Networks and Protocols

research group

Wireless sub-group

LSIIT

CNRS UMR 7005

RP group – Wireless Sensor Networks

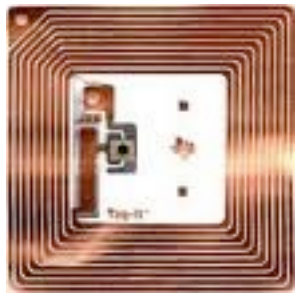
http://lsiit-cnrs.unistra.fr/rp-en/

- Members
  - Faculties
    - Prof. Jean-Jacques Pansiot (group leader)
    - Prof. Thomas Noel (All Wireless Internet leader)
    - Dr. Antoine Gallais (associate professor)
    - Dr. Julien Montavont (associate professor)
    - Dr. Fabrice Theoleyre (CNRS researcher)
  - Engineer
    - Erkan Valentin (starting on July 5th, 2010)
  - PhD students
    - Julien Beaudaux (starting on Sept. 1st, 2010)
    - Romain Kuntz (expected to end on Sept. 2010)
    - Damien Roth (started on Oct. 1st, 2009)






Key research areas



- Internet of things
  - Integrating the sensors into the Internet
  - A universal access
- Efficient transmission
  - A node should sleep most of the time
  - Radio transmissions are unreliable
  - Trade-off energy consumption/bandwidth
- In-network processing
  - Push the operations in the network
    - E.g. Data aggregation
- Localization
  - Use network information to obtain a geographical location
    - Coarse localization technique (more proximity than absolute position)

Applications

- Environmental monitoring
  - Several weather stations
    - They exchange information
    - Sensorscope project [EPFL]
  - Floodings
    - To control the water height
- Smart building
  - House automation
  - Air-conditioning system
- Urban Wireless Sensor Networks
  - Smart metering [EDF, Coronis]
  - Green Cities [senscity]
    - Recycling containers
    - Smart Lights
    - Pollution

Key expertise

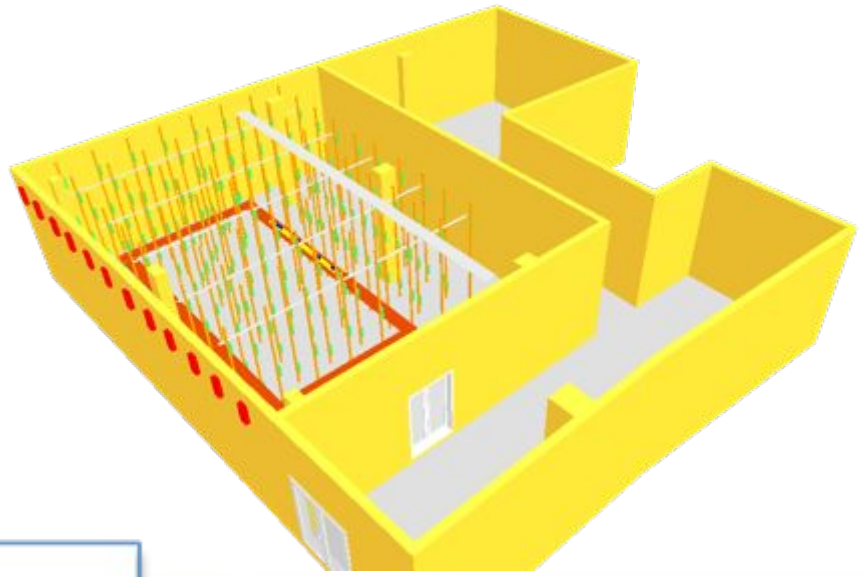
- Distributed algorithms
  - Minimizing the overhead
    - Exchanging data only with neighbors
  - Limiting the energy consumption
  - To cope with transmissions errors
  - Self-stabilization properties
    - Robustness, reliability
- Protocol's design
  - MAC layer: how to distribute the bandwidth
  - Network layer: how to forward the traffic
  - Transport layer: how to offer reliability, etc.
- Models / simulations
  - Radio propagation (high level)
  - Discrete event simulation
- What we *don't* do
  - OS design
  - Hardware design

