Abhishek Gupta

PhD, Cloud S/w Architect - Performance & Security, Researcher, Consultant, HPC Cloud, Containers

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Summary

Education:

I graduated with a PhD from University of Illinois at Urbana Champaign - Computer Science in July 2014 with GPA 4.0. Prior to that, I did by B.Tech in CS from IIT Roorkee where I was gold medalist.

Google Scholar, CV, Github links in contact info.

Research Interests:

My research interests are: Computer systems in general, and in particular - Cloud computing, Parallel programming, high performance computing, Performance optimizations, Job Scheduling, Load Balancing, Linux containers, cloud security etc.

Current Role:

I am currently a cloud software architect and technical lead at Intel Corp with focus on performance and security. Focus areas include trusted cloud computing, Docker containers, integration with Openstack, performance acceleration of workloads using H/W features, network security including SDN/NFV and SDI infrastructures such as Apache Mesos, Kubernetes, Docker Swarm etc. Driving through:

1. Problem identification, research and conceptualizing solution
2. Architect and quickly prototype hands-on solutions involving complex systems
3. Demonstrating them to internal/external stakeholders, customers
4. Technical team leadership to productize and GA solution

Speaking and Talks:

I have presented speaking sessions and demos of my work at various conferences including Openstack Summit, Intel Developer Forum (IDF), DockerCon 2015, and MesosCon.

Research papers, talks and Service:

I have co-authored several conference and journal papers. I have also given various research talks including keynotes at prestigious conferences/workshops. I also serve on program committee of conferences/wprkshops such as IEEE/ACM CCGrid and Middleware conference. I am a regular reviewer of IEEE journals such as Transactions on Cloud (TCC) ,(TC), TDPS.

Recognition:

Based on my contributions, I was awarded O-1 extraordinary ability visa and US permanent residency with EB-1 outstanding research category. Several of my papers got best paper awards.

Experience

HPC and Cloud Architect at STIC at Schlumberger

January 2017 - Present (2 months)

Applying cutting edge cloud technologies to HPC application and systems in Oilfield software and products at Schlumberger Software and Technology Innovation Center (STIC) in Silicon Valley

Adjunct Professor - Cloud Computing at Santa Clara University

January 2017 - Present (2 months)

Adjunct Professor in Computer Engineering at SCU from Jan 2017. Teaching graduate level course on Cloud Computing in Winter quarter 2017: includes lectures, assignments, exams, projects.

For cloud computing class:
- Got AWS and Google cloud grants for student projects
- Class of 35 graduate students, 8 projects with IEEE style project reports - helped them develop the projects and plan potential conference publications
- Designed course syllabus and material, got access to presentation slides from publishers and adapted them to meet academia and industry trends in cloud computing
- developed homeworks and mid-terms to give students both theoretical as well as hands-on knowledge of cloud computing including cloud providers like AWS, GCE and cloud technologies such as kvm, mapreduce, docker containers.

Cloud Software Architect - Security and Performance at Intel Corporation

July 2014 - January 2017 (2 years 7 months)

- Research and develop solutions for cloud and data center security - data security and network security including SDN/NFV and SDI
- Architect and perform pathfinding for trusted computing in cloud - such as Docker containers and VMs in openstack clouds
- Trusted Docker containers, integration with Openstack
- Feature awareness in Mesos, Kubernetes, Docker Swarm
- H/W assisted performance acceleration of critical security workloads such as VPN, IPsec

Graduate Research Assistant at University of Illinois at Urbana-Champaign

August 2009 - June 2014 (4 years 11 months)

Worked on various projects: large-scale HPC applications, parallel runtime systems, and schedulers for both clouds and HPC (select projects lised below).

Visiting Researcher/Contingent Worker at Hewlett-Packard Laboratories

September 2011 - September 2013 (2 years 1 month)

  Designed and implemented methods for bridging HPC-cloud divide. Presently, collaborating on performance
   evaluation and simulation of next-generation systems for data-intensive applications

Research Associate Intern at   Hewlett-Packard Laboratories

May 2012 - August 2012 (4 months)

  Researched techniques for application-aware VM placement in cloud (mentor Dr.
  Dejan Milojicic)

Research Associate Intern at   Hewlett-Packard Laboratories

May 2011 - August 2011 (4 months)

  Evaluated the performance and mapping of HPC applications in cloud (mentor
  Dr. Dejan Milojicic)

Software Engineer at   Independent contractor

February 2009 - July 2009 (6 months)

  Self employed as independent software engineer consultant. Helped clients with software engineering
   projects

Software Design Engineer at   Microsoft

July 2008 - February 2009 (8 months)

  Worked in the team Microsoft CRM (Customer Relationship Management)

Software Engineer Intern at   Oracle

May 2007 - July 2007 (3 months)

  Worked on Apache Tomcat server deployment
  Worked on multi-threaded SOAP request generator

Honors and Awards

Intel recognition award (IRA)

Intel corp

August 2015

  For presenting at Intel developer Forum and awarded top speaking session for the presentation "Trusted
   containers and VMs in the cloud", Aug 2015

Best Paper at IEEE CloudCom 2013

December 2013

Best Ph.D. Forum poster award at IEEE IPDPS, 2013.

