Curriculum Vitae of
Balachander Krishnamurthy

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Primary Areas of Expertise and Interest

Internet Privacy, Online Social Networks, Internet Measurement, Internet Protocols

Education

Ph.D. Department of Computer Science, Purdue University, W. Lafayette Indiana. Dec. 1987
   Thesis: "A Uniform Model Of Interaction In Interactive Systems"

M.S. Department of Computer Science, Purdue University, W. Lafayette Indiana. Dec. 1985

M.S. Dept. of Mathematics, College of William & Mary, Williamsburg, Virginia, Aug. 1982

B.Sc Mathematics, University of Madras, India, 1980

Experience

Jan. 1988 - present : Lead Inventive Scientist, AT&T Labs–Research

I am among a select set of researchers worldwide combining deep knowledge of privacy, Internet measurements, and online social networks. I excel in issues related to Internet privacy based on publications, impact, talks/consulting, and press interviews (such as Wall Street Journal, LA Times, and USA Today). My work has directly led to the U.S. Federal Trade Commission settling charges against multiple social networking companies (many of whom have subsequently fixed the problems) for their role in leaking personal information about users to third parties. I have pioneered work in making data sharing transparent through market mechanisms.

I have led numerous Internet Protocol and Web measurements research projects with impact on Internet standards and influence on research directions. With colleagues, I added delta and compression encoding to the HTTP protocol to improve bandwidth usage, which is now an Internet standard. I have designed and constructed packet monitors and gathered data at all the network layers and came up with the first scheme based on economic disincentives to fight spam (about which I was interviewed by The Economist magazine).

I have written and edited ten books with some translated into several languages. I co-wrote the first book on Internet Measurements examining network infrastructure, traffic, and applications. I co-authored the first in-depth book on HTTP/1.1—the technology underlying the Web. The book is widely considered to be the canonical reference for HTTP/1.1, is used in several universities, and has been translated into Chinese, Japanese, Portuguese, and Russian. Earlier, I edited and co-wrote the book "Practical Reusable UNIX Software" that describes a well-known collection of software developed in AT&T.

I have founded several successful technical conferences. In 2001, I founded the highly successful Internet Measurement Conference and served on its steering committee for five years. The conference now in its 15th year attracts over 150 papers annually with a community exceeding 600 researchers worldwide. In 2008, I co-founded the Workshop on Online Social Networks (WOSN) and in 2013 I managed to merge five other workshops in this field (held in venues such as VLDB, SIGMOD, WWW, Usenix, SIGCOMM, Eurosys) and WOSN into a single conference: COSN (http://cosn.acm.org). COSN ran for three years and in its first year when I was PC co-chair and organizer, attracted nearly 140 high quality submissions and had an acceptance rate of 15.8%. I was PC chair for Data Transparency Lab 2016, a venue that hands out 300,000 Euros to successful privacy project applicants. I have been involved in DTL from its founding. I co-organized the Dagstuhl 2013 Decentralized Systems for Privacy Preservation (# 13062).

I have collaborated with over eighty researchers worldwide, presented numerous tutorials at several industrial sites and conferences, and given invited talks in thirty five countries including a dozen keynotes and two plenary talks at IETF. I have 66 issued patents and over 40 applications pending on a wide range of topics.

Honors

2009 AT&T Science and Technology medal (awarded to 2-3 people out of 300,000 employees)

Books

Internet Measurement: Infrastructure, Traffic and Applications
(with M. Crovella, 525pp, John Wiley & Sons. 2006)

Web Protocols and Practice: HTTP/1.1, Networking Protocols, Caching, and Traffic Measurement
(with J. Rexford, 672pp, Addison-Wesley, 2001)
Translations available: Chinese, Japanese, Portuguese, Russian

Series Editor: **Trends in Software** (John Wiley & Sons., 1995-1999)

Titles: User Interface Software, Configuration Management, Software Fault Tolerance Formal methods for real-time computing, Software Process, Computer Supported Co-Operative Work, Data Visualization Techniques.

