D-NET
Dynamic Networks

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http://www.ens-lyon.fr/LIP/D-NET/

Inria Evaluation Seminar — March 2012

Tiny Dream Team Composition

- Project Head
  - Eric Fleury, Professor, ENS Lyon
- Permanent Researchers
  - Guillaume Chelius, CR1, INRIA
  - Christophe Crespelle, MdC, Lyon 1
- Visitors
  - Mariano Beiro
  - Ha Duong PHAN
  - Renaud Lambiotte
  - Artur Ziviani
- Assistant
  - Sèverine Morin
- Engineers
  - Sandrine Avakian (FLAB)
  - Guillaume Roche (SensLAB)
  - Clément Burin des Roziers (SensLAB)
  - Fabien James (SenSAS)
  - Gaetan Harter (SensLAB)
  - François Lefebvre (SensLAB)
  - Fabien Jammes (SensAS)
- PhD Students
  - Andreaa Chis
  - Adrien Friggeri
  - Lucie Martinet
  - Qinna Wang

Outline

- Challenges & Objectives
- Main Projects
- Future

Challenges & Objectives

Vision & goal

- Study of **dynamic evolving interaction networks**
  - Characterization and modeling of complex dynamic properties.
- Study **dynamic processes occurring on dynamic networks**
  - Dynamics **of and on** the network structure.
- Develop **distributed measurement architectures (WSN)**
  - Capture physical phenomena in space and time;
- **Large scale experimental data sets**
- Set up and foster **multidisciplinary collaborations**
  - Life Science Health

Four main scientific axes

- **Measure**
  - Monitor & sample large scale *in situ* network
  - Partial biased view of the dynamic object studied
- **Analyze**
  - Describe the structure, main properties
  - Statistical / structural notions
  - Robustness / pertinence of the measure
- **Model**
  - The dynamic(s)
  - Generate random networks that reproduce dynamics/behaviors
- **Algorithmic**
  - Evaluation & Optimization of distributed algorithms
  - Dynamic process on dynamic networks

Measure = Embedded Networked Sensing

Promise of Embedded Networked Sensing (ENS)

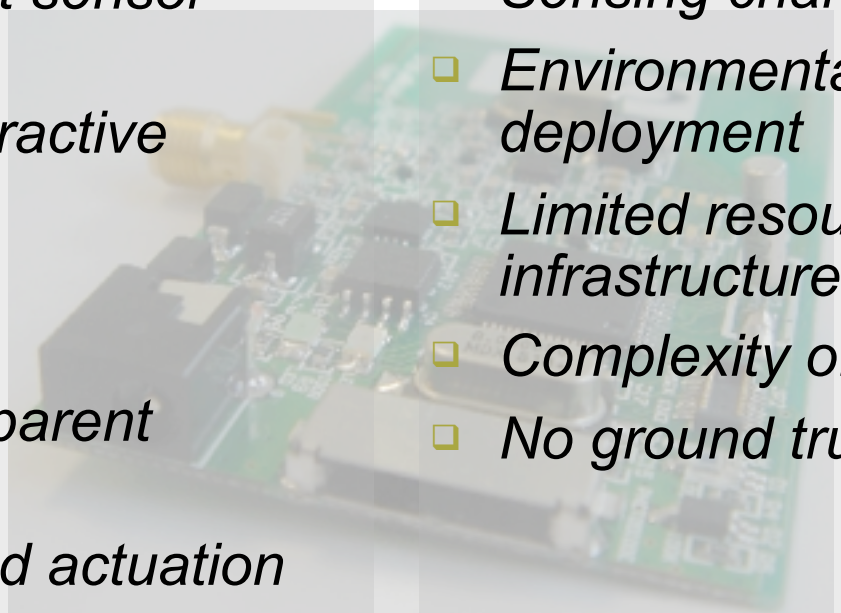
Dense monitoring & analysis of complex phenomena over large regions of space for long periods

Objectives

- *Embeddable, low-cost sensor devices*
- *Robust, portable, interactive systems*
- *Data integrity, system dependability*
- *Programmable, transparent systems*
- *Multiscale sensing and actuation*

