GEORGE VARGHESE

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EDUCATION

Massachusetts Institute of Technology, Ph.D. (Computer Science), Feb 1993.

North Carolina State University, Raleigh, M.S. (Computer Studies), Aug 1983.

Indian Institute of Technology, Bombay, B.Tech (Electrical Engineering), Aug 1981.

EXPERIENCE

Academic:

Aug 2016 - present: Chancellor's Professor, Department of Computer Science, University of California, Los Angeles

Aug 2012 - Aug 2016: Partner and Principal Researcher. Microsoft Research. Verification for Microsoft networks, geo-distributed analytics

Aug 2011 - June 2012: Academic Visitor, Yahoo! Research, Santa Clara. Designing a content markeplace and coordination tools.

Aug 2010 - July 2011: Distinguished Visitor, Department of Computer Science, Stanford University. Static Checking for Networks, Abstractions for Genomics.

Aug 2004 - Dec 2012: Full Professor of Computer Science, ending at Step 6

Sept 1993 - Aug 99: Associate Professor/Full Professor of Computer Science, Washington University at St. Louis.

Non-academic:

May 2005 - Present: Technical Leader, ISBU, Cisco Systems Inc. Helped transition the NetSift technology to a 20 Gbps chip called Hawkeye

May 2004 - May 2004: President, CTO, and Co-Founder of NetSift Inc. NetSift was a UCSD spinoff that developed automated techniques for learning and detecting attack signatures. NetSift was acquired by Cisco in May 2005

Aug 1983 - Aug 1993: DECNET Architecture and Development, Digital, Littleton, MA. Various positions, ending as a Principal Engineer. Network Architect for DEC's Corporate DEC's next generation network and wrote specification for DEC's Bridge Architecture, later adopted by the IEEE 802.1 committee

Technical Advisory Boards:

Memoir Memory Systems (acquired by Cisco); Sanera (acquired by McData), Jibe (acquired by Citrix), and SwitchOn (acquired by PMC-Sierra).

Industry Visits:

May 2011(5 weeks): Microsoft Research, Bangalore. Fast VM Migration (NSDI 2011 submission)
May 2010 (4 weeks): Microsoft Research, Seattle. Design of a multipath transport protocol.

June 2009 (6 weeks): Microsoft Research, Bangalore. Algorithms for end host de-duplication (NSDI 2010 and patent application), network management via theorem provers.

May 2007 (4 weeks): Thompson Labs, Paris. Conceptualizing Mobile social networks (Mobiclique, WOSN 2009).

Consulting:

Consultant for Digital Equipment Corporation, America Online, Microsoft Corporation, Cascade Corporation, Procket Corporation. AOL, Fujitsu, ST MicroElectronics, Greenfield Networks, Chiaro Networks.

AWARDS/HONORS

2015 IIT Bombay Distinguished Alumnus Award

2015 Best of CCR Award, SIGCOMM for the P4 paper

2014 SIGCOMM Lifetime Award for "sustained and diverse contributions to network algorithmics, with far reaching impact in both research and industry"

2014 Koji Kobayashi Award for Computers and Commpunications for "contributions to the field of network algorithmics and its applications to high-speed packet networks"

2014 SIGCOMM Best Paper Award, for "Distributed Congestion Aware Load Balancing"

2014 IETF Applied Networking Research Prize 2014 for "Header Space Analysis"

Best Paper Award, ANCS 2013, for "Design Principles for Packet Parsers"

2010-2011 Distinguished Visitor, Department of Computer Science, Stanford University

2008 OSDI Best Paper Award, OSDI 2008 for "Harnessing Memory Redundancy"

2002, Inducted as ACM Fellow

2001 Best Teacher Award in Computer Science, UCSD, 2001, voted by graduating undergraduate students

1998 Best Tutorial Award, SIGMETRICS

1997 Big Fish, Mentor of the Year Award, Association for Graduate Engineering Students (AGES), Washington University 1997.

1996 ONR Young Investigator Award 1996 (34 awarded out of 416 applications across the sciences, among 2 computer scientists chosen in 1996)

1996 PODC Best Student Paper, for a paper jointly written with student Mahesh Jayaram.

1993 Sproull Prize for best MIT Thesis in Computer Science and nominated by MIT for ACM Thesis Prize.

1989-1991 DEC Graduate Education Program (GEEP) Scholar

RESEARCH IMPACT ON INDUSTRY

- P4 (CCR 2014) standards body founded with support from several companies including Cisco and Dell (2015)
- Multistage Counter algorithm (SIGCOMM 2002) added to Linux via kernel patch (net-qdisc-hhf) by Dukkipatti, Dumazet, and Lam to reduce latency for small ows (2014)
- Load Balancing using Remote Congestion, implemented in Enseme/Nexus 9000 Switches via Alizadeh, Edsall, et al (2014)
- Grey box testing for Load Balanced Networks using Probabilistic Covers via James Zeng; in Microsoft's Autopilot framework used across all the company's Data Centers (2013)
- LR(T) counter algorithm (SIGMETRICS 2003) used to implement counters in TI/Barefoot chip by Pat Bosshart (2012)
- Genomic Compression using Slimgene (Recomb 2010) being used at Illumina via Semyon Kruglyak (2011)

- NetSift technology introduced automated signature extraction to Cisco resulting in the Hawkeye chip (2005)
- Hypercuts for packet classification used in Cisco routers including CRS-1 (2005)
- Tree bitmap algorithm IP lookup currently used in Cisco's fastest routers (CRS-1, CRS-3) (2003)
- Fast string matching for Intrusion Detection algorithm (Fisk-Varghese) ported to to the Snort open-source Intrusion Detection tool in Branch 1.9 (2003)
- Router Lookup Engineer: With Tony Li and others, designed the lookup architecture for Procket Networks (2002)
- Lookup and classification algorithms for SwitchOn, with Iyer, Kompella, Shelat, acquired by PMC (2002)
- IP Route Lookup patents licensed to five major vendors (Microsoft, GTE, BBN, Ascend, NEC) and three startups (Quarry, Chiaro, Onex) (1998)
- Packet classification algorithms patented and licensed by Onex (1998)
- Timing wheels: used in Linux via Justin Gibbs (1997)
- Deficit Round Robin for fair queuing used in most routers (called MDRR by Cisco) and Microsoft in Windows NT (1996)
- Load Balancing algorithms implemented in Cisco's IOS 11.3(1) by Dana Blair (1996)
- Threaded Indices idea predates Cisco tag switching and used in patent suits by Juniper and Cisco to defend MPLS
- Update Process for OSI Routing Protocol (Patent P3): essentially similar algorithm used by all OSPF routers (1992)
- Bridge architecture specification: became 802.1 Spanning Tree Bridge Specification and basis for commercial Ethernet and FDDI bridges (1987)

PROFESSIONAL ACTIVITIES

Keynotes and Distinguished Lectures: UC Berkeley Distinguished Lecture Sept 2015, SIGCOMM 2014 Keynote, Aug 2014, Northwestern University, Dec 2013, COMSOCS Bangalore Keynote, Dec 2012, High Performance Switching and Routing (HPSR) Keynote, July 2010, University of California Irvine Distinguished Lecture in CS (May 2009), University of Wisconsin Madison, Distinguished Lecture in Computer Science, Dec 2007 Texas A &M Distinguished Lecture (March 2002).

