Yibo Huang

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Research Interests

- Distributed Systems, Data Center Networking, RDMA-enable Systems, Network Stack Design, High-performance RPC Framework, Hybrid computing

Education

- **Fudan University** — Shanghai, China
  Ph.D. Student - Computer Science; GPA: 3.8/4.0(Top 2%) — *Sep 2016 - Dec 2021*
  Advisor: *Prof. Jie Wu, Prof. Yang Xu, Prof. Zhihui Lv*
- **Central South University** — Changsha, China
  B.S. - Software Engineering; GPA: 3.9/4.0(Top 1%) — *Sep 2012 - Jun 2016*
  Advisor: *Prof. Liu Yang*

Publications and In Preparation

- Yibo Huang, Yukai Huang, Jiayu Hu, Ming Yan, Jie Wu, Cunming Liang, Yang Xu, Jokul Li. *NTSocks: A Ultra-Low-Latency, Scalable and Isolated User-Space In-Rack Interconnection over PCIe NTB Fabric.* under submission (NSDI 2022 Fall).
- Yibo Huang, Wenxiong Zou, Yukai Huang, Kai Zhang, Zhihui Lv, Jie Wu, and Patrick CK Hung. *RHC: RDMA-Enabled Hybrid Computing Framework in Workload-Aware Manner.* in preparation.
- Bobo Huang, Rui Zhang, Zhihui Lv, Yiming Zhang, Jie Wu, Lu Zhan, and Patrick CK Hung. *BPS: A reliable and efficient pub/sub communication model with blockchain-enhanced paradigm in multi-tenant edge cloud.* Journal of Parallel and Distributed Computing (JPDC), Volume 143, p.167-178, 2020
- Bobo Huang, Li Jin, ZhiHui Lv, Xin Zhou, Jie Wu, Qifeng Tang, and Patrick CK Hung. *BoR: Toward high-performance permissioned blockchain in rdma-enabled network.* IEEE Transactions on Services Computing (TSC), Volume 13, Issue 2, p.301-313, 2019
- Bobo Huang, Li Jin, Zhihui Lv, Ming Yan, Jie Wu, Patrick CK Hung, and Qifeng Tang. *RDMA-driven MongoDB: An approach of RDMA enhanced NoSQL paradigm for large-Scale data processing.* Information Sciences (Inf. Sci.), Volume 502, p.376-393, 2019
- Jie Wu, Ming Yan, Chengrong Wu, Wenwei Li, Guangsheng Luo, Bobo Huang. *A Approach of Protocol-Independent Double Congestion Control.* China, CN108882302A[P], 2018-11-23.

Research Experience

- **High-Performance RDMA IO Engine & RPC for Training & Storage Systems** — May 2020 - Present
  Cooperating with Bytedance, we propose a fast, scalable and highly available RDMA engine and RPC framework.
  - **Supervisors**: Prof. Jie Wu, Prof. Yang Xu, Dr. Yi Cui, Jianxi Ye, Dr. Chuanxiong Guo
  - **Highlight 1**: Design & implement *BE*, an industry-leading user-level high-performance RDMA IO framework for Bytedance large-scale online/offline training and storage systems. Design & implement a RDMA-enabled, general-purpose, and high-performance RPC library, termed *be4brpc*.
  - **Highlight 2**: For distributed key-value caching system, we use *be4brpc* to build Redis Proxy component and use *BE* to build Redis Server component, respectively. We also leverage *BE* to build online inference system.
  - **Highlight 3**: The real-world evaluation shows that RDMA Redis improves performance than TCP Redis by up to 4.35×; RDMA inference achieves better average and p99 tail latency than TCP-based by up to 35.7% and 43.7%, respectively.
- **RDMA-Based Hybrid Computing for HPC and AI Fusion System** — Mar 2019 - Present
  Design general, iterative and distributed matrix computing via RDMA-enabled HPC-AI fusion platform.
  - **Supervisors**: Prof. Sean Xiaoyang Wang, Prof. Jie Wu, Prof. Kai Zhang
  - **Highlight 1**: Explore how to offload Matrix-based iterative linear algebra tasks into MPI-based HPC via RDMA, and return the computing results to general DAG-enabled streaming computing platform.
  - **Highlight 2**: Explore the relationship between MPI-based matrix computing efficiency, matrix storage layout and RDMA-based transfer overhead.
  - **Highlight 3**: Explore how to efficiently distribute immediate matrix data into MPI workers located at HPC through RDMA verbs according to the demand of MPI-based matrix computing.
- **Intel DPDK and SPDK technology accelerate Hybrid Cloud services** — Jan 2019 - Jul 2020
  Cooperating with Intel NPG, we propose a ultra-low latency and scalable in-rack interconnection over PCIe fabric.
  - **Supervisors**: Prof. Jie Wu, Jokul Li (Intel), Steve Cunming Liang (Intel), Jiayu Hu (Intel)
  - **Basic Idea**: We argue that PCIe fabric is an ideal high-speed in-rack network technology, as it eliminates the translation overhead between PCIe bus and network protocol, unlike existing hardware offloading and user-space IO.
  - **Highlight 1**: We design & implement *NTSocks*, the first user-space in-rack interconnection over PCIe NTB fabric that virtualizes native NTB into high-level network functionalities for rack-scale systems with software-hardware co-design.

