

Robert Ricci

*Research Associate Professor
School of Computing, University of Utah*

□ 50 South Central Campus Drive, Room 3190, Salt Lake City, Utah 84112

✉ ricci@cs.utah.edu ☎ +1-801-581-8354 🌐 www.flux.utah.edu/users/ricci

Research Interests

I work in **infrastructure**: the systems underneath the software and services that we use everyday. I've published in **operating systems, networking, distributed systems, cloud computing**, and more. I'm also interested in the **security** of those systems, because concerns of security and privacy need to be built into infrastructure from the ground up. Infrastructure is a very empirical field, requiring lots of implementation and experimentation, so I'm also interested in **experiment design and analysis**, and in building **testbeds** for research; I have worked on Emulab and its successors, including CloudLab, parts of GENI, and PhantomNet, since 2000. One of the fundamental parts of the research process is building on and comparing to existing systems, so I also work in **research reproducibility**.

Education

- 2010 **Ph.D.**, University of Utah
Advised by Jay Lepreau until his passing in 2008, then by Sneha Kasera.
Dissertation: *Enhancing Realism and Scalability in Network Testbeds* 🌐
- 2001 **Honors B.S.**, University of Utah
Thesis: *Agile Protocols, an Application of Active Networking to Censor-Resistant Publishing Networks* 🌐

Academic Appointments

- 2016–present **Research Associate Professor**, University of Utah School of Computing
Co-director of the Flux Research Group, which has more two dozen members, including faculty, research staff, postdocs, and students (Ph.D., Masters, and undergraduate).
- 2010–2016 **Research Assistant Professor**, University of Utah School of Computing
Co-director of the Flux Research Group
- 2007, 2009 **Adjunct Professor**, Westminster College, Salt Lake City, Utah
Taught undergraduate Computer Science classes as an adjunct at a small liberal-arts college.
- 2001–2010 **Research Staff**, University of Utah
Member of the Flux Research Group, founded by Jay Lepreau.
- 2000–2001 **Undergraduate Research Assistant**, University of Utah
I began my research career with the Flux Group while an undergraduate.

Testbeds

I have been one of the primary designers and implementors of the **Emulab** testbed since 2000, and am leading the development of some of its successors, such as **CloudLab**. These testbeds are central resources in the networking, operating systems, and distributed systems communities. Collectively, they have well over **10,000 users** from nearly every US state and dozens of countries throughout the world, spanning every inhabited continent. These users have run more than **half a million experiments** and hundreds of papers have been published based on research conducted on these testbeds. The software base that runs these testbeds is **open-source**, and more than fifty organizations worldwide, ranging from academic institutions to private companies, have built their own testbeds based on it. This software has played a critical role in subsequent testbeds with a variety of focuses: NSF's **CloudLab** (cloud computing), **GENI** (federation), **PhantomNet** (mobile networking), **PROBE** (scale) and **Apt** (adaptability); DARPA's **National Cyber Range** (security), and DHS's **DETERLAB** (security). (I have been directly involved in the development of all of these except DETERLAB.) The Emulab facility and codebase are key parts of the nationwide GENI infrastructure and several international federations in Europe, Brazil, Japan, and South Korea.

These testbeds (particularly CloudLab) have received significant attention in the **press**, including the Boston Globe, the Chronicle of Higher Education, local TV and radio stations, Slashdot, The Register, HPCWire, and numerous other publications [↗](#).

Publications

Most Cited Works

Citations according to Google Scholar [↗](#) as of May 8, 2018

1,615	White, et al., OSDI	2002
	"An Integrated Experimental Environment for Distributed Systems and Networks"	
334	Berman, et al., COMNETS	2014
	"GENI: A Federated Testbed For Innovative Network Experiments"	
276	Ricci, et al., SIGCOMM CCR	2003
	"A Solver For the Network Testbed Mapping Problem"	
235	Hibler, et al., USENIX ATC	2008
	"Large-scale Virtualization in the Emulab Network Testbed"	
230	Johnson, et al., INFOCOM	2006
	"Mobile Emulab: A Robotic Wireless and Sensor Network Testbed"	

Conference and Workshop Proceedings

1. "Fail-Slow at Scale: Evidence of Hardware Performance Faults in Large Production Systems". Haryadi S. Gunawi, Riza O. Suminto, Russell Sears, Casey Gollhofer, Swaminathan Sundararaman, Xing Lin, Tim Emami, Weiguang Sheng, Nematollah Bidokhti, Caitie McCaffrey, Gary

- Grider, Parks M. Fields, Kevin Harms, Robert B. Ross, Andree Jacobson, **Robert Ricci**, Kirk Webb, Peter Alvaro, Mingzhe Hao, Huaicheng Li, and H. Biralil Runesha. In *Proceedings of the 16th USENIX Conference on File and Storage Technologies (FAST)*, February 2018. [↗](#)
2. "Rocksteady: Fast Migration for Low-latency In-memory Storage". Chinmay Kulkarni, Aniraj Kesava, Tian Zhang, **Robert Ricci**, and Ryan Stutsman. In *Proceedings of the Symposium on Operating System Principles (SOSP)*, October 2017. [↗](#)
 3. "The Part-Time Cloud: Enabling Balanced Elasticity Between Diverse Computing Environments". Dmitry Duplyakin, David Johnson, and **Robert Ricci**. In *Proceedings of the Eighth Workshop on Scientific Cloud Computing (ScienceCloud)*, June 2017. [↗](#)
 4. "PopperCI: Automated Reproducibility Validation". Ivo Jiminez, Carlos Maltzahn, Jay Lofstead, Kathryn Mohror, Remzi Arpaci-Dusseau, Andrea Arpaci-Dusseau, and **Robert Ricci**. In *Proceedings of the International Workshop on Computer and Networking Experimental Research Using Testbeds (CNERT)*, May 2017. [↗](#)
 5. "Active Learning in Performance Analysis". Dmitry Duplyakin, Jed Brown, and **Robert Ricci**. In *Proceedings of the IEEE Cluster Conference*, September 2016. [↗](#)
 6. "To Copy or Not to Copy: Making In-Memory Databases Fast on Modern NICs". Aniraj Kesavan, **Robert Ricci**, and Ryan Stutsman. In *Proceedings of the Fourth International Workshop on In-Memory Data Management and Analytics (IMDM)*, September 2016. [↗](#)
 7. "Introducing Configuration Management Capabilities into CloudLab Experiments". Dmitry Duplyakin and **Robert Ricci**. In *Proceedings of the International Workshop on Computer and Networking Experimental Research Using Testbeds (CNERT)*, April 2016. **Awarded best paper.** [↗](#)
 8. "OpenEdge: A Dynamic and Secure Open Service Edge Network". Josh Kunz, Christopher Becker, Mohamed Jamshidy, Sneha Kasera, **Robert Ricci**, and Jacobus Van der Merwe. In *Proceedings of the Ninth IEEE/IFIP Network Operations and Management Symposium (NOMS)*, April 2016
 9. "KnowNet: Towards a Knowledge Plane for Enterprise Network Management". Ren Quinn, Josh Kunz, Aisha Syed, Joe Breen, Sneha Kasera, **Robert Ricci**, and Jacobus Van der Merwe. In *Proceedings of the Ninth IEEE/IFIP Network Operations and Management Symposium (NOMS)*, April 2016

