Programming with Android:
Module Overview

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Dipartimento di Informatica: Scienza e Ingegneria

Università di Bologna

General Course Considerations

- Preliminary considerations: YES, slides in ENGLISH!
  - Dynamic course, with problems due to ongoing adaptation process
    - Lots of the credits for the Android material go to proff. Luca Bedogni and Marco Di Felice
    - People, support, devices and labs, material, numbers…
  - Motivations for the course (…you know why you are here, but…)
    - Enabling expression of potential for students towards apps world and projects
    - Activating bindings with research themes: Social, Privacy, M2M
    - Both Android AND iOS! Highly required both in the market (75% vs 25% share)
    - The classes distribution will be 70% ANDROID and 30% iOS to cope with projects potential
    - Need your help to make it evolve into something better year by year
      - Be patient, be constructive, be ambitious

General Course Considerations

- This year schedule
  - Monday 12-14 (iOS)
  - Tuesday 12-14 (Android)
  - Thursday 12-14 (Android)

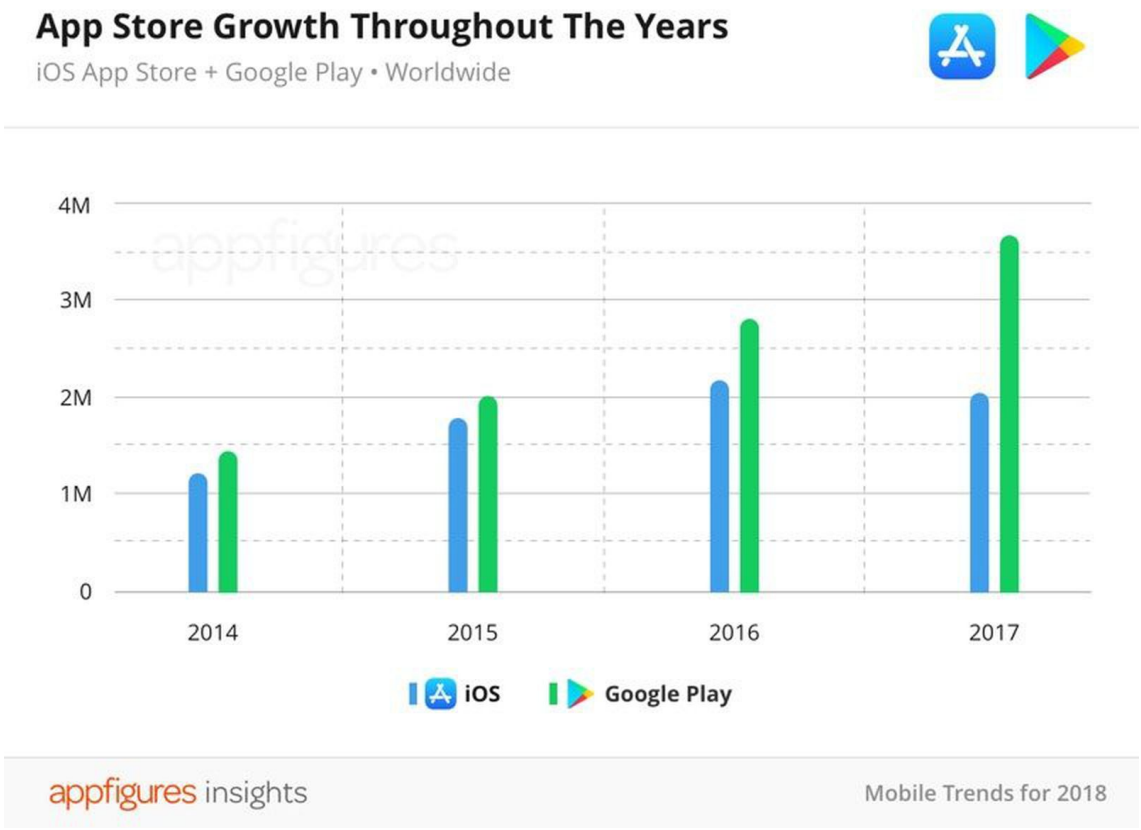
- Always check for last minute changes (news on VIRTUALE, explained later).
- Old material for slides and code on http://www.cs.unibo.it/projects/android/2020/

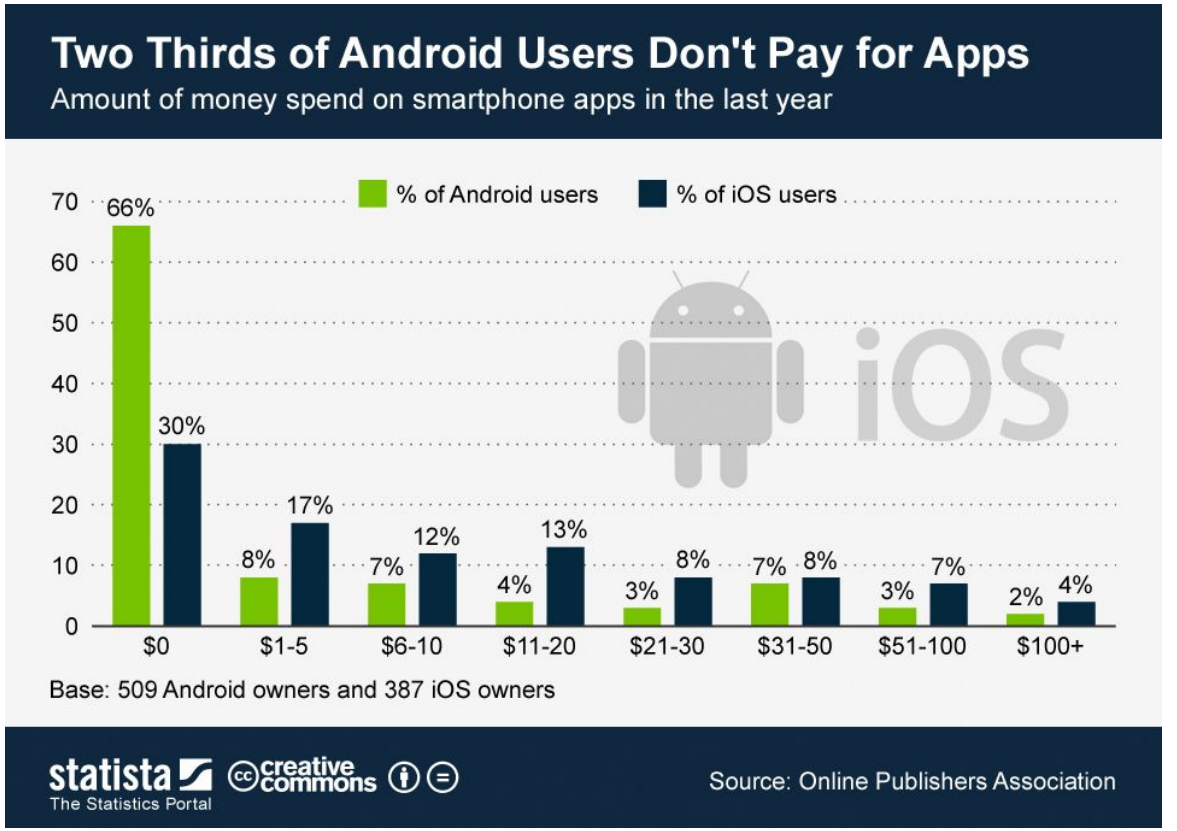
Android … Why?

GOALs OF THE MODULE:

- **Introduce the Android architecture**
- **Implement Android applications**
- **Think in *Android terms***

Android ... Why?





Source: https://www.macrumors.com/2018/04/04/app-store-apps-shrank-in-2017/

Android ... Why?

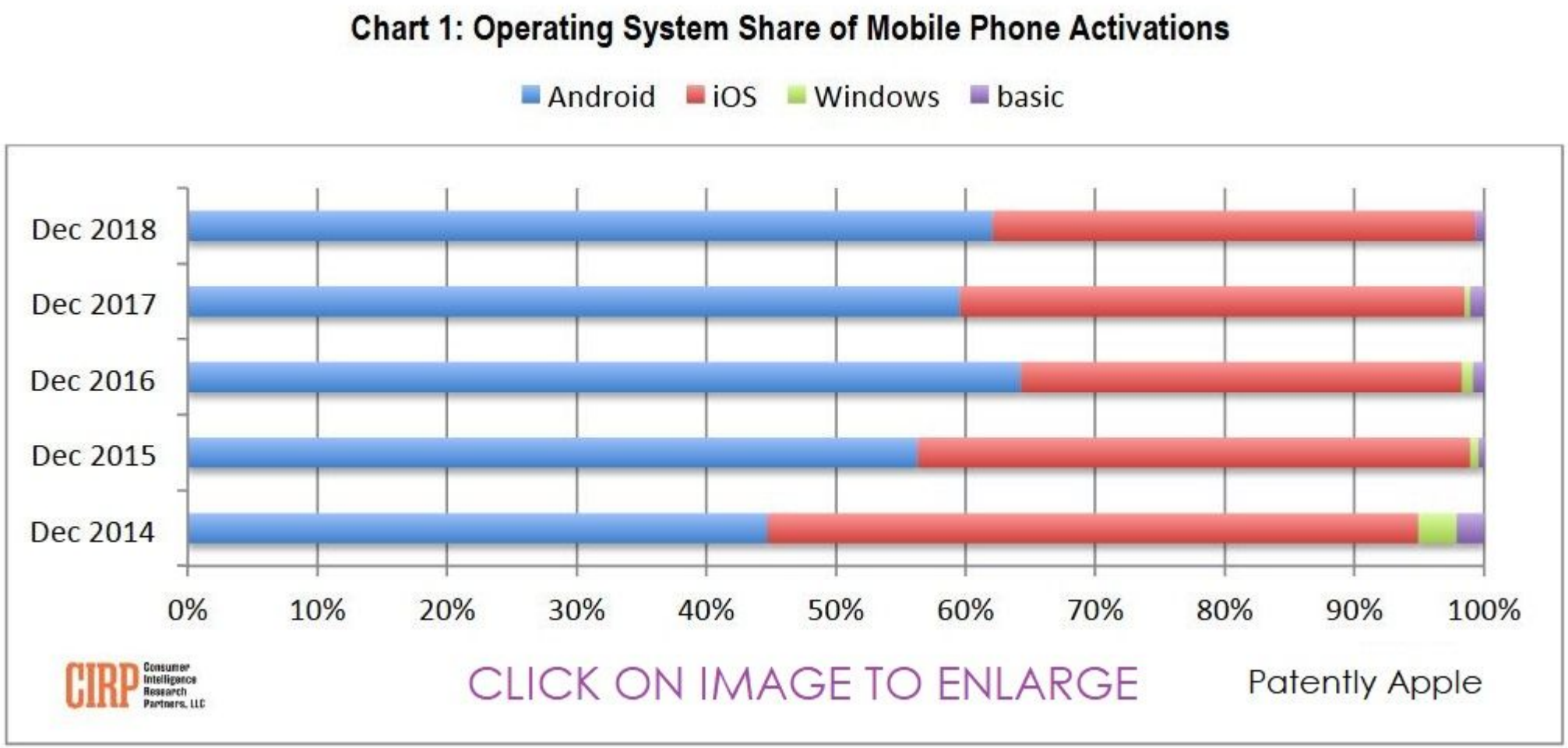
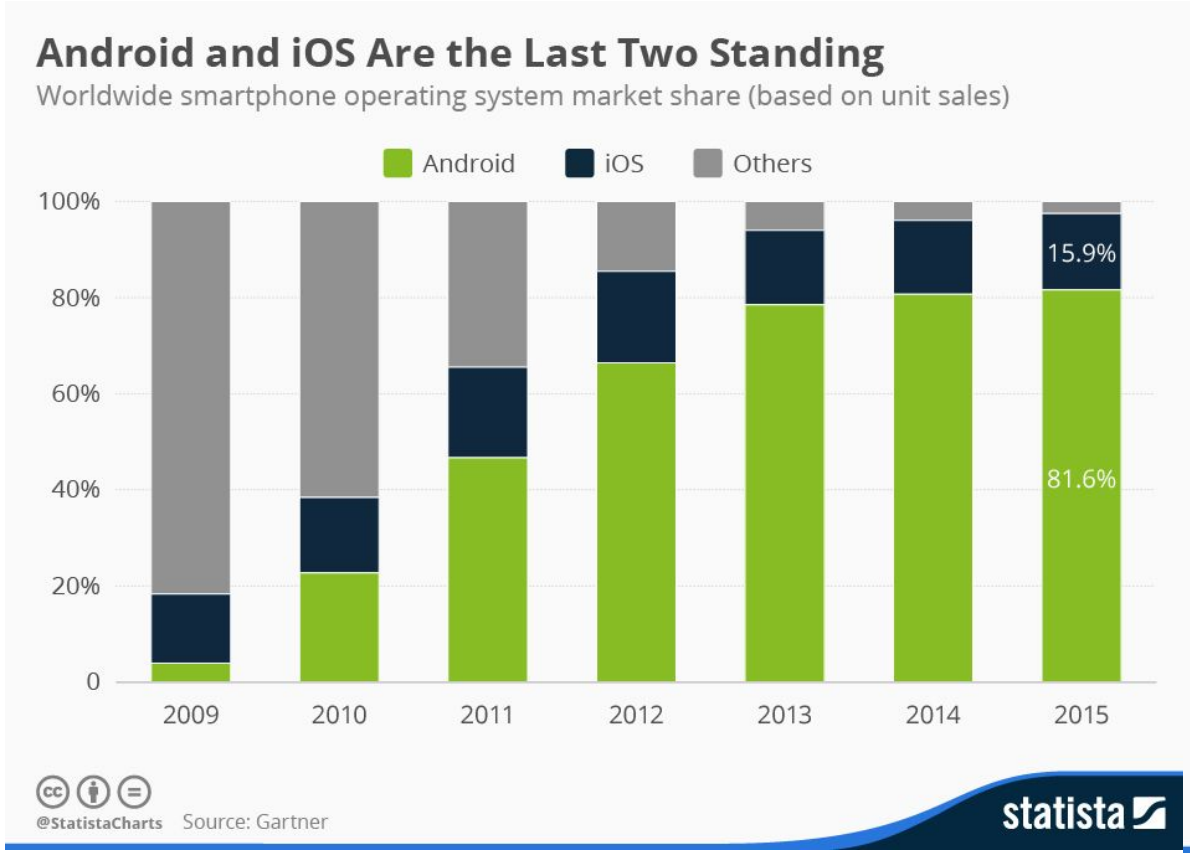
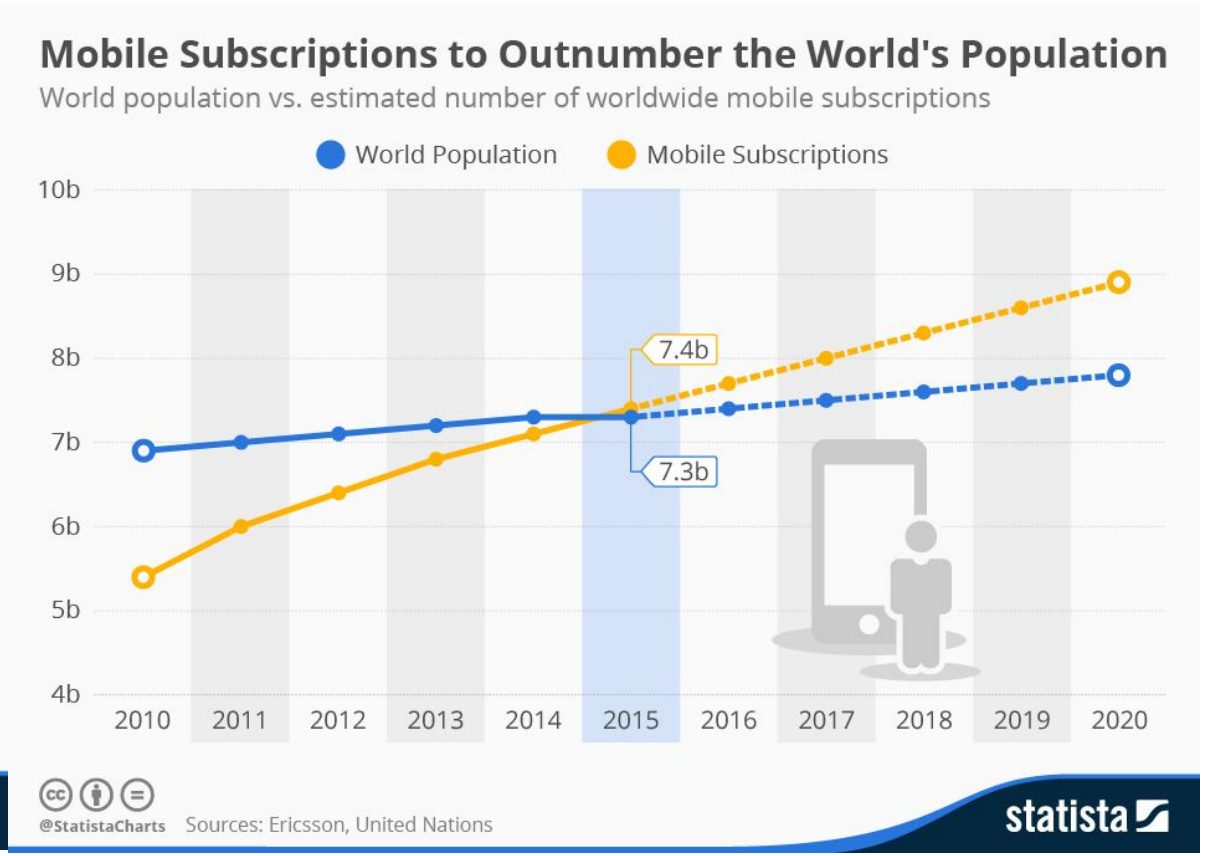


