

Wireless Networking: Fundamentals and Applications

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Before we start: Filtering mechanism

- **We have:**
 - (A) The 57 registered student for this course (09/14 20:30)
 - (B) Those who is not registered, and want to get “the code” to register
- **Bad news: we only have ~60 sets of boards for the lab assignments**
- **Solution: a filtering mechanism**
 - You (each student) need to complete labo + hwo by next Thursday
 - The **top 60 ranking students** for labo + hwo will be able to register for the course
 - (will be announced next Friday afternoon)
 - And of course, if there are less than 60, than everyone gets in! Yay!
 - Important: this applies to both **(A) and (B)**
 - **Find the assignments on the course website**

Before we start:

Warnings

- **First time to teach the course → you are part of the experiment.**
- **Be prepared to time-consuming lab assignments (10+, 20+, or 30+ hrs per assignment!)**
- **Will do my best to prepare the lectures, but don't know if they will be easy to absorb**

Course Objective

- **Learn about wireless communications and networks**
 - Why is it so different from **wired** communications and networks?
 - Wireless communications = lots of random errors, less reliable
 - Learn the **basics** about wireless
 - How to model the wireless channel
 - How to model the wireless system
 - Protocol designs (MAC & routing)
 - Learn some of the most important wireless standards
 - Cellular Technology (GSM/3G/4G/CDMA),
 - WiFi (802.11 a/b/g/n),
 - Wireless Sensor Networks, etc.
- **See the course outline on the course website**

(這就是課程大綱...我有在課程一開始的時候說喔 ~~~)

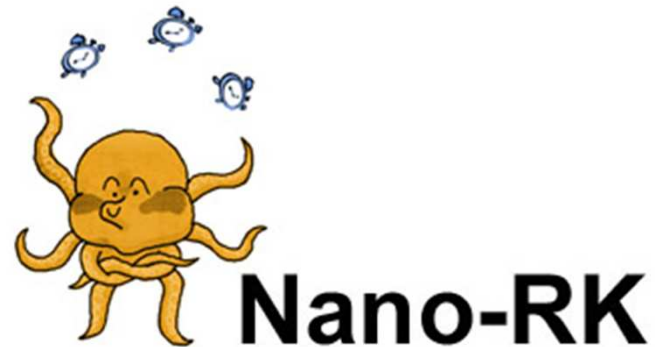
Hands-on Experience

- 4 lab assignments
- Completed by teams of 3 or 2
- **Goal:**
 - Learn from your own experience (1st hand)
 - Not from the lectures/the books (2nd hand)
 - Fun!
- **Cons: need to spend lots of time (20+ hrs per assignment, on average)**

Prerequisite

- I would like to say....**NONE**,
- but the truth is...
- **Just a few ones on the list:**
 - You know the C programming language
 - **Good at using Google** to look for answers (not kidding, very important)
 - Some **basic** knowledge about probability & calculus (basic is the key word)
 - You are **really interested** in wireless communications & networks
- **Optional, but good to have:**
 - You have taken "Computer Networks"
 - You have taken "Data structure" and/or "Algorithm"

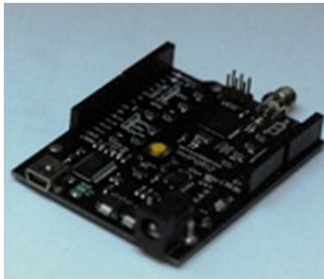
Lab platform: Zigduino + nano-RK



- Microcontroller: Atmega128RFA1
 - On-chip integrated IEEE 802.15.4 radio
 - 2.4 GHz
 - 250 Kb/s
 - External antenna connector (RP-SMA)
 - Various I/O pins for you to connect to other components (LED/light sensor/openlog)
- A fully preemptive reservation-based real-time operating system
 - Designed for wireless sensor networks
 - Developed by Carnegie Mellon University
 - Supports fixed-priority preemptive multitasking
 - <http://nanork.org>

