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SOCS

A computational logic model for the description, analysis, and verification of global and open societies of heterogeneous computees

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Computees & their societies

Computees:

- are abstractions of the entities populating global computing environments;
- can form complex organisations that we call societies – SOCS.

Example of Societies:

- Air-traffic Management Systems;
- Business entities in a global trading environment.

Objectives

- logic-based models of individual computees;
- logic-based models of interactions in societies of computees;
- computational models for (societies of) computees;
- specification and verification of properties of (societies of) computees.
- prototype demonstrator and experimentation.

Individual computees

Computees:

- have knowledge, goals, intentions, reasoning capabilities and rules of behaviour;
- must cope in an open and dynamic environment;
- may have incomplete information about the environment and other computees;
- may have incorrect information about the environment and other computees.

Individual computees (cntd)

Computees must be able to:

- construct plans to achieve their goals and execute actions in a timely fashion;
- make intelligent assumptions in the presence of open environments and incomplete information;
- update and correct their knowledge to assimilate new information;
- communicate with other computees;
- negotiate with other computees in order to obtain and exchange resources;
- adapt their behaviour to new situations and societies.

Interaction

- via direct communication between computees;
- protocol-based (as in distributed systems).

Open & dynamic nature of societies and heterogeneity of computees also require:

- individual patterns of interaction;
- computees following different patterns.

Movement of computees between societies requires:

- emergent patterns of negotiation;
- adaptive behaviour.

Computational models

- For individual computees
  - proof procedures that are operational and executable;
  - emphasis on planning with incomplete knowledge, and knowledge assimilation and belief revision.
- For societies of computees
  - Computational models of interaction between computees using argumentation-based proof procedures;
  - Introduce a computational framework where computees can be combined to form societies according to different medels of interaction e.g. negotiation.

Specification & verification of properties

Examples:

- Under what circumstances is negotiation amongst the computees guaranteed
  - (not) to terminate?
  - to result in acceptances of offers and exchanges of tasks/resources/knowledge in such a way that would allow all computees in the societies to achieve their objectives?
- What would be the best policy a computee can adopt in order to maximise its "gains" during negotiation?

Specification & verification of properties (cntd)

- How can the timeliness of the conclusion of the negotiation process be guaranteed in order for the computees to meet their deadlines?
- Will the computees inhabiting a society consisting solely of altruistic computees be more effective in achieving their objectives than those inhabiting a society consisting solely of self-interested computees?

Implementation &Experimentation

Prototype to animate (societies of) computees:

- computees will be developed as players that interact in societies by playing games (games as a *development metaphor*);
- explicit notion of computee environment to support distributed computation, communication and mobility of computees;
- scenaria to experiment and test the ideas.

Innovation

- to provide logic-based models for (societies of) computees with a well-defined *computational counterpart*, and exhibiting *multiple functionalities*;
- to provide a model of heterogeneous computess, where interaction is regulated by shared protocols as well as individual patterns;
- to identify and verify formally high-level properties of (societies of) computess.