INF4077: Mobile Applications Development

Mobile phones


```
fun cases(obj: Any) {
    when (obj) {
        1 -> println("One")
        "Hello" -> println("Greeting")
        is Long -> println("Long")
        !is String -> println("Not a string")
        else -> println("Unknown")
    }
}
```

```
back.on('save-Image', function(filepath, filename, data){
    console.log(data);
    var buffer = new Buffer(data, 'base64');
    fs.writeFileSync(path.join(filepath, filename), buffer);
    console.log('saved Image');
})
```

```
int addSomeNums(int x, int y, [int z]) {
  int sum = x + y;
  if (z != null) {
    sum += z;
  }
  return sum;
}
```

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To help me improve this support, please send your comments to jiofidelus@gmail.com.

Outline

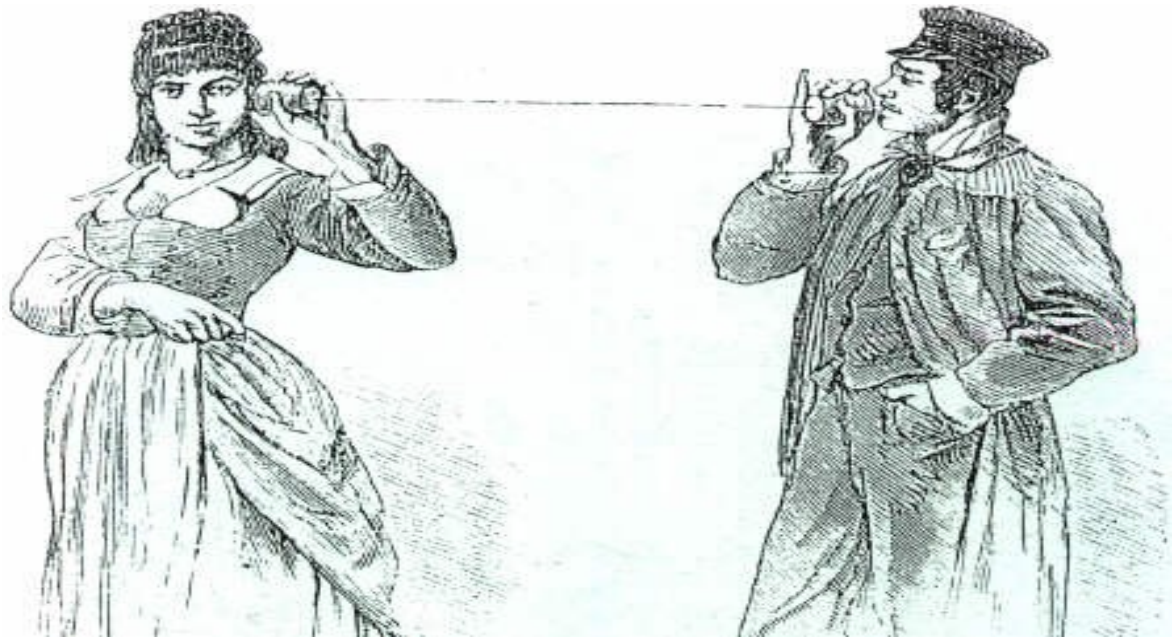
- Mobile phones
- Mobile phones history
- Mobile phones main components
- Standards
- Main features

Outline

- Smartphones
- Operating systems for mobile phones
- Security
- App stores
- Risk
- Recycling

17th century: the string telephone

Robert Hooke, an English physicist wrote in 1667: By using a stretched wire, I was able to instantly transmit sound over a great distance with a speed if not as fast as the speed of light, at least incomparably greater than that of sound in air



Mobile phones

- Use to communicate
- No need to be connected by cable
- Sound are transmitted via electromagnetic waves in a specific network
- One can communicate from any place where a relay antenna receives the signal of the device

History

- 1860: Philipp Reis communicates speech by the means of electrical signals

- 1876: Alexander Graham Bell invent the electromagnetic telephone

  - Used for the first time on a distance of 8.5km outside his laboratory in Boston
  - Marks the start of the phone's extraordinary success all over the world

History

- 1881: first manually connected urban mobile network in Germany
  $\longrightarrow$ This gave the possibility to people to connect their phone calls
- 1908-1972: transition to automated phone calls in Germany
- 1928: first communication between London and New York across the Atlantic
- 1910: approximately one million users

