

Yang Zhou

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RESEARCH INTERESTS

Networked systems, distributed systems, networking stacks, extensible kernels, network telemetry.

EDUCATION

Harvard University, Cambridge, MA

Ph.D. in Computer Science

(Expected) June 2024

M.S. in Computer Science

November 2021

Thesis: Co-Designing Networking Stack and μ s-Scale Applications for Efficiency and Performance

Advisors: Minlan Yu and James Mickens

Peking University, Beijing, China

B.S. in Computer Science

July 2018

Thesis: Towards Faster and More Accurate Data Stream Processing

Advisors: Tong Yang

WORK EXPERIENCE

Harvard University, Research Assistant

August 2018–Present

- *Extensible kernels*: Designed kernel offloads via eBPF for distributed system protocols including Paxos (Electrode [1]) and serializable transactions (DINT [12]). Implemented and evaluated offloads atop unmodified Linux OSes, and achieved kernel-bypass-like performance.
- *μ s-scale RPCs*: Designed an efficient inter-server load balancing scheme for μ s-scale RPCs to achieve low tail latency and high goodput (Mew [11]). Implemented and evaluated for both kernel-bypass and kernel-based networking stacks.
- *SmartNIC architecture*: Designed and prototyped SGX-like TEEs (Trusted Execution Environments) for NFs (Network Functions) in SmartNICs under multi-tenant cloud environments (NFSHield [13]).

Google NetInfra Group, System Research Group, Research Intern

June 2021–May 2023

- *Far memory*: Designed an efficient far memory system that leverages erasure-coding, remote memory compaction, one-sided RMAs, and offloadable parity calculations to achieve fast, storage-efficient fault tolerance (Carbink [2]). Implemented using production networking stack, and evaluated using production applications and workloads.
- *μ s-scale RPCs*: Identified and motivated the inter-server scheduling problem for μ s RPCs (leading to Mew after the end of internship).

VMware Research, Research Intern

July 2020–September 2020

- Applied traffic redundancy elimination (TRE) technique to accelerate geo-distributed data analytics and save WAN traffic cost. Implemented under Alluxio, an in-memory data cache platform, to enable TRE when sending data across different data centers.

Facebook, Research Collaborator

November 2019–May 2020

- *Network telemetry*: Analyzed Facebook's network telemetry system, and identified its evolving nature and necessity of handling changes. Proposed layering design along the data collection pipeline to tolerate changes. Incorporated cross-layer dependency in monitoring system to help troubleshooting (PCAT [3]).

SenseTime, Software Engineering Intern

March 2018–May 2018

- Worked on Ceph setup, testing, maintenance, monitoring, and alerting.

Peking University, Research Assistant

April 2016–July 2018

- *Network telemetry*: Designed and implemented innovative probabilistic data structures (e.g., data sketches and Bloom filters) to improve the accuracy and performance of network telemetry (Elastic Sketch [4], Cold Filter [5]).

PUBLICATIONS

Total **744** citations till October 2024 based on Google Scholar.

