



SAPIENZA  
UNIVERSITÀ DI ROMA

# Introduction to wireless systems

Wireless Systems & Advanced Topics in Networking

a.a. 2013/2014

Un. of Rome "La Sapienza"

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<sup>†</sup> *Department of Computer Science – University of Rome "Sapienza" – Italy*



- *Prof.ssa Chiara Petrioli*
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- E-mail: [petrioli@di.uniroma1.it](mailto:petrioli@di.uniroma1.it)
- What I do:



- Director of the Sensor Networks and Embedded Systems laboratory (SENSES lab); Coordinator of the Cyber Physical System lab of "La Sapienza" center for Cyber Intelligence and Information Security. Member of "La Sapienza" spinoff committee.
  - Founding partner of "La Sapienza" spinoff WSENSE S.r.l.
  - Research interests: design and optimization of wireless, embedded and cyber physical systems; design of solutions for the Future Internet. Over a hundred papers published in international journals and conferences (h-index 25, i-10 index: 50, over 2650 citations).
  - International activities: Member of the steering committee of ACM SenSys, program co-chair of IEEE INFOCOM 2016, general chair of ACM SenSys 2013. She has been member of the steering committee and associate editor of IEEE Transactions on Mobile Computing, associate editor of IEEE Transactions on Vehicular Technology, member of the executive committee of ACM SIGMOBILE, and has been program co-chair of leading conferences in the field such as ACM MobiCom and IEEE SECON.
  - Research Projects: PI of over twenty national and international research projects. Coordinator of two EC projects (FP7 projects GENESI and SUNRISE).
  - Regularly serves as reviewer for the European Commission and other international research funding institutions.
- SENSES lab web page: [http://reti.dsi.uniroma1.it/SENSES\\_lab/index.html](http://reti.dsi.uniroma1.it/SENSES_lab/index.html)
  - Web page : <http://twiki.di.uniroma1.it> → laurea magistrale → sistemi wireless
  - Orario di ricevimento/office hours:
    - Send me an email to agree on a schedule (fast answer) +
    - After the class



