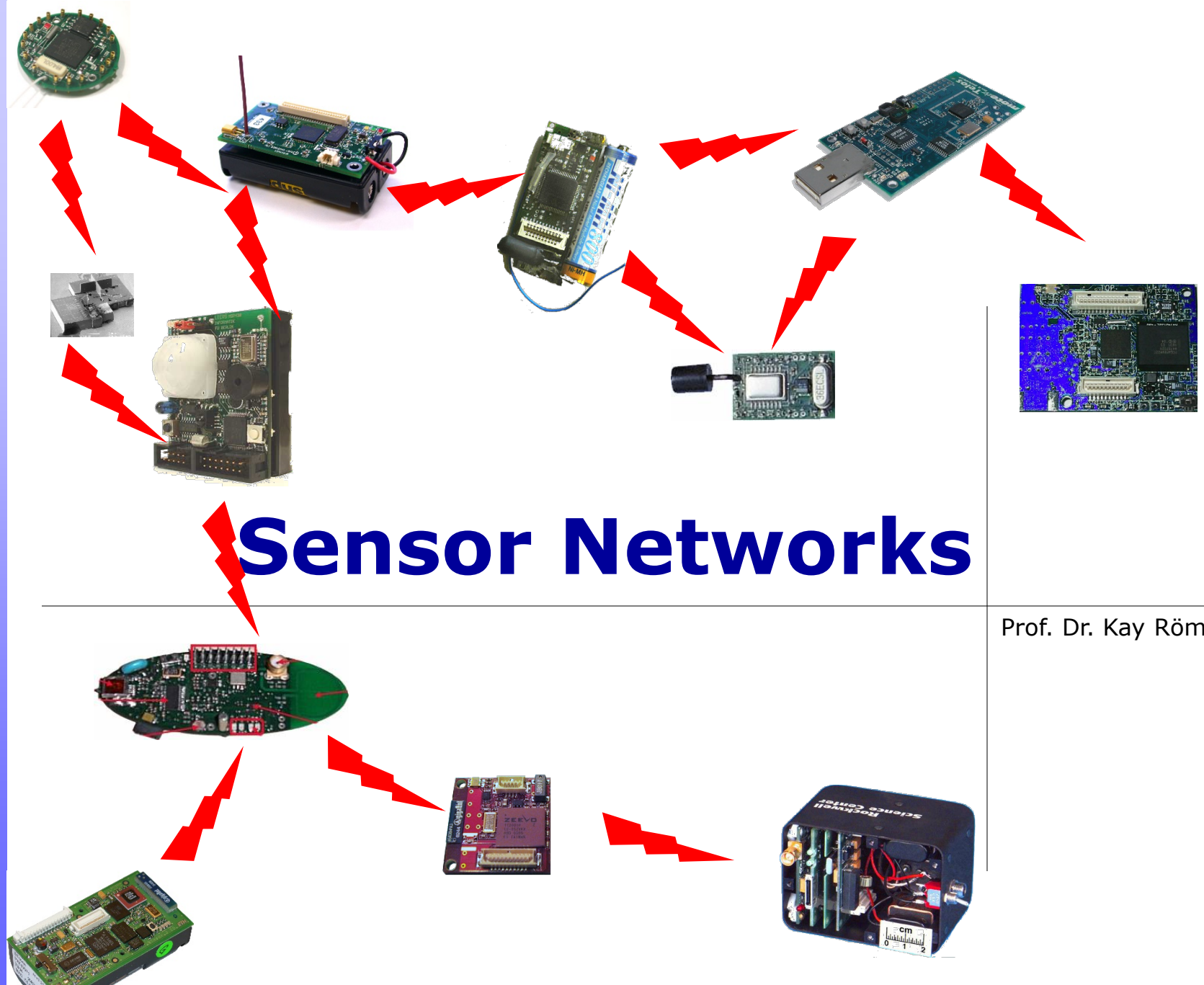
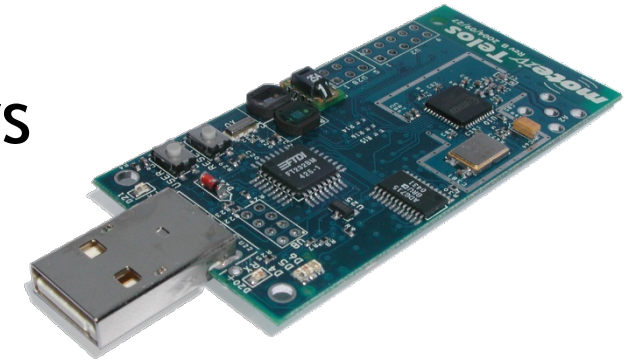