Chart 1: Operating System Share of Mobile Phone Activations
Android
iOS
Windows
basic
Dec 2018
Dec 2017
Dec 2016
Dec 2015
Dec 2014
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
CIRP Consumer Intelligence Research Partners, LLC
CLICK ON IMAGE TO ENLARGE
Patently Apple

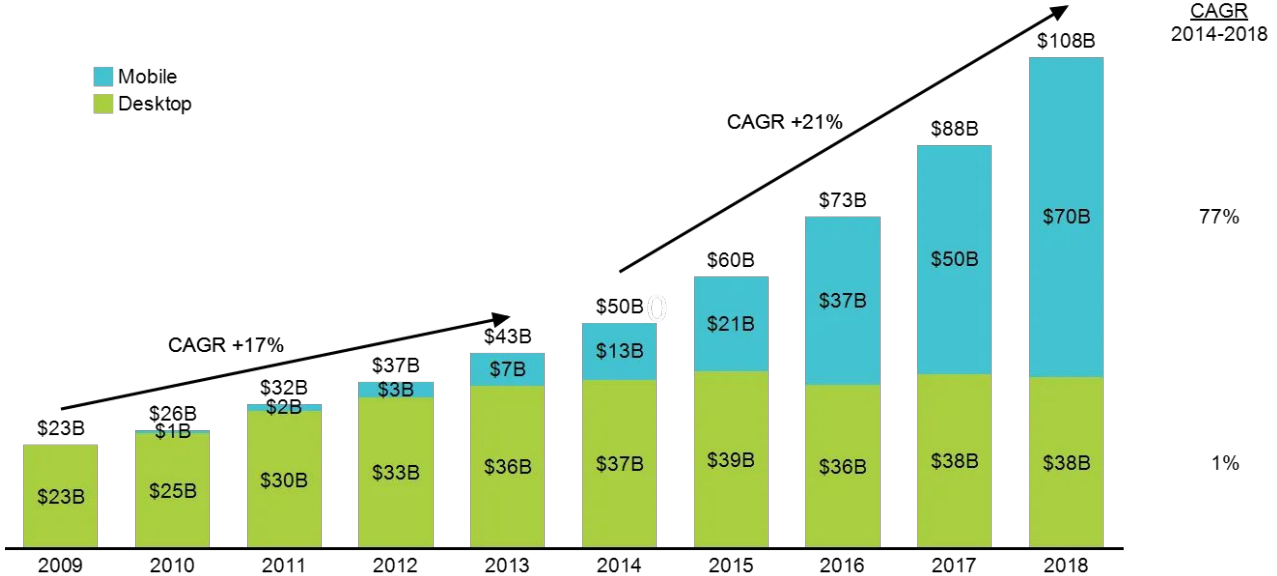
Android ... Why?


Android and iOS Are the Last Two Standing
Worldwide smartphone operating system market share (based on unit sales)
Android
iOS
Others
100%
80%
60%
40%
20%
0
15.9%
81.6%
2009
2010
2011
2012
2013
2014
2015
@StatistaCharts
Source: Gartner
statista


Mobile Subscriptions to Outnumber the World's Population
World population vs. estimated number of worldwide mobile subscriptions
World Population
Mobile Subscriptions
10b
9b
8b
7b
6b
5b
4b
7.4b
7.3b
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
@StatistaCharts
Sources: Ericsson, United Nations
statista

Android ... Why?

MOBILE INTERNET USERS WORLDWIDE

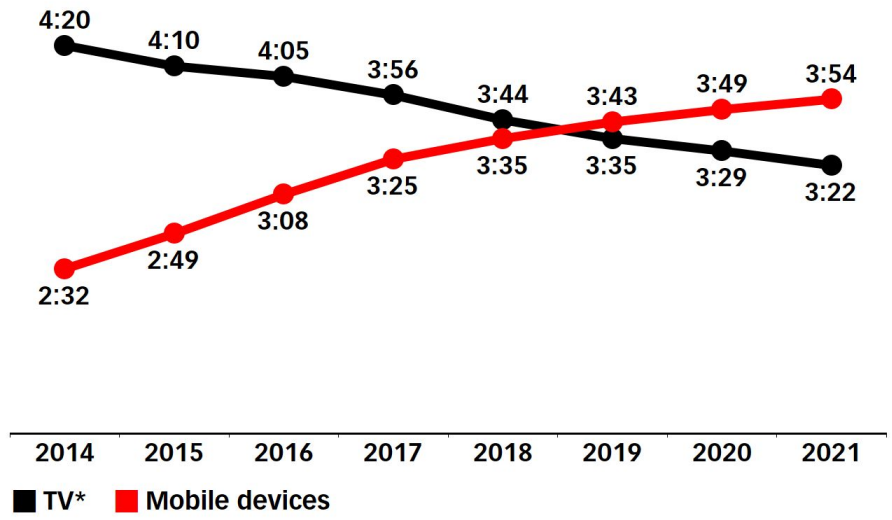


	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
YoY Growth Mobile		167%	113%	109%	76%	66%	77%	37%	40%	
YoY Growth Desktop		19%	10%	8%	4%	5%	-8%	6%	-2%	
Mobile % of Total		5%	9%	17%	25%	35%	51%	57%	65%	

MOBILE DEVICE DIVERSIFICATION

TV and Mobile Devices: Average Time Spent in the US, 2014-2021

hrs:mins per day among population

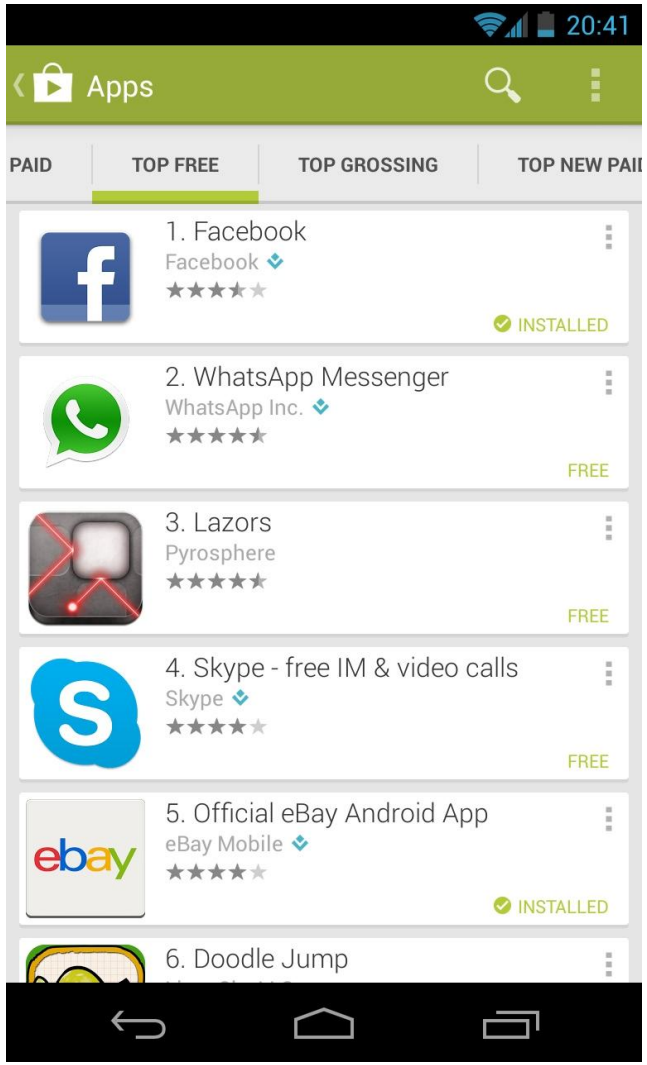


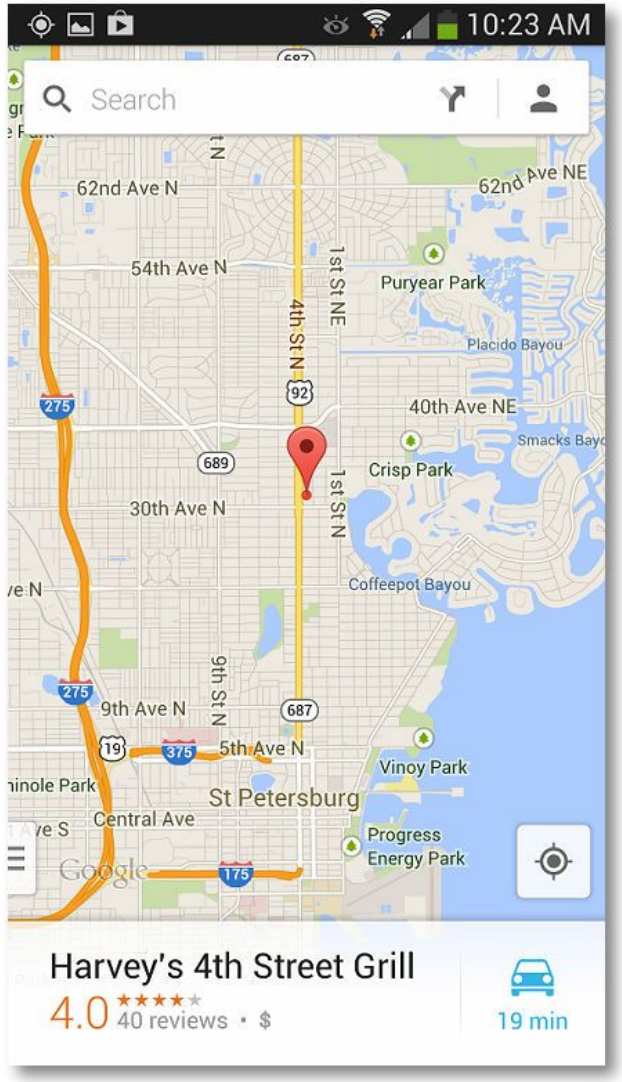
*Note: ages 18+; time spent with each medium includes all time spent with that medium, regardless of multitasking; for example, 1 hour of multitasking on desktop/laptop while watching TV is counted as 1 hour for TV and 1 hour for desktop/laptop; *excludes digital*