Students



Career Aspirations



Background



Status



Interests

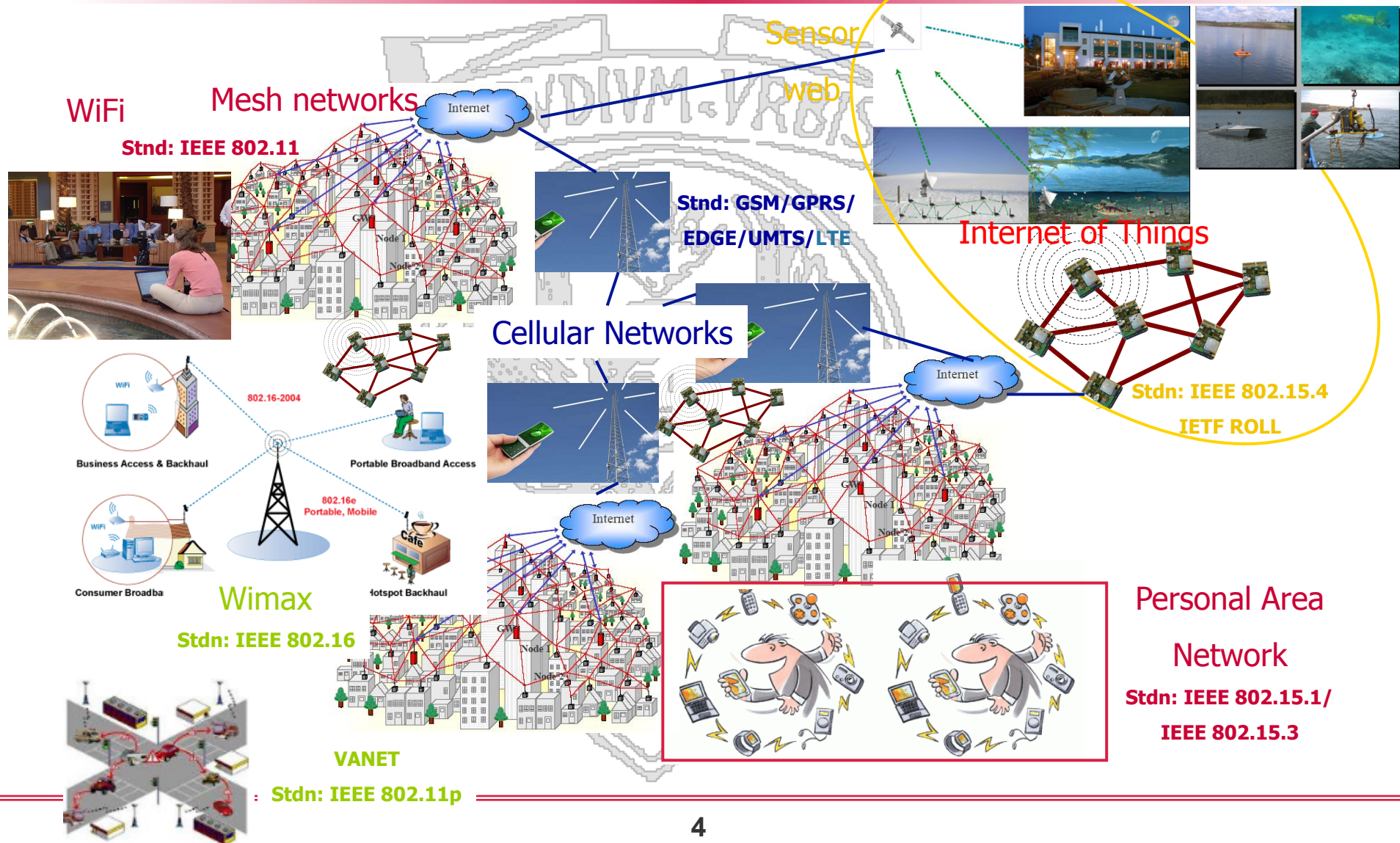




# What we will do

## Why a class on wireless systems?

Wireless systems are becoming the usual way to connect to the Internet, and communicate...





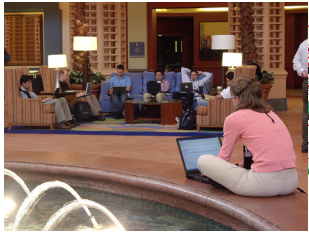
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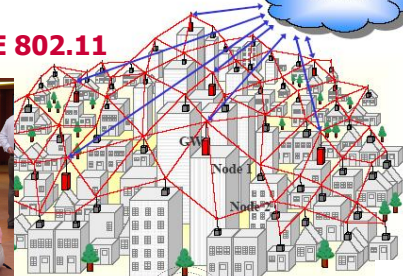
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WiFi

