Statement of Purpose

Mishal Shah, MS CS Applicant, University of Texas at Austin, Fall 2024

I've gained experience in computer science through my work as a software engineer at Google & Cisco and through undergraduate studies in Computer Science and Engineering at the National Institute of Technology Karnataka (NITK), Surathkal. Both of these experiences have made me realize that to make significant contributions, I need to have a deeper knowledge and understanding of the fundamentals of computer science. My area of interest lies in enhancing the performance, resiliency, resource efficiency, and affordability of computing systems. An MS in CS would be the first step towards making meaningful contributions in the computing systems field. This degree program would allow me to expand my knowledge in the area and help me grow professionally.

During my undergrad, I worked closely with Dr. Mohit P. Tahiliani to understand more about the computer network space. I implemented a congestion avoidance algorithm called TCP New Vegas in ns-3 (an open-source network simulator). It used the best measurement for a particular period to detect and measure congestion. In the advanced computer networks course, I compared and evaluated the throughput, packet drop behavior, and slow-start threshold variations of the kernel bypass libraries, netmap, and Data Plane Development Kit (DPDK) in ns-3 by simulating packet flows with iperf. This gave me a strong foundation for understanding kernel bypass techniques and their importance in achieving higher performance.

Following this, I joined Dr. Mohit's research on Quantitative Understanding of Energy Efficiency in Network Function Virtualization (NFV) Frameworks as my undergraduate thesis. I explored how network functions work, specifically OpenNetVM and DPDK. I developed a lightweight software-based library leveraging the RAPL interface of Intel to measure real-time power consumption. In order to avoid the energy overhead associated with floating-point arithmetic while measuring power at small time intervals, an integer arithmetic approach was followed. I evaluated the power consumption of DPDK applications and virtual network function chains in OpenNetVM by simulating various real-world packet processing scenarios. The results showed that power consumption in virtual network function chains remained persistently high due to Poll Mode Drivers in DPDK. This project helped me learn about configuring systems to communicate on NICs, network functions, scaling governors, registers, traffic generators, and simulating complex traffic flows. Intel supported this work, which was then published at the 2020 IEEE NFV-SDN conference.

Beyond research, I actively sought practical experience. I optimized the build system of ns-3 as part of the Google Summer of Code program in 2019, streamlining module management and reducing build times. An internship at IIIT, Hyderabad, in 2018 involved building interactive educational experiments from textual content, requiring me to design and implement a parser, linker, and renderer. At NITK, I participated in hackathons, contributed to open-source software, and mentored students in web development and parallel programming. I also joined the team building IRIS NITK, a digital solution that streamlined university

operations, demonstrating my ability to collaborate to build scalable software, work with diverse stakeholders, and lead teams.

My professional experiences at Cisco and Google further solidified my passion for optimizing system performance. At Cisco, I worked on their Edge Intelligence IoT application, where I reduced continuous integration runtime by 20% and designed a cloud-to-device data transfer system. At Google, I tackled latency issues in an internal learning management system by implementing local and remote caching with a cache freshness mechanism. I also proposed and developed a proof-of-concept framework for integrating LLMs into Google's support system based on the ReAct (Synergizing Reasoning and Acting in Language Models) concept. I design and build tools for Google Ads support from scratch, mentor teammates, and collaborate across teams at Google. This experience has honed my skills in systems thinking, problem-solving, programming, and teamwork, which will be valuable assets for the masters program.

The MSCSO program at the University of Texas at Austin perfectly aligns with my aspirations. The courses on Advanced Operating Systems, Parallel Systems, and Virtualization directly address my interests in optimizing system performance and efficiency. The program's flexibility allows me to continue working while gaining valuable knowledge and skills. This will equip me for a future in core computer science teams at Google or potentially founding a company specializing in scalable services. UT Austin's world-class faculty, research environment, and exceptional peers will undoubtedly foster my growth and enable me to make significant contributions to the field.