# Jiakun Yan

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## Research Interests

My research interest lies in parallel computing, especially in **high-performance RDMA-based system design**. Currently, I am focusing on designing better communication libraries for highly dynamic/irregular programming systems and applications. I am the main developer of *Lightweight Communication Interface (LCI)* and also contributed/contributing to *MPICH* , *HPX* , *Legion* , and *Charm++*
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## Education

**University of Illinois at Urbana-Champaign** **Illinois, USA**
- Computer Science PhD student, advised by Marc Snir . *Aug. 2020 - Dec. 2025 (Expected)*
- Research around high-performance communication libraries, especially *Lightweight Communication Interface (LCI)* , investigating their support for asynchronous and multithreaded execution and their implications for emerging programming models.
- GPA: 4.0/4.0

**Shanghai Jiao Tong University** **Shanghai, China**
- Bachelor's Degree of Engineering, Dept. of Computer Science. *Sep. 2016 - Jun. 2020*
- Zhiyuan Honors Program of Engineering (an elite program for top 5% talented students)
- GPA: 91.88/100 | Ranking: 4th/151.

**University of California, Berkeley** **California, USA**
- Exchange student, Berkeley Global Access Discover Program, GPA: 4.0/4.0. *Jan. 2019 - May 2019*

## Experience

**GPU Software, Legate Group** **NVIDIA**
*Software Engineer Intern, worked with Manolis Papadakis and Hessam Mirsadeghi* *May. 2024 - Aug. 2024*
- Performance profiling and optimization for *Legion* UCX backend.

**Programming Models and Runtime Systems Group** **Argonne National Laboratory**
*Research Intern, advised by Yanfei Guo* *May. 2023 - Aug. 2023*
- Design and Evaluation of the MPI Continuation and VCI extensions in MPICH.

**Programming Systems and Applications Research Group** **NVIDIA Research**
*Research Intern, advised by Michael Bauer and Michael Garland* *May. 2022 - Aug. 2022*
- Realm Collective: design and implement collective communication operations in *Legion* Realm.

**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

- **Jiakun Yan**, Marc Snir, Yanfei Guo. *Examine MPI and its Extensions for Asynchronous Multithreaded Communication*, Proceedings of the 32nd European MPI Users' Group Meeting (EuroMPI), 2025.
- **Jiakun Yan**, Marc Snir. *LCI: a Lightweight Communication Interface for Efficient Asynchronous Multithreaded Communication*, Proceedings of the 2025 International Conference for High Performance Computing, Networking, Storage and Analysis (SC), 2025.

- **Jiakun Yan**, Hartmut Kaiser, Marc Snir. *Understanding the Communication Needs of Asynchronous Many-Task Systems – A Case Study of HPX+LCI*, preprint, 2025.
- **Jiakun Yan**, Marc Snir. *Contemplating a Lightweight Communication Interface for Asynchronous Many-Task Systems*, Workshop on Asynchronous Many-Task Systems and Applications (WAMTA), 2025.
- Gregor Daiß, Patrick Diehl, **Jiakun Yan**, John K. Holmen, Rahulkumar Gayatri, Christoph Junghans, Alexander Straub, Jeff R. Hammond, Dominic Marcello, Miwako Tsuji, Dirk Pflüger, Hartmut Kaiser. *Asynchronous-Many-Task Systems: Challenges and Opportunities – Scaling an AMR Astrophysics Code on Exascale machines using Kokkos and HPX*, preprint, 2024.
- **Jiakun Yan**, Hartmut Kaiser, and Marc Snir. *Design and Analysis of the Network Software Stack of an Asynchronous Many-task System – The LCI parcelport of HPX*, SC'23 Workshops of The International Conference on High Performance Computing, Network, Storage, and Analysis (SC-W), 2023.
- Benjamin Brock, Yuxin Chen, **Jiakun Yan**, John Owens, Aydın Buluç, and Katherine Yelick. *RDMA vs. RPC for Implementing Distributed Data Structures*, 2019 IEEE/ACM 9th Workshop on Irregular Applications: Architectures and Algorithms (IA$^3$), 2019.

## Project

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

- *Lightweight Communication Interface (LCI)* is an experimental communication library and research tool designed to support asynchronous communication in multithreaded environments. It features a unified interface for common communication primitives, flexible synchronization semantics, and explicit control over communication resources and runtime behavior.
- LCI delivers optimal multithreaded performance, on par with the traditional one-process-per-core setup. LCI has been integrated into *PaRSEC* and *HPX* and outperforms their original communication backends. We are working on integrating LCI into Charm++.

**HPX over LCI** **UIUC**
*Advised by Marc Snir and Hartmut Kaiser* *Aug. 2021 - Oct. 2023*

- *HPX* is a runtime system known for its support for the asynchronous task programming model. In this project, we added an LCI parcelport for HPX, enabling more direct support of HPX communication and scheduling logic.
- Compared to the MPI parcelport, the LCI parcelport achieves up to 100x improvement in microbenchmark and around 2x in a real-world application, Octo-Tiger (on NERSC Perlmutter with 1720 nodes).
- The LCI parcelport has been shipped with HPX releases since HPX 1.8.0 and used in a few HPX applications.

**Collective Communication Operations in Realm** **NVIDIA Research**
*Advised by Michael Bauer and Michael Garland* *May 2021 - Aug. 2021*

- Realm is an event-based low-level runtime system providing a high-performance asynchronous task execution model for the higher-level data-centric parallel programming system *Legion* . In this project, we extended its generic copy operation to handle collective broadcast communication across CPU/GPU buffers.
- We designed and implemented a hierarchical path planning algorithm that includes inter-node radix tree broadcast and intra-node path aggregation. It achieved significant improvement compared to the original point-to-point copies on a set of synthetic benchmarks.

## Honors and Awards

- **Best Poster Award**, WAMTA24 Feb. 2024
  *A Lightweight Communication Interface for Asynchronous Many-Task Systems*

## Skills

- **Programming Language:** C, C++, Python, CUDA, Java, Rust, Go
- **Library & Framework:** libibverbs, libfabric, UCX, MPI, GASNet-EX, UPC++, OpenSHMEM, Argobots