Coordinated Change of State for Situated Agents

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Outline

- Context/motivation of the work
- Coordination for situated agents
  - Coordinated change of state for situated agents
- Concluding remarks and future developments

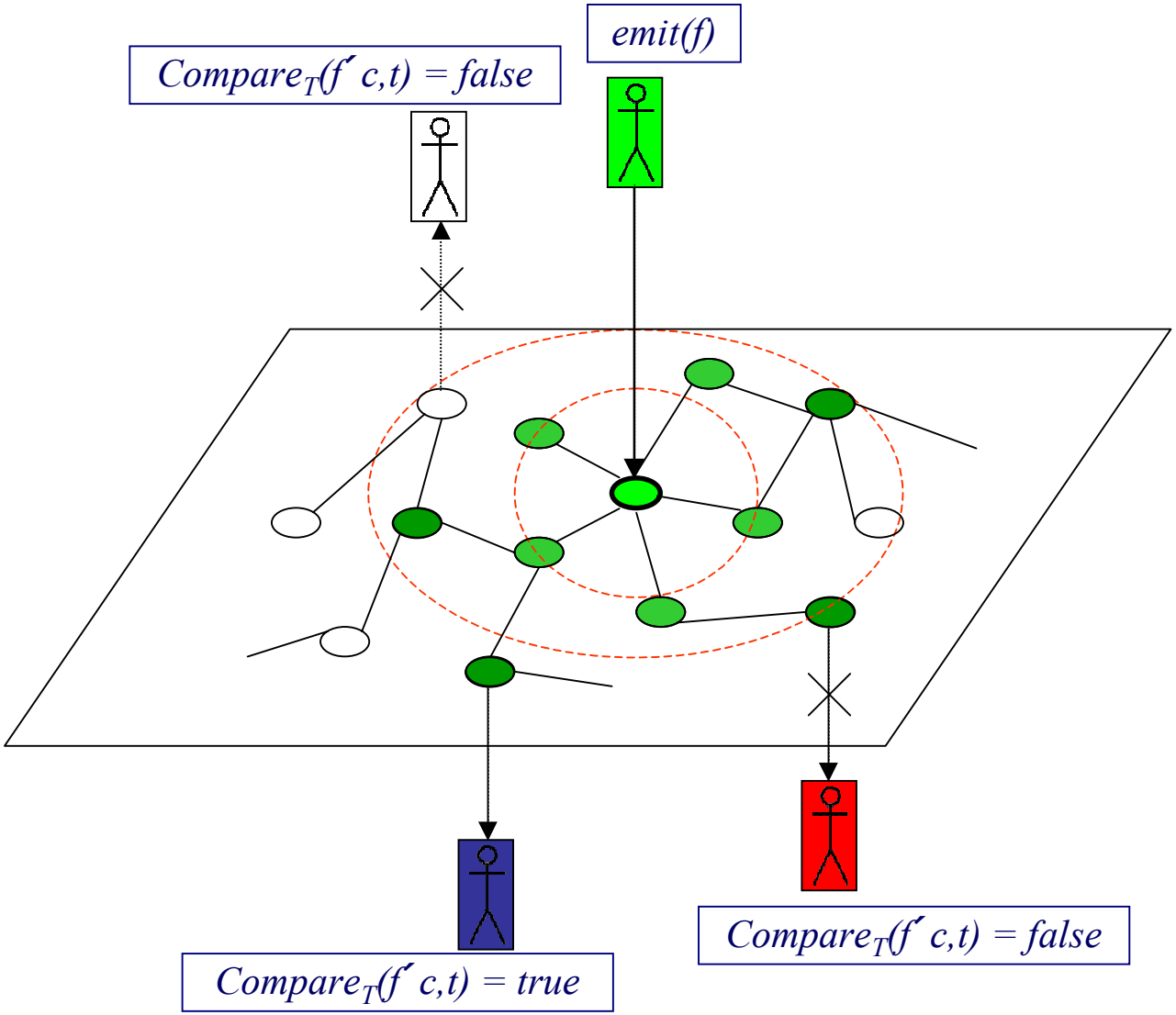
Context of this work

- *Environment* for Multi-Agent Systems [E4MAS workshop at AAMAS04]
  - Environment can be much more than just message transport and brokering systems
  - Towards a clearer definition of *locality* and *perception*
- *Spatial abstractions* can be fruitfully exploited
  - For sake of *simulation* [Manzoni et al. at Woa04]
  - But also in *context-aware distributed systems* [Mamei and Zambonelli at Woa04]
- *Situated agents* → agents which are placed in an environment which determines their perception and influences their deliberation and action