Tutorials: Network Verification (SIGCOMM 2015), Network Algorithmics (Summer School at Indian Institute of Science, 2009), Detecting Packet Patterns at High Speeds (SIGCOMM 2002), Self-stabilization and the Internet (IPAM workshop, July 2002), Designing Practical Protocols using Techniques used in Distributed algorithms (SIGCOMM 95), Efficient Protocol Implementation Techniques (SIGCOMM 96, SIGMETRICS 98), Algorithmic Problems in Internet Research (PODC/SPAA joint conference 98)

Microsoft Faculty Summits: Organized two Microsoft Faculty Summit sessions on "The Coming Software Revolution in Genomics" (with David Heckerman and Bill Bolosky in 2014) and "Network Design Automation" (with Nikolaj Bjorner and Ratul Mahajan in 2015)

Conference Chair: ACM SIGCOMM 2012 (Finland), TPC Chair, joint with Venkat Padmanabhan, ACM SIGCOMM 2001 (San Diego), General chair, joint with Rene Cruz

Program Committees: ACM Special Interest Group on Communication (SIGCOMM) Annual Conference 2008, 1996, 1997, 1999. 2000, 2002. ACM Conference on Principles of Distributed Computing (PODC) 1995. IEEE INFOCOM 1995. 3rd and 4th Workshop on Self-stabilizing systems (WSS 97, 99). NSF Networking Review Panels: Nov 95, July 98, July 2005, July 2009

Reviewer: ACM Trans. on Computer Systems (TOCS), Journal of the ACM, IEEE Trans. Communications, Distributed Computing, IEEE Trans. Software Engg., IEEE Journal of Parallel and Distributed Systems, Computer Networks, PODC, SIGCOMM and INFOCOM

RESEARCH SUMMARY

h-index of 69 (http://www.cs.ucla.edu/ palsberg/h-number.html). 22 papers with citation counts over 150 including 1 with 2423 (from Google Scholar)

Erdos number of 2 via Ron Graham

2 fields: self-stabilization and networking. Specialized in network algorithmics (speeding up network bottlenecks) with a special focus on algorithmic measurement and algorithmic security.

1 Book (Network Algorithmics) and 4 Book Chapters.

107 papers in refereed conferences, most being in highly refereed conferences (22 SIGCOMM, 6 PODC, 4 SIGMETRICS, 8 NSDI, 3 OSDI, 2 FOCS, 10 INFOCOM, 2 ICNP, 1 each in SOSP, POPL, ISCA, STOC, HPCA, MICRO, DCS, NOSSDAV, PADS, CCS). Papers in a variety of forums besides networking including Theory (FOCS, STOC, PODC), Architecture and Systems (ISCA, SOSP, OSDI, MICRO, HPCA), modeling and Measurement (SIGMETRICS), Simulation (PADS), Biology (RECOMB), Databases (CIDR), Programming Languages (POPL) and Security (CCS).

43 journal papers (4 ACM TOCS, 8 ACM/IEEE Transactions on Computer Systems, 2 IEEE JSAC, 1 JACM, 1 SIAM J of Computation, 1 IEEE Trans Software Engineering). 25 granted patents. Roughly 6 million in research funding (3.7 million from NSF, 900,000 from NIST, a 310,000 ONR Young Investigator Award, and several grants from Cisco) in 8 years as a faculty member. Licensing revenue of 700,000 dollars for lookup inventions at Washington University, and 3 million dollars for NetSift patent (UCSD).

BOOKS/CHAPTERS

1. George Varghese. Network Algorithmics, Morgan Kaufman 2004 (Reviewed in Slashdot, 3500 copies sold. Used as a textbook for 12 course adoptions: Georgia Tech, Wisconsin (Madison), University of Chicago, Purdue, UMKC, University of Kansas, University of Kentucky, University of Luxembourg, University of Ljubljana, University of New South Wales, National Cheng Kung University, IDC (Israel). Used as a reference for several other courses and often found in industry shelves, especially router vendors.

2. George Varghese. Network Algorithmics. Chapter 29 in Algorithms and Theory of Computation Handbook: Second Edition: Special Topics and Techniques. M. Attalah and Marina Blanton editors, Taylor and Francis, May 2010. (1 chapter summary of book)

3. A. Kirsch, Michael Mitzenmacher, George Varghese. Hash-based Networking for High Speed Packet Processing. Chapter in Algorithms for Next Generation Networks Handbook, March 2010.

4. A.L. Murphy, G.-C. Roman, and G. Varghese. Dependable Message Delivery to Mobile Units. In Mobile Computing Handbook. CRC Press. I. Mahgoub and M. Ilyas eds. pp 227, 2005.

5. V. Srinivasan and G. Varghese. A Survery of Recent IP Look Algorithms. Algorithms for High Speed Networks. Springer, J. Touch and J. Sterbenz eds. p9, 2000.

