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, SC

2012 Best Poster, LLNL Annual Student Poster Session

2012 Co-winner of HPC Challenge Class 2 (performance), Charm++ Team, SC

2011 Andrew and Shana Laursen Fellowship, Department of Computer Science, UIUC

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*.
- Researched modeling and simulation methods for predicting communication flow on HPC networks.
- Developed new features for Charm++ and its applications (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*.
Developed prediction models for communication performance using supervised machine learning.

Spring 2011 **Dept of Computer Science**, **University of Illinois at Urbana-Champaign**, *Visiting Scholar*.
Researched efficient methods for runtime-level memory management in Charm++.

2009-2011 **IBM Research, India**, *Blue Scholar*.
Developed topology-aware algorithms for optimizing collective communication on Blue Gene systems.

Summer 2007 **Polytechnic Institute of NYU**, *Undergraduate Research Intern*.
Investigated use of obfuscation methods in logic design.

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.

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. *Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis*, November 2017.

[2] **Nikhil Jain**, Abhinav Bhatele, Xiang Ni, Todd Gamblin, and Laxmikant V. Kale. Partitioning low-diameter networks to eliminate inter-job interference. In *Proceedings of the IEEE International Parallel & Distributed Processing Symposium*, IPDPS '17. IEEE Computer Society, May 2017.

[3] **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, 2016.

[4] **Nikhil Jain**, Abhinav Bhatele, Samuel T. White, Todd Gamblin, and Laxmikant V. Kale. Evaluating HPC networks via simulation of parallel workloads. In *Proceedings of the ACM/IEEE International Conference for High Performance Computing, Networking, Storage and Analysis*, SC '16. IEEE Computer Society, November 2016. LLNL-CONF-690662.

[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 *Proceedings of the IEEE International Parallel & Distributed Processing Symposium*, IPDPS '15. IEEE Computer Society, May 2015. LLNL-CONF-663041.

[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 *Proceedings of the ACM/IEEE International Conference for High Performance Computing, Networking, Storage and Analysis*, SC '14, November 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. IEEE Computer Society, November 2013. LLNL-CONF-635857.

[8] **Nikhil Jain** and Yogish Sabharwal. Optimal bucket algorithms for large MPI collectives on torus interconnects. In *Proceedings of the 24th ACM International Conference on Supercomputing*, ICS '10, pages 27–36, New York, NY, USA, 2010. ACM.