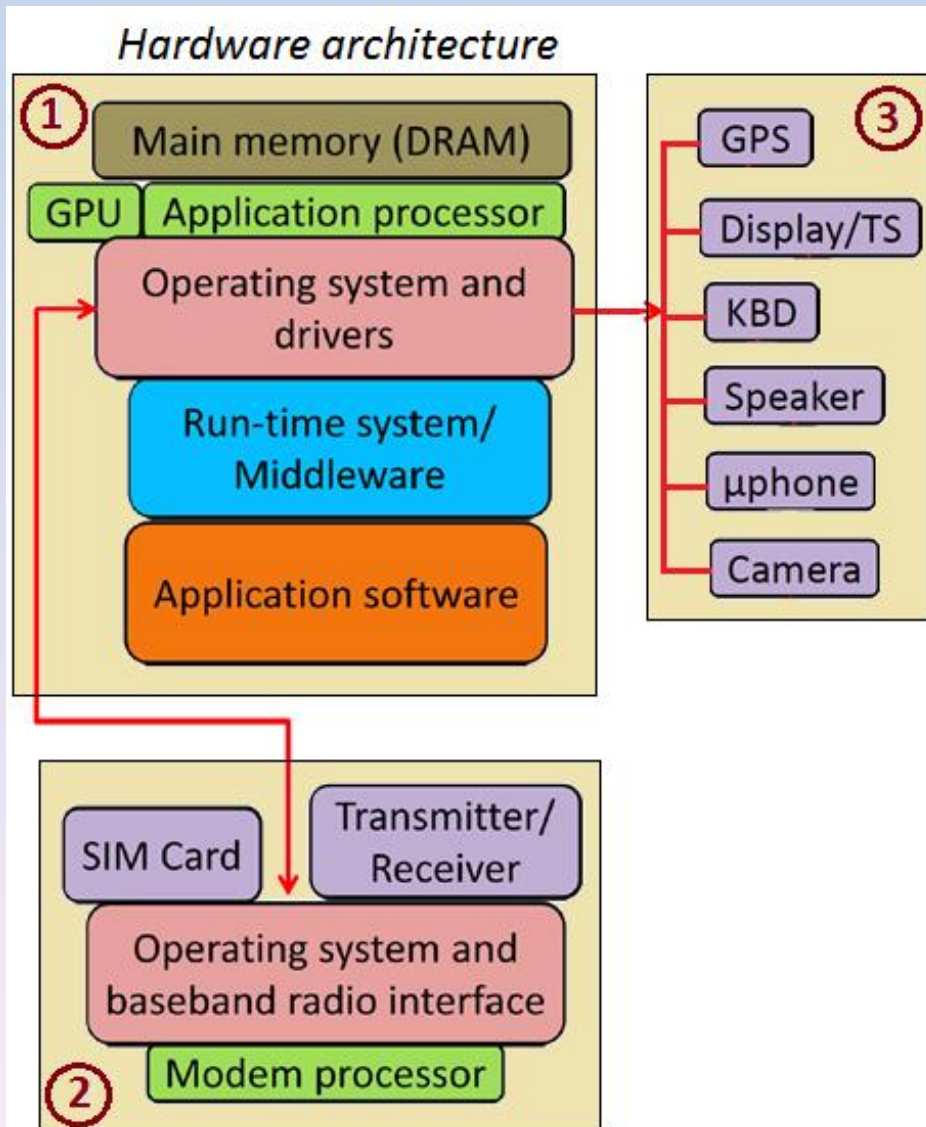
Primary components:

1. an **application processor** executing the end-user's application software with assistance from the middleware and operating system (OS);

2. **a modem** or baseband **processor** with its own operating system components responding to the baseband radio activities (transmission and reception of audio, video, and other data contents)