Source: eMarketer, April 2019

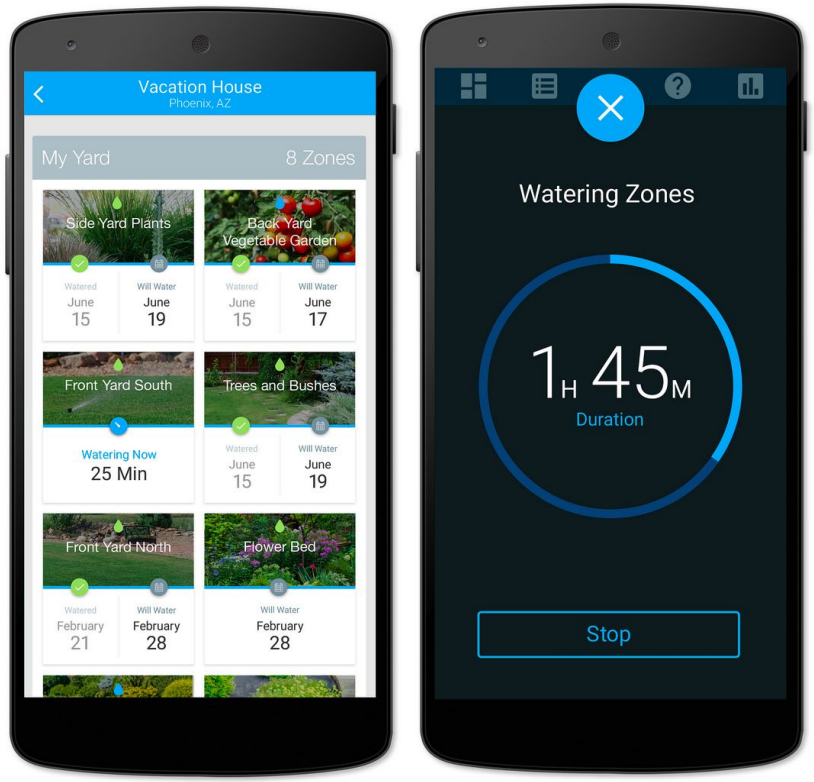
T10195 www.eMarketer.com

Android: Some Examples ...

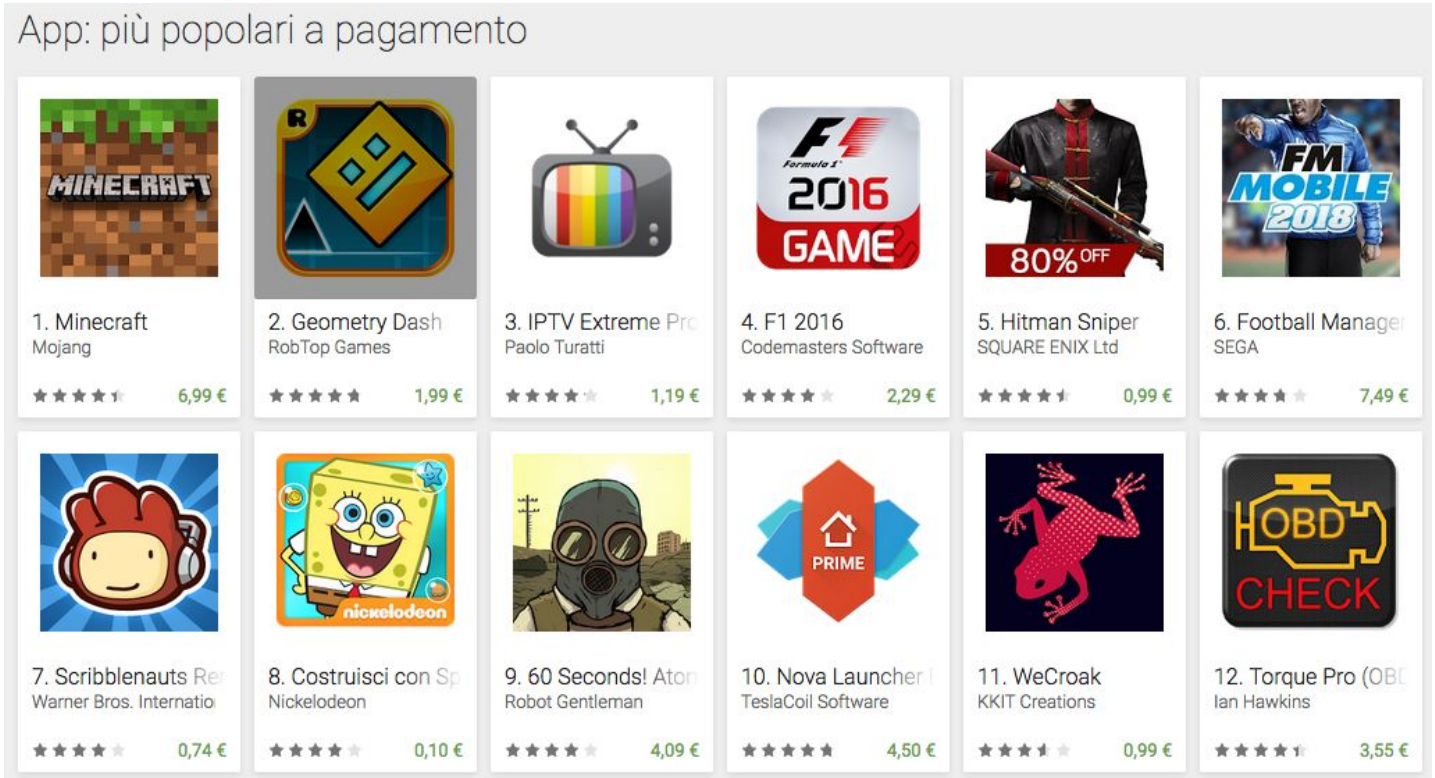


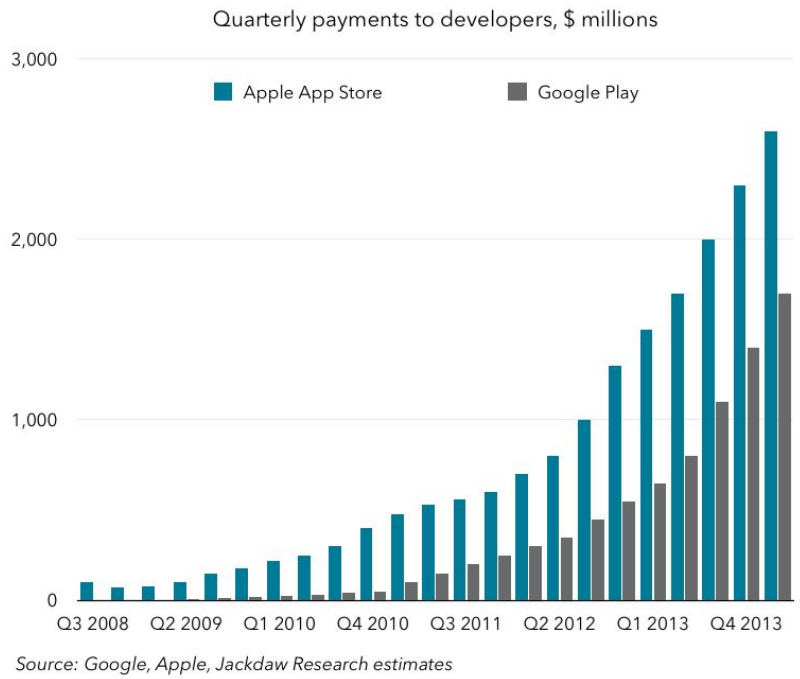


Android: Some Examples ...



Android: where is the business?





Source: Google, Apple, Jackdaw Research estimates

- **RATIONALE**: ***Focus on amount of applications sold, not on price of single applications …***
- ***How to forget ADs …***

	Google	Apple	Microsoft
Number of users (in millions)	900	600	12
Number of apps (in thousands)	800	1250	160
Number of developers (in thousands)	150	235	45
Number of downloads (in billions)	48	50	.65
Paid to developers (in millions)	900	5000	100

Android: versions

2008
API 1

Apple Pie 1.0

2009
API 3

Cupcake 1.5

2009
API 4

Donut 1.6

2009
API 5

Eclair 2.0/ 2.1

2010
API 8

Froyo 2.2

2010
API 9

Gingerbread 2.3.x

2011
API 11

Honeycomb 3.x

Ice Cream Sandwich 4.0.x

2011
API 14

Jelly Bean 4.1/4.2/4.3

2012
API 16

KitKat 4.4

2013
API 19

Lollipop 5.0

2014
API 21

Marshmallow 6.0

2015
API 23

Nougat 7.0

2015
API 24

Oreo 8.0

2017
API 26

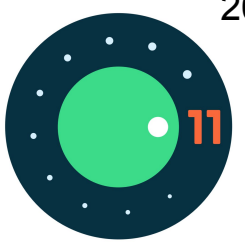
Pie 9.0

2018
API 28

2019 - API 29

Initially “Android Q”

No more desserts...

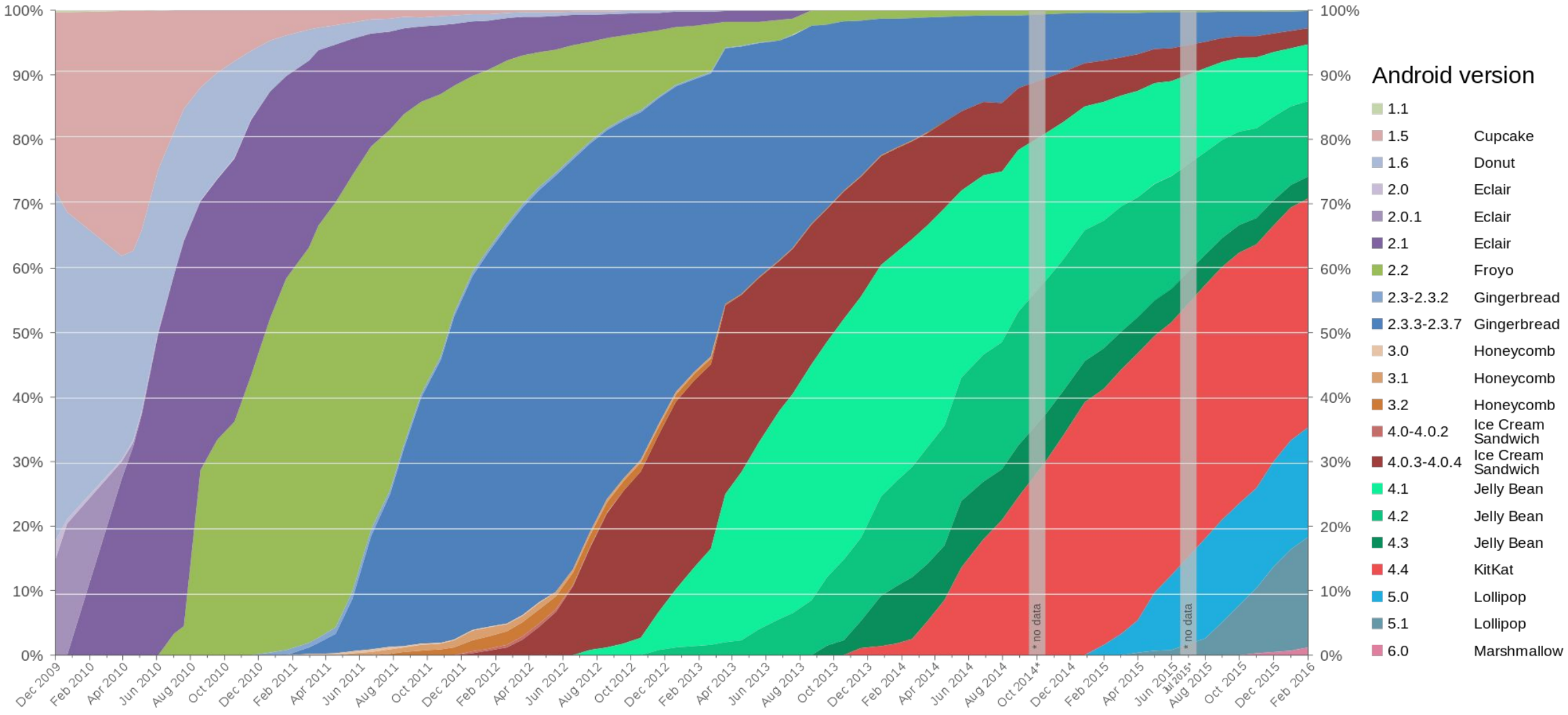


2020 - API 30

2021 - API 31
2022 - API 32

2023 - API 33
Tiramisu

Android: versions



Android … How?

