

Mobile Programming and Multimedia Simple (for real)



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**Disclaimer**

# Course Introduction

The course is based on two parts:

* *Mobile Programming*
  + this is the section that will change, given the nature of it
  + this year we will get to the detail of design of applications
* *Multimedia and Data*
  + this remains pretty much the same
  + this part is focused on understanding how to encode data
    - media can be particularly heavy on memory/battery/bandwidth usage
    - we want to save time in downloading and streaming the files
    - this of course because usage is very much mobile and not desktop anymore

Other general info:

* Slides will be gradually updated according to the need on the Moodle, which is free to access
  + There will be 4x4 (4 slides per page) and normal slides (1 per page)
* After 15 days, data will be collected in order to get account data of labs
* In case of need, an Apple PC is available in the library to be used to develop applications
* Recordings are available but only if attendance doesn’t go down

Quality of the application is measuring “how much it does what it’s supposed to do”. While in Web is important the number of clicks to get to the data, here it’s important how much data is asked to the user.

When creating an application, it’s important also to drive metaphors towards a common goal, giving the everyday use inside what is done inside of a product/application. Consider the desktop, which seems not a metaphor, but it is, actually.

When we are developing an application, consider this is done for smartphone, which do not have OS, but RTOS (Real-Time Operating System): for example, when we receive phone calls, an applications stops, has to save save state, then we get back to what we were doing before.

Immagine che contiene mammifero, grande felino, tigre, Grandi felini

Descrizione generata automaticamenteThe following is an example of compression; the difference is present but not very much:

To understand this, we will understand what we can or cannot perceive in light and image. This way, we can remove all the information we can’t see, without losing quality. It’s more important to know what the formulas do, instead of understanding for real the elaborations.

Representation and encoding revolves around:

* Immagine che contiene fiore, Viso umano, illustrazione, schizzo

  Descrizione generata automaticamenteHow human sight works
* Image properties: size, quality, transmission, visualization
* File formats
  + GIF
  + PNG
  + JPEG
  + JPEG2000
  + others

Also, it’s important to understand how *sound* is made:

* Audio properties: fidelity, ì transmission, playback
* Standard file formats:
  + WAV
  + MP3
  + others
* MIDI
* Compression (lossy – with loss of some data)
  + understanding what to perceive and what not

But also images with audio - *video*:

* Human vision with motion pictures
* Digital and analogic video
* Video properties: quality, representation, transmission
* Standard formats:
  + H261
  + H263
  + MPEG family
  + DivX, Xvid

We also talk about *data compression*, in particular:

* Reasons behind data compression
  + Storage space, transmission time
* Continuous and not-continuous media compression
* Lossless and lossy compression
* Lossless encoding
  + Entropy encoding methods
  + Semantic compression
* Lossy encoding
  + Image compression: JPEG
  + Video compression: MPEG1-2
  + Audio compression: MP3

Prof. says slides are not enough for the examination; Moodle material is suggested and also textbooks are needed here.

Fragmentation is present between platforms (Apple vs Android and all of its versions) and different values of settings according to devices and specific needs (e.g., brightness, virtual environment, singular devices with particular sensors/features, etc.).

This is the knowledge and skills targeted from the course:

* Mobile interface design
* Cross-platform development
* Emotional design
  + transform the user into a customer
* Wearable devices
* Market

The examination will require:

* A presentation of an argument with slides plus an oral examination

Or:

* A small group project with a final report plus a small oral examination
  + Develop an application
  + It should be made for all platforms
  + But it’s not mandatory, can be only for one specific system
  + Should be sent 5 days before the examination
  + Subscribed on Uniweb and poll of what examination was chosen
* In-depth analysis of an argument with a presentation and a small oral examination
  + 10-page essay presented on the end of the course
  + The argument must be defined by the end of April
  + Possible dates: 4th – 7th June 2024
  + It’s very important to choose topics and prepare/explain material seen during lectures

In any case, oral examination is made on two questions about all the class program and material. One can avoid these two oral questions if one attends in presence only the homeworks (exercises). These can be something like “solve a multimedia algorithm problem” or “understanding design flaws of something and explain it to the class”. If all are delivered (or at most you miss one – but at least half or more of the half), then this is considered.

Exercises will be evaluated anyway even if wrong and can be given ½ points, then asked in oral examination, when given feedback of course. It seems they will be on Tuesday afternoon.

# Introduction to Mobile Development

To create the right product, between web and mobile, we have to *study the user and understand his necessities and needs*. As we all know by now, smartphone market has been exploding since years and more and more users are active using a mobile device.

