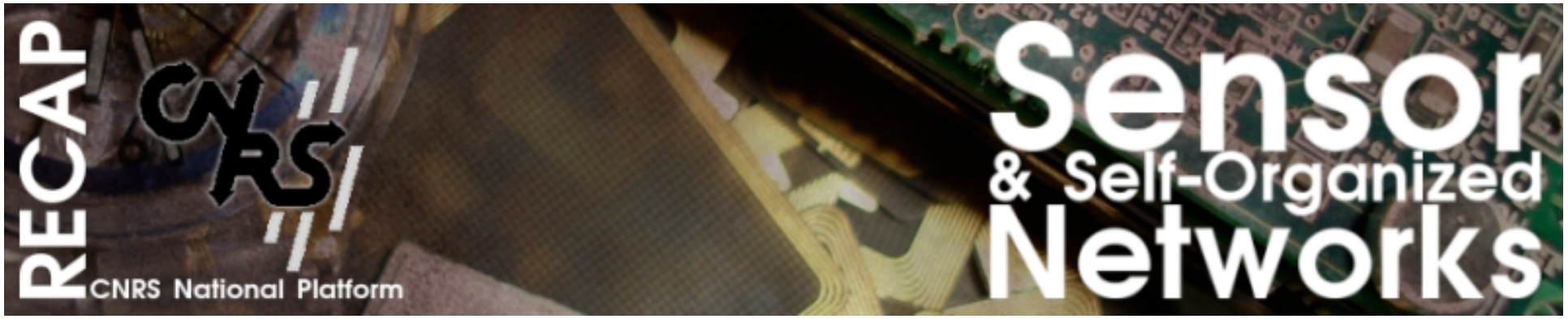


« CNRS RECAP Platform »

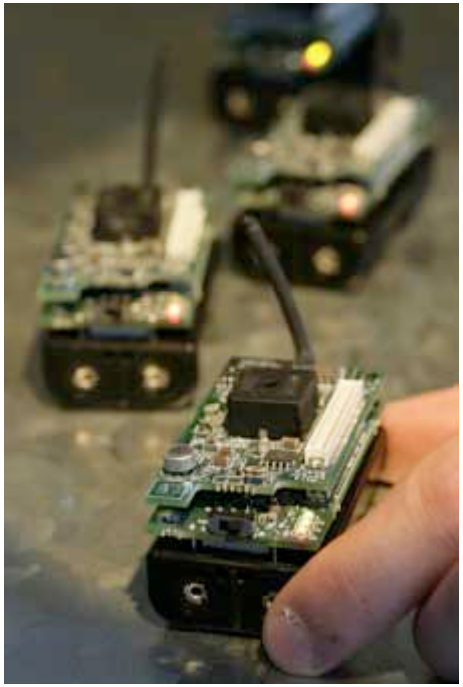
Sensor ans Self-Organized Networks

http://www/lifl.fr/sensor

Outlines

I. Internet of things and
Wireless Sensor Networks

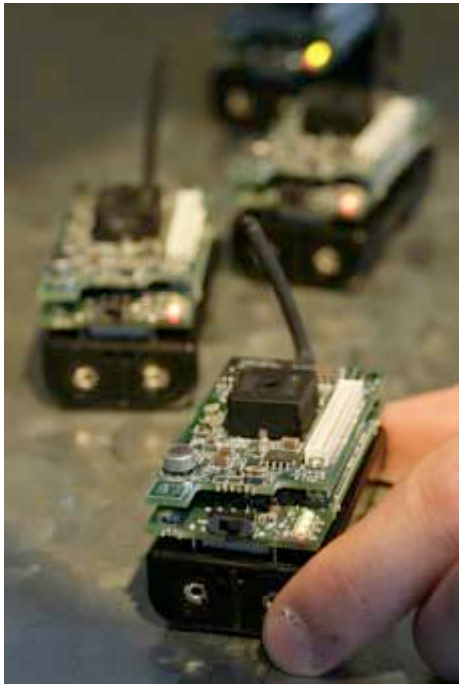
II. RECAP platform



Outlines

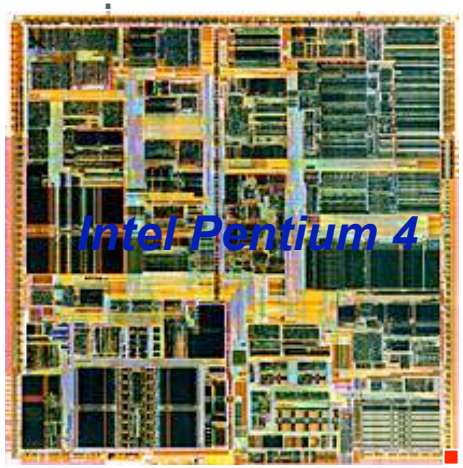
I. Internet of things and Wireless Sensor Networks

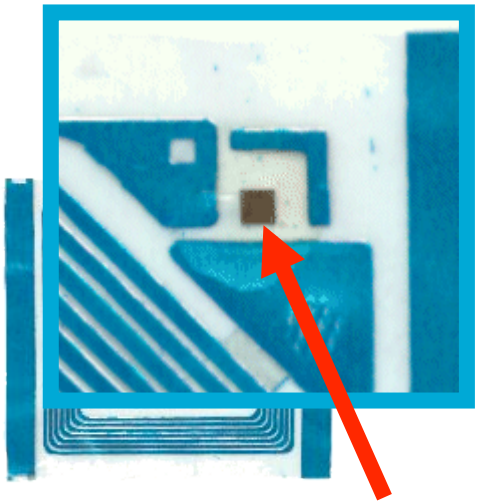
II. RECAP platform



RFID Tags

- Smart labels
  - Radio Frequency Identification Tag
  - By opposition to **bar code** which use **optical** principles
- A stronly limited component:
  - 500 times smaller than a classical





Chip with a size of some mm²

EAS Application

- Electronic Article Surveillance
  - Once powered, the tag emits
  - The reader listen channel and activate alarm as early as transmission is detected
  - During checkout, the tag is burned out
  - Problem: power and hear the tag whatever the tag orientation

