

# Wenfei Wu

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## Education

Ph.D. Computer Science, University of Wisconsin-Madison, 2015, advisor: Prof. Aditya Akella<sup>1</sup>

M.S. Computer Science, University of Wisconsin-Madison, 2012

B.E. Computer Science and Technology, Beihang University, 2010

B.S. (double degree), Applied Mathematics, Beihang University, 2010.

## Employments

Assistant Professor, Institute for Interdisciplinary Information Sciences, **Tsinghua University**, Dean: Andrew Chi-Chih Yao, 2017.4 - now.

Administrative Committee Member, Haihua Institute for Frontier Information Technology (link), affiliated to IIIS, 2018.12 - 2020.11.

Post-doctoral Researcher, Networking Systems Research Group, **Hewlett Packard Labs**, Manager: Sujata Banerjee, Mentor: Ying Zhang, 2016.1 - 2017.4.

## Research Areas

I am broadly interested in networked systems. I am good at the following areas.

### *Research Areas*

**In-Network Computation for Distributed System**, using programmable network hardware to accelerate distributed systems [2,4].

**Model-Driven DevOps for Network Functions**, a model-driven approach to bridge the gap between NF operation and NF development [1,3,6,8,9,10,12,21].

**Cloud Network Diagnostics**, building diagnostic primitives and systems for cloud networks [5,22,23,27].

### *Other Projects*

My other contributions are classified as follows.

**Network Architecture**, including architecture design for the Internet, data center networks, and mobile networks [16,24,25,28,29,31].

**Network Protocols**, including protocol improvement for TCP and QoS appliances [11,14,18,26].

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<sup>1</sup>Prof. Aditya Akella (link) was awarded Applied Networking Research Prize in 2015 and ACM SIGCOMM Rising Star Award in 2014, and he is a PI of CloudLab (link).

**Network Management**, including network diagnostics, network software development, and policy management [13,15,17,19,30].

**Network Security**, including malware analysis, and trusted execution environment for network services [7,20].

## Teaching Experience

I taught “Yao Class” (elite undergraduate students in Tsinghua) and IIIS graduate students.

**Fundamentals for Cryptography**, for Yao Class, in fall 2017, fall 2018, fall 2019, and fall 2020.

**Security Technologies in the Cyberspace**, for IIIS graduate students, in spring 2018, spring 2019, and spring 2020.

## Awards

**Best Paper**. USENIX Symposium on Networked Systems Design and Implementation (NSDI), Virtual Event, 2021.

**Best Paper Runner-up**. International Performance Computing and Communications Conference (IPCCC), London, UK, 2019.

**Microsoft Collaborative Research Award**. Microsoft Research Asia, 2018

**Best Student Paper**. Symposium of Cloud Computing (SoCC), Santa Clara, USA, 2013.

## Grants

I received and managed 9.74 million RMB grant, including 1.61 million from NSFC, 3.2 million from the industry, and internal 4.93 million RMB in the institute.

**Fusion Networks for Smart Medium**, 1.34M RMB, Ministry of Science and Technology, 2020-2024. (The whole program is about 30M RMB for 10 organizations)

**Rapid Development of Network Functions for Heterogeneous Networks**, PI, 270K RMB, National Natural Science Foundation of China, 2019-2022.

**Other grants from the industry**, PI, 3.2M RMB, about NFV, SmartNIC, Network Management, and Optical Networks; provided on request.

**Institute internal grants**, PI, 4.93M RMB, about network verification, and machine learning infrastructure; provided on request.

## Professional Services

### *Technical Program Committee Member*

APNet’21, TPC Member

IM’21, TPC Member

SIGCOMM’20 Poster Session, TPC Member

SIGCOMM'19 Poster Session, TPC Member

ANCS'19, TPC Member

ANCS'18, TPC Member

Hot-IoT'16, TPC Member

Transaction on Computers, Reviewer

Transaction on Networking, Reviewer

Transaction on Network and Service Management, Reviewer

Internet Computing, Reviewer

### *Organizing Committee Member*

SIGMETRICS'21, local management chair

SOSR'20, publication chair

SIGCOMM'19, registration chair

SOSR'19, publicity chair

APNet'18, local management chair

SOSR'17, travel grant chair

## Reference Letters

### **Aditya Akella**

Professor @ University of Wisconsin-Madison

Ph.D. Advisor

Email: akella@cs.wisc.edu

ACM SIGCOMM Rising Star 2014

### **K.K. Ramakrishnan**

Professor @ University of California Riverside

Email: kk@cs.ucr.edu

ACM Fellow 2017

IEEE Fellow 2005

### **Li Erran Li**

Alexa AI, Amazon

Adjunct Professor @ Columbia University

Email: erranlli@gmail.com

ACM Fellow 2017

IEEE Fellow 2013

## Publications

I published 36 papers and 3 patents, and have 7 patents under review. My Google Scholar Citation is 1618, i10-index is 15, and h-index is 15.

