

Kaiyu Hou

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<https://kyhou.com>

I am a computer science Ph.D. candidate at Northwestern University. I have a broad interest in cloud networks, network protocols, and networked systems. My current research focuses on network optimization of serverless based clouds. I have research experience in QUIC, SDN, P4, cellular networks, and protocol formal verification.

Education

- **Ph.D. in Computer Science** 2017 – 2022
Northwestern University Evanston, IL
- Advisor: Prof. [Yan Chen](#) Area: Cloud Networks, Network Protocols GPA: 3.97/4.00
- **Master's in Computer Science** 2014 – 2017
Xi'an Jiaotong University Shaanxi, China
- Advisor: Prof. [Chengchen Hu](#) Area: SDN Rank: 1st/89 GPA: 3.81/4.00 Average: 91.7
- **B.E. in Software Engineering** 2010 – 2014
Xi'an Jiaotong University Shaanxi, China
- Rank: 1st/78 GPA: 3.94/4.00 Average: 92.4 (in Junior and Senior years)

Work Experiences

- **SRI International** Menlo Park, CA
Senior Research Intern, at Computer Science Laboratory Summers of 2020, 2021
- Real-time anomaly detection with P4 switches for NextG networks
- Enterprise-wide radio situational awareness system with AutoML and nPrint

Research: Cloud Networks & SDN

- **Network Optimizing for Serverless Cloud** 2020 – 2022
- Serverless architectures bring flexibility but introduce network communication delay
- Seamlessly integrated **QUIC** into **OpenFaaS/K8s**, reduced cloud network latency by up to 40%
- Designed a clean-slate serverless network architecture for direct function chain communications
- **Generic Security Policy Enforcement System for SDN-based Cloud** 2017 – 2018
- Designed a **policy language** for resource protection and management of SDN-based Cloud
- Implemented in the **OpenDaylight** controller, and deployed on **OpenStack**
- **Routing Policy for Solving Reactive Model Overhead of SDN** 2016 – 2017
- Proposed a routing policy to reduce the SDN control channel bandwidth consumption by up to 80%
- Implemented in the **Floodlight** controller under **OpenFlow/P4** switch and **Open vSwitch**

Research: Formal Methods for Network Protocols

- **Formal Verification and Vulnerability Detection of LTE/5G Protocols** 2019 - 2020
- Used **TLA+** to formally specify the emergency call systems in **4G/5G** cellular network protocols
- Discovered serious availability and security issues in real world, **acknowledged by major carriers**
- **Formal Secure Configuration Search for Network Protocols** 2020 - 2022
- We converted formal verification into a search problem. Given the model and the properties, we search the boundaries of the configuration space where the system is always secure and reliable

Selected Publications

- **Kaiyu Hou**, Sen Lin, Yan Chen, Vinod Yegneswaran, *QFaaS: Accelerating and Securing Serverless Cloud Networks with QUIC*, Under Review, ACM Symposium on Cloud Computing, 2022 (SoCC'22)
- You Li*, **Kaiyu Hou***, Yan Chen, Hai Zhou (*equal contribution), *Property Guided Secure Configuration Space Search*, Under Review, Formal Methods in Computer-Aided Design, 2022 (FMCAD'22)
- **Kaiyu Hou***, You Li*, Yinbo Yu, Yan Chen, Hai Zhou (*equal contribution), *Discovering Emergency Call Pitfalls for Cellular Networks with Formal Methods*, ACM International Conference on Mobile Systems, Applications, and Services, 2021 (MobiSys'21)
- You Li*, **Kaiyu Hou***, Hai Zhou, Yan Chen (*equal contribution), *Network Protocol Safe Configuration Search in One Shot*, ACM SIGCOMM, 2020, Poster (SIGCOMM'20)
- Xiaochun Wu, **Kaiyu Hou**, Xue Leng, Xing Li, Yinbo Yu, Bo Wu, Yan Chen, *State of the Art and Research Challenges in the Security Technologies of Network Function Virtualization*, Internet Computing, 2020
- Yinbo Yu, You Li, **Kaiyu Hou**, Yan Chen, Hai Zhou, Jianfeng Yang, *CellScope: Automatically Specifying and Verifying Cellular Network Protocols*, ACM SIGCOMM, 2019, Poster (SIGCOMM'19)
- Xue Leng, **Kaiyu Hou**, Yan Chen, Kai Bu, Libin Song, *SDNKeeper: Lightweight Resource Protection and Management System for SDN-based Cloud*, IEEE/ACM International Symposium on Quality of Service, 2018 (IWQoS'18)
- Chengchen Hu, **Kaiyu Hou** (1st student author), Hao Li, Ruilong Wang, Peng Zheng, Peng Zhang, Huanzhao Wang, *SoftRing: Taming the Reactive Model for Software Defined Networks*, IEEE International Conference on Network Protocols, 2017 (ICNP'17)
- Xiuwen Sun, **Kaiyu Hou**, Hao Li, Chengchen Hu, *Towards A Fast Packet Inspection over Compressed HTTP Traffic*, IEEE/ACM International Symposium on Quality of Service, 2017 (IWQoS'17)

Awards & Honor

- **Terminal Year Cabell Fellowship**, Northwestern University 2021
- **Best Teaching Assistant Award**, Northwestern University 2020
- **Outstanding Graduate Award**, Xi'an Jiaotong University 2014, 2017
- **Excellent Student Award**, Xi'an Jiaotong University 2011, 2012, 2013, 2015, 2016
- **Google Excellence Scholarship**, Awarded to 3 students from each of 20 top Chinese universities 2013
- **Meritorious Winner**, Mathematical Contest in Modeling (MCM) 2013
- **Silver Medal**, ACM-ICPC China Province Contest 2012, 2013

Activities & Experiences

- **Reviewer/Sub-reviewer** of AISA-CCS (21'), CCS (18', 19'), ICDCS ('18), IEEE ToN
- **Student President of Computer Science Dept.** (Class 2017), Xi'an Jiaotong University 2014 - 2017
- **Chair, the ACM-ICPC Club**, Xi'an Jiaotong University 2012 - 2013

Skills

- Serverless Computing, Serverless Network Architectures, Cloud Networks, SDN, and P4
- QUIC Protocol, TCP/IP Protocols, 3GPP Cellular Network Protocols, and 802.11 Protocols
- Python, Go-lang | Container, Microservices, Kubernetes, and CNI
- Formal Methods for Network Protocols, TLA+, IC3