Applications

- Batch identification
  - It is the capability to collect information from a set of tags
  - In opposition to optical identification

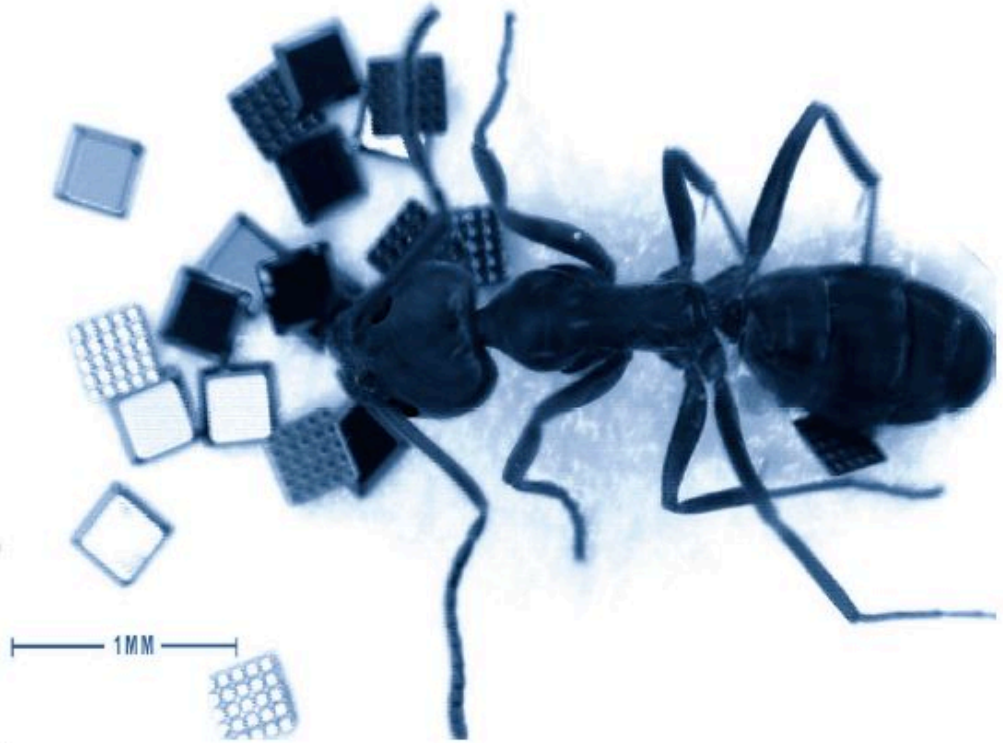
Marathon
Automatic clocking in

Automatic luggage sorting

Automatic inventory
50 items in less than one second

More POPS, smaller POPS…

POPS = Portable Objects Proved to be Safe
POPS = Petits Objets Portables et Sécurisés

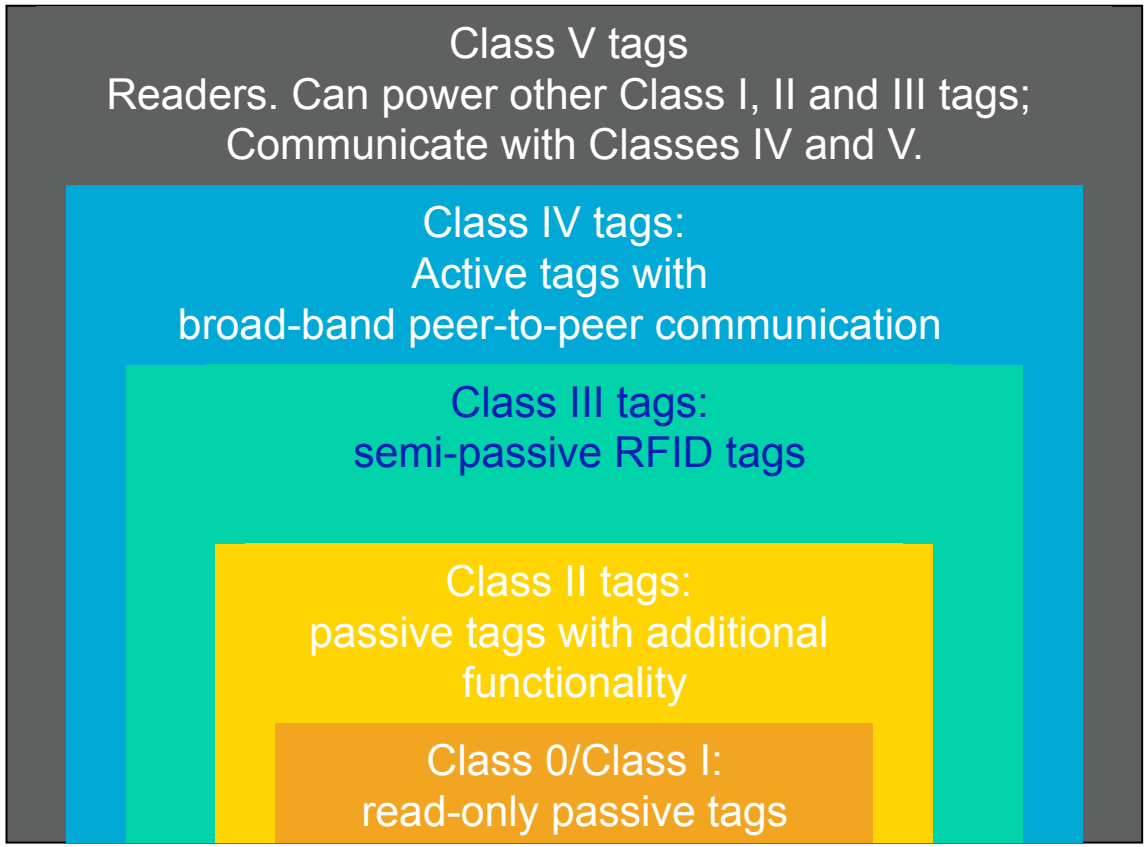


The MIT Auto-ID Center Vision of "the internet of things"

