Introduction to wireless systems

Internet of Things (ex Adavanced Topics in Networking)

a.a. 2015/2016

Un. of Rome "La Sapienza"

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- *Prof.ssa Chiara Petrioli*
- Office: Dip. di Informatica, Via Salaria 113, 3° piano, room n. 311, Tel: 06 4991 8354
- E-mail: 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.
  - 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 30, i-10 index: 77, over 3700 citations).
  - International activities: Member of the steering committee of ACM SenSys and IEEE SECON, 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: senseslab.di.uniroma1.it
- Web page : http://twiki.di.uniroma1.it →laurea magistrale→reti avanzate
- Orario di ricevimento/office hours:
  - Send me an email to agree on a schedule (fast answer) +
  - After the class
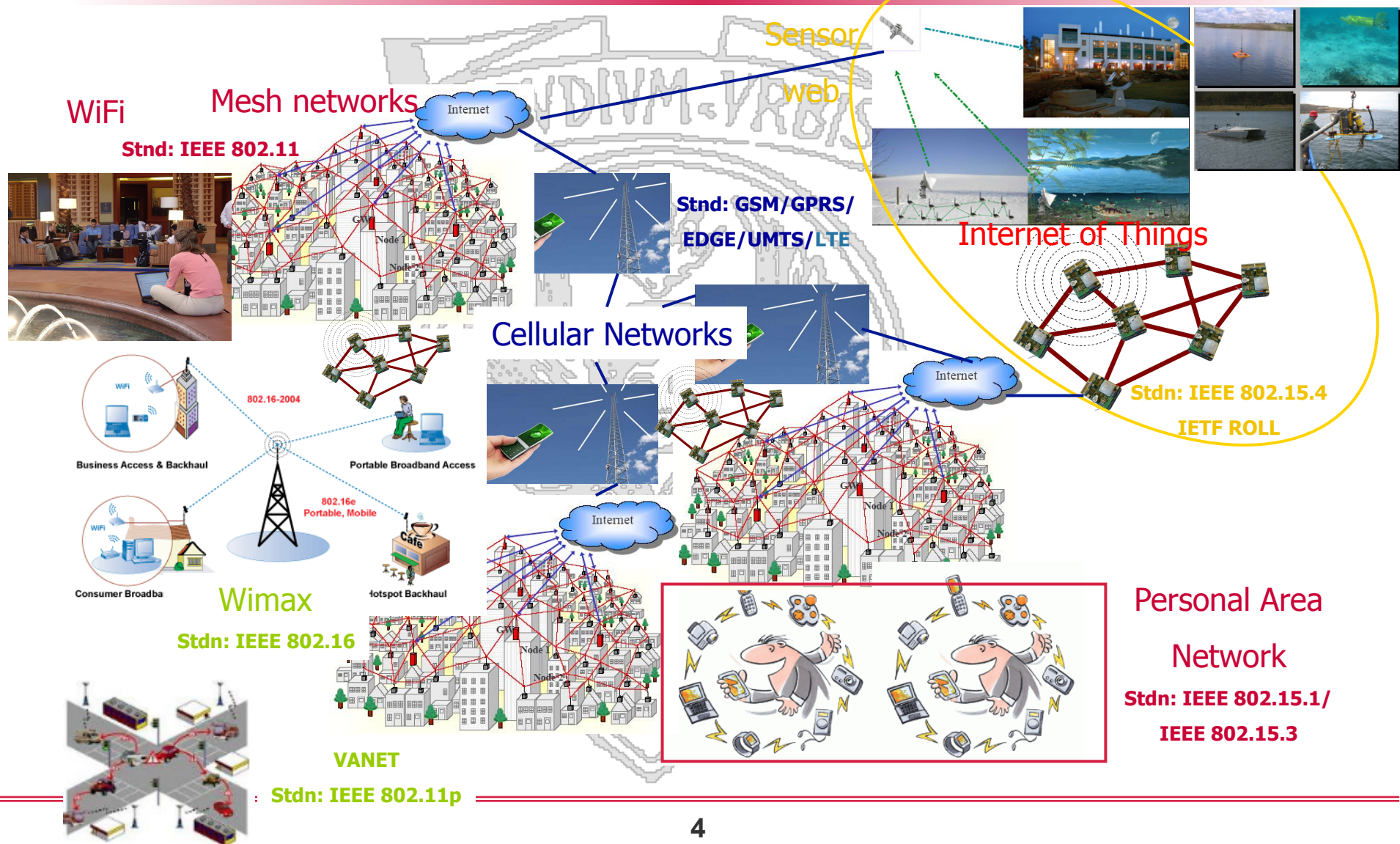
Students

