

# Paul Barford

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## Research Interests

Internet data science emphasizing methods for large-scale analytics, data quality, data mining and modeling. Computer networking, emphasizing techniques for measuring Internet protocols, systems, traffic characteristics and topological structure. Computer security emphasizing identification of traffic anomalies, malicious attacks and intrusions.

## Education

<b>PhD. Computer Science</b> Boston University, Boston, MA	2000
<b>B.S. Electrical Engineering</b> University of Illinois, Urbana-Champaign, IL	1985

## Professional Experience

<b>Computer Science Department, Univ. of Wisconsin</b> , Madison, WI Professor, Director of the Wisconsin Advanced Internet Laboratory (Associate Professor: 2008 - 2011, Assistant Professor: 2001 - 2007)	2011 - present
<b>comScore, Inc.</b> Reston, VA Chief Scientist	2014 - 2018
<b>MdotLabs, Inc.</b> Madison, WI Co-founder, Chief Scientist - Mdot was acquired by comScore, Inc. in 2014	2013 - 2014
<b>Qualys, Inc.</b> Redwood Shores, CA Chief Scientist	2010 - 2011
<b>Computer Laboratory, University of Cambridge</b> , Cambridge, UK Visiting Professor	2010 - 2011
<b>Nemean Networks, LLC</b> , Madison, WI Founder, Chief Executive Officer - Nemean was acquired by Qualys, Inc. in 2010	2007 - 2010
<b>Computer Science Department, Boston University</b> , Boston, MA Research Fellow	1995 - 2000
<b>DeGeorge Financial, Inc.</b> , Cheshire, CT Director of Planning and Research	1991 - 1995
<b>Digital Equipment Corporation</b> , Maynard, MA Senior Engineer	1987 - 1991
<b>Mathematics Department, University of Illinois</b> Urbana-Champaign, IL Teaching Assistant	1985 - 1986

## Consulting Experience

Hitwise, Inc.	2018 - 2019
Technical Advisory Board member - Broadcast Interactive Media	2011 - 2014
Board of Directors - National LambdaRail, Inc.	2003 - 2010
Technical Advisory Board member - epicRealm, Inc., Richardson, TX	1999 - 2003
Technical Advisory Board member - Netheartbeat, Inc., Austin, TX	2000 - 2001
Infolibria, Inc. Waltham, MA	1998 - 1999

## Awards and Honors

Boston University Computer Science Department Distinguished Alumnus	2019
IEEE INFOCOM Test of Time Award for "Power Awareness in Network Design and Routing"	2019
IEEE Fellow	2018
Internet Atlas named one of the 100 Greatest Innovations of 2017 - Popular Science Magazine	2017
ACM Fellow	2016
ACM SIGCOMM Global Access to the Internet for All Workshop, Best Paper Award	2016
ACM CoNEXT, Best Short Paper Award	2014
ACM Distinguished Scientist	2014
University of Wisconsin Computer Science Department Carolyn Rosner Excellent Educator Award	2014
Madison Magazine's M List	2013
Honorary professor - Kappa Eta Kappa, Delta Chapter	2013
ACM SIGCOMM HotPlanet Workshop, Best Paper Award - Runner up	2013
ACM SIGKDD, Best Paper Award	2012
ACM SIGKDD, Best Video Award	2012
IEEE Senior Member	2011
UK Engineering and Physical Sciences Research Council, Visiting Fellowship	2010
Wolfson College, University of Cambridge, Visiting Fellowship	2010
IEEE COMSNETS, Best Paper Award	2009
IEEE Symposium on Computers and Communications, selection for fast-track journal publication	2006
National Science Foundation CAREER Award	2004
IEEE Communications Society William R. Bennett Prize in the Field of Communications Circuits and Techniques - Runner up	2002
ACM SIGCOMM, selection for fast-track journal publication	2000

## Professional Activities

### Memberships

NSF/CISE AC Midscale Infrastructure Subcommittee	2012 - 2014
ACM SIGCOMM Nominating Committee	2009
NSF/GENI Facility Architecture Working Group	2006 - 2007
NSF/GENI Instrumentation and Measurement Working Group (co-chair)	2009 - 2012
ACM Internet Measurement Conference Steering Committee	2006 - 2012
ACM, IEEE	

### Editorial Boards

Associate Editor, IEEE/ACM Transactions on Networking	2007 - 2010
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### Program Chairs

ACM SIGCOMM	2013
ACM SIGMETRICS	2010
ACM SIGCOMM First Workshop on Green Networking	2010
ACM Internet Measurement Conference	2006

### Program Committees

ACM Internet Measurement Conference	2001, 2004 – 2007, 2009, 2010, 2014 – 2017
ACM SIGMETRICS	2003, 2004, 2007, 2008, 2010, 2012, 2018
ACM SIGCOMM	2004, 2007, 2011, 2013, 2014, 2019
ACM SIGMETRICS Workshop on GreenMetrics	2009, 2010, 2012
ACM SIGCOMM Workshop on Green Networking	2010, 2011
USENIX Security Symposium	2008, 2009
ACM/USENIX Workshop on Steps to Reduce Unwanted Traffic on the Internet (SRUTI)	2005, 2007
IEEE ICNP	2003, 2012
Passive and Active Measurement Conference	2012, 2014
International Teletraffic Congress (ITC)	2017 - 2019
USENIX Symposium on Networked Systems Design and Implementation (NSDI)	2016
ACM SIGCOMM Workshop on Hot Topics in Software Defined Networks (HotSDN)	2014
ACM/USENIX Workshop on Hot Topics in Networks (HotNets)	2005
ACM/USENIX Workshop on Hot Topics in BotNets (HotBots)	2007
ACM Computer and Communications Security Conference	2008
ACM Workshop on Rapid Malcode (WORM)	2004
ACM CoNEXT Conference	2006
IEEE Workshop on Internet Applications	2003
IEEE 6th International Computer Performance and Dependability Symposium	2002
USENIX 4th International Workshop on Networking Meets Databases (NetDB)	2008
International Conference on Future Energy Systems	2012
International Workshop on Green Communications	2011
Asian Internet Engineering Conference (AINTEC)	2008

Securecomm Conference	2009
Workshop on Performance Evaluation of Next Generation Networks	2009
Workshop on Cyber Security Experimentation and Test	2009
Workshop on Tackling Computer Systems Problems with Machine Learning Techniques (SysML)	2006
Multiresolution Analysis of the Global Internet Workshop	2000
Boston University Workshop on Internet Measurement, Instrumentation and Characterization	1999
World Wide Web Consortium Workshop on Web Characterization	1998

