Vincent Liu

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Research Interests

My research seeks to rethink the way we design large networks with a focus on tackling emergent network behaviors – effects that have an outsized effect as networked systems scale up, but that may not manifest/matter in smaller networks. My work bridges all layers of the networking stack, from hardware concerns to application and user demands and covers a wide range of topics in service to the above goal. In addition to this work, I have also previously published in fault-tolerant distributed systems, energy-efficient wireless communication, and systems to preserve security and privacy.

Education

Ph.D., Computer Science & Engineering, August 2016
University of Washington
Thesis: "Improving Fault Tolerance and Performance of Data Center Networks"
Advisors: Tom Anderson and Arvind Krishnamurthy

M.S., Computer Science & Engineering, April 2012
University of Washington
Thesis: "F10: Fault-Tolerant Engineered Networks"
Advisors: Tom Anderson and Arvind Krishnamurthy

B.S., Turing Scholars Honors Computer Science, May 2010
B.S., Dean's Scholars Honors Computer Science, May 2010
University of Texas at Austin
Thesis: A Compiler Alternative to Expression Templates
Advisor: Calvin Lin

Professional Experience

Department of Computer and Information Science, University of Pennsylvania
Assistant Professor, January 2017 – Present

Department of Electrical Engineering and Computer Sciences, UC Berkeley
Visiting Scholar, May 2022 – Present

Facebook
Contractor, December 2015 – May 2017

Department of Computer Science & Engineering, University of Washington
Graduate Research Assistant, September 2010 – August 2016

Facebook
PhD Intern, January – April 2015

Google
PhD Intern, September – December 2013

Awards

- VMWare Early Career Faculty Award, March 2019
- Facebook Faculty Research Award, June 2017
- Google Fellowship in Computer Networking, May 2014
- Qualcomm Innovation Fellowship, April 2014

- Boeing Fellowship, August 2013
- Lee Memorial Fellowship, August 2013
- Cohn Fellowship, August 2013
- College of Engineering Dean's Fellowship, July 2013
- Madrona Venture Group Prize Winner (for Ambient Backscatter), May 2013

Award Papers

- 2015 NSDI Best Paper, for "Designing Distributed Systems Using Approximate Synchrony in Data Center Networks"
- 2013 SIGCOMM Best Paper, for "Ambient Backscatter: Wireless Communication Out of Thin Air"
- 2013 NSDI Best Paper, for "F10: A Fault-Tolerant Engineered Network"

Funding

Google Research Award: Localized and Predictive Network Control in the Age of Terabit Networks.
Unrestricted gift, $60,000, 11/2021

CIS Faculty Recognition Grant.
1 year Ph.D. student funding, 08/2021 – 05/2022

FMitF: Track I: Automatic Migration to Serverless Infrastructure, Correctly and Efficiently, NSF award CCF- 2124184.
PI with co-PIs Rajeev Alur, Mayur Naik, and Sebastian Angel, $750,000, 07/2021 – 06/2024.

Collaborative Research: CNS Core: Medium: Movement of Computation and Data in Splitkernel-disaggregated, Data-intensive Systems, NSF award CNS-2107147.
PI with co-PIs Boon Thau Loo, Sebastian Angel, and Ang Chen, $1,198,086 (Penn: $898,087), 06/2021 – 05/2024.

CAREER: A Network Motion Picture Primitive for Network Monitoring and Control, NSF Career award CNS-1845749.
PI, $550,000, 06/2019 – 05/2024.

ProNet: Programmable Networks Enabled by Fast In-Path Analytics, DARPA Dispersed Computing (DCOMP) program.
Co-PI with Boon Thau Loo, Andreas Haeberlen, Andre DeHon, and Linh T.X. Phan, $12,599,857 (Penn: $1.7M), 01/2017 – 01/2021.

VMware Early Career Faculty Award.
Unrestricted gift, $50,000, 03/2019

Facebook Faculty Research Award.
Unrestricted gift, $30,000, 06/2017

Publications

Peer-reviewed Conference Publications

1. Liangcheng Yu, John Sonchack, and **Vincent Liu**, "Cebinae: Scalable In-network Fairness Augmentation" Proceedings of the ACM SIGCOMM Conference

(SIGCOMM '22), Amsterdam, Netherlands, August 2022 (acceptance rate: 19.7%).

2. Yiran Lei, Liangcheng Yu, **Vincent Liu**, and Mingwei Xu, "PrintQueue: Performance Diagnosis via Queue Measurement in the Data Plane" Proceedings of the ACM SIGCOMM Conference (SIGCOMM '22), Amsterdam, Netherlands, August 2022 (acceptance rate: 19.7%).