Situated agents interaction models

- Situated agents interaction is generally *space mediated*
  - Space allows them to *become acquainted*
  - They can interact through a *modification* of the shared *environment* (field based interaction/stigmergy)
- Some interaction mechanisms for situated agents do not necessarily provide a modification of the environment [MMASS *reaction*, Ferber and Muller's *Influence and reaction* model and subsequent works by Weyns and Holvoet]
- Two main reasons
  - Model interactions for which we want to avoid *overhearing*
  - Model interactions that *do not require action at a distance*

Field based interaction: *emission and perception*

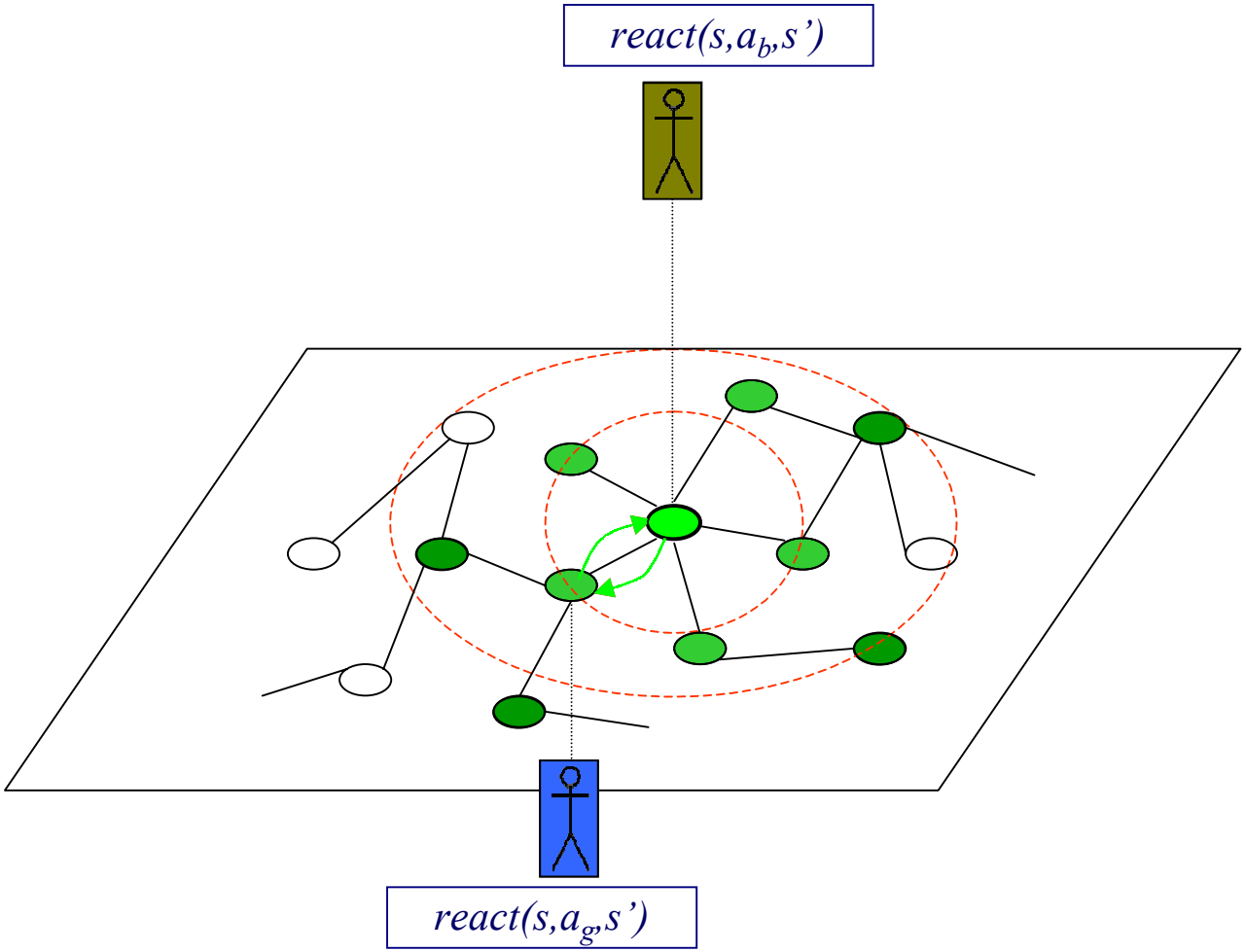


- Fields are *signals* emitted by agents and diffused in the environment
- Their *intensity is modulated* in their diffusion
- Other agents may *perceive these signals* according to their perceptive capability, state and the signal value at their site
- Effect of the perception defined by *agent type behavioural specification*