3. a number of **peripheral devices** for interacting with the end-user

General hardware structure of a smartphone
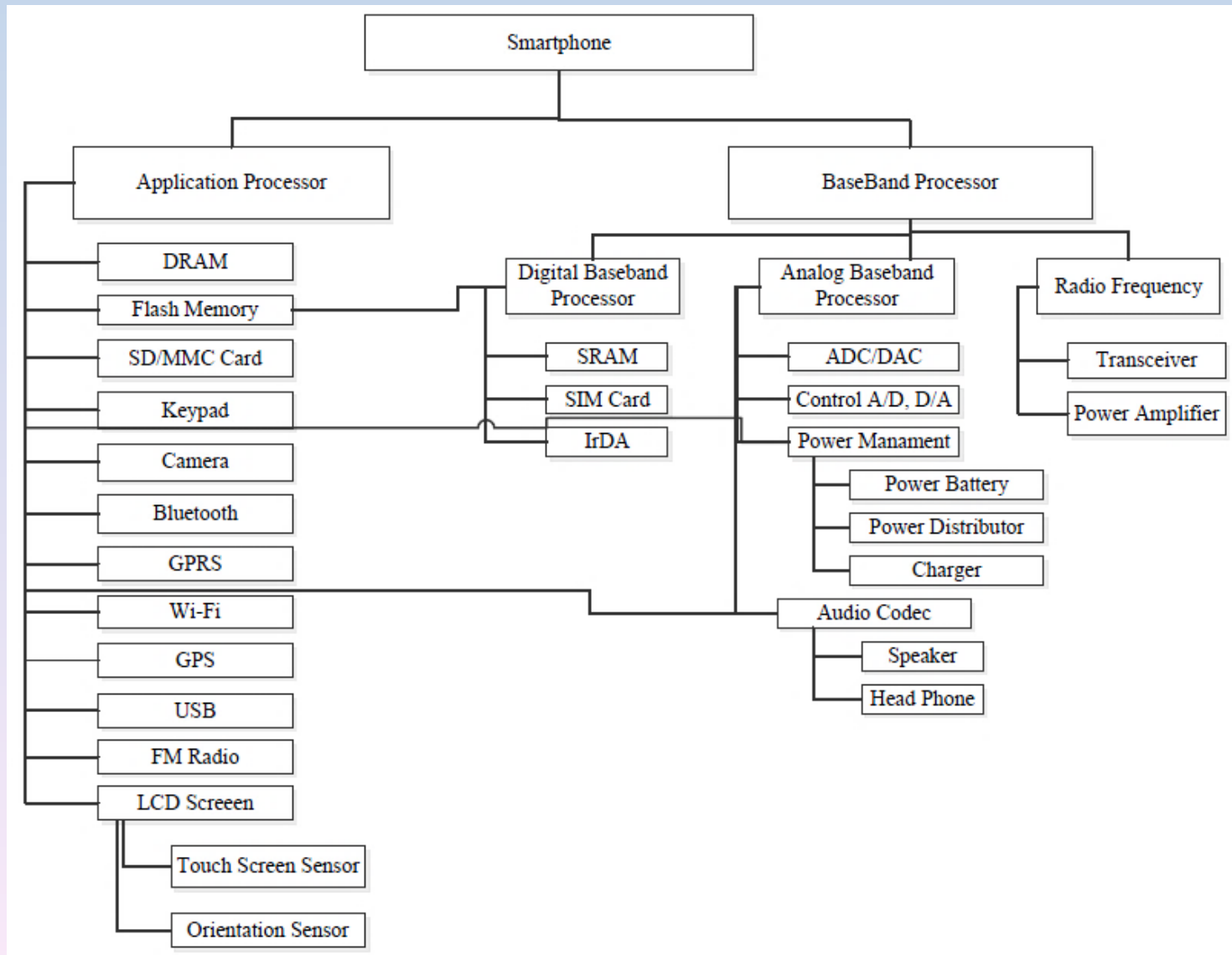
A higher detailed anatomy of smartphone

General hardware structure of a smartphone
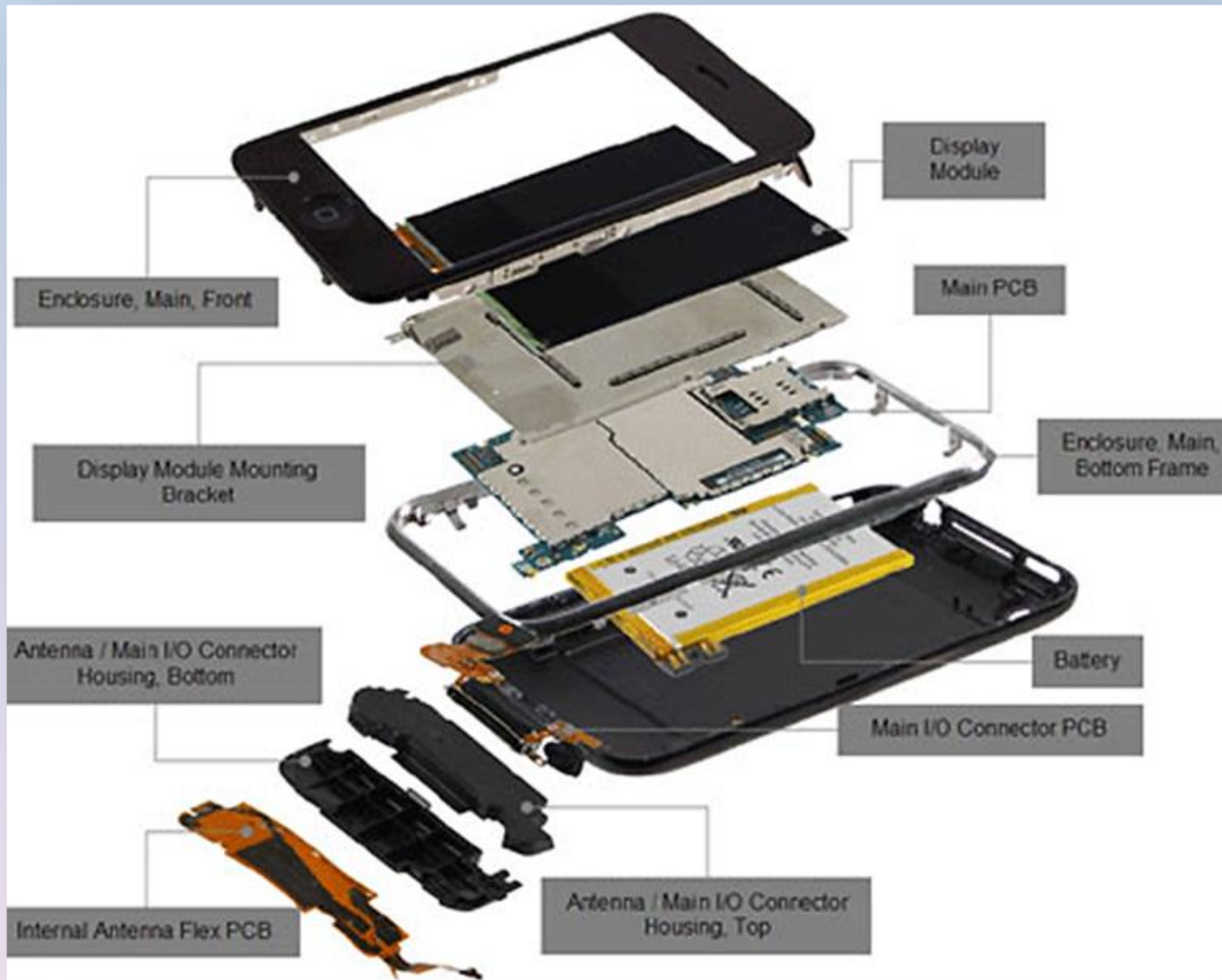
Smartphone's components