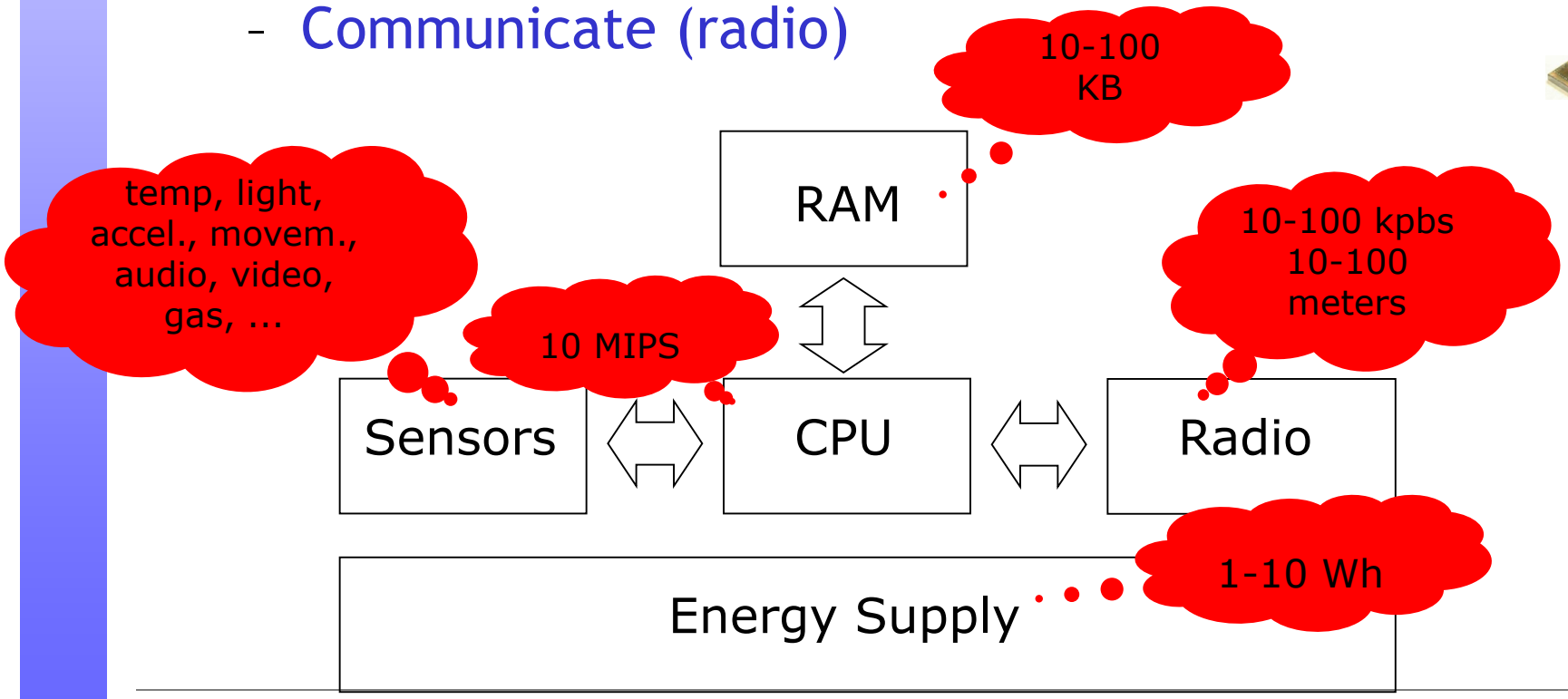
Sensor Networks

Prof. Dr. Kay Römer

Sensor Nodes

- Tiny autonomous computers
  - Perceive (sensors)
  - Process (CPU)
  - Communicate (radio)





Sensor Network

- Wireless network of sensor nodes

10 - 1000
and more

m^2 - km^2

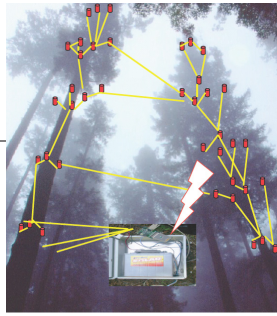
- Large area, long-lived

months -
years

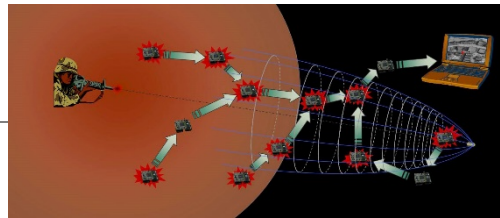
- Detailed monitoring

0.1 Hz – 100 KHz
0.01 – 1 nodes per m^2

Applications



- Scientific instrument („Macroscope“)
  - Animals, plants environmental phenomena
- Industry
  - Infrastructure (pipes, machines)
  - Energy management
- Agriculture
  - Plants (growth, ripeness, soil quality)
