**Vivek Kale**

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**U.S. Citizen**

**General Areas of Interest:** Multi-core Architectures, High-Performance Scientific Computing

**Education:**

Ph.D. in Computer Science at University of Illinois at Urbana-Champaign (May 2015 Graduation)

Lawrence Scholar at Lawrence Livermore National Laboratory

GPA: 3.96/4.00

**Advisor:** ProfessorWilliam D. Gropp

**Research Focus:** Improving scientific application performance through dynamic scheduling

**Experience:**

**Lawrence Livermore Nat’l Lab   Lawrence Scholar                     Feb ‘12 – Jun ‘14**

* Obtained measurements for within-node imbalances on laboratory supercomputers, and developed a cost model for these imbalances.
* Created a software system for automated performance optimization and application programmer usability of low-overhead scheduling strategies.
* Developed a theoretical analysis for obtaining best performing scheduling parameters for a particular application and architecture.
* Developed a ROSE-based custom compiler for automatically transforming MPI+OpenMP applications to use my low-overhead scheduling technique and runtime.
* Assessed further opportunities for performance improvement of low-overhead schedulers, including improvement of spatial locality of low-overhead schedulers.

**Lawrence Livermore and Berkeley Nat’l Lab       Scholar  Jun ‘10 - Sept ‘10 / Jun ‘11 - Sept ‘11**

* Experimented with different OpenMP parameters of implemented MPI+OpenMP application code to understand performance optimizations on LLNL supercomputers.
* Analyzed results for the performance tests developed on NERSC machines, and compared with collectives in reference to MPI (mpich2) runtime system.
* Modified OpenMP gomp runtime system in order to integrate low-overhead schedulers within it.

**Goldman-Sachs     Summer Analyst Jun. ‘09 – Sept. ‘09**

* Wrote code for testing trading system infrastructure functions under extreme market conditions.
* Analyzed performance bottlenecks of system infrastructure functions.

**MIT Research Intern Jun. ‘05 – Sept. ‘05**

* Worked under Professor Alex Pentland to write C code to collect data from bio-sensor and audio data.
* Used spectral methods and statistical methods from Matlab to do simple data analysis of obtained data.

**Technical Skills Highlights:**

*Languages*: C, C++, python, Fortran, python, bash, csh, VHDL, Matlab, Java

*Tools:* LaTeX, gnuplot, emacs, autoconf, cmake, svn, git

*Libraries for Parallelism:* POSIX threads: Pthreads, MPI: mpich2 and mpich3, OpenMP: gomp, UPC: bupc

*Performance Profiling Tools:*OpenSpeedShop, hpcToolkit, PMPI, Intel VTune

*Platforms*: clusters of NUMA multi-core nodes, clusters of SMP nodes, GPUs, desktop multi-core processors.

***Research Overview:*** I have worked on low-overhead dynamic scheduling strategies for performance tuning MPI + OpenMP codes on multi-core processors. The techniques have been applied to dense matrix factorization codes, specifically Communication-avoiding LU and Communication-avoiding QR. I have applied the strategies to regular mesh computations and Lattice-Boltzmann simulations, and most recently, n-body simulations. The scheduling strategies developed can be beneficial to mitigate the amplification problem, a problem shown to cause serious performance bottlenecks for bulk-synchronous and loosely synchronous MPI applications running on next-generation exa-scale machines or the cloud.

**Publications:**

1. Vivek Kale, Simplice Donfack, Laura Grigori, William D. Gropp. ***Balancing the Tradeoff Between Load Balancing and Locality to Improve Performance of Scientific Applications.*** SC' 14. New Orleans, LA.

1. Vivek Kale, Amanda Peters Randles, William D. Gropp. ***Locality-Optimized Mixed Static/Dynamic Scheduling for Load Balancing on SMPs****.* EuroMPI/ASIA 2014. Kyoto, Japan.
2. Vivek Kale, Todd Gamblin, Torsten Hoefler, Bronis R. de Supinski, William D. Gropp. ***Slack-conscious Lightweight Loop Scheduling for Scaling Past the Noise Amplification Problem.*** SC ‘12 Poster. Salt Lake City, Utah.
3. Simplice Donfack, Vivek Kale, Laura Grigori, William D. Gropp. ***Hybrid Static/Dynamic Scheduling for Already Optimized Dense Matrix Factorizations*.** IPDPS 2011. Shanghai, China.
4. Vivek Kale, Abhinav Bhatele, William D. Gropp. ***Weighted Locality-Sensitive scheduling for Noise Mitigation on Multi-core Clusters.*** HiPC 2011. Bangalore, India.
5. Vivek Kale, William D. Gropp. ***Load Balancing for Regular Meshes on a Cluster of SMPs with MPI.*** EuroMPI 2010. Stuttgart, Germany. ***(Selected as a Best Paper).***
6. Torsten Hoefler, James Dinan, Darius Buntinas, Pavan Balaji, Brian Barrett, Ron Brightwell, William Gropp, Vivek Kale, Rajeev Thakur*.* ***MPI+MPI: A New Hybrid Approach to Parallel Programming with MPI Plus Shared Memory*.** EuroMPI 2012. Madrid, Spain.
7. Amanda Peters Randles, Vivek Kale, Jeff Hammond, William D. Gropp, Efthimios Kaxiras. ***Performance Analysis of the Lattice Boltzmann Model Beyond Navier-Stokes.*** IPDPS 2013. Boston, MA.

**Awards and Honors:**

1. *Lawrence Scholar Fellowship:* This is a fellowship sponsored by the Lawrence Livermore National Laboratory and Department of Energy providing up to 4 years of funding for graduate research. Each year a selection is made from a pool of candidates consisting of PhD students from areas including Physics, Chemistry, Biology, and Computer Science. This fellowship award allows a PhD student to conduct their PhD research at Lawrence Livermore National Laboratory in California, with guidance for their research given by both their advisor and one or more Senior Technical Staff at the Lawrence Livermore National Laboratory. This fellowship was awarded to me in November of 2011.
2. *EuroMPI 2010 Best Paper Selection:* This is an award given every year at the highly ranked EuroMPI conference, and my 2010 paper was selected as one of 3 best papers. This award was relevant to me because it was a key reason for me to continue to PhD (was MS at the time of publication) with my advisor.
3. *Heidelberg Laureate Forum Participant:* The Heidelberg Laureate Forum award provides an opportunity for graduate students and postdocs in Mathematics and Computer Science to interact with people who have shaped the two fields. The forum is one week long in the fall.