Field based interaction

- *Intrinsically multicast*
- *Not Agent Communication Language based*, no need to know communication partners
- Dependant on different factors:
  - *Contextual:* the position in the spatial structure of the environment of agents involved in the interaction
  - Related to the *type of signals*: diffusion, comparison and composition functions
  - Related to the *type and state of the interaction partners*: their sensitivity coefficient and threshold for the specific field type
- Fields are *neutral*
  - The effects that they can trigger are defined by agent types behavioural specifications

Coordinated change of state: *reaction*



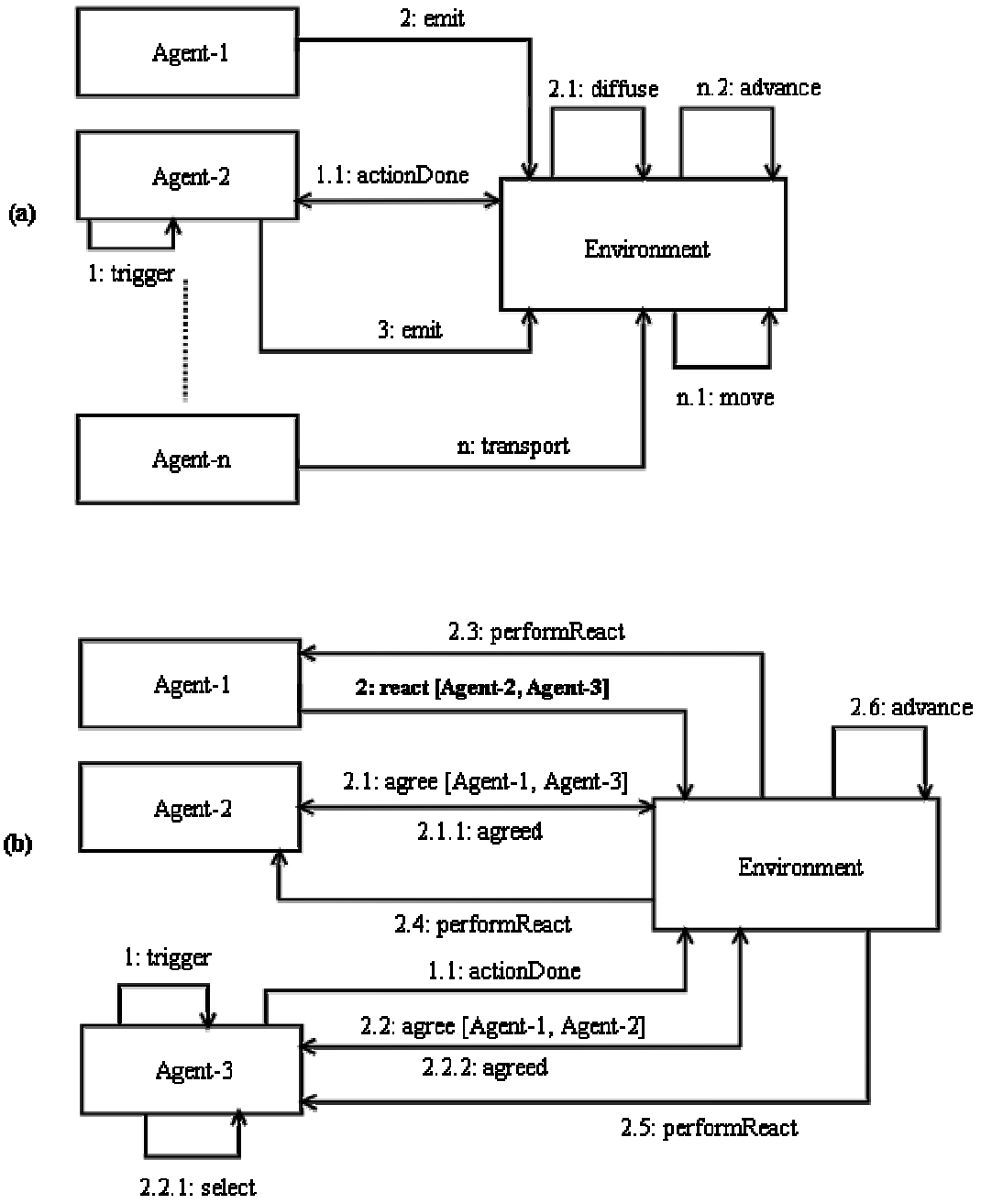
- The *reaction* allows agents to *change their state* in a *coordinated* way
- To perform reaction agents must
  - be situated in *adjacent* positions
  - have *agreed* to perform the operation

