

Teaching Statement

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During my PhD experiences, I deeply enjoyed the process of mentoring and teaching. I have mentored 7 students at Tsinghua University for their theses, 4 of which turned into publications. I also worked as a teaching assistant for an undergraduate computer network course at Carnegie Mellon University and as a tutor for several basic courses at Tsinghua University. These experiences have fascinated me and motivated me to continuously improve my mentoring and teaching practices.

1 Mentoring

During my Ph.D. at Tsinghua University, I have the honor of mentoring 5 undergraduate students and 2 master students. I am also fortunate to be mentored by fantastic advisors from Tsinghua University, Carnegie Mellon University, Massachusetts Institute of Technology, Alibaba, and Tencent. During the process of mentoring and being mentored, I believe that a good advisor should have the following goals in mind.

A good advisor matches the student's interest with the research. Different students have different backgrounds – some have talents in math, and some in system design. It is very important for the advisors to figure out the strength and interests of the students and help them go further in that direction. For example, Tingfeng Wang was a master student I mentored at Tsinghua University. Tingfeng had a very strong background in queueing theory since he held a minor degree in math. Therefore, we found a way to provide a theoretical analysis of what we were optimizing for the frame-rate control. Finally, Tingfeng was able to demonstrate very useful theoretical results about the performance bound on the heuristic algorithms^{1,2}.

A good advisor helps with the student's career path. When starting the research, some students have a strong will to solve problems in a certain direction. Yixin Shen, an undergraduate student at Tsinghua University, who is mentored by me since his sophomore year. When reached out to me, Yixin just wanted to do some groundbreaking research, but the goal is a little vague on what kind of research he was really fond of. We collectively sorted out why Yixin was willing to work on network research by starting with some small projects to explore his interests. Yixin then succeeded to identify the problem of the transient state of congestion control³, which finally went to the finalist of the Student Research Competition in SIGCOMM '21. The publications and competitions also helped him in applying for a PhD position. Yixin finally decided to continue his research on computer networks as a PhD student, still working in congestion control now.

A good advisor helps to control the progress of the project. For congestion control, a shorter control loop would help the algorithm converge faster. The same applies to the research. Junior students often get stuck on minor issues and lose focus on the goal of the project. The issues might be implementation issues, difficulties in understanding a paper, or even the student's bad mood. So, I think the advisor should try to meet with the students in time to sort things out. For example, Jing Chen worked with me since she was in her junior year of undergraduate. I proposed a project on using deep learning to optimize the network topology to her. When leading herself, she got lost several times in some implementation details,

¹ Tingfeng Wang, Zili Meng, Mingwei Xu, Rui Han, and Honghao Liu. [Enabling High Frame-rate UHD Real-Time Communication with Frame-skipping](#). In *Proceedings of the 3rd ACM Workshop on Hot Topics in Video Analytics and Intelligent Edges (HotEdgeVdeo '21)*, 2021

² Zili Meng, Tingfeng Wang, Yixin Shen, Bo Wang, Mingwei Xu, et al. [Enabling High Quality Real-Time Communications with Adaptive Frame-Rate](#). In *Proceedings of the 20th USENIX Symposium on Networked Systems Design and Implementation (NSDI '23)*, 2023

³ Yixin Shen, Zili Meng, Jing Chen, and Mingwei Xu. [Quantifying the Transient Performance of Congestion Control Algorithms](#). In *Proceedings of the SIGCOMM'21 Poster and Demo*, 2021

which were deviated from the insight we discovered. Frequent communication between us helped us to localize the problem and get everything back on track. The project finally led to a full paper at IWQoS 2021⁴.

2 Teaching

My teaching style was formed by working as a teaching assistant at Carnegie Mellon University in Networking and the Internet course, and also as a tutor at Tsinghua University for several basic STEM courses. I believe that a good teacher should keep the following goals in mind.

A good teacher always has good interactions. When I visited Carnegie Mellon University in 2022, I attended the Teaching Assistant Seminar Series. I have learned that one of the most important goals of teaching is to try to keep students engaged and help students learn the content you are teaching. Therefore, interactions between the teacher and the students are very important. For example, when I was giving recitations at Carnegie Mellon University, I would always design some interactive activities such as small games or quizzes to make sure students are following. Keeping students engaged will help me to know more about which part of the lecture needs more effort to understand. In this way, I can also go over the parts that students might still feel confused about.

A good teacher knows the students' needs. When I was helping teach at Carnegie Mellon University, part of my job was to lead the design of a new project on the HTTP server⁵. We feel that one major issue of previous projects is that students can barely learn anything technically by reading the specifications and implementing them without thinking about those design considerations. Moreover, many of them are likely to be real engineers in the near future and they will need to balance a series of design choices. Therefore, we felt that we should ask our students to do any reasoning about the systems they are building with regard to performance. I thus led the redesign of that course project to ensure that students learn these skills in the course.

A good teacher combines technical knowledge with life. Computer network is a direction in which many algorithms and policies have their variants in real life. Linking the technical concepts and algorithms with what the students are experiencing would not only help them to understand but also inspire them to use the experiences in life to solve network problems. Drivers will find congestion control when they get stuck in traffic and customers will think about head-of-line blocking when the grocery staff helps you replace a better apple in check-outs. Students may not have enough knowledge about congestion control, but they do have that experiences from daily life. In this way, students can not only better understand the designs, but also have inspiring thoughts on the potential improvements.

Teaching plan. Given my previous research experience in computer networks and multimedia systems, I would be more qualified and passionate to teach computer networks or multimedia systems at different levels. Besides, a lot more emerging topics are receiving attention from the industry and academia, including my research such as metaverse, virtual reality, cloud gaming. I would also be interested in doing seminars or introductory courses on those topics. Finally, I am also happy to teach any introductory courses in computer science and engineering.

⁴ Jing Chen, Zili Meng, Yanning Guo, Mingwei Xu, and Hongxin Hu. [HierTopo: Towards High-Performance and Efficient Topology Optimization for Dynamic Networks](#). In *IEEE/ACM 29th International Symposium on Quality of Service (IWQoS)*, 2021

⁵ [Systems Class Projects as Science Labs, not Problem Sets](#)