Cuidi Wei, PhD

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My research focuses on developing scalable, data-driven solutions for network security, high-speed traffic analysis, and programmable network infrastructures. In particular, I design and optimize security systems using programmable data planes, including programmable switches and SmartNICs, to support high-throughput network monitoring, threat detection, and attack mitigation. My work combines systems research, large-scale traffic analysis, and machine learning to identify malicious and anomalous network behavior while maintaining low latency and efficient resource utilization.

Education

Aug 2019 – May 2026 **Ph.D. Computer Science, George Washington University**

Sep 2012 – Jun 2016 **B.Sc. Computer Science, North China Institute of Aerospace Engineering**

Employment History

Sep 2025 – Present **Network Research Engineer**, Bytedance (TikTok).

Sep 2019 – Sep 2025 **Graduate Research Assistant**, George Washington University.

Jun 2025 – Aug 2025 **Network Research Engineer Intern**, Bytedance (TikTok).

Jun 2022 – Aug 2022 **Network System Summer Intern Researcher**, Nokia Bell Labs.

Sep 2016 – Aug 2019 **Intermediate Software Development Engineer**, CERNET Corporation (China Education and Research Network), China.

Research Publications

1. **C. Wei**, S. Tu, D. Hata, T. Hasegawa, Y. Koizumi, K. K. Ramakrishnan, J. Takemasa, and T. Wood, "GBUPlane: The Good, the Bad, and the Unknown: Smart Dataplane Defenses for Low-Volume Attacks," in *Proceedings of the 34th IEEE International Conference on Network Protocols (ICNP)*, accepted, 2026.
2. **C. Wei**, S. Tu, D. Hata, T. Hasegawa, Y. Koizumi, K. K. Ramakrishnan, J. Takemasa, and T. Wood, "immUNITY: Detecting and Mitigating Low Volume & Slow Attacks with Programmable Switches and SmartNICs," *arXiv preprint arXiv:2603.20573*, 2026.
3. **C. Wei**, S. Tu, T. Hasegawa, Y. Koizumi, K. K. Ramakrishnan, J. Takemasa, and T. Wood, "Envisioning a Unified Programmable Dataplane to Monitor Slow Attacks," in *2024 IEEE 32nd International Conference on Network Protocols (ICNP)*, IEEE Computer Society, 2024, pp. 1–6.
4. **C. Wei**, S. Tu, T. Hasegawa, Y. Koizumi, K. K. Ramakrishnan, J. Takemasa, and T. Wood, "Poster: A Fast Monitor for Slow Network Attacks," in *2024 IEEE Cloud Summit*, IEEE, 2024, pp. 153–156.
5. **C. Wei**, A. Kak, N. Choi, and T. Wood, "Towards a Scalable 5G RAN Central Unit," in *IEEE INFOCOM 2023-IEEE Conference on Computer Communications Workshops (INFOCOM WKSHPS)*, IEEE, 2023, pp. 1–2.
6. **C. Wei** and T. Wood, "Towards Accurate and Efficient Detection of Slow Attacks in a Programmable Data Plane," in *Proceedings of the SIGCOMM N2 Women Workshop*, SIGCOMM N2 Women Workshop, 2023.
7. **C. Wei**, A. Kak, N. Choi, and T. Wood, "5GPerf: Profiling Open Source 5G RAN Components under Different Architectural Deployments," in *Proceedings of the ACM SIGCOMM Workshop on 5G and Beyond Network Measurements, Modeling, and Use Cases*, 2022, pp. 43–49.
8. Z. Ni, **C. Wei**, T. Wood, and N. Choi, "A SmartNIC-based Load Balancing and Auto Scaling Framework for Middlebox Edge Server," in *2021 IEEE Conference on Network Function Virtualization and Software Defined Networks (NFV-SDN)*, IEEE, 2021, pp. 21–27.

Selected Projects

Programmable Dataplane Security for Low-Volume and Slow Attacks *2022–2026*

Multi-year research project resulting in multiple publications, including a full paper at IEEE ICNP 2026, a workshop paper at IEEE ICNP 2024, and a workshop paper at ACM SIGCOMM N2Women 2023.

- Analyzed traffic patterns associated with diverse network attacks, including Slowloris, SSH/FTP brute-force attacks, DDoS attacks, and various network scanning activities.
- Proposed, designed, and validated an efficient approach for detecting attacks in Tbps-scale network traffic.
- Designed a hybrid programmable-switch and SmartNIC architecture for Tbps-scale monitoring, suspicious-flow identification, and mitigation of low-volume attacks.
- Developed memory-efficient in-switch flow tracking and filtering mechanisms that reduced traffic forwarded to downstream security processors while preserving line-rate performance and low false-positive rates.
- Built multi-stage detection pipelines combining programmable dataplanes, SmartNIC-based inspection, and machine learning for scalable anomalous-traffic detection.
- Evaluated the system using real-world traces and programmable hardware testbeds, producing multiple peer-reviewed publications on slow-attack monitoring and dataplane defense.

High-Performance Packet Processing Optimization for 5G Infrastructure

- Developed and optimized high-performance packet processing pipelines using DPDK (kernel bypass), improving throughput and reducing communication overhead; reduced communication-related CPU usage to 46.73% while increasing CU processing utilization to 45.18%, achieving more efficient resource distribution at peak load.
- Profiled end-to-end data plane execution using perf to identify CPU, cache, and I/O bottlenecks, enabling targeted optimizations for low-latency and high-throughput packet processing.
- Performed detailed latency and throughput analysis across the packet processing pipeline, driving system-level optimizations for scalable, real-time traffic handling in 5G infrastructure.

SmartNIC-Based Flow Load Balancer

- Designed and implemented a flow-aware load balancer on SmartNICs, using weighted scheduling to improve flow distribution consistency and maximize throughput in high-speed data plane environments.
- Developed traffic generators with Zipf-distributed workloads to simulate bursty and skewed traffic patterns, enabling robust evaluation under realistic, non-uniform network conditions.
- Evaluated latency, tail latency, and fairness using tools such as wrk2 and pktgen, comparing weighted and randomized scheduling strategies to optimize performance under high-load scenarios.

Skills

Languages	Python, Go, C/C++, P4, Shell, SQL
Network Protocols	TCP/IP, IPv4/IPv6, DNS, UDP, HTTP/HTTPS, BGP, OSPF, etc
Networking Systems	Linux, DPDK, SmartNIC, Programmable Switches (Tofino)
Machine Learning	Random Forest, XGBoost, Decision Trees, Model Evaluation, Imbalanced Data Analysis, Scikit-Learn
Data Engineering	MySQL, MongoDB, Redis, Kafka, Large-Scale Network Trace Processing
Tools	tcpdump, Wireshark, perf, GDB, pktgen, wrk2, Git, Docker