

# Wei Bai

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## Research Interests

I am broadly interested in computer networking, with special focuses on data center networking, congestion control, and high performance networked systems.

## Education

- 2013.9-2017.6 **The Hong Kong University of Science and Technology (HKUST)**, Hong Kong SAR, China  
Ph.D. Computer Science and Engineering  
Advisor: Prof. Kai Chen  
Thesis: "Congestion Control Mechanisms for Data Center Networks"
- 2009.9-2013.7 **Shanghai Jiao Tong University (SJTU)**, Shanghai, China  
B.E. Information Security

## Work Experience

- Microsoft Research Redmond**, Redmond, USA
- 2021.7-Present Senior Researcher, Networking Research Group
- 2020.9-2021.6 Senior Research Software Development Engineer, Networking Research Group
- 2019.8-2020.8 Research Software Development Engineer 2, Mobility and Networking Research Group
- Microsoft Research Asia**, Beijing, China
- 2017.7-2019.8 Researcher (formerly Associate Researcher 2), Networking Research Group

## Key Projects at Microsoft

- 2019.2-Present **RDMA**: I am working with Azure Networking, Storage, Compute+Host to design, develop and operate high performance and reliable network infrastructure to enable the *largest* remote direct memory access (RDMA) deployments in the world. My responsibilities include designing congestion control mechanisms, switch buffer optimization, and switch/NIC qualification.
- 2018.9-Present **SONiC**: I am contributing to Software for Open Networking in the Cloud (SONiC), an open source cross-platform switch operating system based on Linux. My contributions include dis-aggregated chassis, QoS/RDMA features, and test system based on programmable hardware.

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## Awards and Honors

- 2021 Microsoft Special Stock Award
- 2016, 2017 HKUST Research Travel Grant
- 2015, 2016 USENIX NSDI Student Grant
- 2015 **Microsoft Research Asia Fellowship**
- 2013-2017 HKUST Postgraduate Scholarship
- 2013 SJTU Outstanding Bachelor Thesis Award (Top 1%)
- 2012 First Prize, Software Group, Information Security Contest, National Undergraduate Electronic Design Contest

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## Publications

### Conference Publications

- [C24] Xinhao Kong, Jingrong Chen, **Wei Bai**, Yechen Xu, Mahmoud Elhaddad, Shachar Raindel, Jitendra Padhye, Alvin R. Lebeck, Danyang Zhuo, "Understanding RDMA Microarchitecture Resources for Performance Isolation", *to appear in Proceedings of the 20th USENIX Symposium on Networked Systems Design and Implementation (NSDI)*, Boston, Massachusetts, April 17-19, 2023.
- [C23] Bojie Li, Gefei Zuo, **Wei Bai**, Lintao Zhang, "1Pipe: Scalable Total Order Communication in Data Center Networks", in *Proceedings of the ACM SIGCOMM 2021 Conference (SIGCOMM)*, Virtual Conference, August 23-27, 2021.
- [C22] Hwijoon Lim, **Wei Bai**, Yibo Zhu, Youngmok Jung, Dongsu Han, "Towards Timeout-less Transport in Commodity Datacenter Networks", in *Proceedings of the 16th European Conference on Computer Systems (EuroSys)*, Virtual Conference, April 26-28, 2021.
- [C21] Shuihai Hu, **Wei Bai**, Gaoxiong Zeng, Zilong Wang, Baochen Qiao, Kai Chen, Kun Tan, Yi Wang, "Aeolus: A Building Block for Proactive Transport in Datacenters", in *Proceedings of the ACM SIGCOMM 2020 Conference (SIGCOMM)*, Virtual Conference, August 10-14, 2020.
- [C20] Qun Huang, Haifeng Sun, Patrick P. C. Lee, **Wei Bai**, Feng Zhu, Yungang Bao, "OmniMon: Re-architecting Network Telemetry with Resource Efficiency and Full Accuracy", in *Proceedings of the ACM SIGCOMM 2020 Conference (SIGCOMM)*, Virtual Conference, August 10-14, 2020.
- [C19] **Wei Bai**, Shuihai Hu, Kai Chen, Kun Tan, Yongqiang Xiong, "One More Config is Enough: Saving (DC)TCP for High-speed Extremely Shallow-buffered Datacenters", in *Proceedings of the 39th IEEE International Conference on Computer Communications (INFOCOM)*, Virtual Conference, July 6-9, 2020.
- [C18] Junxue Zhang, **Wei Bai**, Kai Chen, "Enabling ECN for Datacenter Networks with RTT Variations", in *Proceedings of the 15th International Conference on emerging Networking EXperiments and Technologies (CoNEXT)*, Orlando, Florida, December 9-12, 2019.

