Erich M. Nahum

Work:
IBM T.J. Watson Research Center
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560 Riverside Drive Apt. 8J
New York, NY 10027
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OVERVIEW
Experienced industrial researcher in networked systems with 20+ years at the IBM T.J. Watson Research Center.

- Research: Network performance, including Internet of Things, cloud computing, wireless and mobile, TCP, HTTP, SSL, SIP, workload characterization and generation, kernel support for networking, clusters, multiprocessors, load balancing, and security.
- Science: ACM Distinguished Scientist with impact in over 50 publications with greater than 4900 citations and an h-index of 35.
- Industry: Impact via product tech transfer (including two IBM Outstanding Technical Achievement Awards, IBM Master Inventor, and multiple IBM Accomplishments), IP (with 29 patents issued and 11 additional patents filed), and standardization (e.g., SPEC SIP Infrastructure benchmark).
- Academics: Adjunct faculty, Department of Computer Science, Columbia University, 2 separate classes taught. Ph.D. Committee member for 8 Ph.D. students across 4 universities, including Princeton and Columbia.
- Service: 1 General Chair, 3 PC co-chairs, 3 executive committee memberships, 2 journal editorships, and over 30 PC memberships.

EDUCATION

University of Massachusetts Amherst, MA
Ph.D. in Computer Science September 1996
Thesis title: Networking Support for High-Performance Servers.
Thesis Co-Chairs: James F. Kurose and Don Towsley

University of Massachusetts Amherst, MA
M.S. in Computer Science May 1991

University of Wisconsin Madison, WI
B.A. in Computer Science August 1988

EXPERIENCE

IBM T.J. Watson Research Center Yorktown Heights, NY
Research Staff Member October 1996–Present
Conduct research with both academic novelty and business impact. Responsibilities include technical leadership, project leadership, IP generation, and internal and external fundraising.

Columbia University New York, NY
Adjunct Faculty, Computer Science Dept. Spring 2008–Spring 2010

COMS W6998, Network Systems Design and Implementation, Spring 2010.
COMS W4118, Operating Systems, Spring 2008.

University of Massachusetts   Amherst, MA
Research Assistant, Computer Networks Research Group   August 1992–September 1996
Ph.D. thesis in networking support for high-performance servers. Designed and implemented parallelized network protocol software on a shared-memory multiprocessor. James F. Kurose and Don Towsley, advisors.

University of Massachusetts   Amherst, MA
Research Assistant, Real-Time Systems Group   June 1990–August 1992
Designed and implemented the IPC subsystem for the Spring Kernel, a multiprocessor hard real-time operating system. J. A. Stankovic and K. Ramamritham, advisors.

University of Massachusetts   Amherst, MA
Teaching Assistant, Department of Computer Science   September 1989–May 1990
COINS 105, Computer Literacy, Spring 1990.
COINS 121, Introduction to Programming Using Pascal, Fall 1989.

Microsoft Corporation   Seattle, WA
Software Design Engineer, Networks Group   September 1988–August 1989
Developer in User Interface Group for MS LAN Manager 1.1 & 2.0.

AWARDS   IBM Research Accomplishment, "Biloxi Network Insights System", 2019
IBM Patent 11th Plateau Achievement Award, 2019.
IBM Research Outstanding Accomplishment, "Fundamental Contributions to Web Load Balancing", 2018.
IBM Research Accomplishment, "Multipath TCP for Wireless Mobile Devices", 2018.
IBM Master Inventor Award, 2017.
IBM Patent 10th Plateau Achievement Award, 2017.
IBM Patent 9th Plateau Achievement Award, 2017.
IBM Patent 8th Plateau Achievement Award, 2016.
IBM Research Accomplishment, "Contributions to SIP Server Performance", 2016.
IBM Patent 7th Plateau Achievement Award, 2015.
ACM Distinguished Scientist, 2012.
IBM Patent 6th Plateau Achievement Award, 2012.
IBM Patent 5th Plateau Achievement Award, 2012.
IBM Eminence and Excellence Award, 2011.
The Best of IBM Award, 2011.
IBM Patent 4th Plateau Achievement Award, 2010.
IBM Research Accomplishment, "Fundamental Contributions to Web Load Balancing", 2009.
IBM Research Accomplishment, "Research Contributions for SIP/IMS", 2008.
IBM Patent 3rd Plateau Achievement Award, 2008.
IBM Patent 2nd Plateau Achievement Award, 2004.
IBM Patent First Plateau Achievement Award, 2003.
IBM Research Outstanding Technical Achievement Award, "TCP/IP Performance: SpecWeb World Record", 2000.
IBM Server Division Teamwork Award, 1998.
Computer Measurement Group Fellowship for Computer Performance Evaluation, 1995-1996.

