Cai, Yifan

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EDUCATION University of Pennsylvania Philadelphia, PA Master of Science in Computer & Information Science Aug 2024 Advisor: Dr. Linh Thi Xuan Phan Ph.D. Student in Computer & Information Science Present Advisor: Dr. Linh Thi Xuan Phan **Research Interest:** Distributed systems and real-time systems Shanghai Jiao Tong University Shanghai, China

Jun 2020

Bachelor of Engineering, Software Engineering, System Software Track Overall GPA: 3.77 / 4.30 (88.19/100); Major GPA: 3.88 / 4.30 (89.95/100) **Honors/Awards:**

SJTU Scholarships (2016-2017, 2017-2018 & 2018-2019)

PUBLICATIONS

RoboRebound: Multi-Robot System Defense with Bounded-Time Interaction

Neeraj Gandhi, Yifan Cai, Andreas Haeberlen, and Linh Thi Xuan Phan To appear at the 20th European Conference on Computer Systems (EuroSys), 2025

Analysis of Long-term Average Behaviors of Probabilistic Task Systems

Yifan Cai, Linh Thi Xuan Phan, and P.S. Thiagarajan. In International Conference on Real-Time Networks and Systems (RTNS), 2024

Object-oriented Unified Encrypted Memory Management for Heterogeneous Memory Architectures

Mo Sha*, Yifan Cai*, Sheng Wang, Linh Thi Xuan Phan, Feifei Li, and Kian-Lee Tan (* Equal contribution) In International Conference on Management of Data (SIGMOD), 2024

VeriDB: An SGX-based Verifiable Database.

Wenchao Zhou, Yifan Cai, Yanqing Peng, Sheng Wang, Ke Ma, and Feifei Li In International Conference on Management of Data (SIGMOD), 2021

Understanding the Effect of Data Center Resource Disaggregation on Production DBMSs.

Qizhen Zhang, Yifan Cai, Xinyi Chen, Sebastian Angel, Ang Chen, Vincent Liu, and Boon Thau Loo. In 46th International Conference on Very Large Data Bases (VLDB), 2020.

Intra-day Forecast of Ground Horizontal Irradiance Using Long Short-Term Memory Network (LSTM)

Xiuhong Chen, Xianglei Huang, Yifan Cai, Haomin Shen, and Jiayue Lu. In Journal of the Meteorological Society of Japan. Ser. II, 2020, 98(5): 945-957.

Rethinking Data Management Systems for Disaggregated Data Centers.

Qizhen Zhang, Yifan Cai, Sebastian Angel, Ang Chen, Vincent Liu, and Boon Thau Loo. In Conference on Innovative Data Systems Research (CIDR), 2020.

Consensus-based Data Statistics in Distributed Network Systems.

Yifan Cai, Jianping He, Wenbin Yu, and Xinping Guan. In the 57th IEEE Conference on Decision and Control (CDC), 2018

PROJECTS AND EXPERIENCES

 Schedule-based Timing Side-channel Attacks in Real-time IoT devices <i>Ph.D. Project, with Dr. Linh Thi Xuan Phan</i> Designing and implementing an attack that leverages the deterministic nature infer the timing information of an IoT task. 	University of Pennsylvania Nov 2024 – Present of real-time systems to
 Fault Detection and Recovery in Geo-distributed Systems <i>Ph.D. Project, with Dr. Linh Thi Xuan Phan</i> Designed protocols for distributed systems that can detect, account for, and refaults in real time, despite the unreliable nature of the network in geo-distributed 	University of Pennsylvania Sep 2021 – Nov 2024 ecover from Byzantine ited systems.
Resource Allocation for Mega-Scale Gaming Experiences Roblox <i>Research Intern, supervised by Dr. Andreas Haeberlen and Dr. Linh Thi Xuan Phan</i> May 2024 – Aug 2024 • Designed a partitioning system for large-scale multiplayer gaming environments, optimizing server resource allocation while maintaining seamless player experience. Provided an efficient solution for cross-partition border management, minimizing data replication and inter-server communication overhead.	
 Data Security in Systems with Heterogeneous Memory Research Intern, supervised by Dr. Mo Sha and Dr. Sheng Wang Proposed a solution to ensure confidentiality, integrity, and freshness heterogeneous memory architectures, while providing a unified interface t Used centralized data structures to ensure data security, achieving up to traditional security techniques (e.g., AEAD).	Alibaba Group (U.S.) Inc May 2023 – Aug 2023 of data in a system with o the applications. o 6.3x speedup compared to

Schedulability Analysis for Probabilistic Real-time Systems

Ph.D. Project, with Dr. Linh Thi Xuan Phan and Dr. P.S. Thiagarajan

- Proposed a Markov chain-based model to analyze the long-term average of important properties, such as deadline miss ratio and the weakly-hard constraint violation probability of tasks in a real-time system.
- Provided the mathematical basis for the sampling method, which scales well in large task systems.

Data and Execution Integrity for Cloud Database Systems

Research Intern, supervised by Dr. Sheng Wang and Dr. Wenchao Zhou Sep 2020 – May 2021

- Worked on designing and implementing a cloud database providing data and execution integrity that can be verified by the users.
- Improved the performance of the verification process by introducing multiple verifiers and a mechanism to assign workloads to different verifiers. The improvement therefore allowed multiple transactions to be executed concurrently.
- Implemented database operators such as joins and scans with the additional steps needed for verifications, with which the database supported relational queries rather than only key-value lookup.

Database with Resource Disaggregation

Research Intern, Advisor: Dr. Vincent Liu

- Conducted research on the impact of disaggregated data centers on the design of relational databases.
- Developed microbenchmarks of nested loop join, hash join, and grace hash join operators and investigated the relationship between local memory size, the number of remote memory access and the performance degradation of each operation.
- Added features such as relative paths to LegoOS (a disaggregated operating system) by adding more system calls in order to deploy complex systems such as PostgreSQL and MonetDB on it.
- Analyzed the performance drawbacks of existing disaggregated operating systems for query executions and outlined potential solutions.

University of Pennsylvania Jul 2019 – Dec 2019

University of Pennsylvania

Dec 2022 – Oct 2023

Alibaba Cloud

Data Aggregation in Distributed Systems

Research Assistant, Advisor: Dr. Jianping He

- Invented a protocol in distributed network systems to compute probability density functions in a fully distributed way and enable multiple compute nodes to share their statistics.
- Designed and optimized two probability distribution functions (PDF) to calculate algorithms which run under both public and anonymous network conditions.

TEACHING

Teaching Assistant, University of Pennsylvania

- CIS 505 Software Systems, Fall 2021
- CIS 505 Software Systems, Fall 2022

SKILLS

Programming Languages:

Most Familiar: C/C++ and Python **Other:** Java, JavaScript, SQL

Shanghai Jiao Tong University Sep 2017 – Jun 2019