Comp-763

Hybrid Modeling of Agents in Agent-Based Simulation

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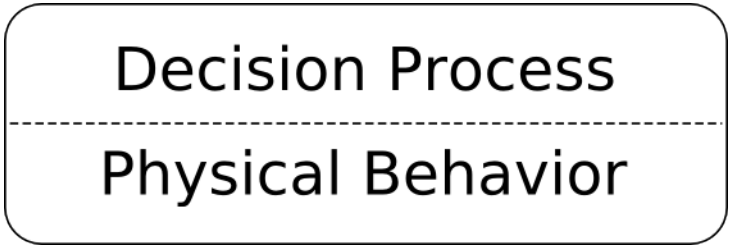
Overview

- Agent-Based Modeling
- Proposed Hybrid Formalism
  - Communication
  - Continuous Evaluation
- DiscWars
  - Disc
  - Arena
  - Decision Process
  - Demo
- Future Work

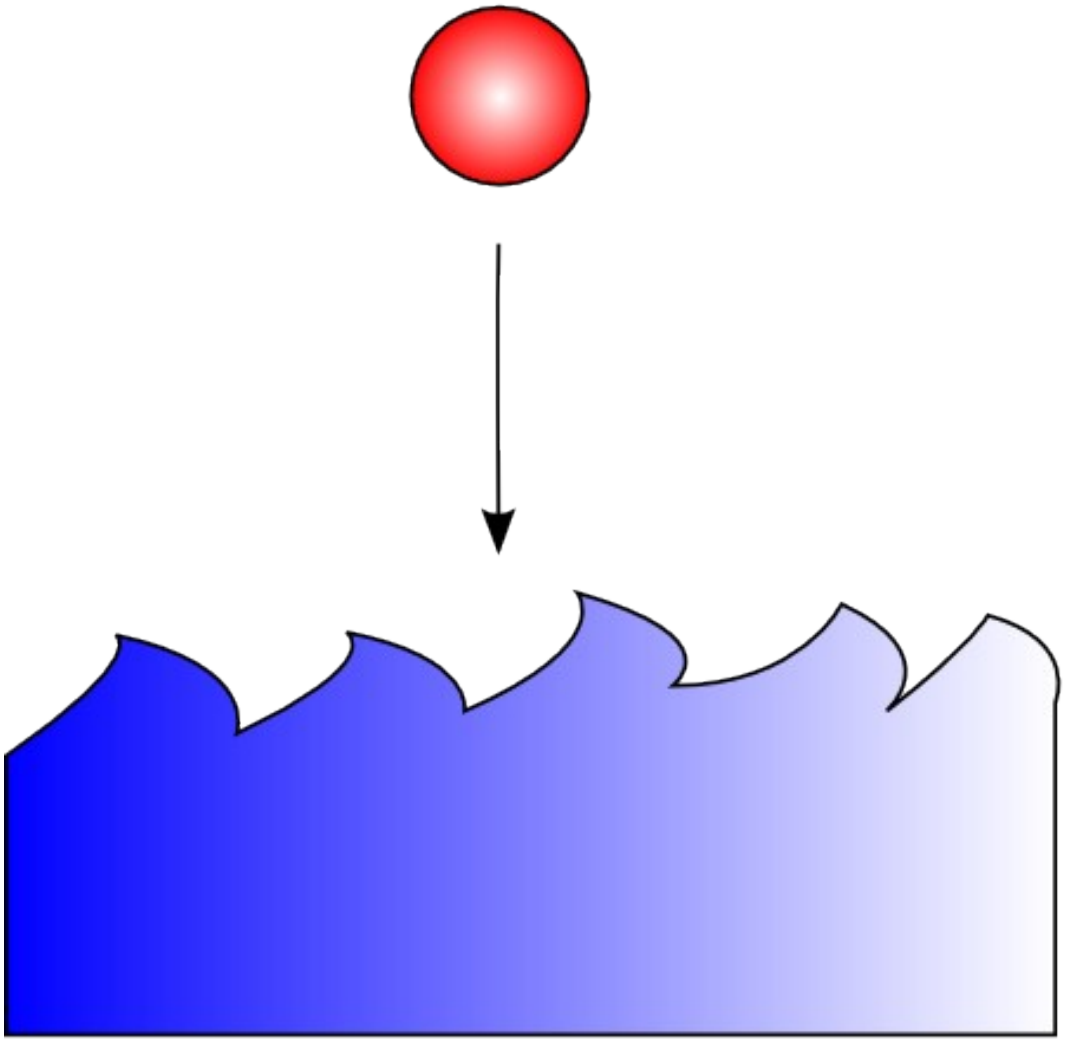
Agent-based Modeling

