

## Katherine E. Isaacs

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### Education

- 2015 Ph.D., Computer Science, University of California, Davis, Davis, CA USA
- 2011 B.S., Computer Science, San José State University, San José, CA USA  
B.A., Mathematics, San José State University, San José, CA USA
- 2001 B.S., Physics, California Institute of Technology, Pasadena, CA USA

### Honors and Awards

- 2021 Department of Energy Early Career Research Program Award
- 2021 Outstanding Faculty Researcher, University of Arizona, Department of Computer Science
- 2019 NSF CAREER Award
- 2019 Outstanding Faculty Researcher, University of Arizona, Department of Computer Science
- 2012 – 2015 US Department of Energy Office of Science Graduate Fellowship (DOE SCGF)
- 2015 Google Anita Borg Memorial Scholarship
- 2014 Facebook Grace Hopper Scholarship
- 2012 National Science Foundation Graduate Research Fellowship (NSF GRFP)  
*Declined for DOE SCGF*
- 2011 – 2012 Graduate Scholars Fellowship, University of California, Davis
- 2011 Hoggatt Award for Outstanding Research Potential, San José State University, Department of Mathematics
- 2011 Outstanding Graduating Senior, San José State University, Department of Computer Science
- 2009 Frederick N. Fitting Scholarship, San José State University, College of Science
- 2009 Department Scholarship, San José State University, Department of Computer Science

### Research Funding

- 2021 - 2026 PI, Node-to-Code Comparison-Centered Interactive Performance Visualization, \$753,709.  
Department of Energy
- 2021 - 2022 PI, Drift Analysis, \$10,858.  
Lawrence Livermore National Laboratory
- 2020 - 2025 Co-I, Exposures, Health Impacts, and Risk for Mine Waste Contamination  
\$10,765,955 (total award project-wide).  
National Institute of Environmental Health Sciences, PI: Raina Maier
- 2019 - 2024 PI, NSF IIS-1844573: CAREER: Comprehensive Techniques and Design for Flexible  
Graph Visualization of Software and Systems, \$527,898.  
National Science Foundation

- 2020 - 2021 PI, Visualization of Binary Code, \$73,890.  
Lawrence Livermore National Laboratory
- 2018 - 2020 PI, Phylanx Engine Enhancement and Visualization Development, \$326,617  
United States Air Force // Booz, Allen, and Hamilton, Incorporated
- 2019 - 2020 Co-I, Risk and Remediation of Metal-Mining Wastes - Administrative Supplements to Support Collaborative Activities to Enhance Interoperability and Reuse of Superfund Research Program (SRP) Center Data, \$54,347 (of \$543,472).  
National Institute of Environmental Health Sciences, PI: Raina Maier
- 2018 - 2020 PI, CFGExplorer Focus on Visualizing Compiler Optimization, \$70,295.  
Lawrence Livermore National Laboratory
- 2017 - 2019 PI, NSF III-1656958: CRII:III: Scalable & Interactive Dependency Visualization to Accelerate Parallel Program Analysis, \$174,518.  
National Science Foundation
- 2018 Co-PI, Bringing Science Up To Par Through Dynamic Binary Analysis and Parallelization, \$99,158 (total award project-wide).  
University of Arizona VPR, PI: Michelle Strout