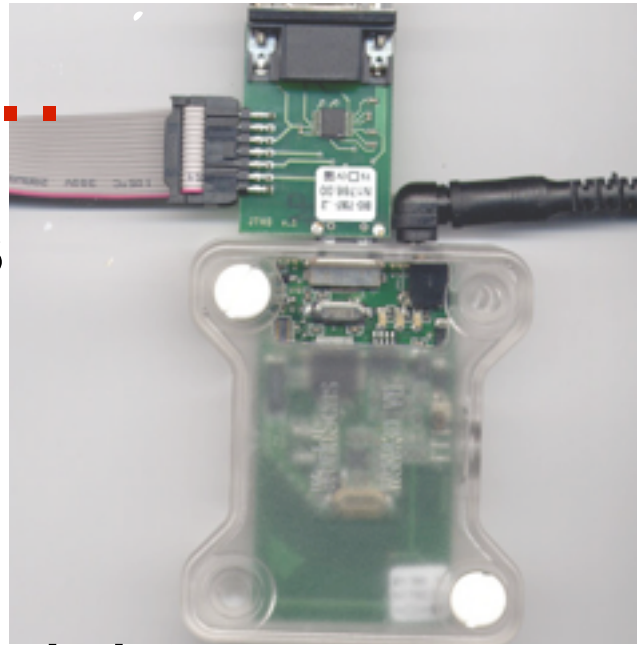
Constraints

- *Sensing channel uncertainties*
- *Environmentally compatible deployment*
- *Limited resources: node, infrastructure*
- *Complexity of distributed systems*
- *No ground truth*



Main projects

Deploy real applications...

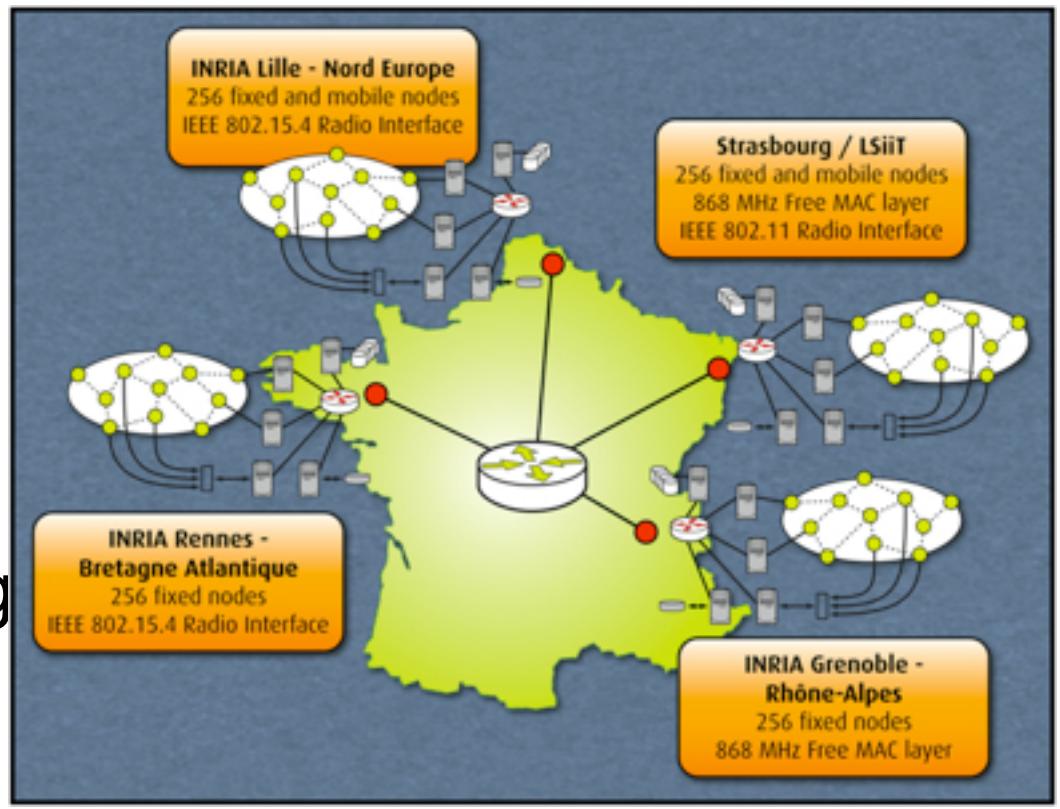


- Build new protocols / applications
  - Specification / Design
  - Simulation
  - Experimentation
- Large scale experimentation is a nightmare
  - Fastidious for a dozen of nodes
  - Manual handling / time consuming / boring

- **Needs to have a specific scientific tool**
  - Reproducibility is a key factor
  - Scientific experiment

