Jiakun Yan

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Research Interests

My research interest lies in **parallel computing** and the broader **computer system** area. Currently, I am interested in designing high-level task-based programming models and low-level communication systems to better utilize modern parallel architectures and improve the performance, scalability, and programmability of modern parallel applications.

Education

University of Illinois at Urbana-Champaign **Illinois, USA**
Aug. 2020 -

- Computer Science PhD student, advised by Marc Snir
- Pursue research in Parallel Computing

Shanghai Jiao Tong University **Shanghai, China**
Sep. 2016 - Jun. 2020

- Senior undergraduate, Dept. of Computer Science.
- Zhiyuan Honors Program of Engineering (an elite program for top 5% talented students)
- Major GPA: 91.88 | Ranking: 4^{th}/151.

University of California, Berkeley **California, USA**
Jan. 2019 - May 2019

- Exchange student, Berkeley Global Access Discover Program.
- 13 units, GPA: 4.0/4.0 with two A+ and one graduate level course

Experience

PASSION Lab **Lawrence Berkeley Laboratory**
Research Assistant, advised by Aydın Buluç and Katherine Yelick *Aug. 2019 - Jan. 2020*

- Asynchronous RPC Library (ARL): a high-throughput RPC system with node-level aggregation and single-node work-stealing.
- RDMA vs. RPC for Implementing Distributed Data Structures

Publication

- Benjamin Brock, Yuxin Chen, **Jiakun Yan**, John Owens, Aydın Buluç, and Katherine Yelick. "RDMA vs. RPC for Implementing Distributed Data Structures", Workshop on Irregular Applications: Architectures and Algorithms (IA3), 2019.

Project

Lightweight Communication Interface **UIUC**
Advised by Prof. Marc Snir *Aug. 2020 - Present*

- The Lightweight Communication Interface (LCI) is designed to be a communication runtime used by libraries and frameworks. It aims to avoid many of the shortcomings of the Message Passing Interface (MPI) exposed by modern parallel architectures and applications, such as the multi-threaded performance, smart NIC utilization, and signaling mechanisms.
- I am one of the major developers of LCI. I developed the Libfabric backend of LCI to enable LCI to run on the Cray/GNI platforms. I am evaluating the multi-threaded performance of LCI and exploring ways, such as utilizing multiple hardware contexts, to improve its multi-threaded performance.

Asynchronous RPC Library (ARL) **LBNL**
Advised by Prof. Aydın Buluç and Katherine Yelick , Github *Aug. 2019 - Present*

- Data-driven HPC applications suffer significant overheads for their fine-grained communication patterns. ARL is a thread-based RPC system that targets data-driven applications. It uses Remote Procedure Call (RPC) to provide powerful expressive ability. It achieves high performance through node-level aggregation, single-node work-stealing, and innovative concurrent data structures. It also provides a flexible programming interface for users.
- Node-level aggregation is the primary idea underlying the ARL, which aggregates RPC requests sharing the same source and target node and sends them together as one large message. Using this methodology, ARL is able to utilize high bandwidth across cores on the same node to achieve low overhead and high throughput.
- I am the main developer of the ARL. ARL is developed as a C++ header-only library based on the GASNet_EX communication library.

RDMA vs. RPC for Implementing Distributed Data Structures **LBNL**
Advised by Prof. Aydın Buluç and Katherine Yelick , preprint *Aug. 2019 - Sep. 2019*

- RDMA and RPC are two primary communication primitives of implementing distributed data structures. In this project, we compared the implementation of distributed data structures using RDMA and RPC. We developed an analytical model to predict the performance of RDMA- and RPC- based data structures based on their constituent operations, and then compared it with real-world performance.
- My primary focus in this project is to design and conduct experiments to investigate the attentiveness problem of RPC, which became one of the motivations for the later ARL system project.
- This project is presented on IA^3 workshop, Supercomputing 2019.

Berkeley Container Library in Rust **UC Berkeley**
UC Berkeley CS267, graduate-level course project, Github *Jan. 2019 - May. 2019*

- The Berkeley Container Library (BCL) is a distributed data structure library based on RDMA written in C++. We re-design and implement BCL using Rust language to provide several safety guarantees for the distributed data structures, including data race, memory leaking, type check, and explicit type convert.
- I am one of the main developers of BCL in Rust. I developed the global pointer based on OpenSHMEM backend, which is the base for high-level data structure and has little overhead compared to the raw backend functions, and the global guard, which prevents data race in reference to the mutex struct in Rust. I also contributed some codes to the distributed Array, GuardArray struct, and their benchmarks.

PPT Ctrl: an interactive PPT control APP **SJTU**
Advised by Prof. Linghe Kong , Github *Sep. 2018 - Jan. 2019*

- PPT is a powerful medium to convey ideas and share information in a broad array of scenarios. However, current PPT remote control tools are far from perfect. PPT Ctrl is a mobile application enabling people to control PPT in an interactive way. It has various functions including page switching, highlighting, magnifying, drawing, and real-time computer screen display.
- I am the main developer of PPT Ctrl. It won the first prize in the Chinese University Student Computer Application Ability Competition, 2019.

Patent

- **Jiakun Yan**, Jingzhu Shao, Zhen Huang, Yanzhou Xiang, Yutong Liao, Ruohan Hu, Jin Qi, Shuo Jiang, "A vibrating alarm clock based on pressure sensors", Utility model ZL 2017 2 1300094.X, China

Honors and Awards

- **Chinese University Student Computer Application Ability Competition, the first price**. 2019
- **Fan Hsu-chi Scholarship** Awarded to about 10 top students in SJTU every year. 2018-2019
- **National Scholarship** Highest honor for undergraduates in China, awarded to top 0.2% students. 2017
- **Zhiyuan Honorary Scholarship** Elite program scholarship for top 5% talented students. 2016-2019