- **Highlight 2**: NTSocks provides compatibility with a fast socket-like abstraction; ensures multi-core scalability using a core-driven dataplane model, which allocates cores on demand for NTB link multiplexing; realizes fair and efficient resource sharing with a multi-tenant performance isolation mechanism.
- **Highlight 3**: In our evaluations with latency-sensitive Key-Value Store, NTSocks achieves better latency by up to 24.5× and 1.58× than kernel and RDMA socket, respectively.

Industrial Experience

- **Research Intern - Bytedance Inc.** Beijing, China
  High-Speed Network Group *May 2020 - Present*
  - **Mentor**: Dr. Yi Cui, Dr. Chuanxiong Guo
  - **Project**: RDMA-Enabled High-Performance IO and RPC Framework for Online/Offline Training & Storage Systems.
- **Software Engineer Intern - Intel Asia Pacific R&D Center** Shanghai, China
  Open Source Technology Center (OTC) *Jul 2015 - Nov 2015*
  - **Mentors**: Dr. Shane Wang, Lianhao Lu
  - **Project**: Development and benchmark for Ceilometer/Neutron component in Openstack.
- **Software Engineer Intern - Intel Asia Pacific R&D Center** Shanghai, China
  Open Source Technology Center (OTC) *Mar 2015 - Jun 2015*
  - **Mentor**: Yongkang You
  - **Project**: Development and maintenance of crosswalk-app-tool-deb packaging tool for web runtime Crosswalk.

Selected Awards

- The Oceanwide Scholar for excellent academic performance in FDU - December, 2020
  - Only 10 winners in FDU each year.
- Intel Fellowship - November, 2020
- The Second Prize in the 8th APAC RDMA Programming Competition - November, 2020
- The Second Prize in the 7th APAC RDMA Programming Competition - November, 2019
- Merit Prize in the 2nd APAC HPC-AI Competition - August, 2019
- "Excellent Doctoral Research Promotion Program" funding - June, 2019
- Outstanding Teaching Assistant, Outstanding Student in FDU - October, 2018
- The Second Prize in the 6th APAC RDMA Programming Competition - October, 2018
- Ph.D. Candidate Scholarship - September, 2018
- The Third Prize in the 14th China Graduate Mathematical Contest in Modeling - December, 2017
- Honored Graduate in CSU - June, 2016
- Guangyun Innovation Scholarship for undergraduate students in CSU - March, 2016
- "Distinguished Student" Award in CSU - March, 2016
  - Only 10 winners in CSU each year, for undergraduate students.
- Outotec Sustainable Development Award for "Hand Drawn Heart Language" project - May, 2015
- The First Place in the Intel Cup 7th National Software Innovation Competition, China - October, 2014
  - Only 1 winner for National Grand Prize each year.
- National Scholarship for undergraduate students - October, 2014

Teaching Experience

- **Teaching Assistant at School of Computer Science, FDU** Fall 2020
  "Frontier Network Technology" for graduate students, supervised by Prof. Jie Wu.
- **Teaching Assistant at School of Computer Science, FDU** Fall 2019
  "Advanced Network" for graduate students, supervised by Prof. Zhihui Lv.
- **Teaching Assistant at School of Computer Science, FDU** Fall 2018
  "Calculus" for international undergraduate students, supervised by Prof. Yitong Wang.
- **Teaching Assistant at School of Computer Science, FDU** Fall 2018
  "Introduction to Python Programming" for undergraduate students, supervised by Prof. Xueping Wang.