Changlai Du

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Employment

Postdoctoral Associate 08/2021 – Present
Department of Computer Science, Virginia Tech

Cybersecurity Manager 01/2019 – 10/2019
Dealalive LLC, Acton, MA

Postdoctoral Fellow 06/2018 – 12/2018
School of Computing and Informatics, University of Louisiana at Lafayette

Research/Teaching Assistant 09/2012 – 05/2018
Department of Computer Science, Virginia Tech

Software Engineer/Project Manager 01/2010 – 07/2012
Department of Energy Management System, NR Electric Co. Ltd, Nanjing, China

Research Assistant/Fellow 09/2006 – 12/2009
Department of Computer Science and Technology, Tsinghua University, China

Software Engineer 08/2003 – 07/2005
Jiangsu Jinling Technology Group Corporation, Nanjing, China

Education

Virginia Polytechnic Institute and State University 09/2012 – 05/2018
Ph.D. in Computer Science
Dissertation: Exploring the Sensing Capability of Wireless Signals
Advisor: Dr. Wenjing Lou
Committee: Professors Wenjing Lou, Thomas Hou, Ing-Ray Chen, Anil Vullikanti, Yingying Chen

Tsinghua University, China 09/2006 – 06/2009
M.S. in Computer Science

Southeast University, China 09/1999 – 06/2003
B.S. in Information Engineering

Research Interests

Privacy Protection in Wireless Networks
Mobile Network Security and Privacy
Wireless Sensing
Internet of Things (IoT) Security
Cyber-Physical Security

Research Experience

Postdoctoral Associate 08/2021 – Present
Department of Computer Science, Virginia Tech

- Authored a survey paper on the challenges and research directions of the mobile tracking problem in 5G and beyond cellular networks;
- Designed a new architecture to address the mobile tracking issues in cellular networks leveraging anonymous credentials (AC) and trusted platform module (TPM). The project was submitted to the NSF SaTC program as a medium grant application with a requested amount of $1.2 million;
- Developed UCBlocker, an attribute-based end-to-end caller authentication and call verification system to block unwanted calls in telephone networks;

– Working on quantification of mobile user privacy leakage due to mobile tracking by the operators and developing new methods for users to protect their privacy;
– Co-authored an anonymous authentication and key agreement scheme to address the mobile tracking problem;
– Co-authored a byzantine resilient network time synchronization scheme;
– Co-authored a secure and efficient inter-SAS (Spectrum Access System) coordination scheme;
– Co-authored a smart local model selection in federated learning with noisy and imbalanced data.

Postdoctoral Fellow 06/2018 – 12/2018
School of Computing and Informatics, University of Louisiana at Lafayette
– Developed EchoAuth, an intrusion detection system for smart homes by taking advantage of speakers and microphones on commodity devices to capture fine grained human gait patterns.

Research Assistant 09/2012 – 05/2018
Department of Computer Science, Virginia Tech
– Performed a comprehensive analysis on the cyclostationarity properties of OFDM-based WiFi signals and demonstrated the application of these properties in signal direction estimation;
– Developed MobTrack, a lightweight, handheld system that can classify signal types based on their cyclic frequencies and identify the line of sight component in multipath environments, for locating interfering radios in ISM band with sub-meter accuracy;
– Developed WiTalk, a context-free and fine-grained motion sensing system using channel state information (CSI) measurements from standard 802.11n network interface cards (NICs);
– Co-authored an attack design that infers sensitive secrets from side-channel information leakage from the electromyography (EMG)-based gesture devices;
– Co-authored three papers on deployment optimization in multi-cloud environments and fog/edge computing system.

Research Assistant/Fellow 09/2006 – 12/2009
Department of Computer Science and Technology, Tsinghua University, China
– Developed VCNF (Video Conference Network Foundation), a secure and scalable video conferencing system based on P2PSIP overlay and a layered data transfer mechanism;
– Co-authored a paper for project "Research on the Basic Theory of New Generation Content Distribution Network" (NSFC 60873254);
– Co-authored three papers for project "Theoretical Research on Safe and High-performance Streaming Media System Based on Peer-to-Peer Technology" (NSFC 60673184).