Career Aspirations

Background

Status

Interests

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UNIVERSITÀ DI ROMA

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

Sensor web

WiFi

Mesh networks

Internet

Stnd: IEEE 802.11

Stnd: GSM/GPRS/ EDGE/UMTS/LTE

Internet of Things

Business Access & Backhaul

802.16-2004

Portable Broadband Access

Cellular Networks

Internet

802.16e
Portable, Mobile

Consumer Broadba

Wimax

Stdn: IEEE 802.16

Hotspot Backhaul

Internet

Stdn: IEEE 802.15.4

IETF ROLL

Personal Area Network

Stdn: IEEE 802.15.1/ IEEE 802.15.3

VANET

Stdn: IEEE 802.11p

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

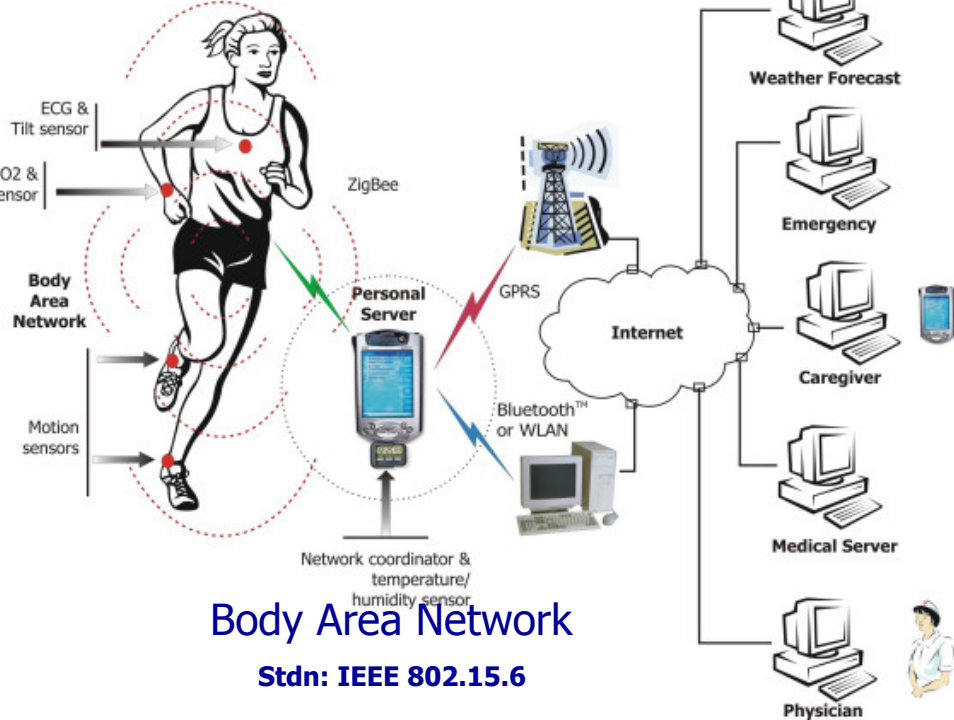Sensor web

WiFi
Stnd: IEEE 802.11

Mesh networks

Internet

Stnd: GSM/GPRS/

ECG & Tilt sensor

SpO2 & Motion sensor

ZigBee

Weather Forecast

Emergency

2.15.4
L

802.16-2004

Business Access & Backhaul

Portable Broadband Access

Body Area Network

Personal Server

GPRS

Internet

Caregiver

802.16e
Portable, Mobile

Consumer Broadband Access

Cafe

Hotspot Backhaul

Motion sensors

Bluetooth™ or WLAN

Medical Server

Wimax
Stdn: IEEE 802.16

Network coordinator & temperature/ humidity sensor

Body Area Network
Stdn: IEEE 802.15.6

Physician

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

WiFi
Stnd: IEEE 802.11
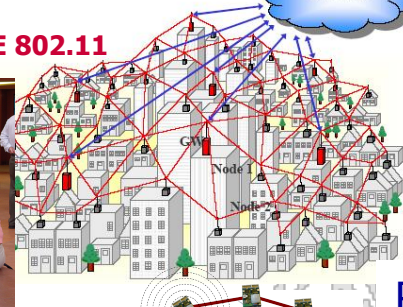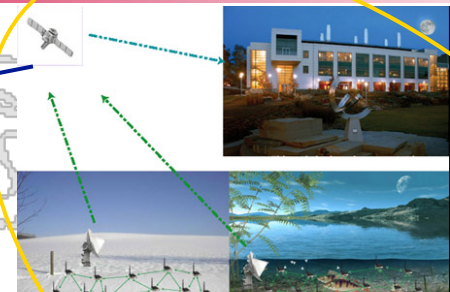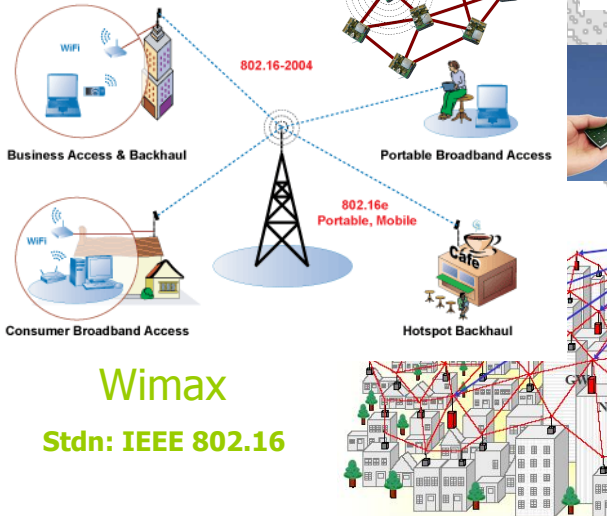
Mesh networks

Internet

Stnd: GSM

Data Analytics
(over the cloud)
+
Green computing
and comms.

