Felix Xiaozhu Lin

January, 2022

Research Interest

Computer systems software, at the intersection of OS $\times$ compilers $\times$ architecture. Recent focus: edge/IoT scenarios. Two themes: i) fast processing of large streaming/video data; ii) OS kernels for security/efficiency.

Education

PhD	Dec 2014	Rice University, Computer Science, Advisor: Lin Zhong
MS	July 2008	Tsinghua University
BS	July 2006	Tsinghua University

Employment

Aug 2020 – present	Associate Professor, CS, University of Virginia
Aug 2014 – Aug 2020	Assistant & Associate Professor, ECE, Purdue University
May 2012 – Dec 2012	Intern, Microsoft Research, with Suman Nath and Jie Liu
Jun 2011 – Aug 2011	Visiting researcher, IBM Research, with Jian Li
Jan 2011 – Apr 2011	Intern, Nokia Research, with Daniel Ashbrook and Sean White

Honors and Awards

[1] NSF CAREER Award, 2019.

[2] Google Faculty Award, 2016.

[3] NSF CISE Research Initiation Initiative (CRII), 2015.

[4] Best Paper Award, ACM Proc. Int. Conf. Architectural Support for Programming Languages and Operating Systems (ASPLOS), 2014.

[5] Reflex (2009), a pioneering project as part of my PhD thesis anticipated the heterogeneous architectures ubiquitous in today's smartphones and smart devices.

Research Grants

- PI, "Collaborative Research: CNS Core: Medium: Understanding and Strengthening Memory Security for Non-Volatile Memory", NSF, 2106893, 10/01/2021–9/30/2024, $262,890
- PI, "Smart City Infrastructures for Safeguarding Autonomous Vehicles Against Cyber Attacks", Commonwealth Cyber Initiative, Virginia, 01/01/2021 – 12/31/2021, $200,000.
- PI, "CAREER: A Trustworthy and Verifiable Software Backplane for the Cloud Edge", NSF, 1846102, 06/01/2019 – 05/31/2024, $479,658.

- co-PI, "SPX: Write Once, Run on Anything: Verified, Tuned Accelerator Kernels from High Level Specifications", NSF, 1919197, 10/01/2019 – 09/30/2023, $312,500.
- PI (as the only Purdue PI), "SaTC: CORE: Small: Collaborative: Guarding the Integrity of Mobile Graphical User Interfaces", NSF, 1718702, 08/01/2017 – 07/30/2020, $250,000.
- PI (as the only Purdue PI), "CSR: Small: Collaborative Research: Efficient Exploitation of Heterogeneous Memory through OS/Compiler Support", NSF, 1619075, 09/01/2016 – 08/30/2019, $249,548.
- PI (sole), "NSF Student Travel Grants for the Twentieth ACM Workshop on Mobile Computing Systems and Applications", NSF, 1902722, 01/01/2019 – 12/30/2019, $20,000.
- PI (sole), "Busting Idle Anomalies on Android Wear", $42,743, 2016, Google faculty award.
- PI (sole), "CRII: CSR: Rethinking Operating System Structure for Wearable Devices", NSF, 1464357, 04/01/2015 – 03/31/2017, $175,000.
- Co-PI, "Democratizing Intelligent Buildings with Internet of Things", $75,000, Purdue University CPS/IoT Seed Grant Program.

Conference Proceedings and Presentations

Author legend: G/ U – grad/undergrad students for whom I serve as the sole faculty advisor
C – students for whom I serve as a co-advisor

[1] "Minimal Viable IO Drivers for TrustZone," Liwei Guo G and Felix Xiaozhu Lin, in *Proc. European Conference on Computer Systems (**EuroSys**)*, 2022.

[2] "GPUReplay: A 50-KB GPU Stack for Client ML," Heejin Park G and Felix Xiaozhu Lin, in *Proc. ACM Int. Conf. Architectural Support for Programming Languages and Operating Systems (**ASPLOS**)*, 2022.

[3] "Video Analytics with Zero-streaming Cameras," Mengwei Xu* C, Tiantu Xu* G, Yunxin Liu, Xuanzhe Liu, Gang Huang, and Felix Xiaozhu Lin, (*=co-primary) in *Proc. USENIX Annual Technical Conference (**USENIX ATC**)*, 2021.