General hardware structure of a smartphone – zoom inside-
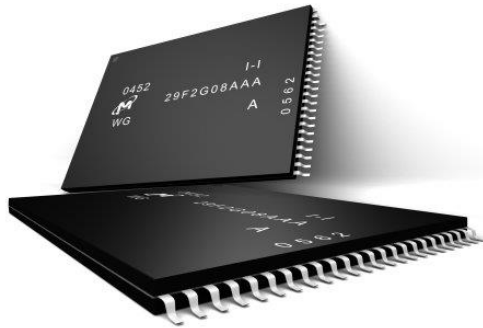
DRAM

App Processor

NAND Flash

Baseband Processor
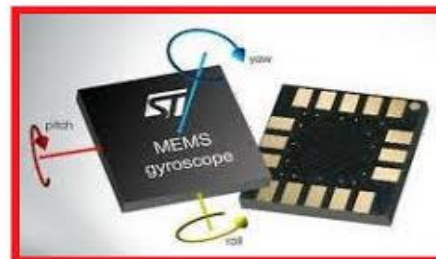
Gyroscope

Gyroscopy contains a tiny oscillanting plate. When the device is rotated, the deviations of the plate from its normal oscillating are detected.
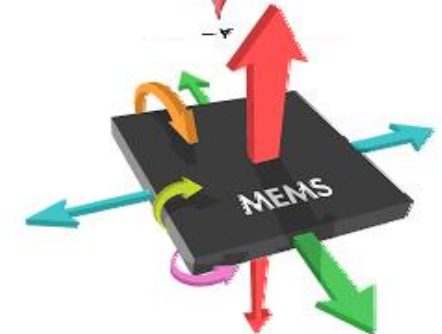
Accelerometer contains a proof mass anchored to a cantilever beam, movement of the device displaces the mass and this movement can be measured.

Camera Module

Accelerometer and gyroscope

General hardware structure of a smartphone

- Mainboard (motherboard);

- Multi-core processor;

- RAM (internal and external);

- Screen (display);

- USB power / charging that ensuring connection with other devices;

- Video-camera (currently, dual);

- Status lights: show the phone state ar announce events (unloading / loading battery, missed events etc);

- Light Sensor (RGB): used to adjust screen brightness and contrast according to the ambient light;

- Key / button to adjust the volume;

- Microphones (up and down): first used during phone calls to retrieve the user's voice and the second used during open calls (the speaker);

- Button stop / start device;

- Gestures sensor: detect movement and gestures of phone's user;

- Proximity sensor: detect how close / far away an object on the screen is (such as the user's face during a call). For example, during a call, the event sensor detects and locks the keypad to prevent accidental key presses.