### Organizing Committees

Institute for Computational and Experimental Research in Mathematics (ICERM)	
Workshop on Mathematics of Data Analysis in Cybersecurity	2014
NSF/DIMACS Workshop on Algorithms in the Field	2011
First NSF/GENI Workshop on Network Measurement	2009
Institute for Pure and Applied Mathematics (IPAM)	
Program on Internet Multiresolution Analysis: Foundations, Applications and Practice	2008
Workshop on Internet Signal Processing	2004
IEEE Opensig	2003
IEEE ICNP (tutorials co-chair)	2003
Institute for Pure and Applied Mathematics (IPAM)	
Workshop on Large Scale Networks: Topology, Routing, Traffic and Control	2002, 2003
Computer Science and Telecommunications Board of the National Research Council	
Study on Internet Under Crisis Conditions	2002

### Panelist

National Science Foundation	2002 – 2005, 2007 – 2010, 2012, 2014, 2017, 2018
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### U.S. Patents

1. Keith Funkhouser, Matt Malloy, Ben Itzkowitz, Paul Deitrick, Frank Pecjak and Paul Barford. “Reporting Of Media Consumption Metrics”, Patent Pending, 2018.
2. Jeff Kline, Aaron Cahn and Paul Barford. “Detection and Estimation of Fraudulent Content Attribution”, Patent pending, 2018.
3. Matthew Malloy, Ceyhun Alp and Paul Barford. “Systems and Methods for Generating and Transmitting Content Based on Access from a Common Device”, Patent pending, 2017.
4. Matthew Malloy and Paul Barford. “System and Method for Transmitting Content Based on Co-location”, Patent pending, 2016.
5. Paul Barford and Jeff Kline. “Method and System for Identifying Anomalous Content Requests”, Patent pending, 2016.
6. Matthew Malloy, Scott Alfeld and Paul Barford. “Fraudulent Traffic Detection and Estimation”, Patent pending, 2016.
7. Michael Brown, Rajesh Bashetty, Paul Barford, Kevin Springborn and Jon Koller. “Method and System for Data-Informed Online Advertisement Delivery”, Patent pending, 2015.
8. Charles Thomas and Paul Barford. “System and Process for Detecting Content Blocking Software”, US Patent #10,282,761

9. Paul Barford, Jeff Kline, Sangnam Nam, Dave Plonka and Amos Ron. “Method and Apparatus for Network Anomaly Detection”, US Patent #9,680,693.
10. Joel Sommers, Paul Barford, Nick Duffield and Amos Ron. “Method and Apparatus for Detecting and Localizing an Anomaly for a Network”, US Patent #9,571,366.
11. Joel Sommers, Paul Barford, Nick Duffield and Amos Ron. “A Methodology and Apparatus for Providing a Measurement of Performance for a Network”, US Patent #8,073,945.
12. Paul Barford, Jonathon Giffin, Somesh Jha and Vinod Yegneswaran. “A Semantically-Aware Network Intrusion Signature Generator”, US Patent #8,065,722
13. Vinod Yegneswaran, Paul Barford and David Plonka. “Scalable Monitor for Malicious Network Traffic”, US Patent #8,015,605
14. Paul Barford and David Plonka, “Apparatus and Method for Classifying Network Packet Data”, US Patent #7,907,543

### Refereed Journal Publications and Book Chapters

1. Ram Durairajan and Paul Barford. “A Techno-Economic Framework for Broadband Deployment in Underserved Areas”, In *ACM SIGCOMM Computer Communications Review*, Vol. 47(2), April, 2017.
2. Brian Eriksson, Paul Barford, Bruce Maggs and Rob Nowak. “Posit: A Lightweight Approach for IP Geolocation”, In *ACM SIGMETRICS Performance Evaluation Review*, Vol. 40(2), September, 2012.
3. Paul Barford, Sem Borst and Mark Squillante: Editors. In *Queueing Systems, Theory and Applications*, Vol. 71(3), July, 2012.
4. Brian Eriksson, Gautam Dasarathy, Paul Barford and Rob Nowak. “Efficient Network Tomography for Internet Topology Discovery”, In *IEEE/ACM Transactions on Networking*, Vol. 20(3), pp. 931-943, June, 2012.
5. Brian Eriksson, Paul Barford, Joel Sommers and Rob Nowak. “Inferring Unseen Components of the Internet”, In *IEEE Journal of Selected Areas of Communications*, November, 2011.
6. Mariyam Mirza, Joel Sommers, Paul Barford and Jerry Zhu. “A Machine Learning Approach to TCP Throughput Prediction”, In *IEEE/ACM Transactions on Networking*, Vol. 18(4), pp. 1026-1039, October, 2010.
7. Joel Sommers, Paul Barford, Nick Duffield and Amos Ron. “Multi-objective Monitoring for SLA Compliance”, In *IEEE/ACM Transactions on Networking*, 18(2), pp. 652-665, April, 2010.
8. Jin-Yi Cai, Vinod Yegneswaran, Chris Alfeld and Paul Barford. “Honeynet Games: A Game Theoretic Approach to Defending Network Monitors”, In the *Journal of Combinatorial Optimization*, February, 2010.
9. Paul Barford, Yan Chen, Anup Goyal, Zhichun Li, Vern Paxson and Vinod Yegneswaran. “Employing Honeynets For Network Situational Awareness”, In *Series: Advances in Information Security*, Springer, 2009.
10. Joel Sommers, Paul Barford, Nick Duffield and Amos Ron. “A Geometric Method for Active Packet Loss Measurement”, In *IEEE/ACM Transactions on Networking*, Vol. 16(2), pp. 307-320, April, 2008.
11. Joel Sommers, Paul Barford, Albert Greenberg and Walter Willinger. “A SLA Perspective on Router Buffer Sizing, In *ACM SIGMETRICS Performance Evaluation Review*, Vol. 35(4), pp.40-51, March, 2008.
12. Joel Sommers, Paul Barford and Walter Willinger. “In Vitro Calibration of Available Bandwidth Estimation Tools”, In *Elsevier Microprocessors and Microsystems Journal*, Vol. 31(4), pp. 222-235, June, 2007.

13. Paul Barford and Vinod Yegneswaran. “A Look Inside Botnets”, In *Series: Advances in Information Security*, Springer, pp. 171-191, February, 2007. ISBN: 0-387-32720-7.
14. Paul Barford and Joel Sommers. “Comparing Probe- and Router-based Packet Loss Measurement”, In *IEEE Internet Computing*, Vol. 8(5), pp. 50-56, September, 2004.
15. James Gast and Paul Barford. “Representing the Internet as A Succinct Forest”, In *IEEE Computer Networks*, Vol. 45(1), pp. 35-44, March, 2004.
16. Paul Barford and Larry Landweber. “Bench-style Network Research in an Internet Instance Laboratory”, In *ACM SIGCOMM Computer Communications Review*, Vol. 33(3), pp. 21-26, July, 2003.
17. Paul Barford and Mark Crovella. “Critical Path Analysis of TCP Transactions”, in *IEEE/ACM Transactions on Networking*, Vol. 9(3), pp. 238-248, June 2001.
18. Mark Crovella, Martin Reiser and Christoph Lindemann: editors, “Internet Performance Modeling,” In *Performance Evaluation*, Vol. 42(2-3), pp. 91-108, October, 2000.
19. Paul Barford and Mark Crovella. “Measuring Web Performance in the Wide Area,” in *ACM SIGMETRICS Performance Evaluation Review*, Vol. 27(2), pp. 37-48, September 1999.
20. Paul Barford, Azer Bestavros, Mark Crovella and Adam Bradley. “Changes in Web Client Access Patterns: Characteristics and Caching Implications,” in *World Wide Web*, Special Issue on Characterization and Performance Evaluation, Vol. 2, pp. 15-28, December, 1998.