1. The Android **Project**
2. Android **Architecture** and **Components**
3. Android Component: **Activities**
4. Android Component: **Intents**
5. Android **Resources** System
6. Android **Layout**: View and ViewGroups
7. Android **Event** Management Systems
8. Android **Data** Management
9. Android **Navigation**

Android … How?

10. Android **Network** Management System
11. Android and Google **Maps**
12. Android **ViewModel** and design patterns
13. Android **System** Services
14. Something about **Kotlin**
15. Something about **hybrid frameworks**

Android … How?

Textbook

Android: Guida per lo sviluppatore

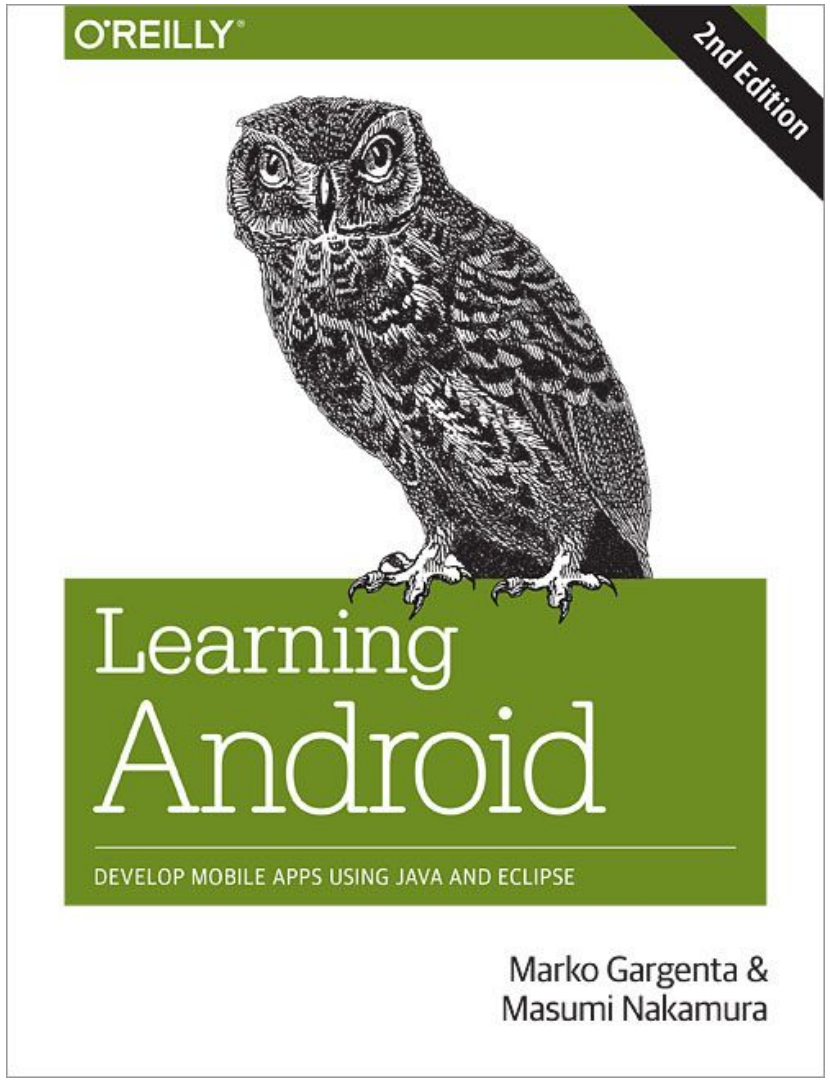
Author

Massimo Carli

Other resources:

- **Slides**
- **Online Tutorials**
- **Newsgroups**

Android … How?



Textbook

Learning Android (O'Reilly)

(outdated but a good reference...)

Author

Marko Gargenta & Masumi Nakamura

Other resources:

- **Slides**
- **Online Tutorials**
- **Newsgroups**

Android … How?

PRE-REQUISITIES:

- **Object-Oriented** Programming

We will use **Java** for Android applications coding.

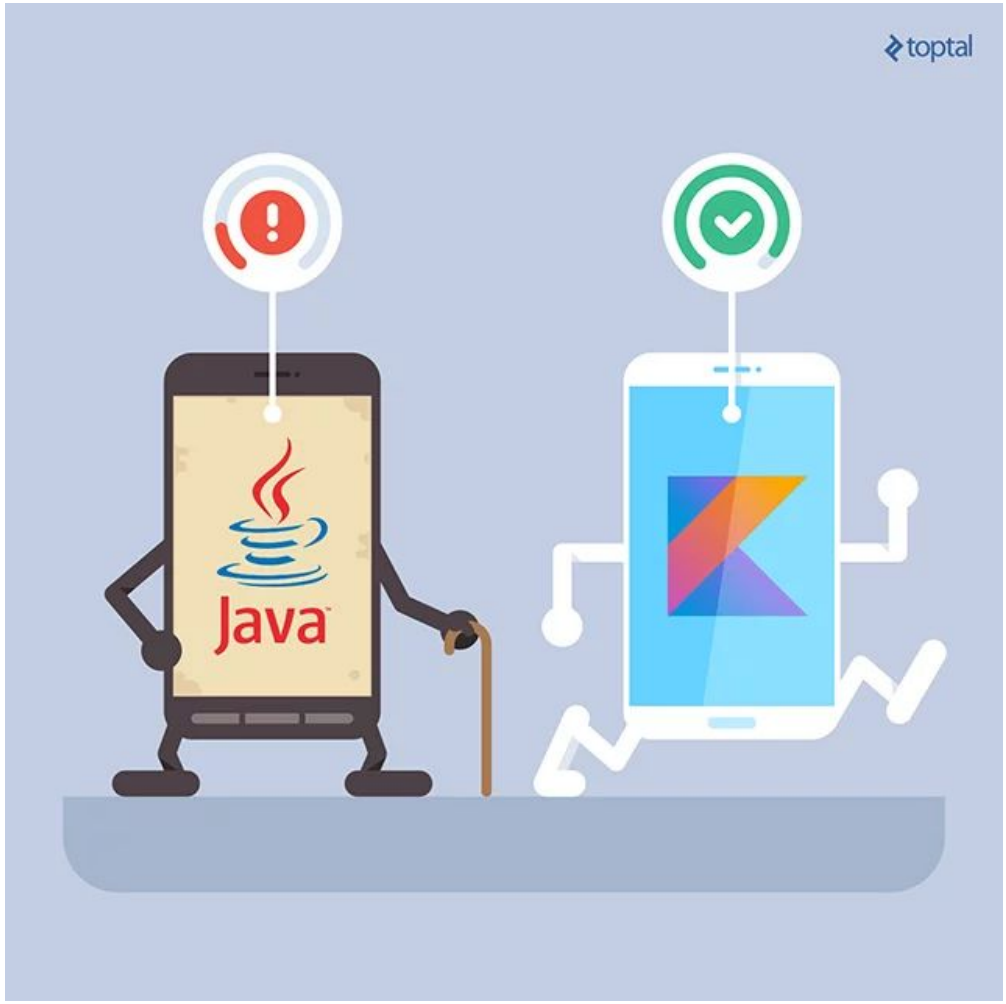
(other languages are used: Kotlin, Lua, Clojure, Kivy …)

This year we will also look into Kotlin!

- **XML** Essentials

(We will mix ***declarative*** and ***programmatic*** approaches, just like Web applications do)

Android … How?



Why Java?

It's been the official language for years and most supported until last year.

As for now, it's not the most used, Kotlin took over last year, however since we know Java we can focus on the Mobile Architecture.

Exam: Project and Oral Exam

- Exam is made of two parts: project and oral.
- Project can be delivered over the year in 6 deadlines: June, July, September, November, January, February.
- Can either follow the specification of the proposed project or propose your own, either way it's **individual** or, at most, for groups of **two**.
  - In the case of your own proposed project, obtaining a confirmation from me or the tutor is **compulsory**.
- The course is not valid for a certification (too short)
- Mixing thesis, project and/or internship (tirocinio)? **Talk to me first**. (see http://iot-prism-lab.nws.cs.unibo.it/proposals/)
- Want to develop in iOS, Angular, Flutter, React Native (etc. etc.)? Specifications are the same.

Exam: Project and Oral Exam (cont'd)

- Exam is made of two parts: project and oral.
- The physical exam has to be booked by the student through AlmaEsami (dates will be announced in advance).
- The oral is on both parts, therefore, do not prepare only the parts concerning your project as theoretical background is demanded.

Android … Contacts

WEBSITE

https://www.unibo.it/it/didattica/insegnamenti/insegnamento/2022/367016

General info about the course

federico.montori2@unibo.it

for meetings (always **upon appointment**), questions, thesis

luca.sciullo@unibo.it

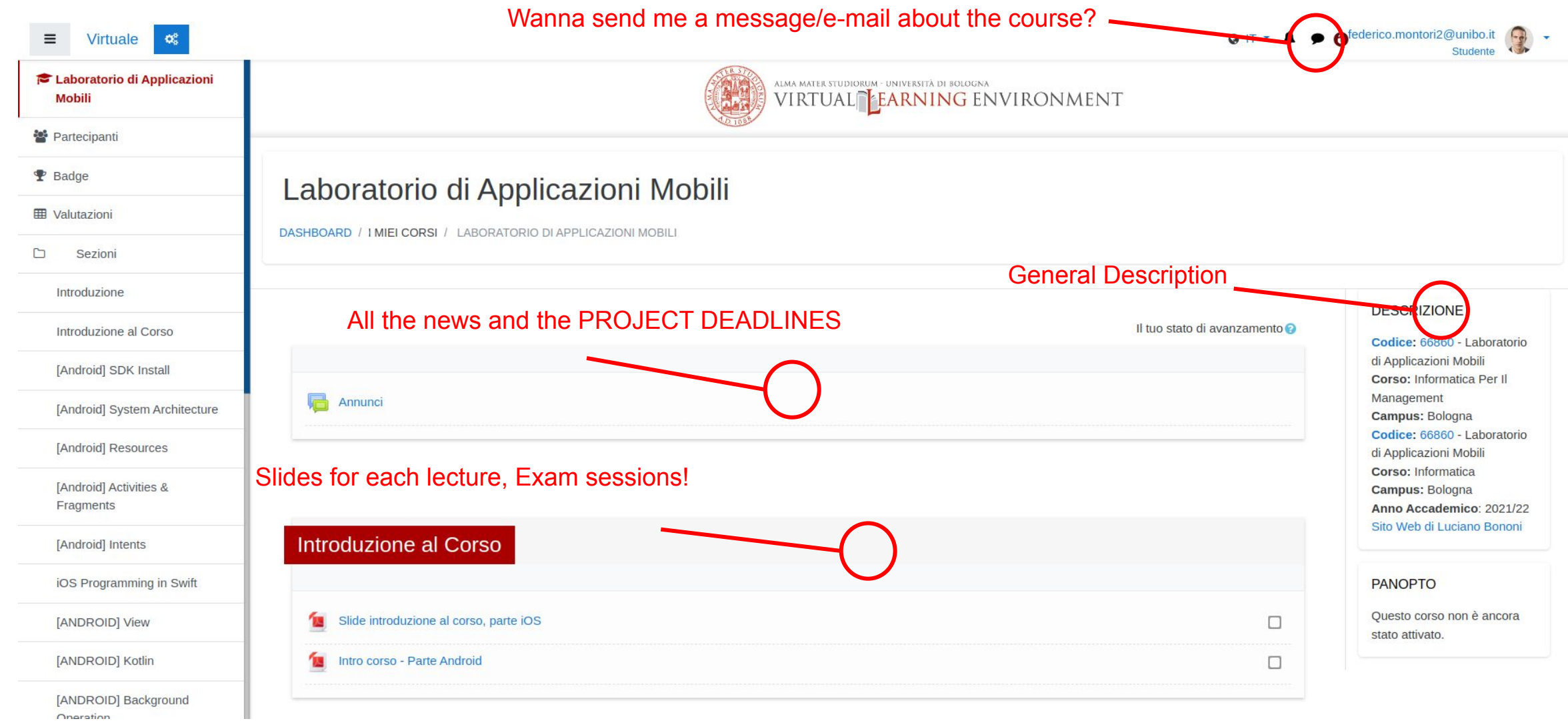
for questions about the projects

Android … Virtuale

WEBSITE

- Register at:
  - https://virtuale.unibo.it/
- Class URL
  - https://virtuale.unibo.it/course/view.php?id=38406
- Registration
  - Should be active automatically for your study plan
  - if not, register spontaneously using the pwd: **lamlamlam**

