

## RESEARCH INTERESTS

Network architecture and measurement. Large-scale traffic analysis and data mining as applied to real-world network security and systems problems.

## EDUCATION

**Massachusetts Institute of Technology** Cambridge, MA  
Ph.D in Electrical Engineering and Computer Science, Jun 2008.

**Massachusetts Institute of Technology** Cambridge, MA  
MS in Electrical Engineering and Computer Science, Sept 2004.

**Georgia Institute of Technology** Atlanta, GA  
BS in Computer Engineering, Dec 1996.  
*Magna Cum Laude*

## PROFESSIONAL EXPERIENCE

**Naval Postgraduate School** Jul. 2016 – Present  
*Associate Professor, Computer Science* Monterey, CA  
Principal investigator for  $\approx$ \$2M total funding from NSF, DHS, SPAWAR, and industry sponsors. Lead and set research vision within the Center for Measurement and Analysis of Network Data (<https://www.cmand.org>) lab. Manage lab personnel, including graduate students, research associates, and staff. Advise Master's and Ph.D theses. Serve as CS department research chair.

**Naval Postgraduate School** Sep. 2009 – Jun. 2016  
*Assistant Professor, Computer Science* Monterey, CA  
Conduct fundamental and applied research with a concentration on large-scale network measurement, architecture, and security. Develop and teach network, security, architecture, and systems courses.

**BBN Technologies** Jul. 2008 – Sep. 2009  
*Network Scientist* Cambridge, MA  
Contributed to the development of a next-generation disruption tolerant network (DTN) platform for DARPA, including intelligent content routing in challenged contexts and DTN service discovery. Implemented time-dilation to emulate large networks and wireless channels on a virtual machine.

**Massachusetts Institute of Technology** Sep. 2002 – Jun. 2008  
*Research Assistant* Cambridge, MA  
Developed and led large-scale Internet neutrality, IP spoofing, and e-mail measurement efforts that were published, used by regulatory bodies, and covered by media. Dissertation examines architectural principles for network learning as applied to routing and security problems.

**MCI, Advanced Internet Technology** Jul. 1998 – Jul. 2002  
*Senior Engineer* Ashburn, VA  
Responsible for the measurement infrastructure of several large, international, mission-critical networks including UUNET IP and MCI Frame Relay. Used flow data from custom-developed high-speed passive optical monitors to analyze traffic for peering decisions and traffic engineering. Engineered and supported the NSF sponsored vBNS R&E backbone.

**Georgia Institute of Technology***Network Support Specialist***Jan. 1997 – Jul. 1998**

Atlanta, GA

Maintained the Georgia Tech campus backbone network routers and switches supporting ~18,000 end-nodes. Responsible for engineering of the regional R&E GigaPOP network of which Georgia Tech was the central hub. Administered critical campus UNIX clusters and servers for students and faculty. Deployed a comprehensive Network Operations Center including fault management, configuration management and performance analysis elements.

## TEACHING EXPERIENCE

**Naval Postgraduate School***Assistant Professor***Fall 2009 – Present**

Monterey, CA

Taught, revamped, and updated CS3502 (Computer Networks), CS4550 (Computer Networks II), CS4538 (Wireless Security). Created and developed CS4558 (Network Traffic Analysis) to meet student and institution demand. Across approximately 15 terms of teaching, received an average instructor rating of 4.8/5.0 from students. Recognized in 2011, 2013, and 2015 with NPS Teaching Excellence Award for top 5% of all teachers. Advised  $\approx$  30 Master's and Ph.D theses; co-authored refereed publications with 15 thesis students at competitive venues.

**Massachusetts Institute of Technology***Teaching Assistant***Fall 2004, Fall 2006**

Cambridge, MA

TA for graduate-level computer networks course. Created and taught selected lectures, led weekly recitations. Wrote and graded tests and homework; assisted students with course projects.

**University of Ghana***Visiting Lecturer***Summer 2005**

Accra, Ghana

Taught and designed an intensive eight-week, eight-hour per-day curriculum on object oriented programming for  $\sim$ 100 college students with fewer than 30 computers.

