

Wentao Cai

PERSISTENT DISK - BLOCK STORAGE FOUNDATION & CORE I/O · GOOGLE CLOUD

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PhD interested in concurrent algorithms, storage systems, and persistent memory.

Had experience in software transactional memory (STM), databases, distributed systems, 3D rendering, and data mining.

Education

University of Rochester

M.S. and Ph.D. Student in Computer Science

- Advisor: Prof. Michael L. Scott

Rochester, NY

Sep. 2016 - Oct. 2022

Xidian University

B.E. in Computer Science and Technology

Xi'an, China

Aug. 2012 - July 2016

Experience

Block Storage Foundation & Core I/O

Google Cloud Persistent Disk

- Designing and implementing in C++ the next-gen block storage system with high performance and low latency.

Google, Kirkland

Oct. 2022 - Present

Optimizing Message Queues

Supervised by Dr. Nick Kidd and Dr. Marc de Kruijf

- Implemented lock-free multi-producer-single-consumer (MPSC) queues in C++ for datacenter message queues.

Google, Madison

Aug. 2021 - Nov. 2021

Adding Transactions to FASTER Key-value Store

Supervised by Dr. Jose Faleiro

- Designed an optimistic concurrency control (OCC) protocol and implemented transactions in FASTER-KV in C#.

Microsoft Research, Redmond

May 2021 - July 2021

Distributed Resource Management for Multiple Workloads

Supervised by Dr. Sahan Gamage

- Designed resource management for coordinating different schedulers (e.g., DRS and Kubernetes) in vSphere cluster.

VMware, Palo Alto

June 2020 - Sep. 2020

Function Support for Complex Array Types

Supervised by James Clampffer

- Implemented Explode (unnests array to rows) and Implode (aggregates rows to array) in C++ in Vertica database.

Vertica, Pittsburgh

June 2019 - Aug. 2019

Selected Work

Transactional Composition of Nonblocking Data Structures

- Developed in C++ a new paradigm for composing transactions of nonblocking operations, with up to 170% speedup.

Nov. 2021 - Aug. 2022

Auto Trading System

- Implemented in Python3 a trading system that runs and backtests componentized strategies.

Aug. 2021 - Apr. 2022

Fast Persistent Data Structures on Persistent Memory (PM)

- Developed Montage, a general system for building persistent concurrent data structures in C++, with >10x speedup.

Jan. 2020 - May 2021

Nonblocking Persistent Memory Allocation

- Developed a fast, nonblocking persistent memory allocator in C++, with up to 100x speedup.

Aug. 2018 - Nov. 2019

Personalized Computerized Cognitive Training (CCT) Program

- Investigated the correlation between ECGs and performance in CCT.

Jan. 2017 - Apr. 2017

3D Rendering System (Bachelor's Thesis)

- Developed a 3D interactive rendering system in C++ for STL files.
- Designed a topological reconstructing algorithm to correct facet normals.

Jan. 2016 - June 2016

- Studied in human age estimation, and implemented an estimation system.

Publications

Transactional Composition of Nonblocking Data Structures

W. Cai, H. Wen, and M. L. Scott

35th ACM Symp. on Parallelism in Algorithms and Architectures (SPAA)

Orlando, US

Jun. 2023

Fast Nonblocking Persistence for Concurrent Data Structures

W. Cai, H. Wen*, V. Maksimovski, M. Du, R. Sanna, S. Abdallah, and M. L. Scott (*Contributed equally)*

35th Intl. Symp. on Distributed Computing (DISC)

Freiburg, Germany

Oct. 2021

A Fast, General System for Buffered Persistent Data Structures

H. Wen, W. Cai*, M. Du, L. Jenkins, B. Valpey, M. L. Scott (*Contributed equally)*

50th Intl. Conf. on Parallel Processing (ICPP)

Chicago, US

Aug. 2021

Nonblocking Persistent Software Transactional Memory

H. A. Beadle, W. Cai, H. Wen, M. L. Scott

IEEE 27th Intl. Conf. on High Performance Computing, Data, and Analytics (HiPC)

Pune, India

Dec. 2020

Understanding and Optimizing Persistent Memory Allocation

W. Cai, H. Wen, H. A. Beadle, C. Kjellqvist, M. Hedayati, M. L. Scott

19th ACM Intl. Symp. on Memory Management (ISMM)

London, UK

Jun. 2020

Interval-Based Memory Reclamation

H. Wen, J. Izraelevitz, W. Cai, H. A. Beadle, M. L. Scott

23rd ACM Symp. on Principles and Practice of Parallel Programming (PPoPP)

Vienna, Austria

Feb. 2018

Skills

- C/C++, C#, Python, Shell Scripting (on Linux and MacOS), LaTeX, OCaml, SQL, MATLAB, R
- Multithreading, Lock-free Data Structures, Persistent Memory, Object-oriented Programming

Honors & Awards

2022 **Student Travel Grant**, NVMW

San Diego, US

2019 **Best Intern Poster**, Vertica

Pittsburgh, US

2018 **Student Travel Grant**, PPOPP

Vienna, Austria

2016 **Outstanding Graduate**, Xidian University

Xi'an, China

2014 **Second Prize**, Xidian ACM/ICPC

Xi'an, China

Professional Service

Reviewer, Software: Practice and Experience (SPE)

2022

Co-reviewer, Intl. Symp. on Memory Management (ISMM)

2022

Co-reviewer, Intl. Symp. on Distributed Computing (DISC)

2021

Artifact Evaluation Committee Member, ACM Symp. on Principles and Practice of Parallel Programming (PPoPP)

2020

Co-reviewer, Trans. on Parallel Computing (TOPC)

2019

Co-reviewer, Programming Models and Applications for Multicores and Manycores (PMAM)

2019

Co-reviewer, ACM Symp. on Principles and Practice of Parallel Programming (PPoPP)

2018

Teaching Assistant

CSC 2/454: Programming Language Design & Implementation

University of Rochester

Led by Professor Chen Ding

Fall 2018

Led by Professor Michael L. Scott

Fall 2017

- Designed, administrated, and graded projects, quizzes, and exams.
- Held weekly office hours and help sessions.

CSC 2/478: Computer Security Foundations

Led by Professor John Criswell

- Covered three lectures on authentication, TCP/IP, and malicious logic.
- Graded projects and exams, and held weekly office hours.

University of Rochester

Spring 2018

Extracurricular Activity

Xidian Multimedia Studio

Manager & Technical Advisor

- Maintained network, audio, and lighting systems in the Xidian Little Theater.

Xi'an, China

Sep. 2012 - Sep. 2014

Xidian Tencent Innovation Club (XDTIC)

Designer & Member

Xi'an, China

Sep. 2012 - Jan. 2014

Qiudi Literature Society

Vice Director & Editor

Xi'an, China

Sep. 2012 - Sep. 2014