

INF567: Wireless Networks: from Cellular to Connected Objects

Marceau Coupechoux and Juan-Antonio Cordero Fuertes
marceau.coupechoux@telecom-paris.fr
juan-antonio.cordero-fuertes@polytechnique.edu

6 Jan. 2021

Objectives of the course

- The course is on wireless networks...
- ... with a particular focus on cellular networks
- We don't explain how a specific technology is working
- We rather explain what are the main concepts and approaches present in all (or many) wireless technologies...
- ... and we give examples from specific technologies
- Wireless networks are not only about radio access (see core networks, services, applications, etc), but this course focuses on it

Program

- 1 Overview of Wireless Networks
- 2 Wireless Communications
- 3 Random Access
- 4 Deterministic Access Schemes
- 5 Radio Link Control
- 6 F/TDMA Cellular Access
- 7 OFDMA Cellular Access
- 8 IoT Protocols (Juan-Antonio Cordero Fuertes)
- 9 Overview of 5G New Radio
- 10 Cellular Architectures and Protocols

Organization

- Course every Wednesday morning until 10th March
- Lecture (~2h), TD (~1h), Project (~1h)
- Take your laptop! with Internet access and your favorite scientific environment
- Book your Tuesday 16th March morning for the project defense

Evaluation

- No exam !
- But : Send me a TD report (in PDF) for every TD sheet, they count for 1/2 of the final grade
- + Project report and defense (16th March), they count for 1/2 of the final grade

Projects

- Objective : study the technological challenges of an emerging technology
- One project per student
- Ideally in 4 main parts (not necessarily in this order) :
 - 1 Technology presentation
 - 2 Scientific/technical/economical challenges
 - 3 Study of one specific challenge (based on 1 or 2 scientific papers)
 - 4 Simulations and analysis
- Report : Form and substance are equally important (use LaTeX), ~10 pages is fine but you can use Appendices, no plagiarism! (cite).
- Hopefully, every week a new step towards the final report : project choice, document selection, literature study, project outlines, scientific paper study, simulations and analysis.
- Defense : 10-15 min of presentation + 10-15 min questions. Teach other students and your prof about what you learned.

A nice project :

ODMAC++: An IoT Communication Manager based on Energy Harvesting Prediction

Samuel Perez
École Polytechnique
91128 Palaiseau, France
samuel@perez.pro

Juan Antonio Cordero Fuertes
École Polytechnique,
91128 Palaiseau, France
juan-antonio.cordero-fuertes@polytechnique.edu

Marceau Coupechoux
LTCI, Telecom ParisTech
Univ. Paris-Saclay, Paris, France
marceau.coupechoux@telecom-paristech.fr

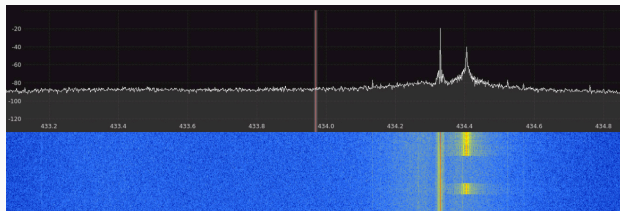
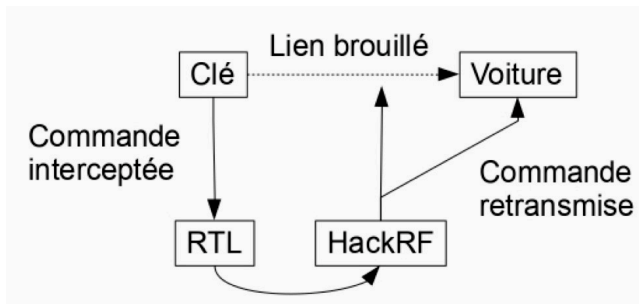
Abstract—In large low-power networks of battery-driven sensors, power outages are a major concern and communication rates have to be carefully designed in order to optimize energy

transmit. If a sensor runs out of energy, it saves power for a few cycles before being able to transmit again. The contention

Published in IEEE PIMRC conference (+a trip to Canada for Samuel!)

Projects

Another nice project : car theft without break-in with SDR



Projects

List of possible projects :

- P1** Comparison of Sigfox, LoRa and NB-IoT
- P2** Full Duplex : Can we double spectral efficiency ?
- P3** Millimeter wave communications : Challenges and performance
- P4** IoT for factory automation
- P5** Energy management in energy harvesting objects
- P6** V2X communications : Challenges and performance
- P7** Cellular network performance using tochastic geometry
- P8** Resource management for network slicing and virtualization
- P9** Mobile analytics : Methods and applications
- P10** 5G New Radio
- P11** UAV path-planning and communication joint optimization

You have another idea ? Tell me

Choose your project before next week and send me an email

References for this course

-  Goldsmith, Andrea. (2005). Wireless communications. Cambridge university press.
-  Stüber, Gordon L. (2011). Principles of mobile communication. Springer Science & Business Media.
-  Tse, David, and Pramod Viswanath. (2005). Fundamentals of wireless communication. Cambridge university press.
-  Lagrange, X., Godelewski, P., and Tabbane, S. (2000). Réseaux GSM : des principes à la norme, Hermes.
-  Kumar, A., Manjunath, D., and Kuri, J. (2008). Wireless networking. Morgan Kaufmann.
-  Coupechoux, M., and Martins, P. (2012). Vers les systèmes radiomobiles de 4e génération, Springer.