10. ❖ “Realistic Packet Reordering for Network Emulation and Simulation”. Aisha Syed and **Robert Ricci**. In *Proceedings of the Eleventh ACM International Conference on Emerging Networking EXperiments and Technologies (CoNEXT)*, December 2015. Short paper. [↗](#)
11. “POTASSIUM: Penetration Testing as a Service”. Richard Li, Dallin Abendroth, Xing Lin, Yuankai Guo, Hyun wook Baek, Eric Eide, **Robert Ricci**, and Jacobus Van der Merwe. In *Proceedings of the Sixth ACM Symposium on Cloud Computing (SOCC)*, August 2015. [↗](#)
12. “Trust as the Foundation of Resource Exchange in GENI”. Marshall Brinn, Nicholas Bastin, Andrew Bavier, Mark Berman, Jeffrey Chase, and **Robert Ricci**. In *Proceedings of the 10th International Conference on Testbeds and Research Infrastructures for the Development of Networks and Communities (Tridentcom)*, June 2015. [↗](#)
13. “Metadata Considered Harmful ... to Deduplication”. Xing Lin, Fred Douglass, Jim Li, Xudong Li, **Robert Ricci**, Stephen Smaldone, and Grant Wallace. In *Proceedings of the 7th USENIX Workshop on Hot Topics in Storage and File Systems*, June 2015. [↗](#)
14. “Using Deduplicating Storage for Efficient Disk Image Deployment”. Xing Lin, Mike Hibler, Eric Eide, and **Robert Ricci**. In *Proceedings of the 10th International Conference on Testbeds and Research Infrastructures for the Development of Networks and Communities (Tridentcom)*, June 2015. [↗](#)
15. “SMORE: Software-Defined Networking Mobile Offloading Architecture”. Junguk Cho, Binh Nguyen, Arijit Banerjee, **Robert Ricci**, Jacobus Van der Merwe, and Kirk Webb. In *Proceedings of the 4th Workshop on All Things Cellular: Operations, Applications and Challenges*, August 2014. [↗](#)
16. “Secret Key Extraction using Bluetooth Wireless Signal Strength Measurements”. Sriram Nandha Premnath, Prarthana Lakshmane Gowda, Sneha Kumar Kasera, Neal Patwari, and **Robert Ricci**. In *IEEE International Conference on Sensing, Communications and Networking (SECON)*, June 2014. [↗](#)
17. ❖ “Operational Experiences with Disk Imaging in a Multi-Tenant Datacenter”. Kevin Atkinson, Gary Wong, and **Robert Ricci**. In *Proceedings of the Eleventh USENIX Symposium on Networked Systems Design and Implementation (NSDI)*, April 2014. [↗](#)
18. “Weir: A Streaming Language for Performance Analysis”. Anton Burtsev, Nikhil Mishrikoti, Eric Eide, and **Robert Ricci**. In *Proceedings of the 7th Workshop on Programming Languages and Operating Systems (PLOS)*, November 2013. [↗](#)

19. ❖ “Fast and Flexible: Parallel Packet Processing with GPUs and Click”. Weibin Sun and **Robert Ricci**. In *Proceedings of the ACM/IEEE Symposium on Architectures for Networking and Communications Systems (ANCS)*, October 2013. [↗](#)
20. ❖ “How To Build a Better Testbed: Lessons From a Decade of Network Experiments on Emulab”. Fabien Hermenier and **Robert Ricci**. In *Proceedings of the 8th International ICST Conference on Testbeds and Research Infrastructures for the Development of Networks and Communities (Tridentcom)*, June 2012. **Awarded best paper.** [↗](#)
21. “Towards Fair Sharing of Block Storage in a Multi-tenant Cloud”. Xing Lin, Yun Mao, Feifei Li, and **Robert Ricci**. In *Proceedings of the 4th USENIX Workshop on Hot Topics in Cloud Computing (HotCloud)*, June 2012. [↗](#)
22. “Designing a Federated Testbed as a Distributed System”. **Robert Ricci**, Jonathon Duerig, Leigh Stoller, Gary Wong, Srikanth Chikkulapelly, and Woojin Seok. In *Proceedings of the 8th International ICST Conference on Testbeds and Research Infrastructures for the Development of Networks and Communities (Tridentcom)*, June 2012. [↗](#)
23. “Harnessing GPU Computing for Storage Systems in the OS Kernel”. Weibin Sun, **Robert Ricci**, and Matthew J. Curry. In *Proceedings of the Fifth International Systems and Storage Conference (SYSTOR)*, June 2012. [↗](#)
24. “Partitioning Trust in Network Testbeds”. Gary Wong, **Robert Ricci**, Jonathon Duerig, Leigh Stoller, Srikanth Chikkulapelly, and Woojin Seok. In *Proceedings of the Software Testing and Internet Testbeds Mini-Track, HICSS 45*, January 2012. [↗](#)
25. “Emergency Service in Wi-Fi Networks Without Access Point Association”. Manav Seth, Sneha Kasera, and **Robert Ricci**. In *Proceedings of the First International Conference on Wireless Technologies for Humanitarian Relief (ACWR)*, December 2011. [↗](#)
26. “Trusted Disk Loading in the Emulab Network Testbed”. Cody Cutler, Mike Hibler, Eric Eide, and **Robert Ricci**. In *Proceedings of the Third Workshop on Cyber Security Experimentation and Test (CSET)*, August 2010. [↗](#)
27. ❖ “Modeling and Emulation of Internet Paths”. Pramod Sanaga, Jonathon Duerig, **Robert Ricci**, and Jay Lepreau. In *Proceedings of the Sixth USENIX Symposium on Networked Systems Design and Implementation (NSDI)*, April 2009. [↗](#)
28. “Securing the Frisbee Multicast Disk Loader”. **Robert Ricci** and Jonathon Duerig. In *Proceedings of the First Workshop on Cyber Security and Test (CSET)*, July 2008. [↗](#)