Courtesy, Auto-ID Center

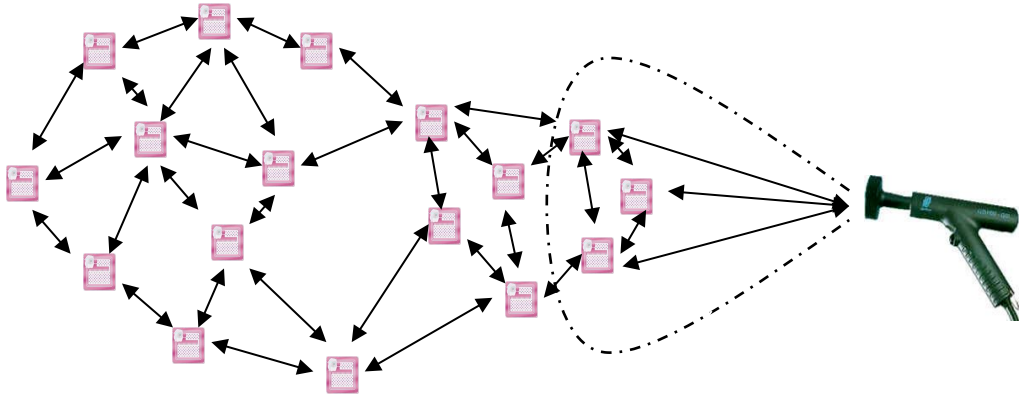
Networking the physical world

Auto-ID Center classification

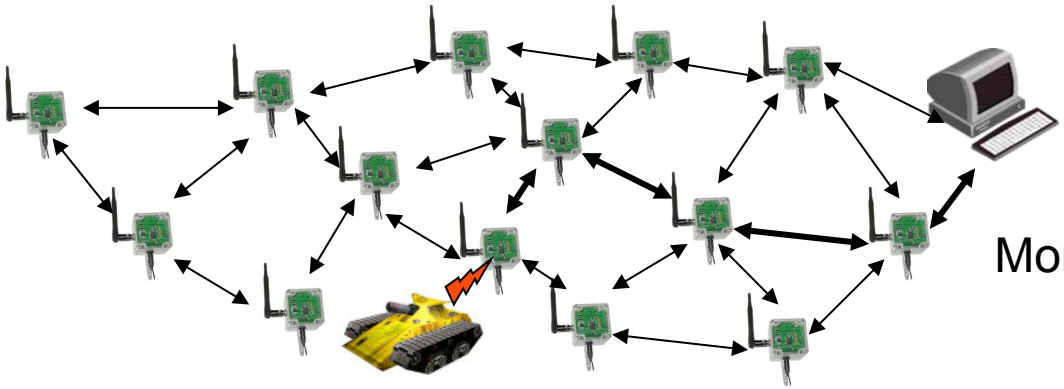


Benefits of class IV tags

- Decentralized behavior
  - The request is broadcasted in the whole network by using multi-hop method