Editor and co-author: **Practical Reusable UNIX Software** (John Wiley & Sons, May 1995)

Some key publications

- Towards Seamless Tracking-Free Web: Improved Detection of Trackers via One-class Learning M. IKRAM, H. ASGHAR, M. KAAFAR, A. MAHANTI, B. KRISHNAMURTHY
  PETS 2017 (Privacy Enhancing Technology Symposium) To appear, July 2017

- Efficient Sampling for Better OSN Data Provisioning NICK DUFFIELD AND BALACHANDER KRISHNAMURTHY
  54th Annual Allerton Conference on Communication, Control, and Computing
  September 2016

- Half-Baked Cookies: Hardening Cookie-Based Authentication for the Modern Web YOGESH MUNDADA NICK FEAMSTER BALACHANDER KRISHNAMURTHY
  Asia-CCS, May 2016

- Measurement and Analysis of OSN Ad Auctions Y LIU, C KLIMAN-SILVER, R BELL, BALACHANDER KRISHNAMURTHY, AND A MISLOVE
  Conference on Online Social Networks, October 2014 **Winner: ACM Community Contribution Award**

- Beyond CPM and CPC: Determining the Value of Users on OSNs D SAEZ-TRUMPER, Y LIU, R BAEZA-YATES, BALACHANDER KRISHNAMURTHY, AND ALAN MISLOVE
  Conference on Online Social Networks, October 2014

- Peeking into Invitation-based Adoption Process of OSN-based Applications M. REZAUR RAHMAN, PIERRE-ANDRE NOEL, CHEN-NEE CHUAH, BALACHANDER KRISHNAMURTHY, RAISSA M. D'SOUZA, AND S. FELIX WU
  ACM SIGCOMM CCR, January 2014 Selected for presentation at SIGCOMM 2014 "Best of CCR" session as best technical publication

- Follow the money: Understanding economics of online aggregation and advertising P GILL, V ERRAMILLI, A CHAINTREAU, B KRISHNAMURTHY, D PAPAGIANNAKI, P RODRIGUEZ
  Internet Measurement Conference, October 2013
  Winner: Best paper award

- Privacy and Online Social Networks: Can colorless green ideas sleep furiously? BALACHANDER KRISHNAMURTHY
  IEEE Security and Privacy, May-June, 2013

- Measuring Personalization of Web Search A HANNAK, P SAPIEZYNSKI, A KAKHKI, B KRISHNAMURTHY, D LAZER, A MISLOVE, AND C WILSON *World Wide Web Conference* May 2013

- For Sale: Your Data By: You C. RIEDERER, V. ERRAMILLI, A. CHAINTREAU, B. KRISHNAMURTHY, P. RODRIGUEZ *ACM SIGCOMM Hotnets Workshop* November 2011

- Network Level Footprints of Facebook Applications A. NAZIR, S. RAZA, D. GUPTA, C. CHUAH, B. KRISHNAMURTHY *Internet Measurement Conference* November 2009

- IXPs: Mapped? B. AUGUSTIN, B. KRISHNAMURTHY, W. WILLINGER *Internet Measurement Conference* November 2009

- On the Leakage of Personally Identifiable Information Via Online Social Networks B. KRISHNAMURTHY AND C. WILLS *ACM SIGCOMM Workshop on Online Social Networks* August 2009

- Collaborating against common enemies, SACHIN KATTI, B. KRISHNAMURTHY, DINA KATABI *Internet Measurement Conference* October 2005

- Remote Profiling of Resource Constraints of Web Servers Using Mini-Flash Crowds P. RAMAMURTHY, V. SEKAR, A. AKELLA, B. KRISHNAMURTHY, A SHAIKH *Usenix Annual Technical Conference* June 2008

- Flash Crowds and Denial of Service Attacks: Characterization and Implications for CDNs and Web Sites, J. JUNG, B. KRISHNAMURTHY, M. RABINOVICH *World Wide Web Conference* May 2002