ARPA Fellowship in High Performance Computing, 1993-1994.
ARPA Research Assistantship in Parallel Processing, 1992-1993.

REFEREED
PAPERS

Multi-Path TCP

F. Le and E. Nahum, "Experiences Implementing Live VM Migration over the WAN with Multi-Path TCP", *IEEE InfoComm*, Paris, France, April 2019. Accept rate: 19 percent.

Y-s Lim, E. Nahum, D. Towsley, R. Gibbons, "ECF: An MPTCP Path Scheduler to Manage Heterogeneous Paths", *ACM CoNext*, Seoul, Korea, December 2017. Accept rate: 18 percent.

Y-s Lim, Y.-C. Chen, E. Nahum, D. Towsley, R. Gibbons, C. Cecchet, "Design, Implementation, and Evaluation of Energy-Aware Multi-Path TCP", *ACM CoNext*, Chicago, Illinois, November 2015. Accept rate: 20 percent.

Y-s Lim, Y.-C. Chen, E. Nahum, D. Towsley, R. Gibbons, "How Green is Multi-Path Transport Protocol for Mobile Devices?", *ACM SIGCOMM Workshop on All Things Cellular*, Chicago, Illinois, August 2014. Accept rate: 37 percent.

Y-s Lim, Y.-C. Chen, E. Nahum, D. Towsley, K. Lee, "Cross-Layer Path Management in Multi-Path Transport Protocol for Mobile Devices", *IEEE INFOCOM*, Toronto, Canada, April 2014. Accept rate: 19 percent.

Y.-C. Chen, Y.-s. Lim, R. Gibbens, E. Nahum, R. Khalili, and D. Towsley, "A Measurement-Based Study of Multipath TCP Performance in Wireless Networks", *ACM SIGCOMM Internet Measurement Conference (IMC)*, Barcelona, Spain, November 2013. Accept rate: 23 percent.

Cloud

L. Chaufournier, P. Sharma, F. Le, E. Nahum, P. Shenoy, D. Towsley, "Fast Transparent Virtual Machine Migration in Distributed Edge Clouds", *ACM/IEEE Symposium on Edge Clouds (SEC)*, San Jose, CA, October 2017.

X. He, T. Guo, E. Nahum, P. Shenoy, "Placement Strategies for Virtualized Network Functions in a NFaaS Cloud", *Fourth IEEE Workshop on Hot Topics in Web Systems and Technologies*, Washington, D.C., October 2016.

F. Le, E. Nahum, D. Kandlur, "Understanding the Performance and Bottlenecks of Cloud-Routed Overlay Networks: A Case Study", *Proceedings of the 2016 ACM Workshop on Cloud-Assisted Networking*, Irvine, CA, December 2016.

Middleboxes and NFV

F. Le, E. Nahum, V. Pappas, M. Touma, and D. Verma, "Deploying a Transparent Split-TCP Middlebox in Operational Networks and the Implications for NFV", *ACM SIGCOMM Workshop on Hot Topics in Middleboxes and Network Function Virtualization*, London, England, August 2015. Accept rate: 37 percent.

