

Kuan-Yen Chou

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

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Summary

I am a PhD candidate in computer science at the University of Illinois at Urbana-Champaign, advised by Prof. Matthew Caesar. My research interests include network verification, network architecture, software engineering, and, more generally, improving the reliability and robustness of networked systems. Before UIUC, I obtained my Bachelor's degree in EECS at National Chiao Tung University in Taiwan.

Experience

Graduate Research Assistant

Illinois, US

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

Aug. 2022 - (now)

- Extend a network testing framework for network functions with virtualization support (e.g., netns, Docker, Xen).
- Work on new ideas of scaling in-network runtime verification with programmable switches (P4).
- Work with VMware as an external collaborator on fine-grained, intent-based distributed data plane verification.

TA for CS 128: Intro to CS II

Illinois, US

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

May 2022 - Aug. 2022

- Hold office hours, answer questions, and manage the online forum.

TA for CS 437: Internet of Things

Illinois, US

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

Jan. 2022 - May 2022

- Course coordination, lab testing, and manage the online forum.

Graduate Research Assistant

Illinois, US

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

Aug. 2021 - Jan. 2022

- Work on a high-coverage network testing framework combining model checking and emulation for network functions, which models multiple simultaneous connections.
- Work with VMware as an external collaborator on distributed and incremental data plane verification.
- Implement distributed data plane analysis for general consistency, utilizing the Samza & Kafka infrastructure.
- Further increase the scalability of data plane verification with fine-grained slicing both in terms of sub-device partial modeling and intent-based partitioning.

Intern - vRealize Network Insight

(remote) Illinois, US

VMWARE INC.

May 2021 - Aug. 2021

- Work on a research project about verifying network intents in a distributed and incremental way.
- Modify the pipeline of the network verification module within vRealize Network Insight, so that the network intents are distributed with Samza & Kafka and can be verified without a centralized, monolithic network model.
- Implement the incremental algorithms for verifying network intents of reachability and segmentation.
- Conduct experiments to evaluate the architectural and algorithmic changes, where, for a large-scale network, the intent verification performance was improved by multiple orders of magnitude both in time and memory compared to the original pipeline.

Graduate Research Assistant

Illinois, US

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

Aug. 2020 - May 2021

- Work on a network testing framework combining model checking and emulation for network functions.
- Utilize binary analysis with LLVM and KLEE to automatically generate faithful models that describe the behavior of software network functions.
- Build energy models for wireless sensor networks to verify and compare network-wide energy schemes, and to predictively estimate energy consumption rate based on application and network level information.

Intern - vRealize Network Insight

(remote) Illinois, US

VMWARE INC.

May 2020 - Aug. 2020

- Work on the network assurance and verification module within the codebase of vRealize Network Insight.
- Augment the network analysis module so that it does not require the full network model in memory as most of the network verification tools in academic literature do.
- Implement the dynamic loading and unloading of partial network models during the process of analysis, which makes the path search analysis 11.4x faster and required 86.6% less memory.

Graduate Research Assistant

Illinois, US

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

Aug. 2019 - May 2020

- Work on a network testing framework combining model checking verification and emulation for network functions.
- Design the programming interface between SPIN model checker and the network verification process.
- Integrate emulation instances within isolated network namespaces with the SPIN-driven model checking process.
- Design and conduct experiments for system evaluation.
- Present a conference paper about Plankton, a network configuration verification tool based on model checking.

Visiting Scholar

Illinois, US

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

Jun. 2018 - May 2019

- Work on Plankton, a network configuration verification project, where we solve the scalability problem of configuration verification with the combination of equivalence partitioning and explicit-state model checking.
- Work on configuration parsing, configuration generation, and refactoring for evaluation experiments.
- Present a workshop paper for Plankton-neo, a high-coverage network testing framework combining verification and emulation, in the 2018 SecSoN workshop of ACM SIGCOMM.
- Work on Bazang, a kernel-level tracing tool for distributed applications, where we utilize gRPC, kernel timestamping, and out-of-band collection.