## Journal Publications

- [1] M. Ramirez-Andreotta, R. Walls, K. Youens-Clark, K. Blumberg, K. E. Isaacs, D. Kaufmann, and R. M. Maier. Alleviating environmental health disparities through community science and data integration. *Frontiers in Sustainable Food Systems*, June 2021
- [2] A. Bigelow, K. Williams, and K. E. Isaacs. Guidelines for pursuing and revealing data abstractions. *IEEE Transactions on Visualization and Computer Graphics (Proceedings of InfoVis '20)*, 27:1503–1513, Feb. 2021
- [3] S. Devkota, P. Aschwanden, A. Kunen, M. Legendre, and K. E. Isaacs. CcNav: Understanding the compilation of binary code. *IEEE Transactions on Visualization and Computer Graphics (Proceedings of VAST '20)*, 27:667–677, Feb. 2021
- [4] K. Williams, A. Bigelow, and K. E. Isaacs. Visualizing a moving target: A design study on task parallel programs in the presence of evolving data and concerns. *IEEE Transactions on Visualization and Computer Graphics (Proceedings of InfoVis '19)*, 26:1118–1128, Jan. 2020
- [5] K. E. Isaacs and T. Gamblin. Preserving command line workflow for a package management system using ASCII DAG visualization. *IEEE Transactions on Visualization and Computer Graphics*, 25:2804–2820, Sept. 2019
- [6] B. Lee, K. E. Isaacs, D. A. Szafir, G. E. Marai, C. Turkey, M. Tory, S. Carpendale, and A. Endert. Broadening intellectual diversity in visualization research papers. *Computer Graphics & Applications, Visualization Viewpoints*, 39:78–85, July/August 2019
- [7] S. Cheng, W. Zhong, K. Isaacs, and K. Mueller. Visualizing the topology and data traffic of multi-dimensional torus interconnect networks. *IEEE Access*, 6:57191–57204, Sept. 2018
- [8] S. Devkota and K. E. Isaacs. CFGExplorer: Designing a visual control flow analytics system around basic program analysis operations. *Computer Graphics Forum (Proceedings of EuroVis '18)*, 2018
- [9] K. E. Isaacs, T. Gamblin, A. Bhatele, M. Schulz, B. Hamann, and P.-T. Bremer. Ordering traces logically to identify lateness in message passing programs. *IEEE Transactions on Parallel and Distributed Systems*, 27(3):829–840, 2016
- [10] K. E. Isaacs, P.-T. Bremer, I. Jusufi, T. Gamblin, A. Bhatele, M. Schulz, and B. Hamann. Combing the communication hairball: Visualizing large-scale parallel execution traces using logical time. *IEEE Transactions on Visualization and Computer Graphics (Proceedings of InfoVis '14)*, 20(12):2349–2358, 2014

- [11] E. A. Dinsdale, R. A. Edwards, B. A. Bailey, I. Tuba, S. Akhter, K. McNair, R. Schmieder, N. Apkarian, M. Creek, E. Guan, M. Hernandez, K. Isaacs, C. Peterson, T. Regh, and V. Ponomarenko. Multivariate analysis of functional metagenomes. *Frontiers in Genetics*, 4(41), 2013
- [12] A. G. Landge, J. A. Levine, K. E. Isaacs, A. Bhatele, T. Gamblin, M. Schulz, S. H. Langer, P.-T. Bremer, and V. Pascucci. Visualizing network traffic to understand the performance of massively parallel simulations. *IEEE Transactions on Visualization and Computer Graphics (Proceedings of InfoVis '12)*, 18(12):2467–2476, 2012

### Conference and Workshop Publications

- [1] S. Brink, I. Lumsden, C. Scully-Allison, K. Williams, O. Pearce, T. Gamblin, M. Taufer, K. E. Isaacs, and A. Bhatele. Usability and performance improvements in hatchet. In *Proceedings of the 2020 IEEE/ACM International Workshop on HPC User Support Tools (HUST) and Workshop on Programming and Performance Visualization Tools (ProTools)*, Nov. 2020
- [2] S. R. Brandt, B. Hasheminezhad, N. Wu, S. Sakin, A. Bigelow, S. Sakin, K. E. Isaacs, K. Huck, and H. Kaiser. Distributed asynchronous array computing with the jetlag environment. In *Proceedings of the 2020 IEEE/ACM 9th Workshop on Python for High-Performance and Scientific Computing (PyHPC)*, Nov. 2020
- [3] S. R. Brandt, A. Bigelow, S. Sakin, K. Williams, K. E. Isaacs, K. Huck, R. Tohid, B. Wagle, S. Shirzad, and H. Kaiser. JetLag: An interactive, asynchronous array computing environment. In *Proceedings of the 2020 Practice and Experience in Advanced Research Computing (PEARC) Conference*, July 2020
- [4] S. Devkota, A. R. Ahmed, F. De Luca, K. Isaacs, and S. Kobourov. Stress-Plus-X (SPX) Graph Layout. In *Proceedings of the 27th Symposium on Graph Drawing and Network Visualization*, Sept. 2019
- [5] R. Tohid, B. Wagle, S. Shirzad, P. Diehl, A. Serio, A. Kheirkahan, P. Amini, K. Williams, K. Isaacs, K. Huck, S. Brandt, and H. Kaiser. Asynchronous execution of python code on task based runtime systems. In *Proceedings of the Fourth International IEEE Workshop on Extreme Scale Programming Models and Middleware (ESPM2)*, Nov. 2018
- [6] H. C. Purchase, K. E. Isaacs, T. Bueti, B. Hastings, A. Kassar, A. Kim, and S. van Hoesen. A classification of infographics. In *Proceedings of Diagrams 2018*, June 2018
- [7] M. M. Strout, S. Debray, K. E. Isaacs, B. Kreaseck, J. Cárdenas-Rodríguez, B. Hurwitz, K. Volk, S. Badger, J. Bartels, I. Bertolacci, S. Devkota, A. Encinas, B. Gaska, B. Neth, T. Sackos, J. Stephens, S. Willer, and B. Yadergari. Language-agnostic optimization and parallelization for interpreted languages. In *Proceedings of the 30th Workshop on Languages and Compilers for Parallel Computing (LCPC)*, October 2017
- [8] K. E. Isaacs, A. Bhatele, J. Lifflander, D. Böhme, T. Gamblin, M. Schulz, B. Hamann, and P.-T. Bremer. Recovering logical structure from Charm++ traces. In *Proceedings of the ACM/IEEE Conference on Supercomputing (SC15)*, SC '15, Nov. 2015
- [9] A. Bhatele, N. Jain, K. E. Isaacs, R. Buch, T. Gamblin, S. H. Langer, and L. V. Kale. Optimizing the performance of parallel applications on a 5D torus via task mapping. In *Proceedings of IEEE International Conference on High Performance Computing, HiPC '14*, Dec. 2014
- [10] C. M. McCarthy, K. E. Isaacs, A. Bhatele, P.-T. Bremer, and B. Hamann. Visualizing the five-dimensional torus network of the IBM Blue Gene/Q. In *Proceedings of the 1st Workshop on Visual Performance Analysis*, pages 24 – 27, Nov. 2014
- [11] K. E. Isaacs, A. Giménez, I. Jusufi, T. Gamblin, A. Bhatele, M. Schulz, B. Hamann, and P.-T. Bremer. State of the art of performance visualization. In *Eurographics/IEEE Conference on Visualization State-of-the-Art Reports*, EuroVis '14, 2014
- [12] A. Bhatele, K. Mohror, S. H. Langer, and K. E. Isaacs. There goes the neighborhood: performance degradation due to nearby jobs. In *Proceedings of the ACM/IEEE Conference on Supercomputing (SC13)*, SC '13, Nov. 2013

