

Z. Morley Mao

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Education

- Ph.D., Computer Science, University of California at Berkeley, December 2003. Advisor: Randy H. Katz, Dissertation: “Solving the Interdomain Routing Puzzle --- Understanding Interdomain Routing Dynamics”.
- M.S., Computer Science, University of California at Berkeley, December 2000. Project: “Fault-tolerant, Scalable, Wide-Area Internet Service Composition”.
- B.S., Electrical Engineering and Computer Science, University of California at Berkeley, May 1998. Highest Honors.

Work Experience

University of Michigan, EECS Department, Sept 2016-present, Professor: Leads the Robustnet networking and network security group.

University of Michigan, EECS Department, Sept 2010-present, Associate Professor: Leads the Robustnet networking and network security group.

University of Michigan, EECS Department, January 2004-Aug 2010, Assistant Professor. Led the Robustnet networking and network security group.

ICIR: ICSI Center for Internet Research, May 2003-Dec 2003, Postdoctoral Researcher.

University of California at Berkeley, Computer Science Division Aug 1998– May 2003, Graduate Student Researcher. Studied BGP route flap dampening algorithm and its adverse interaction with route convergence; designed and implemented a wide-area cluster-based service composition platform that automatically composes Internet services to adapt to wireless mobile clients and achieve fault-tolerance, scalability, and high availability; developed a system architecture for Berkeley sensor motes consisting of a reliable link layer within each isolated local area sensor network and a service using IP to support mobility in the wide area.

AT&T Labs-Research, summer 2004, Researcher, Led a project on network troubleshooting and diagnosis.

AT&T Labs-Research, summer, fall 2002, Research Intern.

- Developed a set of measurement tools, both server-based and client-based, to study the performance bottlenecks in a VPN; evaluated the existing tools and found them to be unscalable if used for a large set of hosts. Developed scalable techniques by taking advantage of topology information to avoid redundant probing of network links, improved the accuracy of the bandwidth measurement tools by combining the results of multiple tools to obtain tighter bounds.

- Formulated the problem of placing fewest caches to satisfy a given user demand and bandwidth constraints, and proved it to be NP-hard. Developed a collection of efficient, approximate cache placement algorithms, suitable for different situations depending on the implementation cost.
- Implemented the BGP Beacon software to actively measure and monitor BGP routing behavior. Improved modeling of BGP convergence based on timer settings, topology information.
- Developed algorithms for an improved AS-level traceroute tool to accurately predict packet forwarding paths in terms Autonomous Systems.
- Decoded a proprietary online game protocol to extract network roundtrip time, packet loss information from traffic statistics.

AT&T Labs-Research, summer, summer 2001, Research Intern.

- Designed and implemented a measurement infrastructure using an HTTP redirector to efficiently and accurately collect Web client to local DNS server IP mappings. Successfully deployed the infrastructure on several commercial and educational Web sites. Analyzed the performance of DNS-based server selection for several commercial content distribution networks (CDNs) using several proximity metrics.
- Created a Web-based debugging tool for analyzing CDN performance and correctness problems. Designed and implemented a tool for debugging DNS based server selection decisions.

Sprint Advanced Technology Lab (ATL), Burlingame, CA, Research Intern.

- Studied the tradeoffs between implementing Internet infrastructure services in hard-state vs. soft-state considering communication overhead, state consistency, robustness, ease of fault recovery and implementation.

Consulting Experience

AT&T Labs-Research, 2004—present

T-Mobile Inc. 2013—present

DOCOMO USA Labs, 2010—2012

Narus, Inc. 2012—2015

Google 2011—2013

Microsoft 2009

Teaching Experience

- Courses Taught
 - Introduction to Computer Security (EECS 388):** Winter 2015, 2016
 - Distributed Systems (EECS 591):** Fall 2013
 - Programming and Data Structures (EECS 280):** Winter 2008, Winter 2009
 - Computer Networks (EECS 489):** Fall 2004, Fall 2005, Winter 2007, Winter 2009
 - Advanced Computer Networks (EECS 589):** Winter 2005, Winter 2006, Fall 2006, Fall 2007, Fall 2009, Fall 2010, Fall 2011, Fall 2014, Fall 2015
 - Advanced Topics in Computer Networks (EECS 598):** Winter 2004
- Courses Developed or Significantly Revised
 - Advanced Computer Networks (EECS 589):** Graduate computer networks course focusing on Internet and wireless network topics including network security and mobile computing. Major revision of course content 2005—2012
 - Computer Networks (EECS 489):** Undergraduate computer networks course covering basic network concepts of essential network protocols across the OSI stack and network application

protocols. Complete revision of course content Fall 2005.