Teaching Assistant, System/Network Administrator

Hsinchu, Taiwan

COMPUTER CENTER OF COMPUTER SCIENCE DEPT. IN NCTU

Jun. 2016 - Jan. 2018

- Manage Linux workstations for the CS department and for some CS courses.
- Manage the Postfix/Dovecot mail servers and proxy servers.
- Administer the PC classrooms.
- Manage some Cisco switches for the CS department campus network.

Intern - Network Infrastructure

Hsinchu, Taiwan

NATIONAL CENTER FOR HIGH-PERFORMANCE COMPUTING

Jul. 2017 - Aug. 2017

- Build NERSC Shifter on a small cluster of workstations.
- Build a GPU cluster with Kubernetes.
- Manage, build, and package Docker images for deep learning applications and for future experiments.
- Conduct an experiment evaluating the performance of the Kubernetes cluster and the Shifter cluster.

Technical Skills

Programming C, C++, Python, Java, Shell, System/Network programming

Networking Linux networking, Cisco IOS, Cisco ASA, Mininet

OS/Distro Arch Linux, Ubuntu/Debian, CentOS, FreeBSD

Virtualization Docker, GNS3, Mininet, KLEE, KVM, QEMU

Other tools Vim, Git, SPIN

Less frequently used Assembly, SQL, McSema, Angr, Kubernetes

Publications

- Bingzhe Liu, **Kuan-Yen Chou**, Pramod Jamkhedkar, Bilal Anwer, Rakesh K. Sinha, Kostas N. Oikonomou, Matthew Caesar, Brighten Godfrey. "Practical automation for management planes of service provider infrastructure." FlexNets@SIGCOMM 2021.
- Santhosh Prabhu, **Kuan-Yen Chou**, Ali Kheradmand, P. Brighten Godfrey, Matthew Caesar. "Plankton: Scalable network configuration verification through model checking." NSDI 2020.
- Sayed Hadi Hashemi, Paul Rausch, Benjamin Rabe, **Kuan-Yen Chou**, Simeng Liu, Volodymyr V. Kindratenko, Roy H. Campbell. "tensorflow-tracing: a performance tuning framework for production." OpML 2019.
- **Kuan-Yen Chou**, Chin-Fan Chiang, Ching-Hsiang Hsu, Zheng-Yu Chen, Jin-Cheng Zhu. "Implementation of Containerized TensorFlow in Heterogeneous CPU/GPU Clusters." TANET 2017.

Presentations

- Santhosh Prabhu, **Kuan-Yen Chou**, Ali Kheradmand, P. Brighten Godfrey, Matthew Caesar. "Plankton: Scalable network configuration verification through model checking." NSDI 2020.
- Santhosh Prabhu, Gohar Irfan Chaudhry, Brighten Godfrey, Matthew Caesar. "High-coverage Testing of Softwarized Networks." SecSoN@SIGCOMM 2018.
- **Kuan-Yen Chou**, Chin-Fan Chiang, Ching-Hsiang Hsu, Zheng-Yu Chen, Jin-Cheng Zhu. "Implementation of Containerized TensorFlow in Heterogeneous CPU/GPU Clusters." TANET 2017.

Education

University of Illinois Urbana-Champaign

PH.D. IN COMPUTER SCIENCE

Illinois, US

Aug. 2019 - Expected May 2024

National Chiao Tung University

B.S. IN ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Hsinchu, Taiwan

Sep. 2014 - Jun. 2018

Awards & Honors

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| 2018 | Exchange Scholarship , scholarship for exchange program with UIUC in spring 2018 | <i>Hsinchu, Taiwan</i> |
| 2017 | Academic Excellence Award , top 3 GPA in the undergraduate program in spring 2017 | <i>Hsinchu, Taiwan</i> |
| 2016 | Third Place and UI/UX Award , MeiChu Hackathon | <i>Hsinchu, Taiwan</i> |