Lab1: Miniature Spectrum Analyzer

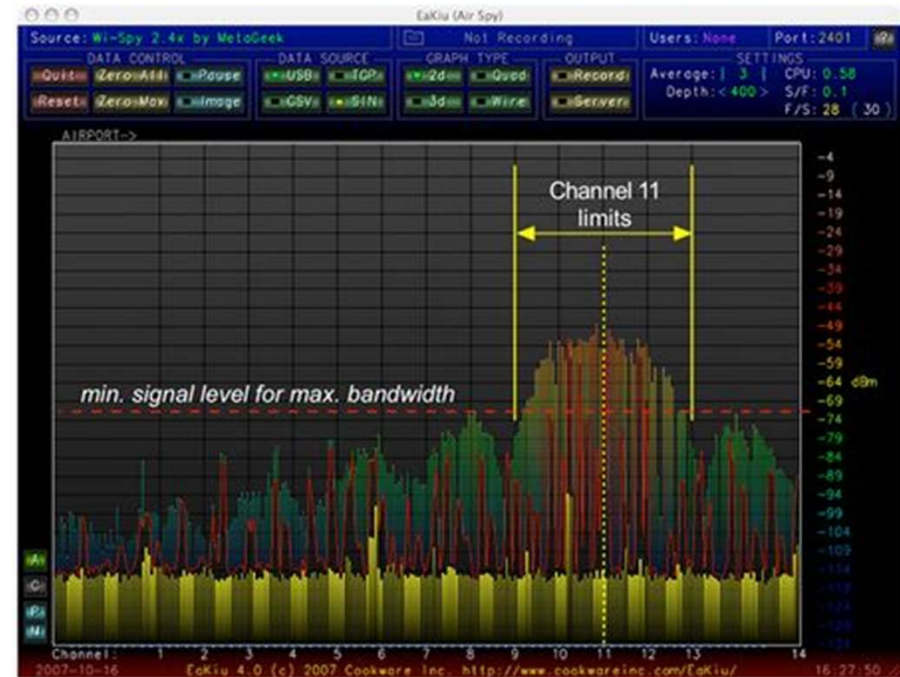
Zigduino



+

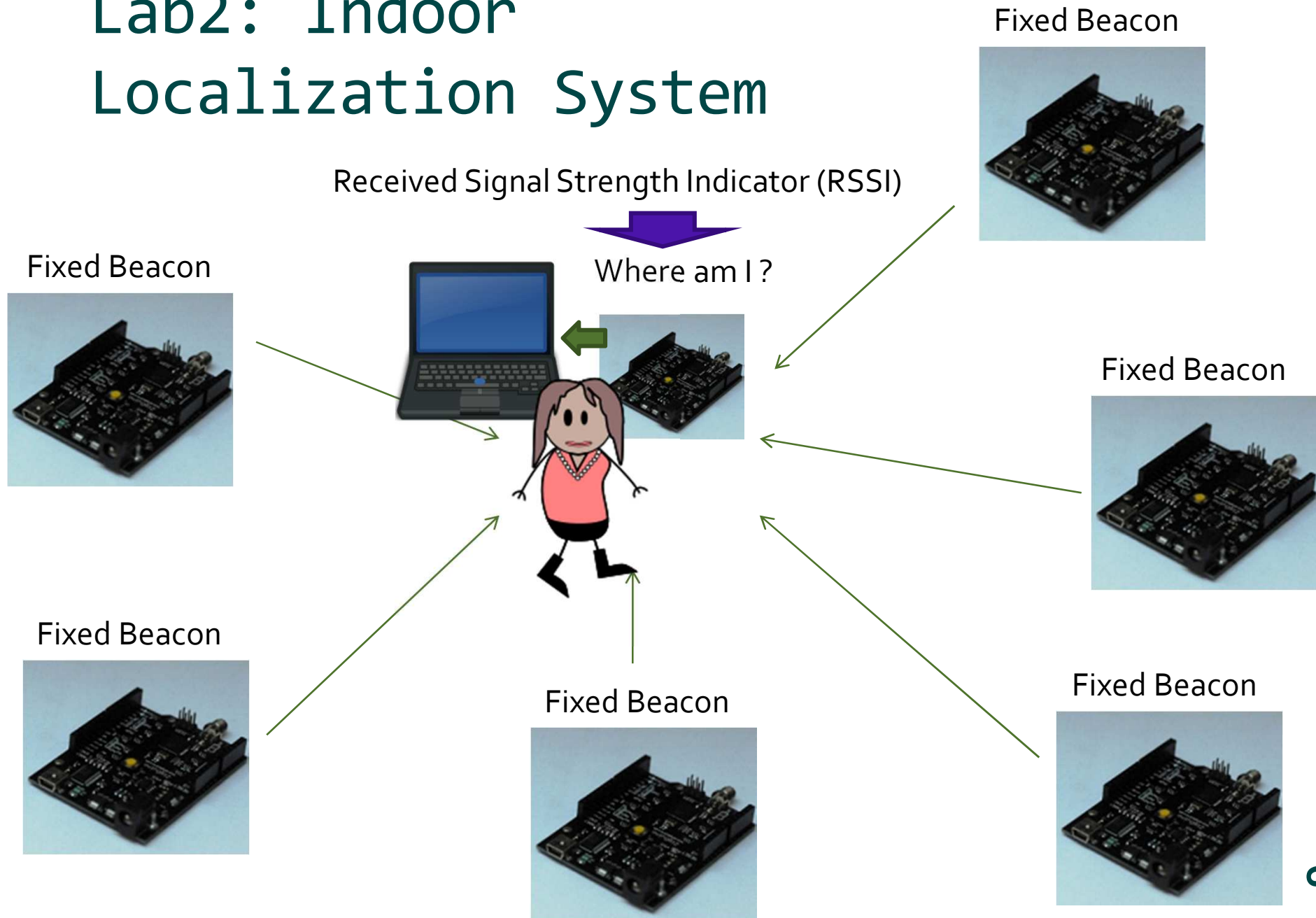


