

Lianjie Cao

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RESEARCH INTERESTS

My research focuses on optimizing system performance and resource scheduling across different layers (*e.g.*, application, system, and hardware) and different computer systems (*e.g.*, NFV, machine learning systems, serverless, 5G, and storage systems).

EDUCATION

Purdue University, West Lafayette, Indiana, USA

▪ Ph.D. in Computer Science

Aug 2011 – May 2018

• Thesis: Data-driven Resource Allocation in Virtualized Environments

• Adviser: [Sonia Fahmy](#)

George Mason University, Fairfax, Virginia, USA

▪ M.S. in Computer Engineering

Aug 2008 – Aug 2011

• Thesis: A Rate-based Congestion Control Overlay System

• Advisor: [Brian Mark](#)

Huazhong University of Science & Technology, Wuhan, Hubei, China

▪ B.E. in Artificial Intelligence and Automation

Sep 2004 – Jun 2008

• Thesis: Email Monitoring System in WLAN

• Advisor: [Xiaoya Hu](#)

PROFESSIONAL EXPERIENCE

Hewlett Packard Labs

Senior Research Scientist

Feb 2023 – Present

Research Scientist

Aug 2018 – Jan 2023

Ph.D. Research Associate Intern

May 2014 – May 2017

Hewlett Packard

Software Development Intern

May 2013 – Jan 2014

Purdue University

Research Assistant

Aug 2011 – May 2018

PUBLICATIONS

Conference

- [15] Yunming Xiao, Diman Zad Tootaghaj, Aditya Dhakal, Lianjie Cao, Puneet Sharma, Aleksandar Kuzmanovic, “Conspirator: SmartNIC-Aided Control Plane for Distributed ML Workloads,” In Proceedings of the USENIX Annual Technical Conference (USENIX ATC), pp. 767–784, July 2024.
- [14] Ali Tariq, Lianjie Cao, Faraz Ahmed, Eric Rozner, Puneet Sharma, “Accelerating Containerized Machine Learning Workloads,” In Proceedings of the IEEE Network Operations and Management Symposium (NOMS), 10 pp., May 2024.
- [13] Umakant Kulkarni, Khaled Diab, Shivang Aggarwal, Lianjie Cao, Faraz Ahmed, Puneet Sharma, Sonia Fahmy, “Understanding the Impact of Wi-Fi Configuration on Volumetric Video Streaming Applications,” In Proceedings of the 15th ACM SIGCOMM Workshop on Emerging Multimedia Systems (EMS), 6 pp., September 2023.
- [12] Zhen Lin, Lianjie Cao, Faraz Ahmed, Hui Lu, Puneet Sharma, “When Caching Systems Meet Emerging Storage Devices: A Case Study,” In Proceedings of the 15th ACM Workshop on Hot Topics in Storage and File Systems (HotStorage), 6 pp., July 2023.
- [11] Amit Samanta, Faraz Ahmed, Lianjie Cao, Ryan Stutsman, Puneet Sharma, “Persistent Memory-Aware Scheduling for Serverless Workloads,” In Proceedings of the 4th Workshop on Extreme-Scale Storage and Analysis (ESSA) co-located with IEEE IPDPS, 6 pp., May 2023.
- [10] Junguk Cho, Diman Zad Tootaghaj, Lianjie Cao, Puneet Sharma, “SLA-Driven ML Inference Framework For Clouds With Heterogeneous Accelerators,” In Proceedings of the 5th Machine Learning and Systems (MLSys), pp. 20–32, August 2022.

- [9] Lianjie Cao, Puneet Sharma, “Co-locating Containerized Workload Using Service Mesh Telemetry,” In Proceedings of the 17th ACM International Conference on emerging Networking EXperiments and Technologies (CoNEXT), pp. 168–174, December 2021.
- [8] Lianjie Cao, Anu Mercian, Diman Zad Tootaghaj, Faraz Ahmed, Puneet Sharma, Vinay Saxena, “eCaaS: A Management Framework of Edge Container as a Service for Business Workload,” In Proceedings of the 4th ACM International Workshop on Edge Systems, Analytics and Networking (EdgeSys) co-located with EuroSys, pp. 73–78, April 2021.
- [7] Lianjie Cao, Sonia Fahmy, Puneet Sharma, “Data-driven Resource Allocation in Virtualized Environments,” In Proceedings of the 16th IFIP/IEEE International Symposium on Integrated Network Management (IM), pp. 659–664, April 2019. Dissertation Paper.
- [6] Lianjie Cao, Sonia Fahmy, Puneet Sharma, Shandian Zhe, “Data-driven Resource Flexing for Network Functions Virtualization,” In Proceedings of the 14th ACM/IEEE Symposium on Architectures for Networking and Communications Systems (ANCS), pp. 111–124, July 2018.
- [5] Lianjie Cao, Xiangyu Bu, Sonia Fahmy, Siyuan Cao, “Towards High Fidelity Network Emulation,” In Proceedings of the 26th IEEE International Conference on Computer Communications and Networks (ICCCN), 11 pp., July 2017. (Invited)
- [4] Lianjie Cao, Puneet Sharma, Sonia Fahmy, Vinay Saxena, “ENVI: Elastic resource flexing for Network function Virtualization,” In Proceedings of the 9th USENIX Workshop on Hot Topics in Cloud Computing (HotCloud), 6 pp., July 2017.
- [3] Amit Sheoran, Xiangyu Bu, Lianjie Cao, Puneet Sharma, and Sonia Fahmy, “An Empirical Case for Container-driven Fine-grained VNF Resource Flexing,” In Proceedings of the 2nd IEEE Conference on Network Function Virtualization & Software Defined Networks (NFV-SDN), pp. 121–127, November 2016. **Best Paper Runner-up**
- [2] Lianjie Cao, Puneet Sharma, Sonia Fahmy, and Vinay Saxena, “NFV-VITAL: A Framework for Characterizing the Performance of Virtual Network Functions,” In Proceedings of the 1st IEEE Conference on Network Function Virtualization & Software Defined Networks (NFV-SDN), pp. 93–99, November 2015. **Best Paper Award**
- [1] Lianjie Cao, Thibaut Provost, and Ramana Kompella, “PhishLive: A View of Phishing and Malware Attacks from an Edge Router,” In Proceedings of the 14th International Conference on Passive and Active Measurement (PAM), pp. 239–249, March 2013.