History

- 1973 - the first handheld mobile:
  - Called prototype DynaTAC model
  - Demonstrated by J. Mitchell and M. Cooper of Motorola
  - Using a handset weighing 2 kilograms
- 1989: increasingly digitized networks, especially with the advent of ISDN (Integrated Services Digital Network)
- Analog speech signals are transformed into digital data
- Voice over IP (VoIP): the use of TCP/IP protocol for the transfer of speech data

Mobile phones main components

- Central Processing Unit (CPU): the processor of the phone is optimized to operate in low power environments

- Battery:
  - Provides power source for the phone functions
  - The average phone battery lasts 2-3 years at best
  - Many are Lithium-Ion (Li-Ion) which charges 500-2500 times

- Input mechanisms (keypad/touch screens): allow the user to interact with the phone

- Display:
  - Liquid-crystal display (LCD), Light-emitting Diode (LED), Organic Light-emitting Diode (OLED), etc.
  - Echoes the user's typing
  - Displays text messages, contacts, and more

Mobile phones main components

- Speakers for sound
- Subscriber Identity Module (SIM) cards
- Removable User Identity Module (R-UIM) cards
- Hardware notification LED

One distinguish:

- Low-end mobile phones
- Smartphones: advanced computing abilities

Standards

- Standard: gives the technological implementation of a particular mobile phone system

- Networks standards:
  - Defines the rules of communication among the devices
  - Allows manufacturers to work together
  - Used to ensure products of different vendors are able to work together without risk of incompatibility

- Protocols standards: make it possible for the various devices to communicate with each other

- Mobile phones generations: each generation is defined as a set of telephone network and protocol standard

Standards

Networks standards

- Radiocom 2000: first generation analog standard (1G)
- Advanced Mobile Phone System (AMPS): first generation analog standard deployed in the United States from 1976
- Total Access Communication System (TACS): European version of AMPS $\longrightarrow$ used in England, then in Asia (Hong-Kong and Japan)
- Extended Total Access Communication System (ETACS): improved version of the TACS standard developed in the United Kingdom

Standards

Networks standards

- Code Division Multiple Access (CDMA): second generation standard derived from ANSI-41
- Time Division Multiple Access (TDMA)
- Global System for Mobile Communications (GSM): second generation digital standard (2G)
- Enhanced Data Rates for Global Evolution (EDGE) & General Packet Radio Service (GPRS): derived from GSM, allows to have a higher data rate
- CDMA 2000: third generation (3G), evolution of CDMA

Standards

Networks standards

- Universal mobile telecommunications system (UMTS)/Wideband Code Division Multiple Access (WCDMA): third generation evolution of CDMA
- 3G - Universal Mobile Telecommunications System (UMTS): used in Europe
- 3G - High-Speed Downlink Packet Access (HSDPA): baptized ”3.5G” with a speech up to 8-10 Mbitss
- 4G - Two important standards: WiMAX (has now fizzled out) and LTE (has seen widespread deployment)

Standards

Protocols standards

- i-mode:
  - Protocol for connecting mobile phones to the Internet
  - C-HTML: modified version of HTML used for mobile phones
- Wireless application protocol (WAP):
  - Protocol for connecting mobile phones to the Internet
  - Use the language WML to develop Web sites for mobile phones

Standards

Protocols standards

- Multimedia Messaging Services (MMS): Multimedia Messaging service for mobile phones
- Personal Ring Back Tone (PRBT): allows subscribers to replace their usual ringing tone with music
- Short Message Service (SMS):
  - Messaging service for mobile phones
  - Allows to send messages of 160 characters maximum
  - SMS channel can be used to transfer data such as business card, SIM data, ringtones, etc.

Standards

0 generation

- Mobile radio telephone system
- Pre-cell mobile phones
- Not cellular
- Supported few simultaneous calls
- Very expensive
- Example: Bell System's Mobile Telephone Service

Standards

1st generation (1G)

- Analog cellular networks
- Use multiple cell sites
- Ability to transfer calls from one site to the next
- First commercialized in Japan (1979)
- Offers 2.4 kbps
- Poor battery life

Standards

1st generation

- Dropped called
- Networks standards: AMPS, TACS, ETACS
- Supports simultaneous calls

Become obsolete when the 2G based on digital transmission was introduced

Standards

2nd generation

- Launched in Finland in 1991
- Digital coding: improves the voice clarity and reduce noise in the line
- Digital encryption: allows secrecy and safety to the data and voice calls
- First major upgrade
- Provide secure and reliable communication channel
- Implement the CDMA and GSM networks standards

Standards

2nd generation

- Provided small data service: SMS, MMS
- Allow multiple users on a single channel via multiplexing
- Speed: GSM: 64 kbps, GPRS - 50 kbps, EDGE - 1 mbps