## REFEREED PUBLICATIONS

1. M. Luckie and R. Beverly. The Impact of Router Outages on the AS-level Internet. In *Proceedings of ACM SIGCOMM*, Aug. 2017. Acceptance rate: 36/250 (14%)
2. J. Martin, E. C. Rye, and R. Beverly. Decomposition of MAC Address Structure for Granular Device Inference. In *Proceedings of the 32nd Annual Computer Security Applications Conference (ACSAC)*, Dec. 2016. Acceptance rate: 48/210 (23%)
3. R. Beverly. Yarrp'ing the Internet: Randomized High-Speed Active Topology Discovery. In *Proceedings of the ACM SIGCOMM Internet Measurement Conference (IMC)*, Nov. 2016. Acceptance rate: 46/182 (25%)
4. E. C. Rye, J. P. Rohrer, and R. Beverly. Revisiting AS-Level Graph Reduction. In *Proceedings of the Eighth IEEE International Workshop on Network Science for Communication Networks (NetSci-Com)*, Apr. 2016. Acceptance rate: 6/25 (24%)
5. M. Luckie, R. Beverly, T. Wu, M. Allman, and kc claffy. Resilience of Deployed TCP to Blind Attacks. In *Proceedings of the ACM SIGCOMM Internet Measurement Conference (IMC)*, Oct. 2015. Acceptance rate: 44/169 (26%)
6. R. Beverly, M. Luckie, L. Mosley, and kc claffy. Measuring and Characterizing IPv6 Router Availability. In *Proceedings of the 16th Conference on Passive and Active Network Measurement (PAM)*, Mar. 2015. Acceptance rate: 27/100 (27%)
7. R. Beverly and A. Berger. Server Siblings: Identifying Shared IPv4/IPv6 Infrastructure via Active Fingerprinting. In *Proceedings of the 16th Conference on Passive and Active Network Measurement (PAM)*, Mar. 2015. Acceptance rate: 27/100 (27%)

8. L. Alt, R. Beverly, and A. Dainotti. Uncovering Network Tarpits with Degreaser. In *Proceedings of the 30th Annual Computer Security Applications Conference (ACSAC)*, pages 156–165, 2014. Acceptance rate: 47/236 (19%)
9. R. Craven, R. Beverly, and M. Allman. A Middlebox-cooperative TCP for a Non End-to-end Internet. In *Proceedings of ACM SIGCOMM*, pages 151–162, Aug. 2014. Acceptance rate: 45/237 (19%)
10. G. Baltra, R. Beverly, and G. G. Xie. Ingress Point Spreading: A New Primitive for Adaptive Active Network Mapping. In *Proceedings of the 15th Conference on Passive and Active Network Measurement (PAM)*, volume 8362, pages 56–66, Mar. 2014. Acceptance rate: 24/76 (32%)
11. M. Luckie, R. Beverly, W. Brinkmeyer, and kc claffy. Speedtrap: Internet-Scale IPv6 Alias Resolution. In *Proceedings of the ACM SIGCOMM Internet Measurement Conference (IMC)*, pages 119–126, 2013. Acceptance rate: 42/178 (24%)
12. A. Berger, N. Weaver, R. Beverly, and L. Campbell. Internet Nameserver IPv4 and IPv6 Address Relationships. In *Proceedings of the ACM SIGCOMM Internet Measurement Conference (IMC)*, pages 91–104, 2013. Acceptance rate: 42/178 (24%)
13. S. Trassare, R. Beverly, and D. Alderson. A technique for network topology deception. In *Military Communications Conference (MILCOM)*, pages 1795–1800, Nov. 2013
14. J. Martin, D. Rhame, R. Beverly, and J. McEachen. Correlating GSM and 802.11 Hardware Identifiers. In *Military Communications Conference (MILCOM)*, pages 1398–1403, Nov. 2013
15. R. Beverly, W. Brinkmeyer, M. Luckie, and J. P. Rohrer. IPv6 Alias Resolution via Induced Fragmentation. In *Proceedings of the 14th Conference on Passive and Active Network Measurement (PAM)*, volume 7799, pages 155–165, Mar. 2013. Acceptance rate: 24/74 (32%)
16. R. Beverly and M. Allman. Findings and implications from data mining the IMC review process. *SIGCOMM Comput. Commun. Rev.*, 43(1):22–29, Jan. 2013
17. G. Kakavelakis, R. Beverly, and J. Young. Auto-learning of SMTP TCP Transport-Layer Features for Spam and Abusive Message Detection. In *Proceedings of the 25th USENIX Large Installation Systems Administration Conference (LISA)*, Dec. 2011. Acceptance rate: 29/62 (47%)
18. S. Bauer, R. Beverly, and A. Berger. Measuring the state of ECN readiness in servers, clients, and routers. In *Proceedings of the ACM SIGCOMM Internet measurement conference (IMC)*, pages 171–180, 2011. Acceptance rate: 42/220 (19%)
19. S. Huchton, G. G. Xie, and R. Beverly. Building and evaluating a k-resilient mobile distributed file system resistant to device compromise. In *Military Communications Conference (MILCOM)*, pages 1315–1320, Nov. 2011
20. R. Beverly, S. Garfinkel, and G. Cardwell. Forensic carving of network packets and associated data structures. *Digital Investigation*, 8(1):S78 – S89, 2011. DFRWS. Acceptance rate: 14/62 (23%)
21. N. C. Rowe, S. L. Garfinkel, R. Beverly, and P. Yannakogeorgos. Challenges in monitoring cyberarms compliance. *International Journal of Cyber Warfare and Terrorism (IJCWT)*, 1(2):35–48, 2011
22. Z. N. J. Peterson, M. Gondree, and R. Beverly. A position paper on data sovereignty: The importance of geolocating data in the cloud. In *Proceedings of the 3rd USENIX workshop on Hot Topics in Cloud Computing*, June 2011. Acceptance rate: 23/72 (32%)
23. R. Beverly, A. Berger, and G. G. Xie. Primitives for active Internet topology mapping: toward high-frequency characterization. In *Proceedings of the ACM 10th annual conference on Internet measurement (IMC)*, pages 165–171, 2010. Acceptance rate: 47/211 (22%)
24. R. Jansen and R. Beverly. Toward anonymity in Delay Tolerant Networks: Threshold Pivot Scheme. In *Military Communications Conference (MILCOM)*, pages 587–592, Nov. 2010
25. R. Beverly, A. Berger, Y. Hyun, and k. claffy. Understanding the efficacy of deployed Internet source address validation filtering. In *Proceedings of the 9th ACM SIGCOMM conference on Internet measurement conference (IMC)*, pages 356–369, 2009. Acceptance rate: 41/183 (22%)