F. Le, H-Y. Wong, R. Raghavendra, V. Pappas and E. Nahum, "Removing TCP Congestion Control on the Last Hop in Split TCP Environments", *IEEE Workshop on Wireless Networks: Measurements and Experimentation (WINMEE)*, May 2016,

Mobile Computing

Y. Papapanagiotou, E. Nahum, and V. Pappas, "DHCP Leases in the Smartphone Era", *ACM SIGCOMM Internet Measurement Conference (IMC)*, Boston, MA, November 2012. Accept rate: 24 percent.

Y. Papapanagiotou, E. Nahum, and V. Pappas, "Smartphones Vs. Laptops: Comparing Web Browsing Behavior and the Implications for Caching" (extended abstract), *ACM SIGMETRICS Conference on Measurement and Modeling of Computer Systems*, London, UK, June 2012. Accept rate: 25 percent.

D. Yates, E. Nahum, J. Kurose, and P. Shenoy, "Data Quality and Query Cost in Pervasive Sensing Systems", *Pervasive and Mobile Computing*, Volume 4, Number 6, December 2008.

D. Yates, E. Nahum, J. Kurose, and P. Shenoy, "Data Quality and Query Cost in Pervasive Sensing Systems", *Sixth Annual IEEE International Conference on Pervasive Computing and Communications*, Hong Kong, March 2008. Accept rate: 11.8 percent. *1 of 7 papers chosen for fast track publication in Pervasive and Mobile Computing*.

SIP/VoIP

C. Shen, E. Nahum, H. Schulzrinne, and C.P. Wright, "The Impact of TLS on SIP Server Performance: Measurement and Modeling", *IEEE/ACM Transactions on Networking*, Volume 20, Number 4, August 2012. An earlier version appeared in *IPTComm*, Munich, Germany, August 2010. Accept rate: 24 percent.

H. Jiang, A. Iyengar, E. Nahum, W. Segmuller, A. Tantawi, C.P. Wright, "Design, Implementation, and Performance of a Load Balancer for SIP Server Clusters", *IEEE/ACM Transactions on Networking*, Volume 20, Number 4, August 2012. An ealier version appeared in *IEEE INFOCOM*, Jio De Janeiro, Brazil, April 2009. Accept rate: 19 percent.

C.P. Wright, E Nahum, D. Wood, J. Tracey, E. Hu, "SIP Server Performance on Multicore Systems", *IBM Journal of Research and Development*, Volume 54, Number 1, February 2010.

C. Shen, H. Schulzrinne, and E. Nahum, "SIP Server Overload Control: Design and Evaluation", *IPTComm 2008*, Heidelberg, Germany, July 2008. **Best Student Paper Award.** Accept rate: 30 percent.

E. Nahum, J. Tracey, and C.P. Wright, "Evaluating SIP Proxy Server Performance", *17th International Workshop on Network and Operating System Support for Digital Audio and Video (NOSSDAV)*, Urbana-Champaign, Illinois, June 2007. Accept rate: 34 percent. An earlier extended abstract appeared in the *ACM SIGMETRICS Conference on Measurement and Modeling of Computer Systems*, San Diego, California, June 2007.

Web Servers

Y. Ruan, V. Pai, E. Nahum, and J. Tracey, "The Impact of Simultaneous Multithreading on Network Server Performance using Real Hardware", *ACM SIGMETRICS Conference on Measurement and Modeling of Computer Systems*, Banff, Canada, June 2005. Accept rate: 13.1 percent.

D. Freimuth, E. Hu, J. LaVoie, R. Mraz, E. Nahum, P. Pradhan and J. Tracey, "Server Scalability and TCP Offload", *USENIX Annual Technical Conference*, Annaheim, California, April 2005. Accept rate: 20.3 percent.

D. Olshefski, J. Nieh and E. Nahum, "ksniffer: Determining the Remote Client Perceived Response Times from Live Packet Streams", *Sixth USENIX Symposium on Operating Systems Design and Implementation (OSDI)*, San Francisco, California, Dec 2004. Accept rate: 14.0 percent.