Honors and Awards

- The George J. Huebner, Jr. Research Excellence Award (College of Engineering, University of Michigan) 2017.
- Best paper Award for “Accelerating Mobile Applications through Flip-Flop Replication” at MobiSys 2015.
- EECS Department (University of Michigan) Outstanding Achievement Award 2012
- FCC Open Internet Apps Challenge: Open Internet App Award and People’s Choice App Award 2011
- Best Paper Award for “Contrail: Enabling Decentralized Social Networks on Smartphones,” in Proc. ACM/IFIP/USENIX 12th International Middleware Conference 2011
- Morris Wellman Faculty Development Assistant Professor 2008-2010
- Sloan Fellowship 2009
- Invitation to Cisco BGP Research Symposium 2008
- Invitation to Network Architecture Geeks 2008
- Invitation to present Cisco Network Security Seminar 2008
- DARPA Computer Science Study Panel 2007
- NSF Faculty Early Career Award 2007, titled “Intent-based network management”
- IBM Faculty Partnership Award 2007, 2008
- Invitation to attend the PRESTO Workshop (Workshop on Programmable Routers for the Extensible Services of TOmorrow) 2007
- Invitation to present at The IEEE 21st Annual Computer Communications Workshop (CCW) 2007
- Invitation to attend Cisco Network Management Research Summit 2005, 2006
- Invitation to attend WIRED Routing workshop 2003, 2006
- Young Investigator Award (Grace Hopper Celebration of Women in Computing 2002)
- Invitation to attend CAIDA Leiden Workshop 2002
- Best paper awarded out of all 2001 Journal of Computer Networks papers: “The Ninja Architecture for Robust Internet-Scale Systems and Services”.
- Micro Fellowship (UCB 1998-1999)
- Frank Edward Kraft Scholarship (1999)
- AP scholar awarded by the College Board (1994)
- Bausch Lomb Honorary Science Award (1994)

Research Interests

- Networking, networked systems, distributed systems, mobile computing/systems, software-defined networking (SDN), Internet protocols, data center computing, cloud computing.
- Network, system, mobile network and OS security.
- Cyber-manufacturing.
- Energy-efficient network system design.
- Enterprise networks: performance and security.

University Service

- Member of Information and Infrastructure Assurance (IIA) Council, 2016
- Member of CSE Curriculum Committee, 2015.

- DCO Committee, EECS Dept., University of Michigan, 2015
- Member of CS Program Committee, EECS Dept., University of Michigan, 2015
- Member of Graduate Admission Committee, EECS Dept., University of Michigan, 2004—2009, 2013—2014.
- Member of CSE Chair Search Committee, EECS Dept., University of Michigan, 2009—2012.
- Member of CSE Search Committee, EECS Dept., University of Michigan, 2009—2012.
- GEECS (Girls in EECS) faculty advisor, 2004—2016.
- ECSEL - Ensemble of CSE Ladies - Graduate Women in CSE faculty advisor, 2015-2016.

