

Ying Zhang

Contact Information	Staff Research Scientist Facebook <i>Email:</i> winginsky@gmail.com <i>Phone:</i> 4082509961 <i>WWW:</i> http://zhangying.org
Research Interests	Networking and Systems: Software-Defined Networks, Network Function Virtualization, Network monitoring, Internet routing, Network security.
Education	University of Michigan , Ann Arbor, Michigan, USA 2004 - 2009 Ph.D. in Computer Science and Engineering August 2009 Dissertation Title: "Effective Wide-Area Network Performance Monitoring and Diagnosis from End Systems" M.S. in Computer Science and Engineering May 2006 Peking University , Beijing, China 2000 - 2004 B.S. in Computer Science June 2004
Honors and Awards	Inventor of ZMW Attack First person that discovered ZMW routing attack and the attack is named after me. (https://en.wikipedia.org/wiki/ZMW_attack) Mobile Network Ten Brightest Researchers 2013 - 2015 Top 10 Patent Contributors in Ericsson globally. Reported by Swedish Tech Media NyTeknik as "Mobile network ten brightest researchers". Have 25 patents granted worldwide from 2013-2015. (http://www.nyteknik.se/nyheter/mobilnatens-tio-skarpaste-forskare-6335907) Hewlett Packard Labs NFV Recognition Award 2016 Awarding for the outstanding contribution in NFV research area. Ericsson Young Advisor Board Summer 2013 - Summer 2014 5 people selected out of 113,000 employees globally to provide to the Ericsson Leadership Team with new ideas, taking special assignments directly from the CEO Runner-Up Best Paper Award June 2016 IEEE International Conference on Sensing, Communication and Networking (SECON), London, UK, June 2016 Rackham Predoctoral Fellowship Fall 2008 - Spring 2009 To top doctoral students with outstanding dissertation research in all departments under Rackham graduate school, University of Michigan. Third Place, Univ. of Michigan CSE Graduate Student Honors Competition Fall 2007 For the best research and presentations among CSE graduate students.
Professional Experience	Facebook Staff Research Scientist Menlo Park, CA, USA March 2017 - Present Working on large scale network management in Facebook production network. Focus on BGP network management and monitoring Hewlett Packard Labs Research Manager Palo Alto, CA, USA December 2016 - March 2017 Led the Networking Systems group at Networking, IoT and Mobility Lab at Hewlett Packard Labs. She is working with a number of talented researchers and engineers on the next generation enterprise and cloud networking. In her role, Ying is responsible for setting up research visions, driving research programs, interacting with many business units in HPE, and inventing disruptive technologies for the future of HPE networking technologies. In particular, her group focus on the following areas:

Hewlett Packard Labs

Palo Alto, CA, USA

Senior Researcher

December 2014 - December 2016

Lead SDN/NFV verification research project in the following aspects.

- SDN network management: improving the performance management of large enterprise and ISP networks using automation, testing, verification, and intelligent resource management.
- Engaging with the SDN/NFV eco-system: my team has been actively contributed to OpenFlow standardization, OpenDayLight (ODL) controllers, Openstack and OPNFV platform.
- Network Function Virtualization (NFV): Ying is leading the team to tackle various research challenges in NFV: VNF performance benchmarking, VNF performance optimization, resource management in service function chaining.
- IoT policy management: building a secure and robust IoT policy management platform using centralized control and graph based troubleshooting.

Ericsson Research

San Jose, CA, USA

Senior Researcher

August 2012 - December 2014

- Service chaining in SDN: including architecture design, performance optimization, service chaining OAM, its application in virtual home gateway and service chaining implemented with optical/packet hybrid architecture. Had several publications and US patents under this subject.
- SDN OAM: proposed various measurement techniques in the SDN environment for DDoS prevention, prefix hijacking mitigation, and various traffic anomaly detection. Collaborate with faculties and students from the University of Southern California on this topic.
- Theoretical and practical studies on the scalability and resilience of Openw based Software Defined Network (SDN): SDN controller placement, control channel communication resilience, SDN fault tolerance.