SensLAB:First Class Scientific Tool for Large Scale WSN Experiments

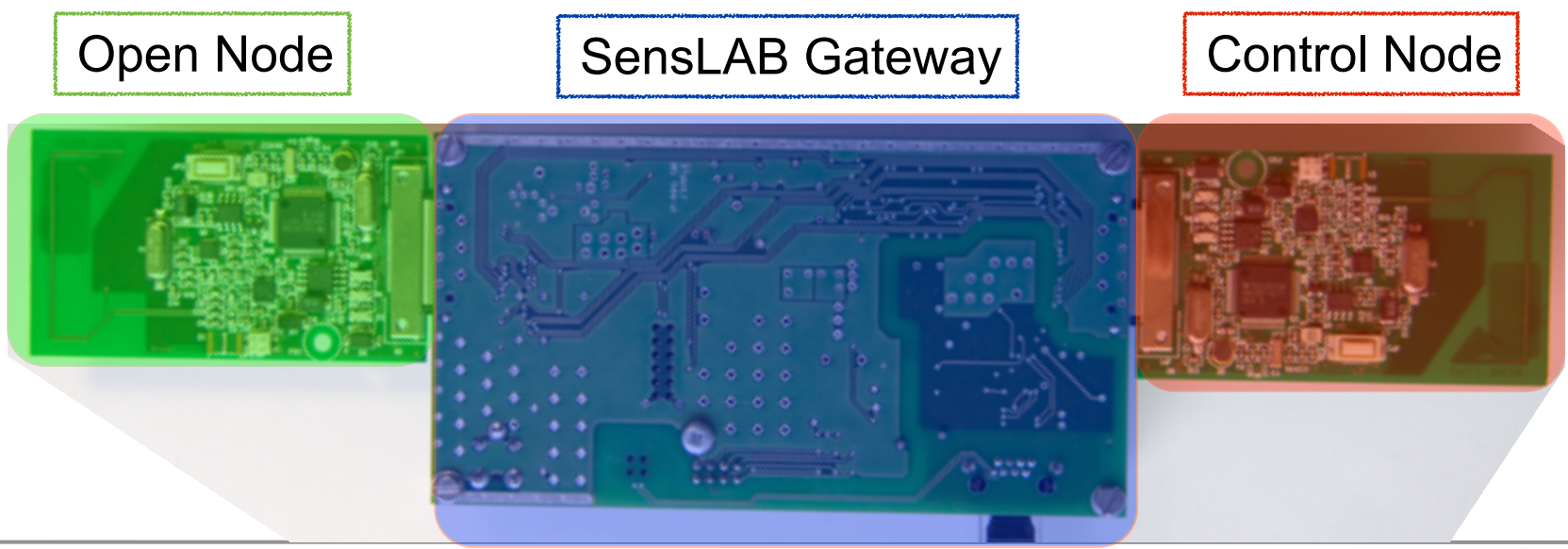
- 1024 nodes
- Generic / Open
- Heterogeneous
- Automation
- Remote access
- Non intrusive Monitoring
- Reproducible