Professional Activities

- Associate Editor, IEEE Transactions on Mobile Computing (TMC) 2014--now
- Associate Editor, ACM Transactions on Networks (TON) 2009—2012
- Associate Editor, ACM Transactions on Internet Technology (TOIT) 2008—2014
- Member of Steering Committee: AllThingsCellular Workshop 2012—present
- Member of Steering Committee: AsiaCCS, 2014—present
- Conference/Workshop Organization
 - Program Co-Chair, The 12th International Conference on Mobile Systems, Applications, and Services (MobiSys) 2014
 - Program Co-Chair, 9th International Conference on Security and Privacy in Communication Networks (SecureComm) 2013
 - Workshop Co-Chair, CellNet 2012
 - Guest Editor of IEEE Network Magazine on Interdomain Routing 2005
 - Student Travel Grants Committee Member, SIGCOMM 2005, 2009
 - Vice chair for Routing09 (the 2009 IEEE International Symposium on Network Evolution and Routing Innovation)
 - Publicity chair for SecureComm 2009
- Tutorials at conferences
 - Internet Routing: Measurement, Modeling, and Analysis, by Jia Wang and Z. Morley Mao, ACM SIGMETRICS, Banff, Canada, June 2005.
 - Inter-domain Routing: Today and Tomorrow, by Jia Wang and Z. Morley Mao, IEEE INFOCOM, Hong Kong, China, March 2004.
- Technical Program Committee Member
 - ACM Computer and Communications Security Conference (CCS) 2008, 2014
 - ACM Conference on Data and Application Security and Privacy (CODASPY) 2013
 - ACM The Symposium on SDN Research (SOSR) 2016
 - ACM Symposium on Information, Computer and Communications Security (AsiaCCS) 2012—2013, 2016
 - ACM Hotnets workshop 2007, 2011, 2016
 - ACM The International Conference on Mobile Systems, Applications, and Services (Mobisys) 2011-2013, 2015-2016
 - ACM Multimedia 2005
 - ACM OSDI 2016
 - ACM Sigcomm Workshop on Large Scale Attack Defense (LSAD) 2006, 2007
 - ACM Sigcomm (PC Light) 2006 2009, regular PC 2008, 2012, 2015
 - ACM Sigcomm Workshop in Asia 2005
 - ACM Workshop on Internet Network Management (INM'08)
 - Annual Network & Distributed System Security Symposium (NDSS) 2011

- Hot Topics in Management of Internet, Cloud, and Enterprise Networks and Services (HotIce'11)
- IEEE Automated Network Management (ANM) Workshop 2008
- IEEE Global Internet Symposium 2004
- IEEE INFOCOM 2005-2011
- IEEE Symposium on Security and Privacy (Oakland), 2010, 2012-2013
- IEEE SIGMETRICS 2009
- IEEE International Conference on Network Protocols (ICNP) 2008, 2011
- IEEE International Conference on Distributed Computing Systems (ICDCS), Areas of Security and Privacy, 2008-2009, 2012
- IEEE IWQoS Workshop 2007
- Internet Measurement Conference (IMC), 2004, 2007-08, 2011, 2013
- International Conference on Mobile Computing and Networking (Mobicom) 2013, 2015-2016
- International Conference on Security and Privacy in Communication Networks (SecureComm) 2008
- International Conference on Parallel Processing (ICPP) 2009
- International Conference on Computer Science (ICCC) 2007
- International World Wide Web Conference (WWW) 2007
- International Conference on emerging Networking EXperiments and Technologies (CoNext) 2006, 2011
- CoNext Student Workshop 2006
- Passive and Active Measurement Conference (PAM) 2006, 2008, 2010
- Usenix Annual Technical Conference (ATC) 2007
- Usenix Security Symposium 2008

Research Grants and Gifts

- National Science Foundation, “CI-SUSTAIN: Collaborative Research: Sustaining Successful Smartphone Testbeds to Enable Diverse Mobile Experiments,” \$350,000. PI: Z. Morley Mao. 07/15/2016 to 06/30/2019.
- National Science Foundation, “XPS: FULL: Collaborative Research: Enabling Scalable Cloud and Edge-device Integration Using Cross-layer Parallelism,” \$577,987. PI: Z. Morley Mao. 09/01/2016 to 08/31/2020.
- National Science Foundation, “CPS: TTP Option: Frontiers: Collaborative Research: Software Defined Control for Smart Manufacturing Systems,” \$2,919,233. 1/1/2016 - 12/31/2020. PI: Dawn Tilbury, Co-PI: Z. Morley Mao, Kira Barton (other collaborators: UIUC, Cornell).
- National Science Foundation, “XPS: FULL: Collaborative Research: Enabling Scalable Cloud and Edge-device Integration Using Cross-layer Parallelism,” \$679,875. 09/01/2016 - 8/31/2020, PI: Z. Morley Mao, Co-PI: Scott Mahlke (other collaborators: Indiana).
- National Science Foundation, “CI-SUSTAIN: Collaborative Research: Sustaining Successful Smartphone Testbeds to Enable Diverse Mobile Experiments,” \$350,000. PI: Z. Morley Mao.
- National Science Foundation, “EAGER: Cybermanufacturing: Enabling Production as a Service (PaaS),” \$250K. (my share: \$140,287). 10/1/2015 – 9/30/2017. PI: Z. Morley Mao, Co-PI: Dawn Tilbury, Kira Barton.
- National Science Foundation (Single-PI) \$605,282, “TWC: TTP Option: Small: Differential Introspective Side Channels ---Discovery, Analysis, and Defense,” PI: Z. Morley Mao. 10/1/2015 – 9/30/2018.