### Refereed Conference and Workshop Publications

1. Yugali Gullapalli, Jeremy Koritzinsky, Meena Syamkumar, Paul Barford, Ram Durairajan and Joel Sommers. “Bokeh: Obfuscating Physical Infrastructure Maps”, In Proceedings of the ACM SIGSPATIAL Workshop on Location-based Recommendations, Geosocial Networks and Geoadvertising, Chicago, IL, November, 2019.
2. Jeff Kline, Ed Oakes, and Paul Barford. “A URL-based Analysis of WWW Structure and Dynamics”, In Proceedings of the IFIP Network Traffic Measurement and Analysis Conference, Paris, France, June, 2019.
3. Ed Oakes, Jeff Kline, Aaron Cahn, Keith Funkhouser, and Paul Barford. “A Residential Client-side Perspective on SSL Certificates”, In Proceedings of the IFIP Network Traffic Measurement and Analysis Conference, Paris, France, June, 2019.
4. Jeff Kline, Aaron Cahn and Paul Barford. “Placement Laundering and the Complexities of Attribution in Online Advertising”, In Proceedings of the 17th International Conference on WWW/Internet (ICWI 2018), Budapest, Hungary, October, 2018.
5. Sathiya Mani, Ram Durairajan, Paul Barford and Joel Sommers. “An Architecture for IoT Clock Synchronization”, In Proceedings of the 8th International Conference on Internet of Things (IoT 2018), Santa Barbara, CA, October, 2018.
6. Ram Durairajan, Sathiya Mani, Paul Barford, Rob Nowak and Joel Sommers. “TimeWeaver: Opportunistic One Way Delay Measurement via NTP”, In Proceedings of ITC30 - Teletraffic in a Smart World, Vienna, Austria, September, 2018.
7. Keith Funkhouser, Matt Malloy, Enis Ceyhun Alp, Philip Poon and Paul Barford. “Device Graphing by Example”, In Proceedings of ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD), London, UK, August, 2018.
8. Giovanni Comarela, Ram Durairajan, Paul Barford, Dino Christenson and Mark Crovella. “Assessing Candidate Preference through Web Browsing History”, In Proceedings of ACM SIGKDD, Conference on Knowledge Discovery and Data Mining (KDD), London, UK, August, 2018.

9. Meena Syamkumar, Paul Barford and Ram Durairajan. “Deployment Characteristics of “The Edge” in Mobile Edge Computing”, In Proceedings of the ACM SIGCOMM Workshop on Mobile Edge Communications, Budapest, Hungary, August, 2018.
10. Ram Durairajan, Carol Barford and Paul Barford. “Lights Out: Climate Change Risk to Internet Infrastructure”, In Proceedings of the ACM/IRTF/ISOC Applied Networking Research Workshop, Montreal, Canada, July, 2018.
11. Meena Syamkumar, Sathiya Mani, Ram Durairajan, Paul Barford and Joel Sommers. “Wrinkles in Time: Detecting Internet-wide Events via NTP”, In *Proceedings of the IFIP Networking*, Zurich, Switzerland, May, 2018.
12. Joel Sommers, Ram Durairajan and Paul Barford. “Automatic Metadata Generation for Active Measurement”, In *Proceedings of the ACM Internet Measurement Conference*, London, UK, November, 2017.
13. Jeff Kline, Aaron Cahn, Paul Barford and Joel Sommers. “On the Structure and Characteristics of User Agent Strings”, In *Proceedings of the ACM Internet Measurement Conference*, London, UK, November, 2017.
14. Matthew Malloy, Paul Barford, Enis Ceyhan Alp, Jon Koller and Adria Jewell. “Internet Device Graphs”, In *Proceedings of the ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD)*, Halifax Nova Scotia, August, 2017.
15. Scott Alfeld, Jerry Zhu and Paul Barford. “Explicit Defense Actions Against Test-Set Attacks”, In *Proceedings of the Conference on Artificial Intelligence (AAAI)*, San Francisco, CA, February, 2017.
16. Sathiya Mani, Ram Durairajan, Paul Barford and Joel Sommers. “MNTP: Enhancing Time Synchronization for Mobile Devices,” In *Proceedings of the ACM Internet Measurement Conference*, Santa Monica, CA, November, 2016.
17. Matt Malloy, Mark McNamara, Aaron Cahn and Paul Barford. “Ad Blockers: Global Prevalence and Impact,” In *Proceedings of the ACM Internet Measurement Conference*, Santa Monica, CA, November, 2016.
18. Meena Syamkumar, Ram Durairajan and Paul Barford. “Bigfoot: A Geo-based Visualization Methodology for Detecting BGP Threats”, In *Proceedings of the IEEE Symposium on Visualization for Cybersecurity (VizSec)*, Baltimore, MD, October, 2016.
19. Charles Thomas, Jeff Kline and Paul Barford. “IntegraTag: a Framework for High-Fidelity Web Client Measurement”, In *Proceedings of ITC 28 Conference*, Wurzburg, Germany, September, 2016.
20. Aaron Cahn, Scott Alfeld, Paul Barford and S. Muthukrishnan. “What’s in the Community Cookie jar”, In Proceedings of the *IEEE/ACM Conference on Advances in Social Network Analysis and Mining (ASONAM ’16)*, San Francisco, CA, August, 2016.
21. Ram Durairajan and Paul Barford. “A Techno-Economic Framework for Broadband Deployment in Underserved Areas”, In Proceedings of the *ACM SIGCOMM Global Access to the Internet for All (GAIA) Workshop*, Florianopolis, Brazil, August, 2016.
22. Aaron Cahn, Scott Alfeld, Paul Barford and S. Muthukrishnan. “An Empirical Study of Web Cookies”, In *Proceedings of the World Wide Web Conference (WWW ’16)*, Montreal, CA, April, 2016.
23. Scott Alfeld, Jerry Zhu and Paul Barford. “Data Poisoning Attacks against Autoregressive Models”, In *Proceedings of the Conference on Artificial Intelligence (AAAI)*, Phoenix, AZ, February, 2016.
24. Ram Durairajan, Sathiya Kumaran, Joel Sommers and Paul Barford. “Times Forgotten: Using NTP to understand Internet Latency”, In *Proceedings of ACM Workshop on Hot Topics in Networks (HotNets)*, Philadelphia, PA, November, 2015.