E. Nahum, "Deconstructing SPECweb99", *7th International Workshop on Web Content Caching and Distribution (WCW)*, Boulder, Colorado, August 2002. Accept rate: 35 percent.

A. Iyengar, E. Nahum, A. Shaikh, and R. Tewari, "Enhancing Web Performance", *IFIP World Computer Congress*, Montreal, Canada, August 2002.

E. Nahum, T. Barzilai, and D. Kandlur, "Performance Issues in WWW Servers", *IEEE/ACM Transactions on Networking*, Vol. 10, No. 1, February 2002. An earlier version appeared in *ACM SIGMETRICS Conference on Measurement and Modeling of Computer Systems*, Atlanta, Georgia, May 1999.

E. Nahum, M. Rosu, S. Seshan, and J. Almeida, "The Effects of Wide-Area Conditions on WWW Server Performance", *ACM SIGMETRICS Conference on Measurement and Modeling of Computer Systems*, Cambridge, Massachusetts, June 2001. Accept rate: 12.9 percent.

V. Pai, M. Aron, G. Banga, M. Svendsen, P. Druschel, W. Zwaenepoel and E. Nahum, "Locality-Aware Request Distribution in Cluster-based Network Servers", *Eighth International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS VIII)*, San Jose, California, October 1998. Accept rate: 23 percent.

Admission Control

B. Schroeder, M. Harchol-Balter, A. Iyengar, E. Nahum, and A. Wierman, "How to Determine a Good Multi-Programming Level for External Scheduling", *Proceedings of the 22nd IEEE International Conference on Data Engineering (ICDE)*, Atlanta, Georgia, April 2006. Accept rate: 19.5 percent.

B. Schroeder, M. Harchol-Balter, A. Iyengar, and E. Nahum, "Achieving Class-Based QoS for Transactional Workloads", *Proceedings of the 22nd IEEE International Conference on Data Engineering (ICDE)*, Atlanta, Georgia, April 2006. Accept rate: 19.5 percent.

A. Kamra, V. Misra and E. Nahum, "Yaksha: A Self-Tuning Controller for Managing the Performance of 3-Tiered Web sites", *International Workshop on Quality of Service (IWQoS)*, Montreal, Canada, June 2004. Accept rate: 15.5 percent.

S. Elnikety, E. Nahum, J. Tracey and W. Zwaenepoel, "A Method for Transparent Admission Control and Request Scheduling in Dynamic E-Commerce Web Sites", *International World-Wide Web Conference (WWW)*, New York, NY, May 2004. Accept rate: 14.6 percent.

Security

H. K. Lee, T. Malkin, and E. Nahum, "Cryptographic Strength of SSL/TLS Servers: Current and Recent Practices", *ACM SIGCOMM Internet Measurement Conference (IMC)*, San Diego, California, October 2007. Accept rate: 28 percent.

E. Nahum, D. Yates, S. O'Malley, H. Orman, and R. Schroeppel, "Parallelized Network Security Protocols", *Internet Society Symposium on Network and Distributed System Security (NDSS '96)*, San Diego, California, February 1996.

E. Nahum, S. O'Malley, H. Orman, and R. Schroeppel, "Towards High Performance Cryptographic Software", *Third IEEE Workshop on the Architecture and Implementation of High Performance Communications Subsystems (HPCS '95)*, Mystic, Connecticut, August 1995.

Protocols

E. Nahum, D. Yates, J. Kurose, and D. Towsley, "Cache Behavior of Network Protocols", *ACM SIGMETRICS Conference on Measurement and Modeling of Computer Systems*, Seattle, Washington, June 1997. Accept rate: 19.2 percent.

D. Yates, E. Nahum, J. Kurose, and D. Towsley, "Networking Support for Large Scale Multiprocessor Servers", *ACM SIGMETRICS Conference on Measurement and Modeling of Computer Systems*, Philadelphia, Pennsylvania, May 1996. Accept rate: 21.8 percent.