- [C17] Gaoxiong Zeng, **Wei Bai**, Ge Chen, Kai Chen, Dongsu Han, Yibo Zhu, Lei Cui, "Congestion Control for Cross-Datacenter Networks", in *Proceedings of the 27th IEEE International Conference on Network Protocols (ICNP)*, Chicago, Illinois, October 7-10, 2019.
- [C16] Xiaodong Yi, Junjie Wang, Jingpu Duan, **Wei Bai**, Chuan Wu, Yongqiang Xiong, Dongsu Han, "FlowShader: a Generalized Framework for GPU-accelerated VNF Flow Processing", in *Proceedings of the 27th IEEE International Conference on Network Protocols (ICNP)*, Chicago, Illinois, October 7-10, 2019.
- [C15] Bojie Li, Tianyi Cui, Zibo Wang, **Wei Bai**, Lintao Zhang, "SocksDirect: Datacenter Sockets can be Fast and Compatible" in *Proceedings of the ACM SIGCOMM 2019 Conference (SIGCOMM)*, Beijing, China, August 19-24, 2019.
- [C14] Yang Cheng, Dan Li, Zhiyuan Guo, Binyao Jiang, Jiaxin Lin, Xi Fan, Jinkun Geng, Xinyi Yu, **Wei Bai**, Lei Qu, Ran Shu, Peng Cheng, Yongqiang Xiong, Jianping Wu, "DLBooster: Boosting End-to-End Deep Learning Workflows with Offloading Data Preprocessing Pipelines" in *Proceedings of the 48th International Conference on Parallel Processing (ICPP)*, Kyoto, Japan, August 5-8, 2019.
- [C13] Zhao Lucis Li, Mike Chieh-Jan Liang, **Wei Bai**, Qiming Zheng, Yongqiang Xiong, Guangzhong Sun, "Accelerating Rule-matching Systems with Learned Rankers" in *Proceedings of the 2019 USENIX Annual Technical Conference (ATC)*, Renton, Washington, July 10-12, 2019 (Short Paper).
- [C12] Hong Zhang, Junxue Zhang, **Wei Bai**, Kai Chen, Mosharaf Chowdhury, "Resilient Datacenter Load Balancing in the Wild" in *Proceedings of the ACM SIGCOMM 2017 Conference (SIGCOMM)*, Los Angeles, California, August 21-25, 2017.
- [C11] Ziyang Li, **Wei Bai**, Kai Chen, Dongsu Han, Yiming Zhang, Dongsheng Li, Hongfang Yu, "Rate-Aware Flow Scheduling for Commodity Data Center Networks" in *Proceedings of the 36th Annual IEEE International Conference on Computer Communications (INFOCOM)*, Atlanta, Georgia, May 1-4, 2017.
- [C10] **Wei Bai**, Kai Chen, Li Chen, Changhoon Kim, Haitao Wu, "Enabling ECN over Generic Packet Scheduling" in *Proceedings of the 12th International Conference on emerging Networking EXperiments and Technologies (CoNEXT)*, Irvine, California, December 12-15, 2016.
- [C9] Li Chen, Kai Chen, **Wei Bai**, Mohammad Alizadeh "Scheduling Mix-flows in Commodity Datacenters with Karuna" in *Proceedings of the ACM SIGCOMM 2016 Conference (SIGCOMM)*, Florianopolis, Brazil, August 22-26, 2016.
- [C8] Shuihai Hu, **Wei Bai**, Kai Chen, Chen Tian, Ying Zhang, Haitao Wu, "Providing Bandwidth Guarantees, Work Conservation and Low Latency Simultaneously in the Cloud", in *Proceedings of the 35th Annual IEEE International Conference on Computer Communications (INFOCOM)*, San Francisco, California, April 10-14, 2016.
- [C7] **Wei Bai**, Li Chen, Kai Chen, Haitao Wu "Enabling ECN in Multi-Service Multi-Queue Data Centers" in *Proceedings of the 13th USENIX Symposium on Networked Systems Design and Implementation (NSDI)*, Santa Clara, California, March 16-18, 2016.

