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A General Economic Equilibrium Model of Distributed Computing

| Chapter

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New Directions in Computational Economics

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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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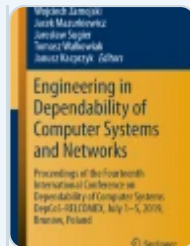
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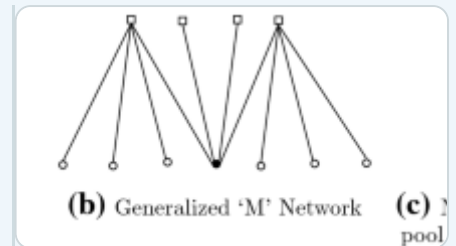
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Bibliography

Arrow, K. and M. Intriligator (Eds.), 1982, *Handbook of Mathematical Economics*,

Volumes I-II, Amsterdam: North-Holland.

[Google Scholar](#)

Binmore, K., 1987, 'Modeling rational players, I and I', *Economics and Philosophy* 3, 179-214, and 4, 9-55.

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Chaudhury, A., D. Stahl, and A. Whinston, 1994, 'The economic theory foundation for neural computing systems', in A. Whinston and J. Johnson (Eds.), *Advances in Artificial Intelligence in Economics, Finance and Management*, J.A.I. Press.

[Google Scholar](#)

Cinlar, E., 1972, 'Superposition of point processes', in P. Lewis (Ed.), *Stochastic Point Processes: Statistical Analysis, Theory and Applications*, New York: Wiley, pp. 549-606.

[Google Scholar](#)

Codsi, G. and K. Pearson, 1988, 'GEMPACK: General purpose software for applied general equilibrium and other economic applications', *Computer Science in Economics and Management* 1, 189-208.

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Debreu, G., 1959, *The Theory of Value*, New Haven: Yale University Press.

[Google Scholar](#)

Dolan, R. J., 1978, 'Incentive mechanisms for priority queueing problems', *Bell J. of Economics* 9, 421-436.

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Ferguson, D., Y. Yemini, and C. Nikalson, 1989, 'Microeconomic algorithms for load balancing in distributed computer systems', T.J. Watson Research Center, Yorktown Heights, New York, research report.

[Google Scholar](#)

Hahn, F., 1982, 'Stability', in K. Arrow and M. Intriligator (Eds.), *Handbook of Mathematical Economics II*, Amsterdam: North-Holland, Chapter 16.

[Google Scholar](#)

Hogg, T., 1990, 'Primed for performance', *Byte* June, 241-250.

[Google Scholar](#)

Manne, A., 1985, 'On the formulation and solution of economic equilibrium models', *Mathematical Programming Study* 23.

[Google Scholar](#)

Mendelson, H., 1985, 'Pricing computer services: queuing effects', *Commun. ACM* 28, 312-321.

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Mendelson, H. and S. Whang, 1990, 'Optimal incentive-compatible priority pricing for the M/M/1 queue', *Operations Research* 38, 870-883.

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Taiman, A. and G. van der Laan, G., 1987, *The Computation and Modeling of Economic Equilibria*, Amsterdam: North-Holland.

[Google Scholar](#)

Varian, H., 1984, *Microeconomic Analysis*, New York: Norton.

[Google Scholar](#)

Waldspurger, C, T. Hogg, B. Huberman, J. Kephart, and S. Stornetta, 1990, 'SPAWN: A distributed computational economy', Working Paper, Xerox Palo Alto Research Center, Palo Alto, CA.

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