REFEREED JOURNALS

1. On Technology Transfer, CCR to appear (invited paper), October 2015
2. Life in the Fast Lane: A View from the Con uence Lens, Computer Communications Review, Jan 2015 (invited paper based on SIGCOMM keynote)
3. P4: programming protocol-independent packet processors , P. Bosshart, D. Daly, G. Gibb,
4. M. Izzard, N. McKeown, J. Rexford, C .Schlesinger, D. Talayco, A. Vahdat, G. Varghese, D. Walker: Computer Communication Review 44(3): 87-95, 2014. Best of CCR award
5. Finecomb: Measuring Microscopic Latency and Loss in the Presence of Reordering. M. Lee, S. Goldberg, R. Kompella, G. Varghese. IEEE/ACM Transactions Networking, 22(4): 1136-1149, 2014
6. Automatic Test Packet Generation, H. Zeng, P. Kazemian, G. Varghese, N. McKeown. IEEE/ACM Transactions Networking, 22(2): 554-566, 2014.
7. Using Genome Query Language (GQL) to uncover genetic variation, C. Kozanitis, A. Heibert,
8. G. Varghese, V. Bafna, Bioinformatics, 30(1): 1-8, 2014.
9. Abstractions for Genomics, C. Kozanitis, V. Bafna, A. Deutsch, A. Heibert, L. Ohno-Machado,
10. G. Varghese, Communications of the ACM, January 2013
11. NetShare and Stochastic NetShare: predictable bandwidth allocation for data centers , V.T. Lam, S. Radhakrishnan, A. Vahdat, G. Varghese, ACM Computer Communications Review, 42(3): 5-11, 2012.
12. Compressing genomic sequence fragments using SlimGene. C. Kozanitis, C. Saunders, S. Kruglyak, V. Bafna, G. Varghese , Journal of Computational Biology, March 2011: 401-13.
13. 1Router Support for Fine-grained Latency Measurements , R. Kompella, K. Levchenko, A. Snoeren, G. Varghese, IEEE/ACM Transactions on Networking, 20(3), 2012.
14. Ramana Rao Kompella, Sumeet Singh, George Varghese. On scalable attack detection in the network. IEEE/ACM Trans. Netw. 15(1): 14-25 (2007)
15. Baruch Awerbuch, Shay Kutten, Yishay Mansour, Boaz Patt-Shamir, George Varghese. A Time-Optimal Self-Stabilizing Synchronizer Using A Phase Clock. IEEE Trans. Dependable Sec. Comput. 4(3): 180-190 (2007)
16. George Varghese. 10 network papers that changed the world. Computer Communication Review 37(5): 77-80 (2007)
17. Fan R. K. Chung, Ronald L. Graham, Jia Mao, George Varghese. Parallelism versus Memory Allocation in Pipelined Router Forwarding Engines. Theory Comput. Syst. 39(6): 829-849 (2006)
18. Cristian Estan, George Varghese, Michael E. Fisk: Bitmap algorithms for counting active flows on high-speed links. IEEE/ACM Trans. Netw. 14(5): 925-937 (2006)
19. Florin Baboescu, Priyank Ramesh Warkhede, Subhash Suri, George Varghese. Fast packet classification for two-dimensional conflict-free filters. Computer Networks 50(11): 1831-1842 (2006)

20. Jack Snoeyink, Subhash Suri, George Varghese. A lower bound for multicast key distribution. Computer Networks 47(3): 429-441 (2005)

21. Florin Baboescu, George Varghese. Scalable packet classification. IEEE/ACM Trans. Netw. 13(1): 2-14 (2005)

22. Christos Papadopoulos, Guru M. Parulkar, George Varghese. Light-weight multicast services (LMS): a router-assisted scheme for reliable multicast. IEEE/ACM Trans. Netw. 12(3): 456-468 (2004)

23. Benjamin J. Raphael, Lung-Tien Liu, George Varghese. A Uniform Projection Method for Motif Discovery in DNA Sequences. IEEE/ACM Trans. Comput. Biology Bioinform. 1(2): 91-94 (2004)

24. Priyank Ramesh Warkhede, Subhash Suri, George Varghese. Multiway range trees: scalable IP lookup with fast updates. Computer Networks 44(3): 289-303 (2004)

25. Will Eatherton, George Varghese, Zubin Dittia: Tree bitmap: hardware/software IP lookups with incremental updates. Computer Communication Review 34(2): 97-122 (2004)

26. Florin Baboescu, George Varghese. Fast and scalable conflict detection for packet classifiers. Computer Networks 42(6): 717-735 (2003)

27. Cristian Estan, George Varghese. New directions in traffic measurement and accounting: Focusing on the elephants, ignoring the mice. ACM Trans. Comput. Syst. 21(3): 270-313 (2003)

28. Amy L. Murphy, Gruia-Catalin Roman, George Varghese. Tracking Mobile Units for Dependable Message Delivery. IEEE Trans. Software Eng. 28(5): 433-448 (2002)

29. Marcel Waldvogel, George Varghese, Jonathan S. Turner, Bernhard Plattner: Scalable high-speed prefix matching. ACM Trans. Comput. Syst. 19(4): 440-482 (2001)

30. George Varghese. Self-Stabilization by Counter Flushing. SIAM Journal of Computation, 30(2): 486-510 (2000)

31. George Varghese, Mahesh Jayaram: The fault span of crash failures. Journal of the ACM, 47(2): 244-293 (2000)

32. H. Adisheshu, G. Varghese, and G. Parulkar, Reliable and Efficient Striping Protocols, ACM Transactions on Computer Systems (TOCS), Nov. 1999.

33. V. Srinivasan and G. Varghese, Fast Address Lookup by Controlled Prefix Expansion, ACM Transactions on Computer Systems (TOCS), Feb 1999.

34. B. Lampson, V. Srinivasan, and G. Varghese, Lookup using Multiway and Multicolumn Binary Search, ACM/IEEE Transactions on Network Systems (TONS), June 1999.

35. A. Costello and G. Varghese, Reimplementing the BSD Callout Facility. Software Practice and Experience, Vol 28, issue 8 July 98, pp. 883-896

36. G. Varghese, Anish Arora, and Mohamed Gouda. Self- stabilization by Tree Correction, Chicago Journal of Computer Science, Article 3, 4 November 1997.

37. G. Varghese and Tony Lauck, Hashed and Hierarchical Timing Wheels: Data Structures for the Efficient Implementation of a Timer Facility, ACM/IEEE Transactions on Networking. Aug 1997.

38. G. Chandranmemon and G. Varghese, Trading Packet Headers for Packet Processing, ACM/IEEE Trans. on Networking, April 96.

39. M. Shreedhar and G. Varghese, Efficient Fair Queuing for Packet Processing, ACM/IEEE Trans. on Networking, June 96.

40. G. Varghese and Nancy Lynch, A Tradeoff Between Safety and Liveness for Randomized Coordinated Attack, Information and Computation, vol 128, Number 1, July 6, 1996. (Chapter 5 in Lynch's book on distributed algorithms is devoted to this result)

41. Anish Arora, Mohamed Gouda and G. Varghese, Distributed Constraint Satisfaction, Journal of High Speed Networks, Volume 4, Number 3, 1996

42. B. Awerbuch, Boaz Patt, and G. Varghese, Self-stabilizing End-to-end Communication, Journal of High Speed Networks, Volume 5, Number 4, 1996.

43. C. Ozveren, R. Simcoe, and G. Varghese, Reliable and Efficient hop-by-hop flow control, IEEE Journal on Special Areas in Communication, May 1995.

44. G. Varghese, Roger Chamberlain, and W. Weihl, Deriving Global Virtual Time Algorithms from Conservative Simulation Protocols, Information Processing Letters, 54, 1995, 121-126.

45. G. Varghese and Radia Perlman, Transparent Interconnection of Incompatible Local Area Networks using Bridges, IEEE Journal on Special Areas in Communication, Jan 1991.

46. R. Perlman, G.A. Harvey and G.Varghese, Choosing the Appropriate ISO Layer for Interconnecting LANs, (invited paper) IEEE Network, Jan 88, vol. 2, 1.