- T-Mobile USA, Inc. (Single-PI), Mobile User Intelligence Project: Phase III. Support. \$139,229K. PI: Z. Morley Mao. 10/01/2014 to 11/30/2015.
- National Science Foundation, XPS: FULL:CCA: Scalable Approximate Computing for Data Parallel Applications. \$850K (my share: \$200K). 08/01/2014 to 07/31/2017. PI: Scott Mahlke, Co-PI: Z. Morley Mao, Jason Mars, Lingjia Tang.
- Department of Navy (Single-PI) \$600K on “Novel Side Channel Attacks against Networked Systems: Automated discovery and Mitigation Solutions. PI: Z. Morley Mao. 6/1/2014 to 5/30/2017
- National Science Foundation (Single-PI) \$350K on “FIA-NP: Collaborative Research: The Next-Phase MobilityFirst Project - From Architecture and Protocol Design to Advanced Services and Trial Deployments” 5/1/2014 to 4/30/2016
- National Science Foundation (Single-PI), TWC:Small:Exposing Attack Vectors and Identifying Defense Solutions for Data Cellular Networks. \$500K. PI: Z. Morley Mao. 09/01/2013 to 08/31/2016.
- ChinaMobile. (Single-PI), SDN based mobility management in mobile networks. \$30K. PI: Z. Morley Mao. 11/15/2013 to 03/24/2014
- T-Mobile USA, Inc. (Single-PI), Mobile User Intelligence Project: Phase II. Support. \$101,815K. PI: Z. Morley Mao. 07/01/2013 to 12/30/2013.
- Intel Corporation. (Single PI), Enabling Energy Smart Systems through Context-aware Software Adaptation. \$100K. PI: Z. Morley Mao. 09/01/2013 to 08/31/2016.
- T-Mobile USA, Inc. (Single-PI), Mobile User Intelligence Project -- Tool Support. \$112K. PI: Z. Morley Mao. 12/20/2012 to 12/19/2013.
- Verisign, Inc. (Single PI), Converged, secure mobile communication support through infrastructure-opportunistic, DHT-based network services. \$200K. PI: Z. Morley Mao. 06/18/2012 to 11/30/2013.
- NTT DOCOMO USA LABS. (Single-PI), Designing and Prototyping the Infinity Programmable Mobile Storage Service-Backend Enhancement. \$84,200. PI: Z. Morley Mao. 01/01/2012 to 12/31/2012.
- Intel Corporation. (Single PI), Security curriculum innovations: Wireless networking and network system security. \$37,500. PI: Z. Morley Mao. 11/14/2011 to 11/13/2021.
- VeriSign, Inc. (Single-PI), Enhancing Mobile Internet Infrastructure for Improved Performance and Security. \$75K. PI: Z. Morley Mao. 03/31/2011 to 10/31/2011.
- National Science Foundation. (Co-PI), NeTS: Large: Collaborative Research: Measuring and Modeling the Dynamics of IPv4 Address Exhaustion. \$1,199,901 (my share: \$400K). PI: Michael Bailey, Co-PI: Z. Morley Mao, Manish Karir. 08/01/2011 to 07/31/2015.
- NTT DOCOMO USA LABS. (Single-PI), Designing and Prototyping the Infinity Programmable Mobile Storage Service. \$96,386. PI: Z. Morley Mao. 01/01/2011 to 12/31/2011.
- Raytheon Company, National Science Foundation-Subcontracts. (Single-PI), Enabling programmable mobile storage services through GENI-enabled WiMAX basestation capabilities. \$225,870. PI: Z. Morley Mao. 10/01/2011 to 09/30/2013.
- National Science Foundation. (PI), CI-ADDO-NEW: MobiLab -- A Global-Scale Live Laboratory to Support Mobile Computing Science. \$1,500,000 (my share: \$500K). PI: Z. Morley Mao. Co-PI: Robert Dick, Prabal Dutta, Scott Mahlke. 02/15/2011 to 01/31/2015.