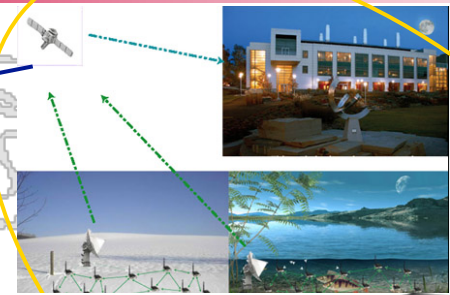
Std: IEEE 802.11



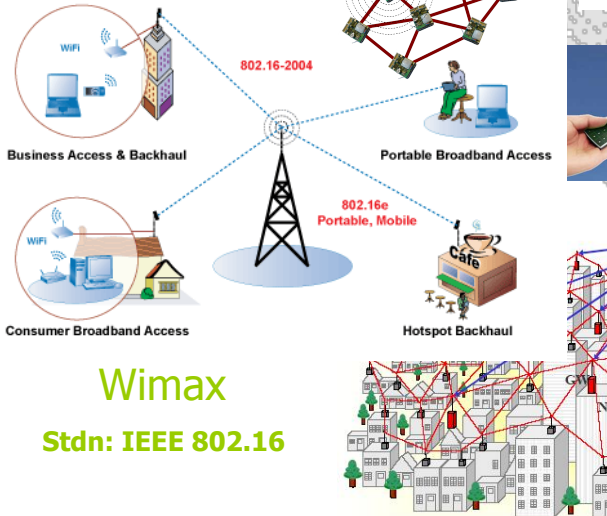
Mesh networks



Std: GSM/GPRS/

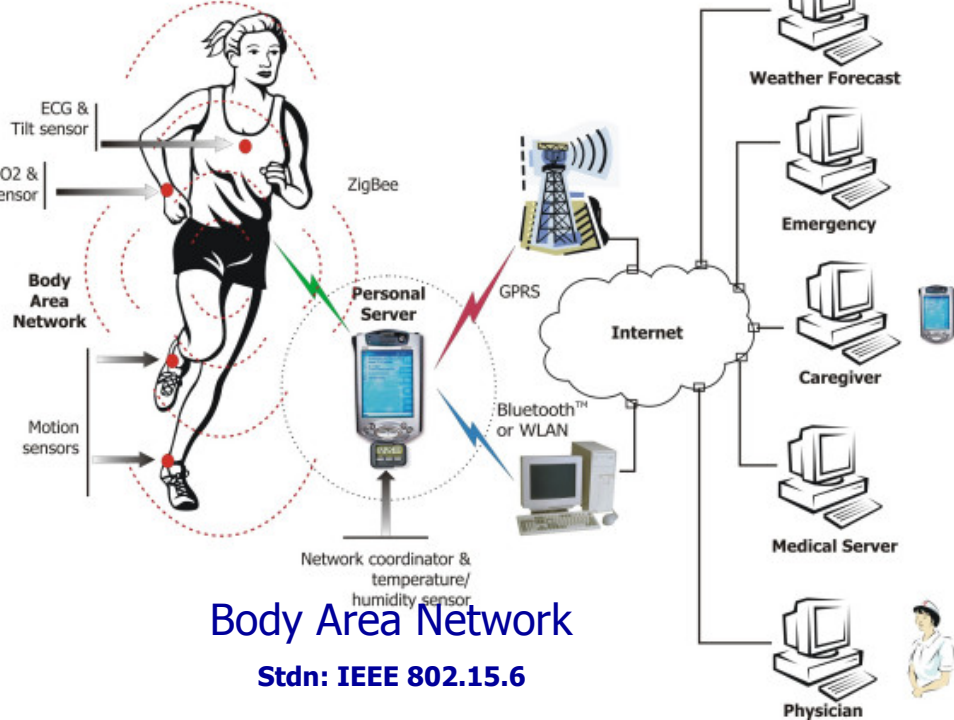


Sensor web



Wimax

Std: IEEE 802.16



Body Area Network

Std: IEEE 802.15.6

2.15.4





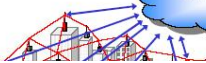
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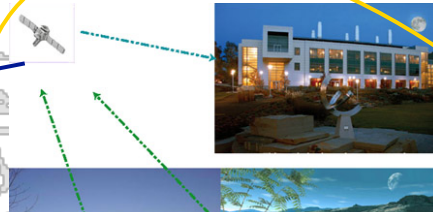
WiFi

Std: IEEE 802.11

Mesh networks



SENDORA project



Sensor web



## UNITED STATES FREQUENCY ALLOCATIONS THE RADIO SPECTRUM

**RADIO SERVICES-COLOR LEGEND**

Mobile Services	Land Mobile Services	Fixed Services
Mobile Satellite Services	Land Mobile Satellite Services	Fixed Satellite Services
Mobile Earth Station Services	Land Mobile Earth Station Services	Fixed Earth Station Services
Mobile Earth Station Satellite Services	Land Mobile Earth Station Satellite Services	Fixed Earth Station Satellite Services
Mobile Earth Station Mobile Services	Land Mobile Earth Station Mobile Services	Fixed Earth Station Mobile Services
Mobile Earth Station Land Mobile Services	Land Mobile Earth Station Land Mobile Services	Fixed Earth Station Land Mobile Services
Mobile Earth Station Fixed Services	Land Mobile Earth Station Fixed Services	Fixed Earth Station Fixed Services
Mobile Earth Station Mobile Satellite Services	Land Mobile Earth Station Mobile Satellite Services	Fixed Earth Station Mobile Satellite Services
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Mobile Earth Station Fixed Satellite Earth Station Services	Land Mobile Earth Station Fixed Satellite Earth Station Services	Fixed Earth Station Fixed Satellite Earth Station Services

**ACTIVITY CODE**

A	Administrative	B	Business
C	Commercial	D	Defense
E	Emergency	F	Federal Government
G	Government	H	Health
I	Industrial	J	Joint
K	Local Government	L	Local
M	Maritime	N	National
O	Other	P	Public
Q	Quasi-Military	R	Radio
S	State	T	Technical
U	Utility	V	Video
W	Wireless	X	Experimental
Y	Yacht	Z	Zone

**ALLOCATION USAGE DESIGNATION**

Primary, Secondary, Shared, etc.