Openlog: miniSD logger

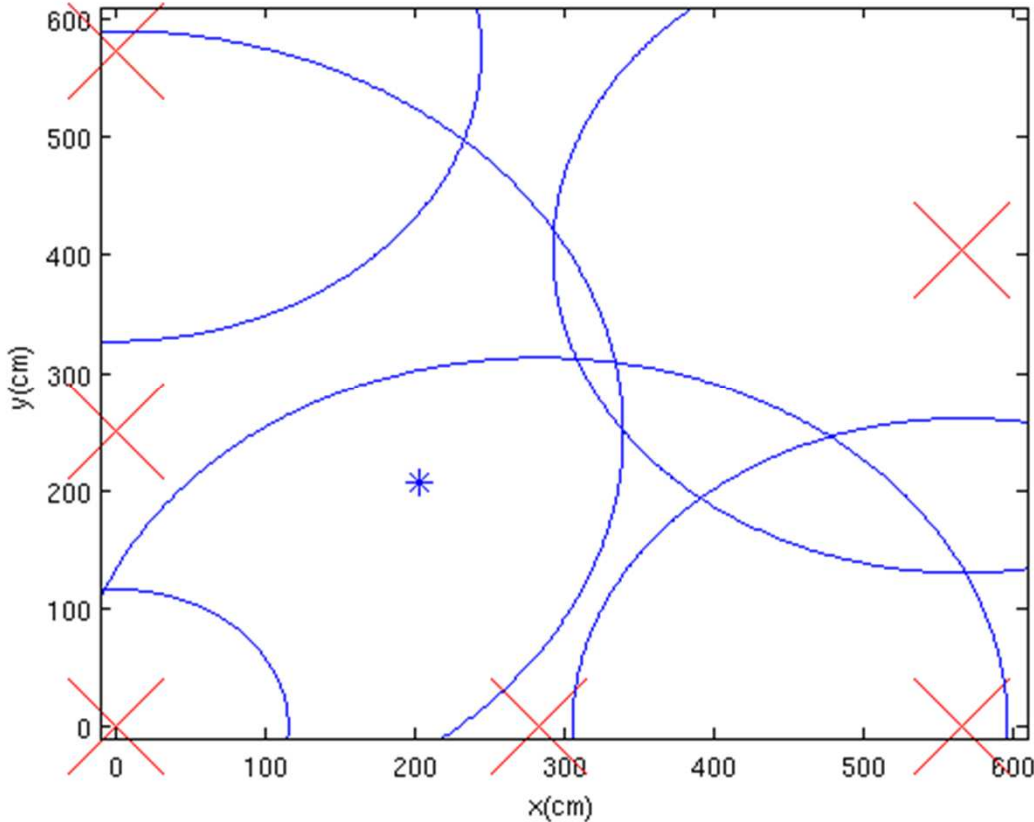


How does different wireless device occupy the spectrum?