- Potential benefits of delta encoding and delta compression for HTTP, J. MOGUL, F. DOUGLIS, A. FELDMANN, B. KRISHNAMURTHY, *ACM SIGCOMM*, Cannes, September 1997

Other publications

1. Privacy Awareness about Information Leakage: Who knows what about me? D MALANDRINO AND L SERRA AND A PETTA AND V SCARANO AND R SPINELLI AND BALACHANDER KRISHNAMURTHY Proceedings of the Workshop on Privacy in the Electronic Society, November 2013

2. Twitter: A Content Analysis of Personal Information LEE HUMPHREYS, PHILLIPA GILL, BALACHANDER KRISHNAMURTHY Information, Communication and Society Journal, 2013

3. Dasu: Pushing Experiments to the Internets Edge M SANCHEZ, J OTTO, Z BISCHOF, D CHOFFNES, F BUSTAMANTE, B KRISHNAMURTHY, W WILLINGER ACM/USENIX NSDI'13, April 2013

4. Beyond Friendship: Modeling User Activity Graphs on Social Network-Based Gifting Applications A NAZIR, A WAAGEN, V VIJAYARAGHAVAN, C CHUAH, R DSOUZA, AND B KRISHNAMURTHY Internet Measurement Conference, Nov 2012

5. Towards extracting semantics by visualizing large traceroute datasets E GANSNER, B. KRISHNAMURTHY, W WILLINGER, F BUSTAMANTE, M SANCHEZ Workshop on Internet Visualization, Nov 2012

6. Historicizing New Media: a content analysis of Twitter L. HUMPHREYS, P. GILL, B. KRISHNAMURTHY, E. NEWBURY Conference of International Communication Association, May 2012

7. Analyzing Facebook Privacy Settings: User Expectations vs. Reality Y. LIU, K. GUMMADI, B. KRISHNAMURTHY, A. MISLOVE Proceedings of IMC 2011, November 2011

8. Privacy leakage vs. Protection measures: the growing disconnect B. KRISHNAMURTHY, K. NARYSHKIN, C. WILLS Web 2.0 Security and Privacy Workshop, May 2011

9. A Socratic method for validation of measurement-based networking research B KRISHNAMURTHY, WALTER WILLINGER, PHILLIPA GILL, MARTIN ARLITT Computer Communications, Volume 34, Issue 1, January 2011

10. I know what you will do next summer BALACHANDER KRISHNAMURTHY ACM SIGCOMM Computer Communication Review, Volume 40, Number 5, October 2010

11. Privacy Leakage in Mobile Online Social Networks B. KRISHNAMURTHY AND C. WILLS Proceedings of Workshop on Online Social Networks, June 2010

12. Prediction Promotes Privacy In Dynamic Social Networks S. BHAGAT, G. CORMODE, B. KRISHNAMURTHY, D. SRIVASTAVA Proceedings of Workshop on Online Social Networks, June 2010

13. How much is too much? Privacy issues on Twitter L. HUMPHREYS, P. GILL, B. KRISHNAMURTHY Conference of International Communication Association, June 2010

14. Understanding Online Social Network Usage from a Network Perspective F. SCHNEIDER, A. FELDMANN, B. KRISHNAMURTHY, W. WILLINGER Internet Measurement Conference, November 2009

15. Class-based graph anonymization for social network data S. BHAGAT, G. CORMODE, B. KRISHNAMURTHY, D. SRIVASTAVA VLDB, August 2009

16. Privacy Diffusion on the Web: A Longitudinal Perspective B. KRISHNAMURTHY AND C. WILLS WWW, April 2009

17. Bringing Signature-Based Anomaly Detection to IP Flows N. DUFFIELD, P. HAFFNER, B KRISHNAMURTHY, H. RINGBERG Infocom, April 2009

18. A measure of Online Social Networks (Invited paper) BALACHANDER KRISHNAMURTHY ComsNets'09, January 2009

19. A few chirps about Twitter B. KRISHNAMURTHY, P. GILL, M. ARLITT ACM SIGCOMM Workshop on Online Social Networks, August 2008