[4] "Approximate Query Service on Autonomous IoT Cameras," Mengwei Xu C, Xiwen Zhang G, Yunxin Liu, Xuanzhe Liu, and Felix Xiaozhu Lin, in *Proc. ACM Int. Conf. Mobile Systems, Applications and Services (**MobiSys**)*, acceptance rate 19% (34/175), 2020.

[5] "Transkernel: Bridging Monolithic Kernels to Peripheral Cores," Liwei Guo G, Shuang Zhai G, Yi Qiao U, and Felix Xiaozhu Lin, in *Proc. USENIX Annual Technical Conference (**USENIX ATC**)*, page 675–692, acceptance rate 20% (71/356), 2019.

[6] "StreamBox-TZ: A Secure IoT Analytics Engine at the Edge," Heejin Park G, Shuang Zhai G, Long Lu, and Felix Xiaozhu Lin, in *Proc. USENIX Annual Technical Conference (**USENIX ATC**)*, page 537–554, acceptance rate 20% (71/356), 2019.

[7] "VStore: A Data Store for Analytics on Large Videos," Tiantu Xu [G], Luis Materon Botelho [U], and Felix Xiaozhu Lin, in *Proc. European Conference on Computer Systems (**EuroSys**)*, page 16:1–16:17, acceptance rate 22% (45/207), 2019.

[8] "A First Look at Deep Learning Apps on Smartphones," Mengwei Xu [C], Jiawei Liu, Yuanqiang Liu, Felix Xiaozhu Lin, Yunxin Liu, and Xuanzhe Liu, in *Proc. the World Wide Web Conference (**WWW**)*, page 2125–2136, acceptance rate 18% (225/1247), 2019.

[9] "StreamBox-HBM: Stream Analytics on High Bandwidth Hybrid Memory," Hongyu Miao [G], Myeongjae Jeon, Gennady Pekhimenko, Kathryn S. McKinley, and Felix Xiaozhu Lin, in *Proc. ACM Int. Conf. Architectural Support for Programming Languages and Operating Systems (**ASPLOS**)*, page 167–181, acceptance rate 21% (74/350), 2019.

[10] "Power SandBox: Power Awareness Redefined," Liwei Guo* [G], Tiantu Xu* [G], Mengwei Xu [C], Xuanzhe Liu, and Felix Xiaozhu Lin, (*=co-primary) in *Proc. European Conference on Computer Systems (**EuroSys**)*, page 37:1–37:15, acceptance rate 16% (43/262), 2018.

[11] "DeepCache: Principled Cache for Mobile Deep Vision," Mengwei Xu [C], Mengze Zhu, Yunxin Liu, Felix Xiaozhu Lin, and Xuanzhe Liu, in *Proc. ACM Int. Conf. Mobile Computing and Networking (**MobiCom**)*, page 129–144, acceptance rate 22% (42/187), 2018.

[12] "ProfDP: A Lightweight Profiler to Guide Data Placement in Heterogeneous Memory Systems," Shasha Wen, Lucy Cherkasova, Felix Xiaozhu Lin, and Xu Liu, in *Proc. Int. Conf. on Supercomputing (**ICS**)*, page 263–273, acceptance rate 19% (36/193), 2018.

[13] "Rethinking Resource Management in Mobile Web: Measurement, Deployment, and Runtime," invited paper, Xuanzhe Liu, Yun Ma, and Felix Xiaozhu Lin, in *Proc. IEEE Int. Conf. Distributed Computing Systems (**ICDCS**)*, page 1347–1356, acceptance rate 21% (78/378), 2018.

[14] "StreamBox: Modern Stream Processing on a Multicore Machine," Hongyu Miao [G], Heejin Park [G], Myeongjae Jeon, Gennady Pekhimenko, Kathryn S. McKinley, and Felix Xiaozhu Lin, in *Proc. USENIX Annual Technical Conference (**USENIX ATC**)*, page 617–629, acceptance rate 21% (60/283), 2017.

[15] "Characterizing Smartwatch Usage in The Wild," Xing Liu, Tianyu Chen, Feng Qian, Zhixiu Guo, Felix Xiaozhu Lin, Xiaofeng Wang, and Kai Chen, in *Proc. ACM Int. Conf. Mobile Systems, Applications and Services (**MobiSys**)*, page 385–398, acceptance rate 18% (34/188), 2017.