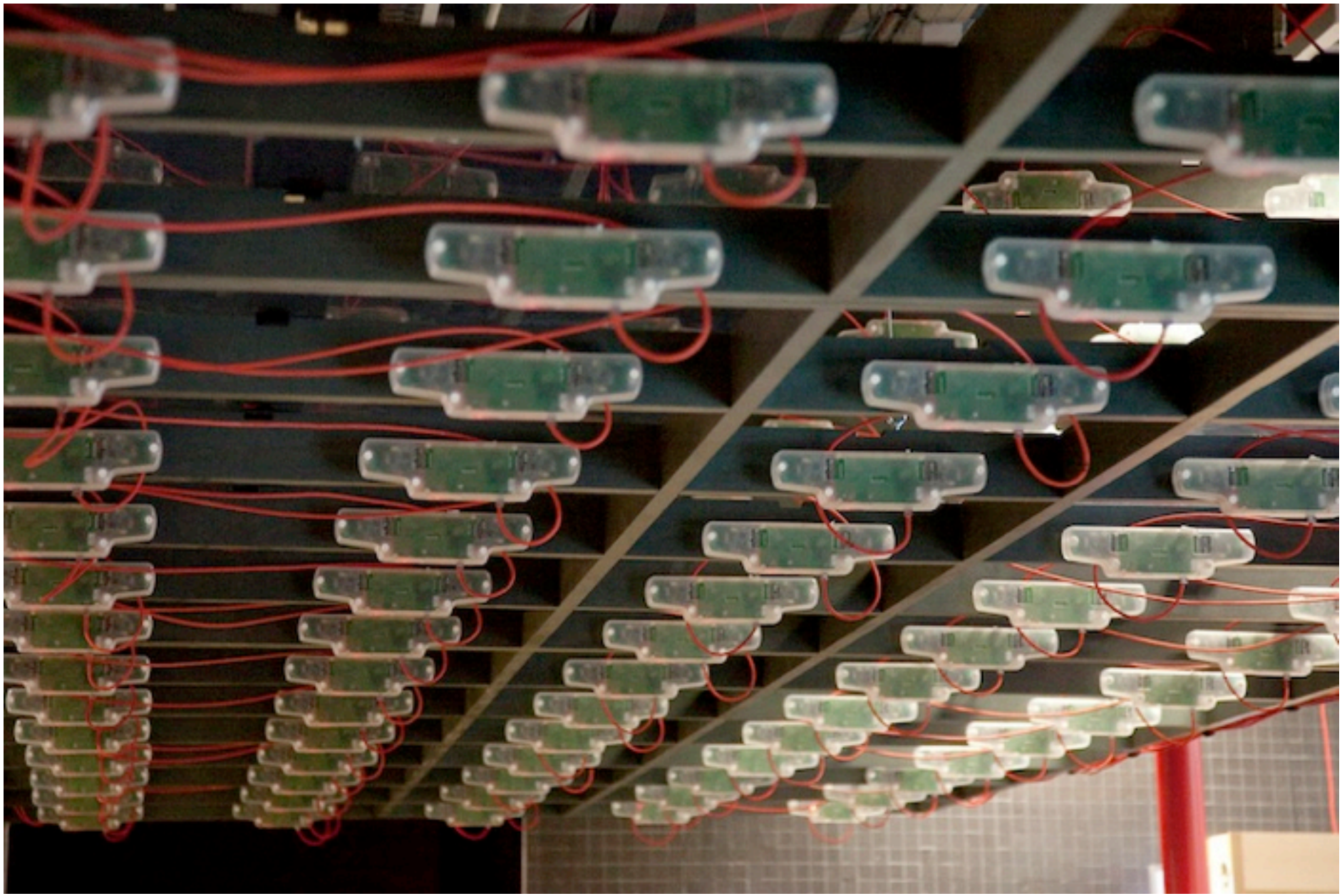


Senslab

Design of SensLAB: Hard & Soft

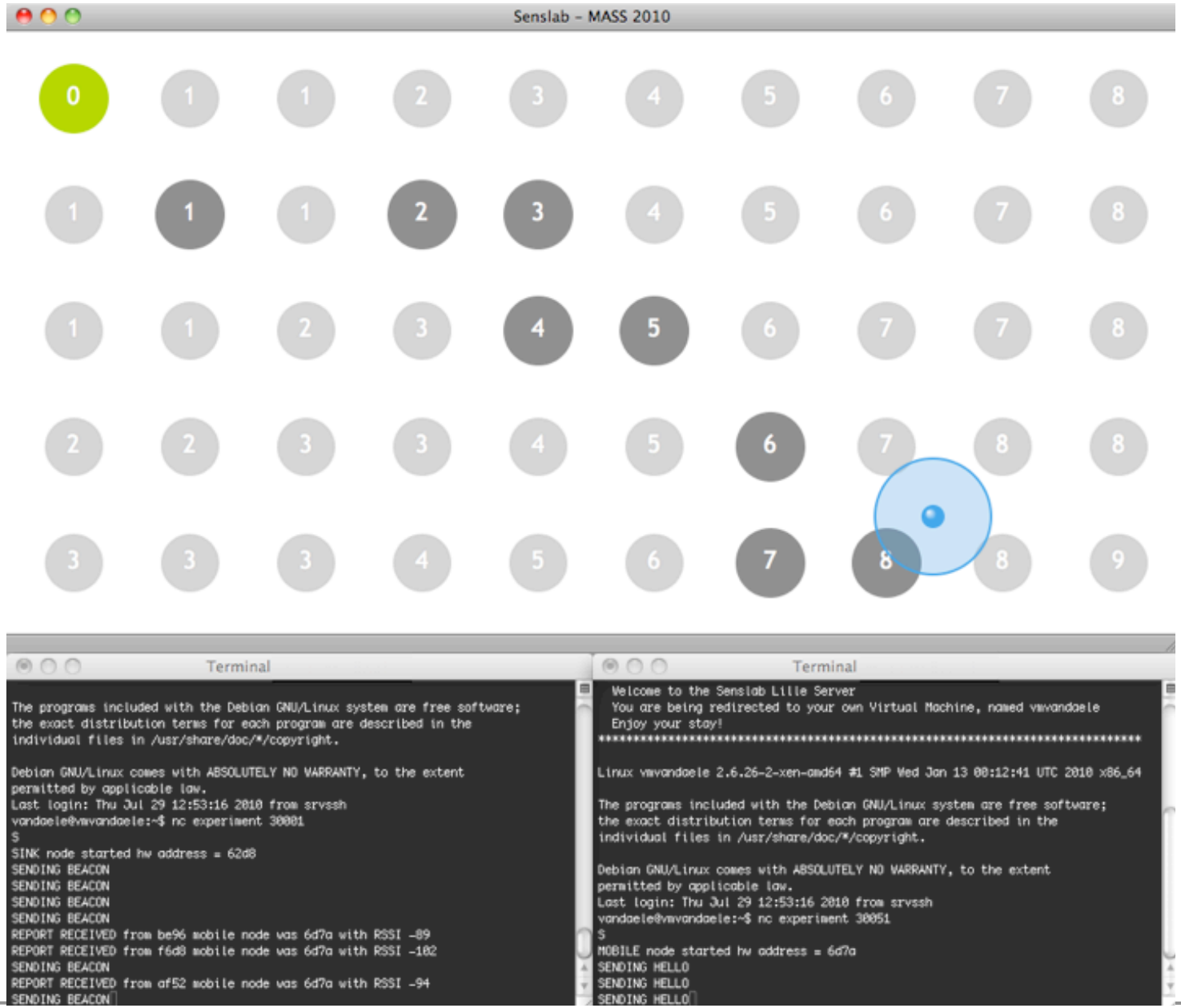
- OPEN: no assumption
- Reliable feedback channel
- Replay stimuli
- Monitor energy consumption
- Each node could be a SINK



