Extending the Gillespie's Stochastic Simulation Algorithm for Integrating Discrete-Event and Multi-Agent Based Simulation

Sara Montagna, Andrea Omicini, **Danilo Pianini**

sara.montagna@unibo.it

Alma Mater Studiorum—Università di Bologna a Cesena

The XVI International Workshop on Multi-Agent Based Simulation
May 5, 2015 - Istanbul, Turkey

1. Background
   - Discrete Event Simulation (DES)
   - Agent Based Modelling (ABM) and Simulation (MABS)
2. Motivation
3. A Unified Stochastic Computational Model
   - Gillespie's SSA as an event-driven algorithm
   - Gillespie's SSA in MABS: related work

DES

. . . The most used approach in the simulation mainstream

- Instantaneous events responsible for the changes in the system state
- In between events, no change to the system is assumed to occur
- Different events cannot be simultaneous
- It is normally very efficient since it allows to jump in time from one relevant event

Defining a DES means to model the behaviour of a system as an ordered sequence of non-continuous events, by specifying for each of them the perturbations in the system state it provokes, and the exact point in time when it has to be triggered.

MABS

. . . Introduced as a novel and alternative approach to Discrete Event Simulation (DES) and to Systems Dynamic (SD)

- More than a simulation method...it is a **philosophy**...
- ABM models the system at the *micro-level*
  - active entity are autonomous and interacting agent,
  - dynamic environment
  - global system-level behaviour as a result of the agent-to-agent interactions

The simulation platform

- Various platforms were developed for the purpose [**?**, **?**],
  - tools for developing, editing, and executing ABM, as well as for visualising the simulation dynamic.
- How they operate over a timeline?
- How are agents and environment behaviours coupled and scheduled?