ZHIYAO MA

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RESEARCH INTEREST

Zhiyao Ma is a Ph.D candidate in the department of computer science at Yale University. He is advised by Professor Lin Zhong, Ph.D. His research interests lie in the field of operating systems, specifically its design and implementation on resource constrained platforms. His current focus is on building a Rust-based embedded operating system called Hopter, which enables memory safe, memory efficient, reliable, and responsive applications via co-design between the kernel and compiler. His is also exploring to empower a resource constrained computer at the OS layer, aided by a resourceful computer connected over the network. He is interested in the broader fields of programming languages and compilers as well. Zhiyao enjoys driving on tracks at HPDE, currently in the intermediate run group, and he also holds a Kendo 3rd Dan rank.

EDUCATION

Yale University, New Haven, USA *August 2020 - Present*

- Department of Computer Science
- Ph.D Candidate
- Master of Science (2023) & Master of Philosophy (2024)
- Efficient Computing Group (Advised by Prof. Lin Zhong)

Peking University, Beijing, China *September 2016 - July 2020*

- School of Electronics Engineering and Computer Science
- Bachelor of Science (Summa Cum Laude)
- Excellent Graduate, Merit Student (twice)
- GPA: 3.80/4.00
- Scholarship: National Scholarship (2%), 1st Prize Scholarship of EECS Department (5%, twice)

Rice University, Houston, USA *June 2019 - September 2019*

- Visiting undergraduate researcher, advised by Prof. Lin Zhong

PUBLICATIONS

- Zhiyao Ma, Samantha Detor, and Lin Zhong. “Offloading Operating System Functions to the Cloud.” In Proceedings HotMobile 2024.
- Zhiyao Ma, Guojun Chen, and Lin Zhong. “Panic Recovery in Rust-based Embedded Systems.” In Proceedings PLOS 2023.
- Zhiyao Ma, and Lin Zhong. “Bringing Segmented Stacks to Embedded Systems.” In Proceedings HotMobile 2023.
- Yunzhe Ni, Feng Qian, Taide Liu, Yihua Cheng, Zhiyao Ma, Jing Wang, Zhongfeng Wang, Gang Huang, Xuanzhe Liu, and Chenren Xu. “POLYCORN: Data-driven Cross-layer Multipath Networking for High-speed Railway through Composable Schedulerlets.” In Proceedings NSDI 2023.
- Shuang Jiang, Zhiyao Ma, Xiao Zeng, Chenren Xu, Mi Zhang, Chen Zhang, and Yunxin Liu. “Scylla: Qoe-aware continuous mobile vision with fpga-based dynamic deep neural network reconfiguration.” In Proceedings INFOCOM 2020.
- Chenren Xu, Jing Wang, Zhiyao Ma, Yihua Cheng, Yunzhe Ni, Wangyang Li, Feng Qian, and Yuanjie Li. ”A first look at disconnection-centric TCP performance on high-speed railways.” In JSAC 2020.

OPEN-SOURCE PROJECTS

Hopter - Safe, Efficient, Reliable, and Responsive Rust-based Embedded OS

Hopter is a Rust-based embedded operating system built to enable memory-safe, efficient, reliable, and responsive applications. It is co-designed with a customized compiler that guarantees additional invariants beyond what Rust can express. Also, Hopter does not rely on any hardware protection mechanisms, providing safety purely through software.

- Memory safety: Hopter prevents stack overflows on top of other memory safety aspects guaranteed by Rust.
- Memory efficiency: Hopter can allocate stacks on-demand in small chunks called stacklets, time-multiplexing the stack memory among tasks.
- Reliability: Hopter is not afraid of panic. Tasks can be spwaned as restartable tasks, which automatically restart if they panic.
- Responsiveness: Hopter supports zero-latency IRQ handling. The kernel never disables IRQs, ensuring that pending interrupts are handled immediately.

Repository: `https://github.com/hopter-project/hopter`

Hadusos - Half-Duplex Session Over Serial Protocol

Hadusos is a session protocol allowing reliable communication over serial devices. Two participants of the protocol either assumes the sender or the receiver role at a time, thus half-duplex. Hadusos has the following features:

- Simple: The simple design of the protocol leads to slim implementation code and thus small binary overhead which is especially important for storage constrained embedded devices.
- Zero-copy: No dynamic memory allocation is needed. Most received bytes goes directly into the client buffer without any copying, and all bytes to be sent goes directly to the serial devices.
- Panic-free: The protocol implementation code never panics.

Repository: `https://github.com/ZhiyaoMa98/hadusos-protocol`

Documentation: `https://docs.rs/hadusos/0.2.1/hadusos/`

TEACHING EXPERIENCE

Mobile and Embedded Systems @ Yale University
Teaching Assistant *February 2022 - May 2022*

Operating System Design and Implementation @ Yale University
Teaching Assistant *August 2021 - September 2021*

Computer Organization and Architecture @ Peking University
Teaching Assistant *February 2019 - June 2020*

Introduction to Computer Systems @ Peking University
Teaching Assistant *September 2019 - January 2020*
Teaching Assistant *September 2018 - January 2019*