Journal Publications

1. B. Huang, **C. Du**, M. Sun, and X. Yuan, "A Dynamic Virtual Datacenter Selection Strategy for Integrated Cloud Service Platform Construction with Multiclouds," *IEEE Access*, vol. PP, pp. 1-1, Nov. 2019, doi: 10.1109/ACCESS.2019.2956169

2. Y. Zhao, J. Liu, Q. Fang, L. Xu, **C. Du**, and X. Yuan, "A strategy for improving NetClust server placement for multicloud environments," *Turkish Journal of Electrical Engineering & Computer Sciences*, vol. 26, no. 1, pp. 115–124, Jan. 2018, doi: 10.3906/elk-1704-206

3. R. Zhang, N. Zhang, **C. Du**, W. Lou, Y. Hou, and Y. Kawamoto, "From Electromyogram to Password: Exploring the Privacy Impact of Wearables in Augmented Reality," *ACM Transactions on Intelligent Systems and Technology (TIST)*, vol. 9, no. 1, pp. 13, Sep. 2017, doi: 10.1145/3078844, (Impact Factor 4.654)

4. X. Liu, H. Yin, C. Lin, and **C. Du**, "Efficient User Authentication and Key Management for Peer-to-Peer Live Streaming Systems," *Tsinghua Science & Technology*, vol. 14, no. 2, pp. 234–241, Apr. 2009, doi: 10.1016/S1007-0214(09)70035-5, (Impact Factor 2.016)

5. H. Yin, **C. Du**, C. Ren, Z. Chen, G. Min, and C. Lin, "A secure and scalable video conference system based on peer-assisted content delivery networks," *Computer Systems Science and Engineering*, vol. 24, no. 5, pp. 361–371, Sep. 2009, (Impact Factor 1.486)

Conference Publications

1. **C. Du**, H. Yu, Y. Xiao, W. Lou, C. Wang, R. Gazda, and Y. Hou, "Mobile Tracking in 5G and Beyond Networks: Problems, Challenges, and New Directions," in *The 19th IEEE International Conference on Mobile Ad-Hoc and Smart Systems (MASS)*, 2022, pp. 1–9, doi: 10.1109/MASS56207.2022.00067
2. **C. Du**, X. Yuan, W. Lou, and Y. Hou, "Context-Free Fine-Grained Motion Sensing using WiFi," in *2018 15th Annual IEEE International Conference on Sensing, Communication, and Networking (SECON)*, 2018, pp. 1–9, doi: 10.1109/SAHCN.2018.8397118, (Acceptance Rate 49/211=23.2%)
3. X. Yuan, Y. He, Q. Fang, X. Tong, **C. Du**, and Y. Ding, "An Improved Fast Search and Find of Density Peaks-Based Fog Node Location of Fog Computing System," in *Internet of Things (iThings) and IEEE Green Computing and Communications (GreenCom) and IEEE Cyber, Physical and Social Computing (CPSCom) and IEEE Smart Data (SmartData), 2017 IEEE International Conference on*, 2017, pp. 635–642, doi: 10.1109/iThings-GreenCom-CPSCom-SmartData.2017.100
4. R. Zhang, N. Zhang, **C. Du**, W. Lou, Y. Hou, and Y. Kawamoto, "AugAuth: Shoulder-Surfing Resistant Authentication for Augmented Reality," in *Communications (ICC), 2017 IEEE International Conference on*, 2017, pp. 1–6, doi: 10.1109/ICC.2017.7997251
5. **C. Du**, R. Zhang, W. Lou, and Y. Hou, "MobTrack: Locating Indoor Interfering Radios With A Single Device," in *INFOCOM 2016-The 35th Annual IEEE International Conference on Computer Communications, IEEE*, 2016, pp. 1–9, doi: 10.1109/INFOCOM.2016.7524344, (Acceptance Rate 300/1644=18.2%)
6. **C. Du**, H. Zeng, W. Lou, and Y. Hou, "On Cyclostationary Analysis of WiFi Signals for Direction Estimation," in *Communications (ICC), 2015 IEEE International Conference on*, 2015, pp. 3557–3561, doi: 10.1109/ICC.2015.7248876
7. X. Yuan, H. Yin, X. Liu, **C. Du**, and G. Min, "Dynamic Resource Provision in Multi-Channel P2P Live Streaming Systems," in *Computer and Information Technology (CIT), 2010 IEEE 10th International Conference on*, 2010, pp. 1849–1855, doi: 10.1109/CIT.2010.318
8. X. Yuan, H. Yin, X. Liu, **C. Du**, and G. Min, "Server Placement for Peer-to-Peer Live Streaming Systems," in *Computer and Information Technology (CIT), 2010 IEEE 10th International Conference on*, 2010, pp. 349–355, doi: 10.1109/CIT.2010.88
9. **C. Du**, H. Yin, C. Lin, and Y. Hu, "VCNF: A Secure Video Conferencing System Based on P2P Technology," in *High Performance Computing and Communications, 2008. HPCC'08. 10th IEEE International Conference on*, 2008, pp. 463–469, doi: 10.1109/HPCC.2008.128, (Acceptance Rate 90/455=19.8%)