  - Animals (diseases, fertility, virtual fences)
- Health („Body Sensor Networks“)
  - Wireless intensive care
  - Elderly care
  - Medical research
- Military / police
  - Detection, classification, localization of hostile activities



Lecture Course

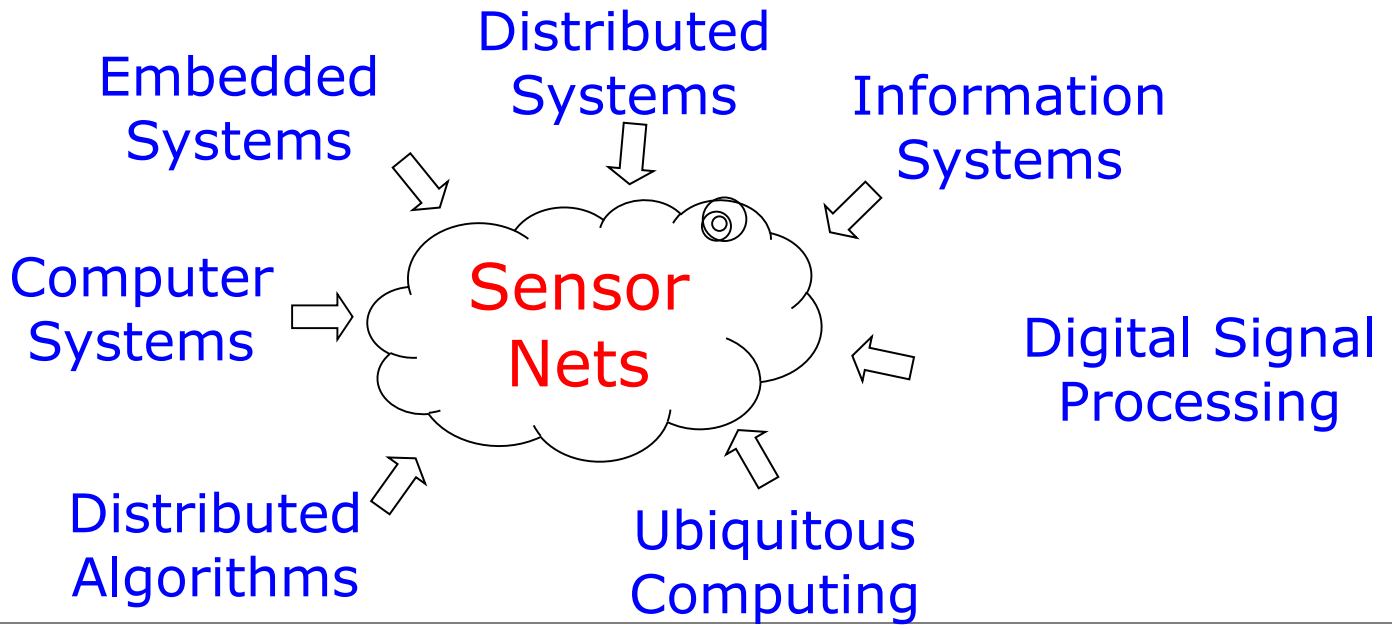
- Fr, 10.00-12.00
- 11 Lectures (See TUGonline)
- Slides in TeachCenter
  - https://tc.tugraz.at/main/course/view.php?id=371
- Regular attendance required (VU)
  - 15 min repetition at begin of lecture
- Literature:
  - Holger Karl, Andreas Willig: Protocols and Architecture for Wireless Sensor Networks, Wiley, Chichester, 2005, ISBN 0-470-09510-5

