# SMART CITIZENS IN SMART CITIES

**challenging case studies for the group projects of "S&SE"**

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**March 2015**

# MOTIVATIONS (OF THIS TALK AND OF THE PROJECTS IN GENERAL)

- Trying to work on something interesting, i.e.,
  - Interesting technology/science for pervasive cyber-socio-technical systems in "smart cities" scenarios
  - How to apply such technologies and how science can be of help to better understand them
  - Seeing far in the future of software engineering for adaptive socio-technical systems
  - Apply the standard lessons of SE to non standard scenarios
- Trying to have you discuss with each other and exchange experience and knowledge
  - Think about in visionary terms
  - Group work for software engineering

# THE GROUP PROJECTS: OVERVIEW

- Now (with this talk):
  - Identify a few interesting/visionary/challenging future application scenarios related social services provided by citizens in future cities scenarios
  - In which "pervasive socio-technical adaptation" research/technology can be effectively applied
- After this talk
  - Group students in teams of 3-5 and assign a case study to each one
- Following (during the course)
  - Adopt the identified case studies as the themes of group projects (one for each group)
  - To be expanded/developed by exploiting the lessons learnt during the course, and your own fantasy
  - To develop them as if they were software projects
  - With some prototyping and simulations

# THE METHODOLOGY FOR GROUP PROJECTS (1)

- I will only "sketch" the vision behind the case studies
  - Do not go into technical details or into the details of the envisioned functioning of applications within
- You will have to detail the scenario with your own visions of usage, functionalities, and technological solutions
  - Possibly revising (or even scrambling) it if you think so
  - Going as far as possible in terms of "conceptual design"
  - Trying to identify open challenging issues too
- This will be a sort of first exercise of **Requirements Engineering**
  - Early term presentation (after Easter): The Refine Scenario
  - First term presentation (late April): The Requirements Document
- There are specific time slots devoted to group project
  - However, since we are all here, we can work on projects at any time and at any place
  - Inter-group interactions are encouraged

# THE METHODOLOGY FOR GROUP PROJECTS (2)

- After the definition of the scenarios
  - Architectural Design
  - Specific Technical Solutions & Issues
  - Societal Issues (acceptance, fidelization, critical mass)
- Second term presentation
  - The Design Document (Mid May)
- Evolving the solutions
  - We will make several specific lessons to learn new possible approaches to software and service engineering
  - We could see how to integrate such approaches in the projects
  - Make some small simulations of the scenario
  - Make a prototype implementation of an app (i.e. a JSP server and an HTML5 mobile app).
  - Make a business plan
- Final presentation
  - Late May / Early June
- In general
  - Inter-group interactions are encouraged

# WHAT CHARACTERIZES THE CASE STUDIES?

- Medium/long-term social/technological scenarios in which:
  - Pervasive computing technologies (sensors, tags, smart phones, wireless communications, etc.) have become massively pervasive (houses, streets, offices, etc.) along with Social computing technoLogies
  - And can be put to the service of people (whoever) and society to improve quality of social life in cities
  - Can enrich human capabilities and cities "smartness"
- Yet, for them to be very useful
  - They require capability of dynamically self-organize and self-adapt their computational/communication activities
  - i.e., they require "Complex Adaptation at the Socio-Technical Level"

# THE SELECTED CASE STUDIES

- A single scenario:
  - Smart and social services in ***urban superorganism***
- Different specific case studies with different goals
  - Supporting more social and sustainable mobility
  - Making cities a better and safer place for children
  - Making cities a better and safer place for disabled people
- Yes many common points
  - Intensive exploitation of pervasive computing technologies
  - Strongly embedded in the physical and social fabrics
  - Dealing with social (and psychological) aspects
  - Need for adaptation at both the social and the ICT level
- Also (possibly, you will tell us)
  - Many solutions that can be shared by more than a single scenario
  - Many "sub-parts" than can be useful to several scenarios

# THE URBAN SUPERORGANISM (i)

- An ICT-enriched urban environment with rich sensing, actuating, and computing capabilities
  - Sensing: sensor networks, rfid tags, smart objects, traffic and crowd detectors
  - Actuation: traffic lights, traffic inhibitors, digital traffic signs, public digital displays, but also critical infrastructures (electric grid, heating, phone, and wifi networks)
  - Computing: distributed and decentralized, with computational engines available everywhere, simple pattern recognition
- People with smart phones or alike (or whatever will appear in the future as wearable devices) contribute to such capabilities
  - Sensing: beside the 5 senses (which people can input to their personal devices), also cameras, accelerometers, microphones, to contribute to the sensing capabilities of the town
  - Actuating: the body, social persuasion
  - Computing: human intelligences, networked via social collaboration tools, complex pattern & emotioin recognition

