Social simulation for AmI systems engineering

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Contents

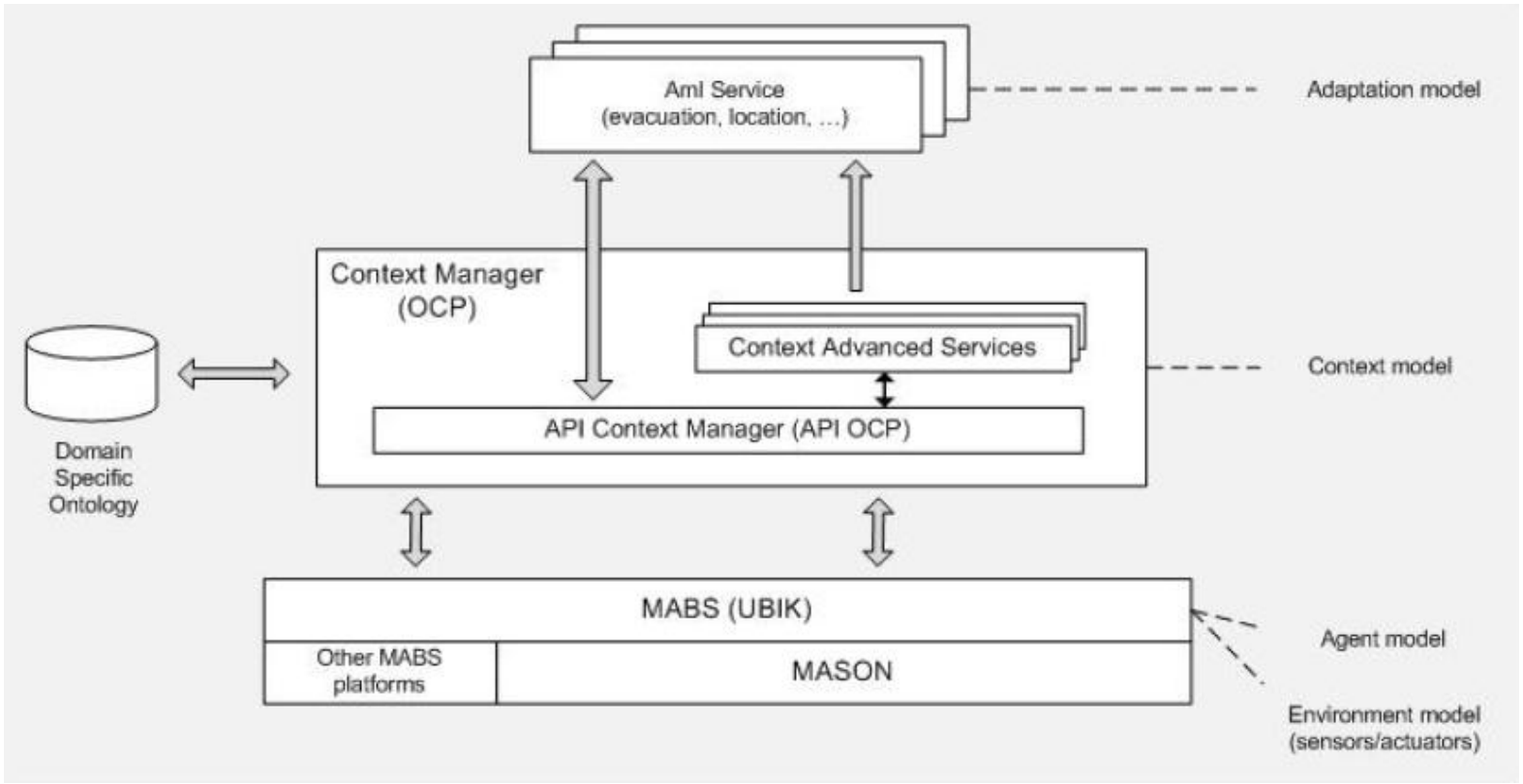
Proposal and motivation

- The use of MABS (multi-agent based simulations) to develop and test AmI (Ambient Intelligence) applications
- Real tests may be too costly or impractical.
  - Thousands of tests
  - Thousands of people
  - Emergencies
- Social Simulation and MABS can be used
  - Cheap
  - Great flexibility
  - Very expressive
    - sociology, biology, physics, chemistry, ecology, economy, etc.