- [13] A. Bhatele, T. Gamblin, S. H. Langer, P.-T. Bremer, E. W. Draeger, B. Hamann, K. E. Isaacs, A. G. Landge, J. A. Levine, V. Pascucci, M. Schulz, and C. H. Still. Mapping applications with collectives over sub-communicators on torus networks. In *Proceedings of ACM/IEEE Conference on Supercomputing (SC12)*, SC '12, Nov. 2012
- [14] A. Bhatele, T. Gamblin, K. E. Isaacs, B. T. N. Gunney, M. Schulz, P.-T. Bremer, and B. Hamann. Novel views of performance data to analyze large-scale adaptive applications. In *Proceedings of ACM/IEEE Conference on Supercomputing (SC12)*, SC '12, Nov. 2012
- [15] M. Schulz, A. Bhatele, P.-T. Bremer, T. Gamblin, K. Isaacs, J. A. Levine, and V. Pascucci. Creating a tool set for optimizing topology-aware node mappings. In *5th Parallel Tools Workshop*, Sept. 2011

### Extended Abstracts

- [1] C. Scully-Allison, O. Pearce, and K. E. Isaacs. Missing the trees for the branches: Graphical scripting interaction with large-scale calling context trees. In *Proceedings of the 2021 SC Companion: ACM/IEEE Conference on Supercomputing*, SCC '12, Nov. 2021
- [2] K. E. Isaacs, T. Gamblin, A. Bhatele, P.-T. Bremer, M. Schulz, and B. Hamann. Extracting logical structure and identifying stragglers in parallel execution traces. In *Proceedings 19th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming*, PPOPP '14, pages 397–398, 2014
- [3] K. E. Isaacs, A. G. Landge, T. Gamblin, P.-T. Bremer, V. Pascucci, and B. Hamann. Exploring performance data with Boxfish. In *Proceedings of the 2012 SC Companion: ACM/IEEE Conference on Supercomputing*, SCC '12, pages 1380–1381, Nov. 2012

### Book Chapters

- [1] M. Schulz, J. Belak, A. Bhatele, P.-T. Bremer, G. Bronevetsky, M. Casa, T. Gamblin, K. E. Isaacs, I. Laguna, J. A. Levine, V. Pascucci, D. Richards, and B. Rountree. Performance analysis techniques for the exascale co-design process. In M. Bader, A. Bode, H.-J. Bungartz, M. Gerndt, G. R. Joubert, and F. Peters, editors, *Parallel Computing: Accelerating Computational Science and Engineering, Proceedings of the International Conference on Parallel Programming, ParCo 2013*, Advances in Parallel Computing, pages 19–32. IOS Press, Mar. 2014
- [2] K. Isaacs, J. Hsieh, and M. Moh. Extending OSPF for MANET routing. In S. Khan, J. Lloret, J. Ortiz, and J. Loo, editors, *Mobile Ad hoc Networks: Current Status and Future Trends*. CRC Press: Taylor and Francis, Auerbach-Publications, 2011