- Similar to sensor networks



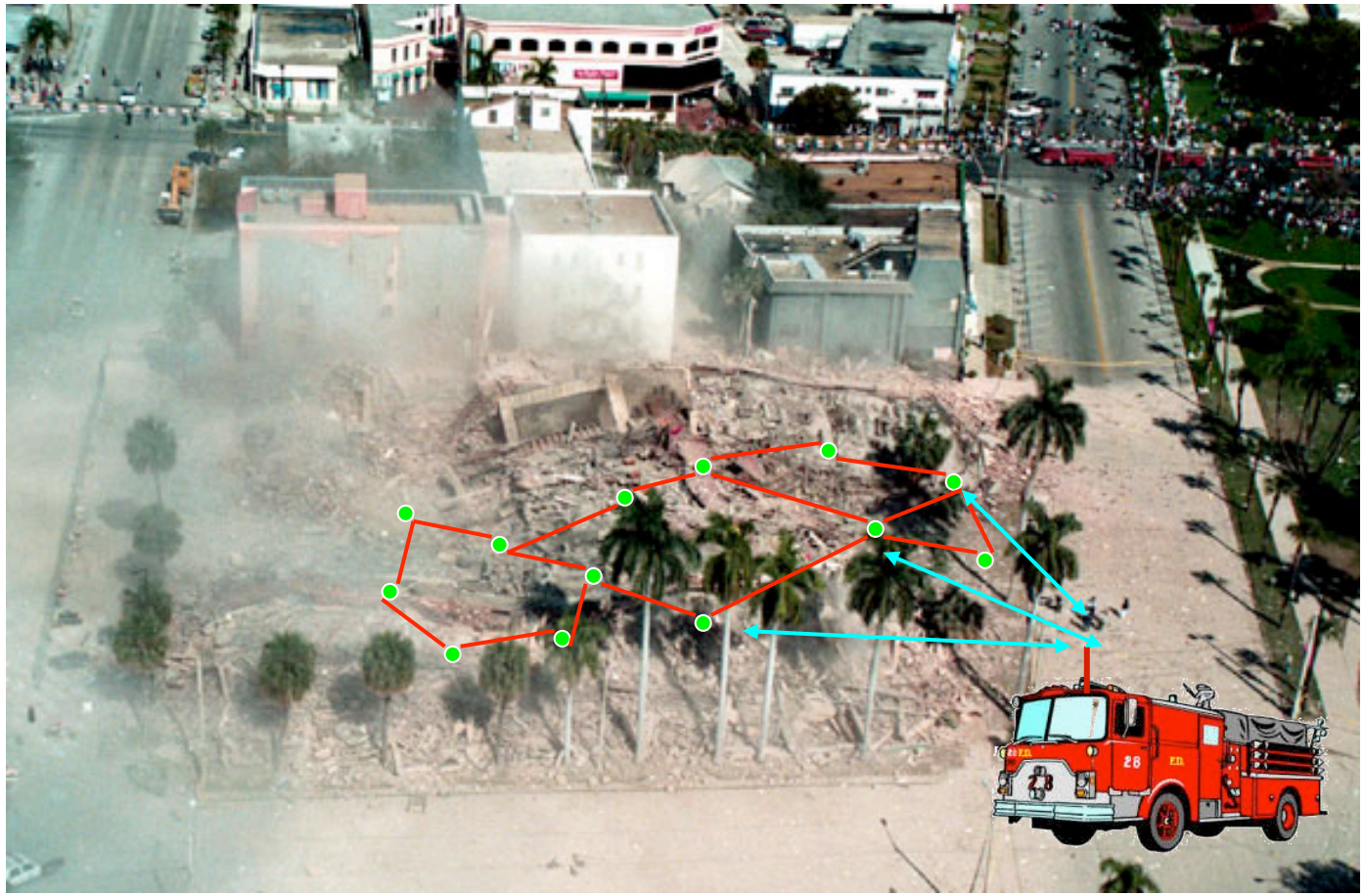
Monitoring station

Sensor Nets for Search and Rescue

- **Inactive Sensor**

Sensor Nets for Search and Rescue

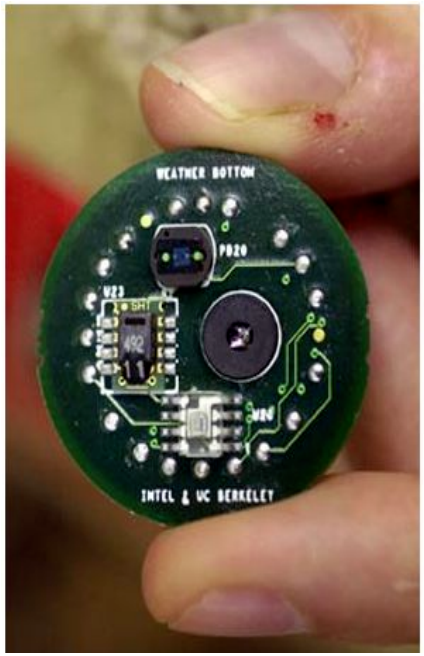
Sensor Nets for Search and Rescue



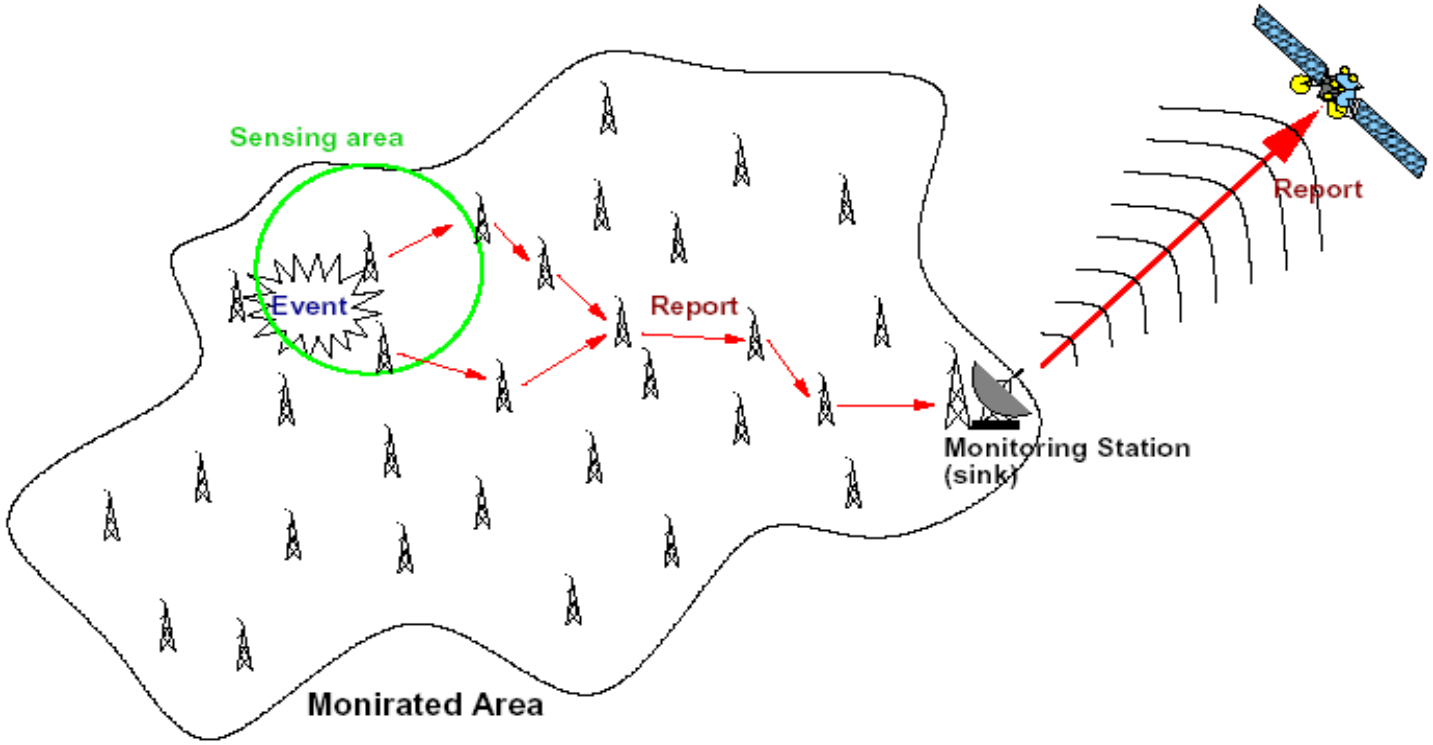
- **Active Sensor**

Application

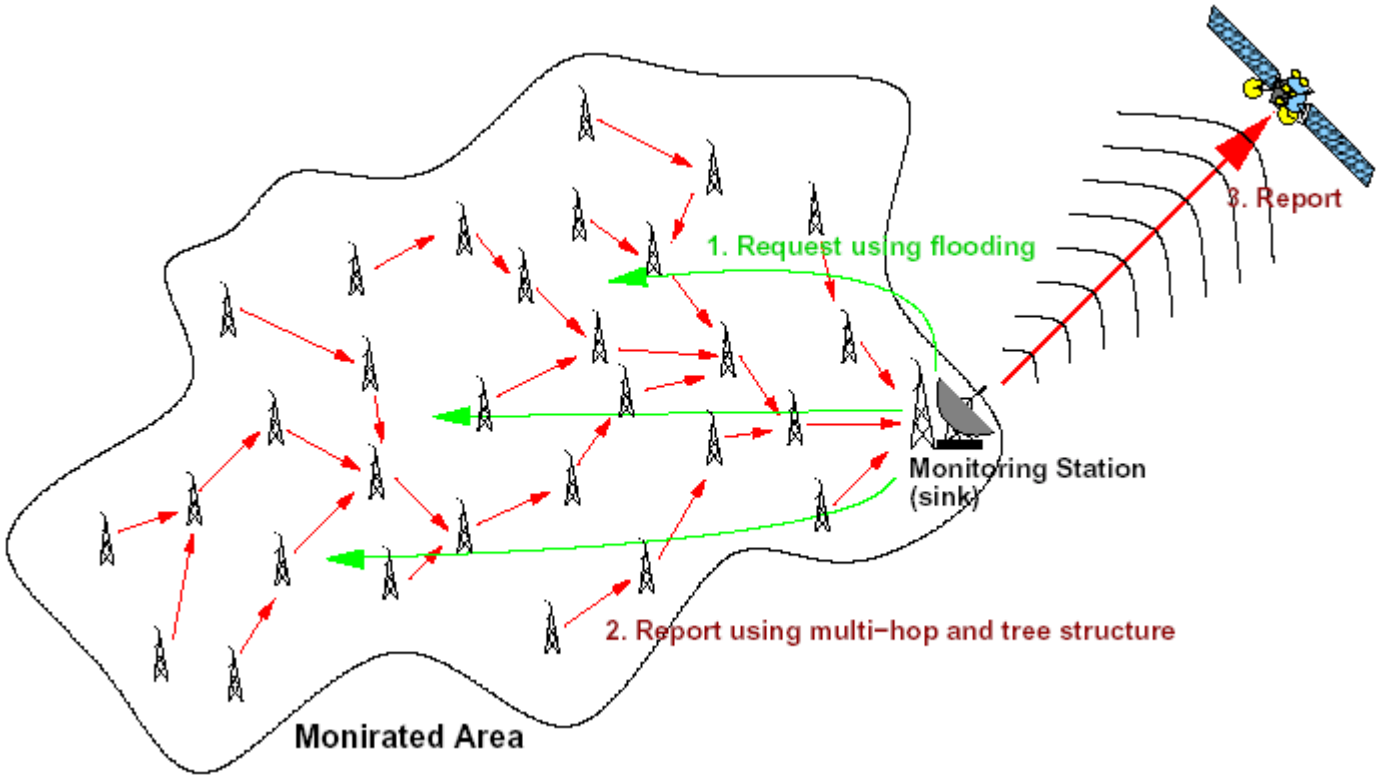
- In the UC Berkeley Botanical Garden, 50 “micromotes” sensors are dangled like earrings from the branches of 3 redwood trees to monitor their growth.



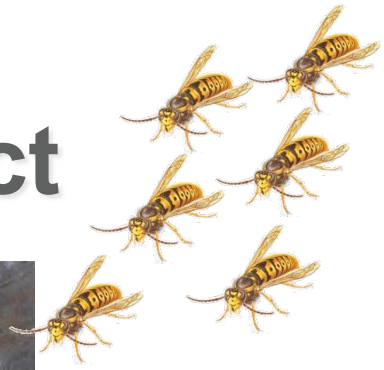
Event-driven model



On-demand model



