Kuan-Yen Chou

Applied Scientist · Amazon Web Services

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Summary

I am an applied scientist in the automated reasoning group at AWS. Previously, I studied computer science at UIUC, advised by Prof. Matthew Caesar. My research interests include network verification, formal methods for systems and networks, programmable networks, distributed computing, and networked systems in general.

Education

University of Illinois Urbana-Champaign *Urbana, Illinois*

Ph.D. in Computer Science *Aug. 2019 - Dec. 2024*

National Chiao Tung University *Hsinchu, Taiwan*

B.S. in Electrical Engineering and Computer Science *Sep. 2014 - Jun. 2018*

Experience

Applied Scientist *Minneapolis, Minnesota*

Amazon *Dec. 2024 – now*

- Automated Reasoning Group

Graduate Research Assistant *Urbana, Illinois*

University of Illinois Urbana-Champaign *Aug. 2019 – Dec. 2024*

- Implement Plankton, a highly scalable network configuration verification system based on model checking (SPIN).
- Design and implement Neo, a concolic network testing tool that combines network emulation with model checking (SPIN).
- Design and implement Scylla, a fine-grained, distributed data plane verification system that enables efficient scale-out.
- Design and implement Mimesis, a system that auto-extract formal models from stateful network programs by adapting full-system symbolic execution.

Teaching Assistant *Urbana, Illinois*

University of Illinois Urbana-Champaign *Jan. 2022 – Dec. 2024*

- CS 128: Introduction to Computer Science II (Summer 2022)
- CS 437: Internet of Things (Spring 2022) (Fall 2024)

Intern (P4-Based Automated Reasoning) *(remote) Urbana, Illinois*

Google LLC *May 2023 – Aug. 2023*

- Implement symbolic execution for parsers in P4 programs, used for automated test generation for software switches.
- Implement a generic packet deparser for any input P4 program to serialize packets from solved SMT formulas.
- Design and implement the symbolic execution of P4 programs with symbolic table entries to synthesize the control plane output with criteria involving data plane semantics.

Intern (vRealize Network Insight) *(remote) Urbana, Illinois*

VMware Inc. *May – Aug. 2020/2021*

- Enable network verification with incomplete network models, which greatly improves time and memory usage.
- Design and implement intent-based slicing for network verification, where the network intents are distributed and verified across a cluster without needing a monolithic network model.
- Implement algorithms to incrementally verify common types of network intents.
- Evaluate performance differences caused by the intent-based slicing and incremental verification.

Visiting Scholar

Urbana, Illinois

University of Illinois Urbana-Champaign

Jun. 2018 – May 2019

- Improve the scalability of network configuration verification with the combination of equivalence partitioning and explicit-state model checking.
- Present a workshop paper for Plankton-neo, a high-coverage network testing framework in 2018 SecSoN SIGCOMM.
- Implement Bazang, a kernel-level tracing tool for distributed applications, utilizing gRPC, kernel timestamping, and out-of-band trace collection.

Teaching Assistant, System/Network Administrator

Hsinchu, Taiwan

Computer Center of Computer Science Dept. in NCTU

Jun. 2016 – Jan. 2018

- Maintain Linux workstations, mail servers, and Cisco switches for the CS department.

Open Source Contributor

Individual Contributor

- `leagueoflegends`, `wine-lol`: Make playing League of Legends on Linux through Wine easier.
- `wideriver`: A window manager (layout generator) for river, a wayland compositor.
- `aur`: Maintain several packages in the Arch User Repository (AUR).

Technical Skills

Programming	C, C++, Bash, Python, System/Network prog., Java, Lua, Assembly (in order of proficiency)
Networking	Linux networking, P4, Mininet
OS/Distro	Arch Linux, Ubuntu/Debian, CentOS, FreeBSD
Virtualization	Docker, QEMU/KVM, Mininet, GNS3
Formal method tools	SPIN, S2E, KLEE, Z3, Angr
Other tools	Vim/Neovim, Git, tmux

Publications/Patents

- Santhosh Prabhu, **Kuan-Yen Chou**, Aanand Nayyar, Giri Prashanth Subramanian, Wenxuan Zhou, Philip Brighten Godfrey. "Handling device configuration changes in distributed network verification application" US Patent 2024/0086221A1, 2024.
- Santhosh Prabhu, **Kuan-Yen Chou**, Aanand Nayyar, Giri Prashanth Subramanian, Wenxuan Zhou, Philip Brighten Godfrey. "Evaluation of Network Correctness Requirement." US Patent 2024/0089257A1, 2024.
- Santhosh Prabhu, **Kuan-Yen Chou**, Aanand Nayyar, Giri Prashanth Subramanian, Wenxuan Zhou, Philip Brighten Godfrey. "Distributed Network Verification." US Patent 2024/0089184A1, 2024.
- Bingzhe Liu, **Kuan-Yen Chou**, Pramod Jamkhedkar, B. Anwer, Rakesh Sinha, K. 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.