26. R. Beverly. A human factors approach to spam filtering. In *Proceedings of the Sixth Conference on Email and Anti-Spam (CEAS)*, July 2009
27. R. Beverly and K. Sollins. An Internet protocol address clustering algorithm. In *Proceedings of the USENIX Third conference on Tackling computer systems problems with machine learning techniques*, SysML'08, pages 5–5, 2008
28. R. Beverly and K. Sollins. Exploiting transport-level characteristics of spam. In *Proceedings of the Fifth Conference on Email and Anti-Spam (CEAS)*, Aug. 2008
29. R. Beverly, S. Bauer, and A. Berger. The Internet is not a big truck: toward quantifying network neutrality. In *Proceedings of the 8th Conference on Passive and Active Network Measurement (PAM)*, pages 135–144, 2007. Acceptance rate: 21/80 (26%)
30. R. Beverly and M. Afegan. Machine learning for efficient neighbor selection in unstructured p2p networks. In *Proceedings of the 2nd USENIX workshop on Tackling computer systems problems with machine learning techniques*, pages 1:1–1:6, 2007
31. R. Beverly, K. Sollins, and A. Berger. SVM learning of IP address structure for latency prediction. In *Proceedings of the 2006 SIGCOMM workshop on Mining network data*, MineNet '06, pages 299–304, 2006
32. S. Bauer, P. Faratin, and R. Beverly. Assessing the assumptions underlying mechanism design for the internet. In *Proceedings of ACM Economics of Networked Systems (NetEcon)*, June 2006
33. R. Beverly and S. Bauer. The spoofer project: inferring the extent of source address filtering on the internet. In *Proceedings of the USENIX Steps to Reducing Unwanted Traffic on the Internet Workshop (SRUTI)*, 2005. Acceptance rate: 13/35 (37%)
34. M. Afegan and R. Beverly. The state of the email address. *SIGCOMM Comput. Commun. Rev.*, 35:29–36, January 2005
35. R. Beverly. A Robust Classifier for Passive TCP/IP Fingerprinting. In *Passive and Active Network Measurement (PAM)*, volume 3015 of *Lecture Notes in Computer Science*, pages 158–167. 2004. Acceptance rate: 30/174 (17%)
36. R. Beverly. RTG: A Scalable SNMP Statistics Architecture for Service Providers. In *Proceedings of the 16th USENIX Large Installation Systems Administration Conference (LISA)*, pages 167–174, Nov. 2002

