MCLab

Model Checking Lab

Computer Science Department
Sapienza University of Rome, Italy

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http://mclab.di.uniroma1.it

Sapienza University of Rome

- Founded in **1303**
- The **largest** university in Europe
    - **115K** students
    - **7K** foreign students
    - **1K** incoming Erasmus students / year
- Steadily within **top 3%** world universities [Shangai Ranking]
- **250** Bachelor & Master Programmes
- **11** Faculties
- **63** Departments

Computer Science Dept. @ Sapienza

- **45** Faculty Members
- **23** Post-Doc Researchers
- **20** PhD Students
- Internationally active in most of main stream CS **research areas**.
- Organized in informal **research groups**.
- Research group involved in this project:

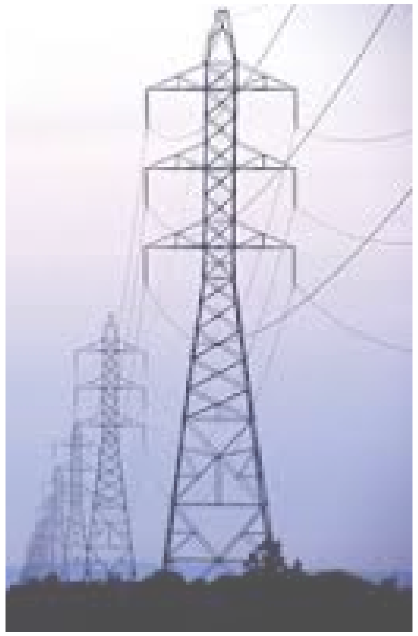
Model Checking Lab (MCLab) (http://mclab.di.uniroma1.it)

Model Checking Lab @ Sapienza

- Research group within the Computer Science Department
- **4** faculty members, **1** post-docs, **3** PhD students,
  1 research fellow, **10** graduate students
- **Research focus**: design and development of **AI and Machine Learning-based** software tools for **simulation-driven** verification, validation and synthesis of **mission/safety-critical distributed intelligent systems.**

Typical domains for MCLab activity:

- aerospace
- critical infrastructures
- transportation
- medicine
- smart grids



Safety/Mission Critical Intelligent Systems V&V

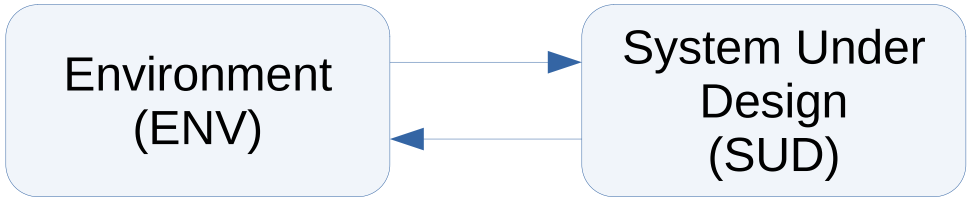
- Define properties to be verified.
  - ► Model properties through KPI (Key Performance Indicators) computed during simulation.

- Provide evidence that *all possible plausible scenarios* (e.g., fault sequences, attacks, etc) have been adequately considered.
  - ► Model environment using Markov Chains and show completeness and soundness.

- *Testing may change our SUD,* since intelligence often implies that system behavior changes in order to adapt to environment behavior.
  - ► Use adversarial learning to challenge SUD.

- *High statistical confidence* values about correctness are typically required. This entails a huge number of simulation runs (easily many millions).
  - ► Use Statistical Model Checking and scenario optimization to save on number of simulation runs.

- Amount of *time needed for each simulation run*.
  - ► Use Surrogate Models and HPC to save on simulation time.



MCLab in Aerospace

EC FP7 Ulisse (4.8 M€)
Verification & Validation of mission planning and on-board procedures

ESA ITI Verifying Satellite Operational Procedures (150 k€)
Verification & Validation of ground segment satellite operational procedures

ESA ITT System & Software Functional Requirements Technique (200 k€)
Verification & Validation of system level design for satellite and avionics vehicles

POR FESR Aerospace and security - A system for hostile UAV detection in critical areas (340 k€). Optimal positioning of antenna relays for radiogoniometry

MCLab in Transportation

MIUR Tramp, Setram, Interception (3.5 M€)
Optimal management of intermodal transportation of dangerous goods, guaranteeing security standards

Safety verification of communication protocols and control policies for the control center

FILAS Sintesi (100 k€)
Sense and response system for critical resource management

MCLab in Critical Infrastructures

SAPP, IRRIIS, Safeguard, SafeTunnel, Icaro (10 M€)
Design and safety verification of control and communication systems for critical infrastructures

Ministry of Defense - TOD - Formal verification of a protocol for automatic compensation of line delays.