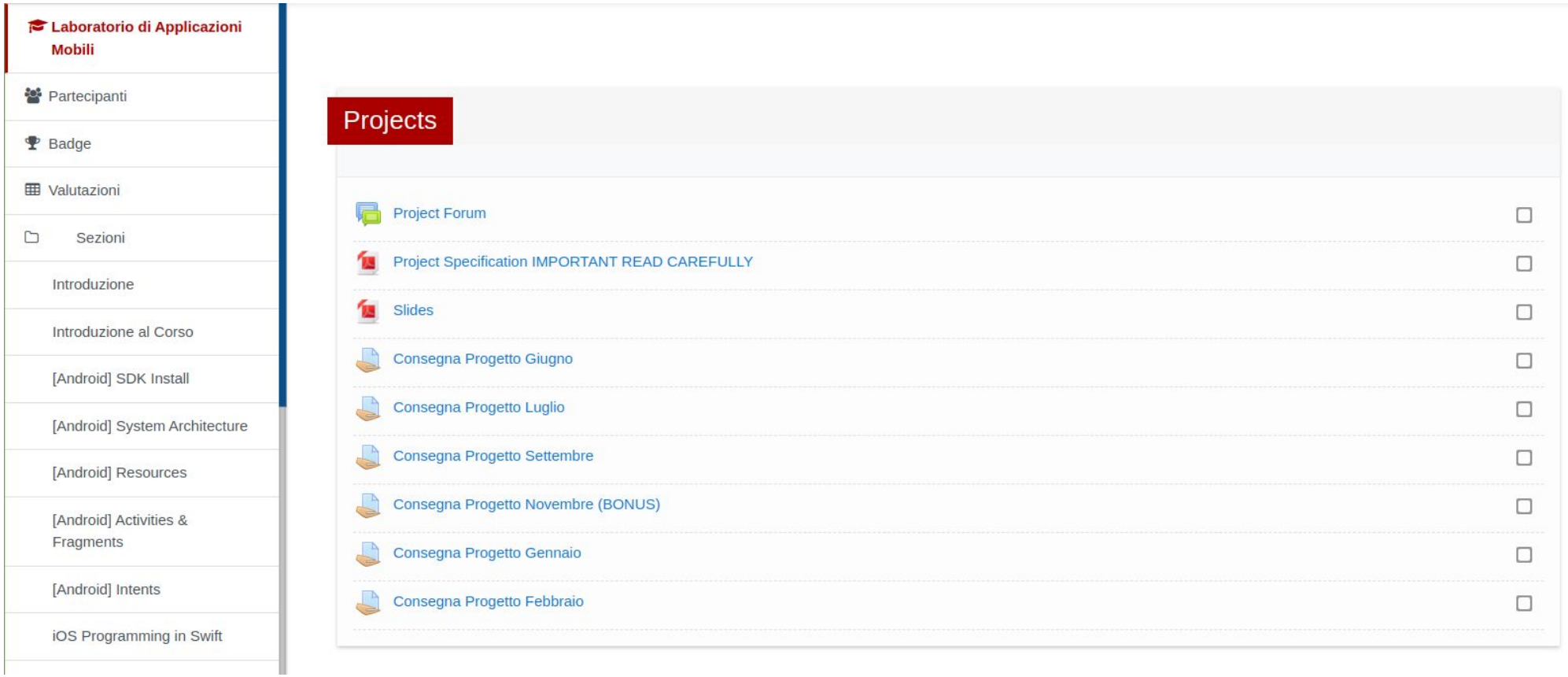
Android ... Virtuale



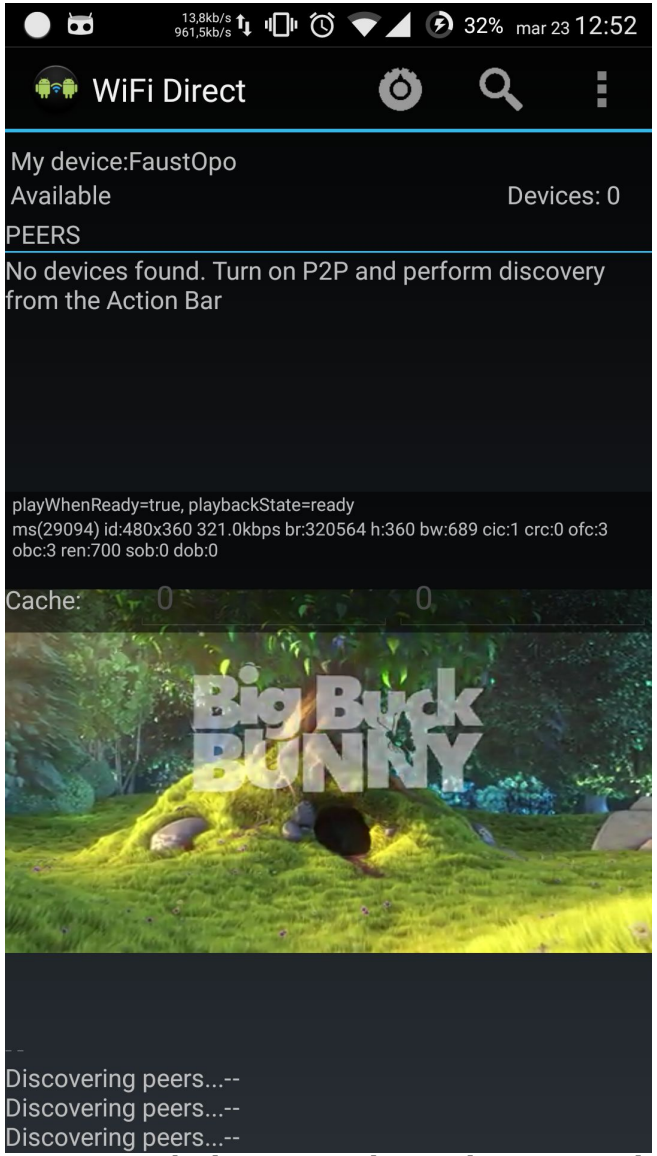
Android ... Virtuale

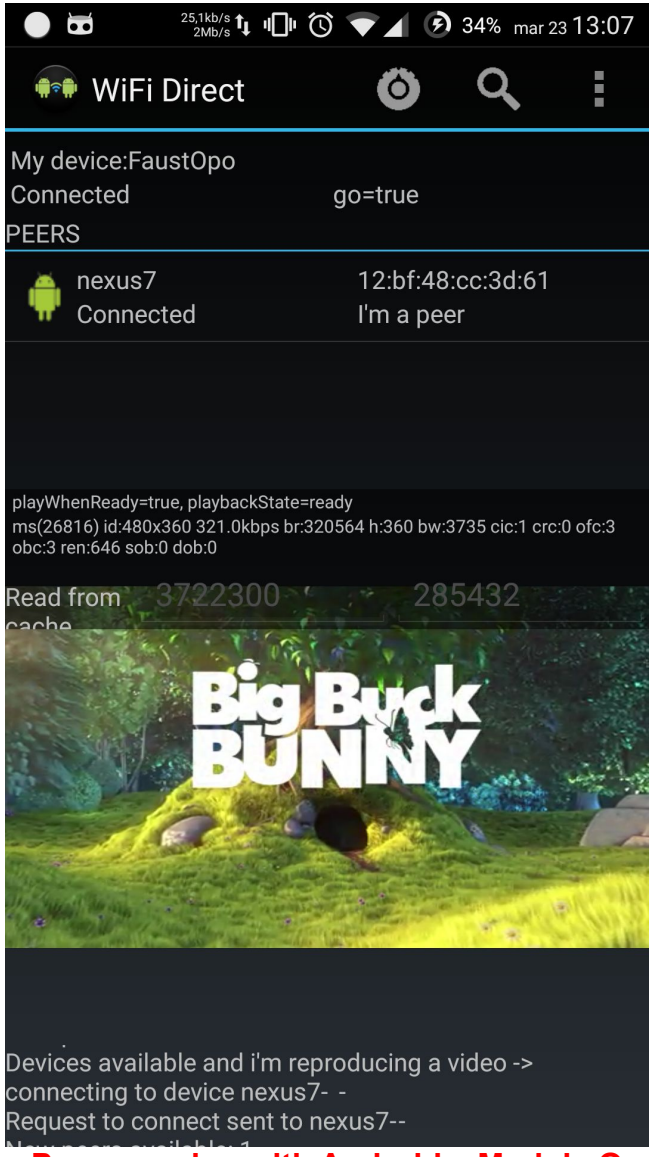
We will use Virtuale for the project delivery. There you will find the track and a place where to deliver your project.