Ericsson Research

San Jose, CA, USA

Researcher

August 2009 - December 2012

- Data center resource optimization: studied topics including VM placement, bandwidth guarantee mechanisms, QoS in the multi-tenant environment. Collaborate with universities, had several US patents and publications in this topic.
- Self-organizing network: developed SON functionality in metro-Ethernet carrier networks. Demonstrated the self-organizing capabilities across radio access network, access and aggregation network, and the evolved packet core (EPC) networks, ranging from network monitoring, diagnosis, and resource management.
- QoE measurement: developed modeling and monitoring techniques for user Quality of Experience (QoE) for web applications and over the top video (OTT) for network operators.
- Lead the Ericsson and Stanford Collaboration, representing the SDN research in Ericsson in Mobile World Congress.

Microsoft Research

Redmond, WA, USA

Internship

Summer 2008

Designed and built a “what-if” analysis tool for resource provisioning in the large data centers.

AT&T Labs-Research

Florham Park, NJ

Internship

Summer 2005, Summer 2006

Designed and developed a troubleshooting system for layer-3 MPLS-VPN networks using association mining. The system is running in the operational network to detect anomalies and to infer root causes by exploring the correlation across layers and across geographic locations.

SOSR 2017 (PC and Publication Chair)
HotIoT 2016
MobiSys 2016
ACM SIGCOMM HotMiddlebox 2016
IEEE 22nd Asia-Pacific Conference on Communications (APCC) 2016
ACM SIGCOMM CSWS 2014
NPsec 2014
MobiSys 2014 (external review committee)
SecureComm 2013/2014
ICC NGN 2012/2013/2014
GLOBECOM 2012/2013/2014
ITC 2011

Reviewer for Journals:

ACM/IEEE Transaction on Networking (TON)
ACM Computer Communications Review (CCR)
ACM Transaction on Internet Technology (TOIT)
IEEE Special Issue on Management of Softwarized Networks
IEEE Transactions on Dependable and Secure Computing
IEEE Internet Computing Special Issue on NFV
IEEE TWireless
IEEE ComMag

Books

Software Defined Infrastructures: Concepts and applicability of SDN and NFV in 5G networks Ying Zhang, Mallik Tatipamula, To be published by John Wiley & Sons, Inc, 2017

Cloud Mobile Networks: from RAN to EPC Ying Zhang, Mojtaba Vaezi, To be published by Springer International Publisher AG, 2017

**Referred
Conference and
Workshop
Publications**

SLA-Verifier: Stateful and Quantitative Verification for Service Chaining Ying Zhang, Wenfei Wu, Sujata Banerjee, Joon-Myung Kang, Mario Sanchez. *IEEE INFOCOM, Atlanta, GA, April 2017.*

SFC-Checker: Checking the Correct Forwarding Behavior of Service Function Chaining Brendan Tschaen, Ying Zhang, Theophilus Benson, Sujata Banerjee, Jeongkeun Lee, Joon-Myung Kang. *IEEE NFV-SDN, Palo Alto, CA, November 2016.*

Automatic synthesis of NF models by program analysis Wenfei Wu, Ying Zhang, Sujata Banerjee. *ACM HotNets, Atlanta, GA, November 2016.*

Providing Bandwidth Guarantees, Work Conservation and Low Latency Simultaneously in the Cloud Shuihai Hu, Wei Bai, Kai Chen, Chen Tian, Ying Zhang, Haitao Wu. *IEEE INFOCOM, San Francisco, CA, April 2016.*

MOZART: Temporal Coordination of Measurement Xuemei Liu, Meral Shirazipour, Minlan Yu, Ying Zhang. *Symposium on SDN Research (SOSR), Santa Clara, CA, March 2016.*

A Spectral Approach for Large Scale Data Traffic Load: Analysis and Applications Hongzhi Shi, Yong Li, Di Wu, Ying Zhang. *The IEEE International Conference on Sensing, Communication and Networking (SECON 2016), London, UK, 2016.*

PGA: Using Graphs to Express and Automatically Reconcile Network Policies C. Prakash, J. Lee, Y. Turner, J.-M. Kang, A. Akella, S. Banerjee, C. Clark, Y. Ma, P. Sharma, and Y. Zhang. *ACM SIGCOMM 2015.*

Virtual Machine Migration in Service Based Networks Hongzhi Shi, Ying Zhang, Y. Zhang. *IEEE Transactions on Network and Service Management, 2016.*