- Can be considered decentralized, individual-centric approach to modeling.
- Individual participants each have their own behavior and are known as agent.
- The agents are store inside an environment, where they may or may not communicate with each other.
- The combined behavior of the agents create a system level behavior.

Agents



Proposed Formalism



In the Air

Equation:

$d(V)/dt = -g$

$[y < 0]$

In the Water

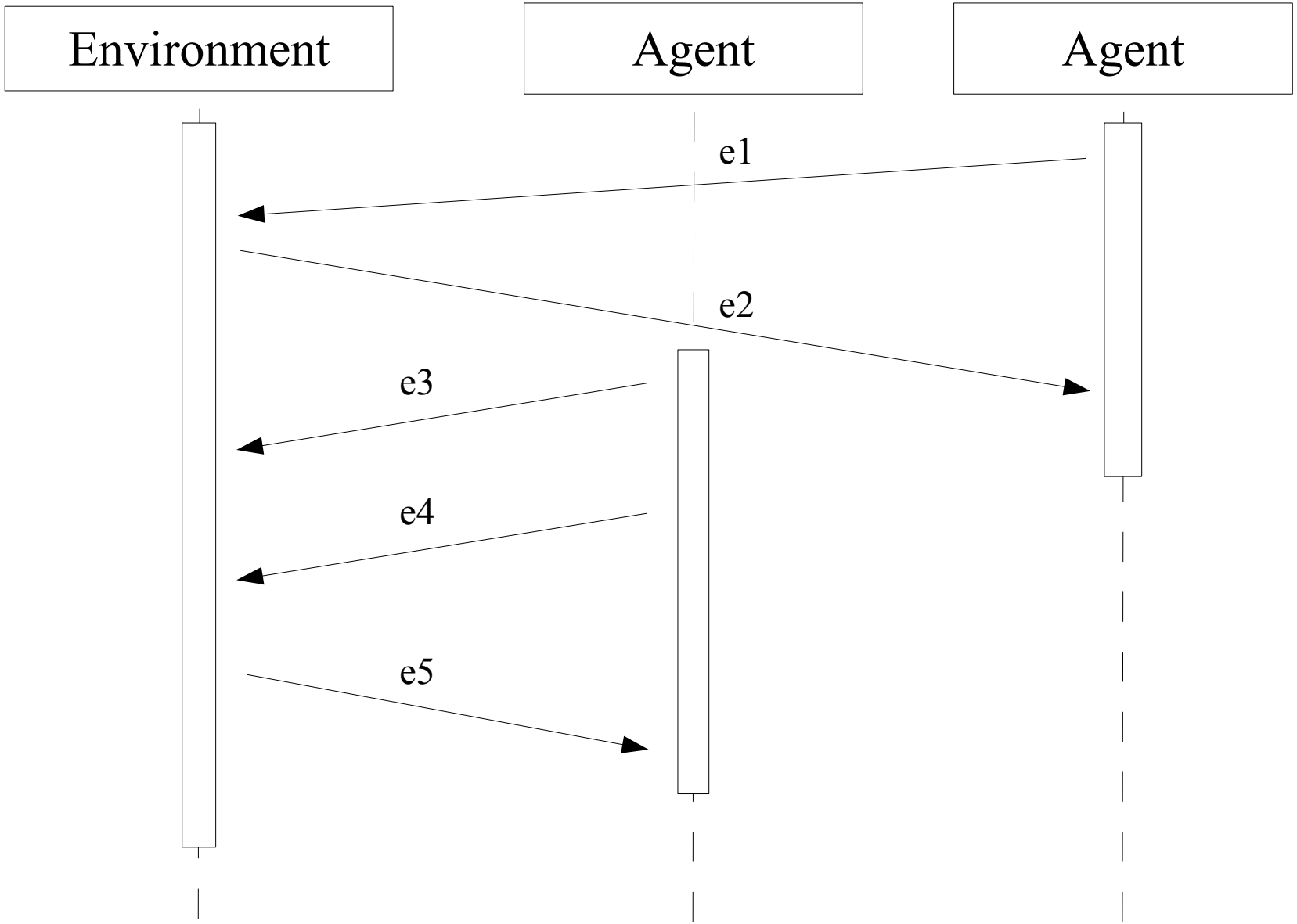
Equation:

$d(V)/dt = -g+kV^2$

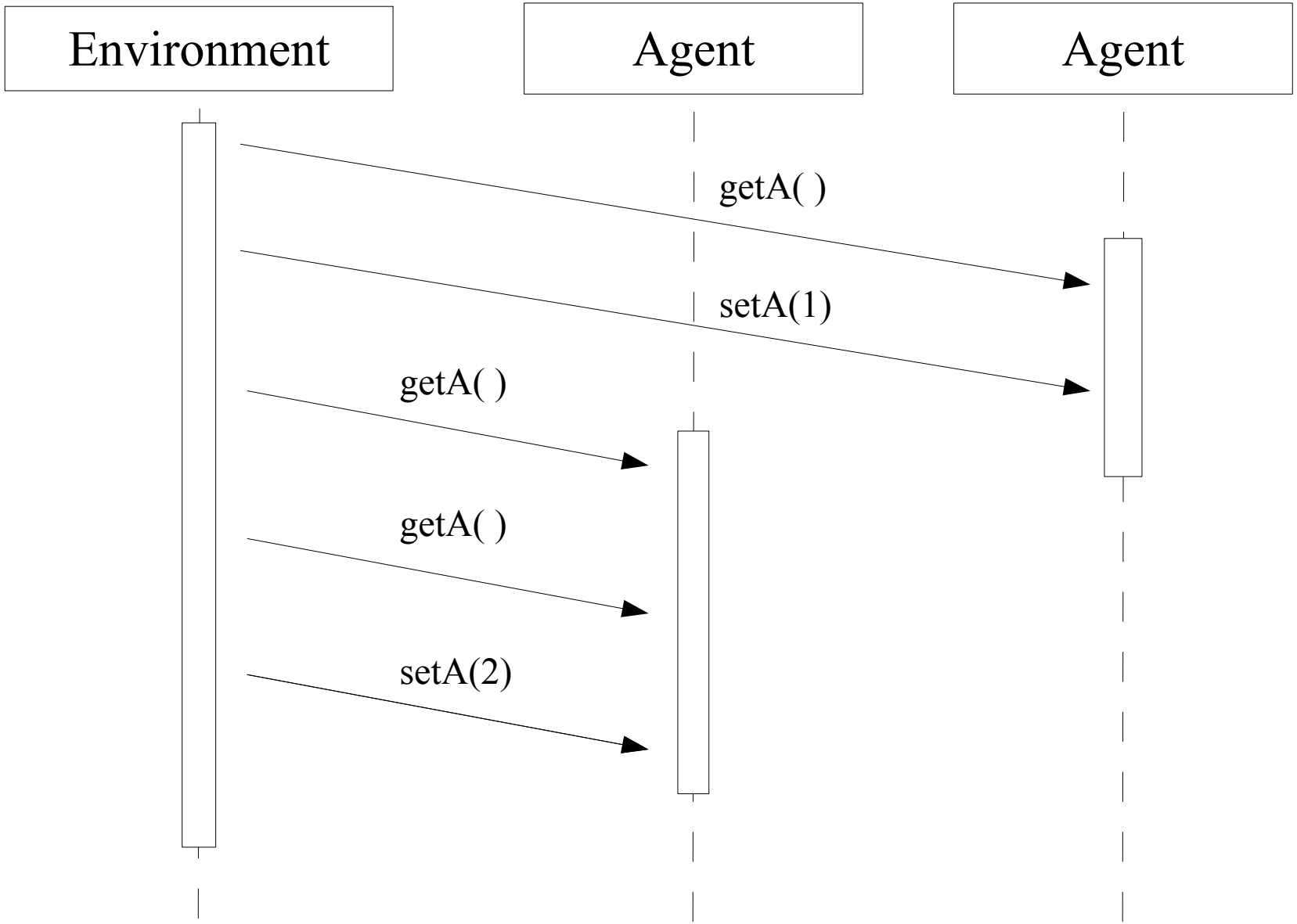
Communication

In Agent-Based Simulations, agents do not communicate with each other. Rather, they communicate with the environment, which in turn, can send back information about their peers.

