

Statement of Purpose

Application to the Ph.D. Program

Inspired by the ambition of advancing high-speed networking technologies, I am excited to embark on the journey of pursuing a Ph.D. in Computer Science at the University of Washington (UW). My passion for this field stems from my Master's thesis, **which delved into a problem related to the Remote Direct Memory Access (RDMA) deployment at scale in the optical electrical hybrid data centers, igniting my desire to contribute to the field of computer networking (explain why the thesis ignites your passion for Ph.D program?).**

[Academic]

My academic journey commenced at Shanghai Jiao Tong University, where I embarked on a research endeavor that revolved around my master's thesis. Under the expert guidance of Prof. Shizhen Zhao, I decided to navigate uncharted territories within the field of data center networking. Together with my supervisor, Prof Zhao, I co-first author a paper titled "Flattened Clos: Designing High-performance Deadlock-free Expander Data Center Networks Using Graph Contraction" which represented a significant milestone in my academic journey and received recognition at NSDI 2023.

This paper introduces a novel topology routing co-designed approach to combating with Priority Flow Control (PFC)-induced deadlock in expander networks, which potentially hinders the large scale deployment of RDMA in expander data centers. Building high throughput Clos data centers is cost-prohibitive in the AI era, **where the network traffic is surging**. Optical data centers **has emerged as a solution to meet this challenge**, evidenced by Google's recent work "Jupiter Evolving". Our research offers a valuable pathway for the safe adoption of RDMA in Optical Data Centers at scale, **with the potential applications in enhancing data center speed(need to modify)**.

During this project, I played the pivotal role as a first author, responsible for conducting packet-level and testbed experiments, collecting and analyzing data, and drafting some parts of the manuscript. The experience significantly enhanced my research skills, including proficiency in the NS3 simulator and a deep understanding of RoCE protocol, encompassing congestion control, lossless transport mechanisms, and parameters tuning. These skills have not only established a solid foundation in RoCE but have also fueled my passion for optimizing RoCE transport, **aligning with my aspiration to make enduring contributions to this field.** (补充与各个教授项目的联系) **(TODO: potential application, tell my individual contribution to this paper)**

[Industry]

Building on the foundation of the RDMA transport protocol laid by my previous research experience, I transitioned into the SmartNIC industry following my graduation. Our products integrated some much-needed networking technologies, such as OpenVSwiTh, RDMA, TCP Offload Engine (TOE), etc., into one SmartNIC. These technologies played a vital role in enhancing networking capabilities in storage services such as distributed file systems and cloud storage within our company. Although my work centered on TOE instead of RDMA, I firmly believed that they shared a lot of similarities. For over a year experience, I luckily experienced a period of production, during which, I clearly understood the work principles of TOE, and

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addressed some tough performance problems of TOE. One of the skills I honed during this time was the ability to utilize Wireshark captures to analyze and diagnose NIC-related bugs, further enhancing the reliability and performance of our SmartNICs. This experience fueled my enthusiasm for exploring potential problems of widespread usage of SmartNIC. (relationship with Ph.D. studies)

[Research Interests]

Building upon my academic background and professional experience, my research interests for Ph.D. studies revolve around the exploration of practical application scenarios for Data Processing Units (DPUs) and the optimization of smartNIC mechanisms at scale. Specifically, I am eager to delve into the application of DPUs in accelerating various computational workloads, with a focus on their potential to enhance data center performance and efficiency(some thoughts). Additionally, I am interested in addressing the challenges that arise when deploying smart NICs in large-scale network environments. This includes investigating issues related to scalability, resource management, and network orchestration.

[Interested Professor]

In my pursuit of a Ph.D., I am drawn to the Computer Science department at your university, primarily due to Professor Simon Peter's research work. His research directions overlap my interests. I greatly admire his contributions to TOE. Joining their research group would provide me with valuable insights, and I am eager to contribute to their ongoing work. My immediate goal is to become an expert in the area of DPU, contributing to leading publications and conferences. Beyond that, I aspire to be an individually researcher in a famous university. I believe UW's Ph.D. program is the perfect platform to realize these goals

[Conclusion]

In conclusion, my academic journey, research experiences, and unwavering passion for SmartNIC have shaped my desire to pursue a Ph.D. program. I am excited about the prospect of joining the vibrant research community at UW, where I am confident that I can contribute meaningfully to ongoing research and make significant strides in SmartNIC. The challenges and opportunities ahead only serve to fuel my determination, and I eagerly await the chance to embark on this academic journey.