Wang, Yong Li, Ying Zhang, Depeng Jin. *Proceedings of the 34th Annual IEEE Conference on Computer Communications (INFOCOM 2015), Hong Kong, April 2015.*

Network Function Placement for NFV Chaining in Packet/Optical Data Centers. Ming Xia, Meral Shirazipour, Ying Zhang, Howard Green, Attila Takacs. *European Conference on Optical Communications (ECOC), Cannes, France, 2014.*

A Compressive Method for Maintaining Forwarding States in SDN Controller. Ying Zhang, Sriram Natarajan, Xin Huang, Neda Beheshti, Ravi Manghirmalani *ACM SIGCOMM Workshop on Hot Topics in Software Defined Networking (HotSDN), Chicago, August 2014.*

Understanding the HTTP Flow Rates in Cellular Networks. Ying Zhang, Ake Arvidsson, Matti Siekkinen, Guillaume Urvoy-Keller *Proceedings of the IFIP Networking 2014, Trondheim, Norway, 2014.*

SDN and Optical Flow Steering for Network Function Virtualization. Ming Xia, Meral Shirazipour, Ying Zhang, Howard Green, Attila Takacs *Open Networking Summit (Research Track), Santa Clara, CA, March 2014.*

SENS: Software-defined Security Service. Minlan Yu, Ying Zhang, Jelena Mirkovic, Abdulla Alwabel *Open Networking Summit (Research Track), Santa Clara, CA, March 2014.*

User Mobility from the View of Cellular Data Networks. Ying Zhang *The 33rd Annual IEEE Conference on Computer Communications (INFOCOM 2014), Toronto, Canada, April 2014.*

An SDN based Flow Counting Framework for Anomaly Detection. Ying Zhang *The 9th International Conference on emerging Networking EXperiments and Technologies (CoNEXT 2013), Santa Barbara, California, December, 2013.*

Zeppelin - A Third Generation Data Center Network Virtualization Technology based on SDN and MPLS. James Kempf, Ying Zhang, Neda Beheshti and Ramesh Mishra *In Proc. of The 2nd IEEE International Conference on Cloud Networking (IEEE CloudNet), San Francisco, California, November, 2013.*

StEERING: A Software-Defined Networking for Inline Service Chaining . Ying Zhang, Neda Beheshti, Ludovic Beliveau, Geoffrey Lefebvre, Ramesh Mishra, Ritun Patney, Erik Rubow, Ramesh Subrahmaniam, Ravi Manghirmalani, Meral Shirazipour, Catherine Truchan and Mallik Tatipamula *In Proc. of The 21st IEEE International Conference on Network Protocols (ICNP 2013), Goettingen, Germany, October, 2013.*

Detecting User Dissatisfaction and Understanding the Underlying Reasons. Ake Arvidsson and Ying Zhang *Extended Abstract, In Prof. of ACM SIGMETRICS,,Pittsburgh, June, 2013.*

The Freshman Handbook: A Hint for the Server Placement of Social Networks. Ying Zhang, Du Li and Mallik Tatipamula *In Proc. of the 18th International Conference on Parallel and Distributed Systems (ICPADS),, Singapore, December, 2012.*

Fast Failover for Control Traffic in Software-defined Networks. Neda Beheshti and Ying Zhang *In Proc. of IEEE GLOBECOM 2012 - Next Generation Networking Symposium, , Anaheim, December, 2012.*

OpenFlow and Multi-Layer Extensions: Overview and Next Steps. Meral Shirazipour, Ying Zhang, Neda Beheshti, Geoffrey Lefebvre and Mallik Tatipamula *In Proc. of European Workshop on Software Defined Networks (EWSDN12), October, 2012.*

Towards Bandwidth Guarantee in Multi-tenancy Cloud Computing Networks. Jing Zhu, Dan Li, Jianping Wu, Hongnan Liu, Ying Zhang and Jincheng Zhang *In Prof. of IEEE ICNP, Austin, October, 2012.*

Understanding the Characteristics of Cellular Data Traffic. Ying Zhang and Ake Arvidsson *In Prof. of ACM Sigcomm CellNet Workshop, Helsinki, Finland, August, 2012.*