POR FESR Aerospace - Satellite Driven Fire Simulator (250 k€). Faster-than-real-time simulation based forecasting of fire propagation.

MINISTERO DELLA DIFESA

ENEA

LOG.IN

MPM TELECOMMUNICATIONS

MCLab in Smart Grids

EC FP7 SmartHG (3.5 M€)
Energy Demand Aware Open Services for Smart Grid Intelligent Automation

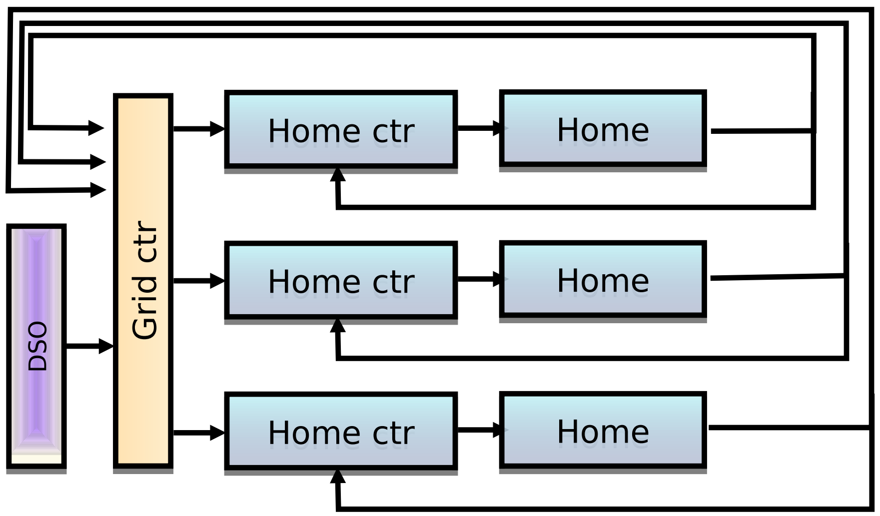
SEVENTH FRAMEWORK PROGRAMME

Coordinator: Enrico Tronci

SAPIENZA UNIVERSITÀ DI ROMA

Design and formal verification of hierarchical control policies for the Smart Grid

SmartHG benefits: optimisation of grid management, minimisation of energy cost and CO_2 emissions



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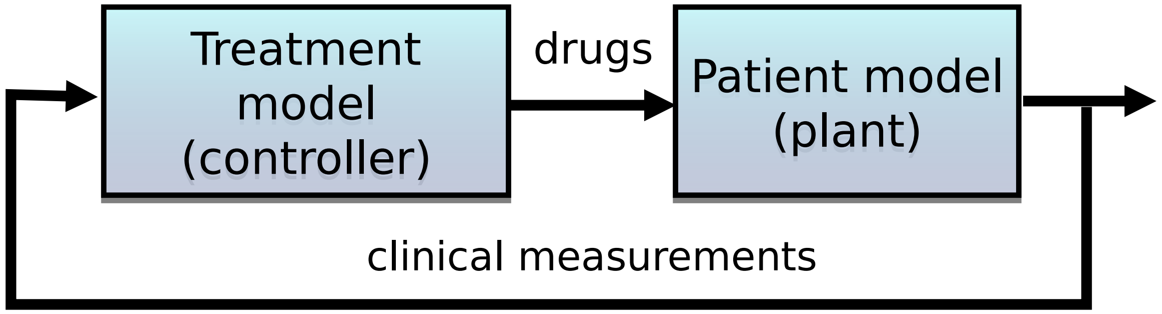
MCLab in Medicine

EC FP7 Paeon (2.5 M€)
Model Driven Computation of Treatments for Infertility Related Endocrinological Diseases

Coordinator: Enrico Tronci



Computational models of human physiology (virtual physiological human).

Simulation-based verification and synthesis of personalized clinical treatments

Contacts

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