29. ❖ “Large-scale Virtualization in the Emulab Network Testbed”. Mike Hibler, **Robert Ricci**, Leigh Stoller, Jonathon Duerig, Shashi Guruprasad, Tim Stack, Kirk Webb, and Jay Lepreau. In *Proceedings of the USENIX Annual Technical Conference*, June 2008. [↗](#)
30. ❖ “The Flexlab Approach to Realistic Evaluation of Networked Systems”. **Robert Ricci**, Jonathon Duerig, Pramod Sanaga, Daniel Gebhardt, Mike Hibler, Kevin Atkinson, Junxing Zhang, Sneha Kasera, and Jay Lepreau. In *Proceedings of the Fourth USENIX Symposium on Networked Systems Design and Implementation (NSDI)*, April 2007. [↗](#)
31. “Flexlab: A Realistic, Controlled, and Friendly Environment for Evaluating Networked Systems”. Jonathon Duerig, **Robert Ricci**, Junxing Zhang, Daniel Gebhardt, Sneha Kasera, and Jay Lepreau. In *Proceedings of HotNets-V. ACM SIGCOMM*, June 2006. [↗](#)
32. “Leveraging Bloom Filters For Smart Search Within NUCA Caches”. **Robert Ricci**, Steve Barrus, Dan Gebhardt, and Rajeev Balasubramonian. In *Proceedings of the Sixth Workshop on Complexity-Effective Design (WCED)*, June 2006. [↗](#)
33. “Mobile Emulab: A Robotic Wireless and Sensor Network Testbed”. David Johnson, Tim Stack, Russ Fish, Daniel Flickinger, Leigh Stoller, **Robert Ricci**, and Jay Lepreau. In *Proceedings of IEEE INFOCOM*, April 2006. [↗](#)
34. “Integrated Network Experimentation using Simulation and Emulation”. Shashi Guruprasad, **Robert Ricci**, and Jay Lepreau. In *Proceedings of the First International Conference on Testbeds and Research Infrastructures for the Development of Networks and Communities (TridentCom)*, February 2005. [↗](#)
35. “Implementing the Emulab-PlanetLab Portal: Experiences and Lessons Learned”. Kirk Webb, Mike Hibler, **Robert Ricci**, Austin Clements, and Jay Lepreau. In *Proceedings of the First Workshop on Real, Large Distributed Systems (WORLDS)*. USENIX, December 2004. [↗](#)
36. ❖ “Fast, Scalable Disk Imaging with Frisbee”. Mike Hibler, Leigh Stoller, Jay Lepreau, **Robert Ricci**, and Chad Barb. In *Proceedings of the USENIX Annual Technical Conference*. USENIX, June 2003. [↗](#)
37. ❖ “An Integrated Experimental Environment for Distributed Systems and Networks”. Brian White, Jay Lepreau, Leigh Stoller, **Robert Ricci**, Shashi Guruprasad, Mac Newbold, Mike Hibler, Chad Barb, and Abhijeet Joglekar. In *Proceedings of the USENIX Symposium on Operating System Design and Implementation (OSDI)*. USENIX, December 2002. [↗](#)

38. "Active Protocols for Agile Censor-Resistant Networks". **Robert Ricci** and Jay Lepreau. In *Proceedings of HotOS-VIII*. USENIX, May 2001. [↗](#)

Journal and Magazine Articles

1. "Beyond Simple Request Processing with RAMCloud". Chinmay Kulkarni, Aniraj Kesavan, **Robert Ricci**, and Ryan Stutsman. *Data Engineering*, 40(1), March 2017
2. "Path Boxplots: A Method for Characterizing Uncertainty in Path Ensembles on a Graph". Mukund Raj, Mahsa Mirzargar, **Robert Ricci**, Robert M. Kirby, and Ross T. Whitaker. *Journal of Computational and Graphical Statistics (JCGS)*, 26(2):243–252, 2017. [↗](#)
3. "PhantomNet: Research Infrastructure for Mobile Networking, Cloud Computing and Software-Defined Networking". Arijit Banerjee, Junguk Cho, Eric Eide, Jonathon Duerig, Binh Nguyen, **Robert Ricci**, Jacobus Van der Merwe, Kirk Webb, and Gary Wong. *ACM GetMobile*, 19(2), April 2015. [↗](#)
4. ❖ "Apt: A Platform for Repeatable Research in Computer Science". **Robert Ricci**, Gary Wong, Leigh Stoller, Kirk Webb, Jonathon Duerig, Keith Downie, and Mike Hibler. *ACM SIGOPS Operating Systems Review*, 49(1), January 2015. [↗](#)
5. ❖ "Introducing CloudLab: Scientific Infrastructure for Advancing Cloud Architectures and Applications". **Robert Ricci**, Eric Eide, and The CloudLab Team. *USENIX ;login:*, 39(6), December 2014. [↗](#)
6. "The InstaGENI Initiative: An Architecture for Distributed Systems and Advanced Programmable Networks". Nicholas Bastin, Andy Bavier, Jessica Blaine, Jim Chen, Narayan Krishnan, Joe Mambretti, Rick McGeer, **Robert Ricci**, and Nicki Watts. *Computer Networks*, 61(0):24–38, March 2014. [↗](#)
7. ❖ "GENI: A Federated Testbed For Innovative Network Experiments". Mark Berman, Jeffrey S Chase, Lawrence Landweber, Akihiro Nakao, Max Ott, Dipankar Raychaudhuri, **Robert Ricci**, and Ivan Seskar. *Computer Networks*, 61(0):5–23, March 2014. [↗](#)
8. "An Architecture For International Federation of Network Testbeds". **Robert Ricci**, Gary Wong, Leigh Stoller, and Jonathon Duerig. *IEICE Transactions*, E96-B(1), January 2013. Invited paper. [↗](#)
9. "Getting Started with GENI: A User Tutorial". Jonathon Duerig, **Robert Ricci**, Leigh Stoller, Matt Strum, Gary Wong, Charles Carpenter, Zongming Fei, James Griffioen, Hussamuddin Nasir, Jeremy Reed, and Xiongqi Wu. *ACM SIGCOMM Computer Communication Review (CCR)*, 42(1):72–77, January 2012. Invited paper. [↗](#)

10. "Lessons From Resource Allocators for Large-Scale Multiuser Testbeds". **Robert Ricci**, David Oppenheimer, Jay Lepreau, and Amin Vahdat. *ACM SIGOPS Operating Systems Review*, January 2006. [↗](#)
11. ❖ "A Solver for the Network Testbed Mapping Problem". **Robert Ricci**, Chris Alfeld, and Jay Lepreau. *ACM SIGCOMM Computer Communications Review (CCR)*, 33(2):65–81, April 2003. [↗](#)