Studying Impacts of Prefix Interception Attack by Exploring BGP AS-PATH Prepending. Ying Zhang and Makan Pourzandi *In Proc. of the 32nd International Conference on Distributed Computing Systems (ICDCS 2012), Macau, China, June, 2012.*

Characterization and Design of Effective BGP AS-PATH Prepending. Ying Zhang and Mallik Tatipamula *In Proc. of The 19th IEEE International Conference on*

ALIAS: Scalable, Decentralized Label Assignment for Data Centers. Meg Walraed-Sullivan, Radhika Niranjan Mysore, Malveeka Tewari, Ying Zhang, Keith Marzullo and Amin Vahdat *In Proc. of The ACM Symposium on Cloud Computing (ACM SOCC 2011)*, Cascais, Portugal, October 2011.

On Resilience of Split-Architecture Networks. Ying Zhang, Neda Beheshti and Mallik Tatipamula *In Proc. of IEEE GLOBECOM 2011 - Next Generation Networking Symposium*, Houston, December, 2011.

Metering Re-ECN: Performance Evaluation and its Applicability in Cellular Networks. Ying Zhang, Ingemar Johansson, Howard Green and Mallik Tatipamula *In Proc. of 23rd International Teletraffic Congress (ITC)*, San Francisco, September, 2011.

Mobile Communication Congestion Exposure Scenario. D. Kutscher, R. Winter, S. Krishnan and Ying Zhang *IETF Internet-Draft, Prague, Czech Republic, March 2011.*

Detecting Traffic Differentiation in Backbone ISPs with NetPolice. Ying Zhang, Z. Morley Mao and Ming Zhang, *Proceedings of ACM Internet Measurement Conference (IMC)*, Chicago, Illinois, November 2009.

HC-BGP: A Light-weight and Flexible Scheme for Securing Prefix Ownership. Ying Zhang, Zheng Zhang, Z. Morley Mao and Y. Charlie Hu, *Proceedings of 39th Annual IEEE/IFIP International Conference on Dependable Systems and Networks (DSN)*, June 2009.

Ascertaining the Reality of Network Neutrality Violation in Backbone ISPs. Ying Zhang, Z. Morley Mao, and Ming Zhang, *Proceedings of the Seventh Workshop on Hot Topics in Networking (HotNets-VII)*, October 2008.

iSPY: Detecting IP Prefix Hijacking on My Own. Zheng Zhang, Ying Zhang, Y. Charlie Hu, Z. Morley Mao, and Randy Bush, *Proceedings of ACM SIGCOMM*, August 2008.

Effective Diagnosis of Routing Disruptions from End Systems. Ying Zhang, Z. Morley Mao, and Ming Zhang, *Proceedings of 5th USENIX Symposium on Networked Systems Design and Implementation (NSDI)*, April, 2008.

A Measurement Study of Internet Delay Asymmetry. Abhinav Pathak, Himabindu Pucha, Ying Zhang, Y. Charlie Hu, and Z. Morley Mao, *Proceedings of Passive and Active Measurement Conference (PAM)*, April 2008.

Practical Defenses Against BGP Prefix Hijacking. Zheng Zhang, Ying Zhang, Y. Charlie Hu, and Z. Morley Mao, *Proceedings of 3rd International Conference on emerging Networking EXperiment and Technologies (CoNEXT)*, December 2007.

Internet Routing Resilience to Failures: Analysis and Implications. Jian Wu, Ying Zhang, Z. Morley Mao, and Kang G. Shin, *Proceedings of 3rd International Conference on emerging Networking EXperiment and Technologies (CoNEXT)*, December 2007.

On the Impact of Route Monitor Selection. Ying Zhang, Zheng Zhang, Z. Morley Mao, Y. Charlie Hu, and Bruce Maggs, *Proceedings of ACM Internet Measurement Conference (IMC)*, October 2007.

A Firewall for Routers: Protecting Against Routing Misbehavior. Ying Zhang, Zhuoqing Morley Mao, and Jia Wang, *Proceedings of 37th Annual IEEE/IFIP International Conference on Dependable Systems and Networks (DSN)*, June 2007.

Understanding Network Delay Changes Caused by Routing Events. Himabindu Pucha, Ying Zhang, Z. Morley Mao, Y. Charlie Hu, *Proceedings of ACM SIGMETRICS*, June 2007.