### Conference Papers

- [1] Bangwen Deng and **Wenfei Wu\***. “**NFReducer: Redundant Logic Elimination for Network Functions with Runtime Configurations**”. In: *the 2021 IEEE International Conference on Computer Communications*. INFOCOM '21. 2021.
- [2] Yongchao He, **Wenfei Wu\***, Xuemin Wen, Haifeng Li, and Yongqiang Yang. “**Scalable On-Switch Rate Limiters for the Cloud**”. In: *the 2021 IEEE International Conference on Computer Communications*. INFOCOM '21. 2021.
- [3] Hongyi Huang, **Wenfei Wu\***, Yongchao He, Bangwen Deng, Ying Zhang, Yongqiang Xiong, Guo Chen, Yong Cui, and Peng Cheng. “**NFD: A Development Framework for Cross-Platform Network Functions**”. In: *the 2021 IEEE International Conference on Computer Communications*. INFOCOM '21. 2021.
- [4] ChonLam Lao, Yanfang Le, Kshiteej Mahajan, Yixi Chen, **Wenfei Wu\***, Aditya Akella, and Michael Swift. “**ATP: In-Network Aggregation for Multi-Tenant Learning**”. In: *the 18th USENIX Symposium on Networked Systems Design and Implementation*. NSDI '21. 2021.
- [5] Ming Sun, Ya Su, Shenglin Zhang, Junliang Tang, Yuanpu Cao, Yuqing Liu, **Wenfei Wu\***, Dan Pei, Yongsu Zhang, and Xiaozhou Liu. “**CTF: Anomaly Detection in High-Dimensional Time Series with Coarse-to-Fine Model Transfer**”. In: *the 2021 IEEE International Conference on Computer Communications*. INFOCOM '21. 2021.
- [6] Bohan Zhao, Xiang Li, Boyu Tian, Zhiyu Mei, and **Wenfei Wu\***. “**DHS: Adaptive Memory Layout Organization of Sketch Slots for Fast and Accurate Data Stream Processing**”. In: *Proceedings of the 27th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*. KDD '21. 2021.
- [7] Bangwen Deng, **Wenfei Wu\***, and Linhai Song. “**Redundant Logic Elimination in Network Functions**”. In: *Proceedings of the 2020 Symposium on SDN Research*. SOSR '20. Google Scholar Citation 0. 2020.
- [8] Qingxiu Liu, **Wenfei Wu\***, Qingsong Liu, and Qun Huang. “**T2DNS: A Third-Party DNS Service with Privacy Preservation and Trustworthiness**”. In: *Proceedings of the 29th International Conference on Computer Communications and Networks*. ICCCN '20. Google Scholar Citation 0. 2020.
- [9] Harsha Sharma, **Wenfei Wu\***, and Bangwen Deng. “**Symbolic Execution for Network Functions with Time-Driven Logic**”. In: *Proceedings of the 2020 Symposium on Modelling, Analysis, and Simulation of Computer and Telecommunication Systems*. MASCOTS '20. Google Scholar Citation 0. 2020.
- [10] Yongheng Chen, Linhai Song, Xinyu Xing, Fengyuan Xu, and **Wenfei Wu**. “**Automated Finite State Machine Extraction**”. In: *Proceedings of the 2019 Workshop on Forming an Ecosystem Around Software Transformation*. FEAST '19. Google Scholar Citation 0. 2019.
- [11] Yimin Jiang, Yong Cui, **Wenfei Wu**, Zhe Xu, Jiahua Gu, K. K. Ramakrishnan, Yongchao He, and Xuehai Qian. “**SpeedyBox: Low-Latency NFV Service Chains with Cross-NF Runtime Consolidation**”. In: *Proceedings of the 39th IEEE International Conference on Distributed Computing Systems*. ICDCS '19. Google Scholar Citation 6. 2019.
- [12] Junfeng Li, Dan Li, **Wenfei Wu**, K. K. Ramakrishnan, Jinkun Geng, Fei Gui, Fanzhao Wang, and Kai Zheng. “**Sphinx: A Transport Protocol for High-Speed and Lossy Mobile Networks**”. In: *Proceedings of the 38th IEEE International Performance Computing and Communications Conference*. IPCCC '19. Google Scholar Citation 0. 2019.