25. Ram Durairajan, Paul Barford, Joel Sommers and Walter Willinger. “InterTubes: A Study of the US Long-haul Fiber-optic Infrastructure”, In *Proceedings of ACM SIGCOMM*, London, UK, August 2015.
26. Mukta Gupta, Ram Durairajan, Meena Syamkumar, Paul Barford and Joel Sommers. “pfs: Parallelized, Flow-based Network Simulation”, In *Proceedings of ACM SummerSim*, Chicago, IL, July 2015.
27. Matt Malloy, Scott Alfeld and Paul Barford. “Contamination Estimation via Convex Relaxations”, In *Proceedings of IEEE International Symposium on Information Theory*, Hong Kong, June, 2015.
28. Ram Durairajan, Joel Sommers and Paul Barford. “Controller-agnostic SDN Debugging”, In *Proceedings of ACM CoNEXT*, Sydney, Australia, December, 2014.
29. Oliver Hohlfeld, Enric Pujol, Florin Ciucu, Anja Feldmann and Paul Barford. “A QoE Perspective on Sizing Network Buffers”, In *Proceedings of the ACM Internet Measurement Conference*, Vancouver, BC, November, 2014.
30. Ram Durairajan, Joel Sommers and Paul Barford. “Layer 1-Informed Internet Topology Measurement”, In *Proceedings of the ACM Internet Measurement Conference*, Vancouver, BC, November, 2014.
31. Scott Alfeld and Paul Barford. “Targeted Residual Analysis for Improving Electric Load Forecasting”, In *Proceedings of the IEEE Energy Conference (Energycon '14)*, Dubrovnik, Croatia, May, 2014.
32. Paul Barford, Igor Canadi, Darja Krushevska, Qiang Ma and S. Muthukrishnan. “Adscape: Harvesting and Analyzing Online Display Ads”, In *Proceedings of the World Wide Web Conference (WWW '14)*, Seoul, South Korea, April, 2014.
33. Brian Eriksson, Ram Durairajan and Paul Barford. “RiskRoute: A Framework for Mitigating Network Outage Threats”, In *Proceedings of ACM CoNEXT*, Santa Barbara, CA, December, 2013.
34. Kevin Springborn and Paul Barford. “Impression Fraud in On-line Advertising via Pay-Per-View Networks”, In *Proceedings of the 22nd USENIX Security Symposium*, Washington, DC, August, 2013.
35. Mukta Gupta, Joel Sommers and Paul Barford. “Fast, Accurate Simulation for SDN Prototyping”, In *Proceedings of the ACM SIGCOMM Workshop on Hot Topics in Software Defined Networking (HotSDN)*, Hong Kong, August, 2013.
36. Ram Durairajan, Subadip Ghosh, Xin Tang, Paul Barford and Brian Eriksson “Internet Atlas: A Geographic Database of the Internet”, In *Proceedings of the 5th ACM SIGCOMM HotPlant Workshop Conference*, Hong Kong, August, 2013.
37. Joe Chabarek and Paul Barford. “Whats in a Name? Decoding Router Interface Names”, In *Proceedings of the 5th ACM SIGCOMM HotPlant Workshop Conference*, Hong Kong, August, 2013.
38. Joe Chabarek, Sujata Banerjee, Puneet Sharma, Jayaram Mudigonda and Paul Barford. “Networks of Tiny Switches (NoTS): In Search of Network Power Efficiency and Proportionality”, In *Proceedings of the 5th Workshop on Energy-Efficient Design*, Tel Aviv, Israel, June, 2013.
39. Joe Chabarek and Paul Barford. “EnergyAudit: Monitoring Power Consumption in Diverse Network Environments”, In *Proceedings of the 4th International Green Computing Conference (IGCC '13)*, Arlington, VA, June, 2013.
40. Dave Plonka and Paul Barford. “Assessing Performance of Internet Services on IPv6”, In *Proceedings of IEEE Symposium on Computers and Communications (ISCC 13)*, Split, Croatia, July, 2013.
41. Joel Sommers and Paul Barford. “Cell vs. WiFi: On the Performance of Metro Area Mobile Connections”, In *Proceedings of the ACM Internet Measurement Conference*, Boston, MA, November, 2012.
42. Igor Canadi, Paul Barford and Joel Sommers. “Revisiting Broadband Performance”, In *Proceedings of the ACM Internet Measurement Conference*, Boston, MA, November, 2012.



43. Qi Ding, Natallia Katenka, Paul Barford, Eric Kolaczyk and Mark Crovella. “Intrusion as (Anti)social Communication: Characterization and Detection”, In *Proceedings of the ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD)*, Beijing, China, August, 2012.
44. Charles Thomas, Joel Sommers, Paul Barford, Dongchan Kim, Ananya Das, Roberto Segebre and Mark Crovella. “A Passive Measurement System for Network Testbeds”, In *Proceedings of Tridentcom*, Thessaloniki, Greece, June, 2012.
45. Scott Alfeld, Carol Barford and Paul Barford. “Toward an Analytic Framework for the Electrical Power Grid”, In *Proceedings of the Third International Conference on Future Energy Systems (e-Energy)*, Madrid, Spain, May, 2012.
46. Joel Sommers, Paul Barford and Ben Liblit. “A Router Primitive Approach for Building Diverse Network Services”, In *Proceedings of the International Conference on Communication Systems and Networks*, Bangalore, India, January, 2012.
47. Joel Sommers, Brian Eriksson and Paul Barford. “On the Prevalence and Characteristics of MPLS Deployments in the Open Internet”, In *Proceedings of the ACM Internet Measurement Conference*, Berlin, Germany, November, 2011.
48. Joe Chabarek and Paul Barford. “Power-Awareness Extensions for Network Testbeds”, In *Proceedings of the Fourth ICC Workshop on Green Communications*, Kyoto, Japan, June, 2011.
49. Dave Plonka and Paul Barford. “Flexible Traffic and Host Profiling via DNS Rendezvous”, In *Proceedings of the Workshop on Securing and Trusting Internet Names (SATIN '11)*, London, UK, April, 2011.
50. Mariyam Mirza, Paul Barford, Xiaojin Zhu, Suman Banerjee and Mike Blodgett. “Fingerprinting 802.11 Rate Adaptation Algorithms”, In *Proceedings of IEEE INFOCOM*, Shanghai, China, April, 2011.
51. Joel Sommers, Rhys Bowden, Brian Eriksson, Paul Barford, Matt Roughan and Nick Duffield. “Efficient Network-wide Flow Record Generation”, In *Proceedings of IEEE INFOCOM*, Shanghai, China, April, 2011.
52. Brian Eriksson, Paul Barford, Rob Nowak and Joel Sommers. “Ghost in the Machine: Inferring Unseen Components in the Internet Core”, In *Proceedings of IEEE INFOCOM (Mini-Conference)*, Shanghai, China, April, 2011.
53. Brian Eriksson, Paul Barford, Rhys Bowden, Nick Duffield, Joel Sommers and Matt Roughan. “BasisDetect: A Model-based Network Event Detection Framework”, In *Proceedings of the ACM Internet Measurement Conference*, Melbourne, Australia, November, 2010.
54. Brian Eriksson, Paul Barford, Joel Sommers and Rob Nowak. “A Learning-based Approach to IP Geolocation”, In *Proceedings of the Passive and Active Measurement Conference (PAM '10)*, Zurich, Switzerland, April, 2010.
55. Brian Eriksson, Gautam Dasarathy, Paul Barford and Rob Nowak. “Toward the Practical Use of Network Tomography for Internet Topology Discovery”, In *Proceedings of IEEE INFOCOM*, San Diego, CA, March, 2010.
56. Joel Sommers, Paul Barford and Mark Crovella. “Router Primitives for Programmable Active Measurement”, In *Proceedings of ACM SIGCOMM PRESTO Workshop*, Barcelona, Spain, August, 2009.
57. Mariyam Mirza, Kevin Springborn, Suman Banerjee, Mike Blodgett and Jerry Zhu. “On the Accuracy of TCP Throughput Prediction for Opportunistic Wireless Networks”, In *Proceedings of IEEE Conference on Sensor, Mesh and Ad Hoc Communications and Networks (SECON '09)*, Rome, Italy, June, 2009.
58. Jin-Yi Cai, Vinod Yegneswaran, Chris Alfeld and Paul Barford. “An Attacker-Defender Game for Honeynets”, In *Proceedings of the the 15th International Computer and Combinatorics Conference (COCON '09)*, Niagara Falls, NY, June, 2009.

