Vivek L. Kale

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U.S. Citizen

Education

B.S., Computer Science, 2007, University of Illinois at Urbana-Champaign
Ph.D., Computer Science, 2015, University of Illinois at Urbana-Champaign

Experience

Sandia National Laboratories Principal Member of Technical Staff Jul 2024 - present

- Maintainer of HPC Tools and Runtime Interoperability at Sandia Labs, including liason for LLNL Performance Tools.
- Owner and maintainer of Kokkos Software Ecosystem's Kokkos Tools (now part of the Linux Foundation) which provides profiling and debugging capabilities for Kokkos programs (for performance portable parallel programs) as well as sophisticated auto-tuning and performance analysis capabilities.
- Sandia Rep and contributor to OpenMP specification and MPI forum as Sandia Representative.
- Developing software packages for Tools of HPC Software stacks, in particular using Spack.

Sandia National Laboratories Senior Member of Technical Staff Aug 2022 - Jul 2024

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Brookhaven National Laboratory Computational Scientist May 2019 - Aug 2022

- Designed and implemented LLVM's OpenMP user-defined and task-to-multiGPU scheduling strategies to improve within-node load balancing of applications running on supercomputers having multiple GPUs per node.
- Developed benchmarks and evaluating OpenMP implementations, e.g., LLVM's OpenMP, NVIDIA's OpenMP, on Exascale Supercomputers.
- Served as Technical Project Manager for US DoE Exascale Computing Project's SOLLVE project.
- Represented Brookhaven National Laboratory in the OpenMP Architecture Review Board.

Charmworks, Inc. Software Developer Jun 2018 - Apr 2019

- Did research and development for User-defined Loop Schedules in OpenMP.
- Integrated a shared memory library for sophisticated loop scheduling strategies, including some based on my dissertation, into the current version of Charm++.

Publications

Papers

1. Mathialakan Thavappiragasasm and Vivek Kale. *CPU-GPU Performance Tuning for Improving Performance of Modern Scientific Applications on Exascale Supercomputers*. IEEE HiPC 2023. Goa, India. December 18-21, 2023.

2. Shravan Kale, Kevin Huck, David Boehme, Vanessa Surjadidjaja and Vivek Kale. *Performance Analysis and Auto-tuning Tools for Performance Portable Parallel Programs.* 2023 ACM/IEEE International Conference for High Performance Computing Networking, Storage, and Analysis. Denver, CO, USA. November 12-17, 2023.
3. Vivek Kale, Vanessa Surjadidjaja, Christian Trott and James Brandt. *Data Order Reduction for Performance Monitoring of Supercomputers via the Kokkos Tools Sampler Utility.* LDMSCon 2023. Boston, MA, USA. June 13-15, 2023.
4. Vivek Kale and Shyamali Mukherjee. *Tools to Rapidly Develop Sophisticated HPC Software Libraries.* SIAM Computational Science and Engineering Conference 2023. Amsterdam, Netherlands. March 2, 2023.
5. Mathialakan Thavappiragasam and Vivek Kale. *OpenMP's Asynchronous Offloading for All-pairs Shortest Path Graph Algorithms on GPUs* HiPar 2022 Workshop at The 2022 ACM/IEEE International Conference for High Performance Computing Networking, Storage, and Analysis. November 16, 2022. Dallas, Texas, USA.
6. Seonmyeong Bak, Colleen Bertoni, Swen Boehm, Reuben Budiardja, Barbara M. Chapman, Johannes Doerfert, Markus Eisenbach, Hal Finkel, Oscar Hernandez, Joseph Huber, Shintaro Iwasaki, Vivek Kale, Paul R.C. Kent, JaeHyuk Kwack, Meifeng Lin, Piotr Luszczek, Ye Luo, Buu Pham and P.K. Yeung. ***OpenMP Application Experiences: Porting to Accelerated Nodes***. In Journal of Parallel Computing. October 23rd, 2021.
7. Vivek Kale, Wenbin Lu, Anthony Curtis, Abid Malik, Barbara Chapman and Oscar Hernandez. ***Toward Supporting MultiGPU targets via taskloop and User-defined Schedules*** Proceedings of the 2020 International Workshop of OpenMP. September 23-25, 2020. Austin, USA. (virtual).
8. Vivek Kale, Christian Iwainsky, Michael Klemm, Jonas H. Muller Korndorfer, Florina M. Ciorba. ***Toward a Standard Interface for User-Defined Scheduling in OpenMP***. International Workshop on OpenMP. September 23, 2019. Auckland, New Zealand.
9. Vivek Kale and William D. Gropp. ***Composing Low-Overhead Scheduling Strategies for Improving Performance of Scientific Applications***. IWOMP 2015. October 2015. Aachen, Germany.
10. Simplice Donfack, Vivek Kale, Laura Grigori and William D. Gropp. ***Hybrid Static/Dynamic Scheduling for Already Optimized Dense Matrix Factorizations***. IPDPS 2012. May 2012. Shanghai, China.
11. Vivek Kale and William D. Gropp. ***Load Balancing for Regular Meshes on a Cluster of SMPs with MPI***. EuroMPI 2010. September 2010. Stuttgart, Germany. *(Selected as a Best Paper)*
12. Torsten Hoefler, James Dinan, Darius Buntinas, Pavan Balaji, Brian Barrett, Ron Brightwell, William Gropp, Vivek Kale and Rajeev Thakur. ***MPI+MPI: A New Hybrid Approach to Parallel Programming with MPI Plus Shared Memory***. EuroMPI 2012. September 2012. Madrid, Spain.