- [13] Soo-Jin Moon, Jeffrey Helt, Yifei Yuan, Yves Bieri, Sujata Banerjee, Vyas Sekar, **Wenfei Wu**, Mihalis Yannakakis, and Ying Zhang. “**Alembic: Automated Model Inference for Stateful Network Functions**”. In: *Proceedings of the 16th USENIX Symposium on Networked Systems Design and Implementation*. NSDI '19. Google Scholar Citation 8. 2019.
- [14] Qi-An Fu and **Wenfei Wu\***. “**TUS: A Transactional Update Service for SDN Applications**”. In: *Proceedings of the 9th ACM SIGOPS Asia-Pacific Workshop on Systems*. APSys '18. Google Scholar Citation 0. 2018.
- [15] Qingmei Ren, Yong Cui, **Wenfei Wu**, Changfeng Chen, Yuchi Chen, Jiangchuan Liu, and Hongyi Huang. “**Improving Quality of Experience for Mobile Broadcasters in Personalized Live Video Streaming**”. In: *2018 IEEE/ACM 26th International Symposium on Quality of Service*. IWQoS '18. Google Scholar Citation 1. 2018.
- [16] Ye Yu, Ying Zhang, **Wenfei Wu**, and Chen Qian. “**NetCP: Consistent, Non-interruptive and Efficient Checkpointing and Rollback of SDN**”. In: *2018 IEEE/ACM 26th International Symposium on Quality of Service*. IWQoS '18. Google Scholar Citation 3. 2018.
- [17] Anubhavnidhi Abhashkumar, Joon-Myung Kang, Sujata Banerjee, Aditya Akella, Ying Zhang, and **Wenfei Wu**. “**Supporting Diverse Dynamic Intent-based Policies using Janus**”. In: *Proceedings of the 13th ACM International on Conference on emerging Networking Experiments and Technologies*. CoNEXT '17. Google Scholar Citation 18. 2017.
- [18] Anubhavnidhi Abhashkumar, Jeongkeun Lee, Jean Tourrilhes, Sujata Banerjee, **Wenfei Wu**, Joon-Myung Kang, and Aditya Akella. “**P5: Policy-driven optimization of P4 pipeline**”. In: *Proceedings of the 2017 Symposium on SDN Research*. SOSR '17. Google Scholar Citation 15. 2017.
- [19] Keqiang He, Weite Qin, Qiwei Zhang, **Wenfei Wu**, Junjie Yang, Tian Pan, Chengchen Hu, Jiao Zhang, Brent Stephens, Aditya Akella, and Ying Zhang. “**Low Latency Software Rate Limiters for Cloud Networks**”. In: *Proceedings of the 2017 Asia-Pacific Workshop on Networking*. APNet '17. Google Scholar Citation 9. 2017.
- [20] Ying Zhang, **Wenfei Wu**, Sujata Banerjee, Joon-Myung Kang, and Mario A Sanchez. “**SLA-Verifier: Stateful and Quantitative Verification for Service Chaining**”. In: *Proceedings of the 2017 IEEE Conference on Computer Communications*. INFOCOM '17. Google Scholar Citation 16. 2017.
- [21] Linhai Song, Heqing Huang, Wu Zhou, **Wenfei Wu**, and Yiyang Zhang. “**Learning from Big Malwares**”. In: *Proceedings of the 7th ACM SIGOPS Asia-Pacific Workshop on Systems*. APSys '16. Google Scholar Citation 5. 2016.
- [22] **Wenfei Wu**, Ying Zhang, and Sujata Banerjee. “**Automatic Synthesis of NF Models by Program Analysis**”. In: *Proceedings of the 15th ACM Workshop on Hot Topics in Networks*. HotNets '16. Google Scholar Citation 27. 2016.
- [23] Aaron Gember-Jacobson, **Wenfei Wu**, Xiujun Li, Aditya Akella, and Ratul Mahajan. “**Management plane analytics**”. In: *Proceedings of the 2015 ACM Conference on Internet Measurement Conference*. IMC '15. Google Scholar Citation 16. 2015.
- [24] **Wenfei Wu**, Keqiang He, and Aditya Akella. “**Perfsight: Performance diagnosis for software dataplanes**”. In: *Proceedings of the 2015 ACM Conference on Internet Measurement Conference*. IMC '15. Google Scholar Citation 30. 2015.
- [25] Mehrdad Moradi, **Wenfei Wu**, Li Erran Li, and Zhuoqing Morley Mao. “**SoftMoW: recursive and reconfigurable cellular WAN architecture**”. In: *Proceedings of the 10th ACM International on Conference on emerging Networking Experiments and Technologies*. CoNEXT '14. Google Scholar Citation 63. 2014.
- [26] **Wenfei Wu**, Li Erran Li, Aurojit Panda, and Scott Shenker. “**PRAN: Programmable radio access networks**”. In: *Proceedings of the 13th ACM Workshop on Hot Topics in Networks*. HotNets '14. Google Scholar Citation 28. 2014.