General hardware structure of a smartphone

-continued-

- Receiver: which allows listening to other conversational partner

- Blitz (flash light): used to retrieve images (photo or video) in low light;

- Temperature and humidity sensor: read the ambient;

- IR Transmitter IR (infra-red): for control of external devices;

- Accelerometer sensor: for measuring the specific force (g-force) on three axes useful in measuring inclination, orientation and acceleration device;

- Gyroscope sensor: for measuring rotational movement in a 3-axis coordinate system;

- GPS (Global Positioning System): that allows providing location information via a GPS satellite;

- WiFi transmitter / receiver: which allows local communications via a wireless access point;

- Cellular radio: radio reception apparatus;

- Bluetooth: allows connection to other devices nearby;

- Audio input / output connector: to connect an external microphone or headphones;

General hardware structure of a smartphone

-in brief-

Smartphone is a portable device that encapsulates computing capabilities and cellular network access functionalities in a single integrated multicore processor.

In modern smartphones, dual/quad core processor is composed of two/four processors, each one with a separate RAM and flash memory access and distinct objectives.

The baseband processor is responsible for radio access of the wireless network environment and the application processor is specially designed for the execution of application software (apps).

Application processor is assisted by some specialized multimedia modules in the execution of multimedia functions such as audio, and video with optimal computing resources consumption.

A hardware interface bridges the functionalities gap between application processor and baseband processor.

At the foundation of any smartphone an operating system is.

Operating platforms – short presentation

- Mobile Operating System (mOS) are complex software (a set of data and programs) that allows smartphones, tablet or other mobile device to run mobile applications (apps)

- A mOS optimizes the efficacy of the apps in the device.

- A mOS manages mobile multimedia functions, mobile and Internet connectivity and so on in a mobile device.

- A mOS typically starts up when mobile device powers on.

Operating platforms – short presentation

- The main functions of mOS conssist in to manage phone cellular and network connectivity (wireless, bluetooth or USB), multimedia functions.

- Most mOS are tied to specific hardware, with little flexibility, or not at all. In cases of newer mobile devices, user can root these devices to install another mOS.

Some of mOSs are open source software

With the exception of Android (developed by Google), mOSs are developed by different mobile phone manufacturers:

- Nokia (Symbian, MeeGo, Maemo);

- Apple (Apple iOS);

- Research In Motion (RIM) (BlackBerry OS);

- Microsoft (Windows Mobile, Windows Phone)

- Samsung (Palm WebOS).

Most of mOSs (Android, LiMo, Maemo, Openmoko and Qt Extended (Qtopia)) are based on the Linux open-source OS.

Operating platforms – short presentation

The main components of mOSs are:

- **Kernel**: provides basic level control over all of the computer hardware devices: reading and writing data from/to memory, processing execution orders, and determining how to interpret data received from networks.

- **User Interface**: allows interaction with the user (through graphical icons or a command line).

- **Application Programming Interfaces**: allows application developers to write modular code.

Operating platforms – short presentation

Definition

Kernel **is the core/main component of an OS. It is like a bridge between applications and the data processing performed at the hardware level**.

At the beginning, when OS is loaded into system memory, the kernel loads first and remains in memory until the OS is in use.

The kernel is responsible for low-level tasks such as disk management, task management and memory management.

The kernel provides and manages hardware system resources, allowing other programs to run and use these resources.

The kernel sets up memory address space for applications, loads files with application code into memory, sets up the execution stack for programs and branches out to particular locations inside programs for execution.

The main roles of kernel are:
- process management for application execution
- memory management, allocation and memory I/O operations
- device management, using device's drivers

Operating platforms – short presentation

Definition

<u>*User interface*</u> **(UI) is a broad term for any system, either physical or software based, that allows a user to connect with a given technology.**

UI depends on devices and software programs.

Even more UI have some basic similarities, although each one is unique.

The current types of user interface are graphical user interface (GUI), like Windows OS, Android OS… In these kind of UI, all are driven mainly by icons or images rather than text commands. More, GUI can include touch screen interfaces (a common type of UI for mobile devices)

Definition

Application Programming Interface (API) *is a software program that facilitates interaction with other software programs.*

- API allows a programmer to interact with an application using a collection of callable functions. The goal of an API is to allow programmers to write programs that will not stop/cease to function if the underlying system is upgraded.

- An API can be general or specific. The full set of a general API is bundled in the libraries of a programming language.

- An API is language dependent or independent:
    - language dependent: API is only available by using the syntax and elements of a particular language, making it more convenient to use.
    - language independent: API is written to be called from several programming languages.

Operating platforms – short presentation- 1. Apple's iOS

- **iOS 1.0** - 06/2007- Iphone 2G- Core iOS UI, Multi-touch gestures, Mobile Safari, iPod ,Visual Voicemail, Maps, iTunes Sync

iOS 1.1 - 09 / 2007- iPhone 2G, iPod Touch 1st Gen- iTunes Wi-Fi Music Store, iPod Touch compatibility

iOS 1.1.1 - 01 / 2008- iPhone 2G, iPod Touch 1st Gen- Better location, Web clips on home screen, Re-arrange icons, Multi-touch keyboard