Theses & Dissertations

1. **C. Du**, "Exploring the Sensing Capability of Wireless Signals," Virginia Tech, Blacksburg, VA, May 2018
2. **C. Du**, "Interactive Multimedia Communication System Based on CDN," Tsinghua University, Beijing, China, June 2009

Talks & Posters

1. X. Yuan, M. Sun, Q. Fang, and **C. Du**, "DLECP: A Dynamic Learning-based Edge Cloud Placement Framework for Mobile Cloud Computing," IEEE INFOCOM 2019 - IEEE Conference on Computer Communications Workshops (INFOCOM WKSHPS), Apr. 2019
2. **C. Du** and X. Yuan, "Poster: EchoAuth: Gait-based Smart Home Intrusion Detection through Acoustic Sensing," 26th Annual Network and Distributed System Security Symposium (NDSS 2019), Feb. 2019

Submitted & Forthcoming

1. **C. Du**, H. Yu, Y. Xiao, W. Lou, and Y. Hou, "End-to-End Unwanted Call Blocking," (Submitted to USENIX Security 2023)
2. H. Yu, Y. Xiao, **C. Du**, W. Lou, and Y. Hou, "AAKA: Anti- Mobile Tracking in 5G Era," (Submitted to USENIX Security 2023)

3. C. Zhang, N. Wang, S. Shi, **C. Du**, W. Lou, and Y. Hou, "SAMOS: Smart Local Model Selection in Federated Learning with Noisy and Imbalanced Data," (Submitted to ICC 2023)
4. S. Shi, Y. Xiao, **C. Du**, W. Lou, and Y. Hou, "BRENTS: Byzantine Resilient Network Time Synchronization," (Submitted to ICDCS 2023)
5. S. Shi, Y. Xiao, **C. Du**, Y. Shi, W. Lou, and Y. Hou, "SEICO: Secure and Efficient inter-SAS Coordination," (Submitted to ICDCS 2023)
6. **C. Du**, H. Yu, Y. Xiao, W. Lou, and Y. Hou, "Location Privacy Quantification for Anti Mobile Tracking Systems," (To submit to ESORICS 2023)
7. **C. Du**, H. Yu, Y. Xiao, W. Lou, and Y. Hou, "Protecting Users from Mobile Tracking and Profiling in 5G and Beyond Cellular Networks," (To submit to ACM MobiCom 2023)

Patents

1. S. Huang, Y. Zheng, J. Chen, X. Liang, X. Gao, Y. Yang, W. Xuan, K. Ma, L. Cao, H. He, L. Yang, **C. Du**, "Substation Simulation Training System Based on Digital-to-Analogue Hybrid Simulation Technology", CN Patent No. CN102054386B, 2013.

