

Alfred J. Park

CONTACT INFORMATION

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RESEARCH STATEMENT

My research interests are aligned with the exploration of new parallel and distributed simulation technologies utilizing high performance computing spanning grid and distributed computing. My specific focus within these high performance computing infrastructures center on exploiting metacomputing resources such as volunteer, desktop grid, and cloud computing. My recent work includes development and analysis of a portable, scalable, fault tolerant, idle-cycle capturing software system supporting mixed-mode parallel discrete event simulation and task parallel simulations.

EDUCATION

Georgia Institute of Technology, Atlanta, Georgia USA

Ph.D. Candidate, Computer Science (Graduation: May 1, 2009)

- Dissertation Title: Master/Worker Parallel Discrete Event Simulation
- Advisor: Professor Richard M. Fujimoto
- Area of Study: High Performance Computing and Parallel and Distributed Simulation Systems

Georgia Institute of Technology, Atlanta, Georgia USA

M.S., Computer Science, December 2004

- Area of Study: Large-scale Parallel and Distributed Network Simulation

Georgia Institute of Technology, Atlanta, Georgia USA

B.S., Computer Science, *High Honor*, August 2002

- Systems and Networks specialization

RESEARCH AND TEACHING EXPERIENCE

Georgia Institute of Technology, Atlanta, Georgia USA

Graduate Research Assistant

January 2005 to December 2008

- Exploration of the fusion of parallel discrete event simulation (PDES) systems with public resource (volunteer) computing, desktop grid and web service technologies
- Exploit a distributed master/worker approach to deliver a fully scalable, highly-available, fault-tolerant, idle-cycle capturing distributed computing architecture specifically tailored for PDES executions
- Developed *Aurora*, a platform for PDES on volatile volunteer computing and desktop grid infrastructures

Graduate Research Assistant

January 2004 to December 2004

- Integrated the CORSIM Microscopic Traffic Simulation Model and the QualNet Network Simulator providing an Intelligent Transportation Simulation testbed
- Implemented Time Management for the Interoperable Distributed Simulation (IDSIM) framework

Graduate Research Assistant

September 2002 to December 2003

- Investigation of conservative synchronization for large-scale network simulations over hundreds of processors on the Pittsburgh Supercomputing Center (PSC) Lemieux Cluster
- Devised a new algorithm for the Chandy-Misra-Bryant Null Messaging scheme to reduce message output and overhead for time synchronization

Graduate Teaching Assistant

August 2007 to December 2007

CS 6236/4230 Parallel and Distributed Simulation

- Assist with course materials, assignments, and projects as well as grading assignments
- Hold weekly office hours to assist students with lecture material and assignments

Undergraduate Teaching Assistant

January 2002 to August 2002

CS 2200 Systems and Networks

- Devised programming assignments; graded and supervised student homeworks, programming assignments, and exams
- Held weekly office hours and hosted Q&A help sessions for assignments

PROFESSIONAL
EXPERIENCE

GTech Systems, Inc, Atlanta, Georgia USA

Software Engineer and Researcher

February 2008 to Current

- Assist in ITAR-related work in the evaluation and development of simulation tools for the DARPA National Cyber Range

GTech Systems, Inc, Atlanta, Georgia USA

Software Engineer

May 2007 to September 2007

- Enhanced the *Aurora* Parallel and Distributed Simulation System to accommodate task-parallel jobs, push (event) based work distribution, heterogeneous architectures, query protocols, and a GUI interface
- Integration of the GTRI Ballistic Missile Defense (BMD) Benchmark simulation suite written in MATLAB with the *Aurora* framework providing automated distribution of Monte Carlo trials to the client pool to reduce wallclock runtime as well as automatic collection and recombination of output files for easy viewing through the GUI interface

Oak Ridge National Laboratory, SensorNet Group, Oak Ridge, Tennessee USA

Advanced Short-Term Research Opportunity

May 2006 to August 2006

- Analysis of integrated simulations on operational-effects of ad-hoc wireless sensor network systems
- Evaluated interplay between hi-fidelity simulations using accurate models between the environmental and sensor network
- Built prototype framework, *EnvSim*, for integrating the Second-Order Closure Integrated PUFF (SCIPUFF) Atmospheric Transport and Dispersion model with the TinyOS ad-hoc wireless network Simulator (TOSSIM)
- Supervisor: Dr. Kalyan S. Perumalla