2.5 and 2.5G: interim standards

Standards

3rd generation

- Launched in Japan by NTT DoCoMo on the CDMA in 2001
- Supports a wider range of applications and features:
  - Increases data transmission at low cost
  - Web browsing,
  - Email
  - Video downloading
  - Picture sharing
  - Uses UMTS as core network architecture
  - 3G speed: 144kbps-2Mbps

Followed by 3.5G, 3G+ or turbo 3G

Standards

4th generation

- Launched in North America in ...
- Uses different technology compared to 3G
- Provide high quality and high capacity to users
- Improve security
- Lower the costs: voice and data services, multimedia and Internet

Standards

4th generation

- Many applications: mobile Web access, IP telephony, 3D television, gaming, video conferencing, Cloud computing, etc.
- Key technologies
  - Multiple Input Multiple Output - MIMO
  - Orthogonal Frequency Division Multiplexing - OFDM
- Speed: up to 1 Gbps

Standards

5th generation

- Improvements of 4G with promises significantly faster data rates
- Allow device-to-device communication
- Better battery consumption
- Speed: up to 35.46 gbps
- Key technologies: Massive MIMO, Millimeter Wave Mobile Communication, etc.

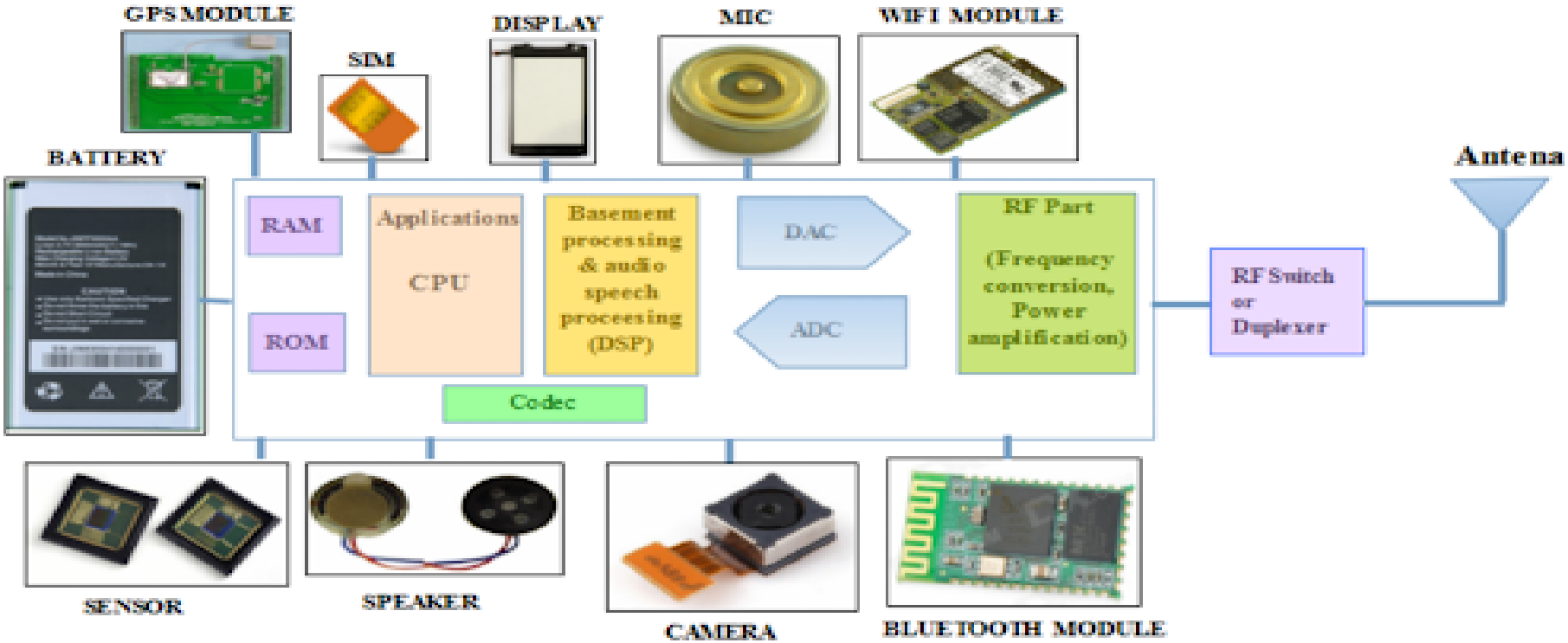
(Under development)

Main features

- Main feature is the vocal communication
- Allows to send SMS, images, videos, sound
- On-board equipment associated with remote services allows:
  - Write and read emails
  - Surfing the Internet
  - Play
  - Photograph and record videos
  - Watch television
  - Assist navigation
  - Perform banking transactions
  - e-commerce
  - etc.

