Dynamics of Continuous, Discrete and Impulsive Systems
Series **B:** *Applications & Algorithms* **12 (2005)** 607-615

Equilibrium Prices for Resource Allocation in Grid Computing

Lihua Chen[1], Ning Chen[2], Xiaotie Deng[3], and Hong Zhu[2]

[1]Guanghua School of Management, Peking University, China.

[2]Department of Computer Science, Fudan University, China.

[3]Department of Computer Science, City University of Hong Kong, Hong Kong.

Abstract. We study resource allocation problem in a grid computing framework, where agents and resources are distributed in a graph and agents get these resources with their price plus bandwidth cost. We focus on pricing resources from Walrasian equilibrium point of view. In our model, Walrasian equilibrium always exists, and we give a polynomial time algorithm to compute one.

Keywords. Resource Allocation, Grid Computing, Walrasian Equilibrium.

1 Introduction

The Computational Grid [12] is a conceptual infrastructure utilizing global distributed computing resources (such as CPU, memory, disk space, network bandwidth) owned by autonomous agents and connected via interconnection networks, to solve large-scale computational problems. While resource utilization can be improved for the benefit of both resource providers (with under-utilized resources) and heavy computational resource users, many issues arise to challenge the resource scheduler: individual rationality and collective optimality of different resource allocation schemes, pricing mechanisms and pricing sequences in time (both the purchase and service time). Computational economics deals with such problems of pricing resources to be allocated to competing agents. Therefore, economic models with their computational methods become more and more intensively studied in resource allocation of computational grid.

While grid computing provides an environment for participating agents to have much greater power of computing, the market-based resource allocation strategies provide incentives to agents to actively join in the grid and share their available resources. The economy of such a market of computational resources is, however, quite different from classic models. Though the issues of price stability such as non-arbitrage, equilibrium and society optimality remain, they are coupled with new types of goods and services. Most importantly, computational and algorithmic issues become practical ones.