Teaching Interests

Information Security; Network Security; Wireless Security; Cryptography;
Computer Architecture; Operation Systems; Computer Networks;
Programming Languages (C, C++, Python); Object Oriented Programming; Functional Programming;
Data Structures; Algorithms; Software Engineering;
Analog Circuits; Digital Circuits; Digital Signal Processing; Microcomputers;
Principles of Communications; Radio Wave Propagation; Antenna; Signals and Linear Systems.

Teaching & Mentoring

PhD Student Mentorship, Virginia Tech

Shanghao Shi — 08/2021 – Present
– Project: Secure and Efficient inter-SAS Coordination
– Project: Byzantine Resilient Network Time Synchronization

Hexuan Yu — 08/2021 – Present
– Project: Anti- Mobile Tracking in 5G Era

Chaoyu Zhang — 08/2021 – Present
– Project: Smart Local Model Selection in Federated Learning

Shaoyu Li — 01/2022 – Present
– Project: Network Layer Security of Blockchain Systems

Graduate Teaching Assistant, Virginia Tech
CS2505, Computer Organization I — 09/2012 – 05/2013

Programming Experience

Software Engineer and Project Manager — 01/2010 – 07/2012
Nanjing NR Electric Co., Ltd
- Implemented an automated 3D model generation subsystem for the company's Electric Substation Simulation and Training System, which reduced the workload by 90%
- Led, designed and deployed the department's test automation project, which included unit test framework using Boost Test and continuous integration policies

Software Architect and Software Engineer — 09/2007 – 01/2008
Tsinghua University, Sponsored by Simpleware
- Designed the system architecture of an information security experimental system that was used in teaching courses on operating system security, database security, computer virus prevention, and network attack and defense
- Implemented core components including communication module and UI

Software Engineer 08/2007 – 10/2007

Tsinghua University, Sponsored by China Mobile

– Implemented a video transmission quality evaluation system in wireless networks using the network Quality of Service (QoS) parameters

Software Engineer 08/2003 – 07/2005

Jiangsu Jinling Technology Group Corporation

– Implemented and deployed Client/Server model software used for Internet traffic collection, monitoring and protocol analysis
– Software Configuration Management (SCM) administrator using IBM Rational ClearCase, Workflow Automation Administrator using IBM Rational ClearQuest

Academic Services

Technical Reviewing

– IEEE Transactions on Dependable and Secure Computing (TDSC) 2023
– ACM Conference on Security and Privacy in Wireless and Mobile Networks (WiSec) 2023
– IEEE/ACM Transactions on Networking (ToN) 2018, 2022
– European Symposium on Research in Computer Security (ESORICS) 2013, 2015, 2022
– International Journal of Communication Systems (IJCS) 2019
– IEEE Journal of Biomedical and Health Informatics (JBHI) 2018
– IEEE International Conference on Computer Communications (INFOCOM) 2018
– IEEE Vehicular Technology Conference (VTC) 2018
– Transactions on Mobile Computing (TMC) 2018
– IEEE Conference on Communications and Network Security (CNS) 2018
– IEEE Wireless Communications and Networking Conference (WCNC) 2017
– IEEE Journal on Selected Areas - Series on Green Communications and Networking (JSAC-SGCN) 2016
– International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc) 2015
– IEEE Wireless Communications Letters (WCL) 2014
– The Workshop on Secure Network Protocols (NPSec) 2013
– International Conference on Information and Communications Security (ICICS) 2013
– International Conference on Security and Privacy in Communication Networks (SecureComm) 2013

Conference Organization

– TPC member for IEEE International Conference on Computer Communications (INFOCOM) demo 2023
– Technical support for ARO workshop on AI security and Security of AI 2023
– Session Chair for IEEE International Conference on Mobile Ad-Hoc and Smart Systems (MASS) 2022
– Technical support for MURI project review meeting 2022
– TPC member for IEEE Vehicular Technology Conference (VTC) 2018, 2020
– Student Volunteer for IEEE Conference on Communications and Network Security (CNS) 2013