- [C6] **Wei Bai**, Li Chen, Kai Chen, Dongsu Han, Chen Tian, Hao Wang, "Information-Agnostic Flow Scheduling for Commodity Data Centers" in *Proceedings of the 12th USENIX Symposium on Networked Systems Design and Implementation (NSDI)*, Oakland, California, May 4-6, 2015.
- [C5] Shuihai Hu, Kai Chen, Haitao Wu, **Wei Bai**, Chang Lan, Hao Wang, Hongze Zhao, Chuanxiong Guo, "Explicit Path Control in Commodity Data Centers: Design and Applications" in *Proceedings of the 12th USENIX Symposium on Networked Systems Design and Implementation (NSDI)*, Oakland, California, May 4-6, 2015.
- [C4] Yangming Zhao, Kai Chen, **Wei Bai**, Minlan Yu, Chen Tian, Yanhui Geng, Yiming Zhang, Dan Li, Sheng Wang, "RAPIER: Integrating Routing and Scheduling for Coflow-aware Data Center Networks" in *Proceedings of the 34th Annual IEEE International Conference on Computer Communications (INFOCOM)*, Hong Kong, April 26-May 1, 2015.
- [C3] Hong Zhang, Kai Chen, **Wei Bai**, Dongsu Han, Chen Tian, Hao Wang, Haibing Guan, Ming Zhang, "Guaranteeing Deadlines for Inter-Datacenter Transfers" in *Proceedings of the 10th European Conference on Computer Systems (EuroSys)*, Bordeaux, France, April 21-24, 2015.
- [C2] **Wei Bai**, Kai Chen, Haitao Wu, Wuwei Lan, Yangming Zhao, "PAC: Taming TCP Incast Congestion Using Proactive ACK Control" in *Proceedings of the IEEE 22nd International Conference on Network Protocols (ICNP)*, Research Triangle, North Carolina, October 21-24, 2014.
- [C1] Yang Peng, Kai Chen, Guohui Wang, **Wei Bai**, Zhiqiang Ma, Lin Gu, "Hadoop-Watch: A First Step Towards Comprehensive Traffic Forecasting in Cloud Computing" in *Proceedings of the 33rd Annual IEEE International Conference on Computer Communications (INFOCOM)*, Toronto, Canada, April 27-May 2, 2014.