Sensor web

of Things

Stdn: IEEE 802.15.4
IETF ROLL

Business Access & Backhaul

802.16-2004

Portable Broadband Access

802.16e
Portable, Mobile

Consumer Broadband Access

Hotspot Backhaul

Wimax
Stdn: IEEE 802.16

Internet

Personal Area Network
Stdn: IEEE 802.15.1/
IEEE 802.15.3

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Senses
SEnsors NetworkS and Embedded Systems Laboratory
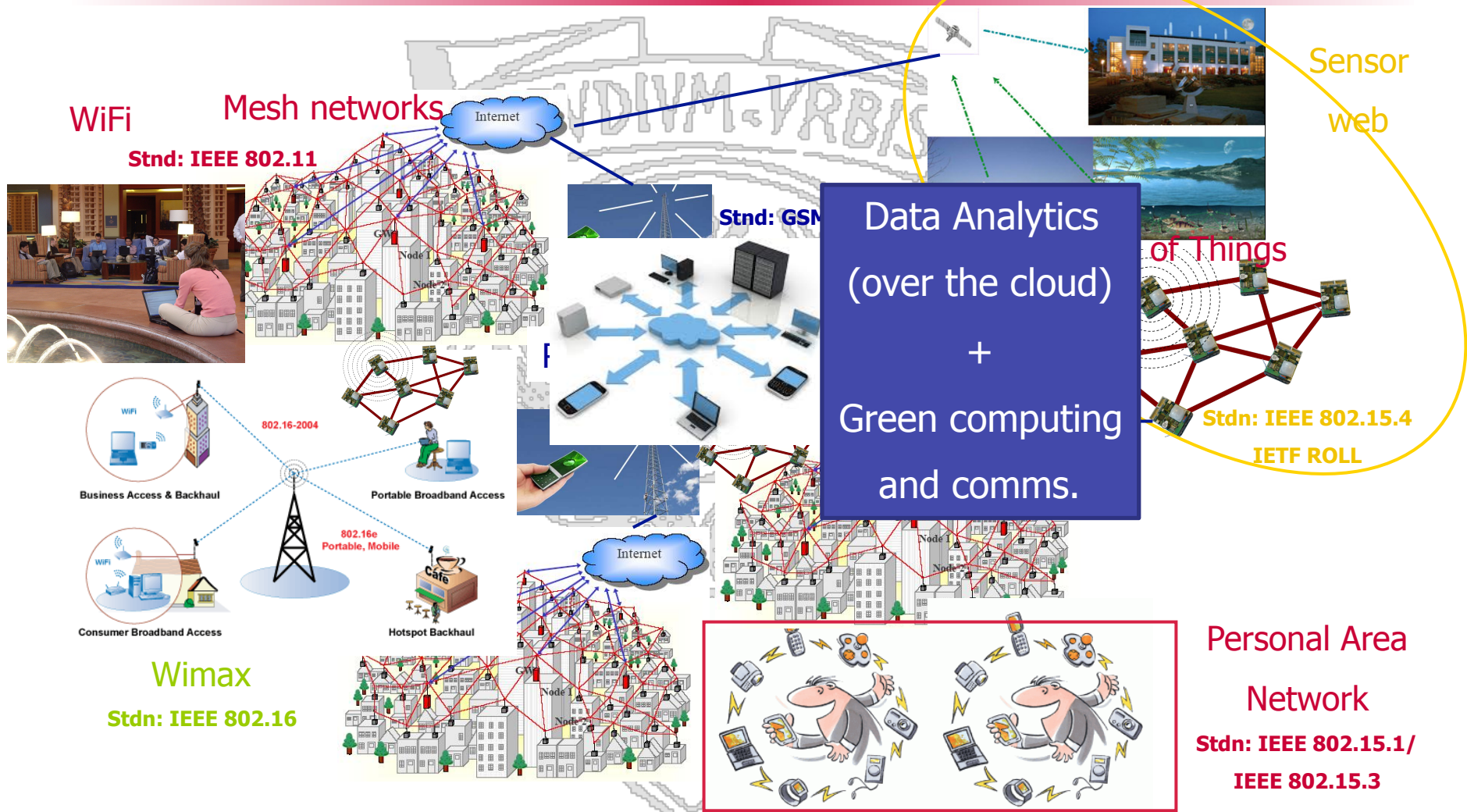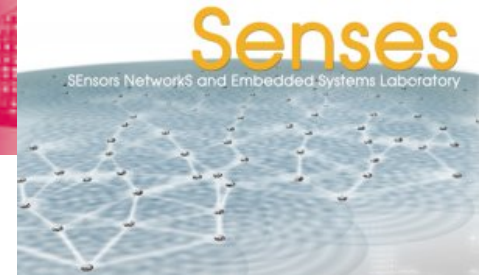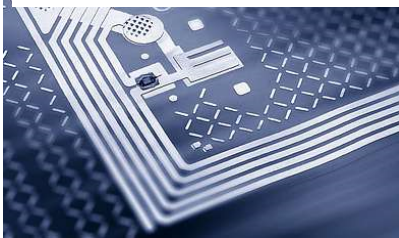
CHIRON project

RFID Anticollision Protocols

PENNSTATE

GENESI Project

Green sensing systems

SENDORA project

UNITED STATES FREQUENCY ALLOCATIONS
THE RADIO SPECTRUM
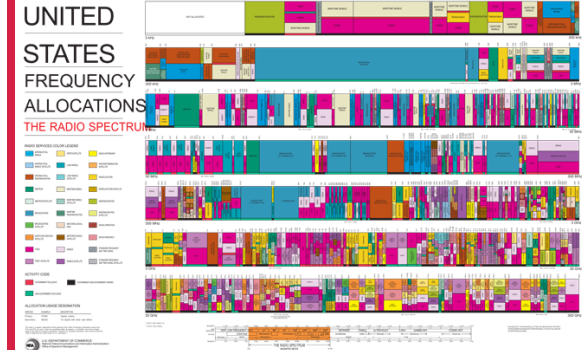
Cognitive networks

CLAM Project; SUNRISE project
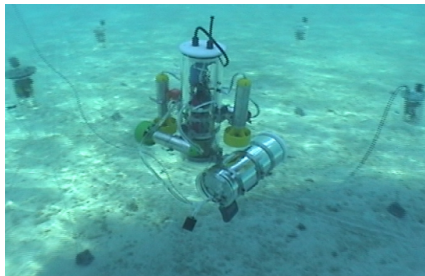
Underwater Monitoring systems

