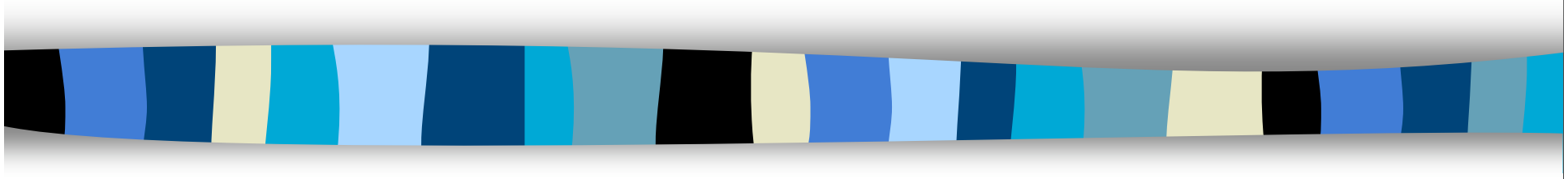
Emergent Socially Rational Utilitarianism in a Peer-to-Peer System



Andrea Marcozzi and David Hales
Department of Computer Science,
University of Bologna

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Bertinoro

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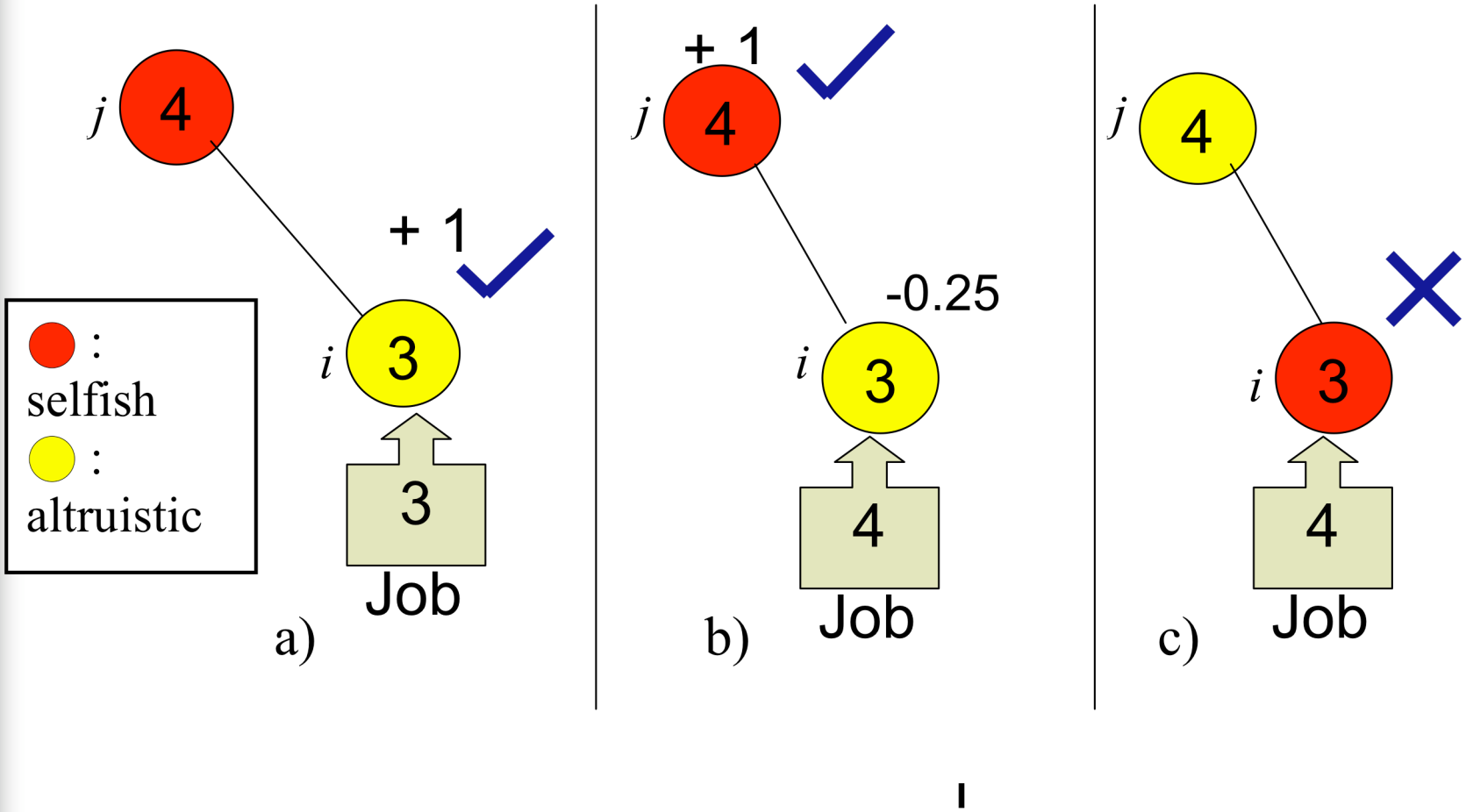
The ResourceWorld scenario