#### Workshop Publications

- [W5] Jiacheng Xia, Gaoxiong Zeng, Junxue Zhang, Weiyan Wang, **Wei Bai**, Junchen Jiang, Kai Chen, "Rethinking transport layer design for distributed machine learning" in *Proceedings of the 3rd Asia-Pacific Workshop on Networking (APNet)*, Beijing, China, August 17-18, 2019.
- [W4] Shuihai Hu, **Wei Bai**, Baochen Qiao, Kai Chen, Kun Tan, "Augmenting Proactive Congestion Control with Aeolus" in *Proceedings of the 2nd Asia-Pacific Workshop on Networking (APNet)*, Beijing, China, August 2-3, 2018.
- [W3] Gaoxiong Zeng, **Wei Bai**, Ge Chen, Kai Chen, Dongsu Han, Yibo Zhu, "Combining ECN and RTT for Datacenter Transport" in *Proceedings of the 1st Asia-Pacific Workshop on Networking (APNet)*, Hong Kong, China, August 3-4, 2017.
- [W2] **Wei Bai**, Kai Chen, Shuihai Hu, Kun Tan, Yongqiang Xiong, "Congestion Control for High-speed Extremely Shallow-buffered Datacenter Networks" in *Proceedings of the 1st Asia-Pacific Workshop on Networking (APNet)*, Hong Kong, China, August 3-4, 2017.

- [W1] **Wei Bai**, Li Chen, Kai Chen, Dongsu Han, Chen Tian, Weicheng Sun, "PIAS: Practical Information-Agnostic Flow Scheduling for Data Center Networks" in *Proceedings of the 13th ACM Workshop on Hot Topics in Networks (HotNets)*, Los Angeles, California, October 27-28, 2014.

#### Journal Publications

- [J10] Gaoxiong Zeng, **Wei Bai**, Ge Chen, Kai Chen, Dongsu Han, Yibo Zhu, Lei Cui, "Congestion Control for Cross-Datacenter Networks", in *IEEE/ACM Transactions on Networking (ToN)*, 2022.
- [J9] Shuihai Hu, Gaoxiong Zeng, **Wei Bai**, Zilong Wang, Baochen Qiao, Kai Chen, Kun Tan, Yi Wang, "Aeolus: A Building Block for Proactive Transport in Datacenter Networks", in *IEEE/ACM Transactions on Networking (ToN)*, 2021.
- [J8] Yang Cheng, Dan Li, Zhiyuan Guo, Binyao Jiang, Jinkun Geng, **Wei Bai**, Jianping Wu, Yongqiang Xiong "Accelerating End-to-End Deep Learning Workflow With Codesign of Data Preprocessing and Scheduling", in *IEEE Transactions on Parallel and Distributed Systems (TPDS)*, 2020.
- [J7] **Wei Bai**, Shuihai Hu, Kai Chen, Kun Tan, Yongqiang Xiong, "One More Config is Enough: Saving (DC)TCP for High-speed Extremely Shallow-buffered Datacenters", in *IEEE/ACM Transactions on Networking (ToN)*, 2020.
- [J6] Shuihai Hu, **Wei Bai**, Kai Chen, Chen Tian, Ying Zhang, Haitao Wu, "Providing Bandwidth Guarantees, Work Conservation and Low Latency Simultaneously in the Cloud", in *IEEE Transactions on Cloud Computing (TCC)*, 2018.
- [J5] Shuhao Liu, Hong Xu, Libin Liu, **Wei Bai**, Kai Chen, Zhiping Cai, "RepNet: Cutting Latency with Flow Replication in Data Center Networks", in *IEEE Transactions on Services Computing (TSC)*, 2018.
- [J4] **Wei Bai**, Li Chen, Kai Chen, Dongsu Han, Chen Tian, Hao Wang, "PIAS: Practical Information-Agnostic Flow Scheduling for Commodity Data Centers" in *IEEE/ACM Transactions on Networking (ToN)*, 2017.
- [J3] Hong Zhang, Kai Chen, **Wei Bai**, Dongsu Han, Chen Tian, Hao Wang, Haibing Guan, Ming Zhang, "Guaranteeing Deadlines for Inter-Datacenter Transfers" in *IEEE/ACM Transactions on Networking (ToN)*, 2017.
- [J2] Shuihai Hu, Kai Chen, Haitao Wu, **Wei Bai**, Chang Lan, Hao Wang, Hongze Zhao, Chuanxiong Guo, "Explicit Path Control in Commodity Data Centers: Design and Applications" in *IEEE/ACM Transactions on Networking (ToN)*, 2016.
- [J1] Yang Peng, Kai Chen, Guohui Wang, **Wei Bai**, Yangming Zhao, Hao Wang, Yanhui Geng, Zhiqiang Ma, Lin Gu, "Towards Comprehensive Traffic Forecasting in Cloud Computing: Design and Application" in *IEEE/ACM Transactions on Networking (ToN)*, 2016.