#### OTHER PUBLICATIONS

1. J. P. Rohrer, B. LaFever, and R. Beverly. Empirical Study of Router IPv6 Interface Address Distributions. *IEEE Internet Computing*, Aug. 2016
2. R. Beverly and L. Alt. On the potential for mining unstructured public data to aid network intelligence. In *ACSAC (Poster)*, Dec. 2014
3. R. Beverly, R. Koga, and kc claffy. Initial longitudinal analysis of IP source spoofing capability on the Internet, July 2013. ISOC Whitepaper
4. R. Craven, K. Foster, and R. Beverly. Adversarial TCP: An Offensive TCP Stack to Penalize Abusive Connectivity. In *USENIX LISA (Poster)*, Dec. 2011
5. L. Nolan, R. Beverly, and J. Young. New approaches to characterizing scam-hosting connectivity. In *USENIX Security (Poster)*, Aug. 2011
6. k. claffy, E. Aben, J. Auge, R. Beverly, F. Bustamante, B. Donnet, T. Friedman, M. Fomenkov, P. Haga, M. Luckie, and Y. Shavitt. The 2nd workshop on active Internet measurements (AIMS-2) report. *ACM SIGCOMM Comput. Commun. Rev.*, 40:53–58, 2010
7. k. claffy, M. Fomenkov, E. Katz-Bassett, R. Beverly, B. A. Cox, and M. Luckie. The workshop on active internet measurements (aims) report. *SIGCOMM Comput. Commun. Rev.*, 39:32–36, October 2009

8. R. Beverly and S. Bauer. Tracefilter: A tool for locating network source address validation filters. In *USENIX Security (Poster)*, Aug. 2007
9. R. Beverly. Robust clustering techniques in bioinformatics (18.417), Dec. 2004. <http://ocw.mit.edu/courses/mathematics/18-417-introduction-to-computational-molecular-biology-fall-2004/projects/>
10. R. Beverly. MS-SQL slammer/sapphire traffic analysis, Jan. 2003. <http://rbeverly.net/research/slammer/>
11. R. Beverly and k. claffy. Wide-Area Multicast Traffic Characterization. In *IEEE Network*, Jan/Feb 2003.
12. R. Beverly, G. Miller, and K. Thompson. Multicast Performance Measurement on a High-Performance IP Backbone. In *Computer Communications.*, 24, pages 461-472, Mar. 2001.

#### PATENTS

1. “Unsolicited message communication characteristics,” US Patent 8,195,754. Jun 2012.
2. “Method for generating packet loss report by a data coordinator in a multicast data transmission,” US Patent 6,732,182. May 2000.

#### SERVICE

1. Program Committee: ACM IMC 2015, PAM 2015-2016, DFRWS 2012-2016, ACM IMC 2010, IEEE NGNI 2010-2011, CEAS 2009.
2. General Chair: ACM SOSR 2016.
3. Forensics Challenge Chair: DFRWS 2016.
4. General Chair: ACM Hotnets 2010.
5. Program Review: NSF ACI, NSF CNS 2008-2015, GENI 2008-2009.
6. External Reviewer: IEEE ToIT 2016, IEEE Privacy and Security 2010-2012, IEEE ToN 2008-2015, ACM CCR 2008-2014, SECON 2009, ACM TISSEC 2008, USENIX SysML 2007, IEEE TDSC 2006, IEEE TPDS 2006, IEEE Sarnoff 2007, MIT CSW 2005-2006.

#### AWARDS

1. ACM IMC Best Paper, 2015
2. PAM Best Paper Finalist, 2013
3. John Jay Schieffelin Award for Teaching Excellence, Top 5%, 2015
4. John Jay Schieffelin Award for Teaching Excellence, Top 5%, 2013
5. John Jay Schieffelin Award for Teaching Excellence, Top 5%, 2011
6. IEEE ComSoc Fred W. Ellersick Prize for Best Paper, 2011
7. DFRWS Best Paper, 2011
8. USENIX LISA Best Paper, 2002

## FUNDING

1. Co-Principal Investigator, “NeTS: User-Centric Network Measurement,” from National Science Foundation (NSF), 2013-2016. Co-PI: M. Allman (UC Berkeley/ICSI).
2. Principal Investigator, “Understanding the Resilience of Active Internet Measurements to Deception,” from Laboratory for Telecommunication Science (LTS), 2015-2016.
3. Principal Investigator, “High-Frequency Active Internet Topology Mapping,” from Department of Homeland Security (DHS), 2012-2015.
4. Principal Investigator, “SDCI Sec: Transport-Layer Abusive Traffic Detection and Mitigation,” from National Science Foundation (NSF), 2011-2014.
5. Co-Principal Investigator, “NeTS: Exploring the Evolution of IPv6: Topology, Performance, and Traffic,” from National Science Foundation (NSF), 2011-2014. Co-PI: K. Claffy (UC San Diego/CAIDA).
6. Principal Investigator, “TCP Countermeasures for the Misconfiguration Adversary,” from Space and Naval Warfare Systems Command (SPAWAR), 2013.
7. Principal Investigator, “Transport-Layer Abusive Traffic Detection and Mitigation,” from Cisco University Research Grant, 2011.