Event-based Communication



Direct-Access Communication

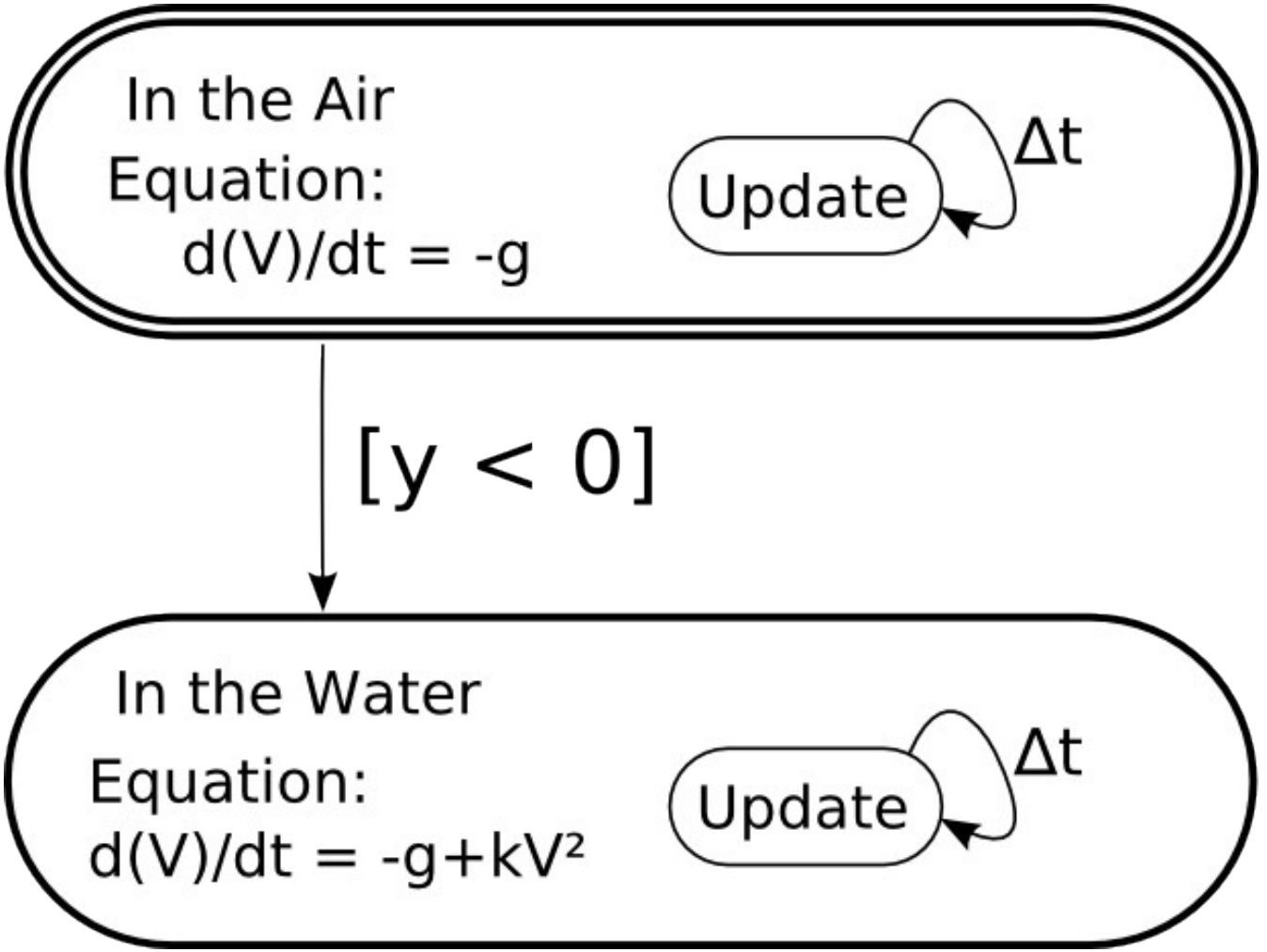


Evaluation

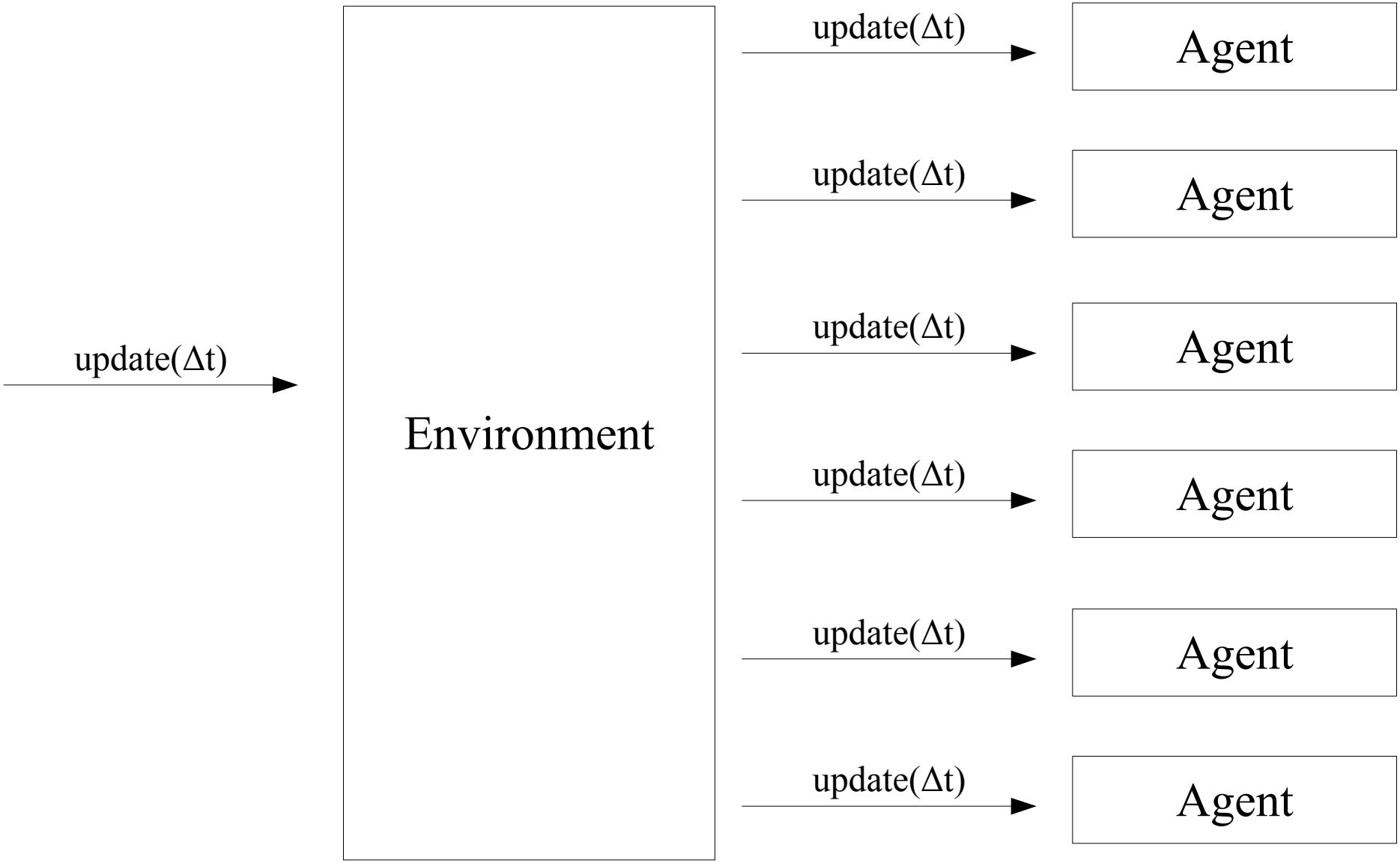
Although the proposed hybrid model is controlled by a discrete formalism, it contains continuous time components, and as such must be evaluated in a continuous fashion.

As with all Continuous Time Systems, continuous valuation is tricky, given the discreet nature of computers.