Supporting reaction

- No generally optimal algorithm/strategy → Application specific features might require/indicate specific solutions
- Main issues with reaction are related to the *agreement process*
  - in synchronous situations it should *stop system evolution*
  - in asynchronous situations *multiple agreement* processes could *occur concurrently*
  - in distributed situations network communication introduces further (mostly non-functional) issues
- As for diffusion, the idea is to *delegate* the management of these issues *to agents' environment*

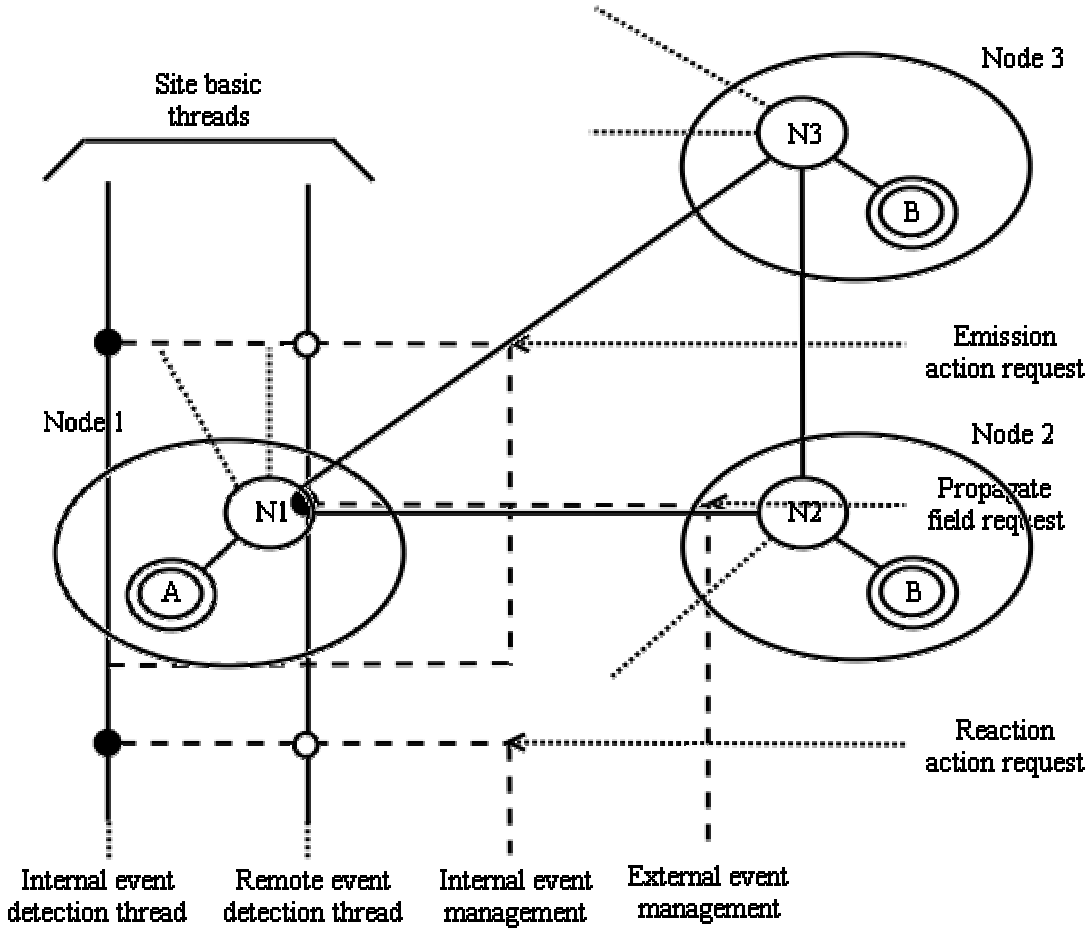
Reaction: synchronous situation

- A *single entity* (the environment or a specific site) can be delegated the management of system synchronicity
- *Every entity interacts with it*, at least to signal the current action
- When a reaction request occurs, *it manages the agreement process* and communicates to the involved entities the success of the operation