59. Paul Barford, Nick Duffield, Amos Ron and Joel Sommers. “Network Performance Anomaly Detection and Localization”, In *Proceedings of IEEE INFOCOM*, Rio de Janeiro, Brazil, April, 2009.
60. Brian Eriksson, Paul Barford and Rob Nowak. “Estimating Hop Distance Between Arbitrary Host Pairs”, In *Proceedings of IEEE INFOCOM*, Rio de Janeiro, Brazil, April, 2009.
61. Archit Gupta, Pavan Kuppili, Aditya Akella and Paul Barford. “An Empirical Study of Malware Evolution”, In *Proceedings of the Conference on Communications Systems and Networks (COMSNETS '09)*, Bangalore, India, January, 2009.
62. Dave Plonka and Paul Barford. “Context-aware Clustering of DNS Query Traffic”, In *Proceedings of ACM Internet Measurement Conference*, Vouliagmeni, Greece, October, 2008.
63. Brian Eriksson, Paul Barford and Rob Nowak. “Network Discovery From Passive Measurements”, In *Proceedings of ACM SIGCOMM*, Seattle, WA, August, 2008.
64. Jeff Kline, Sangnam Nam, Paul Barford, Dave Plonka and Amos Ron. “Traffic Anomaly Detection at Fine Time Scales with Bayes Nets”, In *Proceedings of the International Conference on Internet Monitoring and Protection (ICIMP '08)*, Bucharest, Romania, June, 2008.
65. Joe Chabarek, Joel Sommers, Paul Barford, Cristian Estan, Steve Wright and David Tsiang. “Power Awareness in Network Design and Routing”, In *Proceedings of IEEE INFOCOM*, Phoenix, AZ, April, 2008.
66. Zesheng Chen, Chuanyi Ji and Paul Barford. “Spatial-Temporal Characteristics of Internet Malicious Sources”, In *Proceedings of IEEE INFOCOM (Mini-Conference)*, Phoenix, AZ, April 2008.
67. Joel Sommers and Paul Barford. “An Active Measurement System for Shared Environments”, In *Proceedings of ACM Internet Measurement Conference*, San Diego, CA, October, 2007.
68. Brian Eriksson, Paul Barford, Robert Nowak and Mark Crovella. “Learning Network Structure from Passive Measurements”, In *Proceedings of ACM Internet Measurement Conference*, San Diego, CA, October, 2007.
69. Joel Sommers, Paul Barford, Nick Duffield and Amos Ron. “Efficient Network-wide SLA Compliance Monitoring”, In *Proceedings of ACM SIGCOMM*, Kyoto, Japan, August, 2007.
70. Mariyam Mirza, Joel Sommers, Paul Barford and Jerry Zhu. “A Machine Learning Approach to TCP Throughput Estimation”, In *Proceedings of ACM SIGMETRICS*, pp. 97-108, San Diego, CA, June, 2007.
71. Vinod Yegneswaran, Chris Alfeld, Paul Barford and Jin-Yi Cai. “Camouflaging Honeynets”, In *Proceedings of IEEE Global Internet Symposium*, Anchorage, AK, May, 2007.
72. Joel Sommers, Paul Barford, Nick Duffield and Amos Ron. “A Framework for Multi-objective SLA Compliance Monitoring”, In *Proceedings of IEEE INFOCOM (Mini-Conference)*, pp. 2436-2440, Anchorage, AK, May, 2007.
73. Paul Barford and Mike Blodgett. “Toward Botnet Mesocosms”, In *Proceedings of the USENIX First Workshop on Hot Topics in Understanding Botnets (Hotbots '07)*, Cambridge, MA, April, 2007.
74. Lei Chen, Raghu Ramakrishnan, Paul Barford, Beechung Chen and Vinod Yegneswaran. “Composite Subset Measures”, In *Proceedings of the 32nd International Conference on Very Large DataBases (VLDB '06)*, pp. 403-414, Seoul, Korea, September, 2006.
75. Mark Allman, Paul Barford, Balachander Krishnamurthy and Jia Wang. “Tracking the Role of Adversaries in Measuring Unwanted Traffic”, In *Proceedings of the USENIX Second Workshop on Steps to Reducing Unwanted Traffic on the Internet (SRUTI '06)*, pp. 37-42, San Jose, CA, July, 2006.

