A General Economic Equilibrium Model of Distributed Computing

Chapter

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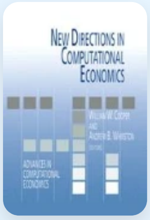

New Directions in Computational Economics

Dale O. Stahl & Andrew B. Whinston

Part of the book series: Advances in Computational Economics ((AICE,volume 4))

Abstract

The operation of a distributed computing system such as Internet can be viewed as a resource allocation problem, and thereby becomes amenable to analysis using the techniques of mathematical economics. We define a general distributed computing system and translate that setup into a model of an economy. In this model, the preferences of users are taken as primitives, and processing units (PU) are viewed as productive firms with input queues. Each PU charges a rental price for its services. In order to avoid the difficulties associated with modelling discrete choices of users over the set of possible programs, we assume that a user benefits depend on the average flow of services and that user choices can be modeled as a stochastic arrival process. This representation may be a more realistic model of a group of users than the more straightforward discrete choice model. Within the context of this model, we characterize optimal system allocations, and prove the existence of stochastic equilibrium rental prices such that total expected demand does not exceed optimal system capacity utilization. The profit measures for each PU can be used to guide the evolution of the distributed computing system. We also propose a tatonnement process for guiding the system towards equilibrium. Since only limited general convergence theorems are available, we propose simulation testing of the dynamic properties. Future research will explore the performance of the pricing mechanism in experimental environments and eventually in actual usage.

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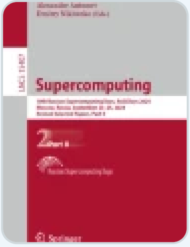
Preview



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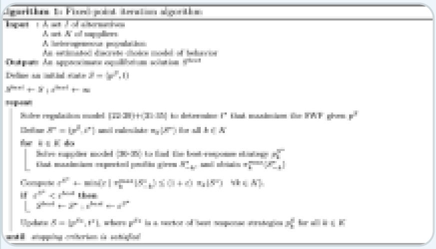

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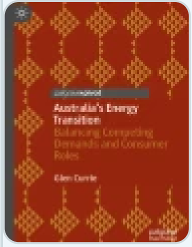

Conclusion

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