WASP Project

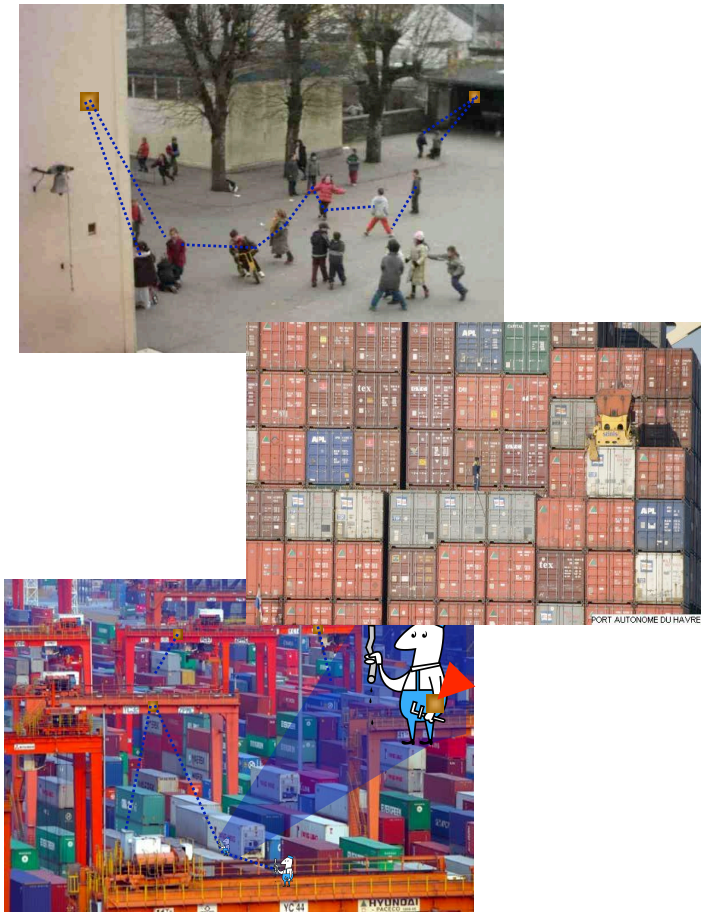


Wirelessly Accessible Sensor Populations

Philips Research Eindhoven, Philips Forschung Laboratorium, IMEC, CSEM, TU/e, Microsoft Aachen, Health Telematic Network, Fraunhofer IIS, Fokus, IGD, Wageningen UR, Imperial College London, STMicroelectronics, INRIA, Ecole Polytechnique Federale Lausanne, Cefriel, Centro Ricerce Fiat, Malaerdalen University, RWTH Aachen, SAP, Univ of Paderborn

SVP Project

Surveiller et Prévenir



CEA, INRIA, Institut Maupertuis, Aphycare, LIP6, M2S, Thales, ANACT

Experiments

Un Anthony motivé par la recherche !

