

Zhutian Liu

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RESEARCH INTERESTS

Ph.D. candidate in Computer Science, specializing in performance optimization and system security of computer networks. My research focuses on measurement that bridges application performance with cross-layer network behavior, developing optimization techniques informed by data-driven insights. My areas of expertise include:

- **TCP/IP Networking:** Transport-layer protocols, congestion control, and network measurement
- **5G Cellular Networks:** 5G protocol stack and Open RAN architecture
- **Wireless Security:** 802.11 security analysis and Open RAN system testing
- **Video Streaming:** Adaptive video delivery (DASH/HLS) and real-time streaming (WebRTC)
- **Computer Vision and Image Processing:** Machine learning frameworks for vision-based analysis

EDUCATION

Ph.D. in Computer Science and Engineering Jan 2021 – Dec 2026
University of California, Riverside. Advisor: Zhaowei Tan Riverside, USA

B.S. in Computer Science and Technology, Minor in Mathematics Sep 2016 – Jun 2020
University of Electronic Science and Technology of China Chengdu, China




PROFESSIONAL EXPERIENCE

Graduate Student Researcher Jan 2021 - Present
University of California, Riverside Riverside, USA

Student Research Intern Aug 2018 - Oct 2018
Tencent Chengdu, China




SELECTED PROJECTS

- [P.7] **WebRTC Live Streaming Orchestration and Measurement Framework [U.1]**
C/C++, Golang, Python, WebRTC 📄
- An automated experiment and measurement framework that conduct experiment and aggregate information from video QoE, streaming application and network transport layer
 - Instrument native WebRTC client, capturing fine-grained frame and packet metrics
 - Automate P2P experiments orchestration over machine clusters
 - Streamline metrics and video processing for CV model training
- [P.6] **Cross-Layer Measurement Framework for HTTP Adaptive Streaming over 5G**
C/C++, JavaScript, Python, TCP/IP, QUIC, HTTP, 5G 📄
- A DASH measurement framework from video encoding to measurement
 - Customize *dash.js* and measure video QoE, ABR internal metrics
 - Collect transport layer congestion control metrics and 5G link-layer metrics
- [P.5] **ARCANE: Model-Based Fuzzing for 5G O-RAN Conformance [C.2]**
C/C++, Python, TLA++, Docker
- A systematic test suite leveraging LLM-assisted specification analysis to identify cross interface procedures
 - Auto-generate conformance test cases from operation traces for crucial procedures
 - Evaluate the F1AP protocol on *OpenAirInterface*; uncovered 149 unique bugs across 9 categories
- [P.4] **M2HO: An in-depth study on 5G Handover Impact on TCP Performance [C.1]**
C/C++, TCP/IP, 5G 📄
- A study into TCP performance anomalies induced by 5G handover mechanisms
 - Designed a client-side adaptive TCP enhancement via a Linux Netfilter module
 - Developed an Android-based emulator reproducing real handover traces for evaluation

- [P.3] **Cross-interface spoofing Attack between Wi-Fi Clients [C.3]**
Python, ARP, 802.11
 – A MITM attack that hijack client traffic from other Wi-Fi interfaces
 – Successfully perform the attack on enterprise hardwares
- [P.2] **Proxy for Fast Bulk Downloading over Lossy Networks**
C/C++, TCP/IP, HTTP 
 – An HTTP proxy boosting download speed in metered network with artificial packet loss
 – Proposed strategy that utilizes redundancy to skip-ahead while downloading in parallel
 – Implemented as a transparent proxy on top of *Squid*
- [P.1] **Mobile LoRa Gateway for Off-Grid Agricultural Sensing**
Docker, C, Python, LoRaWAN  
 – Designed a portable LoRaWAN gateway setup for off-grid telemetry
 – Implemented gateway on a Pi mounted on UAV, collaborated with DAF mentees

SELECTED PUBLICATIONS

[U]: Under Submission, [C]: Conference, [W]: Workshop

- [U.1] **Forgery Detection in Real-time Streaming**
Author
- [C.3] **Demystifying and Breaking Client Isolation in Wi-Fi Networks [P.3]**
NDSS 26
X. Zhou, J. Pu, Z. Liu, Z. Qian, Z. Tan, S. Krishnamurthy, M. Vanhoef.
To be published in Network and Distributed Systems Security, 2026
- [C.2] **Automated Model-Based Fuzzing for 5G O-RAN [P.5]**
MobiCom 25
Sixu Tan, Zeyu Li, Zhutian Liu, Harsh Patel, Zhaowei Tan
Conference on Mobile Computing and Networking, 2025 
- [C.1] **M2HO: Mitigating the Adverse Effects of 5G Handovers on TCP [P.4]**
MobiCom 24
Zhutian Liu, Qing Deng, Zhaowei Tan, Zhiyun Qian, Xinyu Zhang, Ananthram Swami, Srikanth V. Krishnamurthy
Conference on Mobile Computing and Networking, 2024 
- [W.1] **DU-level UE Context Migration [P.4]**
MobiCom 24
Presenter: Zhutian Liu
ACM Open-AI RAN 2024 Workshop 

SKILLS

- **Languages:** C/C++, Go, Python, JavaScript, Shell, Nix
- **Tools:** Docker, eBPF, QXDM, NS3, OpenCV, Android NDK, Pytorch, Git
- **Knowledge:** TCP/IP, Streaming Codecs, Congestion Control, 5G Protocol, Open RAN, Linux, Android, Machine Learning

SERVICES

- **Conference Reviewer:** ICPADS 2025
- **Volunteer:** ACM CoNext 2025

TEACHING EXPERIENCE

Mentorship

- UR2PhD: Anthony Padilla, Claire Lu and Sethya Pugal – 5G energy measurement Aug 2024 – Dec 2024
- DAF: Monse Lopez, Jooahn Park and Sofia Tapia – LoRaWAN sensing Summer 2024, 2025

Teaching Assistant

- CS 169: Mobile Wireless Networks Winter 2022, 2023, 2025

- CS 164: Computer Networks
- CS 153: Design of Operating Systems
- CS 178A: Project Sequence in CSE

Fall 2024
Spring 2025
Fall 2025