### Technical Reports

- [1] F. Beck, A. Bergel, C.-P. Bezemer, and K. E. Isaacs. Visualizing systems and software performance - report on the gi-dagstuhl seminar for young researchers, july 9-13, 2018. <https://peerj.com/preprints/27253/>, 2018

### Presentations

- [1] K. Isaacs. Like by hand: Improving visual exploration of control flow through computing-specific layout and interactive visual analytics design. Computer Science Colloquium, Missouri University of Science & Technology, October 4, 2021
- [2] K. Isaacs. Strategies in visualizing networks. Invited Talk. Women in Data Science - Tucson, University of Arizona, Tucson, AZ, USA, April 21, 2021
- [3] K. E. Isaacs. Preserving command line workflow for a package management system using ASCII DAG visualization. Paper Presentation. IEEE VIS 2020, Vancouver, BC, Canada, October 24, 2020
- [4] K. E. Isaacs. Some other sides of visualization in support of data science. TRIPODS Seminar, University of Arizona, Tucson, AZ, USA, November 4, 2019
- [5] K. E. Isaacs. Enabling fine-grained exploration of application performance through visualization. Invited Talk. Los Alamos National Laboratory, Los Alamos, NM USA, August 8, 2018

- [6] K. E. Isaacs. CFGExplorer: Designing a visual control flow analytics system around basic program analysis operations. Paper Presentation. Eurovis 2018, Brno, Czech, June 7, 2018
- [7] K. Isaacs. Data visualization. Panel Presentation. 4th Workshop on Visual Performance Analysis, VPA '17, Denver, CO, USA, November 17, 2017
- [8] K. Isaacs. The state of the practice of performance visualization. Invited Keynote. 3rd Workshop on Visual Performance Analysis, VPA '16, Salt Lake City, UT, USA, November 18, 2016
- [9] K. E. Isaacs. Recovering logical structure from Charm++ traces. Paper Presentation. Supercomputing 2015, Austin, TX, USA, November 18, 2015
- [10] K. Isaacs. Understanding parallel computing through visualization. Computer Science Colloquium, Sonoma State University, November 12, 2015
- [11] K. Isaacs. An organized view of MPI and Charm++ traces. Contributed Talk. 13th Annual Workshop on Charm++ and its Applications, Charm++ Workshop '15, Urbana, IL, USA, May 7, 2015
- [12] K. E. Isaacs. Boxfish: Mapping performance data and visualizations. Invited Talk. Lawrence Berkeley National Laboratory, Berkeley, CA USA, March 26, 2015
- [13] K. E. Isaacs. Combing the communication hairball: Visualizing large-scale parallel execution traces using logical time. Paper Presentation. IEEE VIS 2014, Paris, France, November 13, 2014
- [14] K. E. Isaacs and A. Giménez. State of the art of performance visualization. STAR Report Presentation. EuroVis 2014, Swansea, Wales, June 12, 2014
- [15] K. E. Isaacs and T. Gamblin. Introduction to performance analysis. Workshop on Visualization and Analysis of Performance on Large-scale Software, Atlanta, Georgia USA, October 14, 2013
- [16] K. Isaacs. A statistical method for environmental prediction in metagenomic samples. Contributed Talk. Joint Math Meetings, San Francisco, California USA, January 14, 2010

## Professional Experience

- 2016 – Present    Assistant Professor, University of Arizona, Department of Computer Science  
*Interests: Data Visualization, High Performance Computing*
  
- Summer 2015    Software Engineering Intern, Facebook  
*Team: Data Science Infrastructure, Decision Tools*
  
- Summer 2011    Computation Intern, Lawrence Livermore National Laboratory  
& Summer 2012    Supervisor: Dr. Peer-Timo Bremer  
*Research topic: Visualization of communication performance data*
  
- 9/2009 – 9/2010    Undergraduate Researcher, Department of Computer Science, San José State University  
Supervisor: Professor Melody Moh  
*Research topic: Routing algorithms for mobile ad-hoc networks*
  
- Fall 2009    Research Team Leader, Department of Mathematics, San José State University  
Supervisor: Professor Martina Bremer  
*Research topic: Linear state space models to detect avionics failures*
  