Lecture Course

- Foundations and some advanced topics in wireless sensor networks
  - Applications, hardware, operating systems
  - Networking, localization, synchronization
  - Sensor data processing
- Goals
  - Overview of research area
  - Opportunities and limitations of sensor networks
  - Understanding key concepts
  - Hands-on experience with selected concepts

Lecture Course

- Multidisciplinary area
  - Application, modification, and integration of concepts already known in computer science and information technology
  - But also fundamentally new aspects
- Basic knowledge in relevant areas helpful, but I will summarize most important aspects

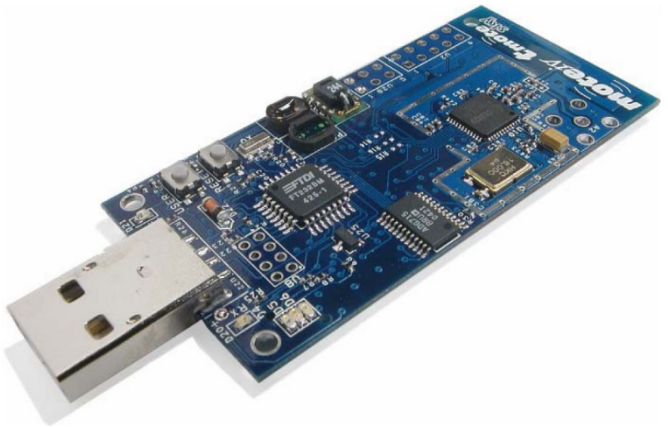


Exams

- Written exam at end of semester
  - 60 min
  - No utilities
  - Questions checking knowledge and ability to apply knowledge to simple problems
  - Two parts, separately graded, both positive

Lab Exercises

- Lab exercises based on concepts taught in lecture
  - Sensor nodes, Contiki operating system
  - Programming
  - Communication
  - Ranging
  - Position estimation



Organization of the lab

- Two main parts
  - 1st part: Wireless sensor networks programming
  - 2nd part: Indoor localization techniques

WSN programming
The Contiki operating system
Measuring data from sensors
Wireless communication (unicast/broadcast)

Relevant chapters from lecture:

- Chapter 2
- Chapter 3
- Chapter 6

Indoor localization
RSSI ranging distance measurement
Localization using min-max algorithm
Localization using Geo-n algorithm

Relevant chapters from lecture:

- Chapter 8