Ceinture POLAR pour la mesure ambulatoire de la FC

VO2000 : Mesure ambulatoire des échanges gazeux

5 capteurs Séréo'Z sans fil

Tapis déroulant
Vélo à effort paramétrable
Sac à dos chargé

Outlines

I. Internet of things and
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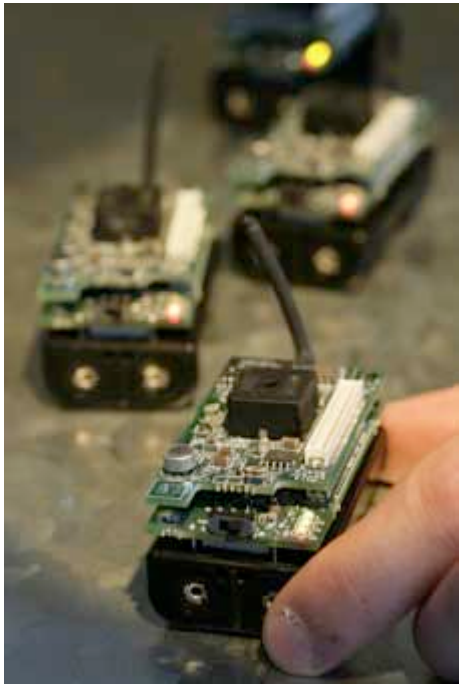
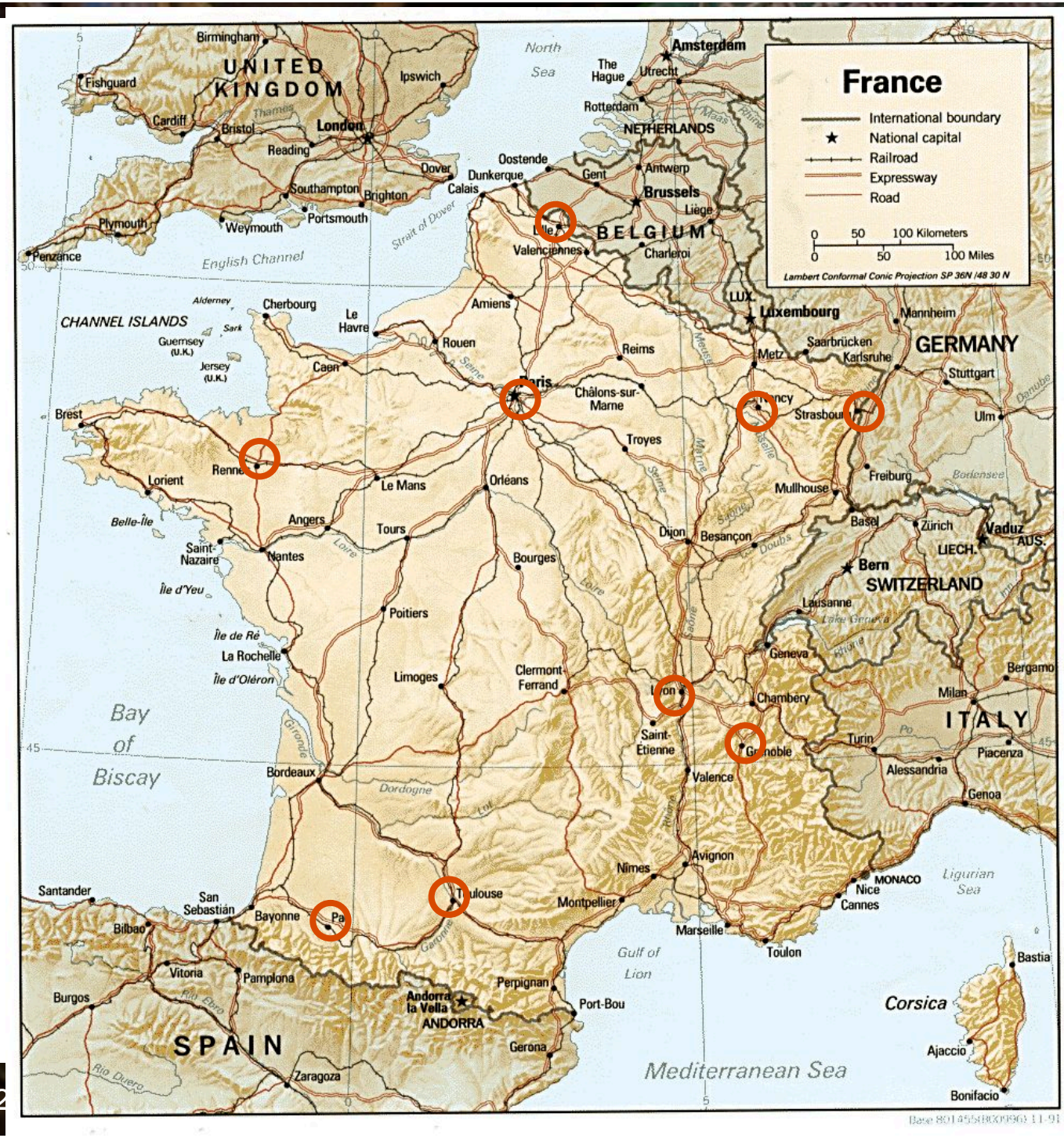


CNRS RECAP Platform

- **RECAP** = **RE**seaux de **CAP**teurs
  - Initially funded by CNRS in 2005
  - National CNRS Platform
    - 9 partners
  - Focus on platforms

- **Public workshops**
  - Nice 2005, Rennes 2006, Lyon 2006, Montpellier 2007
  - Coming event: Toulouse November 13-14, 2008!