AmISim architecture

- The following parts must be considered in an AmI simulator
  - *Environment model*. A model to describe the physical world.
  - *Agent model*. A complex multi-agent model that simulates physical and human behaviour.
  - *Context model*. This model gathers, interprets, and stores the contextual information.
  - *Adaptation model*. A model capable of supporting applications and services which use contextual information.
- The AmISim architecture includes these four models
  - MABS allow cheap and quick experiments
  - Sometimes MABS are absolutley necessary
  - ...realism is important

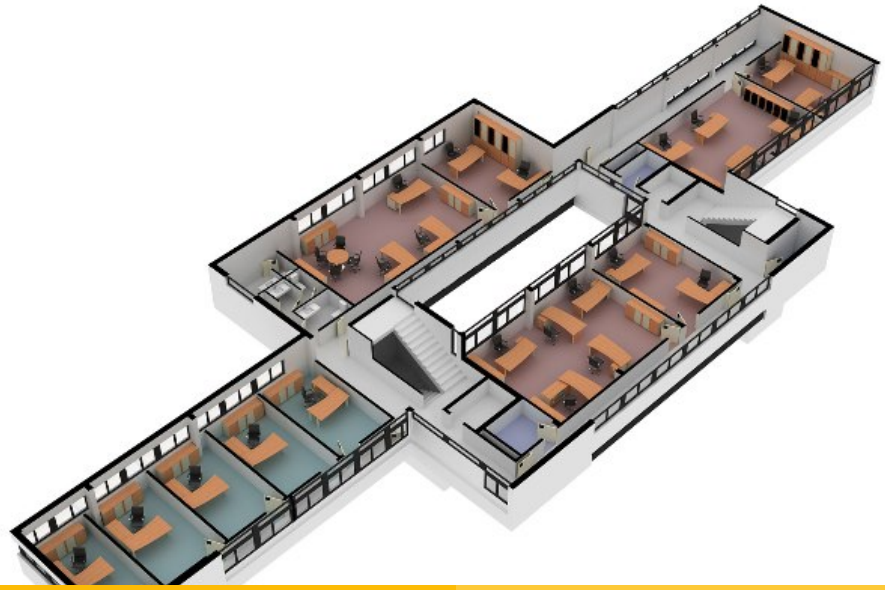
AmISim architecture (II)



- Simulation ⇒ Agent model and Enviroment model
- Real features ⇒ Adaption model and Context model

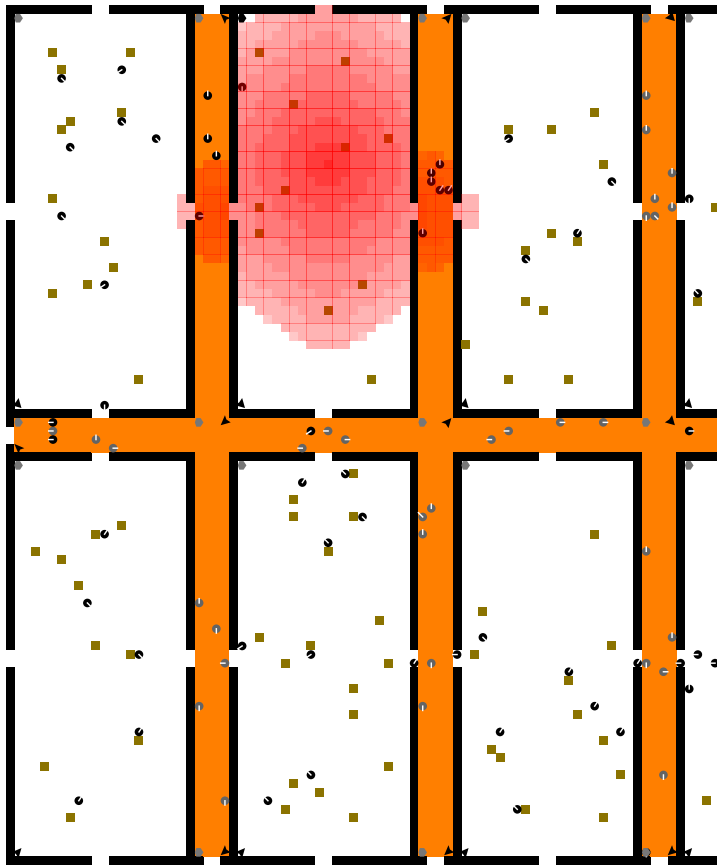
Application

- AmISim architecture is being used for emergency management in a real building
  - European Center of Business and Innovation (CEEIM) at the University of Murcia.
  - http://www.ceeim.es/
- The context model is implemented by OCP.
- The agent and the environment model is implemented by UbikSim.