REFEREED CONFERENCES

1. From Header Space to Control Space: Comprehensive Network Reachability Verification, S. Fayaz, T. Sharma, A. Fogel, R. Mahajan, T. Millstein, V. Sekar, G. Varghese, OSDI 2016

2. Packet Transactions: High-Level Programming for Line-Rate Switches, A. Sivaraman, A. Cheung, M. Budiu, C. Kim, M. Alizadeh, H. Balakrishnan, G. Varghese, N. McKeown, S. Licking, SIGCOMM 2016

3. Scaling Network Verification using Symmetry and Surgery, G. Plotkin, N. Bjorner, N. Lopes, A. Rybalchenko, G, Varghese, POPL 2016

4. High Speed Networks Need Proactive Congestion Control. L. Jose, L. Yan, M. Alizadeh, S. Katti, G, Varghese, N, McKeown, Hotnets 2015

5. Checking Beliefs in Dynamic Networks, N. Lopes, N. Bjorner, P. Godefroid, K. Jayaraman, G. Varghese,

6. Global analytics in the face of bandwidth and regulatory constraints, A. Vulimiri, C. Curino, B. Godfrey, J. Padhye, G. Varghese, NSDI 2015

7. Compiling Packet Programs to Recongurable Switches, L. Yan, L. Jose, G. Varghese, N. McKeown, NSDI 2015.

8. WANAlytics: Analytics for a Geo-Distributed Data-Intensive World, C. Curino, A. Vulimiri, B. Godfrey, K. Karanasos, G. Varghese, Proceedings Conference on Innovative Data Systems Research, CIDR 2014, Asilomar

9. CONGA: Distributed Congestion-Aware Load Balancing for Datacenters M. Alizadeh et al, SIGCOMM 2014. Best paper award

10. Adtributor: Revenue Debugging in Advertising Systems R. Bhagwan, R. Kumar, R. Ramjee, G. Varghese, S. Mohapatra, H. Manoharan, and P. Shah, NSDI 2014

11. Gestalt: Fast, Uni ed Fault Localization for Networked Systems R. Mysore, R. Mahajan, A. Vahdat, G. Varghese: USENIX Annual Technical Conference 2014: 255-267

12. Design Principles for Packet Parsers, Glenn Gibb, George Varghese, Nick McKeown, Mark Horowitz, ANCS 2013 Best Paper Award

13. Forwarding Metamorphosis: Flexible Match Action processing in hardware for SDNs. Pat Bosshart, Glen Gibb, Hun-Suk Kim, George Varghese, Martin Izzard, Nick McKeown, Fernando Mujica, Mark Horowitz SIGCOMM 2013 (initial ideas being pursued vigorously by a startup called Barefoot Networks)

14. MiG: E cient Migration of Desktop VMs using Semantic Compression , A. Rai, R. Ramjee, A. Anand, V. Padmanabhan, G. Varghese, compressing OS pages to speedup VM migration, USENIX Annual Technical Conference, USENIX ATC 2013

15. Using Genome Query Language (GQL) to uncover genetic variation , C. Kozanitis, A. Heibert, G. Varghese, V. Bafna, HiTSeq Conference, July 2013.

16. Real time Network Policy Checking Using Header Space Analysis, P. Kazemanian, M. Chang, H. Zheng, G. Varghese, N. McKeown,S. Whyte, NSDI 2013.

17. Scalable Social Coordination using Enmeshed Queries , J. Chen, A Machanavajjhala, G. Varghese. Proceedings Conference on Innovative Data Systems Research, CIDR 2013, Asilomar, California.

18. Header Space Analysis: Static Checking for Networks, P. Kazemanian, G. Varghese, N. McKeown, NSDI 2012. Applied Networking Research Prize by the Internet Society in 2014, and presented to the IETF

19. Automatic Test Packet Generation, H. Zheng, P. Kazemanian, G. Varghese, N. McKeown, CoNEXT 2012. (Fast tracked for IEEE Transactions Networking among best papers of CONEXT 2012)

20. Lattice games and the Economics of aggregators , P. Jordan, U. Nadav, K. Punera, A. Skrzypacz, G. Varghese, World Wide Web conference,WWW 2012

21. RadioJockey: mining program execution to optimize cellular data usage , P. Athivarapu, R. Bhagwan, S. Guha, V. Navda, R. Ramjee, D. Arora, V. Padmanabhan, G. Varghese, Mobicom 2012.

22. Biff codes: Fast Error Correction for Large Data Sets , M. Mitzenmacher and George Varghese, IEEE International Symposium on Information Theory ISIT 2012,

23. The Complexity of Object Reconciliation and Open Problems related to Set Di erence and Coding , M. Mitzenmacher and George Varghese, 2012 Annual Allerton Conference on Communication, Control and Computing

24. D. Eppstein, M. Goodrich, F. Uyeda, G. Varghese "What's the Difference: Efficient Set Reconciliation without Prior Context", SIGCOMM 2011.

25. M. Lee, R. Kompella, S. Goldberg, G. Varghese, Fine grain latency and loss measurements in the presence of reordering Carousel: Scalably Logging for Intrusion Prevention Systems, SIGMETRICS 2011.

26. F. Uyeda, L. Foschini, S. Suri, F. Baker, G. Varghese. Measuring Network Bandwidth at all Time Scales, NSDI 2011.

27. T. Lam, M. Mitzenmacher, G. Varghese. Carousel: Scalably Logging for Intrusion Prevention Systems, NSDI 2010, August 2010.

28. B. Aggarwal, A. Akella, A. Anand, A. Balachandran, P. Chitis, C. Muthukrishnan, R. Ramjee, G. Varghese. EndRE: An End-System Redundancy Elimination Service for Enterprises, NSDI 2010, Aug 2010.

29. C. Kozanitis, C. Saunders, S. Krugylak, V, Bafna, G. Varghese. SlimGene: Compressing Genomic Sequences using SLIMGENE, RECCOMB 2010, June 2010, Portugal.

30. C. Kozanitis, J. Huber, S. Singh G. Varghese. Leaping Multiple Headers in a Single Bound. Wire Speed Parsing using the Kangaroo System. INFOCOM 2010, March 2010, San Diego.