Example

- On-going collaboration with IPHC
  - *High-Tech* Turtles
- Current research challenges for us
  - Transport protocol: how to cope with transmissions errors?
    - Retransmissions, redundancy, etc
  - MAC layer
    - A huge volume of data to transfer
      - Several gigabytes in at most 20 minutes
  - Routing
    - One sink
    - Several fixed base stations forward the traffic to the sink
  - Reliability
    - Distribute the data to improve the robustness
    - The data of a lost sensor is even retrievable

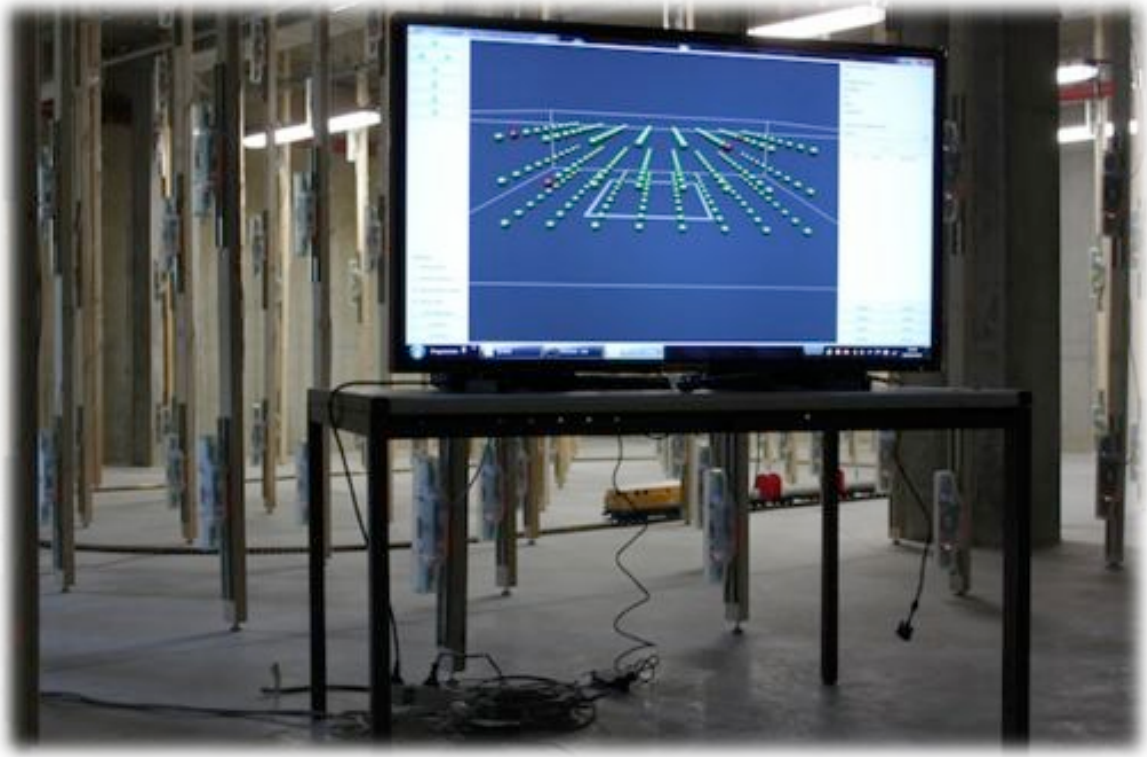
Senslab testbed

- 256 sensor nodes in Strasbourg
  - Same in Lille, Rennes, Grenoble
  - ⇒ 1024 sensor nodes, fully open
- Testing our communication protocols
  - Against realistic conditions (radio range, sensing sensitivity, etc.)
  - In a highly dense network (8 nodes/m)



Senslab
Very large scale open wireless sensor network testbed

Senslab in Strasbourg



Senslab research challenges

- Simulation versus experiments
  - Radio models are simplistic
    - Radio propagation
    - Reliability
  - Experiment in real life
- Rapid prototyping
  - To test before the deployment
- Open platform
  - For the research community
  - *“A la grid5000”*
  - *You will soon be able to come and test*