Books and Book Chapters

1. ❖ Rick McGeer, Mark Berman, Chip Elliott, and **Robert Ricci**, editors. *The GENI Book*. Springer International Publishing, 2016
2. "To Copy or Not to Copy: Making In-Memory Databases Fast on Modern NICs". Aniraj Kesavan, **Robert Ricci**, and Ryan Stutsman. In Spyros Blanas, Justin Levandoski, Rajesh Bordawekar, Andrew Pavlo, and Tirthankar Lahiri, editors, *Data Management on New Hardware*, chapter 5. Springer Lecture Notes on Computer Science, Cham, Switzerland, 2016
3. "The InstaGENI Project". Rick McGeer and **Robert Ricci**. In Rick McGeer, Mark Berman, Chip Elliott, and **Robert Ricci**, editors, *The GENI Book*, chapter 14. Springer-Verlag, New York, 2016
4. "Emulab". **Robert Ricci**. In Rick McGeer, Mark Berman, Chip Elliott, and **Robert Ricci**, editors, *The GENI Book*, chapter 2. Springer-Verlag, New York, 2016
5. "The Need for Flexible Mid-scale Computing Infrastructure". **Robert Ricci**. In Rick McGeer, Mark Berman, Chip Elliott, and **Robert Ricci**, editors, *The GENI Book*, chapter 6. Springer-Verlag, New York, 2016

Tech Reports and Online Articles

1. Amy Apon, Russ Clark, Ada Gavrilovska, Kate Keahey, Rick McGeer, **Robert Ricci**, Glenn Ricart, Wilson Rivera, and Jessie Walker, editors. *Report of the NSFCloud For Everyone Workshop*, Atlanta, GA, November 2016
2. ❖ **Robert Ricci** and Nick Feamster, editors. *Report of the NSF Workshop on Software Defined Infrastructures and Software Defined Exchanges*, Washington, DC, February 2016
3. "Rethinking Abstractions in Big Data: Why, Where, How, and What". Mary Hall, Robert M. Kirby, Feifei Li, Miriah Meyer, Valerio Pascucci, Jeff M. Phillips, **Robert Ricci**, Jacobus Van der Merwe, and Suresh Venkatasubramanian. Technical Report UUCS-13-002, University of Utah, June 2013. arXiv:1306.3295. [↗](#)

4. "Augmenting Operating Systems With the GPU". Weibin Sun and **Robert Ricci**. Technical Report FTN-2011-02, University of Utah, 2011. arXiv:1305.3345. [↗](#)
5. "Optimizing IP Address Assignment on Network Topologies". Jonathon Duerig, **Robert Ricci**, John Byers, and Jay Lepreau. Technical Report FTN-2006-02, University of Utah, February 2006. [↗](#)

Teaching

Courses

- Spring 2015 **CS 6963: Evaluating Networked Systems**, University of Utah
I taught this course, which I designed in Spring 2014, for a second time. It was taken by a mix of eight PhD, MS, and BS students. Materials for this class were used as part of a networking class at NYU Poly.
- Spring 2014 **CS 6963: Evaluating Networked Systems**, University of Utah
Developed a new graduate-level course to acquaint students with the theory and practice of evaluating systems that have a network as a major component, with the goal of preparing students to conduct rigorous evaluations as part of their own research as well as looking with a critical eye at evaluations they find in the literature. Ten students (MS and PhD) took the initial offering of the course. All course materials are available online. [↗](#)
- Spring 2009 **CMPT 355: Compilers**, Westminster College
Taught a four credit-hour class of 5 junior and senior Computer Science majors, covering compilers and related technologies. Took over the class mid-semester when the primary instructor took maternity leave.
- Fall 2007 **CMPT 251: Computer Organization**, Westminster College
Taught a four credit-hour class of 13 second-year Computer Science majors, introducing a range of fundamental topics in operating systems and computer architecture. The course received excellent reviews.

Other

- 2010–2013 **Hands-on tutorials**, GENI Engineering Conferences
I have presented eight tutorials at GENI Engineering Conferences. These hands-on events covered the user of the GENI facility and various experimenter tools, and have typically lasted 2–3 hours with 20–60 attendees.
- Fall 2013 **Guest lectures in CS 6480: Advanced Computer Networks**, Utah
Gave guest lectures on networked systems evaluation in general and the Emulab and GENI testbeds in particular.

- Spring 2007 **Guest lectures in CS 6490: Network Security**, University of Utah
Gave guest lectures, with accompanying homework assignment, on systems and programming aspects of security, including buffer overflows and low-level network attacks such as ARP poisoning and DNS attacks.
- August 2002 **Hands-on Tutorial**, SIGCOMM Conference
Part of a team of three that prepared and presented a well-received full-day tutorial at the premier networking conference. Taught attendees how to use the Emulab testbed for research and classwork, including a hands-on component.
- Summer 1999 **Teaching Assistant for CP SC 2020: Computer Science II**, Utah
TA for an entry-level computer science class. Responsibilities included teaching two discussion sections per week, of about two dozen students each.
- Spring 1999 **Teaching Assistant for CP SC 2010: Computer Science I**, Utah
TA for an entry-level computer science class. Responsibilities included teaching two discussion sections per week, of about two dozen students each.

Advising

Postdocs

- 2017–present **Dimitry Duplyakin**
2011 **Fabien Hermenier** *Faculty, Université Nice Sophia Antipolis*

Ph.D. Students

- 2016–present **Rufaida Ahmed**
2015–2017 **Dimitry Duplyakin** *Postdoc, University of Utah*
Student at University of Colorado Boulder; informally co-advised with Jed Brown of CU-Boulder
- 2014–present **Aisha Syed**
Co-advised with Kobus Van der Merwe
- 2013–present **Junguk Cho**
Co-advised with Kobus Van der Merwe
- 2013–present **Stephen “Ren” Quinn**
Co-advised with Kobus Van der Merwe
- 2009–2015 **Xing Lin** *NetApp Advanced Technology Group*
Thesis: “Using Similarity in Content and Access Patterns to Improve Space Efficiency and Performance in Storage Systems”
- 2009–2014 **Weibin Sun** *Google*
Thesis: “Harnessing GPU Computing in System Level Software” [↗](#)

M.S. Students

- 2017–present **Sonika Jindal**
- 2016–present **Teja Kommineni**
- 2015–2017 **Aniraj Kesavan** *LinkedIn*
Co-advised with Ryan Stutsman
- 2015–2016 **Anil Kumar** *Microsoft*
- 2014–2015 **Anil Mallapur** *LinkedIn*
- 2012–2014 **Aisha Syed** *Ph.D. Student, Utah*
Thesis: “Realistic Traffic Shaping in Dummynet Link Emulator” [↗](#)
- 2010–2014 **Srikanth Manikarnike**
Project: “Enhancing Dummynet to Reproduce Real Link Characteristics”
- 2012–2013 **Nikhil Mishrikoti** *Cisco Systems*
Project: “Performance Analysis of Virtual Environments” [↗](#)
- 2011–2013 **Srikanth Raju** *Coverity*
Project: “Image Import and SSH Security in Emulab” [↗](#)
- 2011–2013 **Yathindra Dev Naik** *NetApp*
Project: “Xen-Cap: A Capability Framework for Xen” [↗](#)
- 2010–2011 **Srikanth Chikkulapelly** *Amazon AWS*
Thesis: “A Scalable and Flexible Node Configuration Service in an Advanced Network Testbed” [↗](#)
- 2009–2011 **Raghuveer Pullankandam** *Adobe Systems*
Thesis: “EmuStore: Large Scale Disk Image Storage and Deployment in the Emulab Network Testbed” [↗](#)