- Google, Inc. (Co-PI), Modeling, Understanding, and Optimizing Android Energy Use. \$60K (my share: \$30K). PI: Robert Dick, Co-PI: Z. Morley Mao. 09/01/2010 to 08/31/2011.
- National Science Foundation (Single-PI), EAGER: Enabling Mobile Services through In-network Storage and Computation--Evaluation using the GENI Infrastructure. \$134,998. PI: Z. Morley Mao. 09/01/2010 to 08/31/2012.
- National Science Foundation (Single-PI at Michigan), FIA: Collaborative Research: MobilityFirst: A Robust and Trustworthy Mobility-Centric Architecture for the Future Internet. PI: Z. Morley Mao. \$540K. 09/01/2010 to 08/31/2013.
- National Science Foundation (Co-PI), TC: Medium: Collaborative Research: WHISPER -- Wireless, Handheld, Infrastructureless, Secure Communication System for the Prevention of Eavesdropping and Reprisal. \$754,756 (my share: \$350K). PI. Robert Dick, Co-PI: Z. Morley Mao. 06/01/2010 to 05/31/2013.
- Sloan, Alfred P., Foundation (Single-PI), Alfred P. Sloan Foundation Research Fellowship. \$50,000. PI: Z. Morley Mao. 09/16/2009 to 09/15/2011.
- Defense, Department of-Navy, Department of the (Single-PI), Attack and Failure-Resilient Networks for Command and Control. \$509,546. PI: Z. Morley Mao. 06/01/2009 to 05/31/2013.
- National Science Foundation (Single-PI), NSF Workshop on Unwanted Traffic. \$28K. PI: Z. Morley Mao. 09/15/2008 to 08/31/2009.
- Defense, Department of-Defense Advanced Research Projects Agency (Single-PI), Predictive Security Assurance for Attack and Failure Resilient Networks. \$486,998. PI: Z. Morley Mao. 04/28/2008 to 04/27/2011.
- International Business Machines Corporation (Single-PI), IBM Faculty Award. \$15K. PI: Z. Morley Mao. 07/27/2007 to 06/30/2012.
- National Science Foundation (PI), CRI-IAD: Collaborative Research: Enabling Security and Network Management Research for Future Networks. \$356,775 (my share: \$300K). PI: Z. Morley Mao, Co-PI: Michael Bailey, Jignesh Patel, Manish Karir. 03/01/2008 to 02/28/2011.
- Defense, Department of-Defense Advanced Research Projects Agency (Single-PI), Computer Science Study Group (CS Study Group): Building Secure and Robust Networks. \$96,262. PI: Z. Morley Mao. 05/14/2007 to 05/13/2008.
- Defense, Department of-Army, Department of the (Single-PI), Hardening the Control Plane to Ensure Network Resilience. \$150K. PI: Z. Morley Mao. 08/12/2008 to 08/11/2011.
- National Science Foundation (Single-PI), SGER: Malware Immunization through Deterrence. \$100K. PI: Z. Morley Mao. 09/15/2006 to 08/31/2007.
- National Science Foundation (Single-PI), CAREER Intent-Based Network Management. \$524,109. PI: Z. Morley Mao. 01/01/2007 to 12/31/2011.
- AT&T Corporation (Single-PI), Research on Distributed Network Troubleshooting. \$100.5K. PI: Z. Morley Mao. Award date (04/20/2004)
- AT&T Corporation (Single-PI), Network DDoS (Distributed Denial of Service) Analysis and In-Network Detection of End-point Compromise. \$15K. PI: Z. Morley Mao.
- Homeland Security, Department of (Co-PI), Virtual Center for Network and Security Data. \$1,256,068 (my share: \$300K). PI: Farnam Jahanian, Co-PI: Michael Bailey, Z. Morley Mao, Jignesh Patel. 08/01/2004 to 07/31/2007.
- Defense, Department of-Army, Department of the (Co-PI), Secure Coordination and

Communication in a Crisis Using Hand-Held Devices. \$1,391,481 (my share: \$450K). PI: Sugih Jamin, Co-PI: Z. Morley Mao, Jignesh Patel. 04/18/2005 to 07/14/2008.