20. Characterizing Privacy in Online Social Networks B. KRISHNAMURTHY AND C. WILLS ACM SIGCOMM Workshop on Online Social Networks, August 2008

21. What are our standards for validation of measurement-based networking research? B. KRISHNAMURTHY AND W. WILLINGER ACM SIGMETRICS HotMetrics 2008, June 2008

22. Key Differences between Web1.0 and Web2.0 G. CORMODE AND B. KRISHNAMURTHY First Monday, 13(2), June 2008

23. A Generic Language for Application-Specific Flow Sampling H. MADHYASTHA AND B. KRISHNAMURTHY ACM SIGCOMM Computer Communication Review, April 2008

24. Filtering Sources of Unwanted Traffic F.SOLDO, K. EL DEFRAWY, A. MARKOPOULOU, B.KRISHNAMURTHY, K. VAN DER MERWE Proceedings of ITA Workshop '08, San Diego, CA, Jan 2008

25. Using Mini-Flash Crowds to Infer Resource Constraints in Remote Web Servers P. RAMAMURTHY, V. SEKAR, A. AKELLA, B. KRISHNAMURTHY, A SHAIKH SIGCOMM INM Workshop, Kyoto, August 2007

26. Measuring Privacy Loss and the Impact of Privacy Protection in Web Browsing B. KRISHNAMURTHY, D. MALANDRINO, C. WILLS Symposium on Usable Privacy and Security, Pittsburgh, 2007

27. Generating a privacy footprint on the Internet, B. KRISHNAMURTHY AND C. WILLS Internet Measurement Conference, Rio display Janeiro, October 2006

28. Tracking role of adversaries in measuring unwanted traffic, M. ALLMAN, P. BARFORD, B. KRISHNAMURTHY, J. WANG Usenix SRUTI (Steps to Reducing Unwanted Traffic on the Internet), July 2006

29. Cat and Mouse: Content Delivery Tradeoffs in Web Access, B. KRISHNAMURTHY AND C. WILLS World Wide Web Conference, Tokyo, May 2006

30. Predicting short-transfer latency from TCP arcana: A trace-based validation, M. ARLITT, B. KRISHNAMURTHY, J. MOGUL Internet Measurement Conference 2005, Berkeley, CA, October 2005

31. Stress Testing Traffic to Infer Its Legitimacy, N. DUFFIELD AND B. KRISHNAMURTHY Usenix SRUTI (Steps to Reducing Unwanted Traffic on the Internet), July 2005

32. ATMEN: A Triggered Network Measurement Infrastructure, B. KRISHNAMURTHY, H. MADHYASTHA, O. SPATSCHECK World Wide Web Conference, Tokyo, May 2005

33. A Short Walk in the Blogistan, E. COHEN, B. KRISHNAMURTHY COMNET, Spring 2005

34. On stationarity in Internet measurements through an information-theoretic lens, B. KRISHNAMURTHY, H. MADHYASTHA, S. VENKATASUBRAMANIAN Ist IEEE International Workshop on Networking Meets Databases (NetDB), Tokyo, April 2005

35. On the (in)stability of large Internet flows, A. FELDMANN, B. KRISHNAMURTHY, J. WALLERICH, W. WILLINGER ACM Computer Communication Review, April 2005

36. On the Responsiveness of DNS-based Network Control, J. PANG, A. AKELLA, A. SHAIKH, B. KRISHNAMURTHY, S. SESHAN Internet Measurement Conference, Taormina, Oct 2004

37. Mohonk: Mobile honeypots to trace unwanted traffic early, BALACHANDER KRISHNAMURTHY ACM SIGCOMM NeTTS workshop, September 2004

38. Sketch-based Change Detection: Methods, Evaluation, and Applications, B. KRISHNAMURTHY, S. SEN, Y. ZHANG, Y. CHEN Proceedings of Internet Measurement Conference, Miami, November 2003