E. Nahum, D. Yates, J. Kurose, and D. Towsley, "Performance Issues in Parallelized Network Protocols", *First USENIX Symposium on Operating Systems Design and Implementation (OSDI)*, Monterey, California, November 1994. Accept rate: 11.8 percent.

Other Areas

K. Zheng, H. Lu, E. Nahum, "Scalable Pattern Matching on Multicore Platform via Dynamic Differentiated Distributed Detection (D4)" *IEEE Transactions on Computers*, Volume 60, Number 3, March 2011.

R. Jennings, E. Nahum, D. Olshefski, Z. Shae, D. Saha, and C. Waters, "A Study of Internet Instant Messaging and Chat Protocols", *IEEE Network*, Vol. 20, No. 4, July 2006.

S. Kandula, A. Shaikh and E. Nahum, "Integrated Network Performance Diagnostics", *2nd NY Metro Area Networking Workshop (NYMAN)*, New York, New York, August 2002.

J.A. Stankovic, K. Ramamritham, and E. Nahum, "Predictable Interprocess Communication for Hard Real-Time Systems", *10th IFAC Workshop on Distributed Computer Control Systems*, Vienna, Austria, September 1991. Pergamon Press, Oxford, England.

D. Niehaus, E. Nahum, and J.A. Stankovic, "Predictable Caching in the Spring System", *10th IEEE Workshop on Real-Time Operating Systems*, Atlanta, GA, May 1991.

BOOK CHAPTERS

E. Nahum, "Web Servers", in *Linux Server Performance Tuning*, Sandra Johnson, Ed., Prentice Hall, 2004.

A. Iyengar, E. Nahum, A. Shaikh, and R. Tewari, "Improving Web Site Performance", in *Handbook of Internet Computing*, M.P. Singh, Ed., CRC Press, 2003.

A. Iyengar, E. Nahum, A. Shaikh, and R. Tewari, "Web Caching, Consistency, and Content Distribution", in *Handbook of Internet Computing*, M.P. Singh, Ed., CRC Press, 2003.

TECHNICAL REPORTS

Y.-C. Chen, Y.-s. Lim, R. Gibbens, E. Nahum, and D. Towsley, "Characterizing 4G and

3G Networks: Supporting Mobility with Multi-Path TCP", *Department of Computer Science Technical Report # 2012-22*, University of Massachusetts at Amherst, September 2012.

Y. Ruan, E. Nahum, V. Pai, and J. Tracey, "On the Effectiveness of Simultaneous Multithreading on Network Server Workloads", *Princeton University Technical Report TR-793-07*, August 2007.

J. LaVoie, E. Nahum, and R. Flynn, "Profiling TCP: An In-depth Analysis of Processing Costs", *IBM Research Report RC24245*, April 2007.

D. Freimuth, E. Hu, J. LaVoie, R. Mraz, E. Nahum, P. Pradhan and J. Tracey, "Evaluating Batching for TCP Offload", *IBM Research Report RC23894*, March 2006.

P. Pradhan, S. Kandula, W. Xu, A. Shaikh, and E. Nahum, "Daytona: A User-Level TCP Stack", *IBM Research Report*, 2002.

G. Hunt, E. Nahum, and J. Tracey, "Enabling Content-Based Load Distribution for Scalable Services", *IBM Research Report*, May 1997.

E. Nahum, "Validating an Architectural Simulator", *Department of Computer Science Technical Report # 96-40*, University of Massachusetts at Amherst, September 1996.

TUTORIALS   "Web Servers: Implementation and Performance." 2004 International World-Wide Web Conference, New York, NY, May 2004.

"Web Sites, Servers, and Services." (With Dilip Kandlur) IEEE InfoCom 2002, New York, NY, June 2002.

"Web Servers: Implementation and Performance." ACM SIGMETRICS 2002, Marina Del Ray, CA, June 2002.