  - More information: http://www.senslab.info


France
International boundary
National capital
Railroad
Expressway
Road
0 50 100 Kilometers
0 50 100 Miles
Lambert Conformal Conic Projection SP 36N /48 30 N
UNITED KINGDOM
BELGIUM
NETHERLANDS
LUX.
Luxembourg
GERMANY
SWITZERLAND
LIECH.
Vaduz
AUS.
ITALY
SPAIN
ANDORRA
Andorra la Vella
MONACO
CHANNEL ISLANDS
Corsica
Bay of Biscay
English Channel
North Sea
Mediterranean Sea
Gulf of Lion
Ligurian Sea
Strait of Dover
Amsterdam
The Hague
Utrecht
Rotterdam
Birmingham
Fishguard
Cardiff
Bristol
London
Reading
Ipswich
Dover
Oostende
Dunkerque
Calais
Gent
Antwerp
Brussels
Liège
Charleroi
Valenciennes
Lille
Plymouth
Weymouth
Portsmouth
Southampton
Brighton
Penzance
Alderney
Sark
Guernsey (U.K.)
Jersey (U.K.)
Cherbourg
Le Havre
Caen
Rouen
Amiens
Reims
Paris
Châlons-sur-Marne
Metz
Saarbrücken
Karlsruhe
Mannheim
Stuttgart
Ulm
Strasbourg
Nancy
Troyes
Brest
Rennes
Lorient
Le Mans
Orléans
Belle-Île
Angers
Tours
Saint-Nazaire
Nantes
Île d'Yeu
Île de Ré
La Rochelle
Île d'Oléron
Poitiers
Bourges
Limoges
Clermont-Ferrand
Mullhouse
Freiburg
Basel
Zürich
Dijon
Besançon
Bern
Lausanne
Lake Geneva
Geneva
Lyon
Chambery
Saint-Étienne
Grenoble
Turin
Milan
Bergamo
Piacenza
Alessandria
Genoa
Valence
Bordeaux
Toulouse
Montpellier
Nîmes
Avignon
Marseille
Toulon
Nice
Cannes
Bayonne
San Sebastián
Bilbao
Santander
Vitoria
Pamplona
Burgos
Perpignan
Port-Bou
Gerona
Zaragoza
Bastia
Ajaccio
Bonifacio

Partners

- **CITI, INSA Lyon, ARES INRIA Rhône-Alpes (Eric Fleury)**
- CRAN, Nancy (Vincent Lecuire)
- IRISA, INRIA, CNRS, Univ. Rennes 1, INSA Rennes (Patrice Quinton)
- **LAAS, Toulouse (Michel Diaz)**
- **LIFL, Univ. Lille 1, POPS INRIA Futurs (David Simplot-Ryl)**
- **LIP6, Univ. Pierre et Marie Curie, Paris (Serge Fdida)**
- LIUPPA, Univ. Pau et des Pays de l'Adour (CongDuc Pham)
- LSIIT, Univ. Louis Pasteur, Strasbourg (Thomas Noël)
- LSR, IMAG, Grenoble (Andrzej Duda)

Hardware platforms – first phase

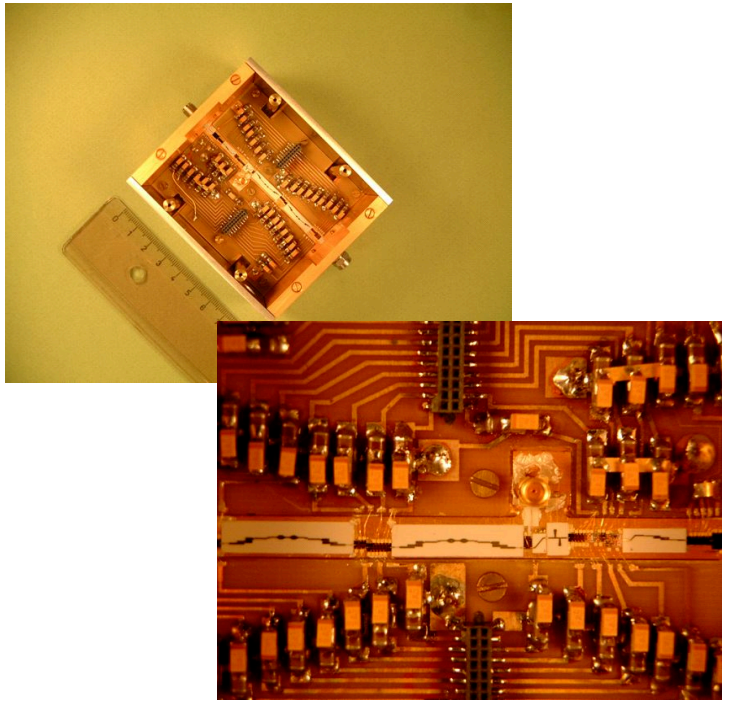
- 3 different platforms

- Motes
  - ~90 nodes
  - Experimentations with TinyOS and SOS
  - Dynamic graph application in Paris and Lille

- Mini-PC
  - ~36 nodes
  - Non-constrained platforms for small scale experimentations
  - Mesh networks in Lyon and Paris
- FPGA Platform
  - ~4 development platforms
  - Core ARM+FPGA dedicated to
    - Hardware-software interface Lille and Lyon