76. Joel Sommers, Paul Barford and Walter Willinger. "A Proposed Framework for Calibration of Available Bandwidth Measurement Tools", In *Proceedings of IEEE Symposium on Computers and Communications (ISCC '06)*, pp. 709-718, Sardinia, Italy, June, 2006.
77. Yolanda Tsang, Mehmet Yildiz, Paul Barford and Robert Nowak. "On the Performance of Round Trip Time Network Tomography", In *Proceedings of IEEE Conference on Communications (ICC '06)*, pp. 483-488, Istanbul, Turkey, June, 2006.
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81. Paul Barford, Robert Nowak, Rebecca Willett, and Vinod Yegneswaran. "Toward a Model for Sources of Internet Background Radiation" In *Proceedings of Passive and Active Measurement Conference (PAM '06)*, pp. 211-220, Adelaide, Australia, March, 2006.
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83. Shilpi Agarwal, Joel Sommers and Paul Barford. "Scalable Network Path Emulation", In *Proceedings of the IEEE International Symposium on Modeling, Analysis and Simulation of Computer and Telecommunication Systems (MASCOTS '05)*, pp. 219-228, Atlanta, GA, September, 2005.
84. Joel Sommers, Paul Barford, Nick Duffield and Amos Ron. "Improving Accuracy in End-to-end Packet Loss Measurements", In *Proceedings of ACM SIGCOMM*, pp. 157-168, Philadelphia, PA, August, 2005.
85. Vinod Yegneswaran, Jon Giffin, Paul Barford, Somesh Jha. "An Architecture for Generating Semantic-Aware Signatures", In *Proceedings of the USENIX Security Symposium*, pp. 97-112, Baltimore, MD, August, 2005.
86. Rouming Pang, Vinod Yegneswaran, Paul Barford, Vern Paxson and Larry Peterson. "Characteristics of Internet Background Radiation", In *Proceedings of ACM Internet Measurement Conference*, pp. 27-40, Taormina, Italy, October, 2004.
87. Yolanda Tsang, Mehmet Yildiz, Paul Barford and Robert Nowak. "Network Radar: Tomography from Round Trip Time Measurements", In *Proceedings of ACM Internet Measurement Conference*, pp. 175-180, Taormina, Italy, October, 2004.
88. Joel Sommers and Paul Barford. "Self-Configuring Network Traffic Generation", In *Proceedings of ACM Internet Measurement Conference*, pp. 68-81, Taormina, Italy, October, 2004.
89. Joel Sommers, Vinod Yegneswaran and Paul Barford. "A Framework for Malicious Workload Generation", In *Proceedings of ACM Internet Measurement Conference*, pp. 82-87, Taormina, Italy, October, 2004.
90. Vinod Yegneswaran, Paul Barford and David Plonka. "On the Design and Use of Internet Sinks for Network Abuse Monitoring", In *Proceedings of the Symposium on Recent Advances in Intrusion Detection (RAID '04)*, pp. 146-165, Sophia Antipolis, France, September, 2004.

91. Vinod Yegneswaran, Paul Barford and Somesh Jha. “Global Intrusion Detection in the DOMINO Overlay System”, In *Proceedings of Network and Distributed Systems Security Symposium (NDSS '04)*, pp. 79-95, San Diego, CA, February, 2004.
92. Jim Gast and Paul Barford. “Evaluating and Modeling Window Synchronization in Highly Multiplexed Flows”, In *Proceedings of IEEE the 6th Workshop on Workload Characterization*, pp. 51-61, Austin, TX, October, 2003.
93. Vinod Yegneswaran, Paul Barford and Johannas Ullrich. “Internet Intrusions: Global Characteristics and Prevalence”, In *Proceedings of ACM SIGMETRICS*, pp. 138-147, San Diego, CA, June, 2003.
94. Paul Barford, Jeff Kline, David Plonka, Amos Ron. “A Signal Analysis of Network Traffic Anomalies”, In *Proceedings of ACM SIGCOMM Internet Measurement Workshop*, pp. 71-82, Marseilles, France, November, 2002.
95. Jim Gast and Paul Barford. “Resource Deployment based on Autonomous System Clustering”, In *Proceedings of IEEE Global Telecommunications Conference (Globcom '02)*, pp. 2240-2244, Taipei, Taiwan, October, 2002.
96. Paul Barford, Azer Bestavros, John Byers and Mark Crovella. “On the Marginal Utility of Network Topology Measurements”, In *Proceedings of ACM SIGCOMM Internet Measurement Workshop*, pp. 5-17, San Francisco, CA, November, 2001.
97. Paul Barford and David Plonka. “Characteristics of Network Traffic Flow Anomalies”, In *Proceedings of ACM SIGCOMM Internet Measurement Workshop*, pp. 69-73, San Francisco, CA, November, 2001
98. Paul Barford and Mark Crovella. “Critical Path Analysis of TCP Transactions”, In *Proceedings of ACM SIGCOMM*, pp. 127-138, Stockholm, Sweden, August, 2000.
99. Paul Barford and Mark Crovella. “A Performance Evaluation of Hyper Text Transfer Protocols,” in *Proceedings of the ACM SIGMETRICS*, pp. 188-197, Atlanta, GA, May, 1999.
100. Paul Barford and Mark Crovella. “Generating Representative Web Workloads for Network and Server Performance Evaluation,” in *Proceedings of the ACM SIGMETRICS*, pp. 151-160, Madison, WI, June 1998.
101. Mark Crovella and Paul Barford. “The Network Effects of Prefetching,” in *Proceedings of the IEEE INFOCOM*, pp. 1232-1239, San Francisco, CA, April 1998.
102. Quinn Canfield, Paul Barford, Paul Kinzelman and Cary Trlica. “A System Simulation Environment,” in *Proceedings of Computer Design: VLSI in Computers and Processors (ICCD '89)*, pp. 555-560, Cambridge, MA, 1989.

## National Reports

1. Paul Barford (Ed.). “GENI Measurement and Instrumentation Specification”, Global Environment for Network Innovations Technical Document GDD-06-12, September, 2006.
2. Computer Science and Telecommunications Board, National Research Council. “The Internet Under Crisis Conditions: Learning from September 11,” *National Academy Press*, November, 2002. ISBN: 0-309-08702-3.

## Posters, Abstracts and Invited Papers

1. Scott Alfeld, Jerry Zhu and Paul Barford. “Machine Teaching as Search”, In *the Symposium on Combinatorial Search - short paper*, Tarrytown, NY, July, 2016.
2. Scott Alfeld, Jerry Zhu and Paul Barford. “Optimal Defense Actions Against Test-Set Attacks”, In *the ICML Workshop on Reliable Machine Learning in the Wild - extended abstract*, New York, NY, July, 2016.

3. Ram Durairajan, Joel Sommers and Paul Barford. "Off: Bugspray for Openflow", In *Proceedings of the ACM HotSDN Workshop - poster session*, Chicago, IL, August, 2014.
4. Joel Sommers and Paul Barford. "Comparing Metro-area Cellular and WiFi Performance", In *Proceedings of ACM SIGMETRICS - poster session*, London, UK, June, 2012.
5. Dave Plonka and Paul Barford. "Network Anomaly Confirmation, Diagnosis and Remediation", In *Proceedings of the Allerton Conference on Communication, Control and Computing*, Monticello, IL, October, 2009.
6. Joel Sommers, Vinod Yegneswaran and Paul Barford. "Recent Advances in Network Intrusion Detection System Tuning". In *Proceedings of the 40th IEEE Conference on Information Science Systems*, pp. 1490-1495, Princeton, NJ, March, 2006.
7. Paul Barford, Somesh Jha and Vinod Yegneswaran. "Fusion and Filtering in Network Intrusion Detection", In *Proceedings of the Allerton Conference on Communication, Control and Computing*, pp. 1546-1556, Monticello, IL, October, 2004.
8. Guido Appenzeller, Nick McKeown, Joel Sommers and Paul Barford. "Recent Results on Sizing Router Buffers", In *Proceedings of the Network Systems Design Conference*, San Jose, CA, October, 2004.
9. Joel Sommers, Hyungsuk Kim and Paul Barford. "Harpoon: A Flow-Level Traffic Generator for Router and Network Tests", In *Proceedings of ACM SIGMETRICS - poster session*, pp. 392-393, New York, NY, June, 2004.
10. Paul Barford and Larry Landweber. "Bench-style Network Research in an Internet Instance Laboratory", In *Proceedings of SPIE ITCOM*, pp. 175-183, Boston, MA, August, 2002.
11. Paul Barford and Mark Crovella. "Critical Path Analysis of TCP Transactions", In *Proceedings of ACM SIGCOMM Latin America*, San Jose, Costa Rica, April 2001.