"Web Servers: Implementation and Performance." Institute for Applied Mathematics (IPAM), Los Angeles, CA, March 2002.

PROFESSIONAL   General Chair, ACM SigMetrics/IFIP Performance 2019
SERVICE
Executive/Steering Committees:

- ACM SIGMETRICS, 2011-2015.
- USENIX HotCloud Workshop, 2010-2012.
- ACM SIGCOMM, 2004-2008.

Editorial Boards:

- *ACM Transactions on Internet Technology*, 2009-2012.
- *IEEE Internet Computing*, 2009-2010.

Program Committee Co-Chair:

- *USENIX HotCloud Workshop*, Boston, Massachusetts, June 2010.

- *USENIX Annual Technical Conference*, Boston, Massachusetts, June 2006.
- *2nd Workshop on Internet Server Performance (WISP)*, in conjunction with *1999 ACM SIGMETRICS*, Atlanta, GA, May 1999.

Other Executive Roles:

- Chair, ACM SIGMETRICS "Test of Time" Award Selection Committee, 2017.
- Chair, ACM SIGMETRICS "Test of Time" Award Selection Committee, 2016.
- Chair, ACM SIGMETRICS "Rising Star" Award Selection Committee, 2013.
- Chair, IBM Research Communications and Networking Professional Interest Community (PIC), 2009-2010. Responsibilities include coordinating the networking research community within IBM; evaluating Ph.D. and faculty award nominations, and funding external conferences.
- Information Director, ACM SIGCOMM, 2004-2008.
- Local Arrangements Chair, *ACM SIGCOMM Co-Next Conference*, 2007.

Program Committee member for the following professional symposia:

- *ACM SIGMETRICS Conference on Measurement and Modeling of Computer Systems*: 2018, 2017, 2016, 2014, 2011, 2010, 2008, 2005, 2004, 1999.
- *ACM Cloud-Assisted Networking Workshop*: 2018.
- *ACM SIGCOMM Internet Measurement Conference*: 2015, 2006.
- *IFIP Performance*: 2013, 2011, 2004, 2002.
- *ACM HotMetrics*: 2010.
- *USENIX Annual Technical Conference*: 2009, 2008, 2007, 2006, 2005.
- *USENIX Operating Systems Design and Implementation*: 2008.
- *The Israel Experimental Systems Conference (SYSTOR)*: 2009.
- *World Wide Web (WWW), Performance Track*: 2019, 2008.
- *IEEE INFOCOM*: 2008, 2000.
- *IEEE Global Internet*: 2004, 2000, 1999, 1998.
- *ACM SIGCOMM*: 2000.

Referee for the following professional journals:

- *IEEE/ACM Transactions on Networking*.
- *ACM Transactions on Computer Systems*.
- *IEEE Transactions on Information Technology*.
- *IEEE Transactions on Computers*.
- *IFIP Performance Evaluation*.

Other Committees:

- Member, 2020 ACM SigMetrics Test-of-Time Award Committee.
- Member, 2018 SPEC Dissertation Award Committee.
- Member, 2011 IBM Raviv Postdoctoral Fellowship Evaluation Committee. The Raviv Fellowship is IBM's most prestigious award for graduate students and extremely competitive with typically 90 applicants for 1 award.
- Member, Editor-in-Chief Search Committee, ACM Transactions on Information Technology, 2007.

Reviewer for Addison-Wesley: *Web Protocols and Practice: HTTP/1.1, Networking Protocols, Caching, and Traffic Measurement* by B. Krishnamurthy and J. Rexford (2001).

Member, ACM and USENIX.

