Internet of Things and Wireless Networks

Labs Overview

Goal of these slides

- Give you an overview of the labs

- Tell you how we will communicate

- What you must submit, and how to pass

Outline

- Lab Structure

- Administrative Information

- Technical Information

Lab Structure

What you will do during the labs

What is the Internet of Things (IoT)?

- New paradigm gaining a spectacular momentum
  - Several billions devices around the globe

- Many use cases
  - Smart homes, smart factories, smart cities…

- What is an IoT device?
  - computation + communication + sensing or actuating capabilities
  - Resource-constrained (CPU: few MHz, RAM: several MB, battery powered, wireless communication)

What are the labs about?

- Understand and design communication protocols
  - Wireless communication -> IEEE 802.15.4
    - Used in smart industries and smart homes (Ikea, Philips HUE, Bosch, etc.)
  - Up to hundreds of devices, across several kilometers

- Implement your own routing solutions and IoT applications
  - On resource-constrained devices
    - 4 MHz CPU, 10 kB RAM
  - In C
    - *You shouldn't be scared to get your hands dirty!*

- Test and evaluate your solutions with an accurate simulator
 - Representative of real-life wireless environments

A bit more concrete…

- How to send from A to B when
  - You don't know if anything can hear you
  - Wifi can completely destroy your message
  - Some nodes are moving away
  - You must not waste energy?

- We will solve this step by step…

A

WiFi interference

Moving away

Moving away

B
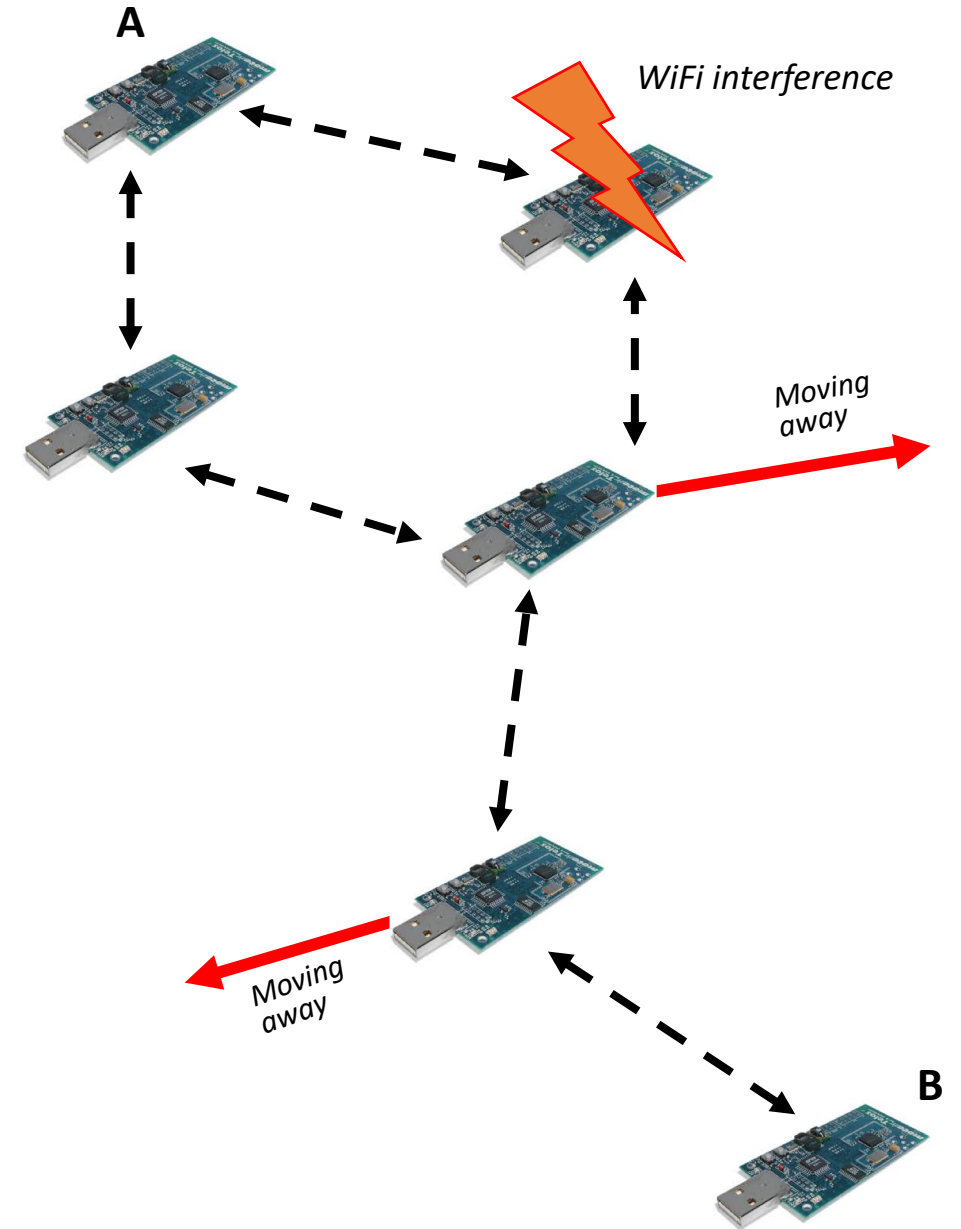
What technology?