Lab2: Indoor Localization System



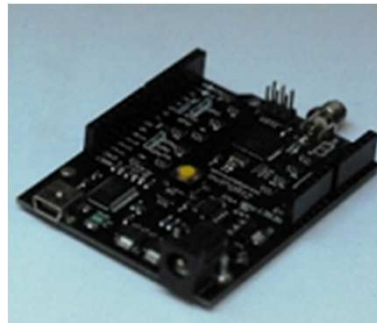
Lab2: Indoor Localization System



Lab3: Whack-a-Mole



Mole



LED: ON means that the mole is UP



Light sensor: cover the light == whacking

Mole



Mole



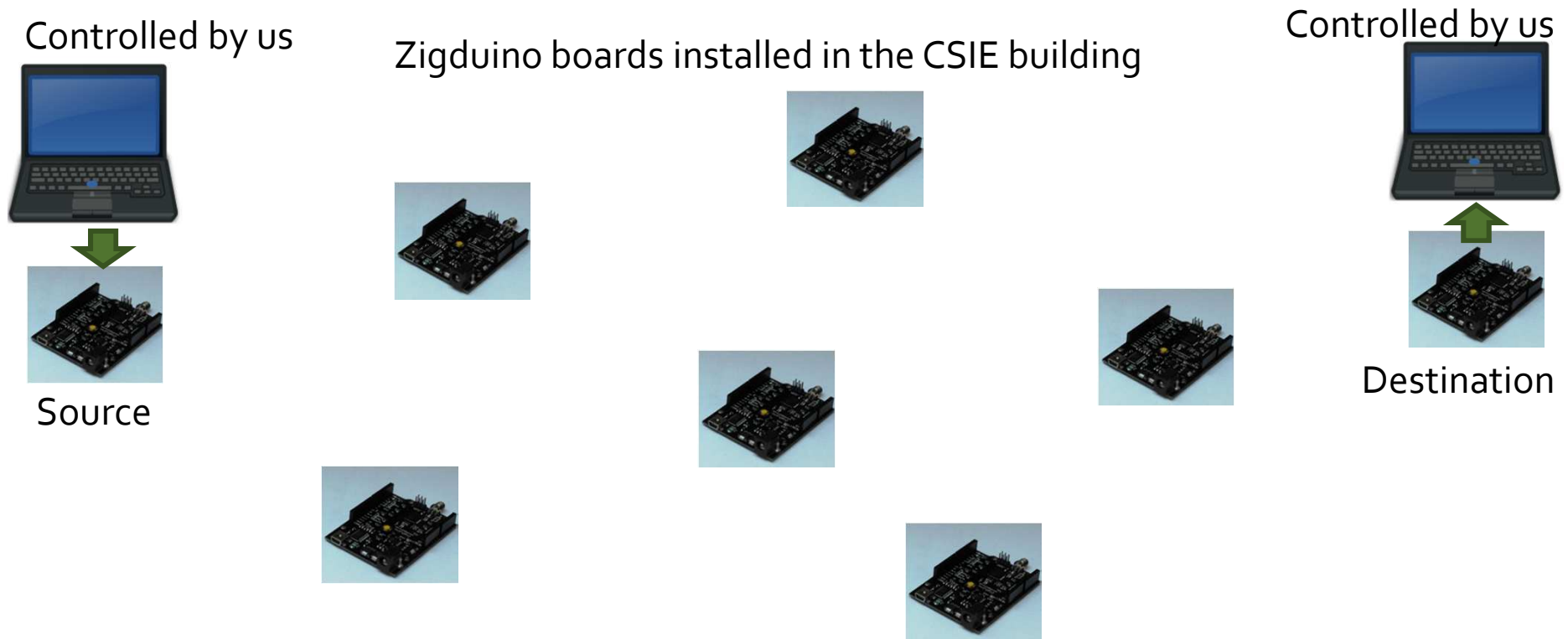
UI to start/stop the game, show the score



Master controller

Coordinate the "moles" to jump up and down via the wireless links.