# THE URBAN SUPERORGANISM (ii)

- The ICT and Human/Social level in the depicted scenarios are not distinct, and are rather blurred to the point of invisibility:
  - ICT-driven actions inter-twined with Human actions
  - People-driven sensing intertwined with and indistinguishable from ICT-driven one
  - Computational decisions and human-made decisions
- Their capabilities well complement each other in a process of extremely high value co-creation
  - There are things ICT still cannot do (e.g. recognize some complex visual events) for which human sensing is necessary.
  - There are things that ICT can do (e.g., enable distributed collaboration among a group of distributed persons) that humans cannot easily do
- In the resulting overall "urban organism", we can therefore achieve very high-level of collective "urban" intelligence
  - That can dramatically change the way we live, work, move, and play, in our towns

# THE SUPERORGANISM LOOP
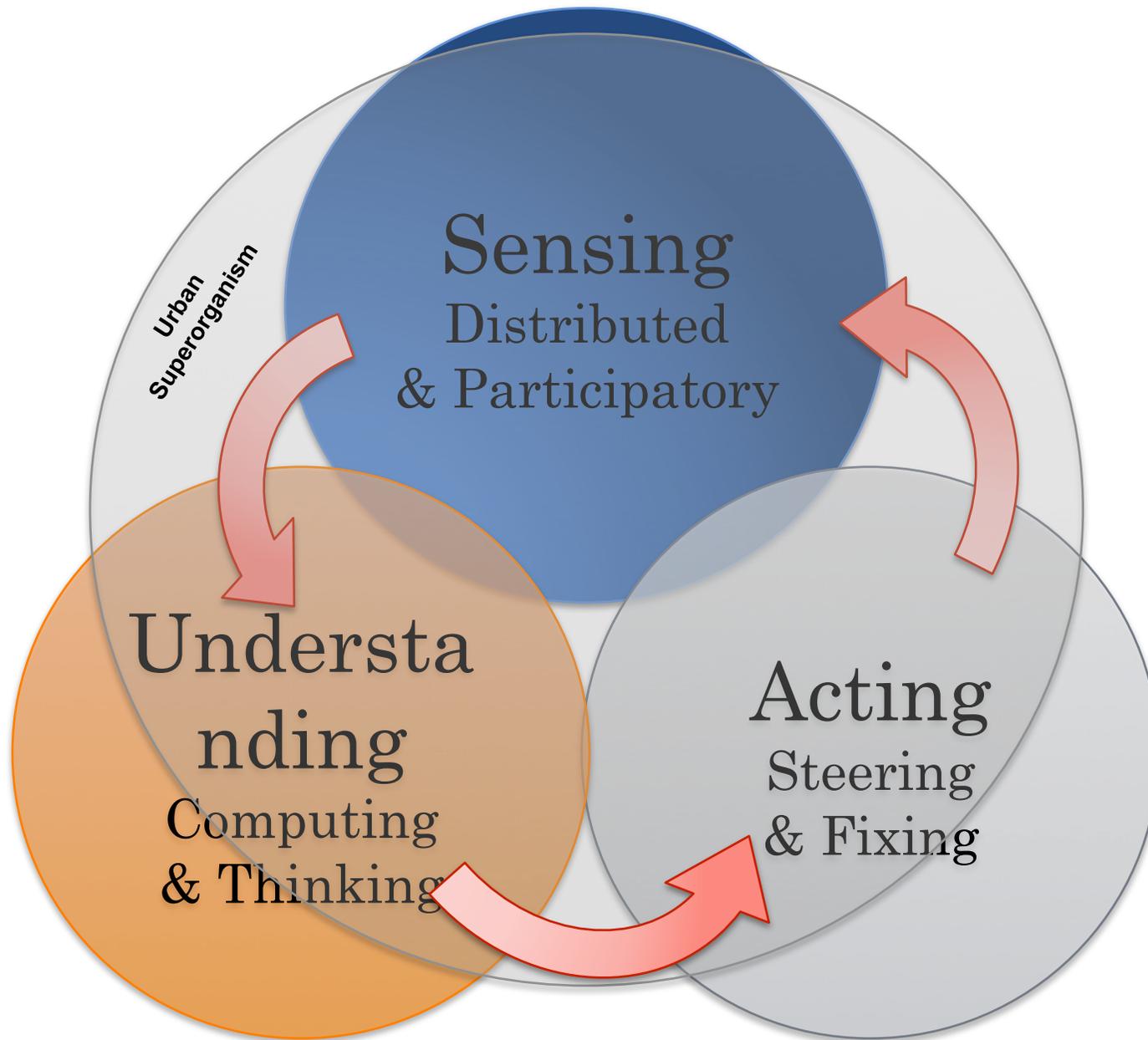
# CASE STUDY 1:
# MULTIMODAL SOCIAL MOBILITY

- Dynamically plan your movements by exploiting at the best all possible transportation means
  - Public transport (bus, metros, taxies)
  - Private transport (hitchhiking a ride on the fly, via the help of smart phones and similar communication means)
  - Private  vehicles (renting a vehicles or a bike)

- A very advanced travel planner
- Also please imagine using it with google glasses (see video on google glasses)

- Huge economic interests by a variety of stakeholders
  - Municipalities, Car rental companies, private car owners, car manifacturers

# MULTIMODAL MOBILITY: HOW COULD IT WORK

- A totally different perspective form current way of acting
  - No (or very little) a priori planning
  - Not even for public transport
- Dynamic sensing of needs (who needs to go where and when)
  - Either by humans(post on facebook or explicit request)
  - or by digital sensors and data analysis and prediction
- Dynamic recruitment of transportation means
  - Public transport
  - Cars passing by (ride sharing)
  - Available cars or vehicles (on-the-fly renting)
- Issues of recruitment
  - Politica: how can municipalities and private companies help'
  - Phychological and Social: How bring people to cooperate?
  - Economical: should I pay them? How much?
  - Technical: How? Via which infrastructures? How to coordinate them?
  - Socio-Technical: Can I keep control over what happens? What dynamics?

- Extending this idea to other area can lead to a radical revolution in our very concept of "mobility" → Zero-stress mobility

# MULTIMODAL MOBILITY: ACTORS AND REQUIREMENTS

- **Actors:**
  - Public transport managers
  - Private citizens (to share rides and vehicles)
  - Car/Bike rentals
  - Municipality and city planners

- **Requirements**