- **iOS 2.0** - 07 / 2008- iPhone 3G, iPhone 2G, iPod Touch 1st Gen - Native 3rd-party apps, App Store, Microsoft Exchange support, MobileMe, Contact Search

iOS 2.1 - 09 / 2008- iPhone 3G,iPhone 2G,iPod Touch 2nd Gen, iPod Touch 1st Gen - Battery life and speed fixes, iTunes ,Genius playlists, Dropped call fixes

iOS 2.2 - 11 / 2008- iPhone 3G,iPhone 2G,iPod Touch 2nd Gen, iPod Touch 1st Gen - Google street vIE & IRw, Podcast downloads

- **iOS 3.0**- 06 / 2009- iPhone 3GS,iPhone 3G,iPhone 2G*,iPod Touch 2nd Gen, iPod Touch 1st Gen*Cut, copy, paste, Voice Control, MMS, Spotlight search, Push notifications, USB & Bluetooth tethering, Landscape keyboard, Find my iPhone

iOS 3.1 - 09 / 2009- iPhone 3GS,iPhone 3G,iPhone 2G*,iPod Touch 3rd Gen, iPod Touch 2nd Gen, iPod Touch 1st Gen*- Genius features, Ringtone downloads, Remote lock, Voice Control over Bluetooth

iOs 3.2 si inca iOS 3.2 update-uri - iPad only

Operating platforms – short presentation- 1. Apple's iOS

- **iOS 4.0** - 06 / 2010- iPhone 4, iPhone 3GS, iPhone 3G*, iPod Touch 3rd Gen, iPod Touch 2nd Gen*- Multitasking, Home screen folders, FaceTime video chat, Unified email inbox, Threaded email messages, Retina Display support, iAd support

- **iOS 5.0** - 10 / 2011- iPhone 4S.iPhone 4, iPhone 3GS, iPad, iPad 2iPod Touch 4th Gen, iPod Touch 3rd Gen- Siri- Notification Center, PC-free, iTunes Wi-Fi Sync, iMessage, iCloud

- **iOS 6** – toamna 2012 - iPhone 5, iPhone 4S, iPhone 4, iPhone 3GS, iPad mini, iPad 4th Gen, iPad 3rd Gen, iPad 2, iPod Touch 4th Gen, iPod Touch 5th Gen- Homegrown Maps and turn-by-turn navigation, Siri enhancements, Facebook integration, Passbook, iCloud Tabs, Mail enhancements, FaceTime over cellular

- **iOS 7** - toamna 2013- la fel - Visual overhaul, Control Center, AirDrop, Refreshed core apps, ITunes Radios, FaceTime Audio

- **iOS 8** – toamna 2014 - + iphone 5c, iphone 5s, iphone 6 , iphone 6+ - Continuity, Widgets, Extensibility, QuickType, iCloud Drive, HealthKit, HomeKit, Family Sharing

Operating platforms -short presentation- Android

- **Android 0.9 -** 2008 Aug 22

- **Android 1.0 (Apple pie)-** 2008 Sep 23- Download and updates via Android Market, Web Browser, Camera support, Gmail, Contacts and Google Agenda synchronization, Google Maps, YouTube application

Android 1.1 (Banana bread**) -** 2009 Feb 9 - "Show" & "Hide" numeric keyboard, in caller application, Ability to save MMS attachments

Android 1.5 (Cupcake**) -** 2009 Apr 30- Bluetooth A2DP, AVRCP support, Soft-keyboard with text-prediction, Record/watch videos

Android 1.6 (Donut**)-**2009 Sep 15- Gesture framework, Turn-by-turn navigation

Operating platforms -short presentation- Android

- **Android 2.0(**Eclair**) -**2009 Oct 26- HTML,Digital zoom, Microsoft Exchange support, Bluetooth 2.1, Live Wallpapers,Updated UI

Android 2.0.1 (Eclair**) -** 2009 Dec 3

Android 2.1 (Eclair**) -** 2010 Jan 12- Updated UI

Android 2.2 (Froyo) - 2010 May 20 - Speed improvements, JIT implementation, USB Tethering, Applications installation to the expandable memory, Upload file support in the browser, Animated GIFs

Android 2.3 (Gingerbread**)-** 2010 Dec 6- Updated UI, Improved keyboard ease of use, Improved copy/paste, Improved power management, Social networking features, Near Field Communication support, Native VoIP/SIP support, Video call support

Android 2.3.4 (Gingerbread**)-** 2011 May 10 - Voice or video chat using Google Talk

Android 2.3.5 (Gingerbread**)-** 2011 Jul 25- Improved network performance for the Nexus S 4G, Fixed Bluetooth issues on the Samsung Galaxy S, Gmail app. Improvements

Android 2.3.6 (Gingerbread**)-** 2011 Sep 2- Voice search issue fixed

Android 2.3.7 (Gingerbread**)-** 2011 Sep 21- Google Wallet support for the Nexus S 4G