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#### Selected Talks

- Oct. 2022 RDMA Deployments at Microsoft Azure: A Researcher's Experience and View, Intel Labs

- Oct. 2022 (Guest Lecture) Inside a Datacenter: Hardware and Software Architecture, Boston University
- July 2022 Towards Understanding the Micro-Behaviors of Hardware Offloaded Network Stacks, Intel Switch Fabric Group
- June 2022 Towards Understanding the Micro-Behaviors of Hardware Offloaded Network Stacks, Keysight
- May 2022 RDMA at Cloud Region Scale: A Researcher's Experience and View, Systems Seminar, Rice University
- Dec. 2020 Aeolus: A Building Block for Proactive Transport in Datacenters, Systems and Networking Seminar, Duke University
- Jan. 2019 Build Reliable Cloud Networks with SONiC and ONE, OCP China Technology Day, Shenzhen, China
- Oct. 2018 Congestion Control Mechanisms for Data Center Networks, HotDC 2018, Beijing, China
- Aug. 2017 Experiments with Data Center Congestion Control Research, APNet 2017, Hong Kong, China
- Dec. 2016 Enabling ECN over Generic Packet Scheduling, CoNEXT 2016, Irvine, California
- Mar. 2016 Enabling ECN in Multi-Service Multi-Queue Data Centers, NSDI 2016, Santa Clara, California
- May 2015 Information-Agnostic Flow Scheduling for Commodity Data Centers, NSDI 2015, Oakland, California

## Professional Activities

### Journal Editorship

Editorial Board (Networking Area) Member, Journal of Systems Research (**JSys**), 2021-2022

### Technical Program Committee

ACM SIGMETRICS 2023

ACM SIGCOMM Symposium on SDN Research 2022 (**SOSR 2022**)

ACM SIGMETRICS / IFIP Performance 2022 (**SIGMETRICS / Performance 2022**)

ACM SIGCOMM Symposium on SDN Research 2021 (**SOSR 2021**)

The 5th Asia-Pacific Workshop on Networking (**APNet 2021**)

The 4th Asia-Pacific Workshop on Networking (**APNet 2020**)

The 11th ACM SIGOPS Asia-Pacific Workshop on Systems (**APSys 2020**)

The 3rd Asia-Pacific Workshop on Networking (**APNet 2019**)

The 38th IEEE International Conference on Distributed Computing Systems (**ICDCS 2018**), "Cloud Computing and Data Centers" Track

### Organizing Committee

Web Chair, ACM SIGCOMM Symposium on SDN Research 2021 (**SOSR 2021**)

Publicity Chair, The 4th Asia-Pacific Workshop on Networking (**APNet 2020**)  
Registration Chair, ACM SIGCOMM 2019 Conference (**SIGCOMM 2019**)  
Web Chair, The 3rd Asia-Pacific Workshop on Networking (**APNet 2019**)  
Web Chair, The 2nd Asia-Pacific Workshop on Networking (**APNet 2018**)

#### Reviewer

IEEE/ACM Transactions on Networking  
Elsevier Computer Networks  
IEEE Transactions on Network and Service Management  
IEEE Communications Letters  
ACM Transactions on Storage  
IEEE Transactions on Cloud Computing  
ACM Transactions on Architecture and Code Optimization  
Elsevier Future Generation Computer Systems

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#### References

Available upon request