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	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. Measurement tools, analysis, and tuning of parallel applications on large clusters (IBM Blue Gene, Cray, Linux). Experience with large science codes at UIllinois.
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.
bgqncl	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 Totoni, 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.