Operating platforms -short presentation- Android

- **Android 3.0 (**Honeycomb**)-** 2011 Feb 22- Multi core support, Better tablet support, Updated 3D UI, customizable homescreens, recent applications viewing, redone keyboard layout, Media/Picture transport protocol, Google Talk video chat, Google eBooks,"Private browsing", System-wide Clipboard, HTTP Live streaming

Android 3.1 (Honeycomb**)-** 2011 May 10- UI improvements. Open Accessory API,USB host API, Mice, joysticks, gamepads... Support, Resizable Home screen widgets, MTP notifications, RTP API for audio

Android 3.2 (Honeycomb) - 2011 Jul 15- Optimizations for a wider range of tablets, Compatibility display mode (zoom for fixed-sized apps),Media sync from SD card

Android 3.2.1 (Honeycomb) - 2011 Sep 20- Android Market updates including easier automatic updates. Google Books updates, Wi-Fi improvements, Chinese handwriting prediction improved

Android 3.2.2 (Honeycomb) - 2011 Sep 30- Minor fixes

Android 3.2.6 (Honeycomb) - 2012 Feb 15-Minor fixes

Operating platforms -short presentation- Android

- **Android 4.0**(Ice Cream Sandwich)-2011 Oct 18- New lock screen actions, Improved text input and spell-checking, Control over network data, Email app supports EAS v14,WI-FI direct,BlueTooth Health Device Profile

- **Android 4.0.1(**Ice Cream Sandwich**)-** 2011 Oct 19- Facial recognition (Face Unlock),UI use Hardware acceleration, Better voice recognition (dictating/Voice typing),Web browser, allows up to 16 tabs, Updated launcher (customizable),Android Beam app to exchange data through NFC

- **Android 4.0.2**Ice Cream Sandwich- 2011 Nov 28- Minor fixes

- **Android 4.0.3**Ice Cream Sandwich -2011 Dec 16- Social stream API in Contacts provider to show updates associated to your contacts, Video stabilization and QVGA video resolution API access,Accessibility API refinements for screen readers, Calendar provider updates

- **Android 4.0.4** Ice Cream Sandwich - 2012 Mar 28 - stability improvements, better camera performance,smoother screen rotation

Operating platforms -short presentation- Android

Android 4.1 Jelly Bean- 2012 Jul 9- Google Now, Voice Search, Speed enhancements, Camera app improvements, Accessibility: gesture mode, enable braille external keyboards…

Android 4.1.1 Jelly Bean- 2012 Jul 23- Fix a bug on screen orIE & IRntation

Android 4.1.2 Jelly Bean- 2012 Oct 9- Home screen rotation, Fix bugs & enhance performances

Android 4.2 Jelly Bean 2012 Nov 13- Lockscreen widgets,360 degree images with Photo Sphere, Gesture Typing, for faster typing, Wireless display with Miracast, Daydream to display information when idle or docked, Multi-user for tablets

Android 4.2.1 Jelly Bean -2012 Nov 27-Fix missing december bug in the People app, support for Bluetooth gamepads and joysticks HID devices

Android 4.2.2 Jelly Bean- 2013 Feb 11-Allow toggling Wi-Fi and Bluetooth state in Quick Settings using long-press, Shows the percentage and estimated time remaining in the active download notifications, Wireless charging and low battery sounds changed, Gallery app updated for faster loading with new image transition, Performance enhancements and bug fixes (Bluetooth A2DP audio streaming fix…)

Operating platforms -short presentation- Android

Android 4.3 Jelly Bean - 2013 Jul 24- Dial pad auto-complete,Photo Sphere enhancements,Camera app UI updated,4K resolution support,Ability to create restricted profiles for tablets,Hebrew and Arabic right-to-left (RTL) support,Bluetooth Low Energy (BLE) support,Bluetooth Audio/Video Remote Control Profile (AVRCP) 1.3 support,Security and performance enhancements

Android 4.4 KitKat- 2013 Oct 31 - Screen recording,New Translucent system UI,Enhanced notification access,System-wide settings for closed captioning,Performance improvements

Android 4.4.1 KitKat- 2013 Dec 5- Bug fixes, Enhance the camera on the Nexus 5

Android 4.4.2 KitKat- 2013 Dec 9 - Bug fixes, Security enhancements

Android 4.4.3 KitKat -2014 Apr 14- Bug fixes, Enable Sprint Spark band 26 and band 41

Android 4.4.4 KitKat - 2014 Jun 23- Fix Heartbleed / OpenSSL vulnerability

Operating platforms -short presentation- Android

- **Android 5.0** Lollipop - 2014 Oct 17- New design (Material design), Speed improvement, Battery consumption improvement

Android 5.0.1 Lollipop - 2014 Dec 2- bug fixes, fix issues with video playback and password failures

Android 5.0.2 Lollipop - 2014 Dec 19- Performance improvements and bug fixes

Android 5.1 Lollipop- 2015 Mar 9- Multiple SIM cards support, Quick settings shortcuts to join Wi-Fi networks or control Bluetooth devices, Lock protection if lost or stolen, High Definition voice call, Stability and performance enhancements