Extended Abstracts

1. Vivek Kale and Martin Kong. ***Enhancing Support in OpenMP to Improve Data Locality in Application Programs Using Task Scheduling***. OpenMPCon 2018. September 2018. Barcelona, Spain.

Posters

1. Raul Torres, Vivek Kale, Abid Malik, Tom Scogland, Roger Ferrer and Barbara M. Chapman. ***Support in OpenMP for Multi-GPU Parallelism***. The International Conference for High Performance Computing Networking, Storage, and Analysis. November 19, 2021. St. Louis, Missouri, USA.
2. Jonas H Müller Korndörfer, Florina M. Ciorba, Akan Yilmaz, Christian Iwainsky, Johannes Doerfert, Hal Finkel, Vivek Kale, Michael Klemm. ***A Runtime Approach for Dynamic Load Balancing of OpenMP Parallel Loops in LLVM***. The International Conference for High Performance Computing Networking, Storage, and Analysis. November 19, 2019. Denver, Colorado, USA.
3. Vivek Kale, Harshitha Menon and Karthik Senthil. ***Adaptive Loop Scheduling with Charm++ to Improve Performance of Scientific Applications***. SC 2017. November 2017. Denver, USA. *(Selected as a Candidate for Best Poster)*

Projects

1. **LLVM's OpenMP**: LLVM OpenMP with user-defined schedules and OpenMP multi-GPU support. *Repo*: `https://github.com/sollve/openmp-rts`
2. **Kokkos/C++**: Kokkos Tools and runtime systems for C++. *Repo*: `https://github.com/kokkos/kokkos-tools`

Technical Skills

Languages: C, C++, python, Fortran, bash, csh, VHDL, Matlab, Java
Tools: LaTeX, gnuplot, emacs, autoconf, cmake, svn, git, Globus Toolkit
Libraries for Parallelism: POSIX threads (Pthreads), MPI (mpich3), OpenMP (gomp, llvm), OpenACC (pgi);
Performance Profiling Tools: OpenSpeedShop, hpcToolkit, PMPI, Intel VTune;
Platforms: Intel Xeon, IBM Power7, AMD Opteron, NVIDIA Keplar, Intel Xeon Phi