31. Ramana Rao Kompella, Kirill Levchenko, Alex C. Snoeren, George Varghese. Every microsecond counts: tracking fine-grain latencies with a lossy difference aggregator. SIGCOMM 2009: 255-266

32. Marti A. Motoyama, George Varghese. I seek you: searching and matching individuals in social networks. WIDM 2009: 67-75

33. Frank Uyeda, Diwaker Gupta, Amin Vahdat, George Varghese. GrassRoots: socially-driven web sites for the masses. WOSN 2009: 19-24

34. Anna Kaisa Pietilinen, Earl Oliver, Jason LeBrun, George Varghese, Christophe Diot. MobiClique: middleware for mobile social networking. WOSN 2009: 49-54

35. Marti A. Motoyama, George Varghese. CrossTalk: scalably interconnecting instant messaging networks. WOSN 2009: 61-68

36. Diwaker Gupta, Sangmin Lee, Michael Vrable, Stefan Savage, Alex C. Snoeren, George Varghese, Geoffrey M. Voelker, Amin Vahdat. Difference Engine: Harnessing Memory Redundancy in Virtual Machines. OSDI 2008: 309-322

37. Sailesh Kumar, Balakrishnan Chandrasekaran, Jonathan S. Turner, George Varghese. Curing regular expressions matching algorithms from insomnia, amnesia, and acalculia. ANCS 2007: 155-164

38. Marios Iliofotou, Prashanth Pappu, Michalis Faloutsos, Michael Mitzenmacher, Sumeet Singh, George Varghese. Network monitoring using traffic dispersion graphs (tdgs). Internet Measurement Conference 2007: 315-320

39. Flavio Bonomi, Michael Mitzenmacher, Rina Panigrahy, Sushil Singh, George Varghese. An Improved Construction for Counting Bloom Filters. ESA 2006: 684-695

40. George Varghese, J. Andrew Fingerhut, Flavio Bonomi. Detecting evasion attacks at high speeds without reassembly. SIGCOMM 2006: 327-338

41. Sumeet Singh, Scott Shenker, and George Varghese, Service Portability: Why HTTP Redirect is the Model of the Future, Proceedings of the 5th ACM Workshop on Hot Topics in Networks (HotNets-V) Irvine, CA , November 2006.

42. Flavio Bonomi, Michael Mitzenmacher, Rina Panigrahy, Sushil Singh, George Varghese. Beyond bloom filters: from approximate membership checks to approximate state machines. SIGCOMM 2006: 315-326

43. George Varghese, Cristian Estan. The measurement manifesto. HotNets 2004.

44. Fan R. K. Chung, Ronald L. Graham, George Varghese. Parallelism versus memory allocation in pipelined router forwarding engines. SPAA 2004: 103-111

45. Cristian Estan, Ken Keys, David Moore, George Varghese. Building a better NetFlow. SIGCOMM 2004: 245-256

46. Sumeet Singh, Cristian Estan, George Varghese, Stefan Savage: Automated Worm Fingerprinting. OSDI 2004: 45-60

47. Ramana Rao Kompella, George Varghese. Reduced state fair queuing for edge and core routers. NOSSDAV 2004: 100-105

48. Nathan Tuck, Brad Calder, George Varghese. Hardware and Binary Modification Support for Code Pointer Protection From Buffer Overflow. MICRO 2004: 209-220

49. Ramana Rao Kompella, Sumeet Singh, George Varghese. On scalable attack detection in the network. Internet Measurement Conference 2004: 187-200

50. Nathan Tuck, Timothy Sherwood, Brad Calder, George Varghese. Deterministic Memory-Efficient String Matching Algorithms for Intrusion Detection. INFOCOM 2004

51. Kirill Levchenko, Ramamohan Paturi, George Varghese. On the difficulty of scalably detecting network attacks. ACM Conference on Computer and Communications Security 2004: 12-20

52. Sriram Ramabhadran, George Varghese. Efficient implementation of a statistics counter architecture. SIGMETRICS 2003: 261-271

53. Sumeet Singh, Florin Baboescu, George Varghese, Jia Wang. Packet classification using multidimensional cutting. SIGCOMM 2003: 213-224

54. Cristian Estan, Stefan Savage, George Varghese. Automatically inferring patterns of resource consumption in network traffic. SIGCOMM 2003: 137-148

55. Harsha Narayan, Ramesh Govindan, George Varghese. The impact of address allocation and routing on the structure and implementation of routing tables. SIGCOMM 2003: 125-136

56. Cristian Estan, George Varghese, Mike Fisk. Bitmap algorithms for counting active flows on high speed links. Internet Measurement Conference 2003: 153-166

57. Timothy Sherwood, George Varghese, Brad Calder. A Pipelined Memory Architecture for High Throughput Network Processors. ISCA 2003: 288-299

58. Florin Baboescu, Sumeet Singh, George Varghese. Packet Classification for Core Routers: Is there an alternative to CAMs? INFOCOM 2003

59. Satish Narayanasamy, Timothy Sherwood, Suleyman Sair, Brad Calder, George Varghese. Catching Accurate Profiles in Hardware. HPCA 2003: 269-280

60. Florin Baboescu, George Varghese. Fast and Scalable Conflict Detection for Packet Classifiers. ICNP 2002: 270-279

61. Cristian Estan, Stefan Savage, George Varghese. Automated measurement of high volume traffic clusters. Internet Measurement Workshop 2002: 177-178

62. Mike Fisk, George Varghese. Agile and scalable analysis of network events. Internet Measurement Workshop 2002: 285-290

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76. V. Srinivasan, G. Varghese, S. Suri, and M. Waldvogel, Fast and Scalable Layer 4 Switching, SIGCOMM 98, Vancouver, Canada, August 98.

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80. B. Lampson, V. Srinivasan, and G. Varghese, IP Lookup using Multiway and Multicolumn Binary Search, Infocom 98, April 98.

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86. J. Andrew Fingerhut and George Varghese Randomized Token Buckets: Reducing the Buffers Required in Multiplexors, Proceedings of the 7th International Workshop on Network and Operating System Support for Digital Audio and Video (NOSSDAV), May 1997.

87. M. Jayaram and G. Varghese, Crash Failures can Drive Protocols to arbitrary states, ACM Principles of Distributed Computing (PODC) 96. (Best student paper award.)

88. A. Costello and G. Varghese, Self-stabilization by Window Washing, ACM Principles of Distributed Computing (PODC) 96.

89. H Adisehsu, G. Parulkar, and G. Varghese, Reliable and Efficient Striping, ACM SIGCOMM 96

90. G. Chandranmenon and G. Varghese, Trading Packet Headers for Packet Processing, Proc SIGCOMM 95, Aug 95, Boston.

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92. G. Varghese and Anish Arora, Mohamed Gouda, Self- stabilization by Tree Correction, 2nd Workshop on Self-stabilizing Systems, Las Vegas, May 1995.

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96. B. Awerbuch, Boaz Patt, and G. Varghese, Bounding the Unbounded, Proceedings of the IEEE Infocom Conference, Toronto,

97. G. Varghese, Roger Chamberlain, and W. Weihl, The Pessimism behind Optimistic Simulations, 8th Workshop on Parallel and Distributed Simulation (PADS), Edinburgh, Scotland, July 1994.

98. Anish Arora, Mohamed Gouda and G. Varghese, Distributed Constraint Satisfaction, Proceedings of the 14th IEEE International Conference on Distributed Computing Systems (DCS), Poznan, Poland, June 1994.