- It is not active yet for this year, this is the one from last year



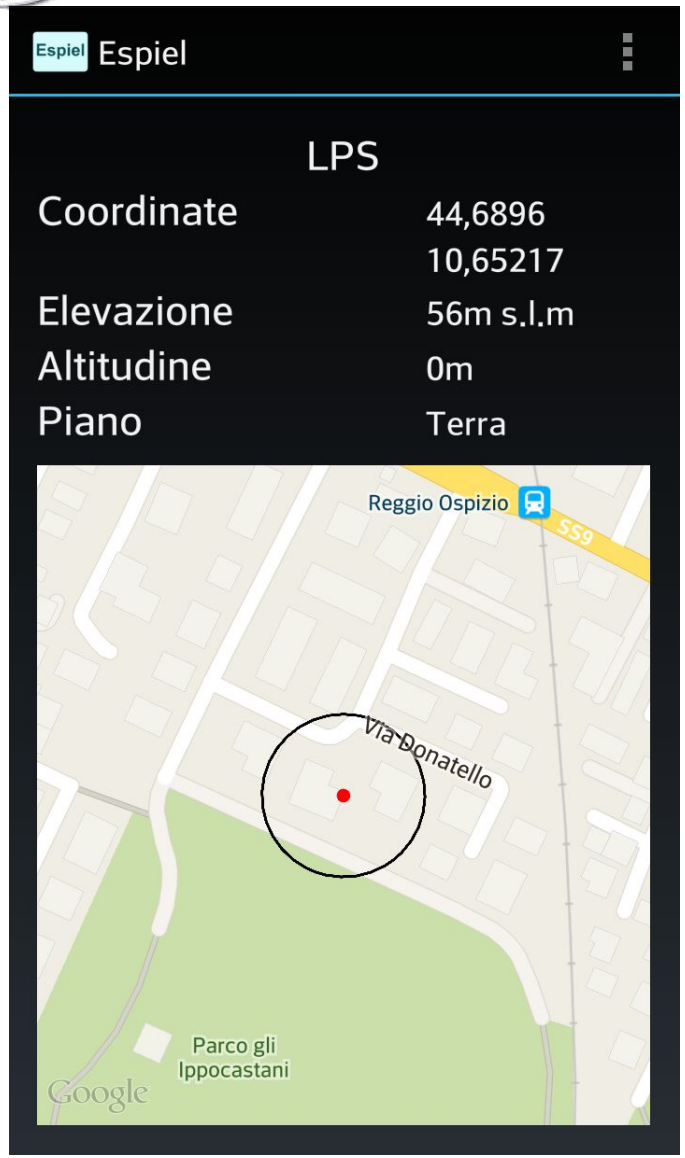
Students Projects

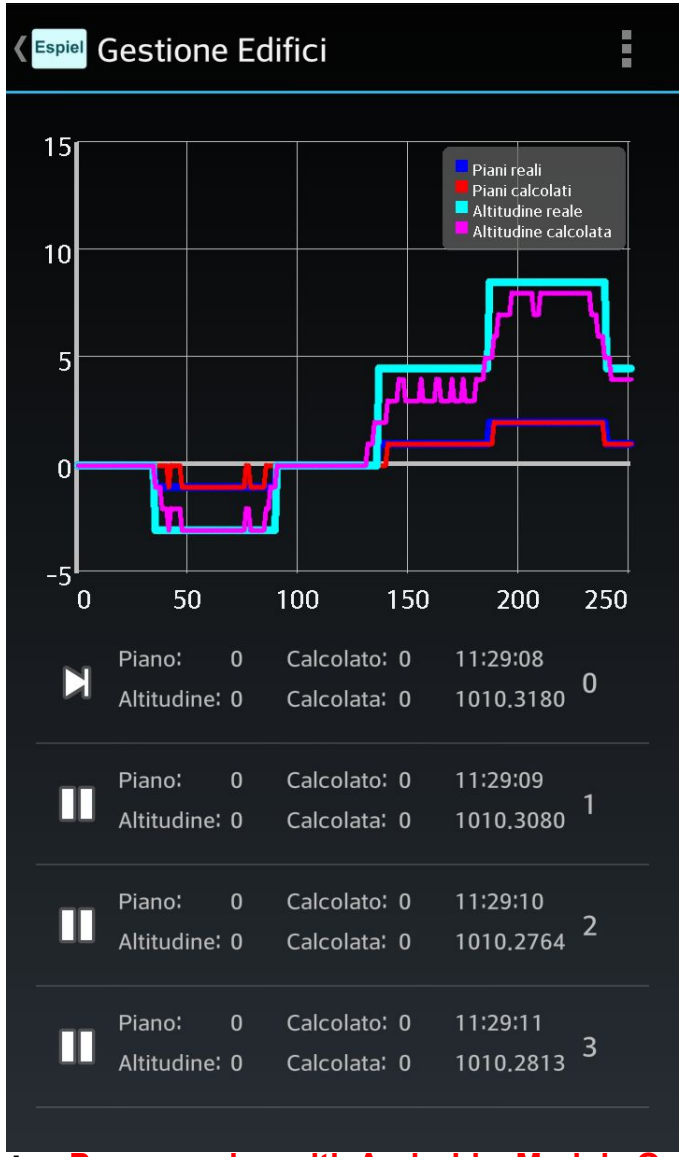




Fausto Di Natale
Collaborative Dynamic Adaptive Video Streaming

Students Projects



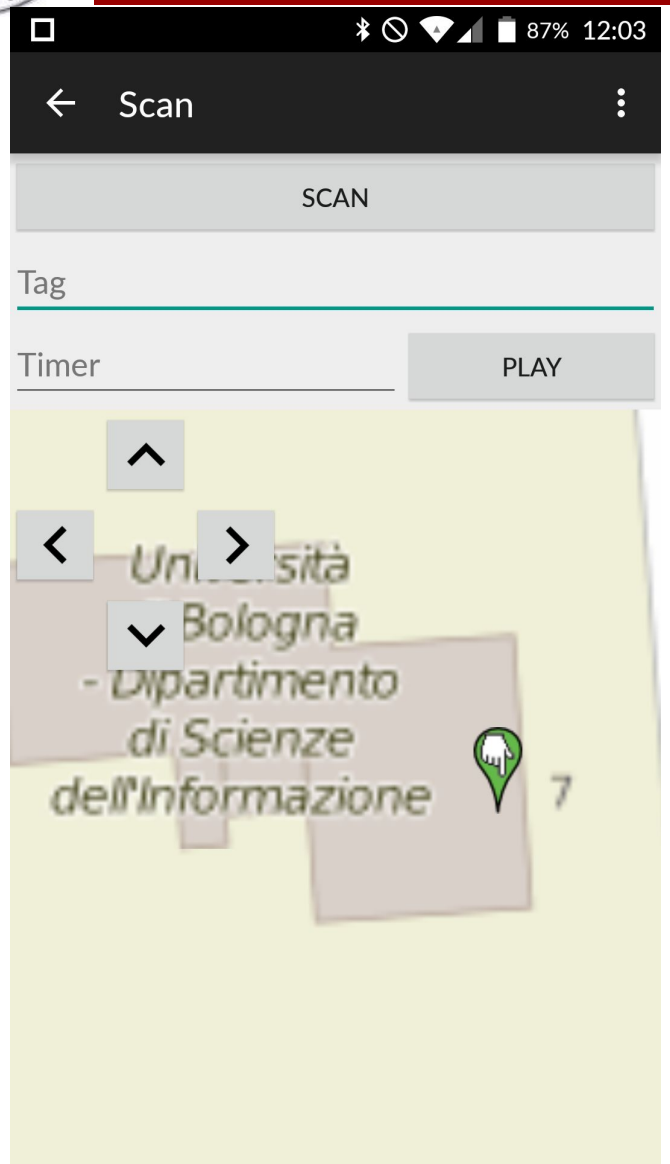


Fabio Franzoso

Espiel – Floor level recognition Using atmospheric pressure

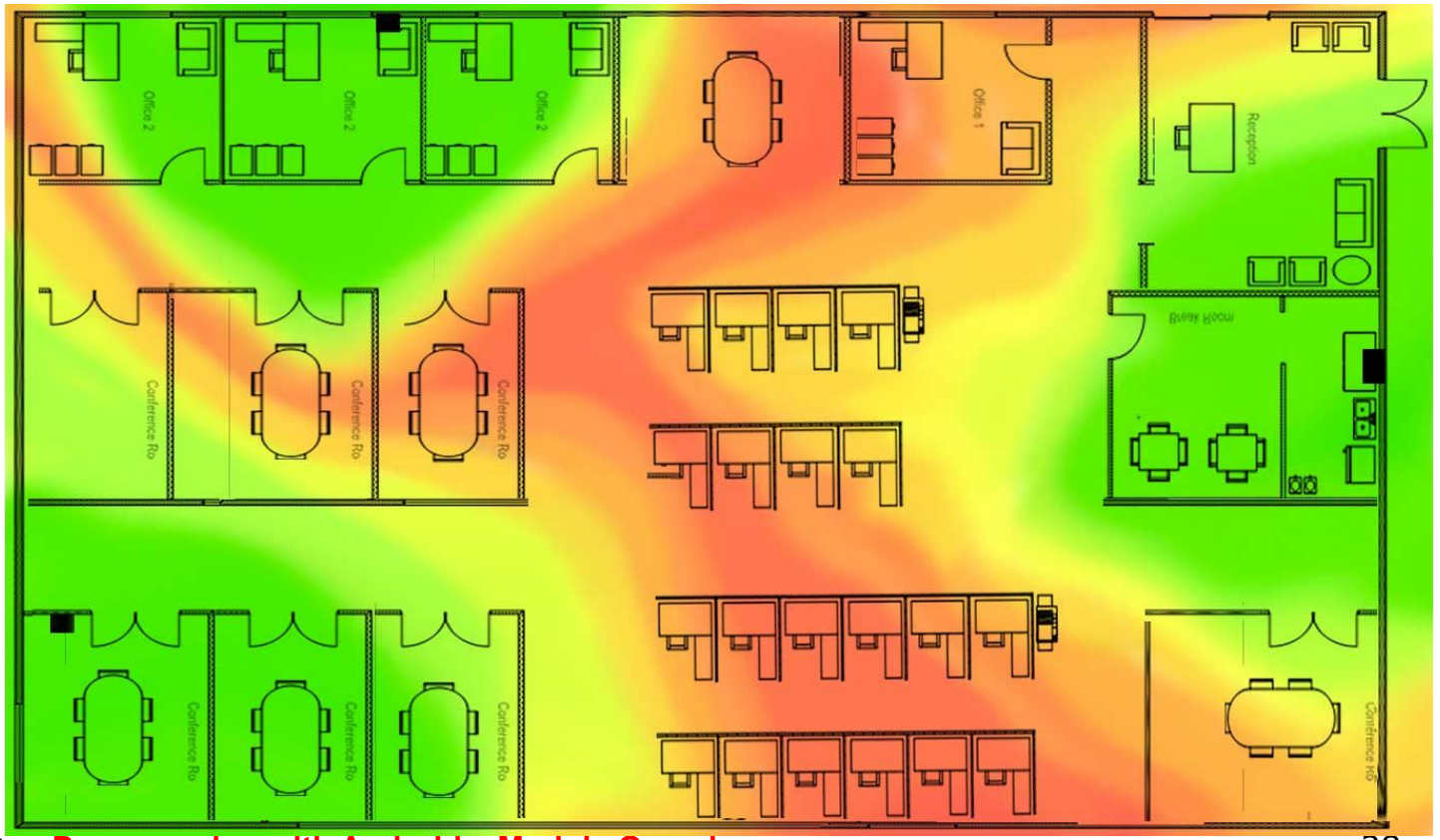
L. Bedogni, F. Franzoso, L. Bononi, “A Self-Adapting Algorithm based on Atmospheric Pressure to Localize Indoor Devices”, on Proceedings of the 2016 IEEE Global Communications Conference: Ad Hoc and Sensor Networks (Globecom 2016) December 4-8 2016, Washington DC, USA

Students Projects



Erik Minarini

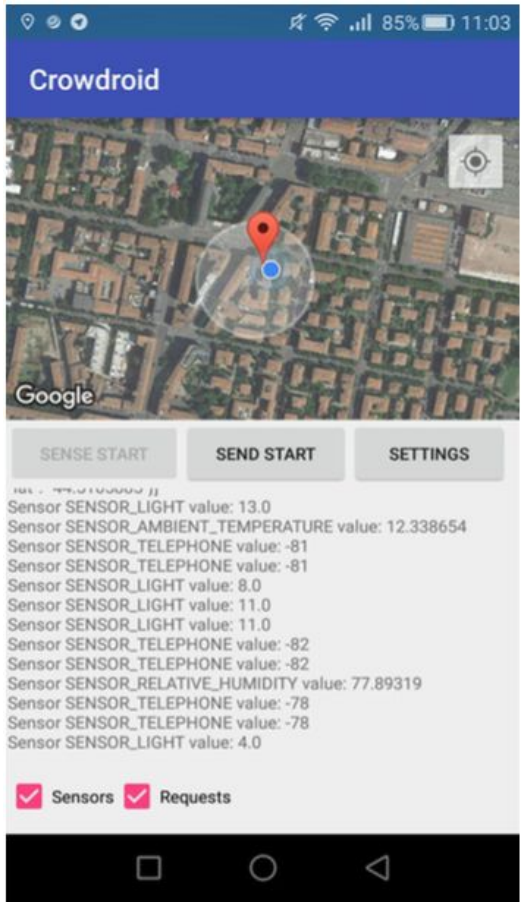
Heterogeneous indoor
Localization using WIFI
Fingerprints

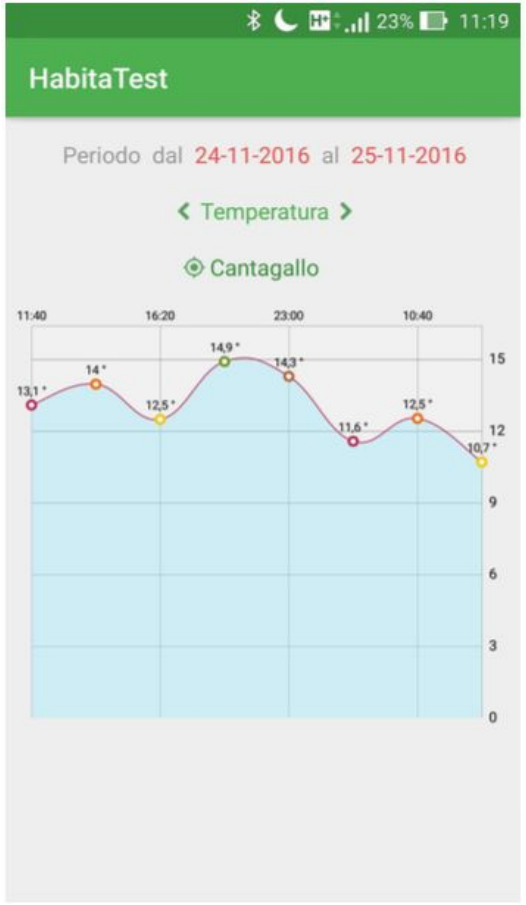


Students Projects

Alain Di Chiappari, Davide Crestini, Valentina Tosto, Gianluca Iselli

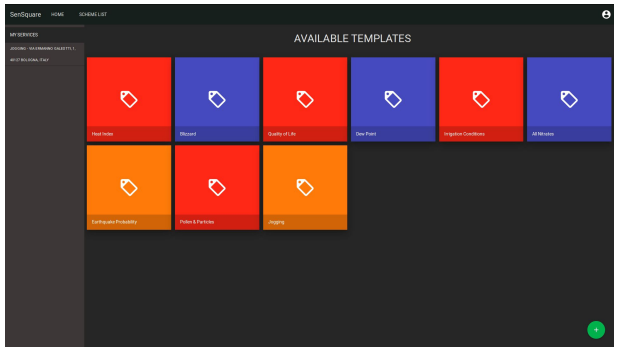
Sensquare, an heterogeneous platform for the IoT

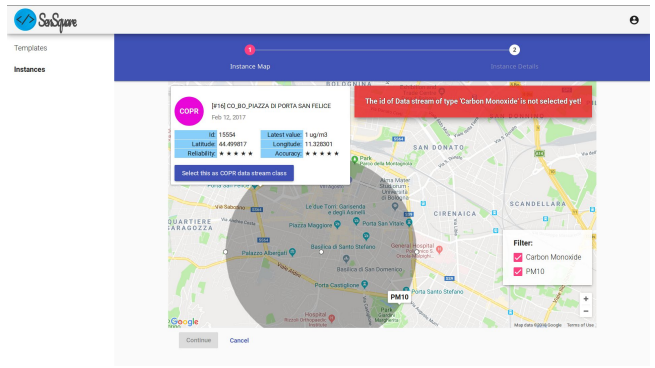




Montori, Federico; Bedogni, Luca; Iselli, Gianluca; Bononi, Luciano, Delivering IoT Smart Services through Collective Awareness, Mobile Crowdsensing and Open Data, In: 5th IEEE International Workshop on Pervasive Context-Aware Smart Cities and Intelligent Transport Systems (PerAwareCity 2020)

Montori, Federico; Bedogni, Luca; Di Chiappari, Alain; Bononi, Luciano, SenSquare: A mobile crowdsensing architecture for smart cities, in: IEEE 3rd World Forum on Internet of Things, WF-IoT, 2016, pp. 536 - 541