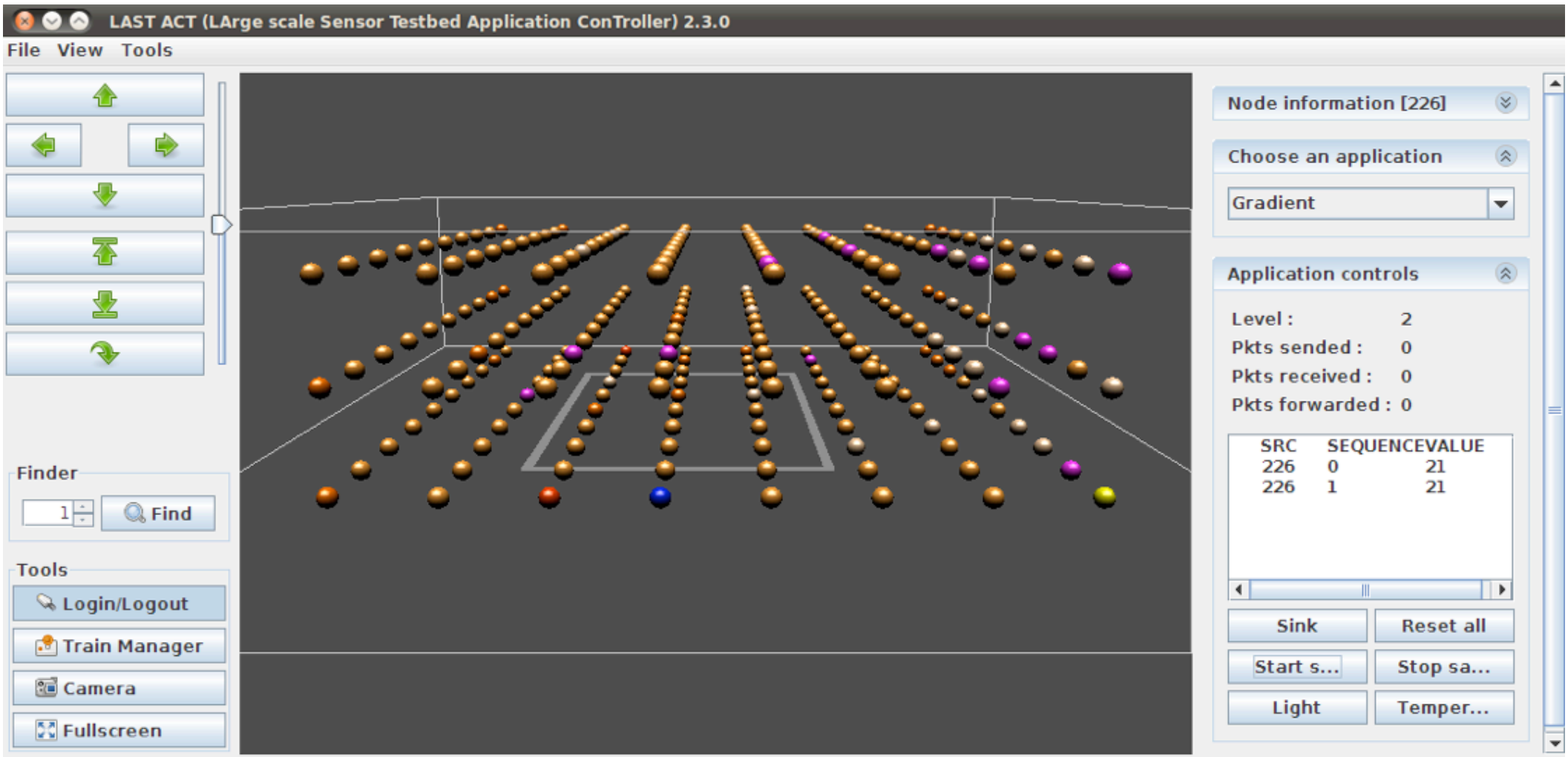



https://grenoble.senslab.info/home.php
Google
ENS de Lyon home D-NET DI INRIA UR Gmail IziGFD Apple Google Maps YouTube Wikipedia
Senslab
Very large scale open wireless sensor network testbed
home experiments store reports account
Home
Personal dashboard
New Experiment
Experiments : 1 running experiment
2 coming experiments
2 past experiments
Profiles : 8 profiles in store
Home's quota :
120 Mo / 500Mo
DB's quota :
640 Mo / 1 Go
VM's status : ON OFF
Senslab activity
10 running experiments on 128 nodes
123 availables, 128 busy, 5 down
View nodes status View Gantt chart

SINK & Mobile Nodes



More on http://www.senslab.info



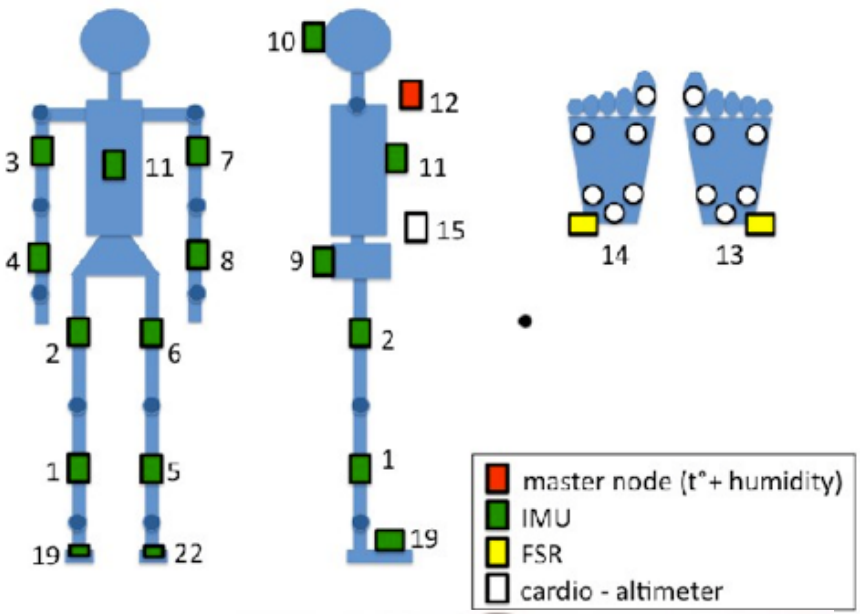
Evolution towards **FIT** (Future Internet of Things)

- One of 52 winning projects in the Equipex research grant program
  - Play a bigger role in the ICT Labs
- Federation with OneLAB
  - SFA & OMF compliant
- Extension of the infrastructure & services
  - more nodes / mobiles / powerful / cognitive radio

