Ana Gainaru

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Research Interest

High Performance Computing, Big Data, Parallel Computing, Distributed Systems, Signal Analysis, Performance modeling, Data Analytics, Storage Systems

Education

University of Illinois at Urbana-Champaign, IL, USA — **Aug 2011 - Aug 2015**
PhD in Computer Science
Advisor: Marc Snir

University Politehnica of Bucharest, Romania — **Oct 2008 - Jul 2010**
Master of Science in Computer Science
Ranked 1st in my year.

University Politehnica of Bucharest, Romania — **Oct 2003 - Jul 2008**
Bachelor of Science in Computer Science
Performance Scholarship 6 semesters out of 10

Professional Experience

Research Assistant Professor — **Jul 2017 - present**
Vanderbilt University, Electrical Engineering and Computer Science Department
Performance analysis and optimization for large sparse structures and algorithms driven by big-data applications and simulations. Developing resource scheduling, fault tolerance and performance scaling techniques for large scale HPC applications.

HPC Architect — **Oct 2015 - Jun 2017**
Mellanox Technologies Inc
Designed and optimized Mellanox' internal collective communication library for extreme-scale systems. Implemented a small data all-to-all algorithm using different data layout patterns at intermediate steps by selectively replacing the CPU based buffer packing and unpacking with Mellanoxs InfiniBand support for Host Channel Adapter (HCA) hardware scatter/gather.

Research Assistanship at NCSA — **Aug 2011 - May 2015**
National Center for Supercomputing Applications, Integrated Systems Console (ISC)
Worked done in the context of the NCSA/UIUC/INRIA Joint Lab for Petascale Computing and the Blue Waters project

Collaboration internship ENS Lyon — **Oct 2013 - Nov 2013**
Ecole normale superieure, Lyon, France

Summer Intern at ANL — **May 2013 - Aug 2013**
Argonne National Laboratory, IL, USA

Summer Intern at Tokyo Tech — **Jun 2012 - Sep 2012**
Tokyo Institute of Technology, Tokyo, Japan

Awards, Honors and Competitions

- 2015 AfterCollege Engineering Student Scholarship recipient, April 2015
- Special Prize for Excellence, Gala of Romanian Students Abroad (LSRS), judged by the Romanian Academy (the most important scientific and cultural forum in Romania), awarded for my entire PhD work, 2015
- 2014 Student of the Year Award, NCSA Employee Recognition Award, 2014

- First place at the Intel Parallel Universe Computing Challenge, 2014
- 2013 Technical Achievement Award, NCSA Employee Recognition Award, 2013
- CS Excellence Fellowship (Saburo Muroga Endowed Fellowship) granted by the University of Illinois at Urbana-Champaign, 2011-2012
- Grad Cohort for Women in Computing Research Association (CRAW) Travel Grant, 2011
- SC Travel Support Grant Scholarship, 2010
- Excellence Title for the Master Program, granted by Automatic Control and Computers Faculty, University Politehnica of Bucharest, graduated first of my class, 2010
- Third prize at the Students Scientific Conference from the University Politehnica of Bucharest for my undergrad thesis: "Mobility Model based on Social Networks for VANETs", 2008.
- Oracle diploma received for my results on Database and Database Design courses studied in Automatic Control and Computer Science Faculty, top 10%, 2007

Publications

1. Guillaume Aupy, Ana Gainaru, Valentin Le Fevrez. *I/O scheduling strategy for periodic applications* [ACM Transactions on Parallel Computing 2019]
2. Ana Gainaru, Hongyang Sun, Guillaume Aupy, Yuankai Huo, Bennett A. Landman, Padma Raghavan
   On-the-fly scheduling vs. reservation-based scheduling for unpredictable workflows [Special Issue of the IJHPCA 2019]
3. Guillaume Aupy, Ana Gainaru, Valentin Honor, Padma Raghavan, Yves Robert, Hongyang Sun
   Reservation Strategies for Stochastic Jobs [IPDPS 2019]
4. Hongyang Sun, Redouane Elghazi, Ana Gainaru, Guillaume Aupy, Padma Raghavan *Scheduling Parallel Tasks under Multiple Resources: List Scheduling vs. Pack Scheduling* [IPDPS 2018]
5. Guillaume Aupy, Ana Gainaru, Valentin Le Fevrez
   Periodic I/O scheduling for super-computers [PMBS@SC 2017]
6. Richard Graham, Ana Gainaru, Artem Polyaiov and Gilad Shainer
   Using InfiniBand Hardware Gather-Scatter Capabilities to Optimize MPI All-to-All [EuroMPI 2016]
7. Leonardo Bautista Gomez, Ana Gainaru, Swann Perarnau, Franck Cappello, Marc Snir, William Kramer
   Reducing Waste in Large Scale Systems through Introspective Analysis [IPDPS 2016]
8. Ana Gainaru, Guillaume Aupy, Anne Benoit, Franck Cappello, Yves Robert, Marc Snir
   Scheduling the I/O of HPC applications under congestion [IPDPS 2015]
9. Ana Gainaru, Franck Cappello, Marc Snir, William Kramer
   Failure prediction for HPC systems and applications: current situation and open issues [IJHPC, Volume 27 Issue 3 Pages 272 281, August 2013]
10. Mohamed Slim Bouguerra, Ana Gainaru , Franck Cappello, Leonardo Bautista Gomez, Naoya Maruyama, Satoshi Matsuoka
    Improving the computing efficiency of HPC systems using a combination of proactive and preventive checkpointing [IPDPS 2013]
11. Franck Cappello, Ana Gainaru
    Resilience through failure avoidance: New detectors of failure precursors and improved prediction workflow [Position paper Operating Systems and Runtime Software for Exascale Systems, 2012]
12. Ana Gainaru , Franck Cappello, Marc Snir, William Kramer
    Fault prediction under the microscope: A closer look into HPC systems [SC 2012]
13. Ana Gainaru , Franck Cappello, William Kramer
    Taming of the Shrew: Modeling the Normal and Faulty Behavior of Large-Scale HPC Systems [IPDPS 2012]