U.S. DEPARTMENT OF COMMERCE  
National Telecommunications and Information Administration  
November 2008



Cognitive networks



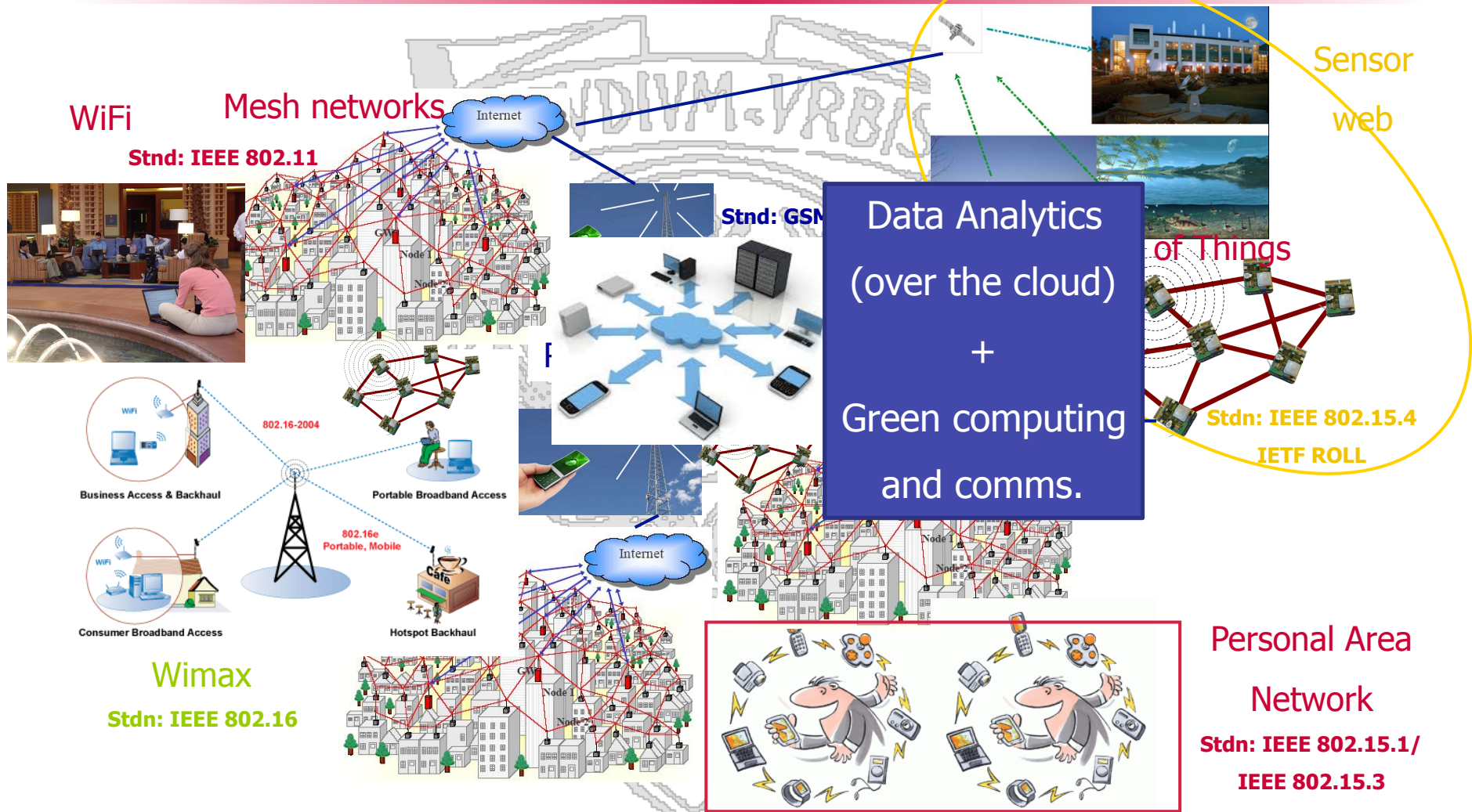
Std: IEEE 802.15.1/  
IEEE 802.15.3



# What we will do

## Why a class on wireless systems?

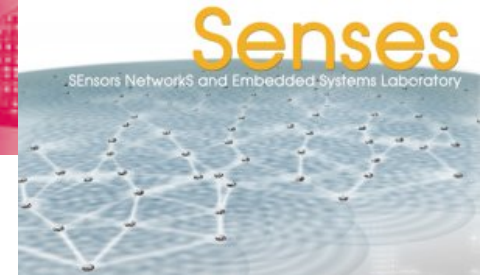
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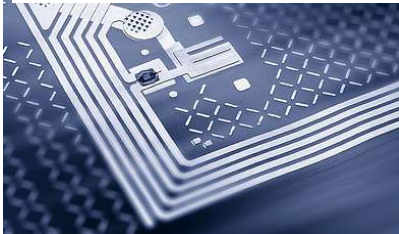