TROPIC Project

Cloud Computing

LTE Advanced

CHIRON project
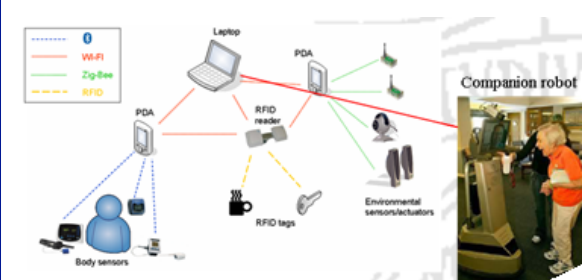
Assisted living

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
  ➢ Internet of Things (ex 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

Internet of Things

Sistemi Wireless Wireless Systems

➢ **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);**
  - ➢ **Ultra low power sensing systems based on wake up radio. Systems based on passive backscattering**
  - ➢ **Embedded device programming (lab);**
  - ➢ **Underwater Internet of Things;**
  - ➢ **Methodologies:**
    - ➢ **Simulations;**
    - ➢ **Implementation and real life testing of protocols/solutions on embedded devices;**
    - ➢ **System optimization tools.**

Mobile systems:
- ➢ **Mobile cellular systems (from 2G to LTE and 5G systems).**
- ➢ **WiFi and extensions (e.g., mesh Networks, IEEE 802.11p for VANETs)**
- ➢ **Cognitive networks and dynamic spectrum allocation.**
- ➢ **Crowdsourcing/urban sensing**
  - ➢ **urban sensing lab**

SENSES lab seminars +

Projects within SENSES

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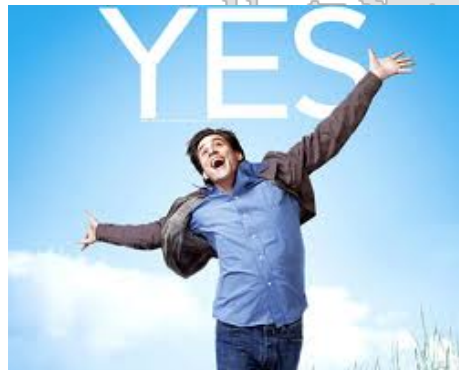
Reti Avanzate
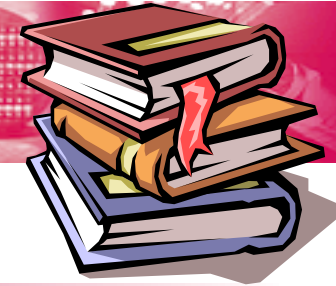Advanced Topics in Networking

Internet of Things
Internet of Things

Why is it listed with both names this year?

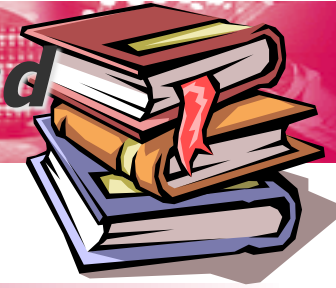Can I attend?

Can I do the exam?

- Book chapters, papers, slides, notes of the class
- Methodology
  - Background
  - Discussion of some key recent results in the area
  - Laboratory (embedded programming, focusing on sensing systems)
  - Analytic tools for system optimization (modeling & optimization)
  - Exam:
    - Written test
    - Lab exam (+3 points)
    - Modeling exercise (+2 points)