Reaction: asynchronous situation

- In this case there is no global synchronicity → *no need of single entity managing reaction*
- Every site acts as reaction manager for the related agent
- Sites are complex modules
  - managing *different events* (internally or externally generated)
  - provided with *multiple threads of control*

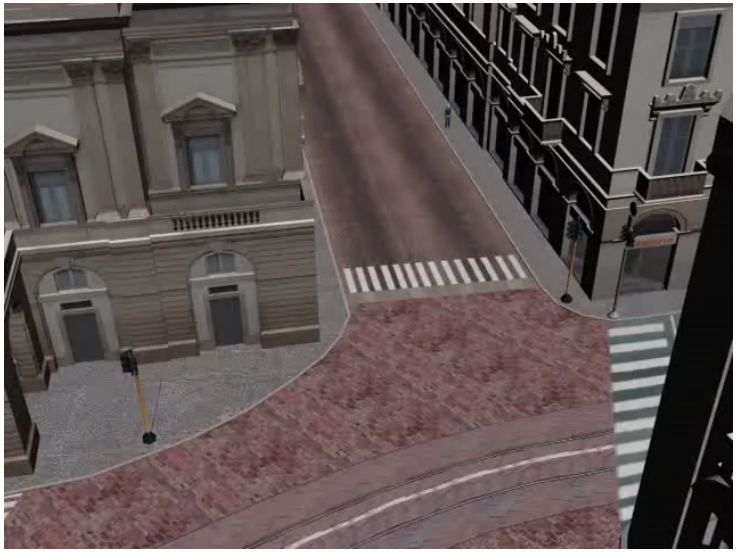


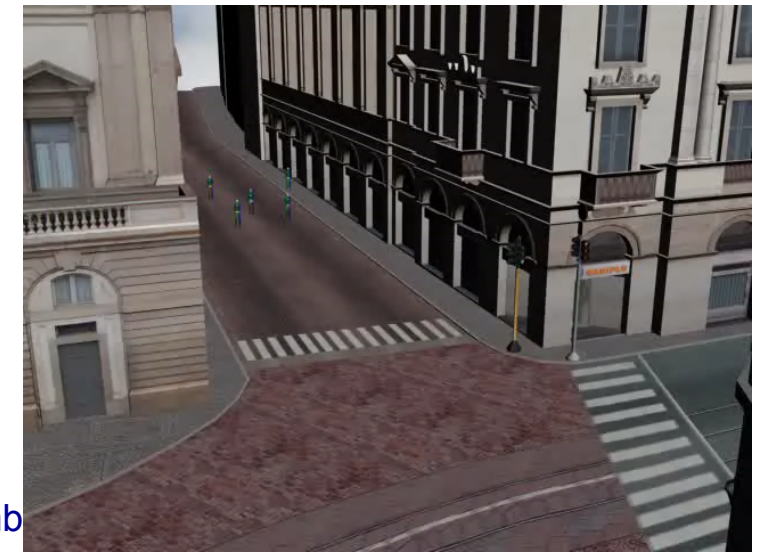
Related works

- At Woa04
  - *Manzoni et al.*, MMASS based model for commutation
  - *Mamei and Zambonelli*, Spatial Computing
  - *Omicini et. al*, A conceptual Framework for Self-Organising MAS
- Other ones
  - *Ferber and Muller*, Influence and reactions
  - *Weyns and Holvoet* subsequent works on situated agents and simultaneous actions
  - Various approaches generally referred to as *stigmergy*

Concluding remarks and future works

- This work is part of a wider project aiming at developing a platform for MMASS-based applications
- Next steps
  - Tools for the specification and interpretation of MMASS elements (first steps in the context of environment modelling for pedestrian simulation in realistic environments)
  - New project in the Pervasive computing application context (coordinated sensors' network)





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Sorry for not being there...

Thank you!

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