Some data we can give about them:

* Over 5 billion people are using smartphones, with 4/5 billions being active social media users/Internet users respectively
* There are at least 7 billions of mobile subscriptions worldwide
* China, India, and the United States are the countries with the highest number of smartphone users, but also Indonesia, Brazil, South America and Africa
* While desktop is mostly used inside USA, South America, Oceania
  + for the first ones, connections can be wireless easily not needing an infrastructure
* Operating systems are Android and iOS
  + who wants to create premium services or something that people will buy, the preferred choice is actually iOS
  + on Android we have a lot of fragmentation between features and various things
* Worldwide users are on smartphones and usage data is collected from developers themselves
  + this does not mean we have to forget desktop however
  + consider mobile devices are also tablets, not only smartphones
    - they weigh more, they cost more, we use them with two hands, and we sit down using them concentrating using it
    - this way the application must come with some way to handle the error situation, recovering from them
* There are differences between males and females
  + females use more mobile apps than desktop
* Smartphones beat TV for younger users (the younger, the more usage)
  + less gestures required, less fatigue, more content present
* There is a relationship daytime-device
  + low-to-middle use between morning and daytime for mobile
  + daytime to early evening for desktop
  + in evenings for tablets
* On average there are more than 2000 interactions with a smartphone on a day
  + consider the user can make a lot of errors because there are a lot of interruptions
    - good quality means good experience, even when errors happen
* Today we have smart\* (smartphones, smart watches, smart homes, etc.)

Mobile phones are not considered anymore as a simple device to make calls, but incorporate a lot of different features:

* Messages, calls
* Internet navigation
* Sensor data collection and usage (app for training, biking, running, etc.)
* Agenda
* Entertainment (games, music, video, reading, etc.)

All these features are provided by apps, in whatever form.

There are different false myths:

* Mobile app development is not expensive
  + A bad app is worse than no app
* Mobile app development is easy

On the contrary:

* Mobile app development requires big teams
* Mobile app development is not like winning at the lottery

The first step to determine if it is better to develop a mobile layout of your own website or a mobile application is to understand the differences between the two:

* Diversified content
* Native interface vs. Company brand
* Development time
* User interaction (ex: push notification)
* Access (icon) vs bookmark
* Target (loyalty vs. reach)

The only data we need from users comes from payment information, all the rest is needed *because the developer asks for it*. The website is the best way to get information in a quick way, apart from push notifications. Also, icons are suitable to do that the best way, because it *remembers the user what to do*.

Remember also *mobile e-commerce* is going strong and has a greater market share each time.

* Usually, transactions are simultaneous and can happen on multiple devices at a time and also multiple apps at the same time
  + bringing an environment together (without having to put all data again)
* Committed retailers capture more transactions on mobile apps rather than browsers
* In both platforms, iOS devices capture the majority of these retailers’ transactions
  + they will definitely spend more money

Other general statistics:

* There are millions of apps in the stores and a 25% of them are used only once
* A user usually spend 90% of the smartphone time using apps
* The 84% of the time is spent using 5 apps that change between users
  + which include, in this order, social apps, games, music, and video streaming
* It does not matter the number of downloads in the end, but the number of installations
* Study the user remember: screen time depends on different factors but also context

There is the *app vs mobile web*:

* A mobile application usually tends to encourage brand fidelity (icon on the desktop, notifications, etc.)
* A website with a mobile layout allows reaching the user in every situation, immediately

There are situations when it’s useful to create an app:

* A lot of graphics or calculations
* Camera, sensors, or microphone usage
* Gallery or contacts' access
* Push notifications or background service
* For games
* It is the only way to have access to the store

The number of installed apps changes depending on the device (and its operating system). According to Nielsen, the best approach is to interview the users to understand if they would accept to install the new app on their device:

* Storage space
* Purpose
* Loyalty

The development of a mobile app requires several *resources*:

* Interface design
* Development
  + E.g., Which operating system?
* Maintenance

There are different *advantages in web apps*:

* They require a very low knowledge base, HTML is popular
* HTML5 now provides access to almost all smartphone features
* More straightforward ‘’conversion’’ to different operating systems
* User *does not have to worry about the update* of the application
* It is not necessary to wait for application approval
  + Apple can require more than 2 weeks

Applications for mobile devices are different from desktop applications:

* Mobile operating systems are soft real-time operating systems:
  + An application can be suspended or terminated in every moment
  + The operating system manages context switch
* Only one application active
  + Not with iOS on iPad
* Limited space, it is not possible to open more windows at the same time
* Easy to install (or at least discourage less the use)
* Incredibly high number
  + To design and create an exciting app is extremely challenging
* Market fragmentation

Bibliography of this chapter: [here](https://www.business.com/articles/mobile-apps-vs-mobile-web-do-you-have-to-choose/) and [here](https://techcrunch.com/2017/05/04/report-smartphone-owners-are-using-9-apps-per-day-30-per-month/).

# Frameworks for Cross-platform Development

# PhoneGap/Cordova Framework

# Corona/Solar 2D Framework

This is made for animations/games pretty much close and not used that much outside of college environment.

# Xamarin Framework

# Flutter Framework

# React Native Framework

# Store Deployment

# iOS Platform

# Android Platform

# Mobile Design

# Wearable Devices

# Multimedia Data Encoding

# Images

# Audio

# Video