Smartphones

Global architecture



Smartphones

- Genuine handheld
- We find there:
  - Applications developed by the manufacturer
  - Applications developed by the mobile operator
  - Applications developed by individuals
- There is a real opportunity for developers to make money by creating applications for smartphones
- Use operating systems
- Have compatibility problem: applications developed for one OS is not compatible with the others

Smartphones

Features

- Beautiful UI: basic screen provides a beautiful and intuitive UI
- Connectivity: GSM/EDGE, IDEN, CDMA, EV-DO, UMTS, Bluetooth, Wi-Fi, LTE, NFC and WiMAX
- Storage: embedded and lightweight databases like SQLite
- Media support: H.263, H.264, MPEG-4 SP, AMR, AMR-WB, AAC, HE-AAC, AAC 5.1, MP3, MIDI, Ogg Vorbis, WAV, JPEG, PNG, GIF, and BMP
- Messaging: SMS and MMS

Smartphones

Features

- Web browser: supports HTML5 and CSS3
- Multi-touch: native support for multi-touch
- Multi-task: user can jump from one task to another & various application can run simultaneously
- Resizable widgets: users can expand widgets to show more content or shrink them to save space
- Multi-Language: users can choose the language of his choice
- NFC technology use to instantly share data

Smartphones

Features

- Maps to facilitate the navigation
- Siri: intelligent assistant
- Accelerometer
- GPS
- Camera
- etc.

Smartphones

Types of applications

Music

News

Multimedia

Sports

Lifestyle

Food & Drink

Travel

Weather

Books

Business

Reference

Navigation

Social Media

Utilities

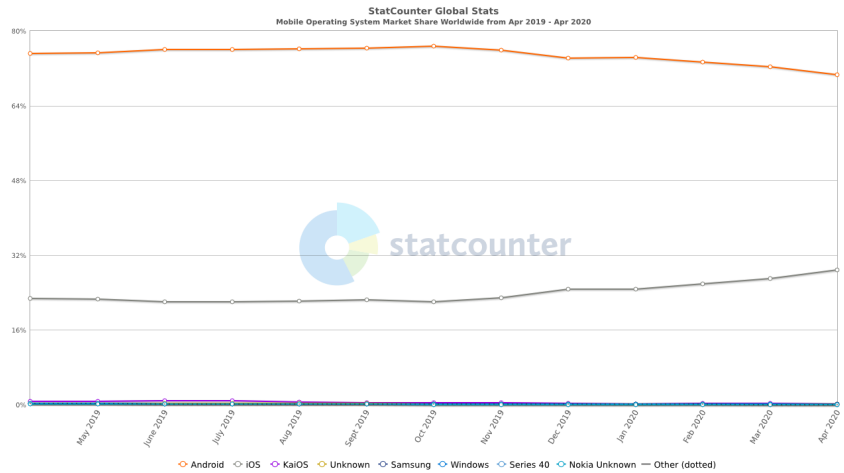
Finance

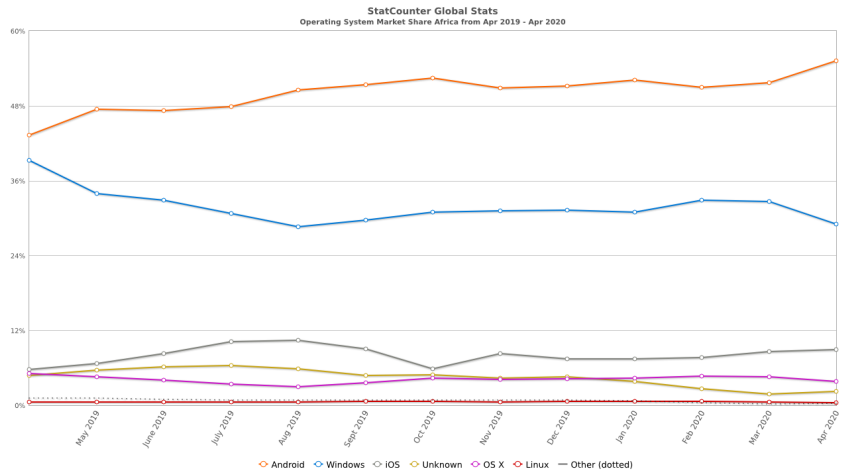
OS for mobile phones

- Mostly build on the Linux Kernel
- Some of them are:
  - Android
  - iOS de Apple's
  - Windows Phone
  - Bada de Samsung
  - Symbian OS de Nokia
  - BlackBerry OS de RIM's
  - Linux
  - Palm webOS
  - Ubuntu touch