Journal

- [4] Choi Sean, Patel Disha, Zad Tootaghaj Diman, Cao Lianjie, Ahmed Faraz, Sharma Puneet, “FedNIC: Enhancing Privacy-Preserving Federated Learning via Homomorphic Encryption Offload on SmartNIC,” In Frontiers in Computer Science, vol. 6, 15 pp., October 2024.
- [3] Faraz Ahmed, Lianjie Cao, Ayush Goel, Puneet Sharma, “NeIL: Intelligent Replica Selection for Distributed Applications,” In IEEE Transactions on Machine Learning in Communications and Networking (TMLCN), vol. 2, pp. 1580–1594, October 2024.
- [2] Arun Raghuramu, Lianjie Cao, Puneet Sharma, Mario Sanchez, Joon-Myung Kang, Chen-Nee Chuah, David Lee, Vinay Saxena, “Metered Boot: Trusted Framework for Application Usage Rights Management in Virtualized Ecosystems,” In IEEE Transactions on Network and Service Management (TNSM), vol. 19, no. 3, pp. 2238–2250, September 2022.
- [1] Amit Sheoran, Sonia Fahmy, Lianjie Cao, Puneet Sharma, “AI-Driven Provisioning in the 5G Core,” In IEEE Internet Computing, vol. 25, no. 2, pp. 18–25, 1 March-April 2021.

Patent

- [10] Faraz Ahmed, Lianjie Cao, Puneet Sharma, “Optimizing Cost and Performance for Serverless Data Analytics Workloads,” US Patent Application 18/175,411.
- [9] Faraz Ahmed, Lianjie Cao, Puneet Sharma, “Enabling Persistent Memory for Serverless Applications,” US Patent Application 17/957,700.
- [8] Faraz Ahmed, Lianjie Cao, Puneet Sharma, “Machine Learning-based Approaches for Service Function Chain Selection,” US Patent Application 17/503,232.
- [7] Lianjie Cao, Puneet Sharma, Faraz Ahmed, Ali Tariq, “Network-aware Resource Allocation,” US Patent Application 17/468,517.

- [6] Lianjie Cao, Puneet Sharma, Faraz Ahmed, Anu Mercian, Diman Zad Tootaghaj, “Deployment and Configuration of An Edge Site Based on Declarative Intents Indicative of a Use Case,” US Patent Application 11,698,780.
- [5] Lianjie Cao, Puneet Sharma, Faraz Ahmed, Ali Tariq, “Systems and Methods of Resource Configuration Optimization for Machine Learning Workloads – II,” US Patent Application 12,001,511.
- [4] Lianjie Cao, Puneet Sharma, Faraz Ahmed, “Systems and Methods of Resource Configuration Optimization for Machine Learning Workloads – I,” US Patent Application 11,797,340.
- [3] Lianjie Cao, Puneet Sharma, “Assignment of Microservices,” US Patent 10,827,020.
- [2] Lianjie Cao, Puneet Sharma, Vinay Saxena, “Virtual Network Function Resource Allocation,” US Patent 11,010,205.
- [1] Lianjie Cao, Puneet Sharma, Vinay Saxena, Vasu Sankhavaram, Badrinath Natarajan, “Determining Virtual Network Function Configurations,” US Patent 10,489,180.

PROFESSIONAL Technical Program Committee

ACTIVITIES

- IEEE/ACM International Symposium on Quality of Service (IWQoS) 2023
- IEEE/IFIP Network Operations and Management Symposium (NOMS) 2022, 2023, 2024, 2025
- Passive and Active Measurement (PAM) 2022
- IFIP/IEEE International Symposium on Integrated Network Management (IM) 2021
- IFIP Networking 2019, 2020

Invited Reviewer

- IEEE Transactions on Network and Service Management (TNSM)
- IEEE Transactions on Network Science and Engineering (TNSE)
- IEEE Sensors Journal
- IEEE Networking Letters
- IEEE International Conference on Network Softwarization (NetSoft)

External Reviewer

- ACM SIGCOMM Symposium on SDN Research (SOSR)
- ACM International Conference on emerging Networking EXperiments and Technologies (CoNEXT)
- IEEE International Conference on Computer Communications (INFOCOM)

SKILLS

Programming Languages

Python, Bash, C/C++, Golang, Java, Matlab, R, LaTeX, JavaScript, HTML, SQL

Tools

TensorFlow, PyTorch, Kubernetes, Docker, OpenStack, Open vSwitch, Mininet

[Updated on 2024-11-11]