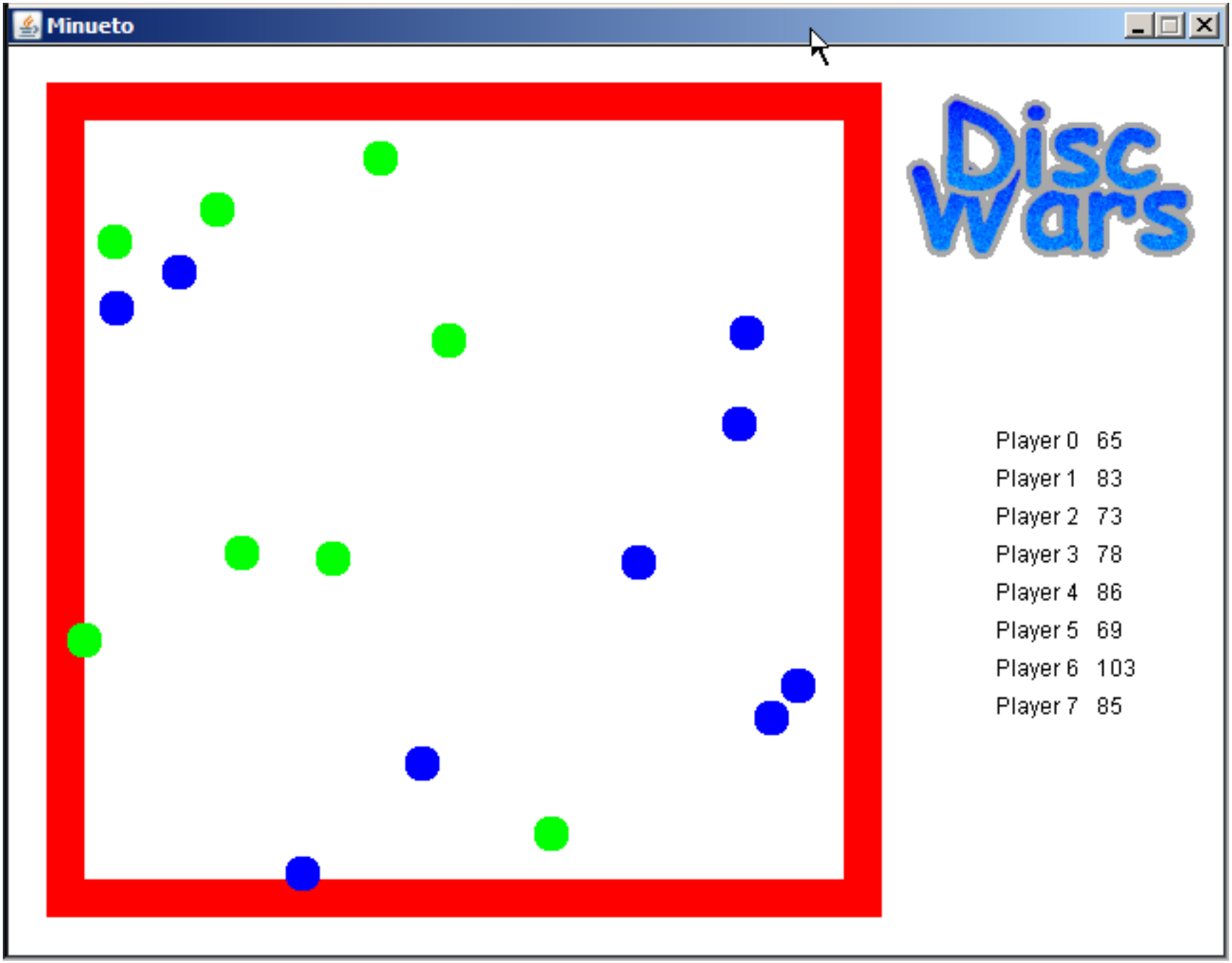
Agent Self-Evaluation



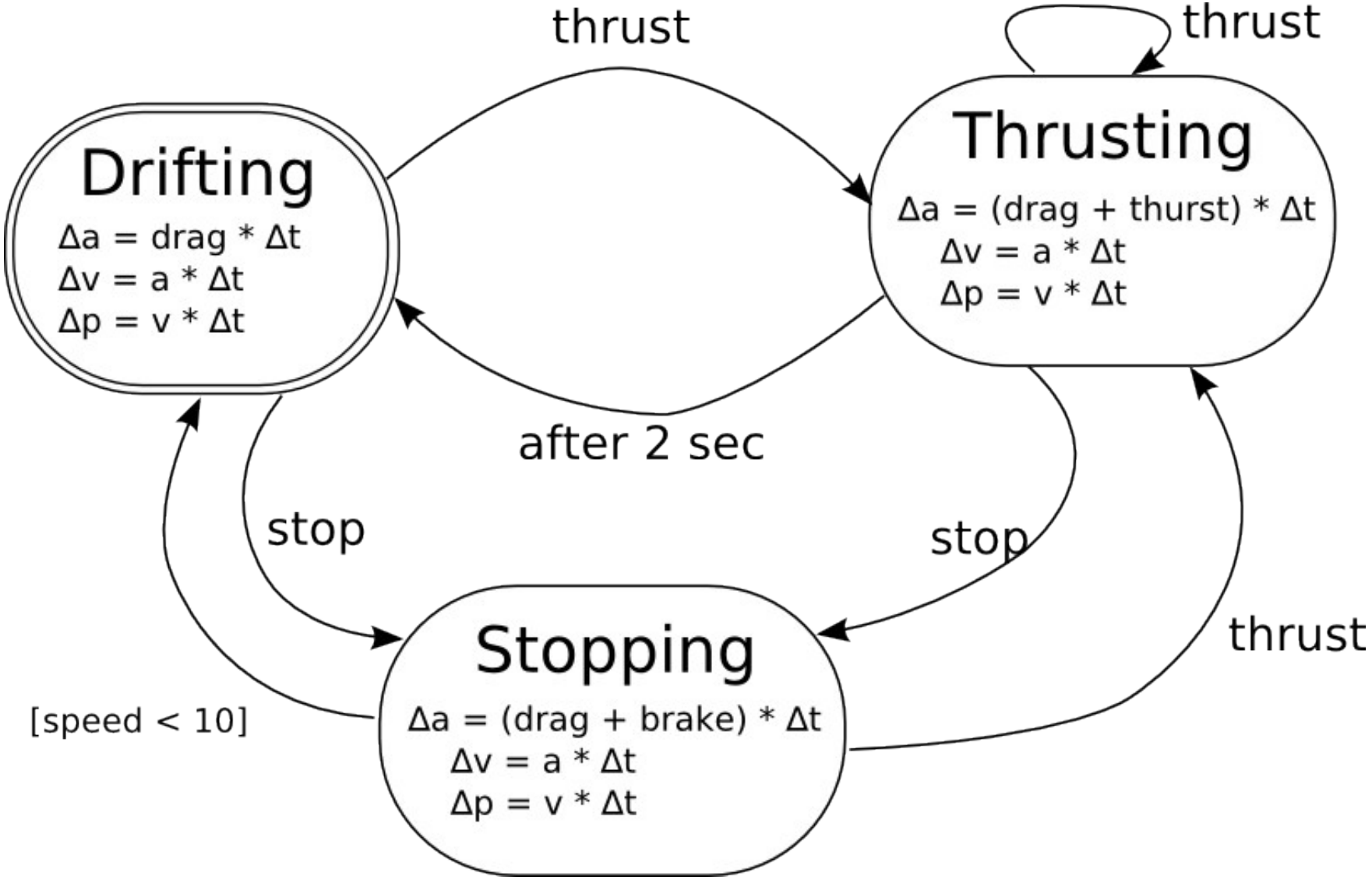
Evaluation from Environment



DiscWars


Minueto
Disc Wars
Player 0 65
Player 1 83
Player 2 73
Player 3 78
Player 4 86
Player 5 69
Player 6 103
Player 7 85

Disc


thrust
thrust
Drifting
Δa = drag * Δt
Δv = a * Δt
Δp = v * Δt
Thrusting
Δa = (drag + thurst) * Δt
Δv = a * Δt
Δp = v * Δt
after 2 sec
stop
stop
thrust
[speed < 10]
Stopping
Δa = (drag + brake) * Δt
Δv = a * Δt
Δp = v * Δt