- [27] **Wenfei Wu**, Yizheng Chen, Ramakrishnan Durairajan, Dongchan Kim, Ashok Anand, and Aditya Akella. **"Adaptive data transmission in the cloud"**. In: *2013 IEEE/ACM 21st International Symposium on Quality of Service. IWQoS '13*. Google Scholar Citation 5. 2013.
- [28] **Wenfei Wu**, Guohui Wang, Aditya Akella, and Anees Shaikh. **"Virtual network diagnosis as a service"**. In: *Proceedings of the 4th annual Symposium on Cloud Computing. SoCC '13*. Google Scholar Citation 33. 2013.
- [29] Dongsu Han, Ashok Anand, Fahad Dogar, Boyan Li, Hyeontaek Lim, Michel Machado, Arvind Mukundan, **Wenfei Wu**, Aditya Akella, David G. Andersen, John W. Byers, Srinivasan Seshan, and Peter Steenkiste. **"XIA: Efficient Support for Evolvable Internetworking"**. In: *Proceedings of the 9th USENIX Symposium on Networked Systems Design and Implementation. NSDI '12*. Google Scholar Citation 196. 2012.
- [30] Ashok Anand, Fahad Dogar, Dongsu Han, Boyan Li, Hyeontaek Lim, Michel Machado, **Wenfei Wu**, Aditya Akella, David G Andersen, John W Byers, et al. **"XIA: An architecture for an evolvable and trustworthy Internet"**. In: *Proceedings of the 10th ACM Workshop on Hot Topics in Networks. HotNets '11*. Google Scholar Citation 154. 2011.
- [31] Kai Chen, Chuanxiong Guo, Haitao Wu, Jing Yuan, Zhenqian Feng, Yan Chen, Songwu Lu, and **Wenfei Wu**. **"Generic and Automatic Address Configuration for Data Center Networks"**. In: *Proceedings of the ACM SIGCOMM 2010 Conference. SIGCOMM '10*. Google Scholar Citation 71. 2010.
- [32] Chuanxiong Guo, Guohan Lu, Helen J. Wang, Shuang Yang, Chao Kong, Peng Sun, **Wenfei Wu**, and Yongguang Zhang. **"SecondNet: A Data Center Network Virtualization Architecture with Bandwidth Guarantees"**. In: *Proceedings of the 6th International Conference on emerging Networking Experiments and Technologies (CoNEXT). CoNEXT '10*. Google Scholar Citation 713. 2010.

### Journal Papers

- [1] Junfeng Li, Dan Li, **Wenfei Wu**, K. K. Ramakrishnan, Jinkun Geng, Fei Gui, Fanzhao Wang, and Kai Zheng. **"Sphinx: A Transport Protocol for High-Speed and Lossy Mobile Networks"**. In: *Computer Networks* (2021).
- [2] Ya Su, Youjian Zhao, Ming Sun, Shenglin Zhang, Xidao Wen, Yongsu Zhang, Xian Liu, Xiaozhou Liu, Junliang Tang, **Wu, Wenfei**, and Dan Pei. **"Detecting Outlier Machine Instances through Gaussian Mixture Variational Autoencoder with One Dimensional CNN"**. In: *IEEE Transactions on Computers* (2021).
- [3] **Wenfei Wu** and Ying Zhang. **"Network Function Modeling and Its Applications"**. In: *IEEE Internet Computing* (2017). Google Scholar Citation 3.
- [4] Kai Chen, Chuanxiong Guo, Haitao Wu, Jing Yuan, Zhenqian Feng, Yan Chen, Songwu Lu, and **Wenfei Wu**. **"DAC: generic and automatic address configuration for data center networks"**. In: *IEEE/ACM Transactions on Networking* (2012). Google Scholar Citation 33.

### Patents

- [1] Joon Myung Kang, Anubhavnidhi Abhashkumar, Sujata Banerjee, Ying Zhang, and **Wenfei Wu**. **"Generating composite network policy"**. In: (2018). US Patent 10812342.
- [2] **Wenfei Wu**, Ying Zhang, and Sujata Banerjee. **"Middlebox modeling"**. In: (2018). US Patent 10594574.
- [3] Ying Zhang, **Wenfei Wu**, and Sujata Banerjee. **"Selectively monitoring a network of network function chains based on probability of service level agreement violation"**. In: (2018). US Patent 10491528.