Hard/soft interface in wireless communications

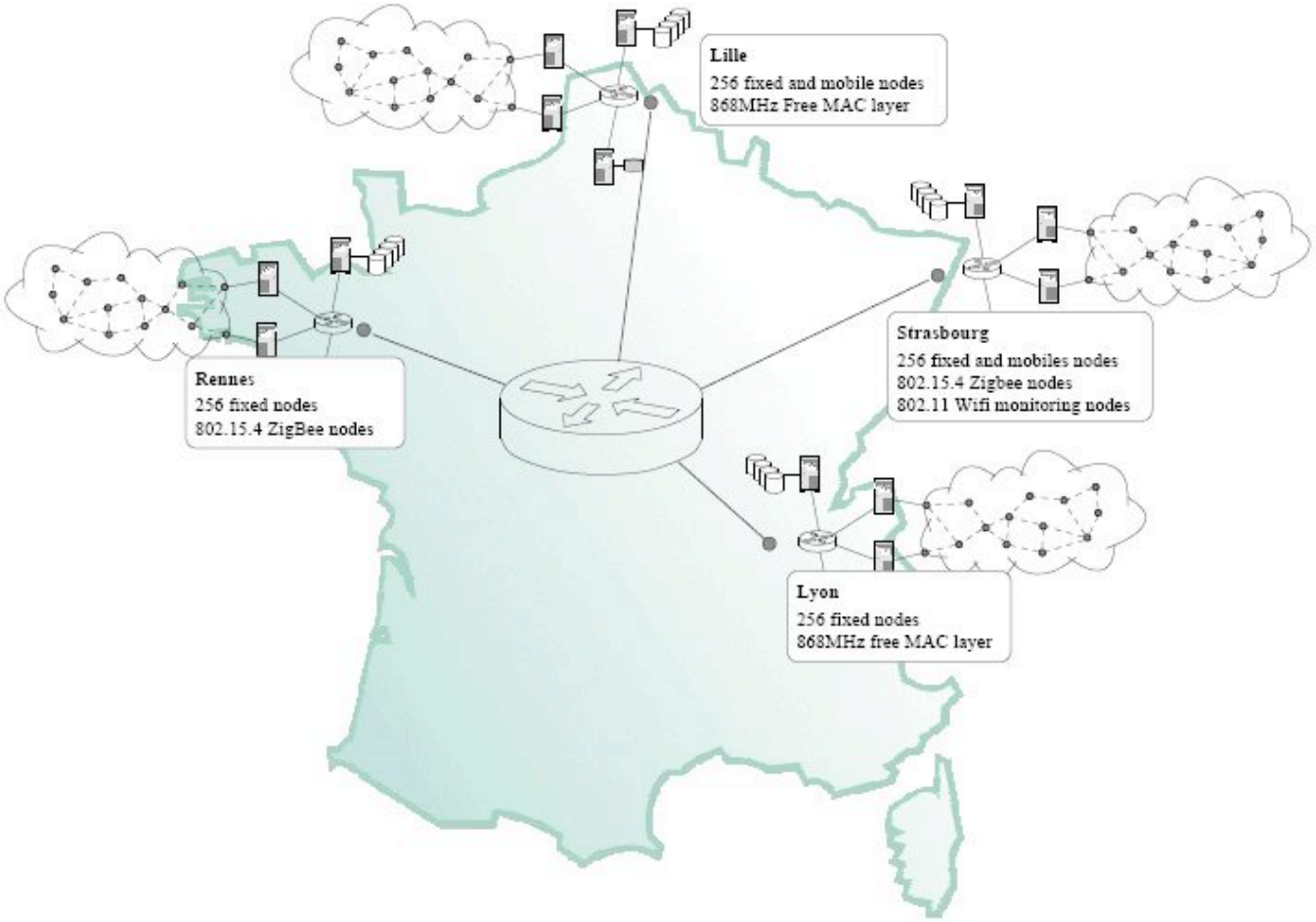
- **In partnership with IEMN**
  - **Research institute in microelectronic area**
- **High rate communication interface for indoor communications**
  - 60 GHz UWB 100 Mb/s
    - Contention free
    - Directional antennas
  - Use of a low rate (12 Mb/s) control channel
    - Random access (variation of CSMA/CA)
    - Omnidirectional reception
    - Directional emission
- **Some challenges**
  - Combination of packet scheduling and topology control
  - Beam switching and reduction of energy consumption



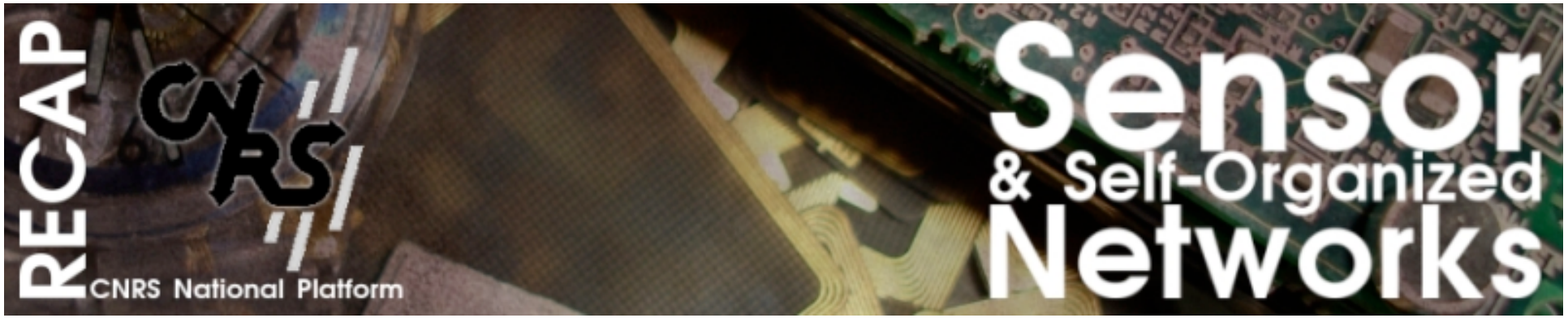
Hardware platform – 2nd phase

- **Open large scale experimentation platform**
  - 4 locations avec 4 different scenarios
    - Number of nodes
    - Topology
    - Mobility?
  - At least 250 nodes per location
  - Applications, network configuration and experimental results available via Internet
    - Experimentation with nodes in a single site
    - Experimentation with nodes in several sites connected via Internet (second phase)

SensLab : very large open wireless sensor network testbed



- Funded by ANR - http://www.senslab.info



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