- Computer Networking: TCP/IP stack
- C programming
- Probability Theory

College experience
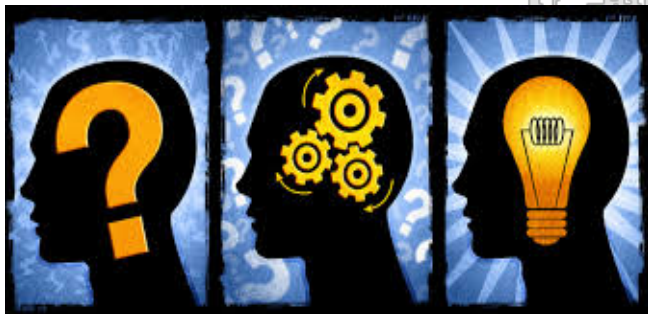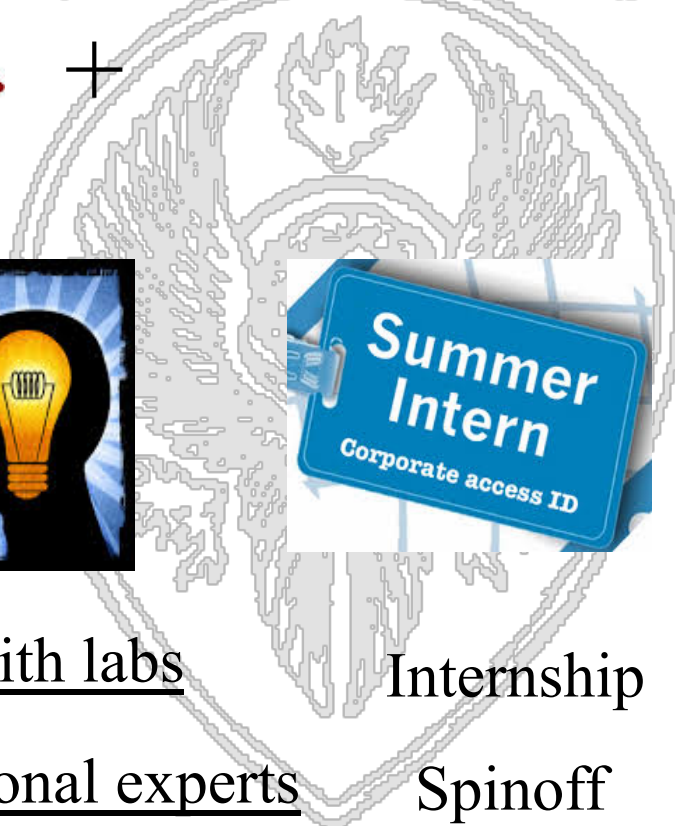
Collaboration with labs

Seminars of international experts
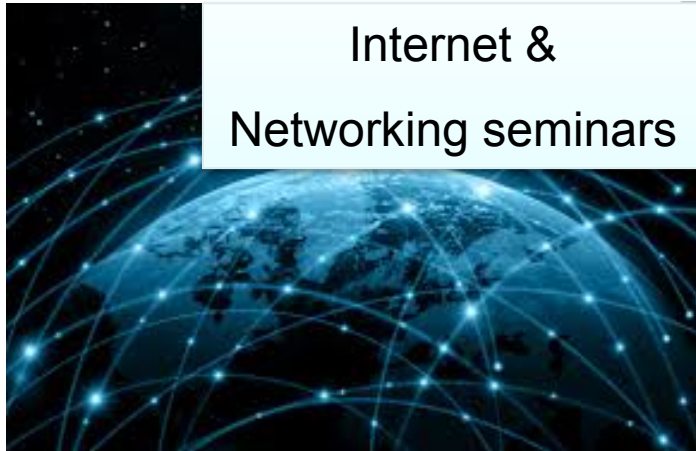
Internship

Spinoff

College experience

Internet & Networking seminars

Extra credits available for

Large projects

Senses
SEnsors NetworkS and Embedded Systems Laboratory
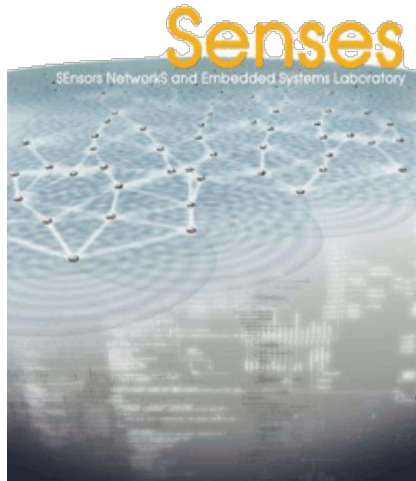
GRANTS "borsa di studio per attività di ricerca"

Contact me AT petrioliATdiDOTuniroma1DOTit

7 in the last two years to top class students

CIS SAPIENZA
CYBER INTELLIGENCE AND INFORMATION SECURITY

http://senseslab.di.uniroma1.it

www.wsense.it