UbikSim

- UbikSim is a MABS which deals with the emergency management and simulates:
  - A building
  - People
  - Fire
  - AmI devices:
    - Sensors
    - Actuators
- The behavior can be observed by
  - Displays of floors
  - Displays of stairs
  - 3D History of deaths
  - Charts
- Presentation video UbikSim.mp4
  - http://ubiksim.sourceforge.net



Configuring UbikSim

Simulation can be configured for specific targets

- Building:
  - Number of:
    - Floors
    - Corridors
    - Rooms
    - Stairs
  - Width of:
    - Corridors
    - Stairs
    - Doors
  - etc
- Fire:
  - Combustibility of the environment
  - Ignition temperature
- People:
  - Number of people
  - Distance to perceive:
    - Fire
    - Actuators
    - Other people fleeing
  - Speed
  - etc
- AmI devices:
  - Number and position.
  - Distance to detect emergencies
  - etc

Configuring UbikSim (II)

- MABS are flexible ⇒ UbikSim is flexible ⇒ AmISim is flexible
- Everything can be changed easily. The user can:
  - Adapt it to a specific building (environment model)
  - Change the type of AmI applications (adaptation model)
  - Include assumptions and new configurations
  - etc

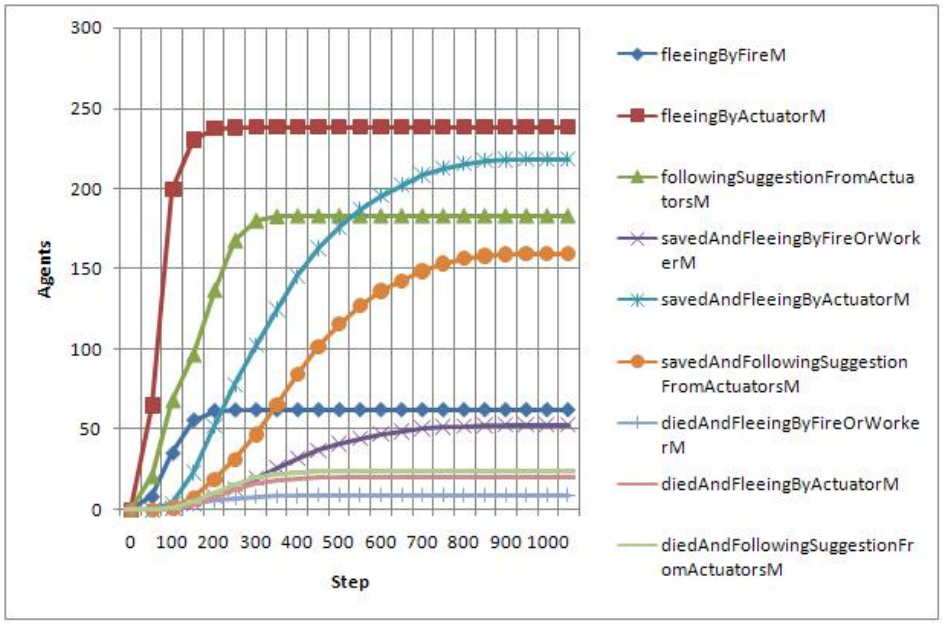
Example of tests

- Application for emergency management
  - suggests closest exit (not crowded or near fire)
- 300 tests were performed simulating a building with three floors and 300 workers (fires at random positions).
- The tests calculated the average of saved and died agents.
- Besides we can analyze numerous elements to improve/test our AmI applications.
  - propagation of fire per unit of time
  - average of time to escape from each floor
  - deaths following suggestions from an actuator
  - average of time needed by sensors to detect fire
  - agents using each stairway per unit of time

...without simulations this kind/number of tests could not be done

Example of tests(II)

- For example:
  - How many agents had...
    - ...started escaping because of a fire?
    - ...started escaping because of an actuator?
    - ...followed suggestion from actuators?
  - Results for a specific AmI application:
    - Most of the agents start escaping after seeing an actuator
    - Most of these are saved.



Conclusions

- The AmI simulators are necessary to test some AmI applications.
- The AmI simulators need to consider several models.
  - AmISim
- Real models can be combined with models implemented in MABS to get more realistic tests.
  - OCP
  - UbikSim
- The models implemented in MABS are very flexible allowing cheap and quick tests.

Thank you very much for your attention

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More on http://ubiksim.sourceforge.net