Yizhou Shan

Ph.D. Candidate
Computer Science and Engineering
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Last Updated: Dec 2021

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 2010-2014
B.E. in Computer Engineering

INDUSTRY EXPERIENCE

Microsoft Research. Research Intern Virtual. Summer 2021
Collaborators: *Ziqiao Zhou*, *Weidong Cui, Andrew Baumann, and Marcus Peinado*

VMware Research. Research Intern Palo Alto, CA. Summer 2019
Collaborator: *Marcos K. Aguilera*

VMware Research. Research Intern Palo Alto, CA. Summer 2018
Collaborator: *Stanko Novakovic*

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

PUBLICATIONS

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

[6] Disaggregating and Consolidating Network Functionalities with SuperNIC
Yizhou Shan, Will Lin, Ryan Kosta, Arvind Krishnamurthy, Yiying Zhang
Under Submission ***Preprint:*** *https://arxiv.org/abs/2109.07744*.

[5] Clio: A Hardware-Software Co-Designed Disaggregated Memory System
Yizhou Shan*, Zhiyuan Guo*, Xuhao Luo, Yutong Huang, Yiying Zhang (co-first authors)
ASPLOS '22 ***Preprint:*** *https://arxiv.org/pdf/2108.03492.pdf*.

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

[3] 🏆 Storm: a fast distributed storage system using remote memory primitives
Stanko Novakovic, ***Yizhou Shan***, Aasheesh Kolli, Michael Cui, Yiying Zhang, Haggai Eran, Liran Liss, Michael Wei, Dan Tsafrir, Marcos Aguilera
SYSTOR '19 ***Best Paper Award***

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

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

WORKSHOPS AND POSTERS

[6] Yizhou Shan, Yutong Huang, Yiying Zhang, "Challenges in Building and Deploying Disaggregated Persistent Memory", 10th Annual Non-Volatile Memories Workshop (***NVMW '19***)

[5] Yizhou Shan, Shin-Yeh Tsai, Yiying Zhang, "Distributed Shared Persistent Memory", 9th Annual Non-Volatile Memories Workshop (***NVMW '18***)

[4] Yizhou Shan, Yiying Zhang, "Disaggregating Memory with Software-Managed Virtual Cache", the 2018 Workshop on Warehouse-scale Memory Systems (***WAMS '18***) (co-located with ASPLOS '18)

[3] Yiying Zhang, **Yizhou Shan**, Sumukh Hallymysore, "Disaggregated Operating System", 17th International Workshop on High Performance Transaction Systems (***HPTS '17***)

[2] Yizhou Shan, Yilun Chen, Yutong Huang, Sumukh Hallymysore, Yiying Zhang, "Lego: A Distributed, Decomposed OS for Resource Disaggregation", Poster at the 26th ACM Symposium on Operating Systems Principles (***SOSP '17***)

[1] Yizhou Shan, Sumukh Hallymysore, Yutong Huang, Yilun Chen, Yiying Zhang, "Disaggregated Operating System", Poster at the ACM Symposium on Cloud Computing 2017 (***SoCC '17***)

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)

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 EXPERIENCE

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