A Framework for Measuring and Predicting Impact of Routing Changes. Ying Zhang, Z. Morley Mao, and Jia Wang, *Proceedings of the 26th Annual IEEE Conference on Computer Communications (INFOCOM)*, May 2007.

Low-Rate TCP-Targeted DoS Attacks Disrupts Internet Routing. Ying Zhang, Z. Morley Mao, and Jia Wang, *Proceedings of 14th Annual Network & Distributed System Security Symposium (NDSS)*, February 2007.

Internet-scale Malware Mitigation: Combining Intelligence of the Control and Data Plane. Ying Zhang, Evan Cooke, and Z. Morley Mao, *Proceedings of ACM CCS Workshop on Rapid Malcode (WORM)*, November 2006.

Web Service Automated Composition in Digital Library. Ying Zhang, Ming Zhang, and Shuan Wang, *Proceedings of National Database Conference, China, 2004.*

Referred Journal, Magazine Publications **Stringer: Balancing Latency and Resource Usage in Service Function Chain Provisioning** Freddy Chua, Julie Ward, Ying Zhang, Puneet Sharma, Bernardo Huberman. *IEEE Internet Computing's special issue: - Network Function Virtualization.*

Optical Service Chaining for Network Function Virtualization. Ming Xia, Meral Shirazipour, Ying Zhang, Attila Takacs. *IEEE Communications Magazine (COMMAG) February, 2015.*

DCloud: Deadline-aware Resource Allocation for Cloud Computing Jobs. Dan Li, Congjie Chen, Junjie Guan, Ying Zhang, Jing Zhu, Ruozhou Yu. *IEEE Transactions on Parallel and Distributed Systems. Issue 99, October, 2015.*

Next Generation Applications on Cellular Networks: Trends, Challenges and Solutions. Nimish Radio, Ying Zhang, Mallik Tatipamula, and Vijay Madiseti *In IEEE Special Issues of New Convergences of Broadband Communications, Computing and Rich Mediam, 2011*

iSPY: Detecting IP Prefix Hijacking on My Own. Zheng Zhang, Ying Zhang, Y. Charlie Hu, Z. Morley Mao, and Randy Bush *In ACM/IEEE Transactions on Networking (ToN), Vol. 18 (6), pp. 1815–1828, December 2010.*

Internet Traffic and Multiresolution Analysis. Ying Zhang, Zihui Ge, Suhas Digvavi, Z. Morley Mao, Matthew Roughan, Vinay Vaishampayan, Walter Willinger, and Yin Zhang *Markov Processes and Related Fields: A Festschrift in Honor of Thomas G. Kurtz/, S. N. Ethier, J. Feng and R. H. Stockbridge (eds.), IMS Lecture Notes–Monograph Series, 2007.*

Issued Patents **Traffic-aware data center vm placement considering job dynamic and server heterogeneity,** Ying Zhang, Du Li, He Wu, US 14/586,758, Issued Sep 27, 2016

Method and system for data set migration over a circuit switching network, Ming Xia, Ying Zhang, David Hood US 14/514,127, Issued Sep 6, 2016

A Method and System of Bandwidth-aware Service Placement for Service Chaining, Ying Zhang, Neda Beheshti, US 14/819,367, Issued Jul 12, 2016

Multi-objective server placement determination, Ying Zhang, Du Li, US 13/684,125, Issued Aug 23, 2016

Method and apparatus for resilient routing of control traffic in a split-architecture system, Neda Beheshti, Ying Zhang, US 13/294,559, Issued Nov 10, 2015

Resiliency-aware Hybrid Design of Controller-Switch Connectivity in the Split Architecture, Neda Beheshti, Ying Zhang, US 13/347,592, Issued Oct 6, 2015

Congestion Control in Packet Data Networking, Neda Beheshti, Ying Zhang, US 13/464,182, Issued Apr 21, 2015

Localized Congestion Exposure, Ying Zhang, Ingemar Johansson, Howard Green, US 12/976,067, Issued Mar 17, 2015

Quantifying User Quality of Experience by Passive Monitoring, Ying Zhang, Neda Beheshti, Ake Arvidsson US 13/401,645, Issued Mar 3, 2015