[16] "AppHolmes: Detecting and Characterizing App Collusion among Third-Party Android Markets," Mengwei Xu [C], Yun Ma, Xuanzhe Liu, Felix Xiaozhu Lin, and Yunxin Liu, in *Proc. the World Wide Web Conference (**WWW**)*, page 143–152, acceptance rate 17% (164/966), 2017.

[17] "Understanding the Characteristics of Android Wear OS," Renju Liu [G] and Felix Xiaozhu Lin, in *Proc. ACM Int. Conf. Mobile Systems, Applications and Services (**MobiSys**)*, page 151–164, acceptance rate 16% (31/197), 2016.

[18] "memif: Towards Programming Heterogeneous Memory Asynchronously," Felix Xiaozhu Lin and Xu Liu, in *Proc. ACM Int. Conf. Architectural Support for Programming Languages and Operating Systems (**ASPLOS**)*, page 369–383, acceptance rate 23% (53/232), 2016.

[19] "Characterizing Emerging Heterogeneous Memory," Du Shen, Xu Liu, and Felix Xiaozhu Lin, in *Proc. ACM SIGPLAN Int. Symposium on Memory Management (**ISMM**)*, page 13–23, acceptance rate 55% (12/22), 2016.

[20] "Characterizing Smartphone Usage Patterns from Millions of Android Users," Huoran Li, Xuanzhe Liu, Tao Xie, Kaigui Bian, Xuan Lu, Felix Xiaozhu Lin, Qiaozhu Mei, and Feng Feng, in *Proc. ACM Internet Measurement Conference (**IMC**)*, page 459–472, acceptance rate 26% (44/169), 2015.

[21] "Automated OS-level Device Runtime Power Management," Chao Xu, Felix Xiaozhu Lin, and Lin Zhong, in *Proc. ACM Int. Conf. Architectural Support for Programming Languages and Operating Systems (**ASPLOS**)*, page 239–252, acceptance rate 17% (48/287), 2015.

[22] "K2: A Mobile Operating System for Heterogeneous Coherence Domains," best paper award, Felix Xiaozhu Lin, Zhen Wang, and Lin Zhong, in *Proc. ACM Int. Conf. Architectural Support for Programming Languages and Operating Systems (**ASPLOS**)*, page 285–300, acceptance rate 23% (49/217), 2014.

[23] "SmartAds: Bringing Contextual Ads to Mobile Apps," Suman Nath, Felix Xiaozhu Lin, Lenin Ravindranath, and Jitu Padhye, in *Proc. ACM Int. Conf. Mobile Systems, Applications and Services (**MobiSys**)*, page 111–124, 2013.

[24] "Reflex: Using Low-power Processors in Smartphones without Knowing Them," Felix Xiaozhu Lin, Zhen Wang, Robert LiKamWa, and Lin Zhong, in *Proc. ACM Int. Conf. Architectural Support for Programming Languages and Operating Systems (**ASPLOS**)*, page 13–24, acceptance rate 21% (32/152), 2012.

[25] "How far can client-only solutions go for mobile browser speed?," Zhen Wang, Felix Xiaozhu Lin, Lin Zhong, and Mansoor Chishtie, in *Proc. the World Wide Web Conference (**WWW**)*, page 31–40, 2012.

[26] "Power-efficient time-sensitive mapping in heterogeneous systems," Cong Liu, Jian Li, Wei Huang, Juan Rubio, Evan Speight, and Felix Xiaozhu Lin, in *Proc. Int. Conf. Parallel Architectures and Compilation Techniques (**PACT**)*, page 23–32, 2012.

[27] "RhythmLink: Securely Pairing I/O-Constrained Devices by Tapping," Felix Xiaozhu Lin, Daniel Ashbrook, and Sean White, in *Proc. ACM Symp. on User Interface Software and Technology (**UIST**)*, page 263–272, 2011.

[28] "Dandelion: A framework for transparently programming phone-centered wireless body sensor applications for health," Felix Xiaozhu Lin, Ahmad Rahmati, and Lin Zhong, in *Proc. ACM Wireless Health (**WirelessHealth**)*, page 74–83, 2010.