3. Qizhen Zhang, Xinyi Chen, Sidharth Sankhe, Zhilei Zheng, Ke Zhong, Sebastian Angel, Ang Chen, **Vincent Liu**, and Boon Thau Loo, "Optimizing Data-intensive Systems in Disaggregated Data Centers with TELEPORT" Proceedings of the ACM SIGMOD International Conference on Management of Data (SIGMOD '22), Philadelphia, PA, June 2022 (acceptance rate: 29.3%).

4. Liangcheng Yu, John Sonchack, and **Vincent Liu**, "OrbWeaver: Using IDLE Cycles in Programmable Networks for Opportunistic Coordination" Proceedings of the USENIX Symposium on Networked Systems Design and Implementation (NSDI '22), Renton, WA, April 2022 (acceptance rate: 19.4%).

5. Qizhen Zhang, Kelvin K.W. Ng, Charles Kazer, Shen Yan, João Sedoc, and **Vincent Liu**, "MimicNet: Fast Performance Estimates for Data Center Networks with Machine Learning" Proceedings of the ACM SIGCOMM Conference (SIGCOMM '21), Virtual, August 2021 (acceptance rate: 22.8%).

6. Haoran Zhang, Adney Cardoza, Peter Baile Chen, Sebastian Angel, and **Vincent Liu**, "Fault-tolerant and Transactional Stateful Serverless Workflows" Proceedings of the USENIX Symposium on Operating Systems Design and Implementation (OSDI '20), Virtual, November 2020 (acceptance rate: 17.6%).

7. Nofel Yaseen, Behnaz Arzani, Ryan Beckett, Selim Ciraci, and **Vincent Liu**, "Aragog: Scalable Runtime Verification of Shardable Networked Systems" Proceedings of the USENIX Symposium on Operating Systems Design and Implementation (OSDI '20), Virtual, November 2020 (acceptance rate: 17.6%).

8. Qizhen Zhang, Yifan Cai, Xinyi Chen, Sebastian Angel, Ang Chen, **Vincent Liu**, and Boon Thau Loo, "Understanding the Effect of Data Center Resource Disaggregation on Production DBMSs" Proceedings of the Proceedings of the VLDB Endowment (VLDB '20), Virtual, September 2020 (acceptance rate: 24.8%).

9. Liangcheng Yu, John Sonchack, and **Vincent Liu**, "Mantis: Reactive Programmable Switches" Proceedings of the ACM SIGCOMM Conference (SIGCOMM '20), Virtual, August 2020 (acceptance rate: 21.2%).

10. Jiaqi Gao, Nofel Yaseen, Robert MacDavid, Felipe Vieira Frujeri, **Vincent Liu**, Ricardo Bianchini, Ramaswamy Aditya, Xiahoang Wang, Henry Lee, David Maltz, Minlan Yu, and Behnaz Arzani, "Scouts: Improving the Diagnosis Process Through Domain-customized Incident Routing" Proceedings of the ACM SIGCOMM Conference (SIGCOMM '20), Virtual, August 2020 (acceptance rate: 21.2%).

11. Nofel Yaseen, John Sonchack, and **Vincent Liu**, "tpprof: A Network Traffic Pattern Profiler" Proceedings of the USENIX Symposium on Networked

Systems Design and Implementation (NSDI '20), Santa Clara, CA, February 2020 (acceptance rate: 18.8%).

12. Henri Maxime Demoulin, Isaac Pedisich, Nikos Vasilakis, **Vincent Liu**, Boon Thau Loo, and Linh Thi Xuan Phan, "Detecting Application-layer Denial-of-Service Attacks with FineLame" Proceedings of the USENIX Annual Technical Conference (ATC '19), Renton, WA, July 2019 (19.9%).

13. Qizhen Zhang, Akash Acharya, Hongzhi Chen, Simran Arora, Ang Chen, **Vincent Liu**, and Boon Thau Loo, "Optimizing Declarative Graph Queries at Large Scale" Proceedings of the ACM SIGMOD International Conference on Management of Data (SIGMOD '19), Amsterdam, Netherlands, July 2019 (20%).

14. Nofel Yaseen, John Sonchack, and **Vincent Liu**, "Synchronized Network Snapshots" Proceedings of the ACM SIGCOMM Conference (SIGCOMM '18), Budapest, Hungary, August 2018 (18%).