- It is based on a previous work: the SkillWorl model (Hales2005)
- We consider a situation in which there are populations of peer nodes that can store and serve some number of resources. Each node has its own single native resource that it wishes to serve to some user community achieving some specified service level.
- In each interaction, nodes get an appropriate utility

The ResourceWorld Model (I)

- Let's consider a P2P overlay network in which each node has the following state:
  - Strategy bit, A $\in$ {0,1} (indicates if the node is altruistic or not)
  - Skill, S $\in$ {1,2,3,4,5} (inicates the resource of the node)
  - Neighbor list (max 20 neighbors)
- In each cycle, with probability 0.5, nodes receive a job to be completed (Job, J $\in$ {1,2,3,4,5})
- With a certain probability, two random nodes are selected and their utilities are compared (SLAC)

The ResourceWorld Model (II)



Experiments (parameters)

- Peersim (http://peersim.sf.net)
- SLAC
- Network size: 4000 nodes
- Initial topology: *random*
- Single node initialization:
  - Strategy bit: *0 (defect)*
  - Skill: *random*
- Mutation: (MRT = 0.01; MRS = 0.005)
- Payoffs:
  - Benefits from 0.1 to 2.0 by 0.1 steps
  - Costs from 0.1 to 2.0 by 0.1 steps
- 10 runs for each experiments meaning

20 X 20 X 10 runs

Experiments (results) (I)

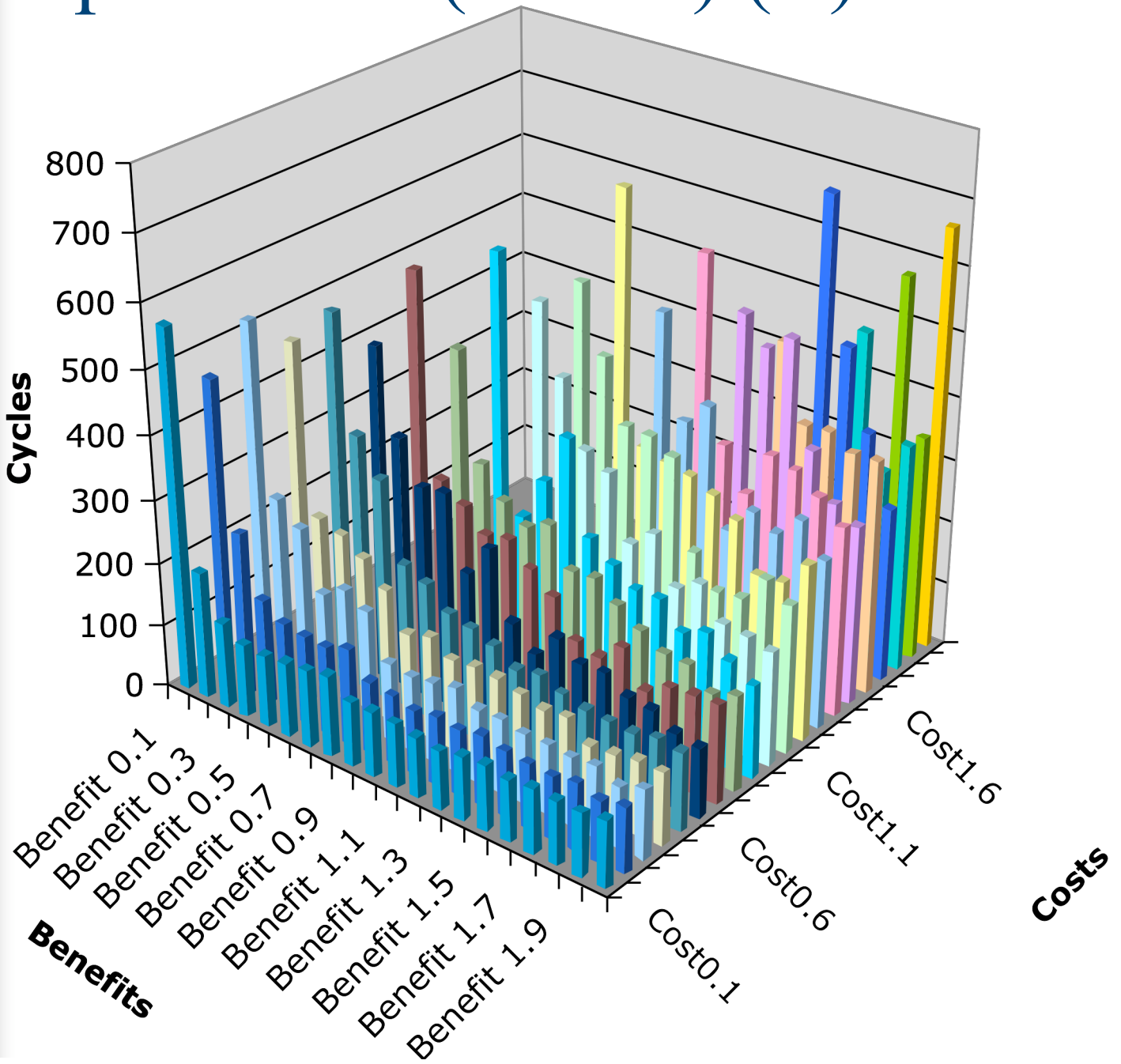
The utility measure we used to evaluate the performaces of the model is the *Pcj* : the percentage of completed jobs

