

A Study on Virtual Market for Pareto Optimal Mediation in Economic Society

Toshiya KAIHARA* and Susumu FUJII**

*Graduate School of Science and Technology, Kobe University, Kobe, Japan

** Faculty of Engineering, Kobe University, Kobe, Japan

E-mail: kaihara@cs.kobe-u.ac.jp

Key Words: Supply chain management, Market-oriented programming, Walrasian economics, Multi-agent, Fixed-point algorithm

ABSTRACT

Market price systems constitute a well-understood class of mechanisms that under certain conditions provide effective decentralisation of decision making with minimal communication overhead. Market-oriented programming is a new approach to design and implementation of resource allocation mechanisms in computer systems. It has its roots in different disciplines, such as economics and computer science, in particular the area of multi-agent systems. Market-oriented programming is seen as a programming paradigm based on abstractions such as prices and demands. Concepts, terminology and theory from microeconomics form the foundations of the paradigm. Central aspects of these foundations are investigated and some new insights are presented. Furthermore, some relations between conventional optimization / resource allocation approaches and market-oriented programming are described in this paper.

There are our previous researches to apply market-oriented programming into resource allocation problems. We defined the agent activities in terms of resource required and produced, reducing an agent's decision problem to evaluate the tradeoffs of acquiring different resources. These tradeoffs are represented in terms of market prices, which define common scale of value across the various resources. The Pareto optimality in market-oriented programming, however, was left into microeconomics, and never tried to be proved in these approaches using multi-agent programming. In this paper we construct a Walrasian type virtual market, that is a principal market model in microeconomics, and try to confirm the Pareto optimality in our market model by comparing the solutions with conventional analytic approaches, such as constraint method and fixed-point algorithm.

The main conclusion of the paper is that there are some potential pitfalls of Walrasian virtual market, but when used with care it provides a highly natural and efficient means for generic resource allocation problems with using computational market.