39. DEW: DNS-Enhanced Web for Faster Content Delivery, B. KRISHNAMURTHY, R. LISTON, M. RABINOVICH World Wide Web Conference, Budapest, May 2003

40. Design, Implementation, and Evaluation of a Client Characterization Driven Web Server, B. KRISHNAMURTHY, C. WILLS, Y. ZHANG, K. VISHWANATH World Wide Web Conference, Budapest, May 2003

41. Fast Prefix Matching of Bounded Strings, A. BUCHSBAUM, G. FOWLER, B. KIRSHNAMURTHY, K. VO, J. WANG Proceedings of ACM SIGACT ALENEX03, Baltimore, Maryland, January 2003

42. Preliminary Measurements on the Effect of Server Adaptation for Web Content Delivery, B. KRISHNAMURTHY, C. WILLS, Y. ZHANG Proceedings of IMW-2002, Marseille, Nov 2002

43. Traffic classification for application specific peering, B. KRISHNAMURTHY AND J. WANG Proceedings of IMW-2002, Marseille, Nov 2002

44. Improving Web experience by client characterization driven server adaptation, B. KRISHNAMURTHY AND C. WILLS World Wide Web Conference 2002, Hawaii, May 2002

45. On the Use and Performance of Content Distribution Networks, B. KRISHNAMURTHY, C. WILLS, Y. ZHANG Proceedings of ACM SIGCOMM Internet Measurement Workshop, Nov 2001

46. Characterizing large DNS traces using graphs, C. Cranor, E. Gansner, B. Krishnamurthy, O. Spatscheck Proceedings of ACM SIGCOMM Internet Measurement Workshop, Nov 2001

47. Early Measurements of a Cluster-based Architecture for P2P Systems, B. Krishnamurthy, J. Wang, Y. Xie Proceedings of ACM SIGCOMM Internet Measurement Workshop, Nov 2001

48. Topology Modeling via Cluster Graphs, B. Krishnamurthy and J. Wang Proceedings of ACM SIGCOMM Internet Measurement Workshop, Nov 2001

49. Looking for science in the art of network measurement, M. Grossglauser and B. Krishnamurthy Proceedings of IWDC, September 2001

50. CORBA Notification Servce: Design challenges and Scalable Solutions, R. Gruber, B. Krishnamurthy, E. Panagos Proceedings of the International Conference on Data Engineering, May 2001

51. PRO-COW: Protocol Compliance on the Web, B. Krishnamurthy and M. Arlitt Proceedings of USITS, March 2001

52. On Network-aware Clustering of Web Clients, B. Krishnamurthy and J. Wang Proceedings of SIGCOMM 2000

53. Measurement and Analysis of IP Network Usage and Behavior, R. Caceres et al. IEEE Communications Magazine Special Issue, 2000

54. Analyzing Factors That Influence End-to-End Web Performance, B. Krishnamurthy and C. Wills World Wide Web - 9 Conference, Amsterdam, May 2000

55. En Passant: Predicting HTTP/1.1 traffic, B. Krishnamurthy and J. Rexford Global Internet '99, Rio di Janeiro, Dec 1999

56. Proxy Cache Coherency and Replacement—Towards a More Complete Picture, B. Krishnamurthy, C. Wills, ICDCS, Austin, June 1999

57. Key Differences between HTTP/1.0 and HTTP/1.1, B. Krishnamurthy, J. Mogul, D. Kristol, World Wide Web - 8 Conference, Toronto, May, 1999.

58. Algorithms for Predicting Requests for Web Servers E. Cohen, B. Krishnamurthy, J. Rexford, Infocom '99, New York, March 1999

59. Software Issues in Characterizing Web Server Logs, B. Krishnamurthy and J. Rexford, World Wide Web Consortium Workshop on Web Characterization, Cambridge, Massachusetts, November 1998

60. HTTP 1.0 Logs Considered Harmful, R. Caceres, B. Krishnamurthy, J. Rexford, World Wide Web Consortium Workshop on Web Characterization, Cambridge, Massachusetts, November 1998