Georgia Institute of Technology, School of Chemistry, Atlanta, Georgia USA

Student Assistant (Sherrill Group)

December 1999 to August 2002

- Set up and maintained heterogeneous machines including IBM RS/6000, Compaq XP1000, and x86 PCs
- System administration of services: OpenPBS, Samba, Apache, Sendmail, NIS, NFS, CUPS; maintained virtualized software solutions through VMWare
- Wrote software to interface the IBM RS/6000 SP supercomputer at the Center for Computational Molecular Science and Technology (CCMST)

- Created custom web interfaces and scripts performing database manipulations for automatic cataloging and search of scientific articles within the group
- Webmaster for both the Sherrill Group and the CCMST
- Held C, Perl, Pthreads, and OpenMP programming workshops
- Assisted graduate students with research work in data gathering and analysis

SOFTWARE

Aurora Parallel and Distributed Simulation System

- Scalable middleware solution for PDES and task-parallel simulations across desktop grid infrastructures
- Sole developer and maintainer; over 25,000 lines of C++ code

EnvSim

- Integrated simulation environment for SCIPUFF and TOSSIM to evaluate interplay between environmental models and the sensor network simulation
- Custom software infrastructure using: NesC, C, Perl, Python, Java, and the Tython (TOSSIM / Python) environment

CORSIM-QualNet Communication Layer (CQCL)

- Cross-platform library providing an integrated and interoperable abstraction layer for communications across functionally different simulators utilizing HLA-like RTI interfaces

Parallel and Distributed NS-2 (PDNS)

- Maintained software and released patches against the mainline NS-2 source (OTcl and C++)
- Developed a TCP Listener module to allow simulation of dynamic TCP endpoints and applications as well as a detailed Distributed Denial of Service (DDoS) model enabling some of the largest packet-level network simulations ever performed

PUBLICATIONS

Journal Publications (Refereed)

- Alfred Park, Richard M. Fujimoto, "Parallel Discrete Event Simulation on Desktop Grid Computing Infrastructures," *International Journal of Simulation and Process Modelling, Special Issue on Parallel and Distributed Simulation*, Accepted for publication.
- George F. Riley, Mostafa H. Ammar, Richard M. Fujimoto, Alfred Park, Kalyan S. Perumalla, Donghua Xu, "A Federated Approach to Distributed Network Simulation," *ACM Transactions on Modeling and Computer Simulation* 14(2): 116-148, 2004.

Conference and Workshop Papers (Refereed)

- Alfred Park and Richard M. Fujimoto, "Efficient Master/Worker Parallel Discrete Event Simulation," Accepted for publication in IEEE PADS 2009.
- Alfred Park and Richard Fujimoto, "Optimistic Parallel Simulation over Public Resource-Computing Infrastructures and Desktop Grids," in *Proceedings of the 12th International Symposium on Distributed Simulation and Real-Time Applications (DS-RT)*: IEEE Computer Society, Vancouver, BC, 2008.
- Matthias Jeschke, Alfred Park, Roland Ewald, Richard Fujimoto, Adelinde M. Uhrmacher, "Parallel and Distributed Spatial Simulation of Chemical Reactions," in *Proceedings of the 22nd Workshop on Principles of Advanced and Distributed Simulation*: IEEE Computer Society, Rome, Italy, 2008.
- Alfred Park and Richard Fujimoto, "A Scalable Framework for Parallel Discrete Event Simulations on Desktop Grids," in *Proceedings of the 8th International Conference on Grid Computing*: IEEE Computer Society, Austin, Texas, 2007.
- Alfred Park, Kalyan Perumalla, Vladimir Protopopescu, Mallikarjun Shankar, Frank DeNap, Bryan Gorman, "On Evaluation Needs of Real-Life Sensor Network Deployments," in *Proceedings of the 2nd European Modeling and Simulation Symposium*: Society for Modeling and Simulation International (SCS), Barcelona, Spain, 2006.