Other *in situ* deployments

http://www.inrialpes.fr/Xtremlog

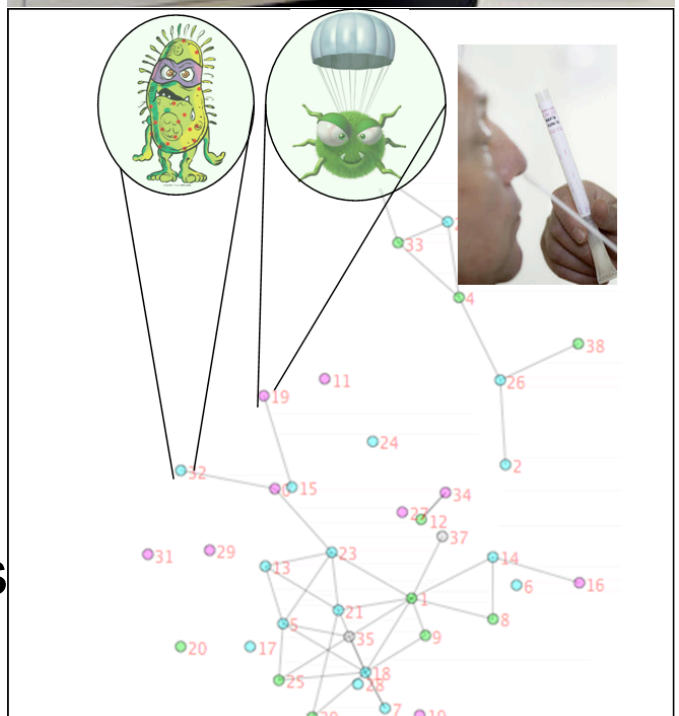
- Desert marathon: 250km
  - self autonomy
- Heterogeneous measurement architecture



mosar

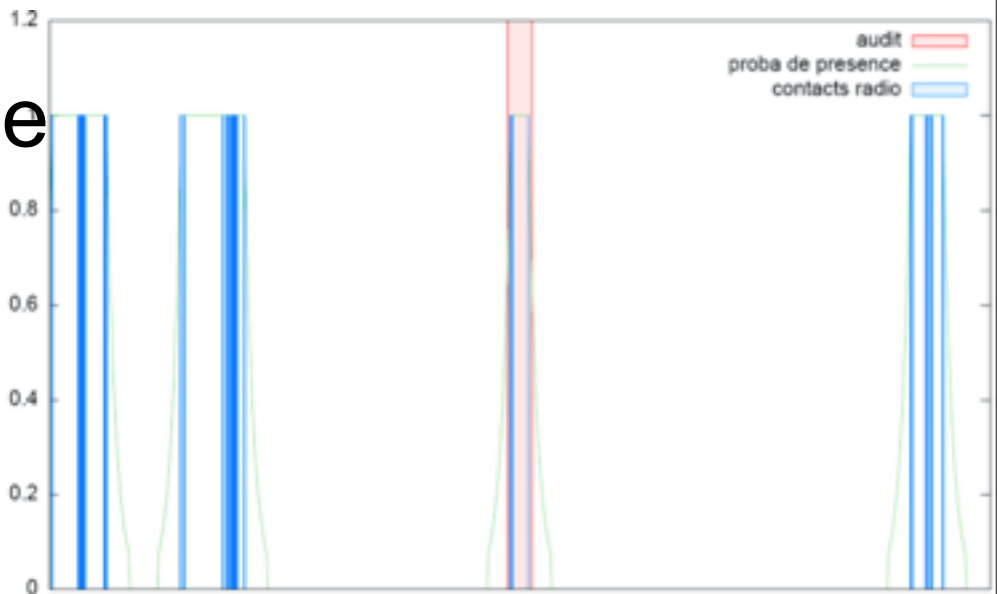
Mastering hOSpital Antimicrobial Resistance in Europe

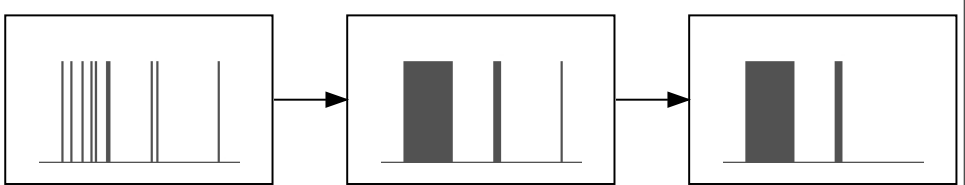
- Understand the dynamic of AMRB
- 1 actor = 1 sensor
- Design hardware & software
- Deploy & Manage
  - All Medical / Nursing staff / Patients
    - 600 people, every 30sec, 24/7, 6 months
  - Individual antibiotic use
  - Swabs every week
    - Characterization of the isolates to determine their epidemicity;