61. Using Regions to Focus Search in Hierarchical Structures. G. Jacobson, B. Krishnamurthy, D. Srivastava, D. Suciu, CIKM '98, Washington D.C., November 1998

62. Higher-Level Constructs in the READY Event Notification System, R. Gruber, B. Krishnamurthy, E. Panagos, SOSP, European Workshop 98, Sintra, Portugal, September 1998

63. Improving end to end performance of the Web using server volumes and proxy filters E. Cohen, B. Krishnamurthy, J. Rexford, SIGCOMM 98, Vancouver, September 1998

64. Evaluating Server-Assisted Cache Replacement in the Web, E. Cohen, B. Krishnamurthy, J. Rexford, European Symposium on Algorithms ESA98, Venezia, August 1998

65. Piggyback Server Invalidation for Proxy Cache Coherency, B. Krishnamurthy and C. Wills, World Wide Web - 7 Conference, Brisbane, April, 1998.

66. Study of Piggyback Cache Validation for Proxy Caches in the World Wide Web, B. Krishnamurthy and C. Wills, USENIX Symposium on Internet Technologies and Systems, Monterey, December 1997

67. Rate of Change and other Metrics: a Live Study of the World Wide Web, Fred Douglis, Anja Feldmann, Balachander Krishnamurthy and Jeff Mogul, USENIX Symposium on Internet Technologies and Systems, Monterey, December 1997

68. Software Reuse Metrics for an Industrial Project, Ferri et al., Metrics'97, Albuquerque October 1997

69. Piggyback Cache Validation for Proxy Caches in the World Wide Web, B. KRISHNAMURTHY AND C. WILLS, NLANR Web Cache Workshop, Boulder, June 1997

70. CML as a development tool. A case study, B. KRISHNAMURTHY, M. BOBROWSKI, S. UCHITEL, D. YANKELEVICH, JAIIO Buenos Aires, August 1996

71. Design Principles of Interactive Software, B. KRISHNAMURTHY WITH IFIP WG 2.7, (book) Chapman and Hall, May 1996

72. Architecture Styles and Services in Building Operations Support Systems, D. BELANGER, Y. CHEN, B. KRISHNAMURTHY, AT&T Technical Journal, December 1995

73. Yeast: A General-Purpose Event-Action System, B. KRISHNAMURTHY AND D. ROSENBLUM, IEEE Transactions on Software Engineering, October 1995

74. An Objective Reuse Metric: Model and Methodology, Y. CHEN, B. KRISHNAMURTHY, K. VO, European Software Engineering Conference, Barcelona, September 1995

75. Using Event Contexts and Matching Constraints to Monitor Software Processes, N. BARGHOUTI AND B. KRISHNAMURTHY, 17th International Conference on Software Engineering, Seattle, April 1995

76. Reuse Thru Software Architecture: Looking at an ongoing experiment, D. BELANGER AND B. KRISHNAMURTHY, Third International Reuse Conference, Rio di Janeiro, November 1994

77. Relations between CSCW and Software Process Research:A Position Statement, PRASUN DEWAN AND BALACHANDER KRISHNAMURTHY, 9th International Software Process Workshop, Airlie, Virginia, Oct 1994

78. Provence: A Process Visualization and Enactment Environment, B. KRISHNAMURTHY AND N. BARGHOUTI, Fourth European Software Engineering Conference, Garmisch, September 1993

79. Yeast: A case study for a practical use of formal methods P. INVERARDI, B. KRISHNAMURTHY, D. YANKELOVICH, TAPSOFT IV, Orsay, April 1993

80. An Open Environment for Process Modeling and Enactment, N. BARGHOUTI AND B. KRISHNAMURTHY, 8th International Software Process Workshop, Dagstuhl, Germany, March 1993

81. Combining interactive tools, E. KOUTSOFIOS AND B. KRISHNAMURTHY, CSCW-92 Tools & Technologies Workshop, Toronto, November 1992

82. COLA: Customized Overlaying, E. KRELL AND B. KRISHNAMURTHY, Usenix Winter 1992 Technical Conference , San Francisco, January 1992