B.S./M.S. Students

- 2015–2017 **Keith Downie** *Ubiquiti Networks*
Project: “Function as a Service, an Ad Hoc Approach to Cloud Computing” [↗](#).
- 2009–2013 **Matt Strum** *Amazon Silk Browser Team*
Thesis: “FlowOps: Open Access Network Management and Operation” [↗](#). Co-advised with Kobus Van der Merwe.
- 2012–2013 **Jared Rose**
Project: “Anonymous File Transfer Network”

B.S. Students

- 2013–2015 **Keith Downie** *B.S./M.S. Student, Utah*
- 2009–2012 **Cody Cutler** *Ph.D. Student, MIT*
Thesis: “Trusted Disk Loading in the Emulab Network Testbed” [↗](#)

Interns

- 2016 **Aleksander Maricq**
Intern working with Flux after graduating with an MS from the University of California, San Diego
- 2015 **Dmitry Duplyakin**
PhD student at the University of Colorado, Boulder
- 2015 **Brenda Lamwaka**
International exchange student from Mbarara University of Science and Technology, Uganda

Professional Activities and Service

External Service

- 2017– **Editorial Board**, IEEE ComSoc Network Softwarization & Enablers
On the editorial board for “Network Softwarization & Enablers”, a series published as part of the IEEE Journal on Selected Areas in Communications (JSAC) by the IEEE Communication Society.
- 2016–2017 **Local Arrangments Chair**, ACM MobiCom Conference
Handling local arrangements for MobiCom, the flagship conference of ACM’s SIGMOBILE, with approximately 350 attendees.
- 2016 **Workshop Co-Organizer**, NSFCloud For Everyone Workshop
On the organizing committee for an outreach workshop aimed at helping underserved communities use NSF-funded infrastructure.
- 2016–present **Stakeholder Advisory Board**, Jetstream
Member of the Stakeholder Advistory Board for Jetstream, a production cloud for domain science funded by NSF.
- 2015–2016 **Workshop Co-Chair**, NSF “Beyond the Internet” planning workshop
Co-chair, with Nick Feamster of Princeton, of a workshop to inform future NSF planning on research programs looking “beyond the Internet.”
- 2015–present **Science Board**, PIK Journal
Member of the scientific board for German journal *Praxis der Informationsverarbeitung und Kommunikation* (articles are in English).
- 2014 **Workshop Co-Chair**, NSFCloud Workshop on Experimental Support for Cloud Computing
Co-organizer (with Kate Keahey of the University of Chicago/Argonne) of a workshop to bring together the community of potential users of the NSFCloud infrastructure.

- 2014 **Workshop Co-Chair**, Workshop on the Development of a Next-Generation Cyberinfrastructure
Co-organizer (with Victor Hazlewood of the University of Tennessee Knoxville) of a workshop that brought together several large NSF-funded infrastructure communities (XSEDE, Grid, GENI, NSFCloud) and federal government attendees to talk about federation and collaboration between these communities.
- 2013–present **Advisory Board**, Fed4FIRE
On the advisory board of Fed4FIRE, a €10M European project consisting of 17 partner organizations from 8 countries.
- 2011–present **Co-chair**, GENI Architecture Group
Co-chair, with Marshall Brinn of BBN Technologies, of the group tasked with defining the architecture of the NSF GENI project.
- 2008–present **Technical lead**, GENI “Cluster C”
As leader of the ProtoGENI project at the University of Utah, acting as head of a large collaborative effort involving over 20 projects from over 15 institutions. This position involves providing architectural vision for the collaboration, coordinating among groups, and planning and leading frequent meetings.
- 2014 **Workshop Organizer**, Workshop on the Development of a Next-Generation Cyberinfrastructure
Co-organizer, with Victor Hazelwood of UTK, of an NSF-sponsored workshop on the development of next-generation cyberinfrastructures; it has a special emphasis on interoperation and federation.
- 2013 **Local arrangements chair**, GENI Engineering Conference
Handled local arrangements for the sixteenth GENI Engineering Conference, held on the University of Utah campus.
- 2010 **Workshop organizing committee**, QUILT GENI Workshop
Participated in the planning of a workshop to engage campus and regional networks in the NSF GENI project.
- 2009–2011 **Co-chair**, GENI Control Framework Working Group
Co-chair, with Jeff Chase of Duke, of the GENI Control Framework Working group.
- 2009 **Local arrangements chair**, GENI Engineering Conference
Handled local arrangements for the sixth GENI Engineering Conference, held in part on the University of Utah campus. The conference had approximately 200 attendees.
- 2009 **Network Research Strategic Planning Team**, Internet2
Helped to set network research priorities for the Internet2 national research and education network.
- 2007–2009 **Active participant**, GENI Control Framework Working Group
Continuation of the work of the GENI Facility Architecture Working group under the guidance of the new GENI Project Office.

- 2006–2007 **Active participant**, GENI Facility Architecture Working Group
Designed facility architecture for GENI, the NSF's effort to create a tested for next-generation Internet designs.
- 1999–2007 **Organizer and judge**, ACM High School Programming Contest
Assisted with the annual High School Programming contest sponsored by the ACM and the University of Utah. I have helped with all aspects of the competition, from judging submissions and designing programming problems to acting as chief judge.

— Departmental Service

- 2014–2015 Hiring subcommittee, Architecture
- 2013–present Track committee, Networked Systems
- 2013–2014 Hiring subcommittee, Operating Systems
- 2010–2014, Graduate admissions committee
2016
- 2013 Assisted with revision of the Graduate Handbook
- 2012–2013 Hiring subcommittee, Security
- 2011–2012 Auxiliary faculty review committee
- 2008–2011 Hiring subcommittee, Lepreau Professorship

— Program Committees

- 2017 Fourth International Workshop on Reproducibility in Parallel Computing (**REPPAR**)
- 2017 Workshop Computer and Networking Experimental Research Using Testbeds (**CNERT**)
- 2017 17th IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing (**CCGrid**)
- 2016 ACM SIGCOMM Workshop on Distributed Cloud Computing
- 2016 Workshop on Reproducibility in Parallel Computing, held in conjunction with EuroPar
- 2014 SIGCOMM Conference on emerging Networking EXperiments and Technologies (**CoNEXT**)
- 2014 SIGCOMM Workshop on Distributed Cloud Computing (**DCC**)
- 2014 Experimental Evaluation and Testbeds track of IEEE International Conference on Mobile Ad hoc and Sensor Systems (**MASS**)
- 2013 IEEE International Workshop on Future Internet Technology (**IWFIT**)
- 2012 Steering committee for a **shadow PC** for the USENIX Symposium on Networked Systems Design and Implementation (**NSDI**)
- 2012 International Conference on Computer Communication Networks (**IC-CCN**), Network Architectures and Clean-Slate Designs track