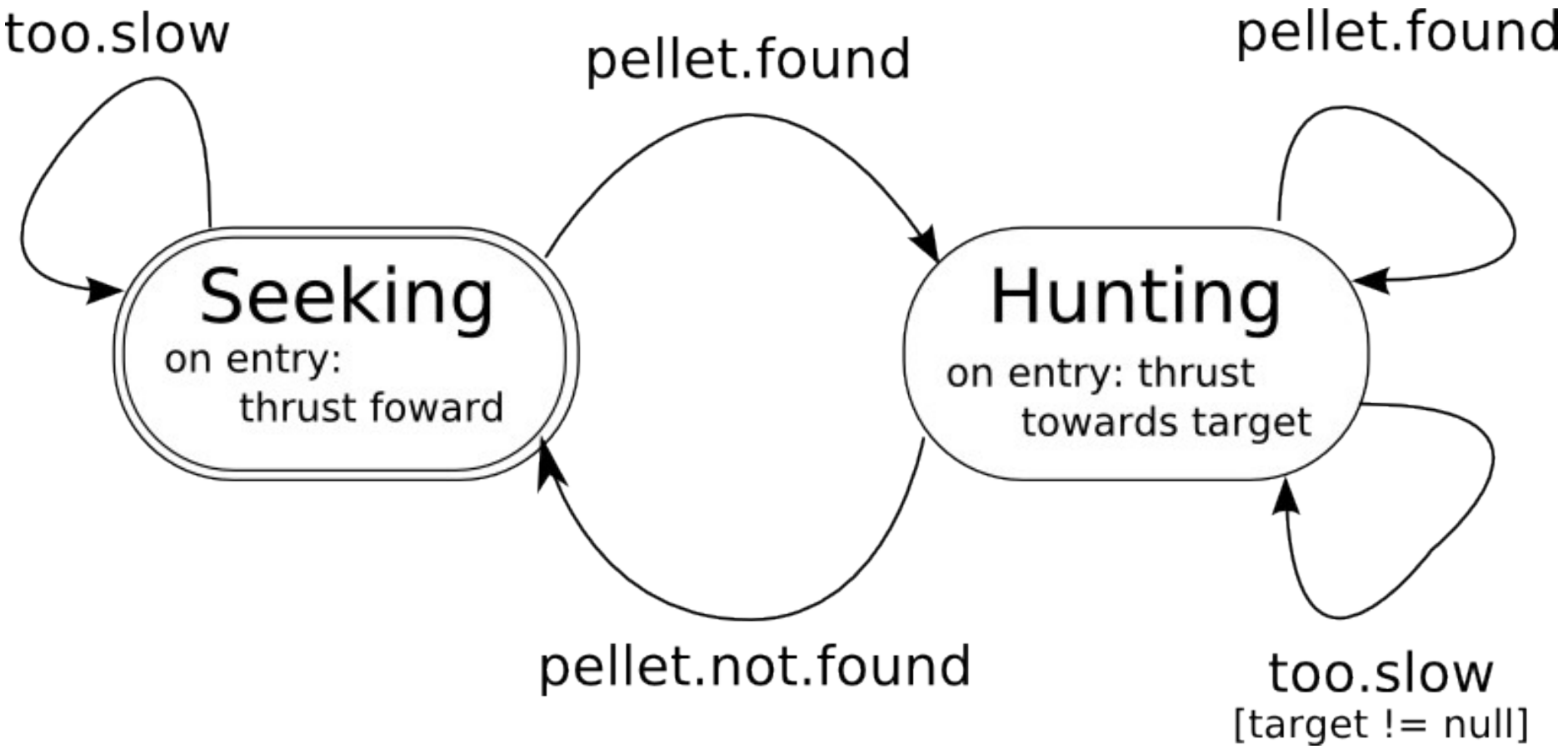
Arena

The arena is the environment for this agent-based simulation.
It has two responsibilities:

Detecting/resolving any collisions that might occur in the arena.

Executing the time step function in all the agents.

Decision Process



Demonstration

To the demo!

Future work

However, more works is required to properly understand ...

... how this formalism should interact with the environment.

... how this formalism should act in a hierarchy of other hybrid systems.

Any Questions?

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Decision Process (2)