A Method and System to Allocate Bandwidth in Cloud Computing Networks, Ying Zhang, Dan Li, Jing Zhu, US 13/663,416, Issued Jan 20, 2015

Methods and Apparatuses to Identify User Dissatisfaction from Early Cancellation, Ying Zhang, Ake Arvidsson US 13/922,864, Issued Dec 25, 2014

Method and System to Dynamically Detect Traffic Anomalies in a Network, Ying Zhang, US 13/872,855, Issued Oct 30, 2014

Service Placement for Inline Services Chaining with Multiple Replicas, Ying Zhang, Neda Beheshti, US 14/026,344, Issued Aug 26, 2014

Optimized Controller Placement for Tunneling-based Protection in the Split-

2014

Controller Placement for Fast Failover in the Split Architecture, Neda Beheshti, Ying Zhang, Mallik Tatipamula US 13/236,296, Issued Aug 12, 2014

Implementing 3G Packet Core in a Cloud with OpenFlow Data and Control Planes, James Kempf, Neda Beheshti, Ying Zhang, US 13/220,471, Issued June 24, 2014

Congestion Control and Resource Allocation in Split Architecture Networks, Ying Zhang, Neda Beheshti US 13/438,631, Issued May 20, 2014

Network-wide Flow Monitoring For Split Architecture Networks, Ying Zhang, US 13/232,719, Issued November 26, 2013

Controller Placement for Split Architecture Networks, Ying Zhang, Neda Beheshti, Mallik Tatipamula US 13/186,272, Issued October 15, 2013

Implement OSPF In Split-Architecture Network, Kiran Yedavalli, Neda Beheshti, Ying Zhang, US 13/208,251, Issued October 15, 2013

Capacity Planning for Data Center Services, Ming Zhang, Paramvir Bahl, Ying Zhang, and Z. Morley Mao, US 12/539,802, Issued on August, 2012.

Method and apparatus for mitigating routing misbehavior in a network, Zhuoqing Morley Mao, Jia Wang, and Ying Zhang, US 11/321,940, Issued May 20, 2012.

A Scalable and Robust Troubleshooting Framework for VPN Backbones, Zhuoqing Morley Mao, Dan Pei, Jia Wang, and Ying Zhang, US 12/005,191, Issued on February, 2011.

Filed Patents

A system for VNF placement that facilitates tradeoff between resource usage and performance, Julie A Ward, Freddy Chua, Ying Zhang, Puneet Sharma, Bernardo Huberman, 710223628, filed in 2016

Modeling and Query language of Service Function Chaining Verification, Ying Zhang, Sujata Banerjee, 710223895, filed in 2016

Real-time verification of high level policies in SDN networks, Ying Zhang, Jeongeun Lee, Puneet Sharma, 90028947, filed in 2015

Static Verification of Service Function Chaining, Ying Zhang, Brendan Tschaen, 700221287, filed in 2015

Service Placement for Inline Service Chaining, Neda Beheshti, Ying Zhang, P41633US1, filed in 2013

A Method and System to Allocate Bandwidth based on Task Deadline in Cloud Computing, Ying Zhang, Dan Li, Jing Zhu, Chongjie Chen, P40721US1, filed in 2013

Method and System for Flow Table Lookup Parallelization in a Software Defined Networking (SDN) System, Neda Beheshti, Ludovic Beliveau, Ying Zhang, P39598US1, filed in 2013

Network Bandwidth Allocation in Multi-Tenancy Cloud Computing Networks, Ying Zhang, P38827US1, filed in 2013

Elastic Enforcement Layer for Cloud Security Using SDN, Tommy Koorevaar, Makan Pourzandi, Ying Zhang, P36773US1, filed in 2012

Handling Heterogeneous Bandwidth Requirements in the Cloud Computing Platforms, Ying Zhang, Dan Li, Jing Zhu, P39515US1, filed in 2012

On-demand Measurement for Metro-Ethernet Self Organizing Networks, Ying Zhang, Neda Beheshti, Catalin Meirosu, Alisa Devlic P35897, filed in 2012

Design of Effective BGP AS-PATH Prepending Strategies, Ying Zhang, P35148US1, filed in 2011

Routing of Control Traffic in the Split Architecture, Neda Beheshti, Ying Zhang, P35294US1, filed in 2011