- 2011 IEEE International Conference on Network Protocols (**ICNP**)
- 2010 ACM SIGCOMM Workshop on Virtualized Infrastructure Systems and Architectures (**VISA**)
- 2009 International Conference on Testbeds and Research Infrastructures (**TridentCom**)
- 2009 Workshop on Cyber Security Experimentation and Test (**CSET**)
- 2009 ACM SIGCOMM Workshop on Virtualized Infrastructure Systems and Architectures (**VISA**)
- 2008 Workshop on Cyber Security Experimentation and Test (**CSET**)

Funding

Current

- NSF, \$9.7M “CloudLab Phase II: Community Infrastructure To Expand the Frontiers of Cloud Computing Research”, 2017–2020, **PI:** Robert Ricci, co-PIs: Aditya Akella (Wisconsin), KC Wang (Clemson), Mike Zink (UMass), Glenn Ricart (US Ignite)
- NSF, \$2.2M “CI-EN: Revitalizing Emulab for Modern Networking and Systems Research”, 2015–2018, PI: Eric Eide, **co-PI:** Robert Ricci
- NSF, \$11M “CloudLab: Flexible Scientific Infrastructure to Support Fundamental Advances in Cloud Architectures and Applications”, 2014–2018, **PI:** Robert Ricci, co-PIs: Aditya Akella (Wisconsin), KC Wang (Clemson), Chip Elliott (BBN), Mike Zink (UMass), Glenn Ricart (US Ignite)
- NSF, \$2M “CI-ADDO-NEW: PhantomNet: An End-to-End Mobile Network Testbed”, 2013–2018, PI: Kobus Van der Merwe, **co-PI:** Robert Ricci
- NSF, \$1.15M “NeTS: Medium: KnowOps - Making Network Management and Operations Software Defined”, 2013–2018, PI: Kobus Van der Merwe, **co-PIs:** Robert Ricci, Sneha Kumar Kasera, and Suresh Venkatasubramanian
- NSF, \$1M “TWC: Medium: Collaborative: TCloud: A Self-Defending, Self-Evolving and Self-Accounting Trustworthy Cloud Platform”, 2013–2018, Grant from the National Science Foundation, PI: Kobus Van der Merwe, **co-PIs:** Robert Ricci, Eric Eide and Fefei Li

Prior

- NSF, \$3.4M “MRI: Development of Apt, a Testbed Instrument With Adaptable Profiles for Network and Computational Science”, 2013–2017, **PI:** Robert Ricci, co-PIs: Kobus Van der Merwe, Eric Eide, Julio Facelli, and Steve Corbató. Includes 30% University of Utah cost-sharing.
- GPO, \$497K “Experimenter Tools and Training for a More User-Friendly and Sustainable GENI”, 2013–2015, **PI:** Robert Ricci, Contract from GENI Project Office (BBN Technologies)

- GPO, \$199K "Adopt-A-GENI: Bringing users into the GENI Community", 2013–2015, PI: Kobus Van der Merwe, **co-PI**: Robert Ricci, Sub-contract via the University of Kentucky from from the GENI Project Office
- NSF, \$1M "CC-NIE Integration: Science Slices Converting Network Research Innovation into Enhanced Capability for Computational Science and Engineering at the University of Utah", 2013–2015, PI: Steve Corbató, **co-PIs**: Kobus Van der Merwe, Robert Ricci, Adam Bolton, and Thomas Cheatham
- Corp., \$150K "Network Management and Operation for Open Access Networks", 2013–2014, PI: Kobus van der Merwe, **co-PIs**: Robert Ricci and Sneha Kasera, Grant from Entrypoint LLC
- GPO, \$272K "InstaGENI Meso-Scale Prototype", 2012–2014, **PI**: Robert Ricci, Sub-contract from HP via GENI Project Office
- GPO, \$254K "Education and Support For GENI Experimenters", 2011–2014, **PI**: Robert Ricci, Contract from GENI Project Office (BBN Technologies)
- NSF, \$50K "The Sixteenth GENI Engineering Conference", 2013, **PI**: Robert Ricci
- NSF, \$1.0M "CI-ADDO-EN: Enhancing Emulab for Virtualization and Clouds", 2011–2013, **PI**: Robert Ricci, **co-PIs**: Eric Eide and Mike Hibler
- Corp., \$25K "Augmenting Operating Systems with the GPU", 2011–2012, **PI**: Robert Ricci, Fellowship awarded to Weibin Sun by NVIDIA
- NSF, \$475K "Collaborative Research: PRObE - The NSF Parallel Reconfigurable Observational Environment for Data Intensive Super-Computing and High End Computing", 2010–2015, **PI**: Robert Ricci, Subcontract from New Mexico Consortium (via NSF)
- GPO, \$534K "Experiment Workflow Tools and Services for GENI", 2010–2012, **PI**: Robert Ricci, Contract from GENI Project Office (BBN Technologies)
- GPO, \$459K "Integrating New Projects into the ProtoGENI Control Framework", 2010–2012, **PI**: Robert Ricci, Contract from GENI Project Office (BBN Technologies)
- GPO, \$760K "End-To-End ProtoGENI", 2008–2012, **PI**: Robert Ricci, Contract from GENI Project Office (BBN Technologies)
- NSF, \$1.7M "MRI: Evolutionary Development of an Advanced Distributed Testbed", 2007–2013, PI: John Regehr, **co-PIs**: Robert Ricci and Steve Corbató
- NSF, \$1.0M 'NeTS-ProWin: Software Radio Testbeds: One Large, Many Small', 2005–2011, PI: Sneha Kasera, **co-PI**: Robert Ricci
- NSF, \$1.2M "NeTS-ProWin: An Open, Low Cost, High Quality Software Radio Platform and Testbed", 2004–2010, PI: Sneha Kasera, **co-PI**, Robert Ricci

Talks

2017

- November ❖ **Software for Reproducibility**, Grand Rounds: Research Reproducibility, Salt Lake City, UT
Talk as part of an interdisciplinary series on research reproducibility organized by the University of Utah Health Sciences Library.
- August **Infrastructure For Building Cyber Experimentation Testbeds**, Research Directions in Cyber Experimentation workshop, Livermore, CA
Invited to give a talk at a workshop on cyber-security experimentation.
- April ❖ **Cloud Research With CloudLab**, Invited talk, University of Colorado, Boulder, Boulder, Colorado
Invited to give a talk at the Department of Computer Science at CU Boulder.