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104. R. Perlman and G. Varghese, Pitfalls in the Design of a Class of Distributed Routing Algorithms, Proceedings ACM SIGCOMM, Stanford, CA, 1988.

105. G. Varghese and Radia Perlman, Transparent Interconnection of Incompatible Local Area Networks using Bridges, ACM SIGCOMM 1987, Vermont

106. G.Varghese and A. Lauck, Hashed and Hierarchical Timing Wheels: Data Structures for the Efficient Implementation of a Timer Facility, Proceedings of the 11th ACM Annual Symposium on Operating Systems Principles (SOSP), Austin, Texas Nov 1987.

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PATENTS

The abstracts and text of all patents can be found using the patent number in the IBM Patent Database at http://patent.womplex.ibm.com/. Claims can be found online at the U.S. Patent Office at http://164.195.100.11/netahtml/search-adv.htm. Citation counts from Google Scholar, updated Feb 2014. Assigned institution noted at end.

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[**P2**] R. Perlman, G. Varghese, A. Lauck, *Reliable Broadcast of Information in a Wide Area Network*, (routing Protocol in OSI Network Layer Protocol 10589 (IS-IS) is based on mechanism disclosed in this patent.) US. Patent 5086428, Feb 4th, 1992. (34 citations) DEC

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[**P5**] G. Varghese, R. Szmauz, A. Smith, and M. Fine *Integrated Communication Link having a dynamically allocatable bandwidth and protocol for transmission of allocation information over*

the link. (voice-data integration protocol and multiplexing scheme), US. Patent 5,313,467, May 17, 1994. (90 citations) DEC

[**P6**] B. Spinney, R. Simcoe, B, Thomas, G. Varghese *packet Format in Hub for Data Communication System* (Gigaswitch packet formats and their use in the forwarding process, U.S. Patent 5,390,173. Feb 14th 1995. (326 citations) DEC

[**P7**] C. Ozveren and G. Varghese, *Apparatus for Rate Based Flow*, (aggregating credits in rate based flow control) US. Patent 5455826, Oct 3, 1995. (75 citations) DEC

[**P8**] H. Wilkinson, G. Varghese and N. Poole, *Compressed Prefix Matching Database Searching*, (path and node compression for IP lookups). U.S. Patent 6,014,659 , Jan 11, 1998 (117 citations) DEC

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[**P11**] G. Varghese, George, Bassett J., et al Device for partitioning ports of a bridge into groups of different virtual local area networks (VLANs), (First patent on VLANs, often cited in lawsuits), U.S. Patent 5,963,556, October 5, 1999 (66 citations) DEC

[**P12**] G. Varghese, V. Srinivasan, *Fast IP Lookups using Controlled Prefix Expansion*, (Fundamental multibit trie patent), U.S. patent 6,011,795, January 4, 2000 (235 citations) Washington University

[**P13**] J. Turner, G. Varghese, Marcel Waldvogel, *High Speed Scalable IP Routing Lookups*, (Fundamental binary search on prefix lengths patent), U.S. Patent 6,018,524, January 25, 2000. (129 citations) Washington University

[**P14**] V. Srinivasan, G. Varghese, S. Suri, and M. Waldvogel, H. Adisheshu, *Fast Level 4 Switching using Tuple Space and Grid-of-Tries*, (Tuple space ideas are now being applied in hardware), U.S. Patent 6,212,184, April 3, 2001 (93 citations) Washington University

[**P15**] G. Varghese, V. Srinivasan, *Fast Level 4 Switching using Crossproducting*, (crossproducting is not used today, but RFC which is a generalization of cross-producting is still in use), U.S Patent 6449256, Sept 10, 2002. (22 citations) Washington University

[**P16**] D. Joshi, A. Shelat, A. Phanslakar, S. Iyer, R. Kompella, G. Varghese *Fast Deterministic Exact Match look-ups in large tables*, (perfect hashing with a hardware twist), U.S Patent 7043494, May 9th 2006. (21 citations) PMC-Sierra

[**P17**] Sushil Singh, G. Varghese, J. Huber, and G. Varghese *Scalably Detecting and Blocking Signatures at High Speeds*, (Fast string matching in hardware), U.S Patent 7602780, October 2009 2010. NetSift assigned to Cisco.

[**P18**] R. Pan, F. Bonomi, G. Varghese, *Modification of Policing Methods to make them TCP Friendly*, (adding Red like randomization to Token Bucket policing), U.S Patent 7817556, October 2010. Cisco

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[**P20**] S. Singh, G. Varghese, F. Bonomi, J. Chang, *System and Method to Process packets in a network using Stateful Processing*, (Using Bloom Filters to do approximate stateful processing), U.S Patent 7813350, October 2010. Cisco

[**P21**] S. Singh, G, Varghese,Detecting malicious attacks using network behavior and header analysis, U.S Patent 7,936,682, May 2011. Cisco

[**P22**] S. Singh, G, Varghese, Method and apparatus to process packets in a network, U.S Patent 7,535,90, May 2009. Cisco

[**P23**] S. Singh, G. Varghese, M. Ayres, M. Semanko, B. Eghbali, T. Newhouse Method and Apparatus for Content Classification, (using signatures to classify general content not just attacks), U.S Patent 8,010,685, August 2011. Cisco

[**P24**] G. Varghese, A. Fingerhut, F. Bonomi Method and System to detect an evasion attack, (detecting evasions without keeping complete state), U.S Patent 8,613,088, December 2013. Cisco

[**P25**] R. Ramjee. B, Aggarwal, P. Chitnis, G. Varghese, A. Anand, C. Muthukrishnan, A, Balachandran , Asymmetric end host redundancy elimination for networks, U.S. Patent, 9,083,708, Issued July 2015. Microsoft.

(3 more patents led while at Microsoft for geo-distributed analytics, Virtual Machine QoS, and packet classification)

DOCTORAL STUDENTS

13 graduated Ph.D. students (7 co-advised), 2 graduated students as unofficial co-advisor, and 6 graduated M.S. students.

A A. Vulimiri: Ph.D. 2015 UIUC (coadvised with Brighten Godfrey). Accepted position at Samsung Research

G. Gibb: Ph.D. 2014, Stanford (co-advised with Nick McKeown). Currently at Barefoot Networks J. Zheng: Ph.D. 2014, Stanford (co-advised with Nick McKeown). Currently at Facebook

C. Kozanitis: Ph.D 2013, UCSD (co-advised with Vineet Bafna). Was a postdoc at Berkeley with Patterson, Stoica and Franklin working on Genomic Databases; has just taken up a research position in Crete.