- Alfred Park and Richard M. Fujimoto, "Aurora: An Approach to High throughput Parallel Simulation," in *Proceedings of the 20th Workshop on Principles of Advanced and Distributed Simulation*: IEEE Computer Society, Singapore, 2006.
- J. Brad Fitzgibbons, Richard M. Fujimoto, Randall Guensler, Michael Hunter, Alfred Park, Hao Wu, "Simulation-Based Operations Planning for Regional Transportation Systems," in *Proceedings of the 2004 Annual National Conference on Digital Government Research (DG.O)*, Seattle, Washington, 2004.
- Alfred Park, Richard M. Fujimoto and Kalyan S. Perumalla, "Conservative Synchronization of Large-Scale Network Simulations," in *Proceedings of the 18th Workshop on Principles of Advanced and Distributed Simulation*: IEEE Computer Society, Kufstein, Austria, 2004.
- Richard M. Fujimoto, Kalyan S. Perumalla, Alfred Park, Hao Wu, Mostafa H. Ammar, George F. Riley, "Large-Scale Network Simulation: How Big? How Fast?," in *Proceedings of the 11th International Workshop on Modeling, Analysis, and Simulation of Computer and Telecommunication Systems*: IEEE Computer Society, Orlando, Florida 2003.
- Kalyan S. Perumalla, Alfred Park, and Richard M. Fujimoto, "Scalable RTI-Based Parallel Simulation of Networks," in *Proceedings of the 17th Workshop on Principles of Advanced and Distributed Simulation*: IEEE Computer Society, San Diego, California, 2003.

Book Chapter

- Richard Fujimoto, Alfred Park, and Jen-Chih Huang, "Towards Flexible, Reliable, High Throughput Parallel Discrete Event Simulations," *Recent Advances in Modeling and Simulation Tools for Communication Networks and Services*. Springer US, 2008. 257-278.

Demonstrations, Posters, and Talks

- Alfred Park, Richard Fujimoto, "Aurora: A Framework for Flexible, Reliable, High Throughput Parallel Simulations," Supercomputing (SC) 07, Reno, Nevada, 2007.
- Alfred Park, Richard Fujimoto, and Steve Ferenci, "Aurora: A Framework for Flexible, Reliable, High Throughput Parallel Discrete Event Simulations," Georgia Tech Integrated BioSystems Initiative, Atlanta, Georgia, 2007.
- J. Brad Fitzgibbons, Richard M. Fujimoto, Randall Guensler, Michael Hunter, Alfred Park, Hao Wu, "Distributed Simulation Test Bed for Intelligent Transportation Systems Design and Analysis," 2004 Annual National Conference on Digital Government Research (DG.O), Seattle, Washington, 2004.

Other Papers

- Matthias Jeschke, Roland Ewald, Alfred Park, Richard Fujimoto, Adelinde M. Uhrmacher, "A Parallel and Distributed Discrete Event Approach for Spatial Cell-Biological Simulations," *ACM SIGMETRICS Performance Evaluation Review* 35(4): 22-31, 2008.
- Alfred Park and Kalyan Perumalla, "Integrated Analysis of Environment-Driven Operational Effects in Sensor Networks," Oak Ridge National Laboratory Technical Report, August 2006.

AFFILIATIONS, SERVICE AND HONORS

Professional Associations

- Institute of Electrical and Electronics Engineers, Inc (IEEE). 2003 - Present.
- Association for Computing Machinery (ACM). 2004 - Present.

Service

- Principles of Advanced and Distributed Simulation (IEEE/ACM PADS) conference paper reviewer.
- Modeling, Analysis, and Simulation of Computer and Telecommunication Systems (IEEE/ACM MASCOTS) conference paper reviewer.

Awards and Honors

- ORNL Advanced Short-Term Research Opportunity (ASTRO) Recipient, 2006.
- Georgia Institute of Technology, College of Computing Dean's List, 2000 - 2002.
- Georgia Institute of Technology, School of Chemistry Dean's List, 1998 - 2000.

- Kaiser Aluminum Scholarship, 1998 - 2002.
- LaRoche Industries Corporate Scholarship, 1998 - 2002.
- Lewis H. Jordan Scholarship, 1998 - 2002.
- George F. Dowman Scholarship, 1998 - 2001.
- Sidney Goldin Scholarship, 1998.