We found that to obtain a Pcj > 80%, the **Benefit payoff must be greater or equal than the Cost payoff**

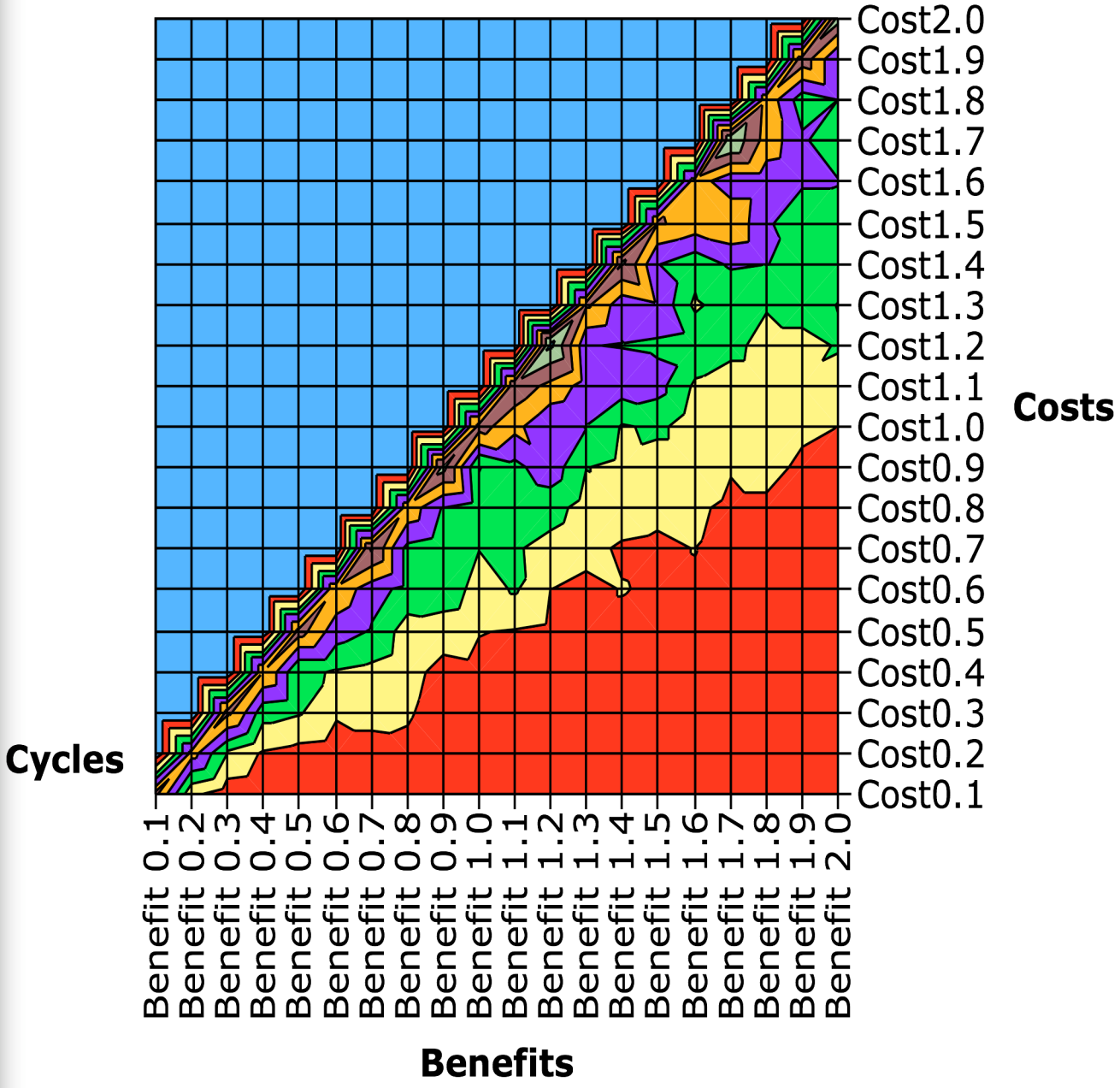
When *Cost* > *Benefit*, we obtain a very low Pcj

