

Nikhil Jain

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Education

- 2016 **Ph.D., Computer Science**, *University of Illinois at Urbana-Champaign*.
Optimization of Communication Intensive Applications on HPC Networks. Advisor: Laxmikant V. Kale
- 2009 **M.Tech., Computer Science and Engineering**, *Indian Institute of Technology*, Kanpur, India.
- 2009 **B.Tech., Computer Science and Engineering**, *Indian Institute of Technology*, Kanpur, India.

Awards & Honors

- 2017 NERSC Award for Innovative Use of HPC
- 2017 Finalist, 10th IEEE International Scalable Computing Challenge
- 2017 Outstanding Mentor Award, Lawrence Livermore National Laboratory
- 2017 Best Poster Award (2nd Place), Computation Postdoc Poster Symposium, LLNL
- 2016 Fernbach Postdoctoral Fellowship
- 2014 IBM PhD Fellowship
- 2013 Silver Award, ACM Student Research Poster Competition, Supercomputing
- 2012 Best Poster, LLNL Annual Student Poster Session
- 2012 Co-winner of HPC Challenge Class 2 (performance), Charm++ Team, Supercomputing
- 2011 Andrew and Shana Laursen Fellowship, Department of Computer Science, UIUC

Skills

- General C, C++, Fortran, Python, numpy, git, svn, CVS, autotools, CMake.
- Parallel Computing Parallel application development in MPI, OpenMP, and Charm++. Parallel runtime system development. Performance tool development in C/C++. MPI and Charm++ profiling tools. Analysis and tuning of parallel applications on large clusters (IBM Blue Gene, Cray, Linux). Experience with large science codes at UIllinois.
- Data Analytics Application of machine learning for application tuning, root cause analysis, and performance analysis of parallel codes.
- Networks and Communication HPC Network simulation tools. Communication and network modelling and analysis. Collective operations on large scale systems. Performance monitoring of networks.

Research and Work Experience

- 2016-present **Lawrence Livermore National Laboratory**, *Fernbach Postdoctoral Fellow*.
 - Research, characterize, and improve communication throughput of HPC networks.
 - Develop data analytics driven methods for performance optimization.
 - Explore new avenues for application of parallel computing.
- 2011-2016 **Dept of Computer Science, University of Illinois at Urbana-Champaign**, *Research Assistant*.
 - Created TraceR and contributed to CODES to enable scalable and accurate simulation of parallel codes on HPC networks.
 - Proposed DamselFly - a fast analytical model for understanding performance of dragonfly networks.
 - Developed new features for Charm++, a widely used parallel programming model.
 - Contributed to development and performance improvements in OpenAtom and NAMD.
- Summer 2014 **Lawrence Livermore National Laboratory**, *Research Intern*.
Analyzed prediction models to identify factors that affect performance on HPC networks.

- Summer 2012 **Lawrence Livermore National Laboratory**, *Research Intern*.
Proposed and demonstrated use of machine learning based models for predicting communication performance of HPC applications.
- Spring 2011 **Dept of Computer Science, University of Illinois at Urbana-Champaign**, *Visiting Scholar*.
Re-designed runtime-level memory management module for speed and efficiency in Charm++.
- 2009-2011 **IBM Research, India**, *Blue Scholar*.
Developed 3× faster topology-aware algorithms for collective communication on Blue Gene systems.

Software Projects

- traceR Trace-driven PDES-based network simulation of parallel applications.
- Damselfly Analytical modeling of steady-state traffic flow on dragonfly networks.
- bgqncI An easy interface for network counters collection on BlueGene/Q systems.
- LeanMD A mini-application for exploring optimizations for molecular dynamics.
- topoAPI Fully-automated profiling, analysis, and mapping on HPC systems.
- Charm-ROSS Charm++ based implementation of the parallel discrete event simulator ROSS.
- Open-source software I contribute to
- CODES Packet-level HPC network simulation.
- Charm++ Object-based message driven parallel programming paradigm.
- OpenAtom Scalable Ab-Initio Molecular Dynamics with diverse features.
- EpiSimdemics Hybrid contagion modeling using Charm++.
- ROSS Scalable parallel discrete simulation with optimistic execution.
- NAMD Highly scalable parallel molecular dynamics.

Representative Publications

Peer Reviewed Conference & Journal Papers

- [1] **Nikhil Jain**, Abhinav Bhatele, Louis Howell, David Bohme, Ian Karlin, Edgar Leon, Misbah Mubarak, Noah Wolfe, Todd Gamblin, and Matthew Leininger. Predicting the performance impact of different fat-tree configurations. In *ACM/IEEE International Conference for High Performance Computing, Networking, Storage and Analysis*, SC '17, Nov 2017.
- [2] **Nikhil Jain**, Abhinav Bhatele, Xiang Ni, Todd Gamblin, and Laxmikant V. Kale. Partitioning low-diameter networks to eliminate inter-job interference. In *IEEE International Parallel & Distributed Processing Symposium*, IPDPS '17, May 2017.
- [3] **Nikhil Jain**, Abhinav Bhatele, Samuel T. White, Todd Gamblin, and Laxmikant V. Kale. Evaluating HPC networks via simulation of parallel workloads. In *ACM/IEEE International Conference for High Performance Computing, Networking, Storage and Analysis*, SC '16, November 2016.
- [4] **Nikhil Jain**, Eric Bohm, Eric Mikida, Subhasish Mandal, Minjung Kim, Prateek Jindal, Qi Li, Sohrab Ismail-Beigi, Glenn Martyna, and Laxmikant Kale. Openatom: Scalable ab-initio molecular dynamics with diverse capabilities. In *International Supercomputing Conference*, ISC HPC '16, June 2016.
- [5] **Nikhil Jain**, Abhinav Bhatele, Jae-Seung Yeom, Mark F. Adams, Francesco Miniati, Chao Mei, and Laxmikant V. Kale. Charm++ & MPI: Combining the best of both worlds. In *IEEE International Parallel & Distributed Processing Symposium*, IPDPS '15, May 2015.
- [6] Bilge Acun, Abhishek Gupta, **Nikhil Jain**, Akhil Langer, Harshitha Menon, Eric Mikida, Xiang Ni, Michael Robson, Yanhua Sun, Ehsan Toton, Lukasz Wesolowski, and Laxmikant Kale. Parallel Programming with Migratable Objects: Charm++ in Practice. In *ACM/IEEE International Conference for High Performance Computing, Networking, Storage and Analysis*, SC '14, Nov 2014.
- [7] **Nikhil Jain**, Abhinav Bhatele, Michael P. Robson, Todd Gamblin, and Laxmikant V. Kale. Predicting application performance using supervised learning on communication features. In *ACM/IEEE International Conference for High Performance Computing, Networking, Storage and Analysis*, SC '13, November 2013.
- [8] **Nikhil Jain** and Yogish Sabharwal. Optimal bucket algorithms for large MPI collectives on torus interconnects. In *ACM International Conference on Supercomputing*, ICS '10, January 2010.