Tradeoffs in Minimizing Computation Load and Communication Cost in Multi-Agent Systems

Kiran Bhutani * Bilal Khan † Birendro Roy ‡
Center for Computational Science
Naval Research Laboratory, Washington D.C.
http://www.nrl.navy.mil/ccs/project/public/DC/web/

September 14, 2003

Abstract

1 Introduction

Agents are mobile, intercommunicating, computational units that can act autonomously within a complex dynamic environment in order to realize a set of goals or tasks for which they are designed [**?**]. An agent's environment consists of other agents as well as the physical infrastructure. The infrastructure in turn is comprised of *machines* that provide computational resources for agents and a *network* that provides resources for agent intercommunication. At any point in time, an agent "resides" on a particular machine, and attempts to realize its goals by communicating with other agents over the network and by performing computation using the resources of the machine on which it resides. Agent communication and computation result in consumption of both network and machine resources. The extent to which each of these resources is consumed depends largely on the distribution of agents to machines. We refer to an entity that determines the assignment of agents to machines as a *controller*. The controller's logic implements an *agent mobility algorithm*. In this paper, we consider the problem of designing agent mobility algorithms which permit the system of agents to make optimal use of computation and communication resources.

*Permanent address: The Catholic University of America. Department of Mathematics, Washington D.C. 20064.
†ITT Industries, Center for Computational Science, Naval Research Laboratory.
‡Massachussetts Institute of Technology, Computer Science Department.

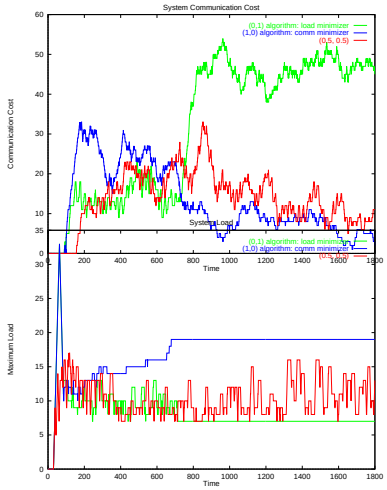
We note that if the system does not satisfy the condition of near-uniform agent communication patterns, then the $(1, 0)$ algorithm may not converge to an optimal solution. This is illustrated by the following example.

*** INSERT EXAMPLE HERE ***

7 Experiments

Here we run some generic experiments to show performance for intermediate values of α and β to show a smooth tradeoff.

*** EXPERIMENTS ***



8 Tradeoffs

Here we try and make quantitive sense of the intuitive idea that communication cost minimization and load minimization are inversely proportional, using whatever analysis and experiments appeared earlier.

9 Conclusion

We summarize.