Yizhou Shan

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UCSD Computer Science and Engineering

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Research Interests

My research interests span Distributed System, Operating System, and Computer Architecture, with a focus on building fast and reliable systems for datacenters. I work at Wuklab, UCSD, under the supervision of Prof. Yiying Zhang.

Education

University of California, San Diego 2019-2022
Ph.D. in Computer Science

Purdue University 2016-2019
Ph.D. in Computer Engineering (Transferred to UCSD)

Beijing University of Aeronautics and Astronautics (BUAA) 2010-2014
B.E. in Computer Engineering

Industry Experiences

Microsoft Research - Intern Virtual
Mentors: Ziqiao Zhou, Weidong Cui, Andrew Baumann, Marcus Peinado 2021

VMware Research - Intern Palo Alto, CA
Mentor: Marcos K. Aguilera 2019

VMware Research - Intern Palo Alto, CA
Mentor: Stanko Novakovic 2018

ICT, Chinese Academy of Sciences - Research Assistant Beijing, China
Mentors: Zhiwei Xu, Jin Xiong, Dejun Jiang 2014-2016

Publications

[7] De-Virtualize the Virtualized Cloud for Performance *and* Security ***Under Submission***
Ziqiao Zhou, ***Yizhou Shan***, Weidong Cui, Xinyang Ge, Marcus Peinado, Andrew Baumann

[6] Disaggregating and Consolidating Network Functionalities with SuperNIC ***Under Submission***
Yizhou Shan, Will Lin, Ryan Kosta, Arvind Krishnamurthy, Yiying Zhang

[5] Clio: A Hardware-Software Co-Designed Disaggregated Memory System ***ASPLOS '22***
Yizhou Shan*, Zhiyuan Guo*, Xuhao Luo, Yutong Huang, Yiying Zhang (co-first authors)

[4] Disaggregating Persistent Memory and Controlling Them Remotely: An Exploration of Passive Disaggregated Key-Value Stores ***ATC '20***
Shin-Yeh Tsai, ***Yizhou Shan****, Yiying Zhang*

[3] Storm: a Fast Distributed Storage System Using Remote Memory Primitives ***SYSTOR '19***
Best Paper
Stanko Novakovic, ***Yizhou Shan***, Aasheesh Kolli, Michael Cui, Yiying Zhang, Haggai Eran, Liran Liss, Michael Wei, Dan Tsafrir, Marcos Aguilera

[2] LegoOS: A Disseminated, Distributed OS for Hardware Resource Disaggregation ***OSDI'18***
Yizhou Shan, Yutong Huang, Yilun Chen, Yiying Zhang ***Best Paper***

[1] Distributed Shared Persistent Memory ***SoCC '17***
Yizhou Shan, Shin-Yeh Tsai, Yiying Zhang

WORKSHOPS AND POSTERS

[6] Challenges in Building and Deploying Disaggregated Persistent Memory ***NVMW '19***
Yizhou Shan, Yutong Huang, Yiying Zhang

[5] Distributed Shared Persistent Memory ***NVMW '18***
Yizhou Shan, Shin-Yeh Tsai, Yiying Zhang

[4] Disaggregating Memory with Software-Managed Virtual Cache ***WAMS '18***
Yizhou Shan, Yiying Zhang

[3] Disaggregated Operating System ***HPTS '17***
Yiying Zhang, ***Yizhou Shan***, Sumukh Hallymysore

[2] Lego: A Distributed, Decomposed OS for Resource Disaggregation *Poster at* ***SOSP '17***
Yizhou Shan, Yilun Chen, Yutong Huang, Sumukh Hallymysore, Yiying Zhang

[1] Disaggregated Operating System *Poster at* ***SoCC '17***
Yizhou Shan, Sumukh Hallymysore, Yutong Huang, Yilun Chen, Yiying Zhang