Lab4 (final project): Smart wireless network competition



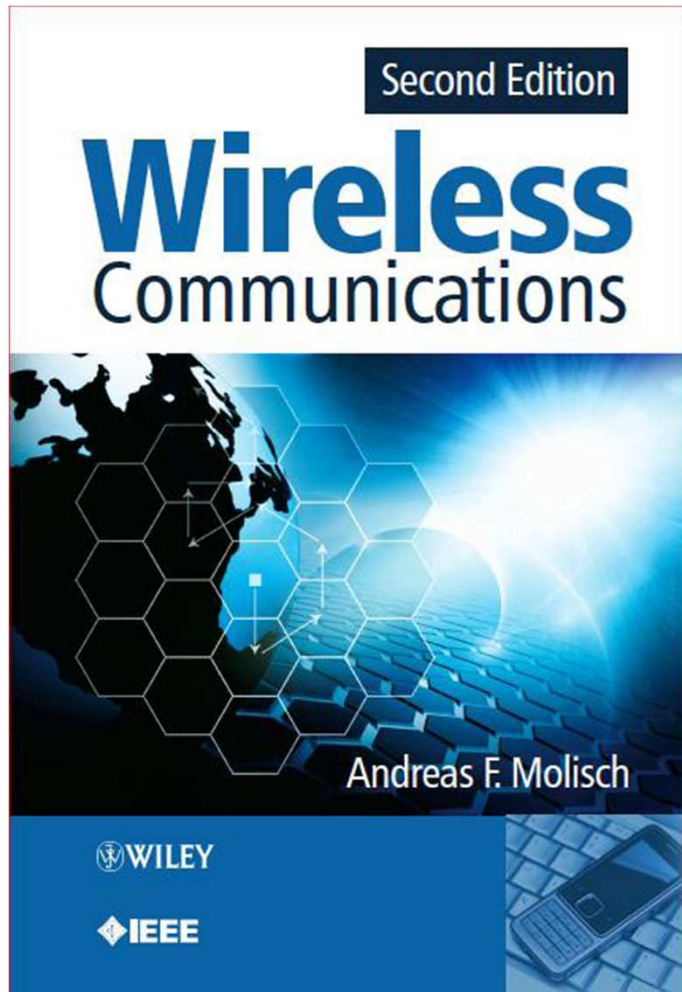
Goal: develop your own MAC/routing protocols so that you relay the most packets correctly and with the shortest delay from the source to the destination (could be more than 1 pair).

Course grade

Items	Weight
Lab assignments:	
lab1	10%
lab2	15%
lab3	15%
lab4 (final project)	30%
Homeworks (handwritten): (2)	20%
In-class quiz: (don't know how many yet)	10%

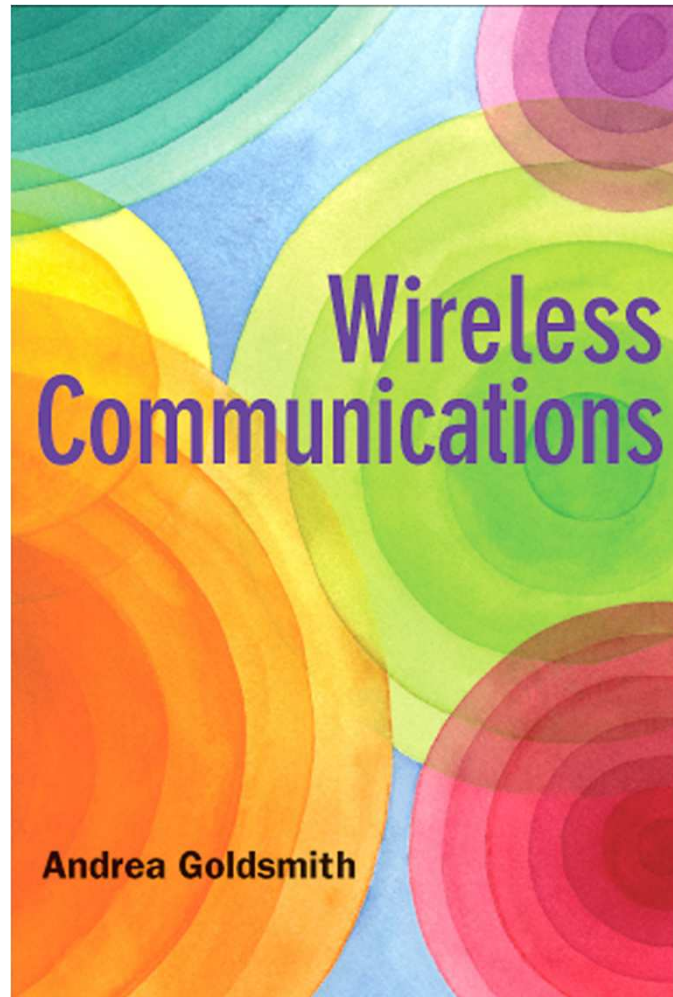
- We will decide the mapping from 100% score to the letter grade at the end of the semester
- Since this is not a required course, the general idea is that we will be generous given that you submitted all assignments.