Conference Papers under Review

[1] "Enabling Large NNs on Tiny Microcontrollers with Swapping," Hongyu Miao [G] and Felix Xiaozhu Lin, in *(**arXiv:2101.08744**)*, 2021.

[2] "Clique: Spatiotemporal Object Re-identification at the City Scale," Tiantu Xu [G],

Kaiwen Shen [U], Yang Fu, Humphrey Shi, and Felix Xiaozhu Lin, in *(**arXiv:2012.09329**)*, 2020.

[3] "Let the Cloud Watch Over Your IoT File Systems," Liwei Guo [G], Yiying Zhang, and Felix Xiaozhu Lin, in *(**arXiv:1902.06327**)*, 2019.

Journal Publications

[1] "ShuffleDog: Characterizing and Adapting User-Perceived Latency of Android Apps," Gang Huang, Mengwei Xu [C], Felix Xiaozhu Lin, Yunxin Liu, Yun Ma, Saumay Pushp, and Xuanzhe Liu, in *IEEE Transactions on Mobile Computing (**TMC**)*, vol 16, issue number 10, page 2913–2926, 2017.

[2] "K2: A Mobile Operating System for Heterogeneous Coherence Domains," Felix Xiaozhu Lin, Zhen Wang, and Lin Zhong, in *ACM Transactions of Computer Systems (**TOCS**)*, vol 33, issue number 2, page 5–32, 2015.

Refereed Workshop Publications

[1] "Hybrid Mobile Vision for Emerging Applications," Nan Wu, Felix Xiaozhu Lin, Feng Qian, and Bo Han, in *Proc. ACM Int. Workshop on Mobile Computing Systems and Applications (**HotMobile**)*, 2022.

[2] "Incremental Perception on Real Time 3D Data," Arup Kumar Sarker and Felix Xiaozhu Lin, in *Proc. ACM Int. Workshop on Mobile Computing Systems and Applications (**HotMobile**)*, 2022.

[3] "Practical Urban Localization for Mobile AR," Tiantu Xu [G], Guohui Wang, and Felix Xiaozhu Lin, in *Proc. ACM Int. Workshop on Mobile Computing Systems and Applications (**HotMobile**)*, page 27–32, acceptance rate 33% (16/48), 2020.

[4] "Decelerating Suspend and Resume in OS," Shuang Zhai [U], Liwei Guo [G], Xiangyu Li [U], and Felix Xiaozhu Lin, in *Proc. ACM Int. Workshop on Mobile Computing Systems and Applications (**HotMobile**)*, page 31–36, acceptance rate 35% (18/52), 2017.

[5] "Tell Your Graphics Stack That the Display Is Circular," Hongyu Miao [G] and Felix Xiaozhu Lin, in *Proc. ACM Int. Workshop on Mobile Computing Systems and Applications (**HotMobile**)*, page 57–62, acceptance rate 33% (18/55), 2016.

[6] "Anatomizing System Activities on Interactive Wearable Devices," Renju Liu [G] and Felix Xiaozhu Lin, in *Proc. ACM Asia-Pacific Workshop on Systems (**ApSys**)*, page 18, 2015.

[7] "Draining our Glass: An Energy and Heat Characterization of Google Glass," Robert LiKamWa, Zhen Wang, Aaron Carroll, Felix Xiaozhu Lin, and Lin Zhong, in *Proc. ACM Asia-Pacific Workshop on Systems (**ApSys**)*, page 10, 2014.

[8] "Device drivers should not do power management," Chao Xu, Felix Xiaozhu Lin, and Lin Zhong, in *Proc. ACM Asia-Pacific Workshop on Systems (**ApSys**)*, page 11, 2014.

[9] "Supporting Distributed Execution of Smartphone Workloads on Loosely Coupled Heterogeneous Processors," Felix Xiaozhu Lin, Zhen Wang, and Lin Zhong, in *Proc. Workshop on Power-Aware Computing and Systems (**HotPower**)*, page 2,

2012.

[10] "Why are Web Browsers Slow on Smartphones?," Zhen Wang, Felix Xiaozhu Lin, Lin Zhong, and Mansoor Chishtie, in *Proc. ACM Int. Workshop on Mobile Computing Systems and Applications (**HotMobile**)*, page 91–96, acceptance rate 33% (16/49), 2011.