Android 5.1.1 Lollipop -2015 Apr 21- Speed improvement ,Bug fixes

Operating platforms -short presentation- **Windows Phone**

- **Windows Phone 7**- October 2010

Windows Phone 7.5 *Mango*- 2011- Internet Explorer 9 , multi-tasking of third-party apps,[Twitter integration for the People Hub, Windows Live SkyDrive access

- **Windows Phone 8-** October 29, 2012- HD displays, multi-core system-on-chips, microSD card readers, enhanced background multi-tasking, , support for NFC, 128-bit Bitlocker encryption, VoIP and voice chat integration, native Skydrive integration and Nokia Maps Technology

Windows phone 8.1- April 10, 2014- Cortana, notification center, Internet Explorer 11 with tab syncing among Windows 8.1 devices and WP devices, separate volume controls, the option to skin and add a third column of live tiles to the Start Screen

- **Windows 10 Mobile**-- primary focus is unification with Windows 10, its PC counterpart, in software and services, face tracking for the front-facing camera

Operating platforms -short presentation- BlackBerry OS

- **BlackBerry OS 1.0 – 01/1999 - Pager BlackBerry 850(telefon) -**
- **BlackBerry OS 2.0 - 2000-** PDA format, **email**, **web browser**, **agenda**, **calendar**,**notes** , **games**
- **BlackBerry OS 3.0 - 2002-** BlackBerry 5810 smartphone- **Java support**
- **BlackBerry OS 4.0 -2004 -** an improved **HTML browser**, a **Gallery** application for viewing photos ,enhanced **two-way chat** capabilitIE & IRs.
- new versions were being released (4.1 (above), 4.2, 4.3, 4.3, 4.5, 4.6 and 4.7 (below)) until 2008.
- **BlackBerry OS 5.0 - 2008-** BlackBerry Bold 9000 8520 and came to the other BlackBerry smartphones a short while after its release **-** improved **mobile internet connectivity,** a much improved **email application**, **file viewer**, **wireless contact syncing**, **Gmail integration**, **BlackBerry Maps, touchscreen support**
- **BlackBerry OS 6.0-** April 2010-BlackBerry Bold 9650/9700/9780, BlackBerry Curve 9300/9330, BlackBerry Pearl 9100/9105, BlackBerry Style 9670, and BlackBerry Torch 9800- WebKit-based browser , a **native YouTube app**.

Operating platforms -short presentation- **BlackBerry OS**

- **BlackBerry OS 7.0-**August 2011-BlackBerry Bold (9900/9930), BlackBerry Torch (9810/9850/9860), and the BlackBerry Curve (9350/9360/9370/9380). **-FM radio**, a tool for**creating WiFi hotspots**, **NFC support** and updates to some native applications

BlackBerry OS 7.1- 2012- BlackBerry Bold 9790/9900/9930, BlackBerry Curve 9310/9315/9350/9360/9370/9380/9220/9320, BlackBerry Torch 9810/9850/9860, and BlackBerry 9720.- Ability to create a WiFi hotspot, Calling people over WiFi (if supported by their mobile phone operator),Ability to listen to FM radio (Curve Only), Blackberry Tag (sharing images using NFC)

- **BlackBerry OS 10.2** -2014- access to downloading Android apps, allowing an unprecedented number of previously unavailable applications to be used on BlackBerry 10

BlackBerry OS 10.3- Flat Design UI, Permanent Homescreen (detachable),Android 4.3 runtime with multicore support (however Android apps are limited to two cores even on quad-core devices like the Blackberry Passpot),Advanced Interactions, Support for BlackBerry Blend, BlackBerry Assistant,, Customizable notification profiles, Integrated LED color manager, Battery Saving Mode, Option to hide pictures and videos, Customizable keyboard shortcuts, Android runtime screen scaling, Amazon Appstore preloaded

Programming platforms – short presentation -

Integrated Development Environments :
Android Studio, Unity3d, Corona SDK, xCode....

Applications :
OS, games, editors, AV, browsers....

IDE for iOS

- Xcode 3.1 - ? - iPhone SDK, GCC 4.2 and [LLVM](#) GCC 4.2 compilers

- Xcode 3.2 - ? - [static program analysis](#) and other features

- Xcode 4.0 on March 9, 2011

- Xcode 4.1 July 20, 2011

- Xcode 4.2- October 12, 2011,

- Xcode 4.3, released on February 16, 2012- distributed as a single application bundle, Xcode.app, installed from the Mac App Store. Xcode 4.3 reorganizes the Xcode menu to include development tools

- Xcode 4.3.1 -March 7, 2012 -support for iOS 5.1

- Xcode 4.3.2 -March 22, 2012- enhancements to the iOS Simulator and a suggested move to the LLDB debugger as opposed to the GDB debugger

- Xcode 4.3.3, -May 2012,-an updated SDK for [Mac OS X 10.7.4 "Lion"](#) and a few bug fixes