Textbook (optional to buy)

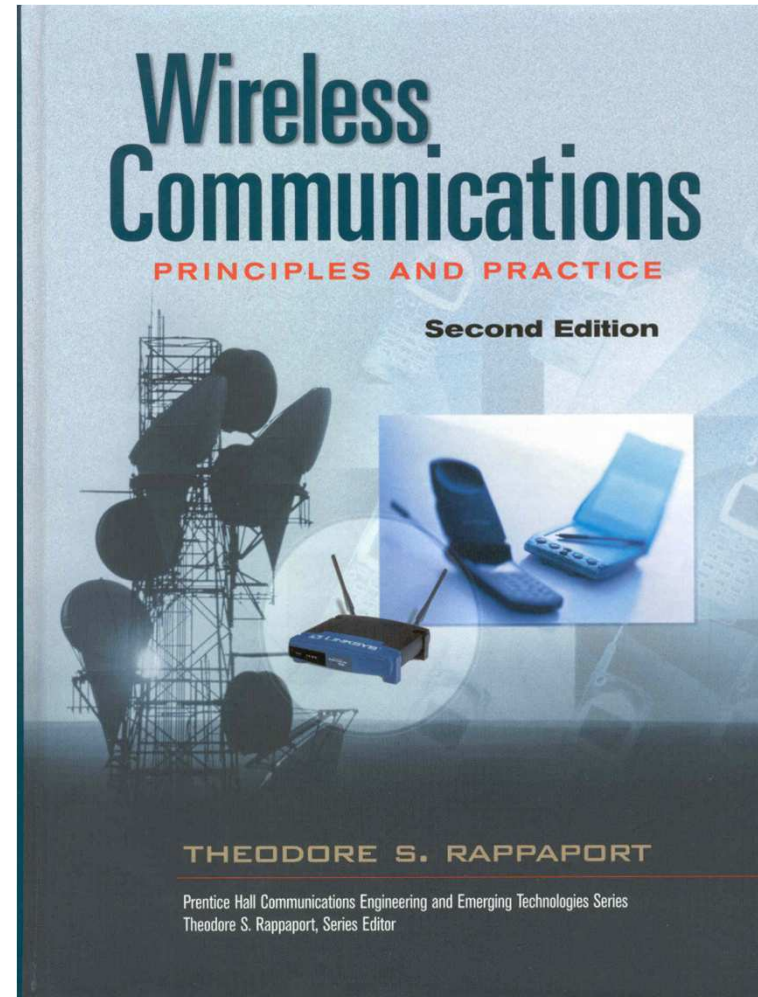


Andreas F. Molisch, *Wireless Communications*, 2nd Edition, Wiley + IEEE, 2011

Some references



Andrea Goldsmith, *Wireless Communications*, Cambridge University Press, 2005



Theodore S. Rappaport, *Wireless Communications: Principles and Practice*, 2nd Edition, 2002

The teaching team



蔡欣穆 (Michael)

Office hour:

Mondays 2-3pm @ CSIE R316

Direct your questions to:

E-mail: wn@csie.ntu.edu.tw

ptt2: HsinMu



林浩民 (阿民)



黃光世 (阿光)



邱柏睿 (Ray)

Office hour: To Be Assigned

Teaching Assistants

Zero-tolerance policy (Plagiarism)

- We will NOT tolerate any PLAGIARISM (Quiz/Lab/Homework).
- Students who gets caught will get an **F**, no second chance. (+ possible university disciplinary actions)
- The TA's will look for
 - (1) signs of copied codes in your lab assignment source codes
 - (2) similar answers in the handwritten homeworks
- **For handwritten homework, please indicate references for each problem**
 - Books or Internet URL or a person.
 - If none, then indicate "none".

Zero-tolerance policy (assignment deadline)

- **Homework deadline is HARD deadline.**
 - You get 0 point for the homework after the submission deadline
 - You get 0 point for the lab if you don't demo on time/submit the source code to the repository
 - However, we will still grade it for you, if you choose to submit it (after the deadline)

My teaching style

- **Interactions in the class**
 - Please please please please ask me questions
 - (Or I will ask you questions...)
 - No question is dumb question
 - (Since lots of you have very little background knowledge)
- **Class material is easy to understand**
- **But lab & homework assignments require lots of efforts**
- **English slides but taught in Mandarin**

Recap

- **Submit your labo AND hwo by next Thursday (or you will not be admitted to this course)**
- **wn@csie.ntu.edu.tw is the e-mail to us**
- **Course website:**
http://www.csie.ntu.edu.tw/~hsinmu/courses/wn_11fall
- **Feel free to come and talk to me after the class or during the office hour**
- **Questions?**