Conference Publications

- [1] **Yang Zhou**, Zezhou Wang, Sowmya Dharanipragada, and Minlan Yu.
“[Electrode: Accelerating Distributed Protocols with eBPF](#)”.
USENIX NSDI 2023.
- [2] **Yang Zhou**, Hassan Wassel, Sihang Liu, Jiaqi Gao, James Mickens, Minlan Yu, Chris Kennelly, Paul Turner, David Culler, Hank Levy, and Amin Vahdat.
“[Carbink: Fault-Tolerant Far Memory](#)”.
USENIX OSDI 2022.
Also appears in The Third Workshop On Resource Disaggregation and Serverless Computing (WORDS 2022).
- [3] **Yang Zhou**, Ying Zhang, Minlan Yu, Guangyu Wang, Dexter Cao, Eric Sung, and Starsky Wong.
“[Evolvable Network Telemetry at Facebook](#)”.
USENIX NSDI 2022.
- [4] Tong Yang, Jie Jiang, Peng Liu, Qun Huang, Junzhi Gong, **Yang Zhou**, Rui Miao, Xiaoming Li, and Steve Uhlig.
“[Elastic Sketch: Adaptive and Fast Network-Wide Measurements](#)”.
ACM SIGCOMM 2018.
- [5] **Yang Zhou**, Tong Yang, Jie Jiang, Bin Cui, Minlan Yu, Xiaoming Li, and Steve Uhlig.
“[Cold Filter: A Meta-Framework for Faster and More Accurate Stream Processing](#)”.
ACM SIGMOD 2018.
- [6] Xiangyang Gou, Chenxingyu Zhao, Tong Yang, Lei Zou, **Yang Zhou**, Yibo Yan, Xiaoming Li, and Bin Cui.
“[Single Hash: Use One Hash Function to Build Faster Hash Based Data Structures](#)”.
IEEE International Conference on Big Data and Smart Computing (BigComp) 2018.
- [7] Omid Alipourfard, Masoud Moshref, **Yang Zhou**, Tong Yang, and Minlan Yu.
“[A Comparison of Performance and Accuracy of Measurement Algorithms in Software](#)”.
ACM Symposium on SDN Research (SOSR) 2018.
- [8] Tong Yang, **Yang Zhou**, Hao Jin, Shigang Chen, and Xiaoming Li.
“[Pyramid Sketch: A Sketch Framework for Frequency Estimation of Data Streams](#)”.
International Conference on Very Large Data Bases (VLDB) 2017.
- [9] **Yang Zhou**, Peng Liu, Hao Jin, Tong Yang, Shoujiang Dang, and Xiaoming Li.
“[One Memory Access Sketch: A More Accurate and Faster Sketch for Per-Flow Measurement](#)”.
IEEE Global Communications Conference (Globecom) 2017.
- [10] Junzhi Gong, Tong Yang, **Yang Zhou**, Dongsheng Yang, Shigang Chen, Bin Cui, and Xiaoming Li.
“[ABC: A Practicable Sketch Framework for Non-Uniform Multisets](#)”.
IEEE International Conference on Big Data (BigData) 2017.

Papers Under Reviews

- [11] **Yang Zhou**, Hassan Wassel, James Mickens, Minlan Yu, and Amin Vahdat.
“[Mew: Efficient Inter-Server Load Balancing for Microsecond-Scale RPCs](#)”.
in submission to *USENIX NSDI 2024*.
- [12] **Yang Zhou**, Xingyu Xiang, Matthew Kiley, Sowmya Dharanipragada, and Minlan Yu.
“[DINT: Fast In-Kernel Distributed Transactions with eBPF](#)”.
in submission to *USENIX NSDI 2024*.
- [13] **Yang Zhou**, Varun Gandhi, Mark Wilkening, James Mickens, and Minlan Yu.
“[NFShield: Securing NIC-Accelerated Network Functions in the Cloud](#)”.
in submission to *ACM EuroSys 2024*.

Workshop and Demo Publications

- [14] **Yang Zhou**, Hao Jin, Peng Liu, Haowei Zhang, Tong Yang, and Xiaoming Li.
“[Accurate Per-Flow Measurement with Bloom Sketch](#)”.
IEEE International Conference on Computer Communications Workshops (INFOCOM WKSHPS) 2018.

Journal Publications

- [15] Zhuochen Fan, Gang Wen, Zhipeng Huang, **Yang Zhou**, Qiaobin Fu, Tong Yang, Alex X Liu, and Bin Cui.
“[On the Evolutionary of Bloom Filter False Positives - An Information Theoretical Approach to Optimizing Bloom Filter Parameters](#)”.
IEEE Transactions on Knowledge & Data Engineering 2022.
- [16] Yuanpeng Li, Xiang Yu, Yilong Yang, **Yang Zhou**, Tong Yang, Zhuo Ma, and Shigang Chen.
“[Pyramid Family: Generic Frameworks for Accurate and Fast Flow Size Measurement](#)”.
IEEE/ACM Transactions on Networking 2021.
- [17] Tong Yang, Jie Jiang, **Yang Zhou**, Long He, Jinyang Li, Bin Cui, Steve Uhlig, and Xiaoming Li.
“[Fast and Accurate Stream Processing by Filtering the Cold](#)”.
The VLDB Journal 2019.
- [18] Tong Yang, Jie Jiang, Peng Liu, Qun Huang, Junzhi Gong, **Yang Zhou**, Rui Miao, Xiaoming Li, and Steve Uhlig.
“[Adaptive Measurements Using One Elastic Sketch](#)”.
IEEE/ACM Transactions on Networking 2019.
- [19] **Yang Zhou**, Omid Alipourfard, Minlan Yu, and Tong Yang.
“[Accelerating Network Measurement in Software](#)”.
ACM SIGCOMM Computer Communication Review 2018.