Professional Services

Program Committee
EuroSys '22 (Shadow PC)
EuroSys '21 (Shadow PC)
ASPLOS '21 (External PC)

Journal Review
Journal of Systems Research: 2021 - Current
ACM Transactions on Architecture and Code Optimization (TACO): 2021
ACM Transactions on Storage (TOS): 2020
IEEE/ACM Transactions on Networking: 2020

Artifact Evaluation
SOSP'21 (Artifact Evaluation)
OSDI '20 (Artifact Evaluation)

Teaching

TA for UCSD CSE120 Undergraduate Operating System

Awards

2020 Facebook Fellowship Finalist
SYSTOR'19 Best Paper Award
OSDI '18 Jay Lepreau Best Paper Award

OSDI '18 Student Travel Grant
SOSP '17 Student Travel Grant
SoCC '17 Student Travel Grant

Research Experiences

Network Design for Disaggregated Datacenter (Work-in-Progress) 2020-Current
UCSD
How to build a disaggregated datacenter when both the number of network ports and bandwidth requirement exploded? We propose a way to solve this issue without disrupting the existing network infrastructure.

Programmable Disaggregated Memory System (Under Submission) 2018-Current
Purdue University and UCSD
We are building a hardware-based active disaggregated memory system using FPGA. This is a follow-up work of LegoOS. We build a distributed hardware-based virtual memory system, and a framework for building memory services.

Serverless on Disaggregated Datacenter (WIP) 2019-Current
UCSD
We are trying to demonstrate when serverless means no server. Instead of using monolithic machines, we explore the possibility of using a disaggregated datacenter. Instead of optimizing existing VM and container technologies, we explore a new way to run serverless functions: using library OS.

An Operating System Inside Cloud FPGA (Concluded) 2019-2020
UCSD
We are building a new operating system inside a cloud FPGA. This new runtime overcomes the limitations of static compile-time approaches and provides a set of new services. We explored how this helps reduce cost and enable new FPGA apps.

Optimize Page Faults 2019 May-Aug
VMware Research
Ancient old page fault handling is the driving wheel for many emerging datacenter systems and applications. But the page fault handling mechanism was designed for millisecond-level disk operations, there is a performance mismatch when it is used by fast devices like RDMA, or PM. We are now trying to close the gap.

LegoOS: A Disaggregated Operating System 2017-2018
Purdue University
We propose a new OS model called the splitkernel to manage disaggregated systems. Splitkernel disseminates traditional OS functionalities into loosely-coupled monitors, each of which runs on and manages a hardware component. Using the splitkernel model, we built LegoOS, a new OS designed for hardware resource disaggregation.

Hotpot: Distributed Shared Persistent Memory 2016-2017
Purdue University
We propose Distributed Shared Persistent Memory (DSPM), a new framework for using persistent memories in datacenter environments. We designed and implemented *Hotpot*, the first DSPM system in the Linux kernel. Hotpot provides low-latency, transparent memory accesses, data persistence, data reliability and high availability.

Non-Volatile Memory (NVM) Emulator 2015-2016
Institute of Computing Technology, Chinese Academy of Sciences
We designed and implemented a NVM emulator in Linux kernel, which leverages Intel's Performance Monitoring Unit to emulate NVM's slower read/write latency and smaller bandwidth on physical DRAM. This emulator runs on bare-metal x86 machines.

ARMv8 CPU Project 2013
Institute of Computing Technology, Chinese Academy of Sciences
I participated in the Register-Transfer Level design and verification of some blocks within the cache unit and load-store unit. It is a commercial project collaborated with Huawei.

Skills

Languages: x86 Assembly, C, C++, Python, Scala, Rust, Go, TCL, Verilog, Java
Systems: Linux Kernel, DPDK/RDMA, KVM, QEMU, Docker, k8s, Pytorch, Tensorflow, Spark, Memcached, Vivado, Vivado HLS, Vitis, SpinalHDL, Chisel