ACADEMIC
SERVICE

Courses taught:

- COMS W6998: Network Systems Design and Implementation, Spring 2010. Course is an advanced graduate class featuring both a lecture and seminar on Linux 2.6.32 networking internals. Features code walkthroughs, related research papers and presentations, and a major project. Course had 7 students, and I received an overall 4.2 evaluation (4=very good, 5=excellent). `http://www.cs.columbia.edu/~nahum/w6998/index.html`
- COMS W4118: Operating Systems, Spring 2008. Course is a graduate class required for the department systems track, covering both OS concepts and Linux kernel internals. Course had 60 students and I received an overall 3.5 evaluation (3=good, 4=very good). `http://www.cs.columbia.edu/~nahum/w4118/index.html`

Ph.D. thesis committee member:

- Yeon-sup Lim, "On Leveraging Multi-Path Transport Protocol in Mobile Networks," School of Computer Science, University of Massachusetts at Amherst, Thesis Defense October 2016.
- Yung-Chih Chen, "Robust Mobile Data Transport: Modeling, Measurements, and Implementation," School of Computer Science, University of Massachusetts at Amherst, Thesis Defense January 2015.
- Charles Shen, "On Scalable, Robust and Secure Signaling for Internet Multimedia Services," Computer Science Department, Columbia University, Thesis Defense April 2010.
- Sharon Goldberg, "Towards Securing Interdomain Routing on the Internet," Department of Computer Science, Princeton University, Thesis Defense July 2009.
- David Olshefski, "Measuring and Managing the Remote Client Perceived Response Time for Web Transactions using Server-side Techniques," Computer Science Department, Columbia University, Thesis Defense April 2006.
- David Yates, "Scaleable Data Delivery for Networked Servers and Wireless Sensor Networks," Computer Science Department, University of Massachusetts at Amherst, Thesis Defense December 2005.

- Bianca Schroeder, "Improving the Performance of Static and Dynamic Requests at a Busy Web Server," Computer Science Department, Carnegie Mellon University, Thesis Defense June 2005.
- Maria Papadopouli, "Resource Sharing in Mobile Wireless Networks," Computer Science Department, Columbia University, Thesis Defense June 2002.

Interns Supervised:

- Jussara Almeida, University of Wisconsin
- Sameh Elnikety, EPFL
- Xin He, University of Massachusetts
- Hongbo Jiang, Case Western Reserve
- Abhinav Kamra, Columbia University
- Yeon-sup Lim, University of Massachusetts
- Yannis Papapanagiotou, NCSU
- Yao-ping Ruan, Princeton
- Bianca Schroeder, CMU
- Charles Shen, Columbia University
- Lucas Chaufournier, University of Massachusetts
- Shonda Witherspoon, Florida International University
- Aditi Agarwal, Cornell University

IBM Faculty Partership Award Mentor:

- Henning Schulzrinne, Columbia University, 2005-2006,1997-1999.
- Vishal Misra, Columbia University, 2002-2003.
- Vivek Pai, Princeton University, 2000-2001.
- Peter Druschel, Rice University, 1999-2000.

STANDARDS
ACTIVITIES
Vice-Chair, SPEC OSG Cloud SubCommittee, 2012-2013.

Chair, SPEC Research Group Cloud Working Group, 2011-2012.

Chair, Systems Performance Evaluation Corporation (SPEC) SIP SubCommittee, 2007-2011. SubCommittee founder. Led design, development, and release of industry-standard SIP server performance benchmark (SPECsip_Infrastructure2011, released September 2011).

INTELLECTUAL
PROPERTY
Issued Patents:

1. "System, Method and Computer Program Product for Network Function Optimization based on Locality and Function Type", issued as Patent 10,361,915 in the U.S.
2. "Client Attachment to an Overlay Network", issued as Patent 10,367,722 in the U.S.
3. "Mechanism for Faults Diagnosis and Recovery of Network Service Chains", issued as Patent 10,530,667 in the U.S.

4. "Dynamic Selection of TCP Congestion Control for Improved Performances", issued as Patent 10,419,968 in the U.S.

5. "Method and System for Client-space Network Monitoring", issued as Patent 10,079,731 in the U.S.

6. "Data Packet Retransmission Processing", issued as Patent 10,069,727 in the U.S.

7. "Distributed Snoop", issued as Patent 10,097,453 in the U.S.

