

SAPERE Analysis tools

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ALMA MATER STUDIORUM—Università di Bologna

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- 1 Tools and methodology
- 2 Simulation tools
 - Alchemist
 - The One
- 3 Novelties in Alchemist since Modena Meeting
 - Stuff completed
 - Stuff still under development



Simulation and methodology

Simulation appear in methodology in two different phases

Architectural design (AD)

- design system roles
- design self-organisation algorithms
- design self-organisation mechanisms
- execute approximate prediction of the models

Detailed design (DD)

- design the actual Eco-laws
- design the actual LSAs
- design the actual LSA Bonds
- verification of the system's behaviour

It is key to clearly identify and contextualise our tools within the phases

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Alchemist is the primary tool for AD

What should it be used for?

- design novel self-* algorithms
- test novel self-* algorithms
- apply algorithms in large-scale networks, with different topologies and mobile nodes
- run approximate model checking to ensure properties

What should it be **not** used for?

- verify that the algorithms work in the actual middleware
- precisely measure the network impact
- in general, if the measure is middleware-dependent, Alchemist is not the right tool

Q: Relationship with RePast: when to use it in AD?



Alchemist's features

- Synthetic and compact DSL for designing a simulation
- Scales well with thousands of nodes
- Embedded approximate stochastic model checker
- Integrated with PVeStA



Alchemist evaluation

As Alois also said, I'll be in Linz for three months. Some of my task will be:

- Evaluate Alchemist by simulating a large scenario, ideally relying on VCM data from JKU guys
- Simulate advanced algorithms (e.g. Anticipative Gradient) in the realistic setup
- Run approximate stochastic model checking to verify system properties
- Deepen integration of Alchemist in methodology



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The One is the primary tool for DD

What should it be used for?

- verify that the algorithms work in the actual middleware
- precisely measure the network impact
- verify how the implemented system will work prior to deployment
- middleware performance assessment

What should it be **not** used for?

- quick design and testing of novel self-* algorithms
- approximate model checking



The One's features

- Runs the real middleware
- Measures network parameters
- Allows for loading / running real world maps



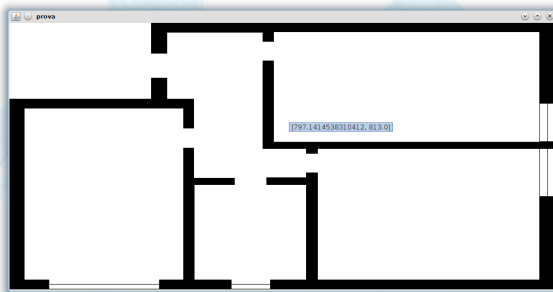
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Environments from images

Load images as Alchemist environments (Ing. Michele Pratiffi)



Detail

- Areas of chosen colors will be interpreted as obstacles
- Ideal solution for the simulation of closed environments
- Ready for being used

Realistic pedestrians

Realistic individual and group dynamics

(Ing. Michele Bombardi, Ing. Chiara Casalboni)

Detail

- Reviewers explicitly asked warranties about realism of pedestrians in simulations
- We contacted Mizar Luca Federici of Crowdixity
- We searched the literature
- Chosen model features:
 - Force-fields among people
 - Force-fields interaction between people and physical hurdles
 - Pheromone based interaction among people of the same group



Realistic pedestrians

Detail

- Realistic interaction among people
- Realistic hurdle avoidance
- Different cultural models (from literature)
- Group dynamics
- Qualitatively evaluated at Almaorienta



PVeStA 4 Alchemist

Parallel Statistical Model Checking and Quantitative Analysis Tool

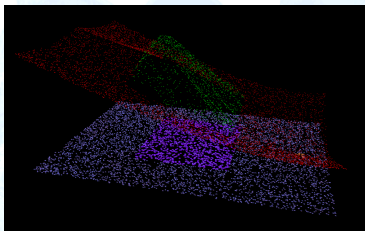
Detail

- Integration completed, a case study will come soon
- Integration module completed and ready for producing the first results
- Efficient approximate model checking
- Collaboration with A. Vandin and A. L. Lafuente (IMT Lucca)
- Verification of properties expressed in:
 - Probabilistic Computational Tree Logic (PCTL)
 - Continuous Stochastic Logic (CSL)
 - Quantitative Temporal Expressions language (QuaTEx)



3D rendering through Blender

Pleasant rendering of the simulation in 3D (Ing. Luca Nenni)



Detail

- Java-Python-Blender bridge completed
- Looking for Somebody with artistic sense to continue and improve the work

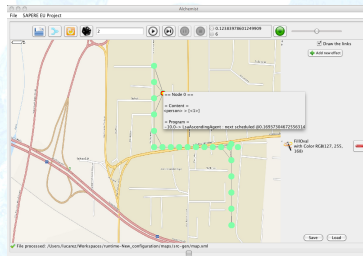
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Maps from the Web

Run simulations on real world maps



Detail

- OpenStreetMap backend, Google Maps backend will come
- Routing of agents through navigation web services
- Support for pedestrians, cars, bicycles and public transport

Complex networks

Support for multiple network topologies (Ing. Luca Mella)

Detail

- Completed, but not well documented yet
- Support for different network types (complex networks, random networks, backbones, etc.)
- Studies on information (and malware) diffusion
- Studies on social network and opportunistic networks
- Used to reproduce experiments of SOCIALNETS EU Projects, in particular social-based forwarding in opportunistic networks



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