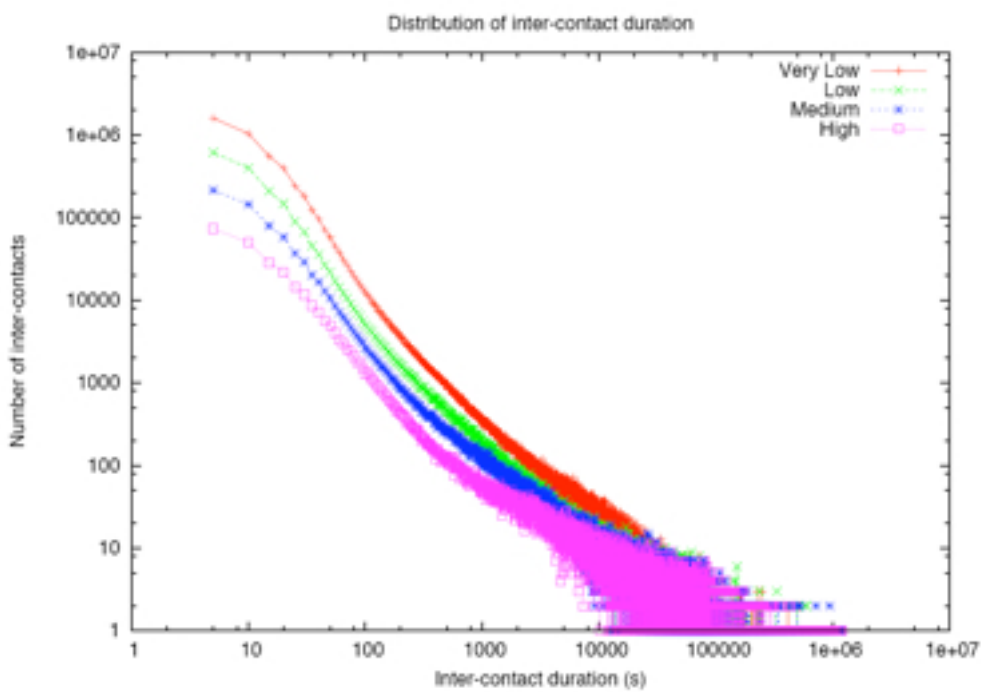


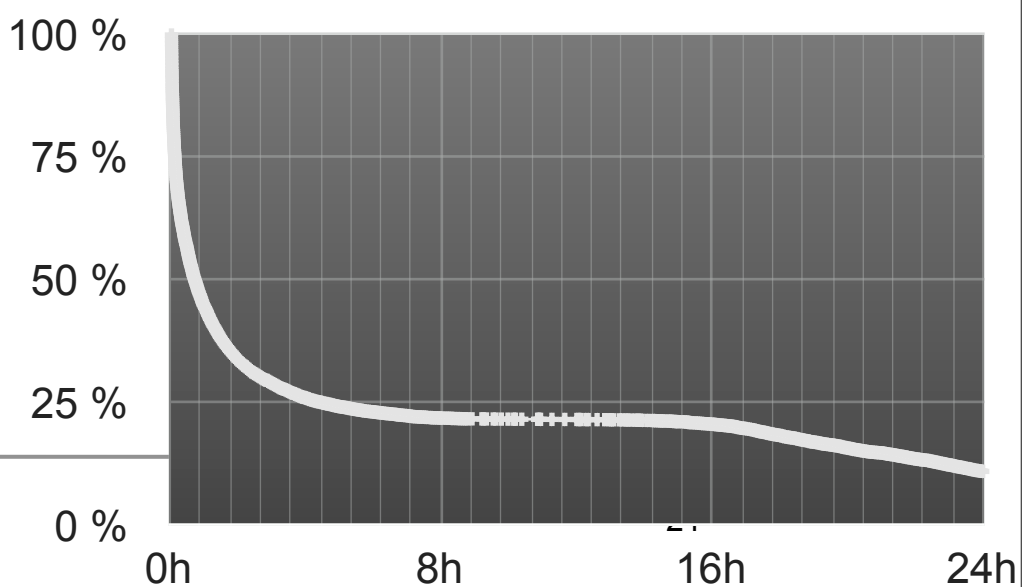
Raw data → observables

- From primitive to analyzable data
- Signal reconstruction
  - Experimental data are "***noisy***"
  - Pkt loss introduces a bias in the measure (*e.g.*, contact time)
  - Statistical signal processing









Future

Evolution(s) & Dynamic !

- G. Chelius, CEO of HiKoB

- Submission of a new Inria team DANTE:
  - ***Dynamic Networks : Temporal and Structural Capture Approach***
- Graph-oriented signal processing
  - **Switching from 1 image to a video sequence!**
  - **Harmonic analysis of dynamic graphs, both in time and space**
  - **Stationarity**
- Dynamic graph theory
- Algorithmic