T. Lam: Ph.D 2013, UCSD. Currently at Google. His work on traffic rebalancing is used in Cisco's Nexus 9000 switches

Sumeet Singh: Ph.D. Candidate UCSD: Co-founded NetSift and winner of MIT TR-35 Award for 2006, Currently at Cisco

M. Motoyama: Ph.D. 2011 UCSD (co-advised with Savage and Voelker). Currently at a startup

F. Uyeda: Ph.D 2011, UCSD. Currently at Google

Ramana Kompella, Ph.D. 2007, UCSD (co-advised with Snoeren): Assistant Professor, CSE Purdue University

Cristi Estan, Ph.D. 2004, UCSD: Formerly Assistant Professor at University of Wisconsin CSE, currently at Google

Florin Baboescu, Ph.D. 2003, UCSD: Worked at Cisco, Qualcomm. Currently at Huawei

Lili Qiu, Ph.D. 1999, Cornell (co-advised with Robert Van Renesse from Cornell): Worked at Microsoft Research. Currently Associate Professor (with tenure) at UT Austin, CSE

V. Srinivasan, Ph.D. 1999, Washington University: Worked at Microsoft Research then co-founded Sahasra Networks, later acquired by NetLogic. Currently at Google.

Marcel Waldvogel Ph.D. 1999, ETH (co-advised with B. Plattner at ETH). Worked as Associate Professor at Washington University CSE. Currently a Full Professor at the University of Konstantz.

Girish Chandranmemon, Ph.D. 99, Washington University: Distinguished Member of Technical Staff at Lucent Bell Labs.

Two other students I was the unofficial co-advisor for and worked closely with on their thesis:

Peyman Kazemian, Ph.D 2012, Stanford (unofficial coadvisor with N. McKeown), Co-founder Forward Networks

C. Papadopolous, D.Sc. 1999, Washington University (unofficial coadvisor with G. Parulkar). Was Assistant Professor at University of Southern California, currently Associate Professor (with tenure) at Colorado State University

GRANTS

Network Verification Strategtic Intern Proposal, Jan 2013, top ranked proposal in Microsoft Research for Interdisciplinary work between the Programming Languages and Networking groups.

Data Center Networking, Research Grant, Aug 2010, National Science Foundation, $750,000 Principal Investigator: Amin Vahdat with co-PI George Varghese

Randomized Admission Control, Cisco University Research Program, $100,000 Principal Investigator: George Varghese, Sept 2008 — Sept, 2009.

Fast Parsing, Cisco University Research Program, $100,000 Principal Investigator: George Varghese, Sept 2007 — Sept, 2008.

NSF Center for Internet Epidemiology and Defense, 6 million over 5 years with Stefan Savage and Vern Paxon PIs, George Varghese as co-PI, 2004-2010 (with extension)

New Directions in Traffic Measurement and Accounting, $650,000, NSF Special Projects, recommended for funding in July 2002 Principal Investigator: George Varghese with David Moore as co-PI, Oct 2002 -Sept 2005

Real time Intrusion Detection, NIST Grant, $909,951 Principal Investigator: George Varghese with Stefan Savage as co-PI, Oct 1 2001 — Oct 1, 2004.

Terabit Lookups, Research Grant ANI 0074004, National Science Foundation, $300,000 Principal Investigator: George Varghese, Oct 1 2000 — Sept 30, 2003.

Fast Scalable Level Four Switching, Research Grant NCR 9813723, National Science Foundation, $965,353 Principal Investigator: George Varghese with co-PIs Subash Suri and Jon Turner, Oct 1 1998 — Sept 30, 2001.

Reconsidering Fragmentation and Reassembly, Research Grant NCR-9612853, National Science Foundation, $163,716, Principal Investigator: George Varghese. May 1,1997 — May 1st, 2000.

Efficient Fair Queuing and Load Balancing, Research Grant NCR-9628145, National Science Foundation, $275,000, Principal Investigator: George Varghese, with Subash Suri as co-PI. Sept 1,1996 — Aug 31, 1999.

Compilation and Automatic Optimization of Network Protocol Implementations, Research Grant NCR-9628218, National Science Foundation, $410,000, Principal Investigator: Ron Cytron with co-PIs: Doug Schmidt and George Varghese, Sept 1,1996 — Aug 31, 1999.

Designing Robust Network Protocols, ONR Young Investigator Award 1996, Office of Naval Research, $310,000, Principal Investigator: George Varghese, May 1996-May 1999.

Reliable Multicast Protocols, Cisco Systems, $75,000 Research Grant from Cisco Systems, Principal Investigator: George Varghese (was originally with Guru Parulkar), Aug 1998 – Aug 1999.

Reliable Multicast Protocols, NSF Networking, roughly $200,000, Principal Investigator: George Varghese (replacing Guru Parulkar, on leave on absence as CTO of Growth Networks), Aug 97-Aug 2000.

Trading Packet Headers for Packet Processing, Research Initiation Award NCR-940997, National Science Foundation, $100,000, Principal Investigator: George Varghese, July 1,1994 — June 30, 1997.

Making Network Protocols Simpler and More Robust using Self-stabilization, Research Grant NCR-9405444, National Science Foundation, $165,000, Principal Investigator: George Varghese, Sept 1,1994 — Aug 31, 1997.

PRESS ARTICLES ON RESEARCH

- Caltech Rigor and Relevance Blog, SIGCOMM Award, July 14, 2014 by Adam Wierman.
- Microsoft Research Blog, Researcher Varghese captures IEEE Kobayashi Award, Aug 5, 2013 by Rob Knies
- ScienceDaily, Aug 20, 2009, *Microsecond latency measurements*

  http://www.sciencedaily.com/releases/2009/08/090820161329.htm (Refers to work in SIGCOMM 2009)
- ArsTechnica, August 21, 2009, *Microsecond latency measurements* (Refers to work in SIGCOMM 2009)

  http://arstechnica.com/business/news/2009/08/new-protocol-could-enable-real-time-network-latency-data.ars"article (Refers to work in OSDI 2004)
- LightReading, July 1st, 2005, *NetSift acquisition*

  http://www.lightreading.com/document.asp?doc_id=76643"
- Business Week, Feb 7th 1998, *Lookup Inventions* by Neil Gross (Refers to work in SIGCOMM 97, and Patents P10 and P11)

  http://www.businessweek.com/1998/06/b3564113.htm
- USA Today, June 1997, Number 2625m Vol 125, Page 6, *Internet Glitches slow smooth surfing.* (Refers to work on crash failures in PODC 96).
- Wired Magazine, April 1998, *Lookups looking up*, by James Glave. (Refers to work in SIGCOMM 97, and Patents P10 and P11)
- Computers and Medicine, January 1998, *Two Inventions to make Internet 10 times faster*,(Refers to work in SIGCOMM 97, and Patents P10 and P11)
- Wired News, January 20, 1998, *Router Breakthrough Takes Net Traffic to Task*, by Gene Koprowski. Archived in:

  "http://www.wired.com/news/news/technology/story/9746.html" (Refers to work in SIGCOMM 97, and Patents P10 and P11)
- St. Louis Post-Dispatch, January 4, 1998, *WU Inventions Make Data Zip Along the Net*, By William Allen. Archived in:

  "http://web3.stlnet.com/archives/pdarc98.nsf/" under ce5cb66cf17fd8b686256363005212c4/b384390a9e13145d86256583006a818b? OpenDocument" (Refers to work in SIGCOMM 97, and Patents P10 and P11)

TEACHING

I enjoy inspiring students. While I was a professor at UCSD and Washington University, I did this for many graduate students who were advised by other professors. I received the Big Fish mentoring award at Washington University. At Microsoft Research, I took mentoring my interns (from Stanford, Berkeley, and UIUC) very seriously, and maintain long term relationships with them, including being part of their thesis committees. I look forward to working with a fresh batch of students at UCLA.

