Colorado State University's Information

Science and Technology Center (ISTeC)

Presents

Dr. Arnold Rosenberg

Distinguished University Professor of Computer Science

University of Massachusetts - Amherst

Thursday January 22, 2004

**Department of Electrical and Computer Engineering and
Department of Computer Science Seminar
Sponsored by ISTeC**

**"How to Share a Bag of Tasks Optimally in a Heterogeneous Cluster
-- Three Models, Three Answers"**

11:00 a.m.

Colorado State University Campus
Lory Student Center, Room 214
Reception at 10:30 a.m.

and

Friday January 23, 2004

ISTeC Distinguished Lecture

"N+1 Heads Are Better Than N -- or Are They?"

4:10 p.m.

Colorado State University Campus
Lory Student Center, Room 214
Reception at 3:30 p.m.

Lectures are free and open to the public

Additional information is available at (970) 491-7982.

ABSTRACTS

"N+1 Heads Are Better Than N -- or Are They?"

It seems to be a truism that one can gain computational efficiency by enlisting more computers in the solution of a single computational problem. (We refer to such use of multiple computers as "collaborative computing.") In order to realize the promise of collaborative computing, however, one must know how to exploit the strengths of the technology used to build the computing platform --- the multiple computers and the networks that interconnect them --- and how to avoid the weaknesses of the technology. Changes in technology call for changes in algorithmic strategy. In this talk, I describe some of the challenges that the algorithm designer has faced as the dominant collaborative computing platforms have changed. I discuss some algorithmic challenges associated with:

Multiprocessors that share a single memory

1. Where to find parallelism
2. How to keep all processors busy

Message-passing multiprocessors

1. How to "hide" communication costs
2. How to control congestion as messages flit about

Clusters of "workstations"

1. How to accommodate differences in workstations' powers
2. How to orchestrate communication that is too costly to "hide"

Computational grids (consortia of far-flung computing sites)

1. How to cope with unpredictable timing of remote computers
2. How to cope with insecure communication media

Web-computing platforms (think of SETI@Home)

1. How to cope with unreliable remote computers (may disappear)
2. How to cope with mischievous remote computers (may hack)

As each new algorithmic challenge is discussed, some sophisticated algorithmic responses will be suggested.

"How to Share a Bag of Tasks Optimally in a Heterogeneous Cluster -- Three Models,

Three Answers"

In the world of sequential computers, the abstract RAM model enables one to design provably efficient algorithms for a broad range of actual architectures and a broad range of workloads. In the world of multiprocessors, the abstract BSP model serves a similar function. No analogue of the RAM and BSP models is known for modern computing platforms such as clusters of workstations --- especially heterogeneous ones, whose constituent workstations may differ in computational power --- and the various modalities of Internet-based computing. In this talk, we present circumstantial evidence that no such single algorithmic model can exist for heterogeneous clusters. We describe three quite similar computational problems related to computing a large collection of mutually independent tasks on a cluster. (Two of the problems can be shown formally to be equivalent.) Despite their similarities, the three problems require drastically different algorithmic approaches if one wants provably optimal solutions.

Dr. Arnold Rosenberg

Dr. Rosenberg is a Distinguished University Professor of Computer Science at the University of Massachusetts Amherst, where he co-directs the Theoretical Aspects of Parallel and Distributed Systems (TAPADS) Laboratory. Prior to joining UMass, he was a Professor of Computer Science at Duke University from 1981 to 1986, and a Research Staff Member at the IBM Watson Research Center from 1965 to 1981. He has held visiting positions at Yale University and the University of Toronto; he was a Lady Davis Visiting Professor at the Technion (Israel Institute of Technology) in 1994, and a Fulbright Research Scholar at the University of Paris-South in 2000. Dr. Rosenberg's research focuses on developing algorithmic models and techniques to deal with the new modalities of "collaborative computing" that result from emerging technologies. He is the author of more than 145 technical papers on these and other topics in theoretical computer science and discrete mathematics and is the coauthor of the book "Graph Separators, with Applications." Dr. Rosenberg is a Fellow of the ACM, a Fellow of the IEEE, and a Golden Core member of the IEEE Computer Society.

Information Science and Technology Center (ISTeC)

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