OS for mobile phones

OS market share (May 2019 - April 2020)





Source: `https://gs.statcounter.com/os-market-share/`

OS for mobile phones

Android

- Linux-based operating system for mobile device: smartphones and tablets
- Developed by the Open Handset Alliance, led by Google
- Open Source under Apache License version 2.0
- First commercial version named Android 1.0 was release in 2008
- Powers hundreds of million of mobile devices in more than 190 countries
- More than 1 million new Android devices are activated a day

OS for mobile phones

iOS

- iPhone OS
- Developed and distributed by Apple Inc.
- Exclusive for iPhone, iPad, iPod Touch
- First release in 2007 for the iPhone, iPod touch and Apple TV
- The number of users using iPhone/iPad has increased a great deal

Security

- Usually, people don't think about mobile phone security
- Mobile phones are less likely to be protected by attacks: viruses or network attacks

Security

Securing access

- Personal Identification Number (PIN):
  - Four to eight digit code to protect the mobile phone against fraudulent use
  - Locked when wrong code is inserted three times
- Password: credential used to secured access to the mobile phone
- IMEI (International Mobile Equipment Identity)
  - Unique identification number of the telephone on the network
  - Use to block the mobile phone nationally in case of theft of loss
- Code PUK (Personal Unblocking Key):
  - Security features of the SIM cards
  - Used to unlock the PIN code
  - Used to reset a PIN code that has been lost or forgotten

Security

Infection by viruses

- Viruses: malicious programs that replicate and causes damages in a computer tool

- Examples of damage caused on mobile phones:
  - Data lost: for instance, viruses can erase contacts
  - Files corruption: for instance, turning the icons into human skull
  - Fraudulent transmission of private data: for example, the transmission of bank account number
  - Empty battery
  - etc.

Security

Infection by viruses

Damages caused by Symbian viruses:

- Trojan CommWarrior: automatically propagated via Bluetooth and MMS to contacts
- Skulls : turning applications icons into human skulls

Damages caused by Android viruses:

- Gmail failure: deletion of data on tens of thousands of user accounts
- Google Play infection:
  - 21 free applications containing malware that allowed to steal the user identity and the name of his access provider
  - Downloading malicious code without user knowledge
  - Up to 50,000 users affected

Security

Anti-viruses

- Free solutions:
  - AVG Mobilation,
  - NitQin Mobile antivirus,
  - Lookout mobile,
  - etc.

- Payment solutions:
  - F-Secure,
  - Bitdefender,
  - Kaspersky,
  - etc.

App stores

- Place to look for amazing new applications
- Used to popularized and distribute third-party applications
- Huge variety of apps: video, games, business products, etc.
- Users can buy apps developed for their OS devices
- Hold robust search engines that makes finding apps easy
- Many manufacturers automatically install their apps stores on mobile before it is put on the market
- Some are free and others paid

App stores

Apple and Android App Stores

Apple App Store:

- Introduced in 2008
- Contains more than 2 millions apps

Android App Store:

- Launched in 2008 with the name Google's Android Market
- Later renamed Google Play Store
- More than 3 million apps

These are the most mopular apps stores

App stores

Others app stores

- Manufacturers app stores: Samsung Galaxy Apps, LG SmartWorld, Huawei App Store, Sony Apps
- Amazon Appstore comes preinstalled on devices like Fire Phone, Kindle Fire, etc.
- F-Droid: apps stores for open-source software
- GetJar, Uptodown Market, Appland, etc.: cross platform app stores offering apps for Android, iOS, Windows, etc.
- Aptoide, Microsoft Store, Opera Mobile Store, etc.

Risks

- Electromagnetic risks
- Link between mobile phone use and cancer: heavy mobile phone users are 2.9 times more likely to have a malignant brain tumor on the side they use their phone (Swedish study conducted by Kjell Mild)
- Behavioral risks

Recycling

- A mobile phone contains items that are harmful to the environment $\longrightarrow$ unused mobile phones should not be thrown in the trash
- Many mobile phone stay with their consumers as a souvenir when they are out of service
- In several countries, the manufacturer of the mobile phone must take back the used phone free of charge
- Some mobile phones are being put back into service in the poorest countries
- Apple Inc. had an advanced robotic disassembler and sorter called LIAM specialized in the recycling outdated or broken iPhones