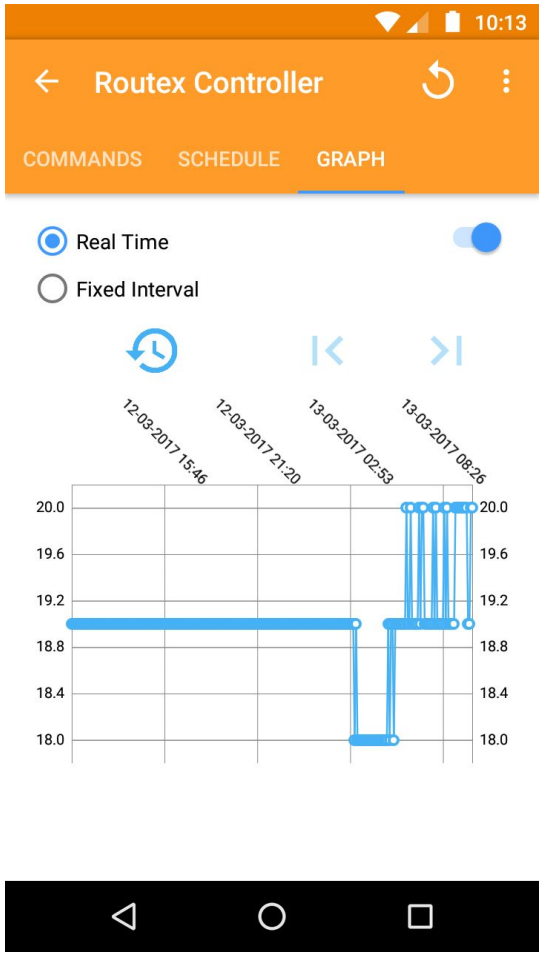


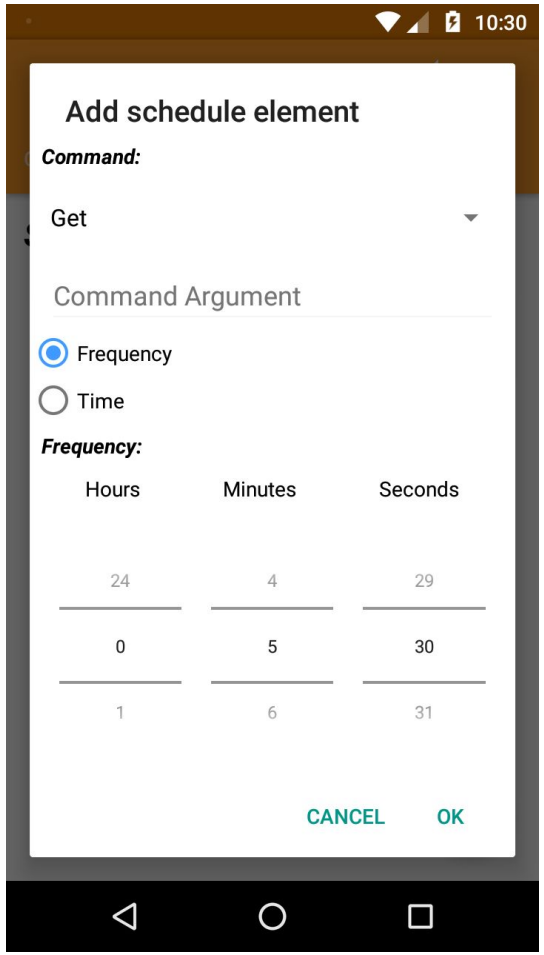


Students Projects

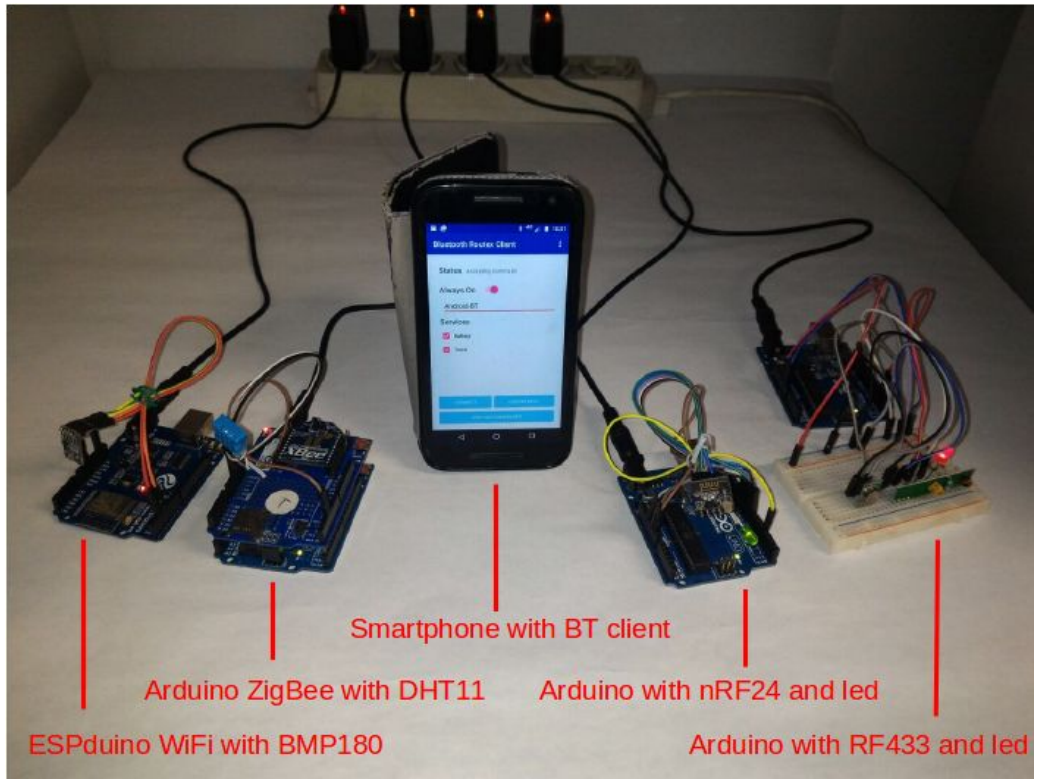
Filippo Morselli

Routex, a service-oriented multi-platform gateway for the IoT





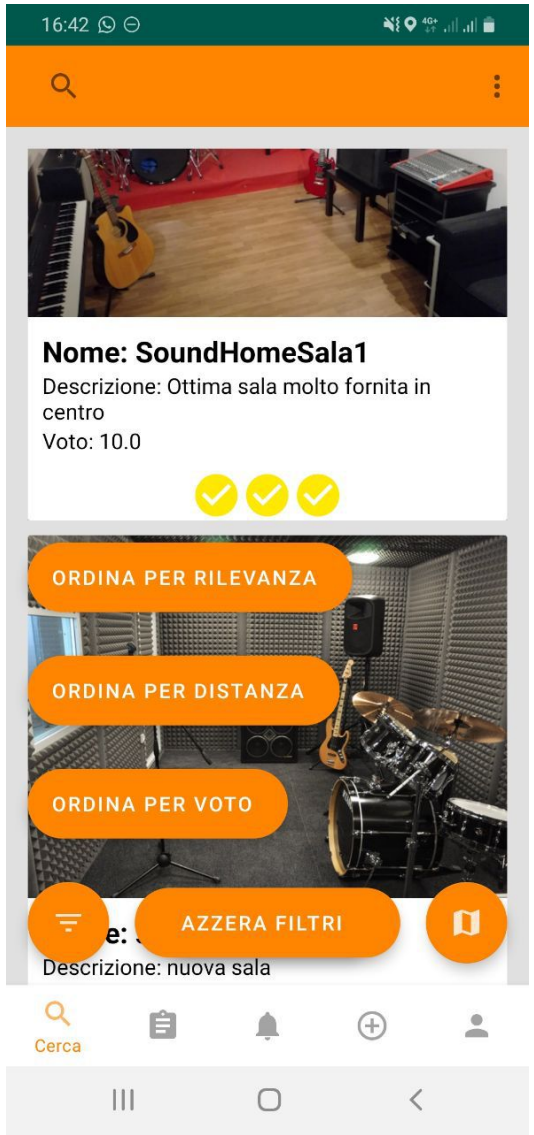
Montori, Federico; Bedogni, Luca; Morselli, Filippo; Bononi, Luciano, Achieving IoT Interoperability through a Service Oriented In-Home Appliance. In: Proceedings of GLOBECOM 2017.



Students Projects

Matteo Tancredi

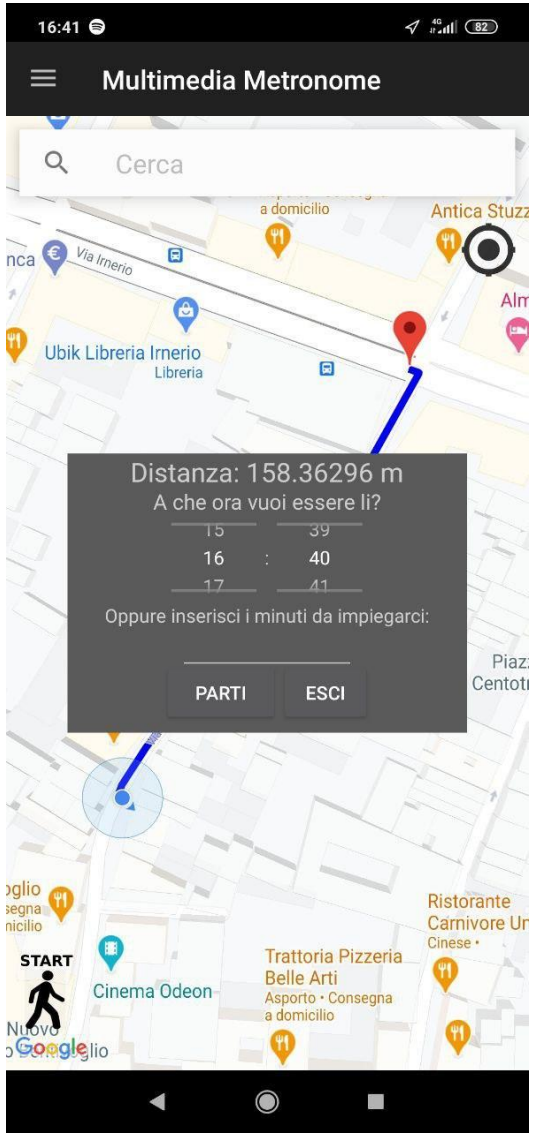
ReHo: a sharing economy app for booking rehearsal rooms and meeting other musicians.

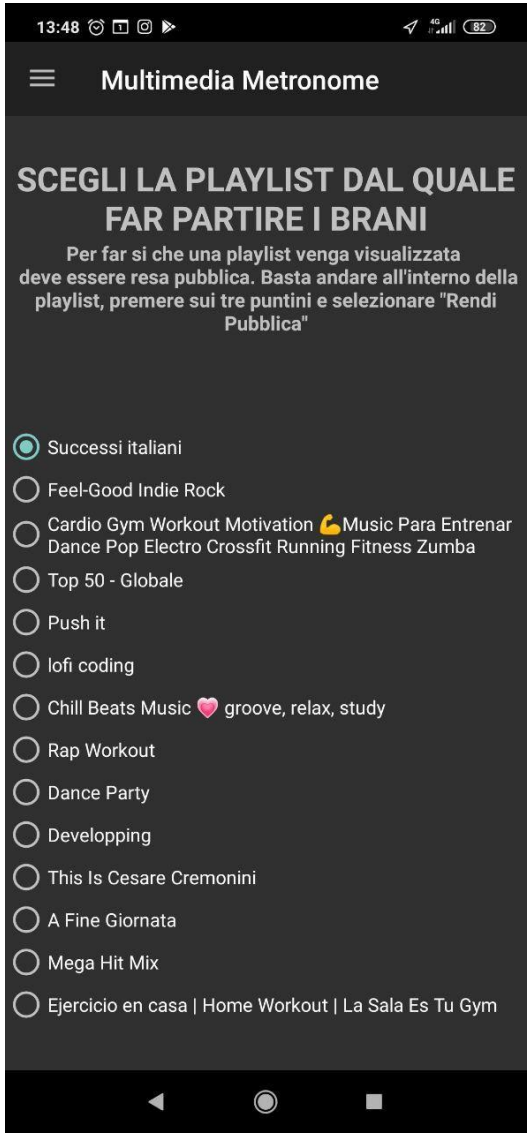


Students Projects

Emanuele Fazzini

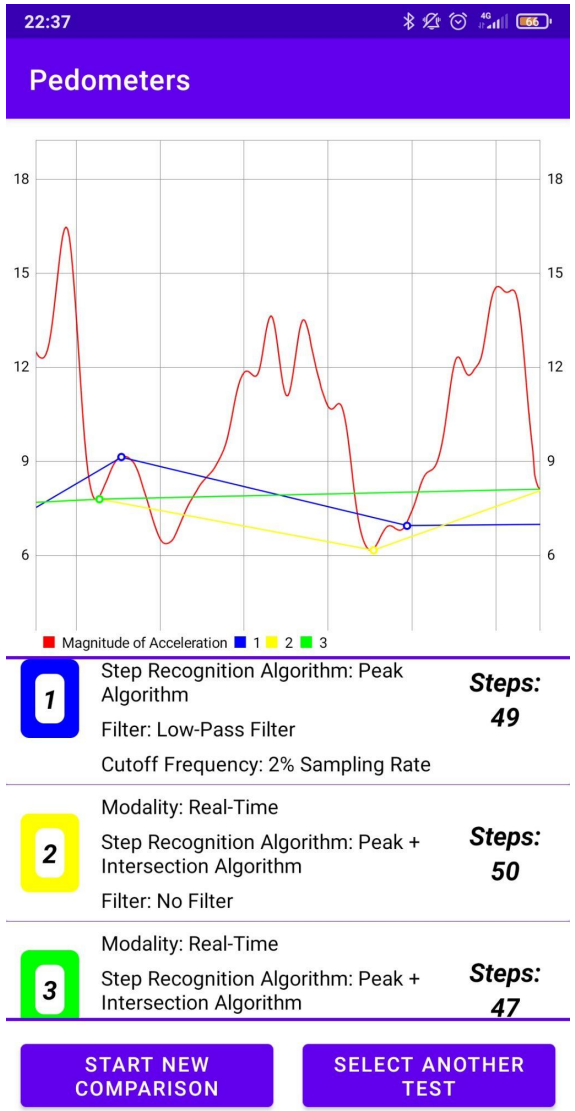
BPMWalker: an adaptive app to guide the user's walking pace through the beat