  - Effectiveness → in terms of costs and time for citizens, and in terms of energy and pollution
  - Zero stress mobility
  - Adaptivity in the long term → capable of working for every situation, as the situation of traffic and needs changes
  - Adaptivity in the long term → evolve methods and algorithms to have the overall system improve as the situation of vehicles and streets changes
  - Openness → anyone should be able to contribute
  - Fairness → try to balance the exploitation of resources

# MULTIMODAL MOBILITY:
# YOUR TASKS

- Within the project work (*the same considerations apply to all other scenarios*) you are expected to:
- Refine the scenario, or scramble as you wish it
  - Define functionalities, expected way of using it, involved actors/devices
- Refine requirements
  - Beside the ones I have roughly indicated
- Identify a sort of "conceptual design" for a working system, which include
  - The overall system architecture
  - Technological/algorithmic solutions to be integrated within
  - Patterns of adaptation and solutions to deal with them
- Go further and try to
  - Identify open issues and grand challenges
  - Produce a mobile app and a web server

# CASE STUDY 2:
# MAKING CITIES SAFER FOR CHILDREN

- In the '60s and '70s it was commong for children of 6-7 to move around our cities in full autonomy
  - The streets were our everyday playground
- No this is mostly unconceivable
  - The cities have changed, less familiar, more traffic, more dangers, etc.
  - And maybe our state of mind has changed too
- Can the urban organism be of help?
  - Continuous monitoring of children activities and movements
  - Actuation actions to prevent dangerous situations
  - Dynamic involvement of adult citizen to support child security
  - Dynamic recruitment of citizen (robots?) to temporarily act as baby sitters or to help cross streets
- E.g., the concept of "walking school buses"

- The same technology can be used to create more compelling and interactive kind of games:
  - Pervasive computing enriched treasure hunt
  - On-line multiplayer in the city (alternate reality games)
  - Tourism and games together

# ADDITIONAL EXEMPLARY CASE STUDIES

- Making cities a better place for disabled
  - E.g., for blind people
  - Annotate the city with vocal information, using GPS or beacons
  - Or simply have an infrastructure to help them moving around

- Social networks of things and places
  - The memory of things
  - Socialize through objects an places

# CONCLUSIONS

- There is a lot of fantasy and technique to be put at work in the selected case studies
- There is a lot to learn from the lessons in the next weeks

- In any case:
    - Do you have alternate case studies to suggest?
    - Do you already have in mind extensions/modification to suggest to the case studies?

- Then, let start working on it!