- Platform: Tmote Sky mote
  - 16-bit MSP430 @ 4 MHz
  - 48 kB flash
  - 10 kB RAM

- OS: Contiki-NG
  - Specifically designed for low-power, resource-constrained devices
  - Open-source, C language

- Environment: Cooja
  - 802.15.4 wireless simulator

- All those tools are actively used and maintained by the research community
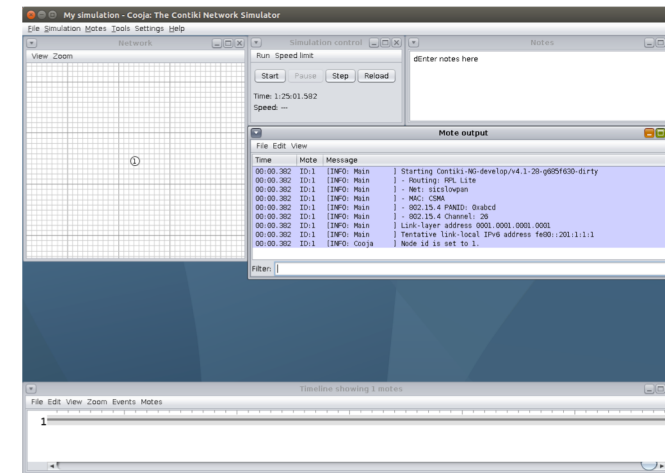
Lab structure

- 1 Prelab
  - Check your C skills, let you install all the tools
  - Pass/Fail, Mandatory, ~1 week

- 3 labs
  - Design, implement and evaluate communication protocols of increasing complexity
  - 2 weeks per lab, 10 points per lab, mandatory

- Your own project
  - You set your goal. What technology, what application?
  - You implement and evaluate it, and try to sell it to us as the best!
  - 20 points

Administrative Information

How to pass the labs

How hard are the labs?

- This course is targeting **M.CS students** (last year B.CS students welcome too)
  - We expect you to know how to think by yourselves
  - But also to clearly justify and defend your design choices
  - (Also to know how to use stack overflow..)

- What knowledge should you bring?
  - An **Operating Systems** course: how is memory managed? What does the kernel do?
  - **Computer Networks**: layered architecture, difference between PHY, MAC, and network concepts, …
  - An experience with **C programming**
    - We will not teach you C!
    - You should understand what are pointers, how to use structs, etc.

The point system

- To pass, you require **50%** of the total points
  - 50% of the labs, **AND** 50% of the project!

- Required:
  - 1/1 for the prelab
  - 15/30 for the lab
  - 10/20 for the project

- Your total points can be used to improve your final exam grade
  - See Olaf's first slides for the formula

Prelab	Lab 1 [10]	Lab 2 [10]	Lab 3 [10]	Idea [5]	Project [15]
1/1	REQUIRED: 15/30			REQUIRED: 10/20	

Your deliverables

Check iLearn for the most up-to-date information

- Prelab
  - Submit a PDF report

- Labs 1-3, per lab
  - Submit a 5-8 min video showcasing your solution, explaining your code and evaluating (with figures/graphs!!!) the efficiency of your approach
  - Submit your code

- Project
  - First, a short presentation of what you want to work on
  - At the end of the course, a full 15 min presentation of your application

Team? No team?

- Groups of 2!
  - One submission per group, per lab (& same for the prelab)

- Make your group on iLearn

- If you don't know anyone, try to contact other people from the same group

- If you hate everybody, please still try to give other people a chance

Technical Information

How to contact us

Teaching staff (*we*, the people you might interact with)

Who to contact?

- Mainly Valentin for most questions
  - Through iLearn or at vpo [AT] informatik.uni-kiel.de
- Olaf, for lecture-related questions
  - Through iLearn

iLearn group responsibles (i.e., who will grade what)

- Group 1: Valentin
- Group 2: Olaf & Valentin

When to contact us?

- You can expect most answers during the Q&A session
  - Monday, 14:15 – 15:45
  - We might do them physically one day?

- You can send messages at other time
  - But don't expect a quick answer…

- Livestreams? Video Q&A?
  - We are not planning any for the labs
  - We will see how it goes

Before you close those slides…

Please be aware, this is the first time we are teaching this course (but we use those tools on a daily basis).

And many people have registered so far.

You should expect some bumps along the road (we are expecting them), plus online teaching adds an additional strain to communication.

Thanks for taking this course!

Your logical next step:

Check the prelab on iLearn