PRESENTATIONS

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| 1. Electrode: Accelerating Distributed Protocols with eBPF
Duke University, ACE Center for Evolvable Computing, Google, USENIX NSDI
Columbia University | April 2023
March 2023 |
| 2. Carbink: Fault-Tolerant Far Memory
Cornell University
WORDS workshop
Microsoft Research Redmond, USENIX OSDI
Google | November 2023
November 2022
July 2022
March & June 2022 |
| 3. Evolvable Network Telemetry at Facebook
USENIX NSDI
Boston University, Meta | April 2022
March 2022 |
| 4. SpeedUp: Accelerating Geo-distributed Data Analytics across the Enterprise
VMWare Research | August 2020 |
| 5. Cold Filter: A Meta-Framework for Faster and More Accurate Stream Processing
Harvard University | October 2018 |

MENTORING EXPERIENCE

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|---|------|
| 1. Zezhou Wang, Peking University undergraduate → University of Washington PhD
Accelerating Paxos using eBPF (NSDI 2023, [1]). | 2022 |
| 2. Matt Kiley, Harvard College undergraduate
Accelerating distributed transactions using eBPF and AF_XDP-based RPC systems. | 2023 |
| 3. Yunxi Shen, Tsinghua University undergraduate
Resource-efficient job scheduling in data centers. | 2023 |

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| 4. Xingyu Xiang, Peking University undergraduate
Accelerating distributed transactions using eBPF. | 2023 |
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TEACHING EXPERIENCE

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| • Teaching Assistant. CS145 Networking at Scale, Prof. Minlan Yu, Harvard University | Spring 2021 |
| • Teaching Assistant. Algorithm Design and Analysis, Prof. Tong Yang, Peking University | Fall 2018 |

PATENTS

- **Yang Zhou,** Hassan Wassel, Minlan Yu, Hank Levy, David Culler, and Amin Vahdat. “Fault Tolerant Disaggregated Memory”. Pending (US20230185666A1), filed by Google in December 2022.

ACADEMIC HONORS

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|---|------|
| • Google Ph.D. Fellowship in Systems and Networking | 2022 |
| • Finalist, Meta Ph.D. Fellowship in Networking | 2022 |
| • Graduate Fellowship, Harvard University | 2018 |
| • Excellent Bachelor Thesis (10/327), School of EECS, Peking University | 2018 |
| • New Academic Star Award (1/193), School of EECS, Peking University | 2018 |
| • Exceptional Award for Academic Innovation (2/193), Peking University | 2017 |
| • Arawana Scholarship (2/193), Peking University | 2017 |
| • Merit Student Award, Peking University | 2017 |
| • Pinyou Hudong Scholarship, School of EECS, Peking University | 2016 |
| • May Fourth Scholarship, Peking University | 2015 |
| • Academic Progress Award, Peking University | 2015 |

PROFESSIONAL ACTIVITIES

- Technical Program Committee Member: *ACM SIGCOMM Poster/Demo 2023, IEEE INFOCOM Workshop on Networking Algorithms 2020.*
- Reviewer (Conferences): *ACM SIGKDD 2023, IEEE INFOCOM Workshop 2020.*
- Reviewer (Journals): *ACM Transactions on Modeling and Performance Evaluation of Computing Systems, IEEE/ACM Transactions on Networking, IEEE Journal on Selected Areas in Communications, IEEE Communications Letters, IEEE Transactions on Network and Service Management, IEEE Transactions on Vehicular Technology, IEEE Systems Journal, IEEE Transactions on Services Computing, IEEE Journal of Biomedical and Health Informatics, Springer Multimedia Systems, KSII Transactions on Internet and Information Systems, Elsevier Computer Networks.*

CURRENT STATUS

U.S. Permanent Resident, Citizen of China

REFERENCES

Available upon request.