- National Science Foundation (Single-PI), Real-Time Internet Routing Anomaly Detection and Mitigation. \$300K. PI: Z. Morley Mao. 10/01/2004 to 09/30/2007.
- Other Single-PI gifts include: \$100K from Sun Microsystems in 2010, \$15K from IBM in 2009, \$200K from Cisco in 2008, 2011, \$60K from Google in 2012, \$40K from Narus/Boeing in 2013.

Work with Graduate Students

PhD graduates

1. Ying Zhang, 2009. Dissertation: “Effective Wide-Area Network Performance Monitoring and Diagnosis from End Systems.” First job: Ericsson Research, Santa Clara, CA.
2. Xu (Simon) Chen, 2010. Dissertation: “Toward Automated Network Management and Operations.” First job: AT&T Labs-Research, Florham Park, NJ.
3. Feng Qian, 2012. Dissertation: “Characterization and Optimization of Resource Utilization For Cellular Networks.” First job: AT&T Labs-Research, Florham Park, NJ. (Will start as assistant Professor in CS at Indiana University Fall 2014)
4. Zhiyun Qian, 2012. Dissertation: “Discover, Analyze, and Validate Attacks With Introspective Side Channels.” First job: NEC Labs, Princeton, NJ. (Will start as assistant Professor in CS at UC Riverside Fall 2014)
5. Junxian Huang, 2013. Dissertation: “Performance and Power Characterization of 3G/4G Networks and Optimizations of Mobile Applications.” First job: Google, Mountain View, CA.
6. Qiang Xu, 2013. Dissertation: “Optimizing Mobile Application Performance through Network Infrastructure Aware Adaptation.” First job: NEC Labs, Princeton NJ.
7. Sanae Rosen, 2016. Dissertation: “Improving mobile network performance through measurement-driven system design approaches.” First job: Yelp, San Francisco, CA.

MS graduates

1. Ranga Vasudevan, 2006. First job: Aster Data Systems Inc.
2. Jonathan Anderson, 2007. First job: Citrix Systems Inc.
3. Birjodh Tiwana, 2011. First job: Expedia.
4. Zhaoguang Wang, 2011. First job: Google.
5. Yudong Gao, 2011. First job: Google.
6. Thomas Andrews, 2013. First job: Amazon.
7. Yuanyuan (Tracy) Zhou, 2015. First job: Yelp.
8. Hongyi Yao, 2015. First job: Panlantiir.

Current students

1. Yihua (Ethan) Guo – Mobile network performance monitoring, started 9/2012.
2. Qi (Alfred) Chen – Network security, started 9/2012.
3. Ashkan Nikravesh – Mobile systems, started 9/2012.
4. Mehrdad Moradi – Data center networking, Internet architecture, started 9/2012.
5. Yunhan (Jack) Jia – Cloud security and network side channels, started 9/2013
6. Yuru (Roy) Shao, started 9/2014
7. Shichang (Shawn) Xu, started 9/2014
8. Ke David Hong, started 9/2014
9. Chao Kong, started 8/2015
10. Yikai Lin, started 8/2015
11. Jeremy Erickson, started 8/2015
12. Jie You, started 8/2016

13. Xiao Zhu, started 8/2016

Major Released Software

- **PowerTutor:** (<http://powertutor.org>): an Android based power monitor and analysis software.
- **Mobiperf:** (<http://www.mobiperf.org>): a mobile performance and policy measurement software.
- **BGP Beacon:** a highly robust and portable BGP monitoring software based on bgpd.pl (<http://bgpd.sourceforge.net/>) that injects route announcements and withdrawals at specified times, currently operational at various international locations. It has been tested by several ISPs to work with a variety of routers and network configurations.
- **SSFnet BGP route flap damping:** RFC 2439 and RIPE-229 compliant route flap damping software that is fully compatible with existing SSFnet BGP simulator.
- **Automatic Path Creation Package:** as part of Berkeley's ICEBERG/Ninja project release, allows a variety of service composition without manual setup.