8. "Method and System for Client-space Network Monitoring", issued as Patent 10,079,731 in the U.S.

9. "Data Packet Retransmission Processing", issued as Patent 10,069,727 in the U.S.

10. "Method and Apparatus for an all software implementation of Network Switch/Router on Massively Multi-core Processors", issued as Patent 10,009,226 in the US.

11. "System and Method for Managing Queue Length in Congested Networks", issued as Patent 9,843,530 in the U.S.

12. "Wireless Network Optimization Appliance", issued as Patent 9,813,295 in the U.S.

13. "Snoop Virtual Receiver Time", issued as Patent 9,515,777 in the U.S.

14. "Mobility Management for UMTS Network with Data Offload at Cell Tower", issued as Patent 9,451,504 in the U.S.

15. "Dynamic Middlebox Redirection Based On Client Characteristics", issued as Patent 9,426,076 in the U.S.

16. "Hybrid Approach For Performance Enhancing Proxies", issued as Patent 9,397,939 in the U.S.

17. "Virtual Consolidated Appliance", issued as Patent 9,331,891 in the U.S.

18. "Transparent Middlebox with Graceful Connection Entry and Exit", issued as Patent 9,148,383 in the U.S.

19. "Method and Apparatus for Load Balancing in Network based Telephony Application", issued as Patent 9,071,608 in the U.S.

20. "Methods and Systems for Determining Resources Consumed by Tasks", issued as Patent 8,863,144 in the U.S.

21. "Differential Dynamic Host Configuration Protocol Lease Allocation", issued as Patent 8,832,007 in the U.S.

22. "Method and Apparatus for Dynamically Scheduling Requests", issued as Patent 8,831,026 in the U.S.

23. "Methods and Apparatus for Randomization of Periodic Behavior for Communication Networks", issued as Patents 7,912,969 and 8,230,082 in the U.S.

24. "Overload Protection for SIP Servers", issued as Patent 7,522,581 in the U.S.

25. "Apparatus and Method for Supporting Memory Management in an Offload of Network Protocol Processing", issued as Patents 7,930,422, 8,316,109, and 8,332,531 in the U.S.

26. "Apparatus and Method for Supporting Received Data Processing in an Offload of Network Protocol Processing", issued as Patent 7,493,427 in the U.S.

27. "State Recovery of Failover of Intelligent Network Adapters", issued as Patent 7,114,096 in the U.S.

28. "Apparatus and Method for Supporting Connection Establishment in an Offload of Server Network Protocol Processing", issued as Patent 7,533,176 in the U.S.

29. "Method and Apparatus for Network Communication Card Memory Management", issued as Patent 6,968,358 in the U.S.

Filed with Patent Office:

1. "System and Method for Maintaining Queuing Policy with Multipath Traffic", US Docket P2018-04138-US01.

2. "Automatic Protocol Discovery Using Text Analytics", US Docket YOR9-2016-2822-US01.

3. "Deferential Support of Request Driven Cloud Services", US Docket YOR9-2016-1475-US1.

4. "System and Method for Optimizing Performance in Overlay Networks", US Docket YOR9-2016-1360-US1.

5. "Method and Apparatus for Reducing Service Downtime during Service Migration", US Docket YOR9-2016-0815-US1.

6. "Transparent Wide-Area Service Migration with MPTCP", US Docket YOR9-2016-0406-US1.

7. "Dynamic Selection of Host Server During Live Service Migration", US Docket YOR9-2015-1461-US1.

8. "Method and System for Load Balancing with Affinity", US Docket YOR9-2009-0146-US1.

9. "Methods and Systems for Routing IP Phone Calls Based on Call Length", US Docket YOR9-2008-0027-US1.

10. "Method and Apparatus for Processing Messages in Messaging System", US Docket YOR9-2007-0235-US1.

11. "Method and Apparatus for Support of Bottleneck Avoidance on an Intelligent Adapter", US Docket YOR9-2003-0167-US1.