Dissertation Research Showcase at Supercomputing Conference (SC) 2013.

Research supported by HP Labs Innovation Research Awards,

2012

Best student paper at Open Cirrus Summit, 2011.

Saburo Muroga Endowed Fellowship, 2010-2011

Department of Computer Science at Illinois

2011 HPC Challenge Class 2 Performance Award

Member of the team which won the 2011 HPC Challenge Class 2 Performance

Award for Charm++ system at Supercomputing Conference (SC), 2011.

Presidents Gold Medalist, IIT Roorkee, India

2008

Presidents Gold Medalist for being the topper of B-Tech (all branches) of graduating batch 2008, IIT

Roorkee, India.

Certificate of Merit and National Gold Medal

Indian National Physics Olympiad

2004

Was awarded Certificate of Merit and National Gold Medal for being in the

top 25 candidates at the Indian National Physics Olympiad-2004

Projects

HPC in the Cloud

2011 to Present

Members:Abhishek Gupta

- Performance analysis and benchmarking: Evaluated the performance, cost, virtualization mechanism, and business models for HPC in the cloud.
- HPC-aware cloud schedulers: Designed an application-aware VM scheduler for improving cloud resource utilization and HPC application performance in infrastructure clouds. Demonstrated benefits using OpenStack and CloudSim.
- Cloud-aware HPC runtime: Developed a heterogeneity and multi-tenancy aware load balancing technique to improve HPC performance in cloud. Also, working on extension of the Charm++ runtime to exploit inherent elasticity in clouds.

Large scale HPC Applications

2010 to Present

Members:Abhishek Gupta

- EpiSimdemics: Collaborated with V-tech researchers to enable parallel simulation of contagion diffusion over very large social networks. The application scales up to 300,000 cores on Blue Waters. My focus was on leveraging (and developing) Charm++ runtime features to optimize performance of EpiSimdemics.
- Information Set for Game Trees: Parallelized information set generation for game tree search applications. Analyzed the impact of load balancing strategies, problem sizes, and computational granularity on parallel scaling.

EpiSimdemics: Contagion Diffusion over Very Large Social Networks

2011 to Present

Members:Abhishek Gupta

Collaborated with V-tech researchers to enable parallel simulation of contagion diffusion over very large social networks. The application scales up to 300,000 cores on Blue Waters. My focus was on leveraging (and developing) Charm++ runtime features to optimize performance of EpiSimdemics.

Runtime Systems and Schedulers

2009 to Present

Members:Abhishek Gupta

- Charm++ Runtime system: Worked on various projects for research and development of Charm++ parallel programming system and the associated ecosystem (tools etc).
- Adaptive Job Scheduler: Working on extending an open-source job scheduler (SLURM) for enabling malleable HPC jobs. Also, added runtime support in Charm++ for such dynamic shrink/expand capability.
- Scalable Tree Startup: Developed a multi-level scalable startup technique for parallel applications.

Charm++ Parallel Runtime system: Research and development

2009 to Present

Members:Abhishek Gupta

Worked on various projects for research and development of Charm++ parallel programming system and the associated ecosystem (tools etc).

Publications

The Who, What, Why, and How of High Performance Computing in the Cloud

Best Paper at 5th IEEE International Conference on Cloud Computing Technology and Science (CloudCom) 2013   December 2013

Authors: Abhishek Gupta

Improving HPC Application Performance in Cloud through Dynamic Load Balancing

13th IEEE/ACM International Symposium On Cluster, Cloud And Grid Computing.   May 2013

Authors: Abhishek Gupta

HPC-Aware VM Placement in Infrastructure Clouds

IEEE International Conference on Cloud Engineering (IC2E) 2013   March 2013

Authors: Abhishek Gupta

Towards Efficient Mapping, Scheduling, and Execution of HPC Applications on Platforms in Cloud

2013 IEEE 27th International Symposium on Parallel & Distributed Processing Workshops and PhD Forum (IPDPSW 2013)   2013

Authors: Abhishek Gupta

Optimizing VM Placement for HPC in the Cloud

ACM Workshop on Cloud Services, Federation, and the 8th Open Cirrus Summit In conjunction with the "International Conference on Autonomic Computing, San Jose, USA   September 2012