- Summer 2009    Research Fellow, Department of Mathematics, San Diego State University  
Supervisor: Professor Imre Tuba  
*Research topic: Statistical analysis of metagenome data*

Spring 2008 Undergraduate Researcher, Department of Mathematics, San José State University  
Supervisor: Professor Slobodan Simić  
*Research topic: Gamma ray propagation in discrete spacetime*

### Professional Activities

2021 Panelist, IEEE Visualization Doctoral Colloquium  
2021 Co-Chair, Lighting Talks, AZ VIS 2021  
2018 Co-Organizer GI-Dagstuhl Seminar on Visualizing Systems and Software Performance  
2018 Co-Chair Workshop on Visual Performance Analysis (VPA) @ SC  
2018 Co-Chair VISSOFT NIER/Tools Track  
2017, 2018 Co-Chair, Posters, Lдав  
2015, 2016 Co-Chair, Student Volunteers, IEEE VIS  
Program Committees IEEE VIS 2021 Short Papers, VISSOFT 2021, Lдав 2021  
ProTools 2021, ISC 2021 PhD Forum, PERMAVOST 2021  
InfoVis 2020, PacificVis 2020, GD 2020, VISSOFT 2020, Lдав 2020  
ProTools 2020, ISC PhD Forum  
InfoVis 2019, VISSOFT 2019, Lдав 2019, SC 2019 Posters, ProTools 2019  
InfoVis 2018, SciVis 2018, SC 2018 (Performance)  
SC 2017 (Performance), Lдав 2017, VISSOFT 2017, VPA 2017, ISPASS 2017  
IEEE CLUSTER 2017 Posters  
Lдав 2016, VPA 2016, VISSOFT NIER Track 2016  
Reviewer ACM CHI 2022  
EuroVis 2021, IEEE VIS 2021, TVCG, CGF  
EuroVis 2020, VAST 2020, TVCG, CGF  
EuroVis 2019, VAST 2019, GD 2019, TVCG  
EuroVis 2018, PacificVAST 2018  
EuroVis 2017, InfoVis 2017  
EuroVis 2016, InfoVis 2016, VAST 2016, VISSOFT AEC 2015,  
VAST 2015, EuroVis 2015, VMLS 2013  
ICT 2017  
TPDS 2016  
SC16 BoFs  
Memberships ACM, IEEE CS, IEEE VGTC

### Community Involvement

2021 – Present Organizer, Broadening Participation in Computing Reading Group,  
University of Arizona  
2021 – Present WISE Mentor, University of Arizona  
2018 – Present Faculty Advisor, University of Arizona Women in Information  
and Computer Science (WICS)  
2020 – 2021 Organizer, Data Visualization Workshop at UA Research Bazaar  
2020 Organizer, Data Visualization Workshop at Hack Arizona

2020 Presenter, UA WICS Professor Engagement Meeting  
2019 Mentor, IEEE VIS Inclusivity & Diversity Scholar Program  
2017, 2019 Lab Host/Mentor, Arizona's Science, Engineering & Math Scholars (ASEMS) Program  
2018 Presenter, UA WICS Research Meeting  
2013 – 2018 Moderator, Student ResearchHers, a Systems technical interest community  
2016 – 2018 Member, CS4AllAZ State Task Force  
2018, 2020 Mentor, Google Summer of Code  
2016 – 2017 Panelist, UA Women in Science and Engineering STEM Pipeline Mentorship Panel  
2015 Organizer, Birds of a Feather: *It's Okay to Fail*, Grace Hopper Celebration  
2015 Panelist, *Women in Computing Societies at University*, Grace Hopper Celebration  
2013 – 2015 Instructor, GirlsWhoCode Club, Dougherty Valley High School  
2011 – 2015 Co-Organizer, Women in Computer Science, University of California, Davis  
2012 – 2013 Mentor, Women in Science and Engineering (WISE), University of California, Davis  
2009 – 2011 Events Coordinator, Math Club, San José State University  
Spring 2010 Co-Organizer, Women in Computing Speaker Series, San José State University

### Software

CFGConf <http://github.com/HDC-Arizona/CFGConf>  
Roundtrip <http://github.com/HDC-Arizona/roundtrip>  
Traveler <http://github.com/HDC-Arizona/traveler-integrated>  
CFGExplorer <http://github.com/HDC-Arizona/CFGExplorer>  
graphterm <http://github.com/kisaacs/graphterm>  
Ravel <http://github.com/LLNL/Ravel>  
Boxfish <http://github.com/LLNL/Boxfish>