15. Qiao Zhang, **Vincent Liu**, Hongyi Zeng, and Arvind Krishnamurthy, "High-resolution Measurement of Data Center Microbursts" Proceedings of the ACM SIGCOMM Internet Measurement Conference (IMC '17), London, United Kingdom, November 2017 (22.3%).

16. Qizhen Zhang, Tengyuan Ye, Meryem Essaidi, Shivani Agarwal, **Vincent Liu**, and Boon Thau Loo, "Predicting Startup Crowdfunding Success through Longitudinal Social Engagement Analysis" Proceedings of the ACM International Conference on Information and Knowledge Management (CIKM '17), Singapore, November 2017 (20%).

17. **Vincent Liu**, Danyang Zhuo, Simon Peter, Arvind Krishnamurthy, and Thomas Anderson, "Subways: A Case for Redundant, Inexpensive Data Center Edge Links" Proceedings of the ACM International Conference on Emerging Networking Experiments and Technologies (CoNEXT '15), Heidelberg, Germany, December 2015 (20.9%).

18. Dan R. K. Ports, Jialin Li, **Vincent Liu**, Naveen Kr. Sharma, and Arvind Krishnamurthy, "Designing Distributed Systems Using Approximate Synchrony in Data Center Networks" Proceedings of the USENIX Symposium on Networked Systems Design and Implementation (NSDI '15), Oakland, CA, May 2015 (19.7%).
Best Paper Award

19. **Vincent Liu**, Vamsi Talla, and Shyamnath Gollakota, "Enabling Instaneous Feedback with Full-duplex Backscatter" Proceedings of the ACM International Conference on Mobile Computing and Networking (MOBICOM '14), Maui, HI, September 2014 (16%).

20. **Vincent Liu**, Aaron Parks, Vamsi Talla, Shyamnath Gollakota, David Wetherall, and Joshua R. Smith, "Ambient Backscatter: Wireless Communication Out of Thin Air" Proceedings of the ACM SIGCOMM Conference (SIGCOMM '13), Hong Kong, China, August 2013 (15.4%).
Best Paper Award

21. Seungyeop Han, **Vincent Liu**, Qifan Pu, Simon Peter, Thomas Anderson, Arvind Krishnamurthy, and David Wetherall, "Expressive Privacy Control with

Pseudonyms" Proceedings of the ACM SIGCOMM Conference (SIGCOMM '13), Hong Kong, China, August 2013 (15.4%).

22. **Vincent Liu**, Daniel Halperin, Arvind Krishnamurthy, and Thomas Anderson, "F10: A Fault-Tolerant Engineered Network" Proceedings of the USENIX Symposium on Networked Systems Design and Implementation (NSDI '13), Lombard, IL, April 2013 (22.3%).
Best Paper Award

Peer-reviewed Workshop Publications

23. Qizhen Zhang, Philip Bernstein, Daniel Berger, Badrish Chandramouli, **Vincent Liu**, and Boon Thau Loo, "Rethinking Data Management Systems for Disaggregated Data Centers" Proceedings of the Conference on Innovative Data Systems Research (CIDR '22), Chaminade, CA, January 2022.

24. Nofel Yaseen, Behnaz Arzani, Krishna Chintalapudi, Vaishnavi Ranganathan, Felipe Frujeri, Kevin Hsieh, Daniel Berger, **Vincent Liu**, and Srikanth Kandula, "Towards a Cost vs. Quality Sweet Spot for Monitoring Networks" Proceedings of the ACM Workshop on Hot Topics in Networks (HotNets '21), Virtual, November 2021 (acceptance rate: 30.6%)

25. Qizhen Zhang, Yifan Cai, Sebastian Angel, Ang Chen, **Vincent Liu**, and Boon Thau Loo, "Rethinking Data Management Systems for Disaggregated Data Centers" Proceedings of the Conference on Innovative Data Systems Research (CIDR '20), Amsterdam, The Netherlands, January 2020.

26. Henri Maxime Demoulin, Nikos Vasilakis, John Sonchack, Isaac Pedisich, **Vincent Liu**, Boon Thau Loo, Linh Thi Xuan Phan, Jonathan M. Smith, and Irene Zhang, "TMC: Pay-as-you-Go Distributed Communication" Proceedings of the Asia-Pacific Workshop on Networking (APNET '19), Beijing, China, August 2019 (37.8%).

27. Charles W. Kazer, João Sedoc, Kelvin K.W. Ng, **Vincent Liu**, and Lyle H. Ungar, "Fast Network Simulation Through Approximation or: How Blind Men Should Describe Elephants" Proceedings of the ACM Workshop on Hot Topics in Networks (HotNets '18), Redmond, WA, November 2018 (20.8%).