Personal

United States citizen.

Patents

US and international patents awarded (inventors, title, number, date issued)

1. Alexandre Gerber, Zhuoqing Mao, Feng Qian, Subhabrata Sen, Oliver Spatscheck, Zhaoguang Wang, Tail optimization protocol for cellular radio resource allocation, US8744367, Jun 3, 2014.
2. Jacobus E Van de Merwe, Xu Chen, Yun Mao, Zhuoqing M Mao, Operating a network using relational database methodology, US 8682940, 25 Mar 2014.
3. Alexandre Gerber, Zhuoqing Mao, Feng Qian, Subhabrata Sen, Oliver Spatscheck, Zhaoguang Wang, Method and apparatus for providing a dynamic inactivity timer in a wireless communications network, US8611825, Dec 17, 2013.
4. Alexandre Gerber, Zhuoqing Mao, Feng Qian, Subhabrata Sen, Oliver Spatscheck, Zhaoguang Wang, Method and apparatus for performing a demotion in a cellular communications network, US8606290, Dec 10, 2013.
5. Alexandre Gerber, Zhuoqing Mao, Feng Qian, Subhabrata Sen, Oliver Spatscheck, Walter Willinger, TCP flow clock extraction, US8576968, Nov 5, 2013.
6. Alexandre Gerber, Zhuoqing Mao, Feng Qian, Subhabrata Sen, Oliver Spatscheck, Zhaoguang Wang, Method and apparatus for inferring state transitions in a wireless communications network, US8570926, Oct 29, 2013.
7. Alexandre Gerber, Zhuoqing Mao, Feng Qian, Subhabrata Sen, Oliver Spatscheck, Walter Willinger, Inferring TCP initial congestion window, US8274886, Sep 25, 2012.
8. Zhuoqing Morley Mao, Jia Wang, Ying Zhang, Method and apparatus for mitigating routing misbehavior in a network, US8141156, 20 Mar 2012.

Provisional patents and patents pending (inventors, title, date submitted)

1. Alexandre Gerber, Zhuoqing Mao, Feng Qian, Subhabrata Sen, Oliver Spatscheck, Zhaoguang Wang, Bundling data transfers and employing tail optimization protocol to manage cellular radio resource utilization, US20120324041, Dec 20, 2012.
2. Alexandre Gerber, Seungjoon Lee, Zhuoqing Mao, Feng Qian, Subhabrata Sen, Zhaoguang Wang, Qiang Xu, Method and apparatus for characterizing infrastructure of a cellular network, US20120155319, Jun 21, 2012.

3. Alexandre Gerber, Zhuoqing Mao, Feng Qian, Subhabrata Sen, Oliver Spatscheck, Zhaoguang Wang, Intelligent mobility application profiling tool, US20120151041, Jun 14, 2012.
4. Alexandre Gerber, Zhuoqing Mao, Feng Qian, Subhabrata Sen, Oliver Spatscheck, Zhaoguang Wang, Method and apparatus for normalizing cellular communications network data, US20120057571, Mar 8, 2012.
5. Jacobus Van Der Merwe, Xu Chen, Zhuoqing Mao, Method and System for Automated Network Operations, US20110153788, Jun 23, 2011.
6. Alexandre Gerber, Zhuoqing Mao, Feng Qian, Subhabrata Sen, Oliver Spatscheck, Walter Willinger, Detecting Irregular Retransmissions, US20110103256, May 5, 2011.
7. Charles Cranor, Frederick Douglass, Zhuoqing Mao, Michael Rabinovich, Oliver Spatscheck, Jia Wang, Method for associating clients with domain name servers, US20030093523, May 15, 2003.

Publications (Journals, Refereed Conferences and Workshops)

Electronic versions are available at <http://www.eecs.umich.edu/~zmao/pubs.html>.