## Other Publications

### Technical Reports

1. Ramakrishnan Durairajan, Paul Barford, Joel Sommers and Walter Willinger. "GreyFiber: A System for Providing Flexible Access to Wide-Area Connectivity", arXiv:1807.05242, July, 2018.
2. Ramakrishnan Durairajan, Sathiya Kumaran Mani, Paul Barford, Rob Nowak, Joel Sommers. "TimeWeaver: Opportunistic One Way Delay Measurement via NTP", arXiv:1801.02123, January, 2018.
3. Paul Barford, Craig Partridge and Walter Willinger. "Internet Multi-Resolution Analysis: A Vision and Framework in Support of Representing, Analyzing and Visualizing Internet Measurements", UW Technical Report #1646, September, 2008.
4. Jin-Yi Cai, Vinod Yegneswaran, Chris Alfeld, and Paul Barford. "Honeygames: A Game Theoretic Approach to Defending Network Monitors", UW Technical Report #1577, December, 2006.
5. Joel Sommers, Paul Barford, Albert Greenberg and Walter Willinger. "An SLA Perspective on the Router Buffer Sizing Problem", UW Technical Report #1569, July, 2006.
6. Joel Sommers, Vinod Yegneswaran and Paul Barford. "Toward Comprehensive Traffic Generation for Online IDS Evaluation", UW Technical Report #1525, May, 2005.
7. Paul Barford and Joel Sommers. "On the Precision of Active Probes for Packet Loss", UW Technical Report #1442, September, 2002.
8. Paul Barford, David Donoho, Georgina Flesia and Vinod Yegneswaran, "Characteristics of Network Delays in Wide Area File Transfers," UW Technical Report #1443, July, 2002.
9. Paul Barford, Jin-Yi Cai and Jim Gast. "Cache Placement Methods Based on Client Demand Clustering," UW Technical Report #1437, June, 2001.

### Position Papers and Notes

1. Paul Barford. “Information and Communication Technology and Innovation: How the US can Maintain its Technology Edge and Defend Against Technological Threats”, Position paper for The Tobin Project meeting on Sustainable National Security Strategy, October, 2011.
2. Paul Barford. “Measurement as a First Class Network Citizen,” Position paper for NSF Workshop on the Next Generation Secure Internet, July, 2005.
3. Vijayan Prabhakaran, Joseph Stanley and Paul Barford. “High Throughput Data Transfers using the Tornado Transport Protocol,” November, 2002.
4. Paul Barford and David Plonka. “Inferring Client Experience from Flow-based Measurements,” July, 2001.
5. Paul Barford. “Global Internet Measurement Infrastructure,” Position paper for NSF Large Scale Networking Workshop, March, 2001.

## Tutorials

1. Paul Barford and Vishal Misra “Measurement, Modeling and Analysis of the Internet,” Presented at:
  - *IMA Workshop on Internet Measurement and Modeling* , Minneapolis, MN, January, 2004.
2. Paul Barford. “Internet-wide Measurement Infrastructures,” Presented at:
  - *IPAM Workshop on Large Scale Communications Networks* , Los Angeles, CA, March, 2002.
3. Paul Barford. “Web Server Performance Analysis,” Presented at:
  - *ACM SIGMETRICS '99*, Atlanta, GA, April, 1999.
  - *IEEE Local Area Networks '99*, Lowell, MA, October, 1999.

## Selected Invited Talks, Panels and Workshops in the Past Decade

1. Invited talk, Oxford University Computer Science Department, 2019.
2. Commencement Speech, Boston University Computer Science Department, 2019.
3. Keynote talk, NANOG 74, Vancouver, BC, October, 2018.
4. Invited talk, Workshop on Challenges of Data and Control of Networks, Adelaide, Australia, December, 2017.
5. Invited talk, Broadband Internet Technical Advisory Group, October, 2017.
6. Invited talk, INTERACT Conference, Lisbon, Portugal, May 2016.
7. Invited talk, Federal Communications Commission, Washington, DC, April, 2016.
8. Invited talk, Science of Security Speaker Series, University of Illinois, Urbana, IL, October, 2015.
9. Invited talk, Google Inc., Mountain View, CA, July, 2015.
10. Invited panelist, Asia Banking CEO RoundTable, Tokyo, Japan, November, 2014.
11. Invited talk, NANOG 61, Bellevue, WA, June, 2014.
12. Invited talk, Symantec Corp., Mountain View, CA, June, 2013.
13. Invited talk, Deutsche Telekom Labs, Berlin, Germany, March, 2013.
14. Distinguished lecture, NEC Corp., Princeton, NJ, September, 2012.
15. Invited talk, NSF Washington Area Trustworthy Computer Hour (WATCH), Arlington, VA, February, 2012.

16. Invited talk, Security Innovations Network Summit, Cambridge, MA, October, 2011.
17. Invited talk, Computer Laboratory, University of Cambridge, Cambridge, UK, November, 2010.
18. Distinguished lecture, Computer Science Department, University of California - Irvine, Irvine, CA, February, 2010.
19. Distinguished lecture, Computer Science Department, University of Utah, Salt Lake City, UT, August, 2009.
20. Invited talk, Fifth Computer Network Defense Research & Technology Workshop, Annapolis Junction, MD, June, 2009.
21. Invited talk, American Mathematical Society, Special Session on The Mathematics of Information and Knowledge, Washington, DC, January, 2009.