Authors: Abhishek Gupta

Cloud Friendly Load Balancing for HPC Applications: Preliminary Work

International Workshop on Cloud Technologies for High Performance Computing (CloudTech-HPC) in conjunction with The 41st International Conference on Parallel Processing (ICPP 2012)   September 2012

Authors: Abhishek Gupta

Exploring the Performance and Mapping of HPC Applications to Platforms in the Cloud
Short paper and poster at 21st International ACM Symposium on High-Performance Parallel and Distributed Computing (HPDC 2012)   May 2012
Authors: Abhishek Gupta

Evaluation of HPC Applications on Cloud
6th IEEE Open Cirrus Summit 2011   October 2011
Authors: Abhishek Gupta

Temperature Aware Load Balancing for Parallel Applications: Preliminary Work
HPPAC'11   May 15, 2011
Authors: Osman Sarood, Abhishek Gupta, laxmikant Kale

Increasing number of cores and clock speeds on a smaller chip area implies more heat dissipation and an ever increasing heat density. This increased heat, in turn, leads to higher cooling cost and occurrence of hot spots. Effective use of dynamic voltage and frequency scaling (DVFS) can help us alleviate this problem. But there is an associated execution time penalty which can get amplified in parallel applications. In high performance computing, applications are typically tightly coupled and even a single overloaded core can adversely affect the execution time of the entire application. This makes load balancing of utmost value. In this paper, we outline a temperature aware load balancing scheme, which uses DVFS to keep core temperatures below a user-defined threshold with minimum timing penalty. While doing so, it also reduces the possibility of hot spots. We apply our scheme to three parallel applications with different energy consumption profiles. Results from our technique show that we save up to 14% in execution time and 12% in machine energy consumption as compared to frequency scaling without using load balancing. We are also able to bound the average temperature of all the cores and reduce the temperature deviation amongst the cores by a factor of 3.

Parallelizing Information Set Generation for Game Tree Search Applications
SBAC-PAD 2012   December 30, 2012
Authors: Abhishek Gupta, Osman Sarood, Mark Richards, Laxmikant Kale

Information Set Generation (ISG) is the identification of the set of paths in an imperfect information game tree that are consistent with a player's observations. The ability to reason about the possible game history is critical to the performance of game-playing agents. ISG represents a class of combinatorial search problems which is computationally intensive but challenging to efficiently parallelize. In this paper, we address the parallelization of information set generation in the context of Kriegspiel (partially observable chess). We implement the algorithm on top of a general purpose combinatorial search engine and discuss its performance using datasets from real game instances in addition to benchmarks. Further, we demonstrate the effect of load balancing strategies, problem sizes and computational granularity (grainsize parame- ters) on performance. We achieve speedups of over 500 on 1,024 processors, far exceeding previous scalability results for game tree search applications.

Skills & Expertise
Algorithms

High Performance Computing

C++

C

Machine Learning

Computer Science

Cloud Computing

Distributed Systems

Linux

Parallel Computing

Software Design

Hadoop

LaTeX

Simulations

Java

Python

Programming

MPI

Virtualization

OpenMP

Security

Network Security

Integration

Software Development

Software Engineering

Data Center

Unix

Shell Scripting

Linux containers

Docker

Apache Mesos

Docker Swarm

Kubernetes

IPSec

OpenStack

High Performance Computing (HPC)

Education

University of Illinois at Urbana-Champaign
Doctor of Philosophy (Ph.D.), Computer Science, 2009 - 2014
Grade: 4.0
University of Illinois at Urbana-Champaign
MS, Computer Science, 2009 - 2011
Grade: 4.0
Indian Institute of Technology, Roorkee

Bachelor of Technology (B.Tech.), Computer Science, 2004 - 2008
Grade: 4.0 (Institute Topper)

Organizations

IEEE

August 2009 to Present

Patents

Mapping high-performance computing applications to platforms A Gupta, DS Milojicic, P Faraboschi

United States Patent US Patent 9,063,750

Inventors: Abhishek Gupta

Balancing the allocation of virtual machines in cloud systems A Gupta, DS Milojicic, P Faraboschi

United States Patent US Patent 9,184,982

Inventors: Abhishek Gupta

Languages

English

Hindi

Abhishek Gupta

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Linked in.

1 person has recommended Abhishek

"Abhishek had been a wonderful mentor to me while I was interning at Intel.He demonstrated a high degree of technical acumen which was a learning experience for me each day there. He willingly gave his time in responding to my questions thoroughly, supporting and guiding me through my technical problems. Abhishek is extremely enthusiastic about his work and as a team member and a mentor, he earns my highest recommendation."

— **Vibha Dhar***, Cloud Security Software Engineer Intern, Intel Corporation*, reported to Abhishek at Intel Corporation

Contact Abhishek on LinkedIn