14. Joshi Fullop, Ana Gainaru, Joel Plutchak
Real Time Analysis and Event Prediction Engine [Cray User Group 2012]
15. Ana Gainaru , Franck Cappello, Joshi Fullop, Stefan Trausan-Matu, William Kramer
Adaptive Event Prediction Strategy with Dynamic Time Window for Large-Scale HPC Systems [SLAML 2011]
16. Eric Heien, Derrick Kondo, Ana Gainaru , Dan LaPine, Bill Kramer, Franck Cappello
Modeling and Tolerating Heterogeneous Failures in Large Parallel Systems [SC 2011]
17. Ana Gainaru , Franck Cappello, Stefan Trausan-Matu, Bill Kramer
Event log mining tool for large scale HPC systems [EuroPar 2011]
18. Ana Gainaru , Emil Slusanschi
Framework for mapping data mining applications on GPUs [ISPDC 2011]
19. Ana Gainaru , Emil Slusanchi, Stefan Trausan-Matu
Mapping Data Mining Algorithms on a GPU Architecture: A Study [ISMIS 2011]
20. Ana Gainaru , Ciprian Dobre and Valentin Cristea
A Realistic Mobility Model Based on Social Networks for the Simulation of VANETs [VTC 2009 Spring]

Panel

Fault Tolerance/Resilience at Petascale/Exascale: Is it Really Critical? Are Solutions Necessarily Disruptive? [SC 2013]
Moderator: Franck Cappello,
Panelists: Marc Snir, Bronis De Supinski, Al Geist, John Daly, Ana Gainaru , Satoshi Matsuoka

Book Chapter

Fault-Tolerance Techniques for High-Performance Computing [Springer Book, Computer Communications and Networks series, 2015], Editors: Thomas Herault and Yves Robert
Chapter 1: Fault and failures (including: source detection, root cause analysis, silent errors, predictors), Authors: Ana Gainaru and Franck Cappello

Professional and Community

- NSF Panel review member, 2019
- On the editorial board for the International Journal for High Performance Computing Applications, since 2019
- Organizer for the Convergence Computing Infrastructure Workshop (CCIW), 2019
- Member of the Program Committee for:
  - SC 2019/2018/2017/2016, the International Conference for High Performance Computing, Networking, Storage and Analysis, technical papers program committee for the Algorithms area
  - ICPP 2019, the International Conference on Parallel Processing
  - IPDPS 2019/2018/2014, the IEEE International Parallel and Distributed Processing Symposium, technical program committee for the System software track
  - ICS 2017, External Review Committee for the ACM International Conference on Supercomputing
  - CCGRID 2016, the 16th IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing
  - EuroMPI 2017, 2016, the MPI users and developers conference
  - FTXS 2015, 2014, 2013, 2012 The Workshop on Fault Tolerance for HPC at Extreme Scale
  - FTS 2016, 2015 The Workshop on Fault Tolerant Systems
  - HPCe 2011 High Performance Computing with application in environment @ SYNASC 2011
- Vice chair for the Poster SC 2018 committee
- Co-chair for the FTS 2017 Workshop on Fault Tolerant Systems in conjunction with CCGRID 2017

- Reviewer for the following international journals:
  - International Journal High Performance Computing IJHPCA since June 2014
  - International Journal on Transactions on Parallel and Distributed Systems TPDS since October 2015
  - Future Generation Computer Systems Journal FGCS since November 2015
  - Journal of Parallel and Distributed Computing, since January 2016
  - Parallel Computing - Systems and Applications PARCO since March 2017
  - Sustainable Computing, Informatics and Systems SUSCOM since June 2017

Teaching experience

Teaching assistant at UIUC **Aug 2014 - Dec 2014**
Course: CS 425 Distributed systems

Instructor for CS498 UIUC **Jan 2011 - May 2011**
Course: CS 498 Hot Topic in High Performance Computing: Networks and Fault Tolerance

Teaching assistant at UPB **Feb 2008 - Jul 2009**
Courses: Architecture of Computing Systems (400 level course), Parallel Processing Architecture (500 level course) and The Utilization of Operating Systems (100 level course)

Patents

Richard Graham, Ana Gainaru
Using Hardware Gather-Scatter Capabilities to Optimize MPI All-to-All [U.S. Provisional Application No. 62/377,616, filed 21 August 2016]

Open Source Software

All my software is available on my github account (user anagainaru).

ScheduleFlow
A python package consisting of series of scripts and classes that offer an API allowing users to create simulation scenarios for online and reservation-based batch schedulers for large-scale computational systems.

HELO (Hierarchical Event Log Organizer)
A tool for extracting event templates from large datasets and updating them as new events get generated. HELO presents an intuitive output to system administrators. It is currently integrated in the Blue Water software stack.