2016

- November **CloudLab**, Invited talk, SC BOF on Cloud Computing, Salt Lake City, UT
Invited to present CloudLab at a Birds-of-a-Feather session at the SC conference.
- November **Building Clouds with CloudLab**, Talk and hands-on tutorial, NSFCloud for Everyone Workshop, Atlanta, GA
Presentation at a workshop aimed at increasing the usage of NSF-funded infrastructure by underrepresented communities.
- August ❖ **Repeatable Experimentation in PhantomNet**, Tutorial, SIGCOMM, Florianópolis, SC, Brazil
With Kobus Van der Merwe and Kirk Webb, helped to present a full-day hands-on tutorial on the PhantomNet mobile wireless testbed.
- May **Building Clouds with CloudLab**, Online
Invited to present the first in a series of GENI-related webinars
- March ❖ **Cloud Research With CloudLab**, Invited talk, Texas Tech, Lubbock, Texas
Invited to give a talk at the Department of Computer Science and Cloud and Autonomic Computing Center at Texas Tech University.

2015

- December ❖ **Infrastructure for Computer Systems Experimentation**, Invited talk, TU Darmstadt, Darmstadt, Germany
Invited to give a talk giving a history of the Flux Group's development of research infrastructure over the last 15 years.
- November ❖ **Building Community Around Testbeds**, Invited talk, NSF Workshop on Accessible Remote Testbeds, Washington, DC
Invited to address a meeting of prospective testbed builders from the NSF ENG and CISE directorates

- September **Federated Monitoring**, GENI-Fed4FIRE Meeting, Washington, DC
Invited talk at a meeting between the US GENI project and EU Fed4FIRE project.
- September **Federation Strategy**, GENI-Fed4FIRE Meeting, Washington, DC
Invited talk at a meeting between the US GENI project and EU Fed4FIRE project.
- September **CloudLab Updates and Federation**, GENI-Fed4FIRE Meeting, Washington, DC
Invited talk at a meeting between the US GENI project and EU Fed4FIRE project.
- August **Cloud Computing in HPC**, Invited talk, RMACC, Boulder, CO
Invited to lead a session on cloud computing in HPC
- July ❖ **CloudLab**, Plenary panel, XSEDE 15, St. Louis, MO
Invited to participate as a panelist in a session discussing new and upcoming NSF-funded infrastructure
- July **Federation in CloudLab**, XSEDE 15, St. Louis, MO
Invited talk about the internal and external federation aspects of CloudLab.
- June **Getting started with CloudLab and OpenStack**, Tutorial, GEC #23, Champaign, IL
2 hour hands-on tutorial presented at GEC #23 on the basics of creating a cloud in CloudLab. Approximately 30 attendees.
- May ❖ **CloudLab Train-the-Trainers session**, Workshop, Salt Lake City, UT
2 day workshop for ACI-REF facilitators and University of Utah CHPC staff. Included a hands-on tutorial, and several presentations on the details of an intended use of CloudLab.
- April **CloudLab**, Cyber-physical Systems Week, Seattle, WA
Remote presentation to a meeting of researchers and industrial practitioners involved in Cyber-physical Systems about how CloudLab can be used for CPS research.
- March ❖ **Getting started with CloudLab and OpenStack**, Tutorial, GEC #22, Arlington, VA
1.5 hour hands-on tutorial presented at GEC #22 on the basics of creating a cloud in CloudLab. Approximately 60 attendees.
- February **CloudLab**, NITRD MAGIC meeting, Washington, DC
Remote presentation to a meeting of the Middleware And Grid Interagency Coordination (MAGIC) group of the federal Networking and Information Technology Research and Development (NITRD) project.

2014

- November ❖ **CloudLab**, NSFCLOUD Workshop, Arlington, VA
Co-organized a community workshop on the NSFCLOUD facilities; gave a talk describing and demonstrating CloudLab.

- November ❖ **CloudLab**, GENI-Fed4FIRE Meeting, Paris, France
Invited talk at a meeting between the US GENI project and EU Fed4FIRE project.
- November **Cloud Research in the US**, GENI-Fed4FIRE Meeting, Paris, France
Invited talk at a meeting between the US GENI project and EU Fed4FIRE project.
- November **Workshop on the Development of a Next-Generation Cyberinfrastructure**, GENI-Fed4FIRE Meeting, Paris, France
Invited talk at a meeting between the US GENI project and EU Fed4FIRE project.
- October ❖ **CloudLab**, GEC #21, Bloomington, IN
- October **Using GENI in "Evaluating Networked Systems"**, GEC #21, Bloomington, IN
- October ❖ **CloudLab**, Workshop, Washington, D.C.
Invited talk at the Workshop for the Development of a Next-Generation Cyberinfrastructure
- June **InstaGENI Administration**, GEC #20, Davis, CA
- June **ProtoGENI Developer Topics**, GEC #20, Davis, CA
- June ❖ **Apt: The Adaptable Profile-Driven Testbed**, GEC #20, Davis, CA
- May **SDN in Software**, GENI-Fed4FIRE Meeting, Cambridge, MA
Invited talk at the second meeting between the US GENI project and EU Fed4FIRE project.
- May ❖ **User Tool Lessons**, GENI-Fed4FIRE Meeting, Cambridge, MA
Invited talk at the second meeting between the US GENI project and EU Fed4FIRE project.
- April ❖ **Operational Experiences with Disk Imaging in a Multi-Tenant Data-center**, Paper talk, Seattle, WA
Paper talk at the Symposium on Networked Systems Design and Implementation (NSDI)
- March **PhantomNet: An End-to-End Mobile Wireless Testbed**, GEC #19, Atlanta, GA

2013

- October **Getting Started with GENI: Part II**, Tutorial, GEC #18, Brooklyn, NY
2.5 hour hands-on tutorial presented at GEC #18 with Vic Thomas of the GENI Project Office
- October **GENI Rack Operations Going Forward**, GEC #18, Brooklyn, NY
- October **Flack Evolved: Jacks**, GEC #18, Brooklyn, NY
- October ❖ **Overview of Federation**, GENI-Fed4FIRE Meeting, Leuven, Belgium
Invited talk at the first meeting between the US GENI project and EU Fed4FIRE project.