### **Grants and Gifts**

1. “Datasets, Methods and Tools for Internet Security Decision Analytics”, Department of Homeland Security, P. Barford PI, \$500K, 2017 - 2019.
2. “SaTC: Large: Investigating the Susceptibility of the Internet Topology to Country-level Connectivity Disruption and Manipulation”, National Science Foundation, P. Barford co-PI, \$1.4M 2017 - 2020.
3. “A Holistic Approach to Data Analytics Services in Cloud Environments”, Laboratory for Telecommunication Sciences, P. Barford PI, \$578K, 2015 - 2017.
4. “Diverse Data Sets for PREDICT” Department of Homeland Security, P. Barford PI, \$765K, 2012 - 2017.
5. “Spatio-temporal Analysis of Current Power Generation and Potential Bioenergy Substitution in the GLBRC Region”, UW-Madison BACTER Institute for Computational Biology, P. Barford co-PI, \$50K, 2011 - 2012.
6. “Information and Software Assurance: A Coordinated Approach to Cyber-Situation Awareness Based on Traffic Anomaly Detection”, Army Research Office, P. Barford co-PI, \$800K, 2011 - 2015.
7. “Toward Strategies for Power Aware Networking”, Engineering and Physical Sciences Research Council, UK, P. Barford PI, £100K, 2010 - 2011.
8. “TC: Medium: Collaborative Research: Wide-Aperture Traffic Analysis for Internet Security”, National Science Foundation, P. Barford co-PI, \$1M, 2009 - 2014.
9. “CT-M: Meta-Environments for Experiments on Diverse Topics in Network Security”, National Science Foundation, P. Barford PI, \$850K, 2008 - 2012.
10. “Instrumentation and Measurement for GENI”, BBN, P. Barford PI, \$499K, 2008 - 2011.
11. “Collaborative Research: CT-T: Logic and Data Flow Extraction for Live and Informed Malware Execution”, National Science Foundation, P. Barford PI, \$1.1M, 2007 - 2010.
12. “Virtual Center for Network and Security Data”, Department of Homeland Security, P. Barford PI, \$336K, 2007 - 2012.
13. “Collaborative Research: CRI: CRD Synthetic Traffic Generation Tools and Resources: A Community Resource for Experimental Networking Research”, P. Barford co-PI, \$60K, 2007 - 2008.
14. “Collaborative HoneyStream Analytics Exploitation System (CHAES)”, Department of Homeland Security, P. Barford PI, \$30K, 2006 - 2007.
15. “Requirements Driven Resource Allocation in Next Generation Routers”, Cisco Systems donation, P. Barford PI, \$175K, 2006.

16. "GENI Instrumentation and Measurement Systems (GIMS)", National Science Foundation, P. Barford PI, \$150K, 2006 - 2008.
17. "Cyber Threat Analytics", Army Research Office, P. Barford PI, \$100K, 2006 - 2007.
18. "NeTS-FIND: Design for Manageability in the Next Generation Internet", National Science Foundation, P. Barford PI, \$650K, 2006 - 2008.
19. "Infrastructure to Support Cyberforensics", Army Research Office, P. Barford PI, \$350K, 2005 - 2006.
20. "Self Directed Intrusion Detection", Army Research Office, P. Barford PI, \$30K, 2004 - 2005.
21. "Datasets for Network Security", Department of Homeland Security, P. Barford PI, \$274K, 2004 - 2007.
22. "Student Travel Grant Support for the First Workshop on Internet Signal Processing", National Science Foundation, P. Barford PI, \$10.5K, 2004.
23. "CAREER: A Multiresolution Approach to Network Anomaly and Intrusion Detection", National Science Foundation, \$501K, P. Barford PI, 2004 - 2009.
24. "An Integrated Program for Content Addressable Storage Research", EMC Corporation, \$590K, P. Barford PI, December, 2003 - 2004.
25. "Evaluating Buffer Behavior in High Performance Routers", Cisco Systems University Research Program, \$92K, P. Barford PI, 2003 - 2004.
26. "MRI: Acquisition of the GLOW Distributed Computing System at the University of Wisconsin - Madison", National Science Foundation, \$2M, P. Barford co-PI, 2003 - 2004.
27. "NMI: An Integrative Testing Framework for Grid Middleware and Grid Environments", National Science Foundation, \$1.8M, P. Barford co-PI, 2003 - 2005.
28. "Collaborative ITR: Modular Strategies for Internetwork Monitoring", National Science Foundation, \$1M, P. Barford co-PI, August, 2003-2007.
29. "NRT: Collaborative Research: A Unified Experimental Environment for Diverse Networks", National Science Foundation, \$4.4M, P. Barford co-PI, 2003 - 2007.
30. "Data Center Traffic Monitoring and Control". Intel Corporation. \$145K. P. Barford PI. 2003 - 2005.
31. "Distributed Storage Research in the Wisconsin Advanced Internet Lab," EMC Corporation, PI, \$1M, 2002.
32. "Distributed Anomaly Characterization and Detection," Army Research Office, P. Barford PI, \$320K, 2002-2005.
33. "The Wisconsin Advanced Internet Laboratory," Cisco Systems/TOSA Foundation, P. Barford PI, \$3.2M, 2002.
34. "The Wisconsin Advanced Internet Laboratory," Sun Microsystems, P. Barford PI, \$135k, 2002.
35. "The Wisconsin Advanced Internet Laboratory," Intel, P. Barford PI, \$50k, 2002.
36. "Network Measurement and Management," Fujitsu Labs America, P. Barford PI, \$25K, 2002.
37. "iSWORD: Instrumented Streaming Research and Testbed," National Science Foundation, P. Barford co-PI, \$800K, 2001 - 2004
38. "Particle Physics Data Grid Collaboratory Pilot," Department of Energy, P. Barford co-PI, \$1.5M, 2001 - 2004.



## Student Supervision

### Current Students

Meenakshi Syamkumar - 7th year PhD., UW Computer Science Department

Shreeshrita Patnaik - 2nd year PhD., UW Computer Science Department

Alex Anderson - 2nd year PhD., UW Computer Science Department

Scott Anderson - 1st year MS., UW Computer Science Department

### Former Students

Sathiya Kumaran (PhD. '19) Scientist, Microsoft Research

Ram Durairajan (PhD. '17) - Assistant Professor, University of Oregon

Scott Alfeld (PhD. '17) - Assistant Professor, Amherst College

David Plonka (PhD. '13) - Scientist, Akamai

Joe Chabarek (PhD. '13) - Scientist, Amazon

Mariyam Mirza (PhD. '12) - Scientist, United Technologies

Brian Eriksson (PhD. '10) - Scientist, Adobe

Joel Sommers (PhD. '07) - Professor, Colgate University

Chris Alfeld (PhD. '07) - Engineer, Google

Vinod Yegneswaran (PhD. '06) - Senior Scientist, SRI International

James Gast (PhD. '03) - Senior Specialist, TDS Telecom

Yuguali Gullapalli (MS. '19) - Engineer, Microsoft

Aaron Cahn (MS. '15) - Data scientist, comScore

Mukta Gupta (MS. '14) - Engineer, Google

Igor Canadi (MS. '13) - Engineer, Facebook

Xin Tang (MS. '13) - Engineer, Amazon

Subhadip Ghosh (MS. '12) - Engineer, Microsoft

Dongchan Kim (MS. '12) - Engineer, Amazon

Sanjay Bharadwaj (MS. '10) - Engineer, Oracle

Charles Xie (MS. '09) - Engineer, Oracle

Kevin Springborn - (MS. '07) - Engineer, Google

Ramanathan Palaniappan (MS. '06) - Engineer, Amazon

Shilpi Agrawal (MS. '04) - Engineer, VMWare

Janani Thanigachalam (MS. '04) - Engineer, Oracle

Badhri Varanasi (MS. '04) - Engineer, Oracle