83. An Event-Based Model of Software Configuration Management, B. KRISHNAMURTHY AND D. ROSENBLUM, Software Configuration Management Workshop 3, Trondheim, June 1991

84. An Event-Action Model of Computer-Supported Cooperative Work: Design and Implementation, B. KRISHNAMURTHY AND D. ROSENBLUM, International Workshop on CSCW, Berlin, April 1991

85. Live Text, C. FRASER AND B. KRISHNAMURTHY, Software, Practice and Experience, August 1990

86. BOSS: A Visual Interface for a Workstation Environment, B. KRISHNAMURTHY, IFIP WG 2.7 Working Conference on Engineering for Human-Computer Interaction, Napa Valley, California, August 1989.

- **Editorial Boards**
    ACM Transactions on Internet Technology (2002–2006)
    ACM Computer Communication Review (2000–2005)

- **Founder and Steering Committees**
    ACM Conference on Online Social Networks (2013–present)
    ACM SIGCOMM Workshop on Online Social Networks (2008–2012)
    ACM SIGCOMM Internet Measurement Conference (2000–2005)
    USENIX Steps to Reducing Unwanted Traffic on the Internet Workshop (2005–2007)

- **International Advisory Board**
    Ragazze Digitali (teaching high school female students to code), Modena, Italy

- **Selected Keynote, plenary, and distinguished lectures**
    "Is measurement *still* an afterthought?", Final mPlane Workshop, Heidelberg, November 2015

    "Internet privacy", University of Trento, May 2015

    "Internet privacy: Towards more transparency", First ISSS Info Security Switzerland Conference, Oct 2013

    "Internet privacy", Jay Modi Memorial Lecture, Drexel University, June 2013

    "Internet privacy: Towards more transparency", Northwestern University, June 2012

    "Internet privacy: It is not getting better", University of Calgary, October 2011

    "The world of Online Social Networks", KACST, Riyadh, September 2011

    "Internet Privacy: Who gathers data and how", UFMG, Brazil, January 2011

    "Privacy leakage on OSNs", Univ of Cambridge, November 2010

    "Privacy and Online Social Networks", KAIST, Seoul, Korea, November 2010

    "Privacy leakage on the Internet", IETF Plenary, Anaheim, March 2010

    "Protocol Compliance on the Web", IETF Plenary, Boston, November 1999

- **Tutorials**
    Unwanted Traffic (with Dina Katabi) ACM SIGCOMM Conference, Portland, OR, August 2004

    Web Protocols, Workloads, Measurement, and Caching (with J. Rexford), Akamai (October 2000)

    Web Protocols (with J. Rexford), NetApp (November 1999)

    Web Protocols and Caching (with J. Rexford), FZI Forschungszentrum Informatik, October 1999

    TCP's impact on HTTP and HTTP/1.1 (with J. Rexford), WWW-9 (May 2000), SIGCOMM'99, (Sep 1999)

- **Patents**

  5,608,908 Open Process Control Systems (1997)

  5,956,027 Method and apparatus for sharing a web page (1999)

  5,956,722 Method for effective indexing of partially dynamic documents (1999)

  5,970,489 Method for using region-sets to focus searches in hierarchical structures (1999)

  6,070,157 Method for providing more informative results in response to search of electronic documents (2000)

  6,073,130 A Method For Improving The Results Of A Search In A Structured Database (2000)

  6,134,553 Method for using region-sets to focus searches in hierarchical structures (2000)

  6,167,397 Method of clustering electronic documents in response to a search query (2000)

  6,330,561 Method and Apparatus for Improving End-to-End Performance of a Data Network (2001)

  6,338,058 Method for providing more informative results in response to a search of electronic documents (2002)

  6,363,379 Method of clustering electronic documents in response to a search query (2002)

  6,434,573 Method for effective indexing of partially dynamic documents (2002)

  6,578,113 Method for cache validation for proxy caches (2003)

  6,606,639 Method for effective indexing of partially dynamic documents (2003)