1. Push or Request: An Investigation of HTTP/2 Server Push for Improving Mobile Performance by Sanae Rosen, Bo Han, Shuai Hao, Z. Morley Mao, Feng Qian, *Proceedings of WWW 2017*.
2. ContextIoT: Towards Providing Contextual Integrity to Appified IoT Platforms by Yunhan Jack Jia, Qi Alfred Chen, Shiqi Wang, Amir Rahmati, Earlene Fernandes, Z. Morley Mao, and Atul Prakash, *Proceedings of NDSS 2017*.
3. Open Doors for Bob and Mallory: Open Port Usage in Android Apps and Security Implications by Yunhan Jack Jia, Qi Alfred Chen, Yikai Lin, Chao Kong, and Z. Morley Mao, *Proceedings of The 2nd IEEE European Symposium on Security and Privacy (EuroS&P'17) 2017*.
4. Understanding On-device Bufferbloat for Cellular Upload by Yihua Guo, Feng Qian, Qi Alfred Chen, Z. Morley Mao, Subhabrata Sen, *Proceedings of IMC 2016*.
5. The Misuse of Android Unix Domain Sockets and Security Implications by Yuru Shao, Jason Ott, Yunhan Jack Jia, Zhiyun Qian, Z. Morley Mao *Proceedings of CCS 2016*.
6. An In-depth Understanding of Multipath TCP on Mobile Devices: Measurement and System Design by Ashkan Nikraves, Yihua Guo, Feng Qian, Z. Morley Mao, and Subhabrata Sen, *Proceedings of Mobicom 2016*.
7. Production as a Service: Optimizing Utilization in Manufacturing Systems by Matthew Porter, Vikram Raghavan, Yikai Lin, Z. Morley Mao, Kira Barton, Dawn Tilbury, *Proceedings of DSCC 2016*.
8. Diagnosing Mobile Apps' Quality of Experience: Challenges and Promising Directions by Z. Morley Mao, *IEEE Internet Computing (Volume:20, Issue: 1) 2016*.
9. MitM Attack by Name Collision: Cause Analysis and Vulnerability Assessment in the New gTLD Era by Qi Alfred Chen, Eric Osterweil, Matthew Thomas, and Z. Morley Mao, *Proceedings of IEEE Symposium on Security and Privacy 2016*.

10. Kratos: Discovering Inconsistent Security Policy Enforcement in the Android Framework by Yuru (Roy) Shao, Jason Ott, Qi Alfred Chen, Zhiyun Qian, and Z. Morley Mao, *Proceedings of Annual Network & Distributed System Security Symposium (NDSS) 2016*.
11. Android UI Deception Revisited: Attacks and Defenses by Earlence Fernandes, Qi Alfred Chen, Justin Paupore, Georg Essl, J. Alex Halderman, Z. Morley Mao, and Atul Prakash, *Proceedings of International Conference on Financial Cryptography and Data Security (FC) 2016*.
12. Incremental Deployment of SDN in Hybrid Enterprise and ISP Networks by David Ke Hong, Yadi Ma, Sujata Banerjee, and Z. Morley Mao, *Proceedings of Symposium on SDN Research (SOSR) 2016*.
13. Revisiting Network Energy Efficiency of Mobile Apps: Performance in the Wild by Sanae Rosen, Ashkan Nikraves, Yihua Guo, Z. Morley Mao, Feng Qian, Shubho Sen, *Proceedings of ACM Internet Measurement Conference (IMC) 2015*.
14. Static Detection of Packet Injection Vulnerabilities -- A Case for Identifying Attacker-controlled Implicit Information Leaks by Qi Alfred Chen, Zhiyun Qian, Yunhan Jack Jia, Yuru Roy Shao, Z. Morley Mao, *Proceedings of ACM Conference on Computer and Communications Security (CCS) 2015*.
15. Performance Characterization and Call Reliability Problem Diagnosis for Voice over LTE by Yunhan Jack Jia, Qi Alfred Chen, Z. Morley Mao, Jie Hui, Kranthi Sontineni, Alex Yoon, Samson Kwong, Kevin Lau, *Proceedings of ACM Mobicom 2015*.
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