In the Spring of 94, I created a new version of a senior undergraduate course on Networking. I combined traditional networking content with techniques for designing protocols and recent advances

in communications technology. Traditional networking classes either stress Internet Protocols or communication technologies or queuing theory, and rarely bridge the gap between these viewpoints. I have enjoyed and worked on research in all three of these perspectives, and so tried to design a unique class that would blend all these points of view.

Since no textbook met these requirements, I made my own lecture notes. The course evolved when I moved from Washington University to UCSD to t the quarter system but has consistently high student ratings including a Best Teacher Award at UCSD.

In the Spring of 97, I developed a new class on Network Algorithmics (which involves hardware design as much as algorithms) and taught tutorials in SIGCOMM 96 and SIGMETRICS 98. A book based on the material called Network Algorithmics was published by Morgan- Kaufman). A set of homeworks and slides were created as a result. I have also taught 8 classes on "Network Algorithmics" at UCSD using my book. The graduate ratings have been very positive. I co-taught a portion of this class with Balaji Prabhakar and Tom Edsall during my sabbatical at Stanford in 2011.

In Sept 2009, I created a new version of a UCSD Course for Freshmen. The goal of this class was to convince entering freshmen that Computing was a vibrant discipline that goes well beyond the perception of merely programming (that appears to be a legacy of High School computer science classes). In particular, this perception seemed to deter women and minorities; we wished to change this.

What was perhaps unique in the class we invented, was that we were able to introduce students to a number of areas of which they knew nothing (e.g., hardware, vision, computational biology, embedded systems) using a set of homeworks that had to be possible without prior knowledge and yet introduced them to the eld. The new innovations nearly doubled the ratings of the course.

As I develop more understanding of the eld of Network Verification, my goal is to co-teach a graduate class on this topic, together with Verification Researchers (like Todd Millstein at UCLA) that have either a CAD or Programming Languages background, and someday write a book on this emerging area. I have made a start by coteaching a SIGCOMM tutorial in this area with Nikolaj Bjorner. I am also teaching a seminar class on "Network Verification and Synthesis and the Creative Habit" in Fall 2016 at UCLA.

INVITED TALKS

From Electronic Design Automation to Network Design Automation, Cambridge University, July 2016, University College London, July 2016, UC Berkeley Sept 2014, CMU Feb 2015, Caltech March 2015, Princeton June 2015, MSR New York June 2015, Microsoft Faculty Summit July 2015

Life in the Fast Lane: A View from the Confluence Lens, SIGCOMM 2014 Keynote talk, Chicago, Aug 2014

Lazy Joins and a Genome Query Language, Stanford Database Infolabs Lunch (Infolunch), November 2013

Network Verification: When Hoare meets Cerf, FMCAD 2016 Keynote, Imperial College, July 2016, UC Berkeley Colloqium/Distinguished Lecture, Sept 2015, Northwestern University, Distinguished Lecture, April 2013,

Querying a Mllion Genomes in a few milliseconds?, Berkeley Cloud Seminar, September 2012, Stanford PPL Retreat December 2012

The Future of Network Algorithmics, COMSNETS conference, Keynote, Jan 2012, Broadcom, Dec 2010, University of Sydney, July 2014

Reconciling Differences: Towards a Theory of Cloud Complexity, Stanford Information Systems Lab Seminar, October 2011

Efficient Set Reconciliation, Berkeley Theory Lunch, March 2011. Google, July 2011. Duke University, July 2011

Abstractions for Genomics, Stanford Database Infolabs Lunch (Infolunch), Jan 2011.

The Future of Network Algorithmics for Chip and Router Vendors, Broadcom, December 2010.

Getting an Edge: Randomized Algorithms for Networking Hardware, Stanford Networking Seminar, Stanford, Oct 2010.

Getting an Edge: Randomized Algorithms for Networking Hardware, University of California, Irvine, Distinguished Lecture May 2009.

Introspective Networks, CMU Systems Seminar, May 2008.

Rethinking Network Security: A Voyage, Distinguished Lecture, University of Wisconson, Madison Dept of Computer Science, Dec 2007.

Introspective Networks, MIT Colloquium, July 2006.

Introspective Networks, Berkeley Colloquium, June 2007.

Introspective Networks, Stanford Networking Seminar, June 2006.

Detecting Worms using Introspection, DIMACS Workshop on Large Scale Attacks

From Fast IP Look to Fast Memory Allocation, Stanford Networking Seminar, March 2001.

From Fast IP Look to Fast Memory Allocation, Cornell, University of Wisconsin, UCSD, University of Texas at Austin, various dates, 1999. Networking Seminar, March 2001.

Fast IP Lookup Techniques: Interop 97 (Atlanta), Hot Interconnects 98 (Stanford), Microsoft Corporation, Sept 97, DEC Littleton, Oct 97, Fujitsu Corporation, 2001, STMicroelectronics (2001).

The Academic Researcher as Entrepreneur, invited presentation to the Rotary Club of St. Louis, March 1998.

General Techniques for Self-Stabilization: University of Iowa, April 1995; DEC System's Research Center, Palo Alto, Aug 1994; Programming Research Group, Oxford University, Sept 1994.

New Techniques for Congestion Control: UCLA, Aug 1994; Computing Laboratory, Cambridge University, Sept 1994.

Self-Stabilization by Local Checking and Correction: IBM T.J. Watson Research Center, Jan 1993; Bell Labs, Murray Hill Jan 1993; Carnegie-Mellon University, March 1993; Stanford University, April 1993; Lab for Information and Decisions Sciences, MIT - April 1993; Indian Institute of Technology, Bombay, May 10th 1993.

Techniques for Self-stabilization: ESSRL Seminar, Washington University, Dec 1993; Industrial Partners Program, Washington University, Dec 1993, ARPA PI meeting Sept 1993.

Several additional conference talks to present the papers in SIGMETRICS 83, SOSP 87, SIGCOMM 87, SIGCOMM 88, FOCS 91, PODC 92, SIGCOMM 95, PODC 96, PODC 97, Interconnects 98, PODC 98, SIGCOMM 2000