28. Danyang Zhuo, Qiao Zhang, Xin Yang, and **Vincent Liu**, "Canaries in the Network" Proceedings of the ACM Workshop on Hot Topics in Networks (HotNets '16), Atlanta, GA, November 2016 (27.7%).

29. Danyang Zhuo, Qiao Zhang, **Vincent Liu**, Arvind Krishnamurthy, and Thomas Anderson, "Rack-level Congestion Control" Proceedings of the ACM Workshop on Hot Topics in Networks (HotNets '16), Atlanta, GA, November 2016 (27.7%).

30. **Vincent Liu**, Seungyeop Han, Arvind Krishnamurthy, and Thomas Anderson, "Tor Instead of IP" Proceedings of the ACM Workshop on Hot Topics in Networks (HotNets '11), Cambridge, MA, November 2011 (20.1%).

Technical Reports

31. **Vincent Liu**, Danyang Zhuo, Simon Peter, Arvind Krishnamurthy, and Thomas Anderson, "Subways: A Case for Redundant, Inexpensive Data Center Edge Links" UW-CSE-14-09-01, 2014.

32. **Vincent Liu**, Daniel Halperin, Arvind Krishnamurthy, and Thomas Anderson, "F10: A Fault-Tolerant Engineered Network" UW-CSE-12-09-05, 2012.

33. **Vincent Liu**, Seungyeop Han, Arvind Krishnamurthy, and Thomas Anderson, "An Internet Architecture Based on the Principle of Least Privilege" UW-CSE-12-09-05, 2012.

Patents

34. Shyamnath Gollakota, Joshua R. Smith, **Vincent Liu**, Aaron N. Parks, Vamsi Talla. US Patent No. 10,447,331 B2. "Ambient backscatter transceivers, apparatuses, systems, and methods for communicating using backscatter of ambient RF signals," granted in October 2019.

Current Ph.D. Students

Liangcheng Yu (3rd year)
Winner of the 2021 Penn Presidential PhD Fellowship

Xinyi Chen (3rd year)

Kelvin K.W. Ng (3rd year)

Haoran Zhang (3rd year, w/ Sebastian Angel)

Yinda Zhang (1st year)
Winner of the 2022 Jonathan M. Smith Fellowship

Former Ph.D. Students

Qizhen Zhang (2022, w/ Boon Thau Loo)
Assistant Professor at University of Toronto (2022)
Winner of the 2019 Jonathan M. Smith Fellowship
Winner of the 2022 Rubinoff Award

Nofel Yaseen (2022)
Meta (2022)
Winner of the 2020 Facebook Fellowship in Networking

Dissertation/ Thesis Committees

Haoxian Chen (Ph.D., advised by Boon Thau Loo), 2022

Lei Shi (Ph.D., advised by Boon Thau Loo and Rajeev Alur), 2022

Caleb Stanford (Ph.D., advised by Rajeev Alur), 2022

Henri Maxime Demoulin (Ph.D., advised by Boon Thau Loo and Linh T.X. Phan), 2021

Isaac Pedisich (Master's, 2019)

John Sonchack (Ph.D., advised by Jonathan M. Smith), 2019

Alex Marder (Ph.D., advised by Jonathan M. Smith), 2019

Ang Chen (Ph.D., advised by Andreas Haeberlen), 2017

Teaching Experience

CIS 455/555 – Internet and Web Systems (Fall 2021, Fall 2020, Fall 2019)

CIS 553 – Networked Systems (Spring 2021, Spring 2020, Spring 2019, Spring 2018, Fall 2017)

CIS 800 – Ph.D. Special Topic: Old and New Research in Networked Systems (Spring 2021, Fall 2020, Fall 2018)

CIS 700 – The Design and Implementation of Cloud Networks (Spring 2017)

Professional Activities

Program Committee

- ACM SIGCOMM Conference 2021
- ACM SIGCOMM Conference 2020
- ACM International Conference on emerging Networking EXperiments and Technologies (CoNEXT) 2020
- USENIX Annual Technical Conference 2019 ("heavy-weight" member)
- ACM Workshop on Hot Topics in Networks 2019
- Asia-Pacific Workshop on Networking 2019
- ACM Workshop on Hot Topics in Networks 2018
- ACM International Conference on Emerging Networking Experiments and Technologies 2018
- Asia-Pacific Workshop on Networking 2018

External Conference Reviewer

- ACM SIGCOMM Conference 2022 (also shepherded a paper)
- The Web Conference 2017

NSF Grant Panelist

- 2022
- 2018