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### CHIRON project



RFID Anticollision Protocols



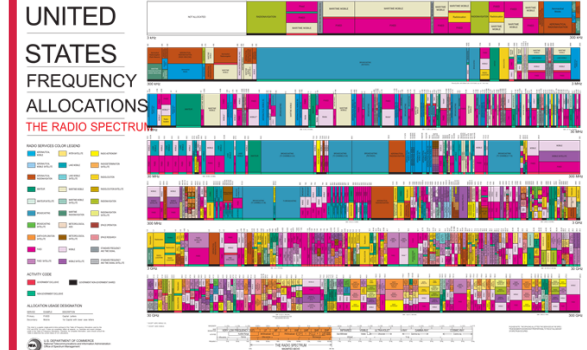
### GENESI Project



Green sensing systems



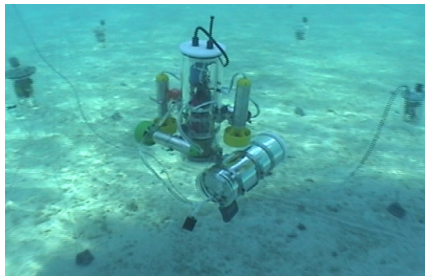
### SENDORA project



Cognitive networks



### CLAM Project; SUNRISE project



Underwater Monitoring systems



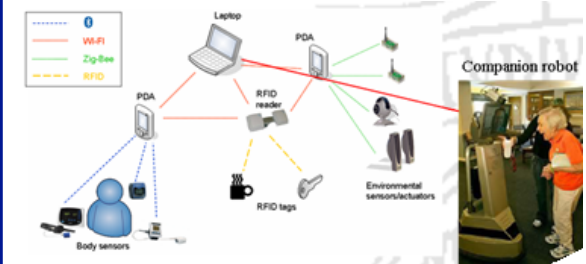
### TROPIC Project



Cloud Computing

LTE Advanced

### CHIRON project



Assisted living

WSN security







Aim of the course is to teach how to design, analyse and implement novel wireless systems and how to optimize existing mobile and wireless technologies.

- The objective is achieved in our curricula by attending two classes
  - Wireless systems
  - Advanced Topics in Networking
- That together
  - Discuss main wireless technologies
  - Describe key open problems and challenges faced by the scientific community, stimulating problem solving abilities in the area
  - Introduce methodologies used to design, evaluate and test solutions for mobile and wireless systems
    - Analytical models
    - Network simulations
    - Embedded programming and real life tests



# Reti Avanzate

Advanced Topics in Networking

# Sistemi Wireless

Wireless Systems

## Mobile systems:

- Mobile cellular systems (including LTE-A future evolutions).
  - How to reduce energy consumption and electromagnetic interference.
- WiFi and extensions (e.g., mesh Networks)
- Cognitive networks and dynamic spectrum allocation.

## Wired networks:

- Optimization of computing and communications: CDN and resource allocation in the Cloud;
- Green data centers and IP communication.

Methodologies: optimization/analytical tools.

- Main Focus on Embedded Systems
  - Introduction to wireless systems;
  - Ad Hoc Networks;
  - Internet of Things technologies: standards, cutting edge technologies and solutions (Including energy harvesting low power comms);
  - Embedded device programming (lab);
  - Underwater monitoring systems;
  - RFID
  - Smart grid
  - VANET
  - Crowd sensing.
- Methodologies:
  - Simulations;
  - Implementation and real life testing;
  - Implementazione di protocolli su sistemi embedded

SENSES lab seminars +

Projects within SENSES





# Reti Avanzate

Advanced Topics in Networking

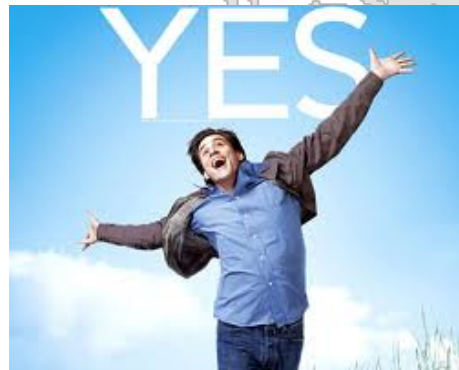
# Sistemi Wireless

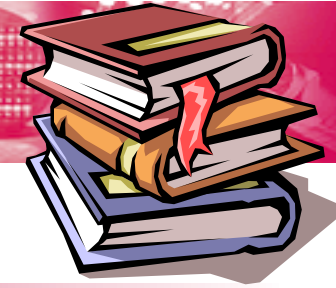
Wireless Systems

Why is it listed with both names this year?