Master's and PhD Thesis Students Currently Being Supervised

Arup Sarker	PhD, started 2021	Autonomous systems
Madellyne Waugh	PhD, started 2020	ML x systems
Xiangfu Li	MS, started 2021	Autonomous systems
Liwei Guo	PhD, started 2016	OS security

PhD Thesis Supervision Completed

- Hongyu Miao, Nov 2021, Thesis title "Systems Support for Data Analytics by Exploiting Modern Hardware"
- Heejin Park, Nov 2021, Thesis title "Towards Trustworthy On-device Computation"
- Tiantu Xu, Apr 2021, Thesis title "Software Systems for Large-scale Retrospective Video Analytics"

Master's Thesis Supervision Completed

- Shuang Zhai, June 2019. Thesis title "Transkernel: an executor for commodity kernels on peripheral cores"
- Michael Glapa (co-chaired with Prof. Saurabh Bagchi), Sept 2018. Thesis title "Malicious Reconfiguration of Executing Program in FPGA and its Defense"
- Ravi Gupta (co-chaired with Prof. Saurabh Bagchi), May 2016. Thesis title "Digital signal processors as HPC accelerator and performance tuning via static analysis and machine learning"

Undergraduate Supervision Completed

- Luis Fernando Materon Botelho, "Large-Scale Video Analytics with Artificial Intelligence", ECE496, 2018.
- Joven Garces, "Characterization and Optimization of Massively Parallel Merge Algorithms", ECE496, 2018.
- Yi Qiao, "Understanding Suspend/Resume Path of Linux Device Drivers", Purdue Undergraduate Summer Research Fellowship, 2018.
- Victor Pan, "Sort vs. Hash Join on Knights Landing Architecture", Purdue Undergraduate Summer Research Fellowship, 2018.
- Xiangyu Li, "Decelerating Suspend and Resume", ECE496, 2016.

Courses In Charge Of

All course survey reports with student comments are available upon request.

ECE 368: Data Structures (undergraduate)

Semester	Students	Course rating	Instructor rating
Fall 2014	60	4.2/5	4.3/5
Fall 2015	67	4.6/5	4.6/5
Fall 2016	69	4.2/5	4.5/5
Fall 2017	83	4.4/5	4.3/5
Fall 2018	96	4.1/5	4.2/5

ECE 695 Operating Systems Design and Implementation (graduate)

Semester	Students	Course rating	Instructor rating
Spring 2015	32	4.2/5	4.3/5
Spring 2016	19	4.5/5	4.6/5
Spring 2017	15	4.8/5	4.8/5
Spring 2018	8	4.3/5	4.9/5
Spring 2019	8	4.8/5	5/5

Courses Developed

ECE 695	Operating Systems Design and Implementation
CS 4414	Operating Systems
CS 6456	Graduate Operating Systems

Professional Society Activities

ACM

Activity: TPC Member, HotMobile, 2022;
Co-chair, Workshop on Simplifying Edge & Mobile Intelligence, 2020;
TPC Member, USENIX ATC, 2020;
TPC Member, HPCA, 2020;
Reviewer, ACM Transactions on Mobile Computing;
TPC Member, ISMM, 2019;
Session Chair, ASPLOS, 2019;
External Review Committee Member, ASPLOS, 2019;
Student Travel Grant Chair, HotMobile, 2019;
TPC Member, HotMobile, 2019;
Publication Co-chair, ASPLOS, 2018;
TPC Member, WearSys, 2017;
External Review Committee Member, MobiSys, 2017;
Web chair & TPC Member, ISLPED, 2016;
External Review Committee Member, ASPLOS, 2016;
TPC Member, Workshop on Mobile Gaming, 2015;
TPC Member, ISLPED, 2015;
TPC Member, HotPower, 2015;
External Review Committee Member, ASPLOS, 2015;

IEEE

Activity: TPC Member, IoTDI, 2022;
TPC Member, ICDCS, 2018;
TPC Member, SECON, 2016;
TPC Member, SECON, 2015

Outreach Activities

Faculty advisor, Purdue Mechatronics Club
Judge, Purdue EXPO Scholarship, 2018
Judge, Spark Challenge, 2018, 2019
Faculty advisor, Purdue SURF, 2016, 2017, 2018, 2019