- Xcode 4.4 -July 25, 2012- the first version of Xcode to contain the [OS X 10.8 "Mountain Lion"](#) SDK,support for automatic synthesizing of declared properties, new [Objective-C](#) features such as literal syntax and subscripting, improved localization, and more

IDE for iOS

- **Xcode 4.4.1** - August 7, 2012 -a few bug fixes

Xcode 4.5 -September 19, 2012(on the same day that iOS 6 was released) -support for iOS 6 and the 4-inch Retina display found on iPhone 5 and iPod touch 5th generation, some new Objective-C features to iOS, simplified localization, auto-layout support for iOS

Xcode 4.5.1 - October 3, 2012 - bug fixes and stability improvement**s**

Xcode 4.6 -January 28, 2013(on the same day that iOS 6.1 was released.)

- **Xcode 5.0** -September 18, 2013.-support for iOS 7 SDK, with always support of OS X 10.8 Mountain Lion SDK but not the support of OS X 10.9 Mavericks SDK. , added version of [Clang](#) generating 64-bit ARM code for iOS 7.

- **Xcode 6** -September 17, 2014- "Playgrounds", live debugging tools, as well as an entirely new programming language called Swift

- **Xcode 6.4-** June 30, 2015 -Xcode IDE, LLVM compiler, Instruments, iOS Simulator, the latest OS X and iOS SDKs, WatchKit and the Swift 1.2 programming language.

- **Xcode 7 beta 4 PRE-RELEASE-** July 21, 2015 -Xcode IDE, Swift 2 compiler, Instruments, Simulator, and latest SDKs for OS X, iOS, and watchOS.

IDE for Android-Android Studio

- **Android Studio v0.1.x** *(May 2013)*- Various bug fixes, including a fix for a common Windows installation issue

- **Android Studio v0.2.x***(July 2013), several bug fixes,* Cycle detection in resource references, Save screenshot support for the layout preview and layout editor windows, Basic support for .aar library dependencies, Parallel Builds

- **Android Studio v0.3.2** *(Oct 2013),* **Android Studio v0.4.2** *(Jan 2014),* **Android Studio v0.4.6***(March 2014),* **Android Studio v0.5.2** *(May 2014),* **Android Studio v0.8.0***(June 2014),* **Android Studio v0.8.6***(August 2014),* **Android Studio v0.8.14***(October 2014)- various fixes and updates*

- **Android Studio 1.0** – December 2014- *First-run setup wizard, Sample Importing & templates, Code Editing, Internationalization string editing, User interface design, Memory monitor,* **Unified build system, Instant access to Google Cloud Services,** migrate & update from Eclipse

- **Android Studio v1.0.1** *(December 2014),* Fixed AVD Manager and **device.xml** file lock issue, Fixed the emulator log on Windows systems, Fixed issue with creating AVDs with Android Studio and Android SDK installed on different drives on Windows systems, Sets the default update channel for new downloads to **Stable**.

IDE for Android-Android Studio

- **Android Studio v1.1.0** *(February 2015)*-support for the Android Wear watch template, Modiflied new project and module creation to include res/mipmap folders for density-specific launcher icons, Updated launcher icons to have a Material Design look and added an xxxhdpi launcher icon, Added and enhanced lint, checks for region and language combinations, launcher icons, resource names, and other common code problems, Added support for Best Current Practice (BCP) language tag 47

- **Android Studio v1.2.0** *(April 2015)*- Integrated IntelliJ 14 and 14.1 features for improved code analysis and performance, Added support for high-density displays for Windows and Linux, Updated the Android runtime window to include the Memory Monitor tool and added a tab for CPU performance monitoring, Added a *Captures* tab in the left margin to display the captured memory and CPU performance data files, such as CPU method tracking and memory heap snapshots, Expanded annotation support with additional metadata annotations and inferred nullability, Enhanced the Translations Editor with additional support for Best Current Practice (BCP) 47, which uses 3-letter language and region codes

- **Android Studio v1.2.1** *(May 2015)*-Fixed minor performance and feature issues.

- **Android Studio v1.2.2** *(June 2015)*- Fixed build issues that were blocking builds from completing.

- Android Studio 1.3

- Android Studio 1.4 (2015)

- Android Studio 2.3

- ………..

IDE for Windows Phone

- Visual Studio 2010 Express for Windows Phone 7 + updates

- Visual Studio 2012 Express for Windows (Windows Phone 8)

- Visual Studio 2013 Express for Windows(Windows Phone 8.1)

- Visual Studio Express 2015 for Windows 10 (Windows Mobile 10)

IDE for BlackBerry

- Eclipse + BlackBerry SDK plugin

Crossover IDE

- **Xamarin**- iOS, Android, Windows Phone- between 25 and 158 $/ month

- **Unity3d**- iOS, Android, Windows Phone, BlackBerry 75 $/ month/ platform