Can I attend?

Can I do the exam?





- Book chapters, papers, slides, notes of the class
- Methodology, per topic
  - Background
  - Seminars of advanced topics on wireless systems
    - Brief introductions
    - Discussion of some key recent results in the area
    - Laboratory (embedded programming, focusing on 'green' sensing systems)
  - Exam:
    - Full written test+ oral (poster) presentation
    - Short written test+project





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## *College experience*



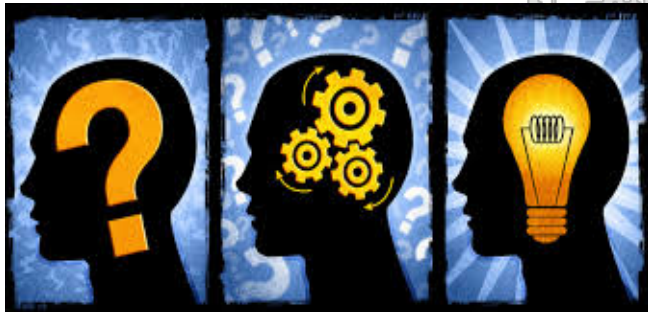
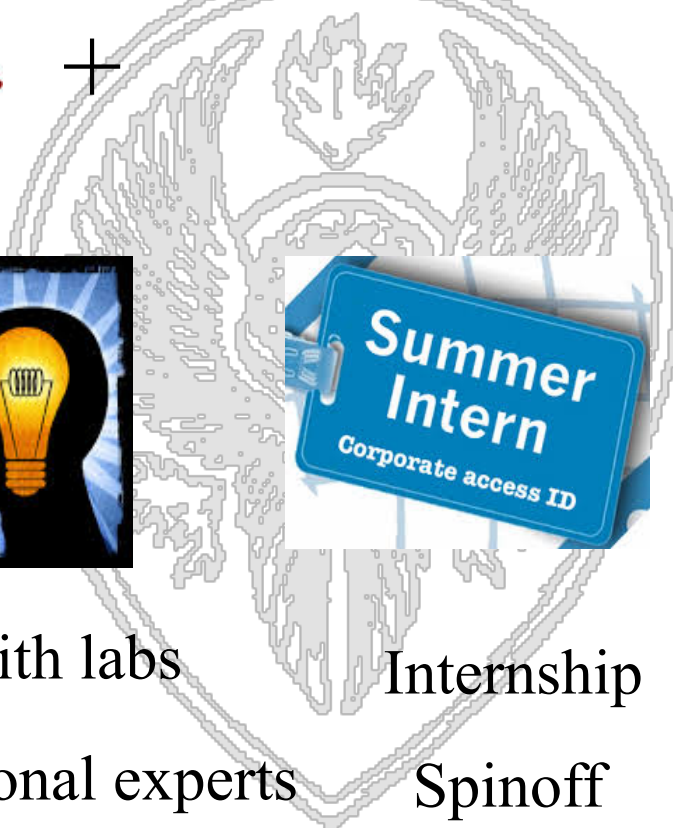


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# College experience



+



Collaboration with labs

Internship

Seminars of international experts

Spinoff





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## College experience



Internet&Networoking seminars

ACM SenSys 2013

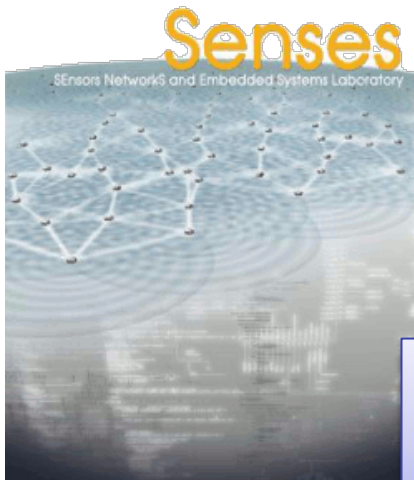
Nov 11-15, 2013 Rome, Italy



Grants to attend the conference

GRANTS

Contact me AT [cpetrioli@gmail.it](mailto:cpetrioli@gmail.it)



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CYBER INTELLIGENCE AND INFORMATION SECURITY

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