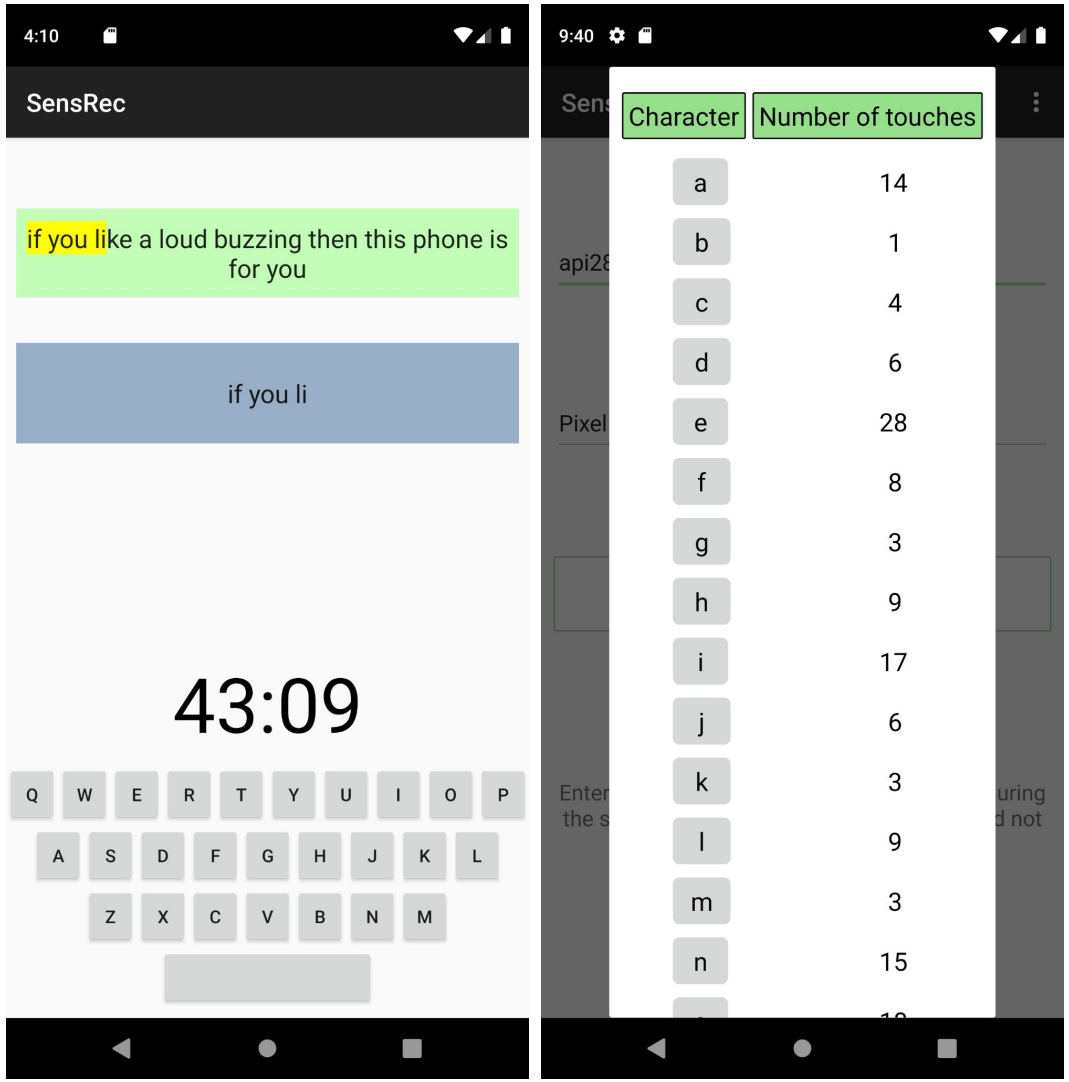
Students Projects

Giacomo Neri
Implementation of several pedometer algorithms and their real-time comparison.



Students Projects

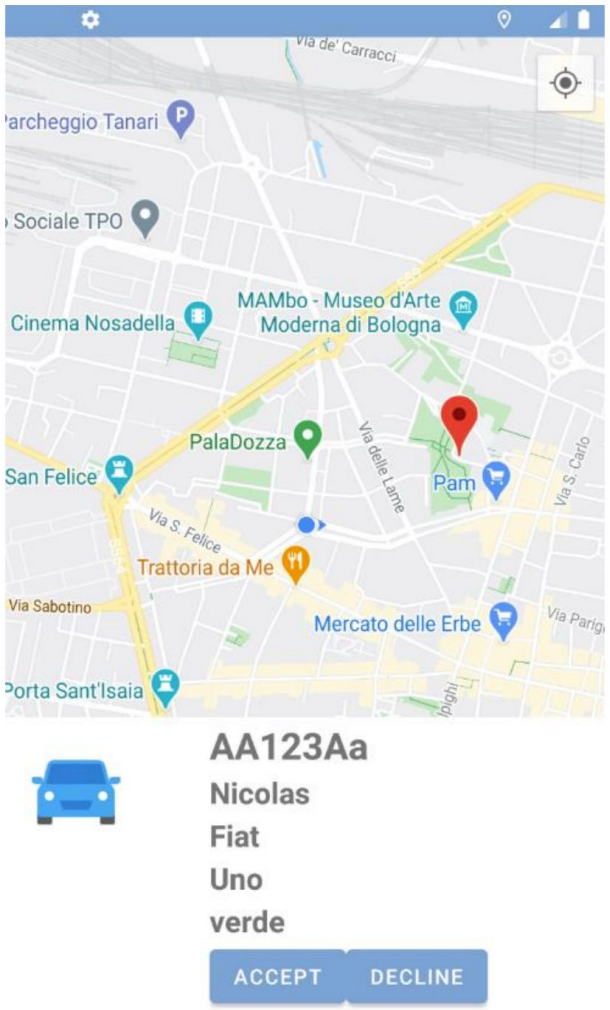
Giulio Augello
Keylogging of human touches through inertial sensors.

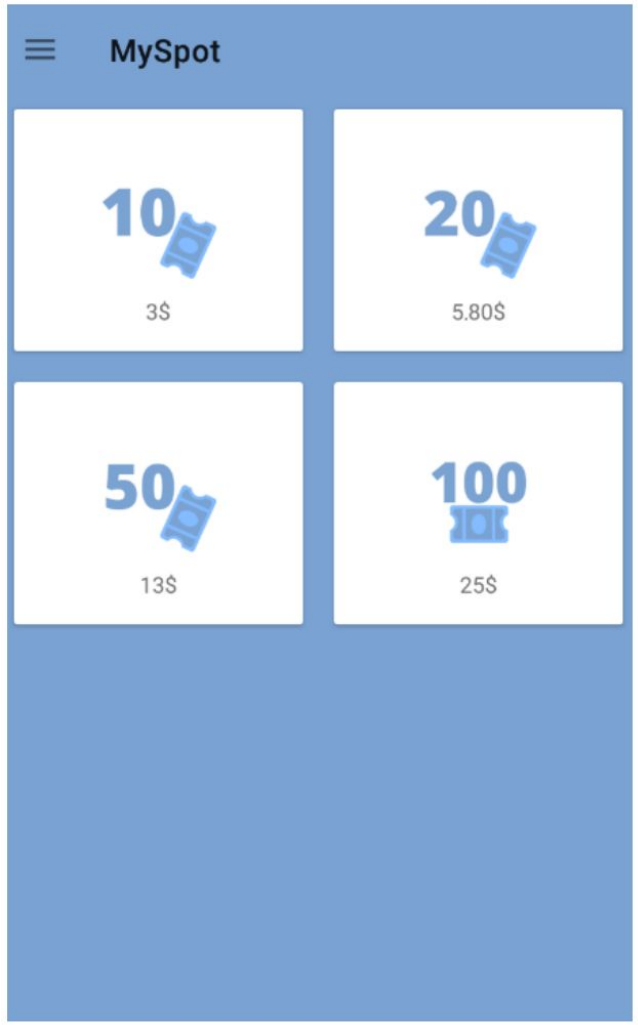


Students Projects

Qazim Mucodema

MySpot: an app for the exchange of parking spots

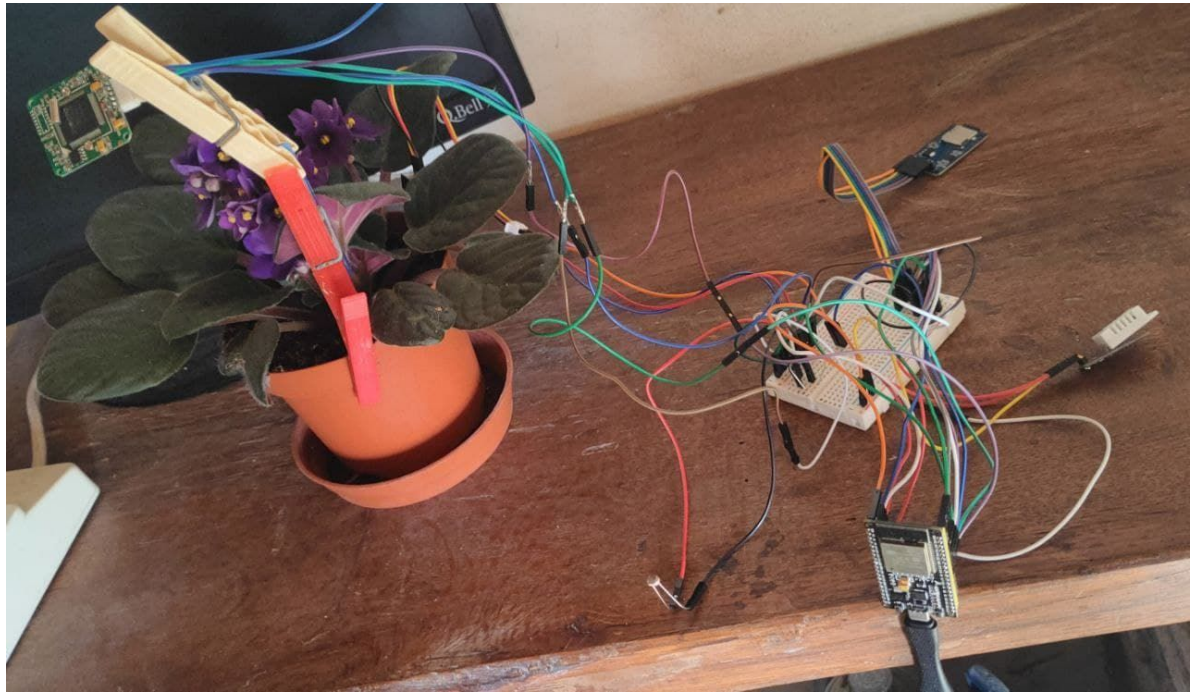


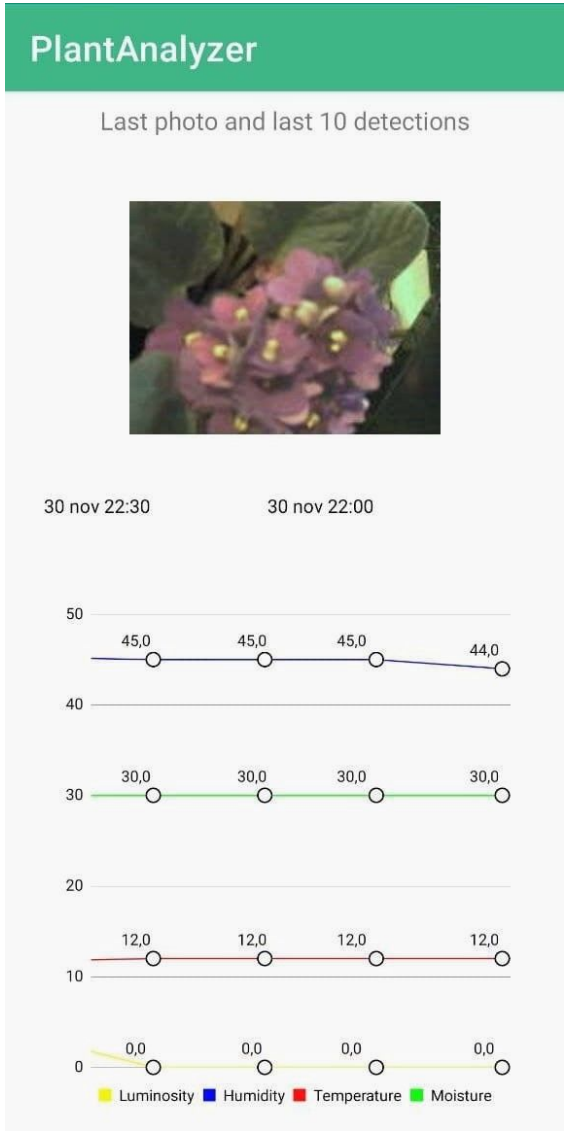


Students Projects

Federico De Giorgio

PlantANalyzer, an app for monitoring plants





Students Proje

Sofia Tortolini

GiftFits, a social network for exchanging gifts and suggestions