- October **GENI Tools**, GENI-Fed4FIRE Meeting, Leuven, Belgium
Invited talk at the first meeting between the US GENI project and EU Fed4FIRE project.
- October **Setting Testbed Policies**, GENI-Fed4FIRE Meeting, Leuven, Belgium
Invited talk at the first meeting between the US GENI project and EU Fed4FIRE project.
- July **InstaGENI Overview**, GEC #17, Madison, WI
- October **Experimentation and Instrumentation using InstaGENI Racks and GEM-INI**, Tutorial, GEC #16, Salt Lake City, UT
2.5 hour hands-on tutorial presented at GEC #16 with Jim Griffioen of the University of Kentucky and Ezra Kissel of Indiana University
- March **New Features in Flack**, GEC #16, Salt Lake City, UT
- March **Speaks-For**, GEC #16, Salt Lake City, UT
- March **InstaGENI Overview**, GEC #16, Salt Lake City, UT

2012

- October **Introduction to GENI and the Experiment Lifecycle**, Tutorial, GEC #15, Houston, TX
2.5 hour hands-on tutorial presented at GEC #15
- July **InstaGENI Tutorial**, Tutorial, GEC #14, Boston, MA
2 hour hands-on tutorial presented at GEC #14 with Gary Wong
- July **❖ InstaGENI Rack Update and Demo**, GEC #14, Boston, MA
Demonstration presented with Rick McGeer of HP Labs
- March **ProtoGENI and Experimenters**, Workshop, Los Angeles, CA
Invited talk at the GENI Experimenters' workshop
- March **ProtoGENI and ABAC**, GEC #13, Los Angeles, CA
- March **❖ PRObE: Parallel Reconfigurable Observable Environment**, GEC #13, Los Angeles, CA

2011

- July **Introduction to GENI using Flack and the Instrumentation Portal**, Tutorial, GEC #12, Kansas City, MO
2 hour hands-on tutorial presented at GEC #12 with Jim Griffioen of the University of Kentucky
- November **Education and Support for GENI Experimenters**, GEC #12, Kansas City, MO
- November **Tickets**, GEC #12, Kansas City, MO
- October **❖ Managing Trust in Federated Testbeds**, Symposium, University of Tokyo, Tokyo, Japan
Invited talk at the Network Virtualization Symposium

- October ❖ **Emulab and ProtoGENI: Enabling Network Research and Education**, Invited talk, KDDI, Tokyo, Japan
Invited talk at the R&D organization of a Japanese telecommunications provider
- July **Introduction to GENI using Flack and the Instrumentation Portal**, Tutorial, GEC #11, Denver, CO
2 hour hands-on tutorial presented at GEC #11 with Jim Griffioen of the University of Kentucky
- July **ProtoGENI Control Framework Update**, GEC #11, Denver, CO
- March **ProtoGENI Stitching**, GEC #10, San Juan, PR
- March **ProtoGENI RSpec**, GEC #10, San Juan, PR
- March **ProtoGENI Identity Management**, GEC #10, San Juan, PR
- March **ProtoGENI Authorization**, GEC #10, San Juan, PR
- March **ProtoGENI Control Framework Update**, GEC #10, San Juan, PR

2010

- July **ProtoGENI Tutorial**, Tutorial, GEC #9, Washington, D.C.
3 hour hands-on tutorial presented at GEC #9 with Jim Griffioen of the University of Kentucky
- November **ProtoGENI Status and Priorities**, GEC #9, Washington, D.C.
- September **Evaluating Networked Systems**, Colloquium, Salt Lake City, UT
Invited talk in the University of Utah School of Computing Research Buffet
- July **ProtoGENI and Emulab: Campus Connection Case Study**, Workshop, San Diego, CA
Invited talk at the QUILT GENI Workshop
- July **ProtoGENI Tutorial**, Tutorial, GEC #8, San Diego, CA
3 hour hands-on tutorial presented at GEC #9 with Jim Griffioen of the University of Kentucky
- July **Supporting ProtoGENI Users**, GEC #8, San Diego, CA
- March **The ProtoGENI Vision for GENI Resource Representation**, Workshop, Durham, NC
Invited talk at the Workshop on Future of Resource Representations in GENI
- March **Credentials in ProtoGENI**, GEC #7, Durham, NC
- February **ProtoGENI and Emulab: Enabling Network Research and Education**, Meeting, Salt Lake City, UT
Invited talk at Internet2/ESNet Joint Techs Meeting
- January **ProtoGENI and Emulab: Enabling Network Research and Education**, Meeting, Salt Lake City, UT
Invited talk at WestNet Meeting

2009

- November ❖ **ProtoGENI Integrated Backbone Demonstration**, Talk and demonstration at GEC #6, Salt Lake City, UT
- November **ProtoGENI Spirals 1 and 2**, GEC #6, Salt Lake City, UT
- October ❖ **ProtoGENI and Emulab: Enabling Network Research and Education**, Meeting, San Antonio, TX
Invited talk at the Internet2 Fall Member Meeting
- July **Federation in ProtoGENI**, Workshop, Seattle, WA
Invited talk at the Second GENI-FIRE Workshop
- July **ProtoGENI Experimenter Tools**, GEC #5, Seattle, WA
- July **ProtoGENI Backbone Plans and Status**, GEC #5, Seattle, WA
- July **Cross-Aggregate Coordination**, GEC #5, Seattle, WA
- June **Measurement and Experiment Specification**, Workshop, Madison, WI
Workshop talk at the GENI Measurement Workshop
- June **The ProtoGENI RSpec**, Workshop, Chicago, IL
Talk at the GENI RSpec Workshop
- April **ProtoGENI and the QUILT**, Meeting
Invited talk to the QUILT GENI Working Group
- April **ProtoGENI Security Model**, GEC #4, Miami, FL
- April **Vertical Integration in Emulab and ProtoGENI**, GEC #4, Miami, FL

2008

- October ❖ **ProtoGENI**, GEC #3, Palo Alto, CA
- June ❖ **Large-scale Virtualization in the Emulab Network Testbed**, Paper talk, Boston, MA
Paper talk at the USENIX Annual Technical Conference
- March **Beyond Experiment Control: Experiment Workflow**, GEC #2, Arlington, VA

2007

- October **RSpec: Resource Specification in GENI**, GEC #1, Minneapolis, MN
- April ❖ **The Flexlab Approach To Realistic Evaluation of Networked Systems**, Paper talk, Cambridge, MA
Paper talk at the Symposium on Networked Systems Design and Implementation (NSDI)

2006

- June **Leveraging Bloom Filters for Smart Search Within NUCA Caches**, Paper talk, Boston, MA
Paper talk at the Workshop on Complexity-Effective Design (WCED)

May **Running PlanetLab in Emulab**, Meeting, Palo Alto, CA
Invited talk at a PlanetLab meeting at HP Labs

2005

November **A Mapper for Managing Shared, Virtualized Computing and Network Resources**, San Francisco, CA
Invited talk at INFORMS, an Operations Research and Management Science conference

2004

May ❖ **Resource Mapping With assign**, Colloquium at Boston University, Boston, MA

2003

June ❖ **Fast, Scalable Disk Imaging with Frisbee**, Paper talk, San Antonio, TX
Paper talk at the USENIX Annual Technical Conference

August ❖ **How to Use the Emulab Public Network Testbeds**, Tutorial, Pittsburgh, PA
Full-day tutorial at SIGCOMM, presented with Jay Lepreau, Mac Newbold, and Chris Alfeld