When *Cost* = *Benefit*, the system takes longer to reach Pcj > 80%

Experiments (results) (II)

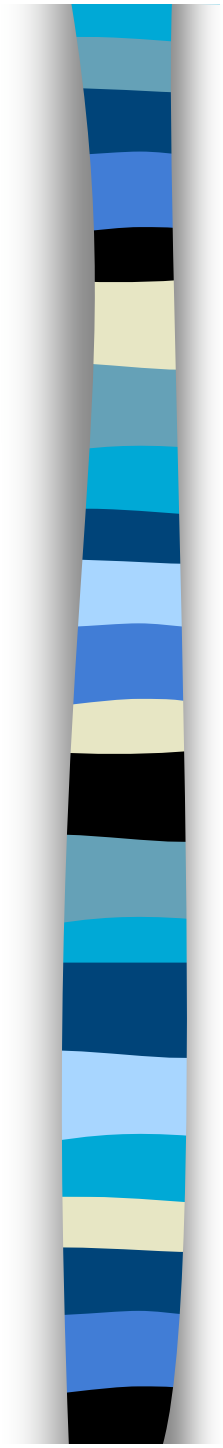


Experiments (results) (III)



ResourceWorld Conclusions

- The aim of this work has been to take the ResourceWorld model and modify both the benefit and cost utilities to explore a large space of possible values
- In each case we checked if the protocol maximized the collective utility or not



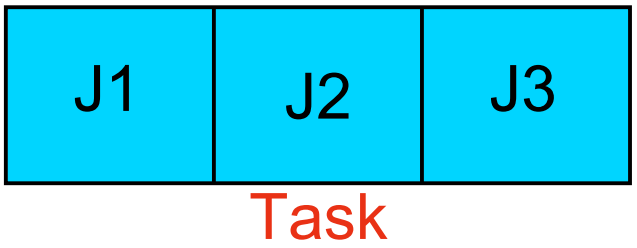
The FirmNet Model (work in progress)

Why FirmNet

- With this model we try to analyze the evolution of Firms
- The job market in which they are involved can be seen as a P2P network, in which nodes having to complete a task can act as *managers* looking for employees able to work on that task

The FirmNet Model

- In collaboration with Edoardo Mollona
- The FN model can be seen as an extension of the RW model
- It models the situation in which agents receive a task composed of 3 jobs. In order to have this task completed it has to find 3 agents holding the appropriate skills



The FirmNet Model (II)

- Payoffs are distributed only when the entire task is completed
- Agents will accept the job only if they have the appropriate skill and the benefit is greater than an user defined *accept threshold*
- When an agent is busy, since executing a job, it won't accept any further job. This will happen only when the entire task will be completed
- If the node holding the task can't complete it only with its immediate neighbors, it will pass the remainig jobs to one of them

References

- Hales, D. (2005) *Choose Your Tribe! - Evolution at the Next Level in a Peer-to-Peer Network*. Presented at the 3rd Workshop on Engineering Self-Organising Applications (EOSA 2005) located with the AAMAS 2005 conference, July 26th, 2005, Utrect, The Netherlands
- Mollona, E., Hales, D. (2005) *Knowledge-Based Jobs and the Boundaries of Firms: Agent-based simulation of Firms Learning and Workforce Skill Set Dynamics.* UBLCS-2005-14 Technical Report