  6,751,608 Method and apparatus for improving end to end performance of a data network (2004)

  6,912,562 Cache invalidation technique with spurious resource change indications (2005)

  6,928,485 Method for network-aware clustering of clients in a network (2005)

  7,191,168 Fast prefix matching of bounded strings (2007)

  7,219,160 Method for fast network-aware clustering (2007)

  7,296,089 Method for improving web performance by adapting servers based on client cluster characterization (2007)

  7,627,691 Method for fast network-aware clustering (2009)

  7,630,949 System and method for inferring traffic legitimacy through selective impairment (2009)

  7,657,553 System and method for improving end to end performance of a data network (2010)

  7,657,735 System and method for monitoring network traffic (2010)

  7,742,409 Method and apparatus for compensating for performance degradation of an application session (2010)

  7,751,325 Method and apparatus for sketch-based detection of changes In network traffic (2010)

  7,916,664 Reverse engineering peering at Internet exchange point (2011)

  7,933,745 System and method for profiling resource constraints of web servers (2011)

  7,979,413 Automatic generation of embedded signatures for duplicate detection on a public network (2011)

  8,069,150 Method and apparatus for improving end to end performance of a data network (2011)

  8,091,131 Method and apparatus for communicating intrusion-related information between ISPs (2012)

  8,098,686 Method and apparatus for providing an application-level utility metric (2012)

  8,141,150 Method and apparatus for automatic identification of phishing sites from low-level network traffic (2012)

  8,156,556 Method and apparatus for providing mobile honeypots (2012)

  8,161,155 Filtering unwanted data traffic via a per-customer blacklist (2012)

  8,307,431 Method and apparatus for identifying phishing websites in network traffic using generated regular expressions (2012)

  8,375,447 System and method for monitoring network traffic (2013)

  8,386,534 Automatic gleaning of semantic information in social networks (2013)

  8,438,267 Internet-wide scheduling of transactions (2013)

  8,438,650 Anonymization of data over multiple temporal releases (2013)

  8,457,016 Reverse engineering peering at internet exchange points (2013)

  8,484,463 System and method for utilizing a rendezvous mechanism for secure information exchange (2013)

  8,510,792 Gated network service (2013)

  8,527,504 Data network content filtering using categorized filtering parameters (2013)

  8,539,576 System And Method For Filtering Unwanted Internet Protocol Traffic Based On Blacklists (2013)

  8,589,443 Method and apparatus for providing anonymization of data (2013)

  8,601,591 Method and apparatus for providing web privacy (2013)

  8,701,185 Method for locating fraudulent replicas of web sites (2014)

  8,732,295 Method and apparatus for providing real friends count (2014)

  8,751,431 System and method for inferring traffic legitimacy through selective impairment (2014)

  8,768,961 System and method of processing database queries (2014)

8,775,605 Method and apparatus to identify outliers in social networks (2014)

8,776,224 Method and apparatus for identifying phishing websites in network traffic using generated regular expressions (2014)

8,819,109 Data network communication using identifiers mappable to resource locators (2014)

8,839,443 Identifying and remedying secondary privacy leakage (2014)

8,839,454 Multi-dimensional user-specified extensible narrowcasting system (2014)

8,862,635 Automatic gleaning of semantic information in social networks (2014)

8,898,785 System and method for monitoring network traffic (2014)

8,943,200 Method and apparatus for reducing unwanted traffic between peer networks (2015)

8,949,327 Method and device to provide trusted recommendations of websites (2015)

9,059,897 Method and apparatus to identify outliers in social networks (2015)

9,106,550 System and method for inferring traffic legitimacy through selective impairment (2015)

9,118,560 Internet-wide scheduling of transactions (2015)

9,172,706 Tailored protection of personally identifiable information (2015)

9,258,217 Systems and methods for rule-based anomaly detection on IP network flow (2016)

9,356,959 System and method for monitoring network traffic (2016)

9,407,527 System and method for inferring traffic legitimacy through selective impairment (2016)